



Interim Report of Commission of Inquiry  
into the Construction Works  
at and near the Hung Hom Station Extension  
under the Shatin to Central Link Project

(The Redacted Version)

With a view to avoiding any prejudice (actual or perceived) to the relevant criminal investigations and criminal prosecutions (if so decided to be justified after the relevant investigations), certain parts of paragraphs 129, 130, 133, 138, 147, 184, 190, 195, 197, 198, 199, 224, 225, 231, 237, 239, 269, 273, 276, 277, 278, 283, 284, 288, 289, 295, 296, 298, 301, 312, 314, 315, 316, 317, 318, 323 and 421 of this Report have been redacted.

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February 2019

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## **Preface**

### ***Why an interim report?***

It was originally anticipated that this report, when it was submitted to the Chief Executive on 25 February 2019, would constitute a full and final report. Two principal intervening events, however, have compelled the Commission to the determination that an interim report only should be submitted at this time.

The Commission's original terms of reference limited its inquiry to one physical area within the greater extent of Contract 1112 under the Shatin to Central Link ('SCL') Project, that limited area being the diaphragm wall and platform slab construction works.

Within this physical limitation, the Commission was given three mandates. By way of an overview, these mandates were as follows:

- a. First, and primarily, the Commission was to inquire into the facts and circumstances surrounding the steel reinforcement fixing works and any other works which had given rise to public concern as to their safety. In short, the Commission was to determine whether these works were fit for purpose; put more directly, whether they were safe.
- b. Second, the Commission was to determine whether the works had been executed in accordance with Contract 1112. If not, why not, and had rectifying steps been taken?
- c. Third, insofar as it was necessary, the Commission was to conduct a review of the relevant supervision, management and control systems of both the Government and the MTR Corporation Limited ('MTRCL'), the Government being the major shareholder in that company.

### ***The first intervening event***

Under the Commission's original terms of reference, its primary mandate, as set out above, was to determine the structural integrity, that is, the safety, of the diaphragm wall and platform slab construction. During the course

of its inquiry into this issue, the Commission was made aware of a number of collateral investigations that were taking place to determine matters of direct relevance to that same issue. Mention is made of those collateral investigations in the body of the interim report.

One such investigation was proposed by MTRCL and was given Government approval on 5 December 2018. This investigation – the ‘Holistic Proposal’<sup>1</sup> – has entailed the physical opening up of selected areas. The first purpose has been to verify the as-constructed conditions of the connections between the platform slabs and the diaphragm walls at locations where relevant documentation has been missing. The second purpose has been to verify the work quality of the coupler connections in view of the allegations concerning the cutting short of reinforcement bars. Both issues go to the question of safety.

During the course of its inquiry, the Commission was kept informed (as was the general public) of the progressive findings of the Holistic Proposal. Pursuant to the Holistic Proposal, when the collection of data has been completed, it will then be subjected to a final assessment. This final assessment will go directly to the issue of structural integrity and will of course be a matter of relevance to the Commission in its determination of its primary mandate: safety. The final assessment, called ‘stage 3’ is described in the executive summary of the original proposal in the following terms, namely, that – “Based on verification findings in Stages 1 and 2, structural assessment will be conducted for the East West Line (‘EWL’) and North South Line (‘NSL’) slabs and the station extension box. Remedial works, if required, will be designed and implemented wherever necessary to reinstate the structure to an acceptable state.”

However, as the Commission understands it, that full assessment will not be available to it until about April of this year.

### ***The second intervening event***

On 29 January 2019, the last day of the Commission’s hearings into the matters which fell for determination and/or review pursuant to its original terms

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<sup>1</sup> The formal name of the proposal is ‘A Holistic Proposal for Verification & Assurance of As-constructed Conditions and Workmanship Quality of the Hung Hom Station Extension (East West Line Platform Slab, North South Line Platform Slab and the Connecting Diaphragm Walls)’.



of reference, the Commission was informed that further matters of public concern had arisen in respect of Contract 1112. These matters concerned an apparent failure to submit a significant number of construction records confirming the nature, extent and quality of work done in respect of three other physical areas of Contract 1112, namely, the North Approach Tunnels, the South Approach Tunnels and the Stabling Sidings.<sup>2</sup> The lack of records caused disquiet not only as to failings in monitoring and control mechanisms but as to the quality of work actually done and, by way of logical deduction, whether any issues as to safety arose.

On the basis that these further concerns all fell within the ambit of Contract 1112 and to a very large extent, certainly in respect of issues reflecting on the adequacy of monitoring and control mechanisms, had already fallen for consideration by the Commission, it was determined that the best way forward was to extend the Commission's Terms of Reference.

The Commission's extended Terms of Reference were given to it on 19 February 2019. In respect of its investigative functions, the Terms state:

Regarding the MTRCL's Contract No. 1112 ('Contract') of the Shatin to Central Link Project:

- (a)(1) in respect of the diaphragm wall and platform slab construction works at the Hung Hom Station Extension,
  - (i) to inquire into the facts and circumstances surrounding the steel reinforcement fixing works, including but not limited to those works at locations that have given rise to extensive public concern about their safety since May 2018;
  - (ii) to inquire into the facts and circumstances surrounding any other works which raise concerns about public safety; and
  - (iii) to ascertain whether the works in (1)(i) and (ii) above were executed in accordance with the Contract. If not, the reasons therefor and whether steps for rectification have been taken;

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<sup>2</sup> Diagram 3 in the interim report (found on page 16) shows the physical layout of the works falling under Contract 1112.

- (2) in respect of the construction works at the North Approach Tunnels, the South Approach Tunnels and the Hung Hom Stabling Sidings,
- (i) to inquire into the facts and circumstances surrounding any problem relating to the steel reinforcement fixing or concreting works, including but not limited to any lack of proper inspection, supervision or documentation of such works undertaken, any lack of proper testing of the materials used for such works and of proper documentation of such testing, and any deviation of such works undertaken from the designs, plans or drawings accepted by the Highways Department or the Building Authority;
  - (ii) to inquire into the facts and circumstances surrounding any works or matters which raise concerns about public safety or substantial works quality; and
  - (iii) to ascertain whether the works and matters involved in (2)(i) and (ii) above were executed in accordance with the Contract. If not, the reasons therefor and whether steps for rectification have been taken;
- (b) to review, in the light of (a) above,
- (i) the adequacy of the relevant aspects of the MTRCL's project management and supervision system, quality assurance and quality control system, risk management system, site supervision and control system and processes, system on reporting to Government, system and processes for communication internally and with various stakeholders, and any other related systems, processes and practices, and the implementation thereof; and
  - (ii) the extent and adequacy of the monitoring and control mechanisms of the Government, and the implementation thereof; and
- (c) in the light of (b) above, to make recommendations on suitable measures with a view to promoting public safety and assurance on quality of works.

In the light of these extended terms, it was the Commission's decision that it would be premature to publish a final report under its original terms at this time when – certainly in respect of matters related to supervision, management and control systems – a determination of the extended terms may require significant amendments to that final report.

## *Summary*

Even though this is an interim report, as far as safety of the diaphragm walls and platform slabs is concerned, on the basis of the extensive evidence received and considered during the course of this inquiry, including evidence from independent structural engineering experts, the Commission finds that the Hung Hom Station Extension diaphragm wall and platform slab construction works are safe.

This leaves one matter for explanation. Why the issue of an interim report at all, why not the issue of a single final report at a later time? In answer, the Commission has recognised that the fundamental reason for its appointment was extensive public concern as to the integrity, that is, the safety, of the integrated structure made up of the diaphragm walls and platform slabs of the Hung Hom Station Extension. As the Commission understands it, those concerns remain. In addition, there are concerns as to the on-going efficiency of the Government and MTRCL in respect of the construction of major infrastructure projects. Hopefully, this interim report will go a long way to alleviating those concerns.

## List of Abbreviations

### **A**

Areas	Area A, Hong Kong Coliseum, Area B and Areas C1, C2 and C3
Atkins	Atkins China Limited

### **B**

BA	Building Authority
BD	Buildings Department
BIM	Building Information Modelling
BOSA	BOSA Technology (Hong Kong) Limited

### **C**

China Technology	China Technology Corporation Limited
Code	Code of Practice for Structural Use of Concrete 2004
Commission	Commission of Inquiry
Competence	The combination of training, skills, experience and knowledge that a person has and their ability to apply them in performing a task effectively. Factors such as attitude and physical ability can also affect someone's competence.
Competent Person	Competent Person under the Buildings Ordinance
Contract	MTRCL's Contract No. 1112
CoP	Code of Practice
COWI	COWI UK Limited

### **D**

D-wall	Diaphragm wall
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### **E**

EWL	East West Line
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<b>F</b>	
Fang Sheung	Fang Sheung Construction Company
<b>H</b>	
Hold point	A point in construction beyond which work was not permitted to proceed until approval had been given
Holistic Proposal	A Holistic Proposal for Verification & Assurance of As-constructed Conditions and Workmanship Quality of the Hung Hom Station Extension (East West Line Platform Slab, North South Line Platform Slab and the Connecting Diaphragm Walls) formulated by MTRCL to conduct tests which involved the physical opening up of the station box structure
Honeycombing	Spalling and voiding of concrete
Hung Choi	Hung Choi Company Limited
<b>I</b>	
ICAC	Independent Commission Against Corruption
Intrafor	Intrafor Hong Kong Limited
ISO9001	An international standard – not confined to engineering – that defines quality management. Organisations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements.
<b>J</b>	
January Report	The 17 January 2017 report that Leighton issued
June Report	The 15 June 2018 report that MTRCL submitted to the Government
<b>K</b>	
km	kilometre
<b>L</b>	
Leighton	Leighton Contractors Asia Limited

<b>M</b>	
m	metre
mm	millimetre
M&V	Monitoring and Verification
MTRCL	MTR Corporation Limited
<b>N</b>	
NCR	Non-conformance Report
NEC	New Engineering Contract
NSL	North South Line
<b>O</b>	
OTE	over track exhaust
Ordinance	Commissions of Inquiry Ordinance, Cap 86
<b>P</b>	
PAUT	phased array ultrasonic test
PIMS	Project Integrated Management System
PCM	Project Coordination Meeting
PMPs	Project Management Plans
PSC	Project Supervision Committee
PYPUN	PYPUN-KD & Associates Limited
<b>Q</b>	
QSP	Quality Supervision Plan
<b>R</b>	
Rankine Engineering	Rankine Engineering Company Limited
RDO	The Railway Development Office within the Highways Department, which served as the single point of contact for overall administrative coordination
Rebars	steel reinforcing bars
RISC	Request for Inspection, Survey and Check

**S**

SCL

Shatin to Central Link

SPV

Special Purpose Vehicle

SSP

Site Supervision Plan

Station box structure

The Hung Hom Station Extension diaphragm wall and platform slab construction works

**T**

TCP

Technically Competent Person

Tremie pipe

A pipe to permit pumping of concrete into diaphragm walls

## Chapter 1

### The appointment of the Commission of Inquiry

#### *The Shatin to Central Link*

1. In May 2000, the Government unveiled a blueprint for the future expansion of Hong Kong's rail network. At the time it was said that the 'Railway Development Strategy 2000' was vital to ensuring the economic and social growth of Hong Kong. It was part of the vision of making Hong Kong a 'world-class' city.

2. Integral to the strategy was the construction of what is known as the 'Shatin to Central Link' ('SCL'). The SCL is divided into two sections. One section extends the existing Ma On Shan Line from Tai Wai to the West Rail Line via East Kowloon to form the 'Tuen Ma Line'; this is known as the East West Line ('EWL'). The other extends the existing East Rail Line across Victoria Harbour to Wan Chai North and Admiralty; this is known as the North South Line ('NSL'). The following diagram is illustrative.

**Diagram 1**



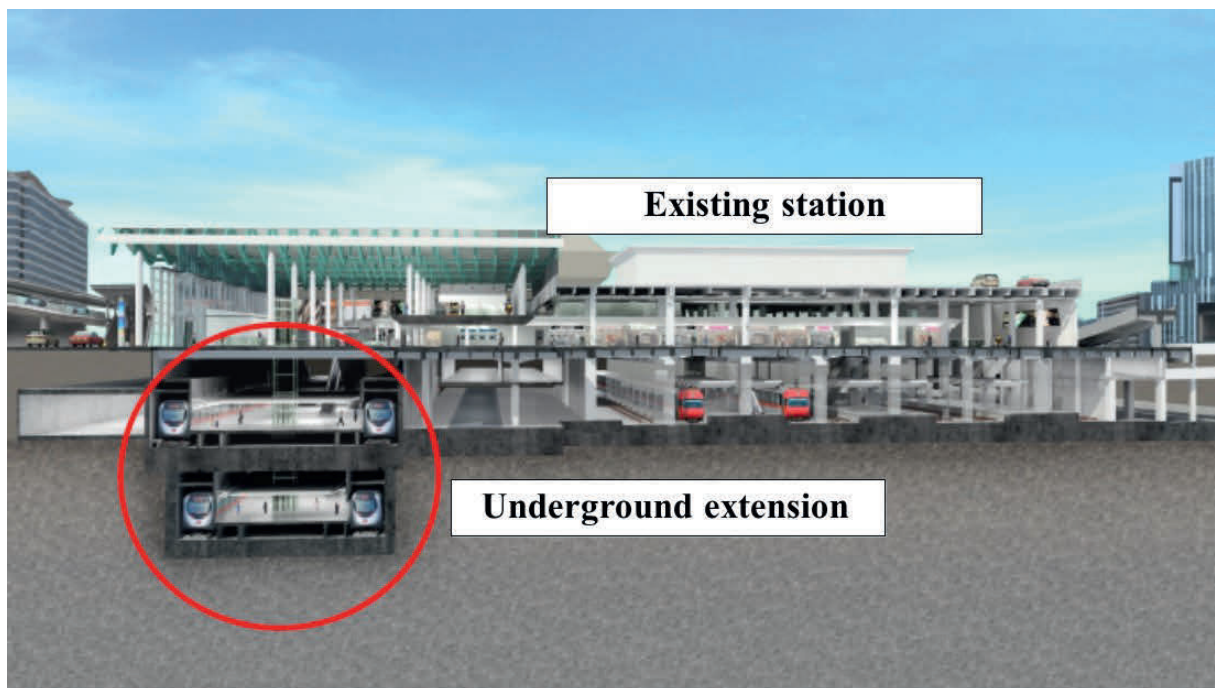


3. The SCL is some 17 kilometres ('km') long. Of the SCL's 10 stations, six are interchange stations linking the SCL to Hong Kong's broader rail network. One of these interchange stations is the extension to the existing Hung Hom Station.

4. The extension works enable the rail lines of EWL and NSL to run through the station so that passengers may alight and disembark. In order to achieve this it has been necessary to construct diaphragm walls and between those walls to construct two platform slabs that carry the rail tracks, an upper slab and a lower slab: the 'station box structure'.

5. The diagram below depicts a cross-section of the Hung Hom Station including the extension to the west. Contained within the red circle marked 'underground extension' are the two platform slabs carrying the rail lines, one above the other. The upper platform slab is the EWL platform slab, the lower platform slab is the NSL platform slab.

**Diagram 2**



6. The construction of the station box structure, essentially, the diaphragm walls and the two platform slabs – all constructed of reinforced concrete – took approximately three years to complete, commencing in about May 2013 and (for all effective purposes) being completed by late 2016.

7. By May 2018, some 18 months after the station box structure had been constructed, although the Hung Hom Station Extension was not yet open to the public, rail tracks had been laid upon the two platform slabs and trains had conducted test runs. There was no evidence of any structural distress; in short, no reason to question its structural integrity.

### *The sudden rise in public concern*

8. However, during May 2018 disturbing reports began to appear in the media as to the safety of the station box structure. Reports spoke of an apparent failure at the time of construction to ensure that the individual bays making up the EWL and the NSL platform slabs had been securely connected at their joints by means of mechanical coupling devices and that the platform slabs themselves had been securely anchored into the diaphragm walls by means of the same devices.

9. The central focus of the media reports – at that time – was the assertion that during construction there had been a systematic and widespread cutting of threads from the end of reinforced bars – commonly called ‘rebars’ – to avoid having to fully engage the rebars into the mechanical coupling devices: the ‘couplers’. In short, the huge reinforcing concrete structures making up the station box structure had not been securely connected to each other. This malpractice, it was said, which had been permitted by a lack of diligent oversight and inspection, threatened the structural integrity of the whole station box structure.

10. Whoever, or whatever, may have been the original source of the media reports, it was a man by the name of Poon Chuk Hung (‘Jason Poon’), the Managing Director of China Technology Corporation Limited (‘China Technology’) who was at the forefront in expressing reservations as to the safety of the station box structure. Jason Poon spoke from an apparent position of knowledge. His company, China Technology, had been one of the main sub-contractors in the construction of the station box structure, indeed responsible for erecting formwork and pouring concrete.

## *Appointment of the Commission of Inquiry*

11. With public disquiet increasing, on 10 July 2018, the Chief Executive in Council appointed the authors of this report, Michael John Hartmann (as Chairman) and Professor Peter George Hansford to constitute a Commission of Inquiry (the ‘Commission’) pursuant to the provisions of the Commissions of Inquiry Ordinance, Cap 86 (the ‘Ordinance’).<sup>3</sup>

12. The full Terms of Reference are annexed to this report as Annexure A. The Terms of Reference will be considered in greater detail later in this report. At this juncture, the terms can be summarised as follows.

13. The Commission’s original terms of reference limited its inquiry to one physical area within the greater physical extent of Contract 1112, that limited area being the diaphragm wall and platform slab construction works: the station box structure. Within this physical limitation, the Commission was given three mandates. By way of an overview, these mandates were as follows:

- a. First, and primarily, the Commission was to inquire into the facts and circumstances surrounding the steel reinforcement fixing works and any other works which had given rise to public concern as to their safety. In short, the Commission was to determine whether these works were fit for purpose, that is, whether they were structurally sound.
- b. Second, the Commission was to determine whether the works had been executed in accordance with Contract 1112. If not, why not, and had rectifying steps been taken?

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<sup>3</sup> The Commission’s terms of appointment initially required it to report to the Chief Executive within six months, that is, by 9 January 2019. However, upon the request of the Chairman of the Commission, that period was extended to 26 February 2019. There were three principal reasons for seeking and obtaining that extension. First, by reason of existing professional commitments, Professor Hansford (who resides in the United Kingdom) was unable to come to Hong Kong to sit at the hearings until late October 2018. Second, considerable difficulty was encountered in identifying expert witnesses in matters of structural engineering and project management who were not excluded from assisting the Commission by reason of conflict of interest. Once experts of sufficient standing were identified (in the United Kingdom), they required time to prepare their reports and find suitable dates when they could be in Hong Kong. Third, with the commencement of hearings, it became evident that the number of issues to be examined – and their complexity – would require an extended period of time. As it was, as stated elsewhere in this report, the Commission heard evidence from a total of 65 witnesses of fact and seven expert witnesses.

- c. Third, the Commission was to conduct a review of the relevant supervision, management and control systems of both the Government and MTRCL, making such recommendations as it considered necessary for improvement.

### ***Appointment of a supporting legal team***

14. On the same date as the appointment of the Commission, that is, on 10 July 2018, Messrs Lo & Lo were appointed as solicitors to the Commission. Later in the same month, Ian Pennicott SC, QC was appointed as leading counsel for the Commission, and two junior counsel, Solomon Lam and Calvin Cheuk, were appointed as counsel for the Commission.

### ***Appointment of experts for the Commission***

15. The Commission has engaged two independent experts, namely, Professor Don McQuillan and Mr Steve Rowsell. Professor McQuillan, a Director of RPS Consulting Engineers, was engaged by the Commission on 13 September 2018 to provide assistance on structural engineering issues. Professor McQuillan submitted his expert report to the Commission on 7 January 2019 and gave evidence at the Commission's hearing on 18 January 2019. Mr Rowsell, a Director at Rowsell Wright Limited, was engaged by the Commission on 17 September 2018 to provide assistance on project management issues. Mr Rowsell submitted his expert report on 20 December 2018 and gave evidence at the Commission's hearing on 10 January 2019.

### ***Preliminary hearing and setting of rules***

16. A preliminary hearing, essentially administrative in nature, was held on 24 September 2018. At that hearing, pursuant to section 4 (1)(m) of the Ordinance, the Commission set down rules to govern its procedure and practice. These rules are annexed to this report as **Annexure B**.

### ***Site visits***

17. Two site visits were conducted to enable the members of the Commission to directly acquaint themselves with the physical parameters of

their mandate. The first visit was conducted on 21 September 2018 by the Chairman, who was accompanied by counsel and solicitors for the Commission. The second visit was conducted on 21 October 2018 by the two Commissioners. On both occasions, representatives of MTRCL gave a briefing, followed by a site walk and a debriefing.

### ***Involved parties***

18. Pursuant to sections 6(1) and (2) of the Ordinance, the following parties participated in the proceedings before the Commission and were legally represented<sup>4</sup>:

- a. Transport and Housing Bureau, Highways Department, Development Bureau and Buildings Department ('the Government')
- b. MTRCL
- c. Leighton Contractors Asia Limited ('Leighton')
- d. Intrafor Hong Kong Limited ('Intrafor')
- e. China Technology Corporation Limited ('China Technology')
- f. Fang Sheung Construction Company ('Fang Sheung')
- g. Atkins China Limited ('Atkins')
- h. PYPUN-KD & Associates Limited ('PYPUN')

### ***Other parties***

19. The following parties, although not considered to be 'involved parties', were represented before the Commission in order to give assistance to it:

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<sup>4</sup> The provisions of the Ordinance require the Commission to determine whether the conduct of any person is the subject of the inquiry or whether any person is in any way implicated or concerned in the subject matter of the inquiry. The Commission may require such 'involved' person to give evidence before the Commission in such manner as the Commission determines. Any person whose conduct is the subject of the inquiry, or who is implicated or concerned in the subject matter of the inquiry, has the right to be legally represented before the Commission.

- a. Hung Choi Company Limited ('Hung Choi')
- b. Rankine Engineering Company Limited ('Rankine Engineering')
- c. BOSA Technology (Hong Kong) Limited ('BOSA')

### *Calling of evidence*

20. The Commission commenced hearing evidence on 22 October 2018. The last day on which evidence was given was 18 January 2019. Closing submissions were made on 28 and 29 of January 2019.

21. Allowing for short adjournments, the longest being over the Christmas and New Year period, the Commission sat for a total of 46 days. In that time, it heard the evidence of 65 witnesses who testified as to matters of fact and seven witnesses who were accepted as being independent experts.

22. Three of the witnesses of fact gave their evidence by way of video link: one from England, two from Australia.

23. A list of the witnesses who testified before the Commission together with the dates of their testimony is annexed to this report as **Annexure C**.

### *Uplifting of proceedings to the Commission's website*

24. To enable the public to remain fully informed on a daily basis of the proceedings before the Commission, the transcript of all testimony given by witnesses of fact was uplifted to the Commission's website<sup>5</sup> together with a copy of their written statements. Equally, the transcript of all testimony given by the expert witnesses was uplifted together with copies of their expert reports. This was subject to one limitation. Annexures to statements and reports were not uplifted on the basis that they were often so voluminous as to make it impracticable.

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<sup>5</sup> The Commission's website will be maintained together with all relevant documentation. Link: <https://www.coi-hh.gov.hk>

## Chapter 2

### Looking to the Commission's mandate

25. For the purposes of this interim report, the Commission accepts that it is required to operate strictly within the Terms of Reference contained in the document of appointment: Annexure A.

26. Pursuant to those terms of reference, the investigative mandate given to the Commission was limited to the physical area housing the construction works that were the subject of such public disquiet, namely, the “diaphragm wall and platform slab construction works at the Hung Hom Station Extension under the MTRCL’s Contract No. 1112”.

27. Pursuant to the Terms of Reference, the first mandate given to the Commission was an investigative one related to the fundamental issue of safety, namely:

- i. to inquire into the facts and circumstances surrounding the steel reinforcement fixing works, including but not limited to those works at locations that have given rise to extensive public concern about their safety since May 2018;
- ii. to inquire into the facts and circumstances surrounding any other works which raise concerns about public safety ...

In addition, the Commission was given a mandate:

- iii. to ascertain whether the works in (i) and (ii) above were executed in accordance with the Contract. If not, the reasons therefor and whether steps for rectification have been taken...

28. Two mandates were therefore given to the Commission. First and fundamentally, by inquiring into the facts and circumstances surrounding the diaphragm wall and platform slab construction works, to determine whether those works are structurally sound, that is whether they are safe for future use by the public and, second, whether those works were built in accordance with Contract 1112, that is, whether, in the execution of the works, without in any

way determining civil or criminal liability, the conduct of the parties complied with their obligations.

29. While obviously contractual compliance should ensure structural integrity, it does not follow that, if the works in respect of the diaphragm wall and platform slabs are found to be safe, issues of contractual compliance can then be ignored. They remain separate issues, the Commission being required to reach determinations in respect of both.

30. During the course of submissions made to the Commission, it was said that the great majority of public inquiries are set up to investigate the cause of an event which had demonstrably and unquestionably happened. In the present inquiry, however, this was not the case. This Commission was constituted in order to investigate and report on allegations of possible dire consequence which had received wide press coverage but which had not at the time been accepted or proved. In the opinion of the Commission, this may explain the broad mandate to inquire into the “facts and circumstances surrounding” the engineering works that “have given rise to extensive public concern about their safety”. In light of this, with so much doubt clouding the “facts and circumstances”, the Commission has, as a primary responsibility, sought to determine the issue: what in fact happened to give rise to such public concern?

31. It is invariably a function of a Commission of Inquiry to make recommendations based on lessons learnt. In this regard, the third mandate given to the Commission was to make recommendations with a view to promoting public safety and the assurance of the quality of works, that is, to conduct a review of:

- i. the adequacy of the relevant aspects of MTRCL’s project management and supervision system, quality assurance and quality control system, risk management system, site supervision and control system and processes, system on reporting to Government, system and processes for communication internally and with various stakeholders, and any other related systems, processes and practices, and the implementation thereof; and
- ii. the extent and adequacy of the monitoring and control mechanisms of the Government, and the implementation thereof.



### *No determination of civil or criminal liability*

32. The Terms of Reference state that the Commission shall not determine the civil or criminal liability of any party (whether an individual or a legal entity). This prohibition is common to the conduct of Commissions of Inquiry in many common law jurisdictions.

33. The Commission, while its proceedings are deemed to be judicial proceedings, is not a court. Its jurisdiction is to inquire and to report and, if appropriate, to make recommendations. In order to discharge this mandate, the Commission has not been bound by strict rules of evidence although, of course, it has ensured a judicious approach.

34. As indicated, the Commission has been careful not to determine the civil or criminal liability of any party. The Commission accepts, however, that, in discharging its responsibilities pursuant to its terms of reference, it does have the power, when necessary and in order to give a full and fair account, to identify courses of conduct which it considers to be worthy of criticism. In the result, damaged reputations may have to be the price to be paid in order, in a balanced but thorough fashion, to analyse events that have caused such extensive public disquiet in respect of the safety of key infrastructure works which the Hong Kong public hope to enjoy for many decades to come.<sup>6</sup>

35. In light of this, the Commission has at all times been aware of the fundamental requirement to act fairly. During the course of the inquiry, allegations of significant blameworthy conduct were made by certain parties against others. Bearing in mind the nature of the Commission's mandate, such allegations were inevitable and have had to be aired. The Commission, however, has striven to ensure that those parties open to criticism, while subject when necessary to searching examination, have been treated fairly.

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<sup>6</sup> See the judgment of Canada (Attorney-General) v Canada (Commission of Inquiry on the Blood System) [1997] 3 SCR 440, paragraph 38 –

“ ... a public inquiry into a tragedy would be quite pointless if it did not lead to the identification of the causes and players for fear of harming reputations and because of the danger that certain findings of fact might be invoked in civil or criminal proceedings. It is almost inevitable that somewhere along the way ... an inquiry will tarnish reputations and raise questions in the public's mind concerning the responsibility borne by certain individuals. I doubt that it would be possible to meet the need for public inquiries whose aim is to shed light on a particular incident without in some way interfering with the reputation of the individuals involved.”

### ***Burden of proof***

36. It is well established that inquisitorial proceedings of the kind conducted by this Commission do not require any party to discharge any formal burden of proof. Put another way: as there are no adversaries as such, no one party takes on the formal burden of proving a fact or a series of facts.

37. During the course of closing submissions, it was suggested that the Commission might nevertheless be assisted if in appropriate circumstances it required a party to discharge a persuasive burden. The Commission has not found it necessary nor helpful to do so. It is not bound by the technical rules of evidence. Nevertheless, it well recognises the need to adopt a rational, judicious approach to the evidence.

### ***Standard of proof***

38. While parties before a Commission of Inquiry may not be required to discharge any formal burden of proof, a Commission must come to its determinations according to the measure of objective standards. That said, in the course of its inquiry it is not bound to a single standard. It may, for good reason, be flexible in this regard.

39. In this inquiry, the Commission will reach its determinations generally on the balance of probabilities. This is the standard adopted in the civil courts of Hong Kong and is a standard adopted in earlier Commissions of Inquiry in this jurisdiction. The balance of probabilities standard, as applied in this inquiry, will mean that the Commission is satisfied an event has occurred if it considers that, on the evidence, the occurrence of the event was more likely than not.

40. In respect of one issue however, that is the primary issue of structural safety, the Commission will adopt a higher standard of proof. The Commission recognises that it would not be in the public interest – indeed it would be contrary to public interest – if it was to go no further than to determine that the structural works which are the subject of this inquiry are more likely than not to be safe or unsafe. What (by clear inference) the Terms of Reference require, and what the public seeks, is an assurance of safety or a clear statement of concern as to lack of safety. Accordingly, whatever language may conveniently

be used in context, any and all findings as to structural safety will be made on the basis that, having considered all relevant evidence, the Commission is satisfied so that it is sure.

*Determining material issues*

41. During the course of the Commission hearings, a great many issues were canvassed. The Commission has not seen the need to seek to resolve all of them. It has sought instead to determine those matters that fall within its mandate and are material to it.

## Chapter 3

### Construction of the station box structure

#### *The entrustment agreements*

42. In order to construct the SCL project, the Government entered into a series of entrustment agreements with MTRCL. The third entrustment agreement, the agreement for the actual construction and commissioning of the SCL project, was entered into between the Secretary for Transport and Housing, representing the Government, and MTRCL in May 2012.

43. In terms of the entrustment agreements, the Government undertook the funding of the entire project on the basis that, upon completion, it would become the owner of the asset. In respect of the future operation of the railway, it was agreed that MTRCL would be granted a concession for its operation.

44. As project manager, MTRCL was entrusted to procure, coordinate, administer, manage and supervise the design and construction of all necessary works (including necessary testing of plant and materials and ensuring quality of workmanship) to bring about the timely completion of the project. In doing so, MTRCL was obliged to follow its own project management system – ‘Project Integrated Management System’ – (‘PIMS’) which is certified ISO 9001 compliant<sup>7</sup> and has been used to manage railway projects in Hong Kong for many years. In consideration for the discharge of its contractual obligations, it was agreed that MTRCL would receive project management fees of approximately HK\$8 billion.

45. For its part, in order to ensure due compliance by MTRCL of its obligations under the entrustment agreements, the Government adopted what has become known as the ‘check the checker’ approach. In terms of this approach, the Highways Department, an executive arm of the Government’s Transport and Housing Bureau, operating through a hierarchy of committees and regular oversight gatherings, has monitored progress of the construction of the project. The Government is assisted in the appraisal, monitoring and audit

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<sup>7</sup> ISO 9001 is an international standard – not confined to engineering – that defines quality management. Organisations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements.

of the activities and processes of MTRCL by an independent ‘monitoring and verification’ (‘M&V’) consultant.

46. It appears that the approach of ‘check the checker’ was adopted on the basis that at the time MTRCL’s project management processes were trusted, being known to be thorough and effective. By way of illustration, in a review document prepared in 2008, Lloyd’s Register Rail (Asia) Limited commented<sup>8</sup>:

“MTRCL’s processes are known to be robust and in line with industry best practice. They are regularly reviewed and audited by outside bodies and have been proven and refined through the delivery of many high-quality railway projects by MTRCL in Hong Kong and abroad.”

47. It has been reported that SCL is Hong Kong’s most expensive rail project; certainly it is a project of daunting proportions which has had to deal with many challenges. To give an indication of its size, as at 1 August 2018 the approved project estimate for the entire project (including cost of design and site investigation works) was approximately HK\$83.1 billion<sup>9</sup>.

### ***Contract 1112***

48. In fulfilling its mandate as project manager, MTRCL has entered into numerous major civil engineering contracts. The focus of this report, however, is limited to just one of those contracts. It is Contract 1112 (the ‘Contract’), a ‘target cost’ contract entered into between MTRCL and Leighton, as contractor, on 7 March 2013.

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<sup>8</sup> ‘Review of Institutional Arrangements for the Hong Kong Section of the Express Rail Link’

<sup>9</sup> The approved project estimate for the entire SCL project comprises (i) Protection Works (Shatin to Central Link – construction of railway works – protection works and Shatin to Central Link – construction of railway works – protection works in Wan Chai Development Phase II) of about HK\$700 million (in money-of-the-day prices); (ii) Advance Works of about HK\$8.6 billion (in money-of-the-day prices); and (iii) Main Works of about HK\$71.4 billion (in money-of-the-day prices). The total is about HK\$80.7 billion. If the cost for design and site investigation works of SCL is included, the total approved project estimate for the entire SCL project is HK\$83.1 billion.

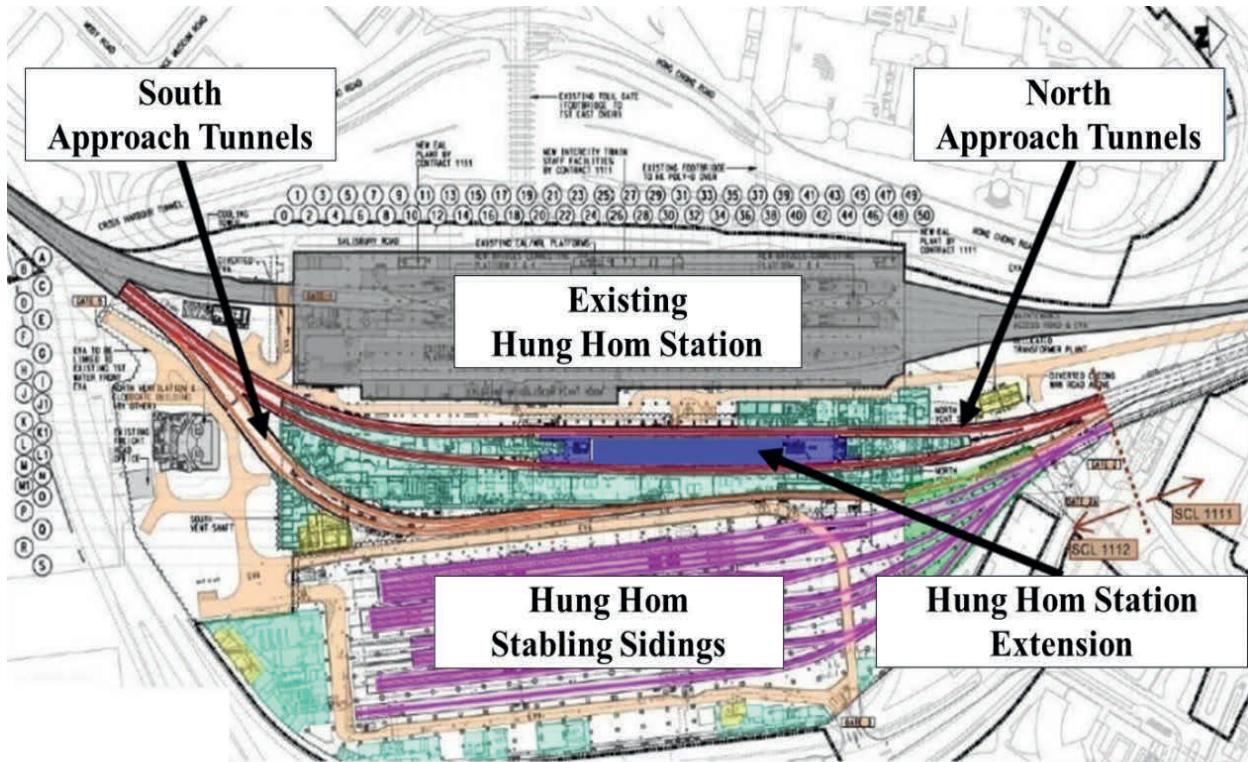
49. In his report, Steve Rowsell, one of the two independent project management experts who assisted the Commission, set out the principal features of ‘target cost’ contracts. Such contracts incentivise the contractor to deliver the works at a lower actual cost. Payment is made to the contractor on the basis of the actual costs incurred together with a fee for its overheads and profits. However, built into the contract is a ‘pain/gain mechanism’ under which, in the present instance, the Government (not MTRCL) and the Contractor (Leighton) share any savings under the target or share any additional costs over the target. In fact, in the Contract – Contract 1112 – there was a cap on the Government’s exposure to additional costs of 10% of the initial target cost. As Steve Rowsell points out, invariably ‘target cost’ contracts require the use of open book accounting arrangements to justify and demonstrate the contractor’s entitlement to payment and also include provisions for disallowable costs in respect of which the contractor does not receive payment.

50. As to the scope of the contract, by way of a broad overview, it provides for extension works to the existing Hung Hom Station for four principal purposes:

- a. To construct the necessary works to enable the rail lines of EWL and NSL to run through the station so that passengers may alight and disembark.
- b. To provide for extended concourse facilities.
- c. To construct stabling sidings.
- d. To construct the north approach tunnels and the south approach tunnels.

51. The diagram which follows – Diagram 3 – gives an indication of the physical extent of the Contract.

**Diagram 3**



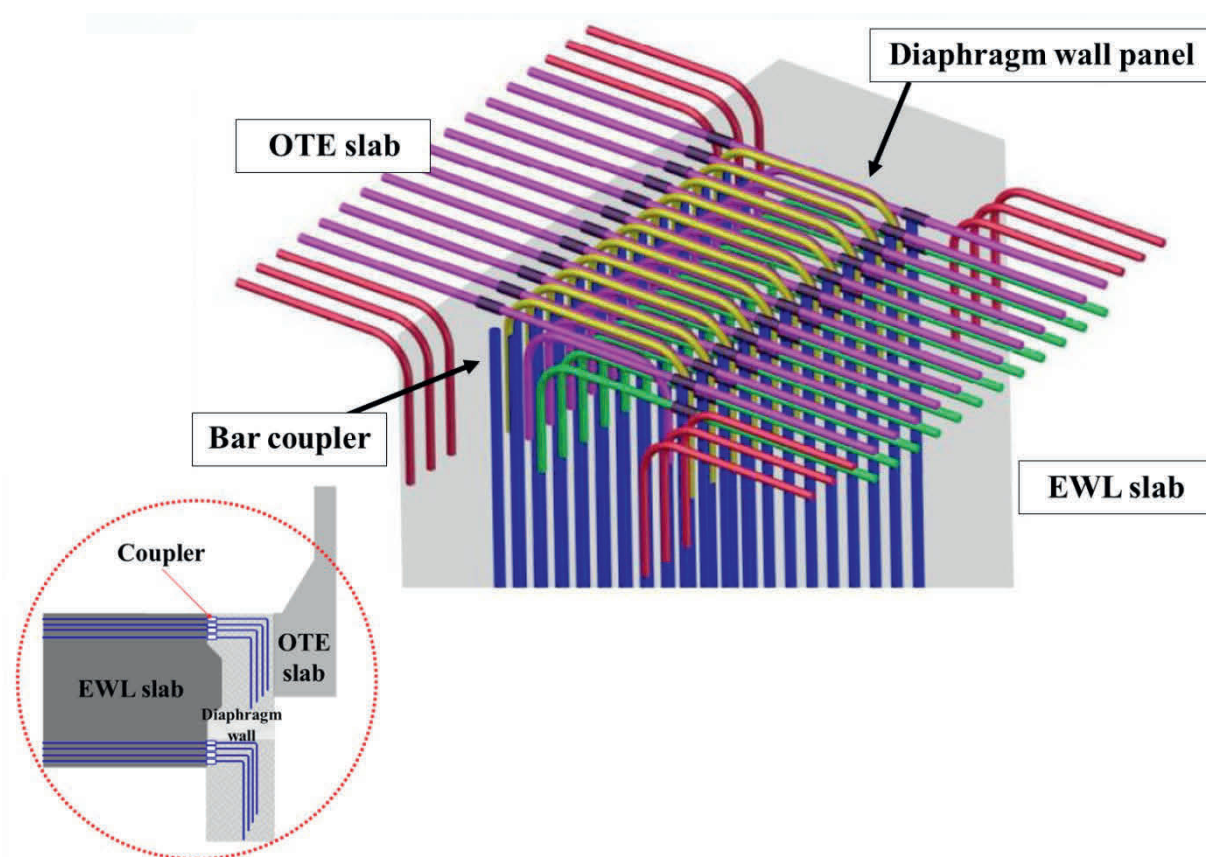
52. This interim report looks only to the first purpose detailed above: namely, construction works (the building of diaphragm walls and platform slabs) to enable the EWL and NSL rail lines to run through the extended Hung Hom Station.

### ***Looking to the structures***

53. The diaphragm wall and platform slab works have required the construction of a number of very large structural elements of reinforced concrete. On its own, concrete is a material that is strong in compression but weak in tension. To compensate for this imbalance in the behaviour of concrete, steel reinforcing bars – commonly called ‘rebars’ – are cast into concrete structures. Steel, by comparison, is a material that is strong in tension. Rebars, especially designed to bond with concrete, therefore provide the tensile strength of the structure. Structures of reinforced concrete are thereby able to resist both compressive and tensile forces.

54. The diagram which follows – Diagram 4 – gives a vivid impression of the density of the rebars set into the concrete structures which are the subject of this report.

**Diagram 4**



55. By way of orientation, what this diagram in fact illustrates can best be understood by having regard to the small inset diagram contained within the red dotted circle. It shows the manner in which the EWL platform slab was originally connected<sup>10</sup> to the east diaphragm wall and connected also to an over track exhaust – ('OTE') – slab. The steel reinforcement in the east diaphragm wall is depicted in the centre of the main illustration.

56. The integrated diaphragm wall and platform slab works – the station box structure – have required the construction of the following connected structures:

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<sup>10</sup> There was a later change to the manner of connection, not by the use of couplers but by the use of through bars, a development considered later in this report.

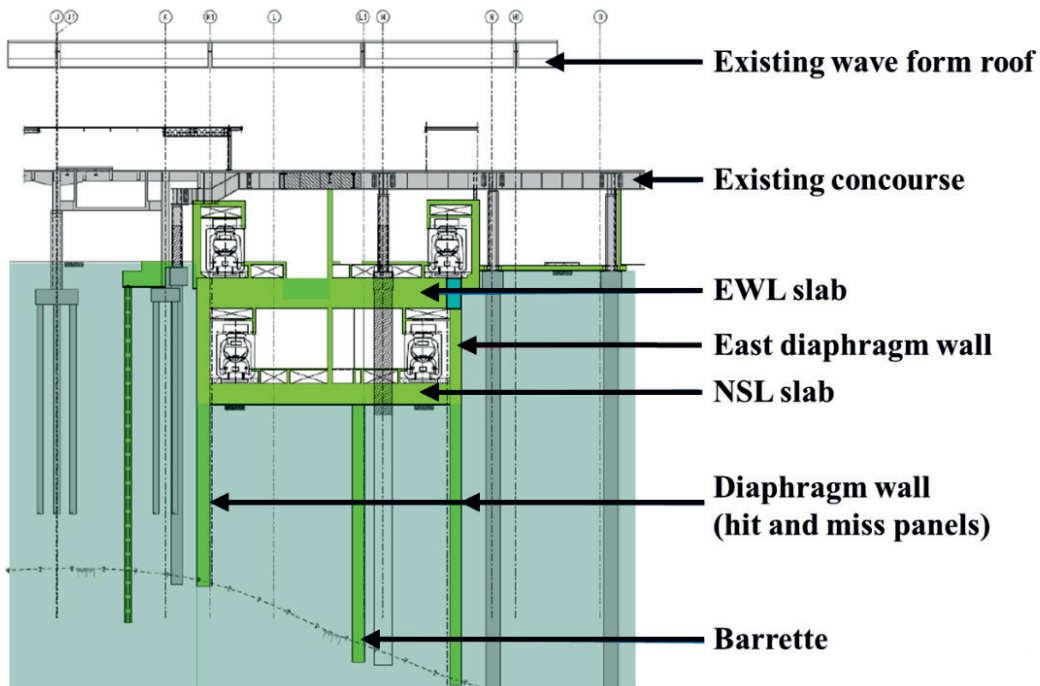


- a. construction of diaphragm walls, these walls running essentially parallel to each other over a distance of some 430 metres ('m');
- b. construction (by means of a top down process) of an upper platform slab (the EWL platform slab) spanning the distance between the diaphragm walls – some 20 to 24 m – and running approximately the same distance as the diaphragm walls; and
- c. construction of a lower platform slab (the NSL platform slab), this structure also spanning the distance between the diaphragm walls and running approximately the same length as those walls.

57. The 'top down process' referred to in sub-paragraph b above describes a method of constructing an underground box whereby, following completion of the sides of the box (the diaphragm walls), a top slab is constructed first, in this case the EWL platform slab. Following construction of the top slab, the soil is excavated below the slab down to the level of the bottom slab. During this stage, the diaphragm walls are supported by temporary propping. When the excavation is complete the bottom slab is constructed, in this case the NSL platform slab. Finally, the temporary propping is removed as the horizontal force is taken up by the new bottom slab.

58. The following diagram – Diagram 5 – gives an indication of the overall structure. The top of the upper EWL platform slab is located approximately at existing ground level. The top of the lower NSL platform slab is located some 10.6 m below existing ground level. The EWL platform slab and the NSL platform slab span the distance – of over 20 m – between the diaphragm walls.

**Diagram 5**



59. It will be seen that the rail lines on the upper platform slab (the EWL slab) sit either fully or partially on top of the diaphragm walls so that the diaphragm walls help to support their weight.<sup>11</sup>

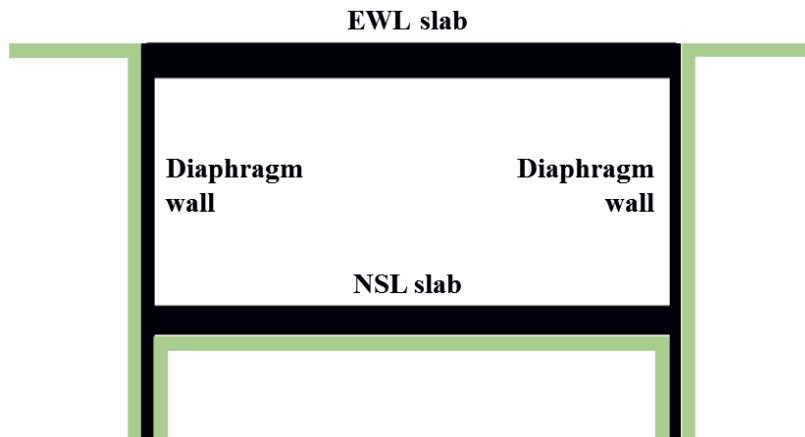
60. The upper EWL platform slab is typically 3 m thick and was described during the Commission hearings as an ‘enormous’ structure. The lower NSL platform slab is typically 2 m thick. The reason for the slabs being so thick is to provide bulk to resist the head of ground water dispersed by the new underground box structure.

61. Conceptually, as the next diagram – Diagram 6 – illustrates, what has been constructed is a rigid, box-like tunnel set into the earth. Dr Mike Glover, who testified before the Commission in his capacity as a structural engineering expert, said that box structures of this kind have been shown universally to be capable of surviving very heavy ground movement, remaining effectively in their elastic zone<sup>12</sup>.

<sup>11</sup> When the structural engineering experts testified before the Commission, it was agreed that, having regard to the design and size of the diaphragm walls and platform slabs, and taking into account the redundancy built into the overall structure (the prudent over-engineering) the weight of the trains with passengers would add very little stress to the structure: perhaps 10%.

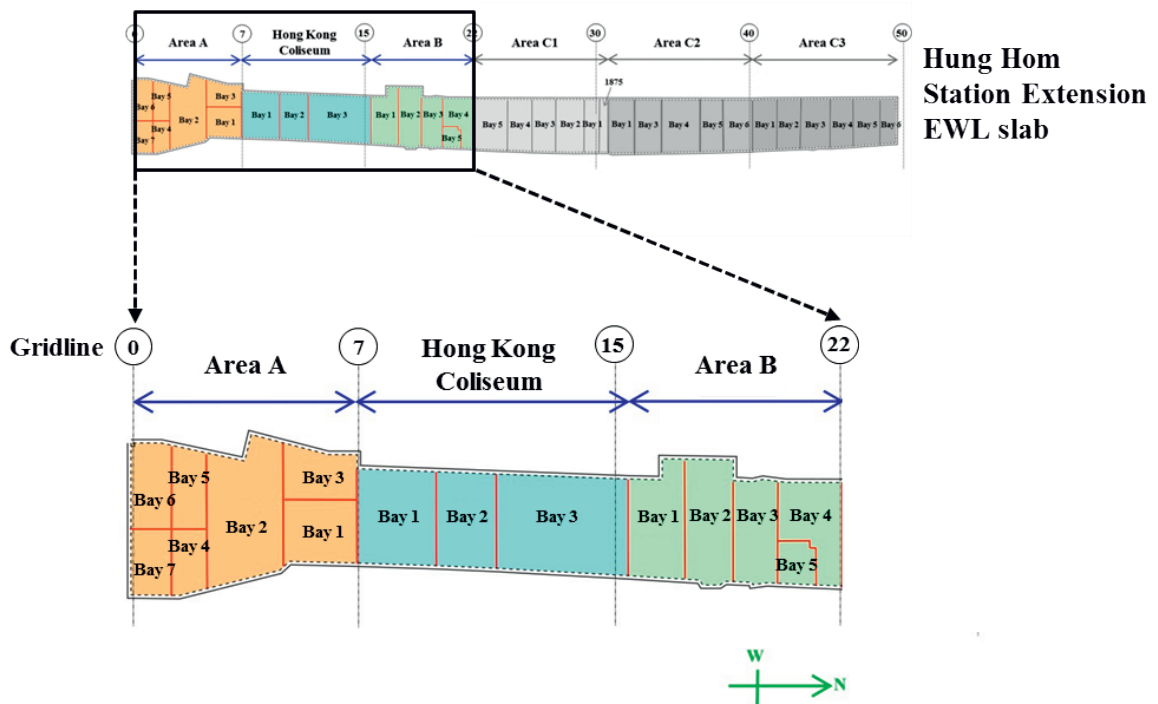
<sup>12</sup> See the testimony of Dr Glover, Day 43 of the inquiry

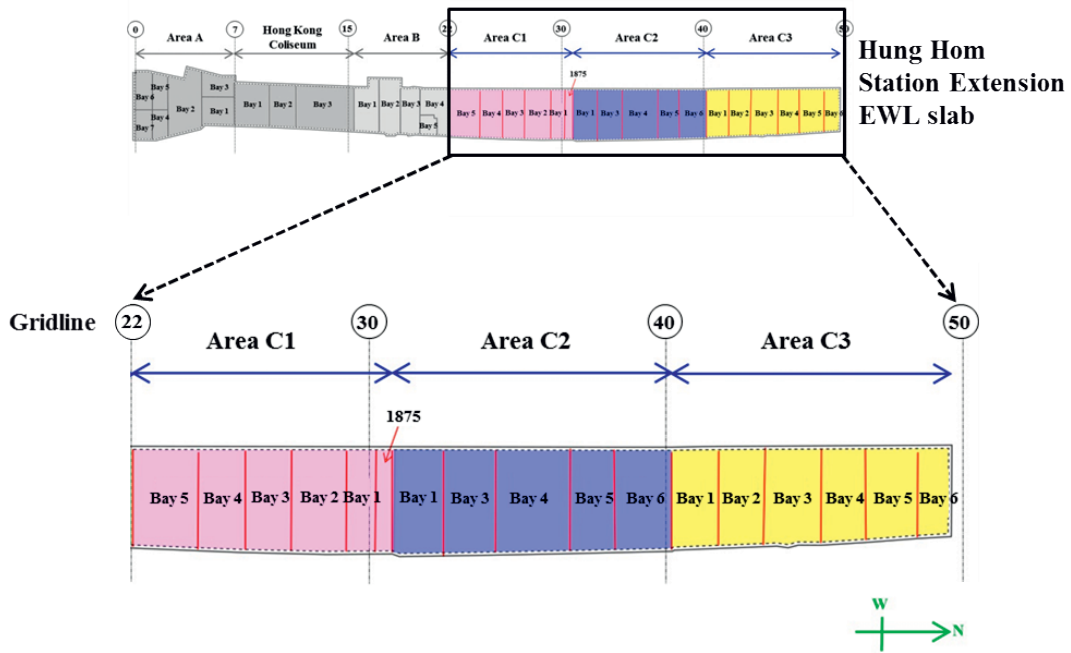
## Diagram 6



62. To better understand the physical extent – that is, the shape and length – of the EWL platform slab (and, by indication, the NSL platform slab below it), the following diagram – Diagram 7 – sets out the division of the EWL platform slab for construction purposes into six separate ‘areas’, each area being divided into separate bays. The ‘areas’ are Area A, Hong Kong Coliseum, Area B and Areas C1, C2 and C3. During the course of this report, a number of references will be made to the areas and bays.

## Diagram 7



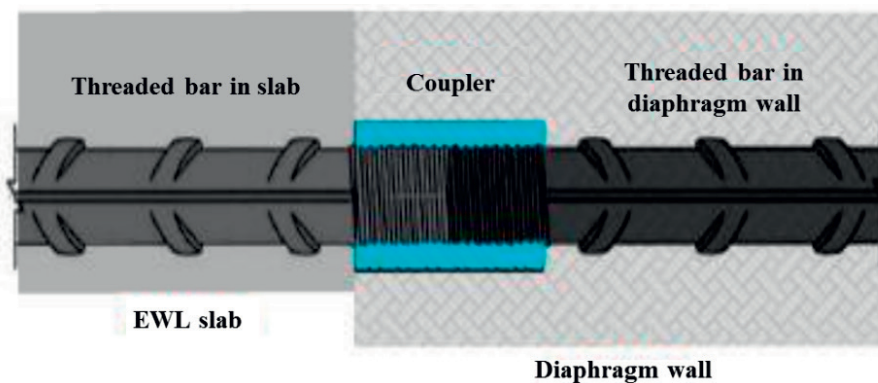


***Use of couplers in the station box structure***

63. In the main, the technical design for the fixed and secure connections of the reinforced concrete structures making up the station box structure – essentially the diaphragm walls and the upper and lower platform slabs – required the steel reinforcement in one structure be connected to the steel reinforcement in another by the use of mechanical couplers.

64. In the context of this report, a coupler may be described as a mechanical device used to connect two rebars at their ends. The diagram that follows – Diagram 8 – depicts a typical coupler connection: the coupler device shown in blue connects a rebar embedded into a diaphragm wall with a rebar embedded into the EWL platform slab.

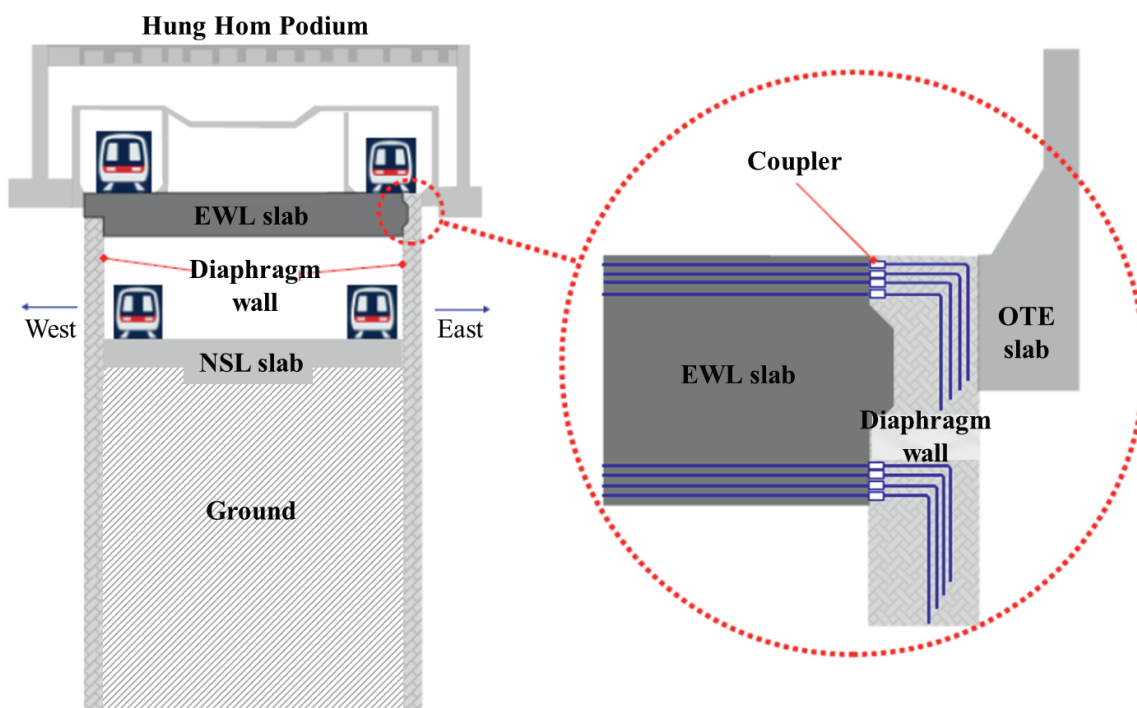
**Diagram 8**



65. As already indicated, both the upper EWL platform slab and the lower NSL platform slab are very large structures. In respect of their connection to the diaphragm walls, both platform slabs are rigidly connected to those walls at each side with ‘shear keys’ and couplers.

66. In Diagram 9 – an illustration depicting the same physical location as Diagram 4 – the shear key is seen as an indentation into the diaphragm wall where the wall connects with the EWL slab.

**Diagram 9**



### ***The supply of couplers***

67. BOSA entered into a contract with Leighton in May 2013 to supply its own proprietary products, namely threaded rebars (bars supplied by Leighton and threaded by BOSA) and couplers. More specifically, it contracted to provide all necessary labour, supervision, plant, equipment and materials for the supply of couplers and the threading of rebars, including the supply of necessary samples, reports, quality plans and the like. It is important to note that BOSA provided seminars to instruct those who would undertake the work

of connecting the rebars into the couplers. In October 2013, BOSA set up a fabrication plant on site.

### ***Classification of rebars and couplers***

68. BOSA supplied two types of rebar<sup>13</sup>, ‘Type A’ and ‘Type B’. Type A rebars had approximately 10/11 threads while Type B rebars had almost twice that number, approximately 20/21 threads.

69. During the course of the Commission hearings, there was evidence that it may have been an occasional practice, if for any reason Type A rebars were in short supply on site, to convert Type B rebars to Type A rebars by cutting away the ‘excess’ threads. While (understandably) this was not a practice recommended by BOSA, provided the shortened threads could be screwed into a coupler, the Commission is satisfied it would not have presented any safety risk.

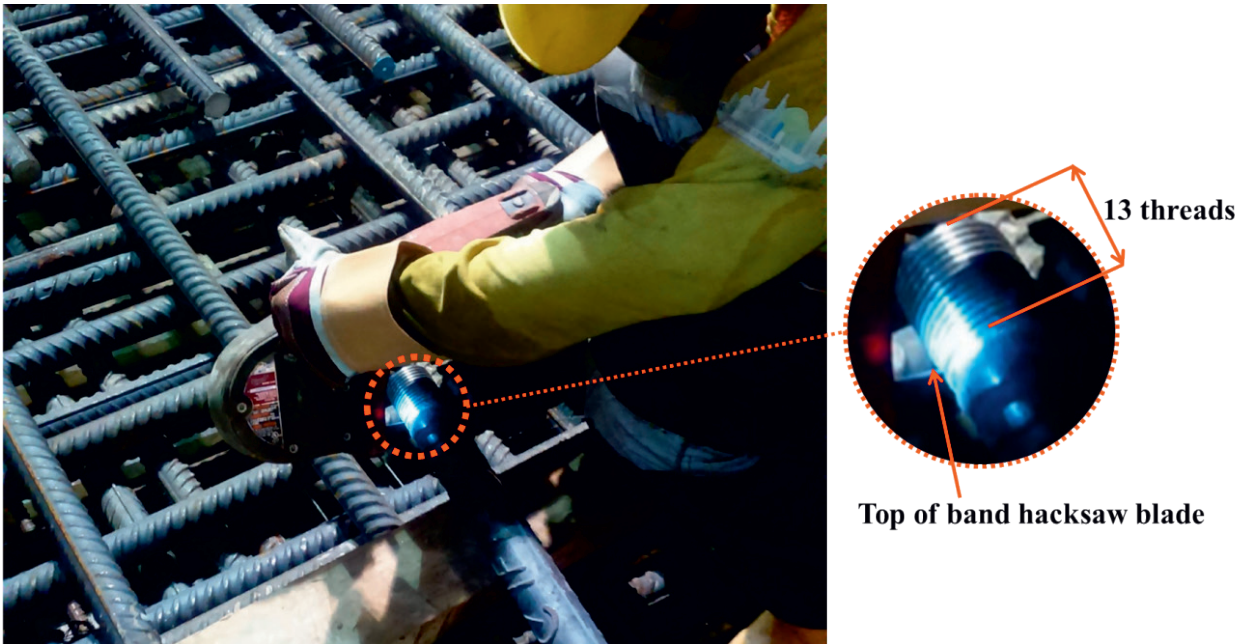
70. A photograph taken by Jason Poon of China Technology – a photograph which took on considerable significance during the hearings – appears to show a worker using a cutting machine to trim 10 or 11 threads from a Type B rebar to convert it into a Type A rebar.<sup>14</sup> An analysis of the photograph (duly enlarged) was made by Professor McQuillan, the Commission’s expert on matters of structural engineering, to demonstrate that the photograph was not simply of a Type A rebar having its 10/11 threads reduced so that it need not be fully screwed into a coupler but was rather of a conversion from Type B to Type A taking place. The photograph appears on the following page.

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<sup>13</sup> Rebar was supplied to BOSA by Leighton. BOSA threaded the Type A and Type B rebars and provided them to the site for steel-fixing by Fang Sheung.

<sup>14</sup> This photograph was one of three or four photographs taken one evening by Jason Poon showing the cutting of threads and almost immediately thereafter the installation of what may well be the same rebar into the diaphragm wall.

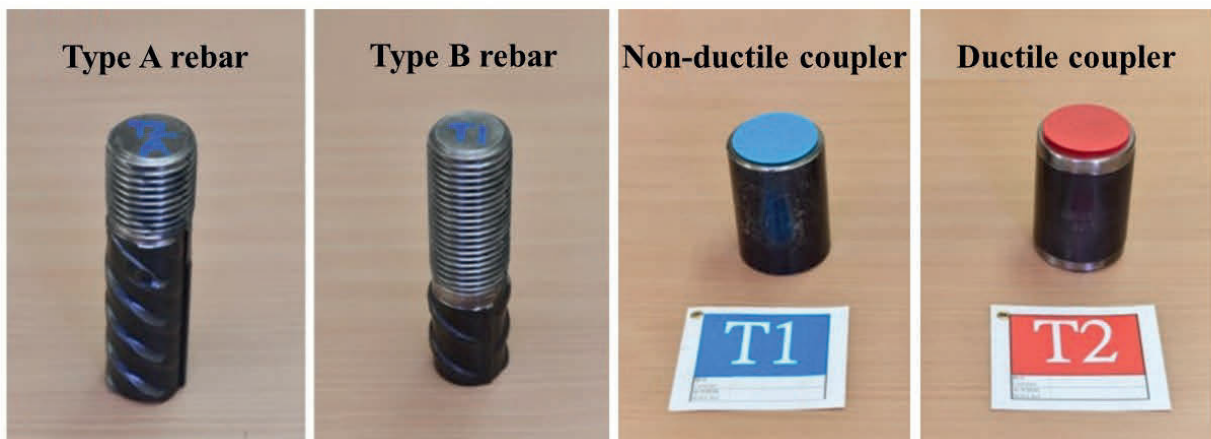
**Photograph 1**



71. BOSA also supplied two types of couplers, Type I and Type II, being non-ductile and ductile couplers respectively. The Commission heard evidence that, in order to avoid error, *only* ductile couplers – ‘Seisplisce’ couplers – were ordered by Leighton.

72. The following photographs show Type A and Type B rebars and Type I and Type II couplers. Type II couplers had red protective caps, whereas Type I couplers would have blue protective caps.

**Photograph 2**



## *Incorporating rebars and couplers into the station box structure*

### *A. The diaphragm walls*

73. The first construction process requiring the use of rebars connecting into couplers was the reinforcement for the diaphragm walls which were constructed by Intrafor.

74. The diaphragm walls are 1.2 m thick and are constructed in a series of panels which vary in width from about 2.8 m to 6.5 m. The length (or depth) of the panels also vary as the diaphragm walls are formed of ‘hit’ and ‘miss’ panels. The ‘hit’ panels are required to be founded on bedrock and the depth of the bedrock naturally varies. The ‘miss’ panels are, in practical terms, in-fills between the ‘hit’ panels and are taken to a shallower depth.

75. Reinforcement is provided by a series of reinforced steel cages.<sup>15</sup> Each cage, when fabricated, is lowered into its excavated site. Each cage, however, must be connected to the next cage and this is achieved by the use of Type B couplers.<sup>16</sup>

### *B. Reinforcement in the platform slabs*

76. The next process of construction which required the use of couplers was the installation of the steel reinforcement for the two platform slabs. In this regard, the following stages of construction may be better understood by having regard to the following diagram (which is an enlargement of Diagram 9):

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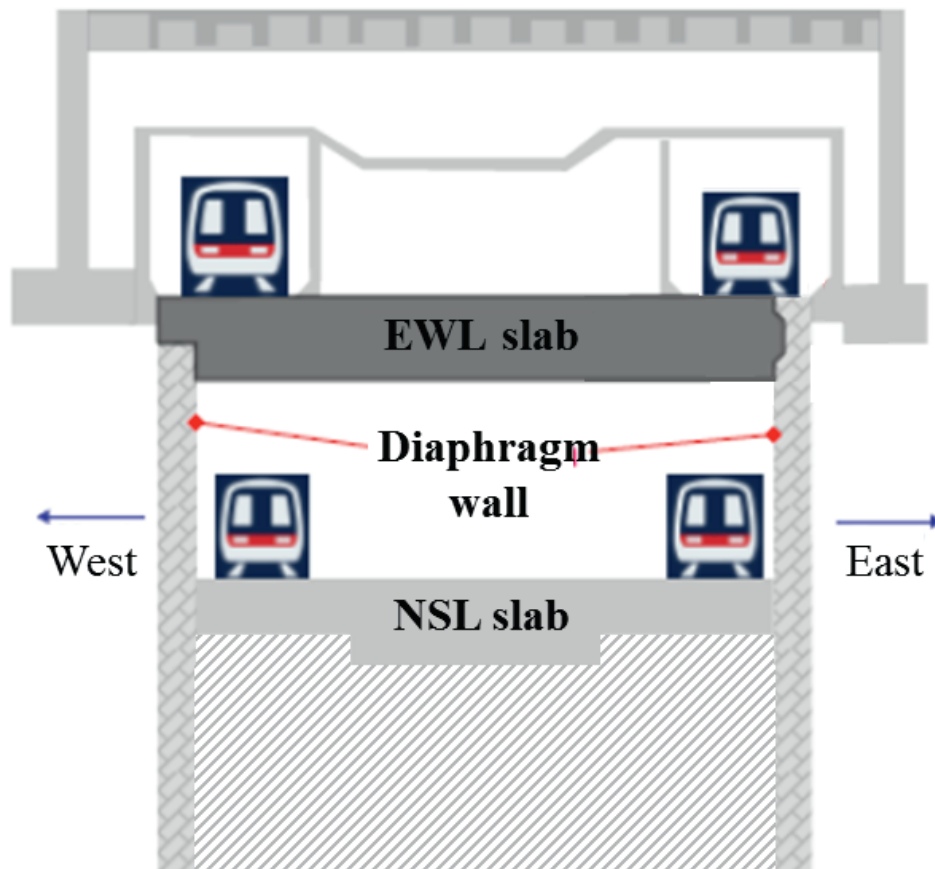
<sup>15</sup> The Commission was informed that the grade of steel used in all the reinforcing works in the station box structure was 460.

<sup>16</sup> ‘Type B couplers’ means Type B threaded bars screwed into couplers.



## Diagram 10

### **Hung Hom Podium**



- a. On the inside of the east diaphragm wall (also known as the excavation side), the reinforcement cages incorporate horizontal rows of couplers designed to connect with rebars set into the EWL platform slab and the NSL platform slab.
- b. Remaining on the inside of the east diaphragm wall, both the EWL platform slab (3 m thick) and the NSL platform slab (2 m thick) contain horizontal rows of rebars towards the top of the slab (the 'top mat') and further horizontal rows of rebars towards the bottom of the slab (the 'bottom mat').
- c. Moving now to the west diaphragm wall, the diagram shows a different design. Here, part of the upper EWL platform slab rests on top of the diaphragm wall. To accommodate this, vertical couplers are incorporated into the top reinforcement cages of the diaphragm wall panels.

- d. There is no change in the manner in which the lower NSL slab connects to the diaphragm wall and here, therefore, the rebars which connect with the wall follow the same formation as in sub-paragraph b above.

### ***C. Connection joints on the two platform slabs***

77. The next stage of construction requiring the use of rebars being spliced with couplers was the formation of connection joints connecting the bays of poured concrete on the EWL and NSL platform slabs. Diagram 7 gives an indication of the various areas and bays.

### ***Putting the construction process into a time frame***

#### ***Design plans***

78. Atkins was engaged by both MTRCL and Leighton. It was first engaged by MTRCL as a detailed design consultant in January 2010. Later, in April 2012, it was engaged by Leighton as a technical adviser, taking up work in this regard a year later in April 2013. To address any concerns as to conflict of interest, Atkins set up two teams (Team A for MTRCL and Team B for Leighton)<sup>17</sup>.

79. Atkins was responsible for preparation of the engineering designs for the construction of the diaphragm walls and both the EWL and NSL platform slabs.

#### ***The diaphragm walls***

80. Intrafor was engaged as a sub-contractor by Leighton on a 'construction only' basis for the construction of the diaphragm walls, barrettes and associated works. Intrafor executed its construction works in accordance with design plans provided to it by Atkins. Intrafor engaged Hung Choi as its sub-contractor for the steel fixing works.

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<sup>17</sup> The issue of conflict of interest will be addressed later in this report.

81. Intrafor commenced work at the site in May 2013. It installed the prefabricated steel reinforcement cages for the first panel of the diaphragm wall (EM 98) in July 2013. Once the cages and their connections had passed inspection, it was permitted to pour the concrete. It then proceeded to build the rest of the panels, doing so between August 2013 and June 2015. The final panel (EH 78) was completed on 27 June 2015.

82. Following the completion of the final panel, Intrafor carried out pumping tests to draw down the groundwater level to permit excavation without flooding. This work was done between the end of June 2015 and January 2016. This marked the completion of Intrafor's work.

83. Intrafor had no involvement with the actual construction of the EWL and NSL platform slabs. Intrafor's only responsibility concerning the two platform slabs was to install, inside the diaphragm walls, a number of starter bars with couplers attached, these starter bars and couplers enabling Leighton (as main contractor) to connect the steel reinforcement of the two platform slabs to the diaphragm walls. The starter bars with couplers attached had to be protected by Intrafor so that they would not be damaged when concrete was poured.

84. When the diaphragm walls were completed, in order to make the connections, Leighton had to do the following:

- a. expose the couplers by breaking out some of the concrete on the face of the diaphragm walls and removing the polystyrene and cardboard protection placed there by Intrafor;
- b. remove the protective plastic caps from the couplers, making sure that the couplers were clear of all foreign materials;
- c. screw the threaded rebars of the platform slabs into the couplers.

85. At this juncture, it is appropriate to state that there has been no suggestion made during the course of the Commission hearings, let alone any evidence put forward, to suggest that the rebars (or their threads) used to fabricate the reinforcement cages for the diaphragm walls were ever cut in any illicit manner or that the connections within the cages or the connections

between the cages are in any way deficient.<sup>18</sup> In summary, the Commission has no reason to question the structural integrity of the diaphragm walls.

### *The platform slabs*

86. China Technology was engaged as a sub-contractor by Leighton in May 2015 to erect the formwork and undertake the concrete placing for the construction of both the EWL platform slab and the NSL platform slab. The sub-contract required it to provide ‘all necessary labour, supervision, plant, equipment and materials’ to undertake the formwork and the concrete placing. It commenced work in terms of the sub-contract in July 2015.

87. Fang Sheung entered into three sub-contracts with Leighton in order to install the steel reinforcement for the platform slabs. This involved all necessary bar cutting, bending and fixing works on the slabs. It further involved connecting the joints between the slabs making up the EWL and NSL platform slabs and connecting the platform slabs to the diaphragm walls. The first subcontract was entered into in April 2014. The sub-contracts were ‘construction only’ contracts.

88. Fang Sheung was not responsible for any of the technical designs nor for the purchase of construction materials, that is, the rebars and couplers.

89. Should any couplers be damaged, it was further the responsibility of Leighton, at its expense and using its own labour, to repair or replace them.

90. The evidence put before the Commission indicated that, if a coupler was intact and set at the correct angle, and if there was a reasonable amount of working room, a rebar – 4 m in length – would take only about 30 seconds to be fully screwed into a coupler. Obviously, if a coupler was not set at the right angle, if its threads were damaged or if it contained concrete debris or dust, the installation process would take much longer. The same would apply if the threads of the rebars to be installed into the couplers were damaged or if the

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<sup>18</sup> In about May or June 2018, a video and photographs were circulated in the media, the suggestion being made that they were evidence of improper coupler connections within steel reinforcement cages in the course of fabrication. It appears that the material was recorded in or about July 2013. Early in the Commission hearings, the photographic material was examined. It suffices to say that, considered in its accurate context, the photographic material was not evidence in any way whatsoever of improper fabrication of cages or improper installation or splicing of couplers.

rebars themselves were overly congested or the couplers set at the incorrect angles.

### ***The order of work by China Technology and Fang Sheung***

91. China Technology and Fang Sheung worked in close proximity to each other. China Technology was required to erect the initial formwork. Fang Sheung would then install the steel reinforcement. Once that was completed, China Technology would erect the remaining formwork, remove any debris and clean out the bay ready for concreting. Finally China Technology would pour the concrete.

92. The Commission heard evidence from Khyle Rodgers, a Leighton Superintendent, that in respect of each bay the process of construction was largely driven by the rebar fixers, that is, by Fang Sheung. China Technology would have to wait until the rebar fixing had been completed and approved before it could complete its formwork and pour concrete. Equally, however, the quicker the rebar fixing was completed in each bay, the quicker China Technology had to work and the more people it had to put on the job.

93. China Technology had no responsibility for ensuring the adequacy of the steel reinforcing works undertaken by Fang Sheung. This was the responsibility of Leighton and MTRCL.

94. In order to give an indication of the overall chronology of events, the recorded concrete pour dates given to the Commission show that China Technology began at the end of May 2015 and completed pouring in mid August 2016<sup>19</sup>.

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19 The pour dates are as follows –

- a. Area C1: 30 May 2015 to 22 December 2015;
- b. Area C2: 14 September 2015 to 23 November 2015;
- c. Area C3: 23 October 2015 to 28 December 2015;
- d. Area B: 25 November 2015 to 12 January 2016;
- e. HK Coliseum: 11 July 2016 to 16 August 2016;
- f. *North Approach Tunnels* : 7 November 2015;
- g. *South Approach Tunnels* : 13 December 2016.

It seems that the last two concrete pours (in italics) were not done by China Technology.

### *The use of hand-held cutting machines*

95. The public concern that arose in May 2018 was focused on assertions that during the installation of the steel reinforcement works there had been systematic and widespread cutting of threads from the end of rebars. That cutting, of course, insofar as it may have taken place, had to be carried out with the use of powered machinery: not the sort of machinery, even though hand-held, that could easily be concealed.

96. What must be understood, however, is that cutting machinery had a legitimate place on the work site for any number of purposes. By way of example, rebars may need to be cut in order to create openings in the steel reinforcement provided for in the design plans.

97. The use of powered cutting machinery to cut rebars was never a concern. The concern arose only in respect of the cutting of BOSA's *threading* at the end of rebars.

## Chapter 4

### Changes in design

98. During the course of the Commission hearings, considerable attention was paid to the changes of design and construction detail that was implemented at the top of the east diaphragm wall in Areas B and C to 66 out of the 76 diaphragm wall panels, essentially between grid lines 15 and 50.

99. On the evidence before the Commission, there were two distinct changes. The Commission notes however that, in the event, neither of these two changes compromised the structural safety of the completed works.<sup>20</sup> The history of the two changes may be summarised as follows.

#### *The first change*

100. In respect of construction detail, the originally accepted design was as follows:

- a. The diaphragm wall was to have ‘U’ bars at the top of the wall, spaced out uniformly.
- b. On the excavation side of the diaphragm wall, in the EWL slab, there were to be two horizontal rows of rebars in the top mat. These rebars were to be connected to the diaphragm wall by couplers. It was through these couplers that the reinforcement continued into the diaphragm wall and bent downwards in order to provide the necessary anchorage.
- c. On the other side of the diaphragm wall, in the OTE slab, there was to be one horizontal row of rebars in the top mat. These rebars were to be similarly connected to the diaphragm wall by couplers. And through these couplers the reinforcement continued into the diaphragm wall and bent downwards to provide anchorage.

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<sup>20</sup> The structural safety implications of the changes in design are discussed in Chapter 9 of this report.

- d. All of the reinforcement was designed with uniform spacing between rebars.

101. This originally intended arrangement of the reinforcement is illustrated in Diagram 4 in the previous Chapter of this report.

102. In about July 2013, when the construction of the diaphragm walls began, Leighton and Intrafor proposed a change to the arrangement of the rebars, leaving out the ‘U’ bars because of the need to accommodate a pipe to permit pumping of the concrete into the diaphragm walls (a so called ‘tremie pipe’).

103. MTRCL’s construction management team had knowledge of this proposal and agreed with it. Atkins Team A (working for MTRCL) and Team B (working for Leighton)<sup>21</sup> were also aware of and agreed with the change, the ‘first change’ was therefore implemented on the site.

104. There was, however, a problem. Seemingly due to miscommunication, MTRCL’s design management team did not know about the change. In the result, there was no consultation submission made by MTRCL to the Buildings Department.

105. It was only in about January 2015 that the MTRCL design management team came to know of the existence of this change and only in about April 2015 that the Buildings Department came to know. In a letter dated 21 May 2015 from the Buildings Department to MTRCL full clarification of the position was required.

### ***The second change***

106. The ‘second change’ is rather more complicated.

107. Apparently in anticipation of the Buildings Department’s reaction to the first change, in February 2015 Atkins Team B produced a remedial proposal that they only intended to be applied to two diaphragm wall panels – panel numbers EH105 and EH107. This proposal entailed breaking down the top

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<sup>21</sup> The role of Atkins is discussed in Chapter 10.



portion of those two particular diaphragm wall panels and adding the required number of rebars as per the accepted design drawings.

108. It appears that iterations of this change proposal were considered, and that by May 2015 Atkins Team B suggested that between gridlines 22 and 40 a way of implementing the ‘first change’ was to:

- a. trim down the top portion of the diaphragm walls;
- b. use ‘through bars’ to replace the couplers; and
- c. concrete the EWL slab, the top of the diaphragm wall and the OTE slab in one piece.

109. By around early June 2015, it appears that Atkins (in this case, through both Teams A and B) had come out with another and different proposal to deal with the ‘first change’. This new proposal did *not* require the trimming down of the top of the diaphragm wall *or* the attendant use of ‘through bars’. Instead, the proposal was to cast the EWL slab and the OTE slab at the same time, leaving the diaphragm wall intact. By doing so, this would ensure “monolithic behaviour” between the various components, thereby providing the missing anchorage that had resulted from the omission of the ‘U’ bars.

110. This latest proposal was apparently discussed between MTRCL’s design management team, Atkins, Buildings Department and PYPUN (the M&V consultant) in June 2015, and was included in the permanent design report sent by MTRCL on 9 July 2015 for the Buildings Department’s consideration.

111. Unfortunately however, when Atkins Team B produced the temporary works design report on or about 17 June 2015, the previous proposal – which included the trimming down of the top of the diaphragm walls – was left in the report.

112. It appears to the Commission that the sequence of events described in the previous five paragraphs caused confusion on site.

113. At around the same time, there were various other construction difficulties encountered with the horizontal couplers at the top of the east

diaphragm wall. As a result, MTRCL's construction management team and Leighton agreed to adopt Atkins' previous proposal to trim down the top portion of the diaphragm walls; use through bars to replace the couplers; and concrete the EWL slab, the top of the diaphragm wall and the OTE slab in one piece. This they implemented to 66 of the 76 east diaphragm wall panels between grid lines 15 and 50. This became the 'second change'.

114. The remaining 10 panels had local constraints – such as accommodating underpinning, culverts or air ducts – that prevented the trimming down of the top of the diaphragm wall. Hence the couplers remained in these few panels.

115. It appears that MTRCL's construction management team was under the impression that its design management team would update the working drawings and would obtain approval for the change from the Buildings Department: part of the consultation process. However, as stated earlier, the design management team did not know about the second change, indeed they only became aware of it in or around July 2018, well after media reports had caused such disquiet in the community as to the manner of coupler installation.

116. Formal permanent works submissions made by MTRCL to the Buildings Department did not include the second change because MTRCL's design management team was simply unaware of it. For the reasons set out later in this report, a direct consequence of this was to have serious ramifications.

## Chapter 5

### **Jason Poon: examining the circumstances in which his concerns came into the public eye**

117. As the Commission noted earlier in this report, it was in May 2018, approximately 18 months *after* the construction of the diaphragm walls and platform slabs had been completed, that disturbing reports began to appear in the media as to their structural integrity.

118. The essential focus of the media reports – at *that* time – was an alleged failure to ensure that the great many coupler connections had been securely fixed. It was suggested that there had been systematic and extensive cutting of the threads at the end of rebars so that they were not fully screwed into the couplers or indeed screwed in at all, an illicit practice made possible by a failure of oversight on the part of MTRCL and Leighton.

119. As the Commission further noted, whoever, or whatever, may have been the original source of the media reports, it was Jason Poon who led the march of concern.

120. Both MTRCL and Leighton refuted the assertions of systematic and extensive cutting of the threads from rebars. It was said that, at best, Jason Poon's assertions constituted a gross exaggeration, at worst, a fabrication. It was said that the genesis of those assertions had been a desire to obtain commercial advantage in on-going commercial disputes between China Technology, as sub-contractor, and Leighton, as contractor and paymaster. It was Leighton's position that the commercial disputes had arisen because of China Technology's own inefficiencies and consequent failure to meet productivity outputs. It was suggested that it was no mere coincidence that Jason Poon's allegations arose (and/or were resuscitated) at those particular times when, on any objective assessment, he must have believed that it would be to his commercial advantage in his dispute with Leighton.

121. Jason Poon testified over a period of six days. It was his evidence that the illicit cutting of threads from rebars, while he could not say that it was widespread, was nevertheless a systematic activity and, in addition, was planned.

122. This systematic activity, he said, was able to continue because, from about August 2015 through until about June 2016, there was an almost complete failure of supervision, this failure permitting the activity to continue. It was his evidence that, although formal inspections took place, hour-by-hour supervision was almost entirely lacking. In this regard, for example, he said:

“There’s no one, no supervisor from Leighton on site watching the works... They did not supervise the carrying out of the works. There were people there but they would not watch the works. They would just sit in their own foremen’s office; they would go out for tea. And other than when the MTRCL came, they wouldn’t show up.”

123. Jason Poon explained what he meant by ‘planned’: it was not merely a case of unintended poor workmanship but constituted calculated conduct.

124. As to the meaning of ‘systematic’, the Commission understood Jason Poon to be saying that there existed a form of condoning of this calculated conduct which enabled it to increase from sporadic, isolated behaviour into a system of conduct that was dishonest, indeed corrupt. It appears that Jason Poon first raised this allegation in an email dated 15 September 2017 sent to Anthony Zervaas, Leighton’s Project Director. In part, it said:

“We opine all damaged and malpractice couplers, including installing without torque test<sup>22</sup> and cheating practice by Leighton direct staffs cutting away most of the threads, estimating over 30,000 pieces involved, must be tackled...”

125. Jason Poon’s evidence before the Commission could not be misunderstood. The following exchange with the Chairman defies ambiguity:

Chairman: “... what you’re suggesting is fairly profound, because you’re suggesting a form of articulated, organised sabotage.”

Jason Poon: (in English) Correct.”

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<sup>22</sup> This allegation of failing to conduct torque tests was not pursued by Jason Poon. It was entirely misguided, the couplers and rebars manufactured by BOSA and supplied to site not requiring such tests.

126. It is to be emphasised that Jason Poon did *not* persist with his allegations of dishonest or corrupt practice on the part of Leighton. In the comprehensive final submissions made in writing on behalf of China Technology, no reference was made to those allegations. To the contrary, in saying that the cutting of threads from rebars had occurred – although not suggesting to what extent – it was submitted in the final submissions that it had been due to a combination of factors related solely to engineering or project management factors: the quality of couplers; poor supervision of, and poor workmanship by the rebar fixers; tight time schedules; and poor quality supervision by the staff of both MTRCL and Leighton.

127. That does not mean however that the issue of corruption can simply be struck from consideration. Once aired publicly before the Commission, it was a matter which demanded resolution.

### *Alleged dishonest / corrupt practice*

128. When he testified before the Commission, Jason Poon said that he had not previously recorded his allegations of dishonest and/or corrupt conduct in any public document (including his statements) because he had provided a statement to the Independent Commission Against Corruption (‘ICAC’) and believed that the terms of the statute governing such reports bound him to secrecy<sup>23</sup>.

129. [REDACTED]  
[REDACTED] It was not a question of under supplying rebars or couplers; it was not a question of supplying items of inferior quality. Jason Poon’s allegations appear instead to have been to the following effect:

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<sup>23</sup> It is recorded that, after Jason Poon had completed his testimony, a copy of his statement made to the ICAC on 5 July 2018 was provided to the Commission. Parts of the statement had been redacted and the names of individuals disguised. The statement was considered by counsel for the Commission. Entirely independently, it was also considered by the two members of the Commission. On 3 December 2018, Mr Pennicott, Counsel for the Commission, announced publicly that he and his junior counsel had formed the view that it would not be appropriate to introduce the statement into proceedings before the Commission. He was of the view that it did not take the matters that had been ventilated in the inquiry any further. The Commission agreed, the Chairman saying the following: “...entirely separately, without any consultation with Mr Pennicott, both myself and Professor Hansford... reached the view that it would not advance any of the matters which have arisen in this Commission of Inquiry and therefore the statement would form no part whatsoever, direct or indirect of this Commission’s decision-making process.”

- a. Leighton, the main contractor, employed a pool of casual labourers, through sub-contractors such as Rankine Engineering, paying them on a daily basis. These labourers were not hired for any specific task but would be deployed to undertake work which was not the responsibility of any specific sub-contractor or, if a sub-contractor met any particular difficulties, would be deployed to assist that sub-contractor and thus ensure that work schedules were kept up-to-date. The pool of manpower was managed by Leighton's on-site superintendents and/or other senior on-site staff.
- b. It was Jason Poon's allegation that this pool of labour was more liberally made available to certain sub-contractors to bolster their workforces in discharging their contractual obligations. This was done without charge thereby reducing the labour costs of those sub-contractors. In return, the Leighton staff who provided the largesse were better able to ensure that these sub-contractors kept up to schedule with their work and enjoyed the added benefit, as Jason Poon put it, of getting something in their pocket: in short, a kickback.
- c. It appeared to be Jason Poon's implication that the inevitable consequence of the injection of essentially untrained and inexperienced labourers into the workforce of these sub-contractors resulted in a lessening of the quality of work that was carried out, a matter in respect of which Leighton's superintendents and other on-site staff effectively turned a blind eye. This, it appeared to be suggested, was one of the reasons for the poor quality of Leighton's supervision and inspection.
- d. As the Commission understands it, [REDACTED] [REDACTED] it was his assertion that the cutting of the threaded ends of rebars was not simply opportunistic or sporadic, an impermissible step taken by workmen facing difficulties, but became 'systematic' and 'planned' because these corrupt practices permitted it to happen. Expressed another way, these daily labourers – employed by Leighton and wearing Leighton uniforms – were able to take shortcuts to part of the system of their work because they knew they could get away with it.

130. [REDACTED]

131. Jason Poon said that in or about August or September 2016 he had met and confided in Malcolm Plummer, Leighton’s Project Director before Anthony Zervaas had taken up the position. However, when Malcolm Plummer gave evidence, he emphatically denied any conversation concerning corrupt conduct. He said that nothing like it had ever occurred. Mr Plummer said that during his time as Project Director of Leighton no allegations of this kind had ever been made to him. In any event, he did not see how it could happen: the ‘day-work labour’, he said, was employed in completely separate areas of the job.

132. No other witnesses who appeared before the Commission raised the possibility of any form of corrupt practice.

133. [REDACTED]

### *Events in 2015 and 2016*

134. China Technology kept an office close to the Contract 1112 site. Regularly, there would be ‘lunch box’ meetings in the office attended by Jason Poon and the more senior members of his company. It was at these meetings, said Jason Poon, that he first received reports that workers, wearing Leighton clothing, had been seen cutting the threads from rebars.

135. In August 2015, said Jason Poon, he himself witnessed it happening. He said that he was conducting a site inspection (between bays 2 and 3 of Area C1) when he saw three men wearing Leighton reflective vests cutting the threads from rebars. He attempted to stop them. He was ignored. In early September, he said, he reported this incident to Gabriel So and Khyle Rodgers, Leighton’s site superintendents, who assured him that they would instruct all Leighton employees that it was impermissible conduct.

136. A month or so later, in about mid-September 2015, Jason Poon said that he was on a site inspection with both Gabriel So and Khyle Rodgers when they saw a workman wearing Leighton clothing using a hand-held cutter to cut the threads off a rebar – his second sighting. Jason Poon said that he wanted to intervene but Gabriel So queried what the problem was and allowed the workman to continue.

137. Jason Poon’s evidence in respect of this incident supported his assertion that even the management of Leighton was prepared to turn a blind eye to the illicit practice. However, both Gabriel So and Khyle Rodgers denied that any such incident had taken place. Gabriel So said that at no time would he have allowed a worker to cut the threads from a rebar.

138. [REDACTED]

139. Jason Poon testified that, as a result of this incident, he determined to obtain a photographic record if he saw further cutting of threads from rebars. As it was, he said, he saw the same illicit activity taking place again – his third sighting. This time he was able to use his mobile telephone to take two photographs and to make a short video clip recording. These photographs were not made available to the Commission. It was Jason Poon’s evidence that much later in time, in September 2017, he was persuaded by Anthony Zervaas and Karl Speed, two senior members of Leighton, to destroy the records. This allegation will be considered later in this report.

140. However, it was Jason Poon’s evidence that on the evening of 22 September 2015 he again saw a workman in Leighton clothing using what he believed to be a hydraulic cutter to remove the threads from a rebar, this being his fourth sighting. That same bar, he said, was then seemingly inserted into a coupler in the diaphragm wall, an action which he was also able to photograph. In respect of this incident, Jason Poon was able to submit to the Commission a



series of some four photographs. The photograph of the actual cutting of the threads appears earlier in this report as Photograph 1: paragraph 70. It shows a worker converting a Type B bar into a Type A bar. While not to be condoned, this practice does not present the same safety risk as cutting the threads on a Type A bar.

141. Jason Poon witnessed no further incidents of the cutting of threads from rebars. He saw no such illicit activity in 2016. It was his evidence, therefore, that over a period of some four or five weeks, between August and late September 2015 he witnessed the activity on four occasions but not thereafter.

142. According to Jason Poon, however, he continued to try and make the management of Leighton aware of the illicit practice. In this regard, he testified that in September 2015 he made a report to Aidan Rooney, the General Manager of MTRCL. Aidan Rooney flatly denied that any such conversation had taken place.

143. Jason Poon testified that almost a year later, in about late November 2016, Anthony Zervaas admitted to him in a conversation that there had been a practice of cutting threaded rebars. The two of them, he said, discussed how best to deal with the problem. Shortly thereafter, however, according to Jason Poon, Anthony Zervaas became reluctant to discuss the matter, telling him that it was none of China Technology's business.

144. Anthony Zervaas denied any such conversations. However, he *did* recall that discussions took place in early December 2016 related solely to commercial matters, more particularly seeking to agree a revised payment schedule. In this regard, in his witness statement dated 13 September 2018 he wrote:

“On 12 December 2016, after several meetings that month, I agreed a revised milestone and final account payment schedule with [Jason] Poon for the Subcontract [that document being exhibited]. Under the revised schedule, China Technology would receive progressive payments from Leighton based on achievement of various milestones, which China Technology agreed to.”

145. A couple of days before the meeting at which a revised payment schedule had supposedly been agreed, on or about 9 December 2016, Jason

Poon said that he had a telephone conversation with Dr Wong Nai Keung, Philco, Dr Wong being the Projects Director of MTRCL and a member of its Executive Directorate. During this conversation, he said, he reported the incidents of illicit thread cutting to Dr Philco Wong. This was denied by Dr Philco Wong. His recollection of the conversation was that it was related solely to commercial matters. He remembered that Jason Poon had asked him for assistance in sorting out his financial dispute with Leighton. After that conversation, he remembered telephoning a colleague, Raymond Au, the Commercial Manager from the Procurement and Contracts Department, asking that he speaks to Jason Poon. He had approached Raymond Au, he said, because, as he understood it at the time, Jason Poon's concerns were entirely commercial.

146. For the period of 18 months calculated from mid-2015 until the end of 2016, therefore, Jason Poon said that he had made reports to the following people: Anthony Zervaas, Leighton's Project Director; Gabriel So, Leighton's General Superintendent; Khyle Rodgers, a Leighton Superintendent; Aidan Rooney, MTRCL General Manager; and Dr Philco Wong, the MTRCL Projects Director. *All* of these persons denied that there had been any such conversations.

147. [REDACTED]

### ***Events in 2017***

148. The first *documentary* evidence of Jason Poon articulating his concerns was contained in an email sent by him to Leighton on the morning of 6 January 2017. It was sent to Anthony Zervaas, copied to Joe Tam, Leighton's Construction Manager for Contract 1112.

149. The email of 6 January 2017 was one of a string of emails in which the progress of work by China Technology, and consequent payments due to it, were in dispute. In the email of 6 January 2017, Jason Poon said that, in its

review of its sub-contract work, China Technology staff had come across photographic and video records confirming malpractice in the coupling of rebars. In the course of his testimony before the Commission, Jason Poon had said that he had only conducted a search of photographic records in order to prove what was due to China Technology under contract. However, in the process of conducting that search, photographic records indicating the true seriousness of the illicit conduct of cutting threads from rebars had been revealed. As to the nature and extent of the malpractice revealed by the cache of photographs, in the email Jason Poon did not limit his allegations to the cutting of threads from rebars. The cutting of threads remained central but within the context of a broader range of criticisms. These criticisms may be summarised as follows:

- a. Along the shear face of the EWL platform slab it was common to find that couplers embedded into the diaphragm wall had been damaged, particularly in respect of their internal threading, or pushed out of alignment. In such instances, Leighton ‘labour’ had cut away the threaded section at the end of the rebars, placing them against the couplers so as to pretend that there had been a true installation. These illicit activities, it was said, had been deliberately conducted in the period between the day shift and the night shift when there was “vacant supervision”.
- b. The same illicit practice had been witnessed and recorded along the shear face of the “transverse construction joints between pour bays on the whole EWL platform slab”.
- c. China technology employees had witnessed that there was no inspection process to ensure secure installation of the rebars into couplers<sup>24</sup>.

150. Jason Poon wrote that, in light of these matters, he doubted the structural safety and life time of the EWL platform slab especially in certain structurally critical areas. He then went on to say (in unnerving terms) that if in the future the EWL track – which would be carrying heavy trains filled with passengers – failed, there would be a crisis in public life. Jason Poon concluded

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<sup>24</sup> This is the meaning given by the Commission to the following phrase: “ ... there is no propose inspection to the use of coupler on site.”

with a threat to make the issue public unless there was an immediate response from Leighton. He wrote:

“We demand a feedback by end of today including records [proving] the certainty [of structural safety], or we will report this finding directly to the LegCo Panel on Transport and ask for [a] public investigation ...”

151. It is to be noted that later that same day Jason Poon sent a further email to Anthony Zervaas informing him that several reporters from the local media would be visiting China Technology’s site office for an interview.

152. Joe Tam, who had been copied into the emails, testified that Jason Poon had never raised such a fundamental issue of safety with him before even though, as Construction Manager, he and Jason Poon had been speaking almost daily throughout the project.

153. Anthony Zervaas replied that same day:

“It is quite alarming that you have not brought this issue to our attention earlier particularly as the alleged malpractice occurred in September 2015.

Please be advised that an investigation has commenced to review the allegation(s) made in your email.”

154. In this regard, an investigation did take place and a report signed on 17 January 2017 – bearing the heading: *Review of EWL Slab Rebar Installation and Checking Procedure* – was issued. More is said of the ‘January 2017 Report’ below.

155. The following morning, 7 January 2017, Jason Poon responded. He alleged that his company’s investigations had revealed that Khyle Rodgers, the superintendent in charge of the site, had been well aware and indeed directing the “activities” to which he had made reference.

156. It should be said that Khyle Rodgers, when he gave evidence before the Commission, rejected the allegations outright, saying they were completely

false. No corroborative evidence of any kind was put before the Commission to support the allegations made in respect of Khyle Rodgers.<sup>25</sup>

157. Importantly, in his email of 7 January 2017, Jason Poon went on to say that it had been Leighton's unfair commercial manner which had led to an extensive review by China Technology of its internal records, the clear implication being that it was this extensive review which had revealed what was not previously fully appreciated, namely, the extent of the cutting of the threads of rebars and other related issues.

158. The sting in the tail was a further warning to the effect that, because of Leighton's unfair way of dealing commercially, further findings of serious nonconformity may be discovered.

### ***Leighton's January 2017 Report***

159. Leighton appointed Stephen Lumb, Head of Engineering in Hong Kong, to conduct the investigation into Jason Poon's allegations. By then, of course, the issues in contention being essentially historical, there could not have been any great urgency. Nevertheless, just one week was given to investigate the matter and write the report.

160. The report, when it was published, said the following in its introduction:

"Further to allegations of possible malpractice in the fixing of the reinforcement bar coupler connection between the EWL Slab and the adjacent supporting diaphragm wall, and also at the construction joints between adjacent slab pours, Leighton's in-house Engineering and Design Group have been asked by the Project Director to carry out an independent investigation of the rebar installation procedures and site practices for the EWL slab."

161. The introduction continued:

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<sup>25</sup> In the opinion of the Commission, a matter of some relevance here is that there had apparently been a number of heated exchanges on site between Jason Poon and Khyle Rodgers which had resulted in some form of confrontation.

“The investigation... involved an inspection of available site records, and interviews with key members of the Construction Team.”

162. The report, therefore, was not only completed in a span of just one week but appears to have been focused on installation procedures and site practices – of which surely Leighton would already have had fairly extensive knowledge – and barely, if at all, in investigating whether there was any substance in Jason Poon’s allegations.

163. Although Jason Poon had made the allegations, no attempt was made to interview him or any of the employees of China Technology. Nor seemingly were any discussions held with members of Fang Sheung, the bar fixers themselves and the ones most likely either to be culpable of cutting threads from rebars or having knowledge of it. Nor indeed, so it would appear, did anybody sit down with MTRCL and Leighton supervision teams to discuss what they witnessed on a day-to-day basis. Strangely, Khyle Rodgers, in respect of whom very serious allegations had been made, even if only obliquely, was not contacted either.

164. What is also significant is that nobody appears to have turned any attention to the photographs seemingly supplied by Jason Poon even though (on a relatively cursory examination) they provided persuasive evidence that, as Jason Poon had alleged, at least one threaded end of a rebar had been cut on site, the bar itself then being installed into the diaphragm wall.

165. The Commission fully appreciates that at the time Leighton would have been very suspicious of Jason Poon’s motives. They were in conflict as to work progress and as to payments. There was bad blood. But, if a report was to be prepared and published – and indeed, although essentially looking inwards to processes and practices, it was a report of some substance – surely it should have turned its attention to the very cause of setting up the investigation in the first place.

166. As it was, however, Jason Poon, having been told by Anthony Zervaas that an investigation was being carried out, knew nothing of the report, not even the fact that it had been published.

167. In the result, as the Commission sees it, the commissioning of the report and the investigation of matters under it very much constituted a lost opportunity. There appears to have been no attempt to ‘get to grips’ with matters, to find out whether there was any substance at all in Jason Poon’s allegations and, if so, to fix the problem. It is to be remembered that Jason Poon was not so much challenging whether systems existed but rather the effectiveness of those systems.

168. It seems that only one matter relating to the cutting of threads from rebars found its way into the report and that was the Non-conformance Report (‘NCR’) number 157, served on Fang Sheung. NCR-157 arose out of the discovery of cut rebar threads on 15 December 2015. It will be considered in the next chapter.

#### *A subsequent MTRCL report*

169. It should be said that a further report was prepared – this time by MTRCL – and published on 8 February 2017. It appears to have been prepared as a result of a conversation between Aidan Rooney and Wu Ka Wah, Carl – ‘Carl Wu’ – of MTRCL. According to Carl Wu, the scope of the report was to examine the construction records in order to confirm whether the steel reinforcement and couplers for the EWL platform slab had been installed according to the requirements of the relevant quality assurance and quality control regimes. While the report recommended that the systematic maintenance of specific records would enhance the robust demonstration of compliance with relevant quality assurance and quality control regimes, it nevertheless concluded that steel reinforcement and couplers for the EWL platform slab had been installed in accordance with the relevant quality assurance and quality control regimes, namely, MTRCL’s PIMS and Leighton’s Quality Supervision Plan (‘QSP’) – this being the quality assurance scheme required by the Buildings Department.

170. Regrettably, however, Carl Wu was not specifically informed that there had been allegations of the cutting of threaded rebars. He only became aware of this by looking at NCR-157 during the course of preparing his review. When testifying before the Commission, Carl Wu accepted that he was informed that documents confirming the frequency of Leighton’s and MTRCL’s supervision

in compliance with the requirements of the QSP were “incomplete”.<sup>26</sup> However, he did not follow-up.

171. Carl Wu’s report, which required just two to three days of investigation and another two to three days to write, was another lost opportunity. It confirmed, for example, that Leighton’s supervision of coupler installation was in compliance with the QSP when it was not.

### *Contractual differences arise again*

172. As to the ongoing commercial relationship between China Technology and Leighton, discussions took place between Anthony Zervaas and Jason Poon which resulted in a revised payment schedule being agreed. In addition, the final account payment was increased by some HK\$5 million. Anthony Zervaas recalled that, after this arrangement had been put into place, some real progress was made.

173. In September 2017, however, commercial conflict was reignited. In a letter dated 11 September 2017, Jon Kitching, Leighton’s new Project Director, sent a warning letter to China Technology as to work progress which was followed two days later by a formal notice issued under the general conditions of the sub-contract. Jason Poon not only contested the criticisms made in these communications but returned to the issue of the cutting of threads from rebars which had last been ventilated in January 2017, some eight months earlier.

174. Jason Poon said that he did not want his company involved in any illegal cover-ups and that the matter must be investigated as one of urgency rather than proceeding with plastering and painting and allied works in order to hide the problem. On the morning of 15 September 2017, Jason Poon sent an email to Anthony Zervaas. In that communication, he reminded Anthony Zervaas that it had been some eight months since he had first reported his concern. He proposed – in the interests of public safety – that:

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<sup>26</sup> In the Commission’s view, it is important to note that, in the preparation of his report, Carl Wu was clearly of the view that the QSP, which had been demanded by the Buildings Department to ensure rigorous inspection of coupler installation applied to, and was binding on, Leighton. One of the bullet points recorded by him at the time stated: ‘obtain confirmation from Leighton that their ‘Technically Competent Person’ (‘TCP’) records could demonstrate full-time T3 supervision of the mechanical couple of works per the Buildings Department requirement.’ In final submissions made to the Commission, Leighton submitted that the QSP, insofar as it required any enhanced form of supervision of coupler installation, did *not* apply to it.



“... ALL shear keys interfacing the diaphragm wall panels and ALL longitudinal construction joints between construction bays must be 100% inspected and assured for structural safety. We [are of the opinion that] all damaged and malpractice couplers, including installing without torque test and cheating practice [by] Leighton direct [staff] cutting away most of the threads, estimating over 30,000 pieces involved, must be tackled ...”

175. Anthony Zervaas testified before the Commission that he was telephoned that day by Jason Poon who wanted an update on payments due to him and who asked about the email that he had sent at the beginning of the year. Anthony Zervaas replied that the matter had been investigated (this being Leighton’s January 2017 Report) but no evidence to support the allegations had been found. It was agreed that there would be a meeting that evening.

176. During the day, said Anthony Zervaas, he was copied into an email that Jason Poon had sent to the Secretary for Transport and Housing, Frank Chan Fan JP. In this email, Jason Poon sought a meeting with the Secretary together with representatives of MTRCL and Leighton in order to discuss – as a matter of urgency – an important issue, one of public concern that related to the execution of works pursuant to Contract 1112.

177. At the meeting held that evening, according to Jason Poon at least, there was an atmosphere of high tension. Jason Poon said that he showed Karl Speed, the General Manager of Leighton, the series of photographs and a video clip which he had kept on his mobile telephone as proof of the illicit cutting of threads from rebars. The evidence, he said, was not well received by Karl Speed who accused him of fabricating it.

### ***Ending the contractual relationship***

178. There was, however, a further meeting on the afternoon of 18 September 2017 attended by Anthony Zervaas and Karl Speed. According to Anthony Zervaas, by now it was appreciated that it was in the mutual interests of Leighton and China Technology “to shake hands and part ways”.

179. According to Jason Poon only, his agreement to terminate the contractual relationship was founded also on Leighton’s undertaking to ensure

the structural integrity of works undermined by the illicit cutting of threads from rebars and other allied issues of poor workmanship.

180. A termination agreement was signed that day with Leighton agreeing to make a final payment to China Technology for work completed to date. In addition to the termination agreement, Jason Poon signed a confidentiality agreement.

181. Some time was spent considering the confidentiality agreement. It was a standard form contract but extensive in its coverage. It does not appear to have been a document generally signed by sub-contractors. During the course of his testimony, Karl Speed said that, as he understood it at the time, the agreement was needed because of China Technology's "false accusations and lies". Having regard to the bad blood existing at the time, the Commission is satisfied that was the reason. The importance of this document lies in the assertion made by Jason Poon that, having signed the confidentiality agreement, he was persuaded by Anthony Zervaas and Karl Speed that he should destroy his photographic records of malpractice on the construction site. Jason Poon said that he complied, destroying the records on his telephone and also – a far more extreme move – his extensive records held with China Technology.

182. Both Anthony Zervaas and Karl Speed denied making any such request. Indeed, on their evidence, neither of them knew that Jason Poon kept such records. By way of illustration, the following exchange took place between the Chairman and Karl Speed:

Q. Did he at any stage, to the best of your memory, say he did have information which you would find embarrassing in his possession?

A. No, he never did.

183. Again, by way of illustration, the following was said in an exchange between counsel for China Technology and Karl Speed:

Q. I would suggest to you that the reason for putting this clause again [in the confidentiality agreement] is because you were shown video clips by Mr Poon and photographs by Mr Poon.

A. I would like to say for the record, this is just blatant lies and it never happened.

184. [REDACTED]

185. That evening, Jason Poon sent a communication to the Government saying that, as a satisfactory agreement had been reached with Leighton, the Government should close its file.

186. Events on 18 September 2017, however, did not fully terminate the contractual relationship between China Technology and Leighton. There was a further sub-contract between Leighton and China Tech-FEWA (seemingly a joint venture) which, for a number of reasons not directly relevant to this report, Leighton terminated on 24 April 2018.

187. According to Anthony Zervaas, in late May 2018 he was emailed by Jason Poon claiming that he had been approached by the media and may have to release details of “persisting malpractice by others”. Anthony Zervaas said that he replied to say that Leighton was not aware of any such malpractice. He received a response in ambiguous terms from Jason Poon indicating (it would seem) that, as Leighton had confirmed there was no malpractice, he would be free to communicate with the media.

*A consideration of Jason Poon’s evidence*

188. Jason Poon’s email to Anthony Zervaas dated 6 January 2017 spoke in apocalyptic terms of the public crisis that would occur if the EWL slab would fail while carrying a train. The email read (in this regard):

“If the EWL Track Slab fails due to the failure on these critical structural key construction in future, it will be a big crisis on public life when heavy trains will carrying hundreds of life travelling on it both up and down tracks in every minutes.”

189. Manifestly, on the face of it, he was deeply concerned as to the structural integrity of the coupler connections. This email however was sent more than a year after Jason Poon himself, as Managing Director of China Technology, had overseen the pouring of concrete onto the same coupler connections, thereby encasing in concrete any evidence of the lack of structural integrity.

190. [REDACTED]

191. How is it then – so many months after his own authorisation to bond the steel reinforcement and coupler connection into concrete – that Jason Poon issued his dire warning to Anthony Zervaas?

192. The answer given by Jason Poon was that he himself had not – until shortly before he sent the email of 6 January 2017 – appreciated the true seriousness of the position concerning the structural integrity of the coupler connections. It was his evidence that during the course of 2015 and almost all of 2016, while he knew that workers were cutting threads from rebars on a

sporadic basis, he had not considered it to be a serious issue, that is, an issue affecting safety. In this regard, when asked why he would continue to pour concrete if he thought there was a real danger, he replied:

“ ... no, I don’t think we have reached that critical stage yet.”<sup>27</sup>

193. He further said:

“ ... I thought there was about 5% of the bars cut, that was my estimate. That’s always been the estimate. I also believe that, *if we’re just talking about cutting threads then it’s within the safety margin.*” [emphasis added]

194. Jason Poon did not advance any statistical basis for his estimate that about 5% of the rebars had been cut. It appears to have been an arbitrary estimate. On the basis of the evidence he gave, it might just as well have been 2% or 3%, or some other figure.

195. [REDACTED]

196. What is important to recognise is that, when he gave evidence before the Commission, Jason Poon asserted that the integrity of the station box structure had been undermined not only by the malpractice of cutting threads from rebars but also by the materially defective manner of the installation of so many rebars into their couplers. In this regard, he spoke of a failure to ensure that couplers were not damaged or out of alignment, a failure also to ensure that they were not blocked in any way with concrete residue. In light of the programme of physical opening up of selected areas under the Holistic Proposal that was conducted during the latter stages of the Commission hearings, it is significant that Jason Poon also spoke of a failure to ensure that each and every rebar was fully screwed into its coupler so that it lay against the rebar inserted

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<sup>27</sup> As set out earlier, the concrete pour records reveal that China Technology completed concrete pouring in respect of Areas C1, C2 and C3 between 30 May 2015 and 28 December 2015. The records show that concrete pouring in respect of Area B took place between 25 November 2015 and 12 January 2016. The Hong Kong Coliseum area was concreted between 11 July 2016 and 16 August 2016.

into the other end of the coupler; as the term has been used: ‘butt to butt’. In summary, when he testified before the Commission, Jason Poon’s stated concerns as to structural integrity went further than the cutting of threads from rebars and identified a more general deficiency.

197. [REDACTED]

198. For the purposes of this inquiry, having considered Jason Poon’s testimony, the Commission is satisfied of the following:

a. Jason Poon did on a number of limited occasions in the latter part of 2015 witness the cutting of threads from rebars (on one occasion at least, what he witnessed being the conversion of a Type B into a Type A rebar).

b. [REDACTED]

c. On his own evidence, his estimate of the number of rebars that were damaged by having their threads cut was put at about 5% of the total rebar connections. As to his estimate of “about 5%”, Jason Poon accepted that it was just that: an estimate and no more.

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<sup>28</sup> [REDACTED] a copy of the relevant transcript is annexed to this report as Annexure D.

## Chapter 6

### How extensive were the failures to fully engage couplers?

199.

[REDACTED]

200. Before looking to the relevant evidence in detail, and leaving aside for the moment any issues going to the rigour and efficiency of oversight and inspection, the Commission has taken note of a number of general observations which it believes are directly applicable. These observations may be summarised as follows:

- a. Rebar fixers were not untrained. They had attended seminars given by BOSA in which they had been instructed how properly and efficiently to install rebars into couplers. Indeed, Cheung Chiu Fung ('Joe Cheung'), the lead foreman of Fang Sheung – the man who supervised the rebar fixing on site – attended two BOSA seminars.
- b. Assuming the uneventful installation of a rebar into a coupler, that is, an installation which presented no difficulties, it was – in purely practical terms – easier for workers to install that rebar in the manner they had been trained rather than to resort to some surreptitious conduct, for example, by cutting the threads from the end of the rebar. As earlier stated in this report, the recommended method of installation was an exercise which took just 30 seconds or so. In short, it was simpler and easier for workers to carry out the exercise in the recommended manner rather than look for alternatives.

- c. Again, assuming the uneventful installation of a rebar, there was simply no purpose in failing to fully engage the rebar in the coupler; it was a matter of a few more screw turns, no more than that. Failure to do so ran the risk that threads would be seen later by the MTRCL and Leighton supervisors and the work would have to be redone.
- d. If, however, installation difficulties were encountered, there was a set process of which the workers were aware. It was then for the rebar fixers (the employees of Fang Sheung) – through the foreman, Joe Cheung – to seek recourse from Leighton. As contractor, Leighton was under an obligation to make good (at its own expense) any damage to couplers or to rebars and, if necessary, to assist in making good any remedial steps.
- e. The improper installation of rebars always carried with it an element of risk. If discovered, remedial action would have to be taken – effectively doubling the workload – and there was, of course, always the possibility of sanction.
- f. In addition, and more fundamentally, the point was made by more than one expert witness that workers in the construction industry, considered as a group, wish to do a good job rather than seeking some way of doing a bad job. Of course, occasionally there will be disgruntled or over lazy workers but invariably there is a pride in a job well done, a pride too in teamwork well executed. As it was put by Dr Glover:

“My experience through life is that operatives generally want to do a good job. They don’t get up in the morning and say, “You know what, I’m going to cut ten bars today.” You know, people want to do a good job... Good operatives – and the construction industry in Hong Kong still has good operatives – they know that if they do the job right first time, it’s the easiest thing in the world. Bodging costs time and runs the risk of you being identified as an individual and having to do it again.”



### *Uncontested evidence*

201. In addition to the incidents which the Commission is satisfied were witnessed by Jason Poon, there was uncontested evidence of the illicit practice. The following is a summary of that uncontested evidence.

202. Two early discoveries were made by Edward Mok, a graduate engineer who, between August 2015 and November 2016, was a member of Leighton's engineering construction team. As a member of that team, Edward Mok was responsible for supervising the work of sub-contractors.

203. On an unknown day in September 2015, during a formal inspection conducted with an MTRCL engineer, Edward Mok discovered a single rebar which had not been screwed into its coupler. Closer inspection revealed that the threaded end of the rebar had been cut leaving a gap of several millimetres between the end of the rebar and the coupler. Immediate remedial steps were taken. The defective rebar was replaced and a new rebar fully installed. Edward Mok said that, as he considered the incident to be an isolated one and as immediate remedial steps had been taken, he did not consider it necessary to take follow-up action other than to speak to the foreman at Fang Sheung, the rebar fixers, asking him to pass on a warning to his workers.

204. About a month later, in or about late October or early November 2015, during another formal inspection with an MTRCL engineer, Edward Mok discovered two further rebars not screwed into their couplers. Closer inspection revealed that the threads of both had been cut. There was a gap of several millimetres between the end of the rebars and the couplers. Again, immediate remedial steps were taken. Although formal action was considered, Edward Mok determined that the best course of action was to talk again to the lead foreman of Fang Sheung.

205. On 15 December 2015, a further discovery was made but this time by Wong Kai Wing – Andy Wong – who had been employed by MTRCL as an assistant inspector of works for over four years. While conducting his own surveillance on the bottom mat of the EWL slab, Andy Wong came across two threaded lengths of steel on the floor that had clearly been severed from rebars. There was a wire cutting machine nearby.

206. Andy Wong, who had been working on different construction sites for more than 20 years, said that he had never seen rebars cut in this way before. He was shocked.<sup>29</sup>

207. Continuing his inspection, Andy Wong came across a cluster of five rebars that were not properly installed into their couplers. Three were not installed at all while two were only partially installed. The threaded ends of all five rebars had been cut. Andy Wong said that the area in which these five cut rebars were found would have been relatively inaccessible for the rebar fixers, presenting difficulties in installation.

208. Andy Wong took photographs and immediately transmitted those photographs (by telephone) to his superior, Wong Chi Chiu – Kobe Wong – who at the time was the Inspector of Works (Civil) for the Contract. He was instructed by Kobe Wong to liaise immediately with Leighton to ensure that rectification measures were taken.

209. Andy Wong said that after about 30 minutes Leighton representatives came to the scene. Edward Mok was one of the Leighton representatives. He testified that remedial measures were immediately undertaken by workers from Fang Sheung who were assisted by daily-paid labourers employed by Leighton. To ensure the problem was not widespread in the immediate area, Edward Mok and Andy Wong unscrewed a number of rebars in the vicinity. All were found to have been satisfactorily installed.

210. Because of the seriousness of what had been discovered, Edward Mok said that a decision was made this time to serve a Non-conformance Report on Fang Sheung: NCR-157. The defective workmanship was said to be the severing of the threaded ends of five rebars.

211. Andy Wong, the MTRCL assistant inspector of works, said that a week or two later he came across five or six rebars which, although apparently of full-length and undamaged, had not been screwed into their couplers. There was therefore a space between the end of each rebar and the entrance to each coupler.

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<sup>29</sup> His evidence in this regard was supported by that of Kevin Harman who at all material times was the Quality and Environmental Manager for Leighton. He had been with Leighton since 2012. He said that, when this incident came to his knowledge, it was the first incident of cutting threads from rebars that he had heard of.

He remembered that the end of the rebars and their couplers were situated along a slab-to-slab construction joint.

212. The matter was immediately reported to Leighton. Andy Wong said that, while it was possible to correctly install the rebars on the top layer of the mat, there were three rebars in a lower layer of the mat that could not be reached. Concreting was taking place at the time and that concreting had to proceed without the three lower rebars being installed into their couplers.

213. By way of summary, therefore, between September 2015 and December 2015, a period of some four months (but not at any time thereafter):

- a. At least eight rebars were discovered with their threads cut. Remedial action was taken in respect of all of these.
- b. Five or six rebars were discovered that were fully intact but had not been connected; three of the rebars discovered in a lower layer of the mat could not be installed before concreting took place. Remedial action was taken in respect of the remaining two or three.

### ***Evidence given on behalf of Fang Sheung***

214. Fang Sheung's sub-contracts required it to install steel reinforcement for the platform slabs. This involved not only all necessary bar bending and fixing works, but also carrying out the work of installing rebars into couplers in order to connect the joints between the slabs making up the EWL and the NSL platform slabs and connecting those slabs to the diaphragm walls. When public disquiet arose as to the possibility that threads had been cut from rebars on a wholesale, systematic and planned basis, the management of Fang Sheung found themselves very much 'in the eye of the storm'.

215. Two witnesses gave evidence before the Commission. They were Pun Wai Shan and Joe Cheung, shareholder and lead foreman on site. Regrettably, the Commission had great difficulty obtaining any constructive assistance from them. It was evident that both were essentially focused on one thing, that is, protecting their individual reputations and the reputation of Fang Sheung. Joe Cheung admitted that the incompleteness of several of his witness statements lay in the fact that he was concerned that Fang Sheung would be blamed for

“massive cutting of rebars, because according to reports it was done massively and also systematically”.

216. A central issue of course was not whether Fang Sheung workers had at any time been culpable of installing rebars into couplers in a way that was negligent or constituted illicit conduct – that had been demonstrated by the objective evidence – but the *extent* of such negligent or illicit conduct.

217. It appeared to be the testimony of both Pun and Joe Cheung that they personally had never witnessed such conduct or, if they had, that it had been immediately stopped. But they recognised that such conduct had taken place. That raised issues as to the manner of such conduct and its extent. In trying to explain these difficulties, both witnesses made statements which initially appeared to be statements of fact but later would be explained as only hypothetical possibilities. The following exchange between counsel for the Commission and Pun illustrates the point:

Q. First of all, is it your evidence that you personally are aware that cutting a Type B threaded rebar, to convert it into a Type A, i.e. a shorter threaded rebar, did in fact take place on this site?

A. That was my imagination. It doesn't mean it had happened.

Q. That was my question, Mr Pun. Did it happen – to your knowledge, did it happen or did it not happen?

A. I haven't seen it personally.

Q. Had anybody spoken to you, if you hadn't seen it personally, had anybody spoken to you about this type of thing happening, that is shortening the type B to convert it to a type A?

A. No one has spoken to me about this happening [on] this site.

218. Joe Cheung testified to the same effect, putting forward a number of situations in which the cutting of threads from rebars had taken place or, in the installation process, there had not been full engagement, and then emphasising that this was a possible hypothesis only.

219. The fact is, of course, that negligent and/or illicit conduct in the installation of rebars into couplers *did* take place and, in the opinion of the Commission, Fang Sheung workers were responsible. As to why this conduct should have taken place, there were occasions when Joe Cheung spoke in a more forthright manner. The following exchange is illustrative:

“I think, for some reason, they [the workers] could not screw the couplers [in] and they didn’t contact myself or the foremen, because if that could be done, perhaps the couplers were damaged and they should be replaced and if there was something wrong with the rebars, they could tell the company and replace the rebars. I believe these were the reasons for the workers to do it – to make the decision to do it on their own and for the sake of convenience.

Q. But were the workers not aware, from time to time, that there was pressure on them getting the work done? I’m not talking about the knowledge of a [project] schedule, but that there was nevertheless pressure to get the work done.

A. They might want to help the company to complete the works faster. For pressure, workers didn’t have any pressure. [They weren’t] responsible for providing workers. Workers did not have to be responsible for anything, so they didn’t have any pressure”

220. Just how extensive was the negligent or illicit installation of rebars into couplers by Fang Sheung workers? The Commission is satisfied that it was not extensive. Nor was it systematic. The Commission is satisfied that, when faced with particular difficulties or when, for any number of reasons, it was simply too much trouble to contact Leighton to ask for assistance with remedial work then ‘shortcuts’ may have been taken. Such instances, however, would have been isolated.

221. Pun, an older man, appears very rarely to have been on site. Joe Cheung, however, was constantly on site. He had immediate responsibility for ensuring that the project remained on schedule. The thoroughness of his supervision in such circumstances is an open question.

*Evidence of the China Technology workers*

222. As the Commission has noted earlier in this report, China Technology employees worked often in close proximity to the Fang Sheung bar fixing teams.

223. Four of Jason Poon’s employees testified that they witnessed incidents of the threads – or more correctly, part of the threads – being cut from rebars. They spoke of hand-held grinders or cutting machines being employed (either red or green in colour). The evidence of the four employees, which took several days to complete, was incisively tested, especially by counsel for MTRCL and Leighton, as to its accuracy and indeed its truthfulness.

224. [REDACTED]

● [REDACTED]

● [REDACTED]

● [REDACTED]

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● [REDACTED]

● [REDACTED]

● [REDACTED]

225. [REDACTED]

*Ngai Lai Chi, Thomas*

226. Ngai had been the project superintendent. He was now retired and recovering from brain surgery. He admitted that his memory was not as good as it had once been but, in respect of the limited matters to which he attested, he was confident in his recollection.

227. In his capacity as superintendent, Ngai would have spent a good deal of time on site. He was clearly a man of experience, cautious in his evidence. He recalled just one incident. He remembered that it took place during December 2015 in the evening. He recalled seeing two workmen – he could not identify by whom they were employed – cutting threads from a single rebar. What was done with the rebar he did not know.

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● [REDACTED]

228. The Commission notes that several other incidents were witnessed in December 2015, including the incident that led to the issue of the NCR.

***Chu Ka Kam***

229. Chu led a team of carpenters working on formwork. On occasions, therefore, he was working in close proximity to the bar fixers. He testified that he witnessed the cutting of threaded ends from rebars on two occasions.

230. The first occasion, he said, was in late October 2015 at around noon. Chu said that he saw two workers cutting threads from rebars, appearing to leave threads measuring about 5 centimetres ('cm') (which would be approximately the length of the threads on a Type A rebar). Chu said that he noticed two or three threaded ends lying on the floor.

231. [REDACTED]

232. The second occasion, said Chu, took place several months later in 2016; again he saw workers cutting threads from a rebar, again leaving about 5 cm: again the measurement of a Type A rebar.

233. As to the physical location of where he witnessed this second incident, Chu was reminded that the area had already been concreted. While he insisted that he was in that particular area, he suggested that the rebars may have been intended for a partition wall or some other miscellaneous works.

***But Ho Yin, Ian***

234. Ian But joined China Technology as an assistant foreman, moving to the project site in or about mid-September 2015. Although he left China Technology apparently in late 2017, he rejoined in August 2018. He was therefore back in the employ of China Technology when he came before the Commission.

235. Ian But testified that the first incident he witnessed involved about 10 rebars. He said that a red cutting machine was being used which took about



one minute to cut each rebar. As to what was done with the cut rebars, he said that, although he could not remember whether the coupling was done at the top or the bottom, he did see workers screwing rebars into couplers on the diaphragm wall.

236. It was Jason Poon's recollection that Ian But had told him that he had intervened to try and stop the cutting. Ian But, however, denied doing so. He had no right to do so, he said.

237. Ian But said that he saw further incidents on two days in February 2016. [REDACTED]  
[REDACTED]  
[REDACTED]

*Li Run Chao*

238. Li said that he was employed by China Technology in January 2016 as an assistant foreman and posted to the project site on 12 January 2016. Li said that he witnessed the cutting of threads from rebars on two occasions.

239. The first occasion, he said, was on his first day on site: in the evening. He said that he witnessed five or six workers who were severing threads from rebars. He remembered that about six rebars were shortened. The workers, he said, proceeded to install the rebars into a diaphragm wall. [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

240. The second incident to which Li referred took place, he said, towards the end of January 2016. He was unable to say on which date exactly but he recalled it was in the morning. Again, he said, he saw a small group of workers cutting the threads from the ends of rebars. On this occasion, he said, he had no memory of the rebars being installed into couplers.

### ***The Commission's conclusions in respect of the four witnesses***

241. On a consideration of the evidence given by the four China Technology workers, the Commission is satisfied on balance that during the period of time when the company was employed as a sub-contractor on site, they witnessed some five incidents of threads being cut from rebars. On a couple of occasions just one or two rebars was seen being cut; on another occasion it appears likely that several rebars were seen being converted from Type B to Type A rebars.

### ***But in any event ...***

242. The Commission wishes to emphasise that in any event, even if it had accepted all of the evidence of the four witnesses without reservation, aside from the fact that to a very limited degree it may have indicated that the failure to ensure proper installation of rebars into couplers was more prevalent, it would have had no impact on the critical issue to be determined, that is, the issue of structural safety.

### ***Was Fang Sheung solely responsible for rebar cutting?***

243. In the course of giving evidence before the Commission, Jason Poon was originally convinced that the workers who he (and his work colleagues) had witnessed undertaking the illicit activity of cutting threads from rebars were employees of Leighton, either full-time or daily paid. In this regard, for example, although Jason Poon had never been able to personally recognise any of the workers, he said the following in his statement of 3 September 2018:

“Throughout the whole process, according to what was reported to me by employees of China Technology or what I saw myself on the Hung Hom Station construction site, it was staff members of Leighton who were cutting the threaded rebars.”

244. This assertion that it was Leighton employees appears to have been based on the knowledge that Leighton employed a number of daily-paid workers who, if the need arose, would be deployed to assist sub-contractors. These daily paid workers were employed through sub-contractors like Rankine

Engineering. Evidence indicated that from time to time, if Fang Sheung workers were in any particular difficulties, these daily paid workers would be deployed by Leighton to assist.

245. Jason Poon appeared to have based his belief on the assumption that different teams of workers employed by different employers wore different uniforms. Accordingly, it was only Leighton workers, either employed full-time or on a daily basis, who wore Leighton uniforms. It transpired, however, that Leighton supplied its uniforms to the workers of a number of sub-contractors – including Fang Sheung. Once Jason Poon was aware of this fact, he accepted that he could not be certain that it had been Leighton workers whom he had witnessed and that it may well have been Fang Sheung workers.

246. Fang Sheung of course was the sub-contractor solely responsible for the work in question. Joe Cheung himself did not dispute the fact that, if rebars had been cut, his workers would have been responsible. In respect of NCR-157 which was served on Fang Sheung, Joe Cheung said:

“It was not until then that I knew that workers without our instruction cut short five rebars. I was very angry. So I feel most regretful about this incident. At once, I called all my workers for a briefing. I gave them a very serious briefing because it was a serious thing, because Mr Mok told me that for sure an NCR, i.e. a warning, would be issued to me. I was very angry about that matter.”

247. There was other evidence too. For example, Andy Wong, the MTRCL inspector of works who was on site every day, said that he was able to recognise two of the workers who appeared in the photographs taken by Jason Poon on the evening of 22 September 2015. He was not asked to give their names. He was however asked to give the name of their employer. He said without hesitation that it was Fang Sheung.

248. On all the evidence, therefore, it is clear to the Commission that, insofar as there was any cutting of threads from rebars and/or a failure to properly install rebars into their couplers, it was not in any way the work of Leighton employees. It was the work of Fang Sheung employees.

## *Summary*

249. On a consideration of all the evidence, therefore, the Commission is satisfied of the following:

- a. Although it was not extensive or systematic, and in context amounted only to isolated behaviour, there were instances when the threaded ends of rebars were cut. On a material number of occasions this was done when workers ran out of Type A rebars and wished to convert Type B rebars into Type A.
- b. Although not extensive or systematic, there were also instances when rebars that were inserted into couplers were not fully engaged.
- c. The persons responsible for this conduct were employees of Fang Sheung.

## Chapter 7

### The collateral tests

250. During the course of the inquiry, although not initiated by the Commission, two tests were commenced in order to test the structural integrity of the station box structure.

#### *The Holistic Proposal*

251. On 5 December 2018, in order to try and further allay public concerns, the Government accepted a proposal – the ‘Holistic Proposal’ – formulated by MTRCL to conduct tests which involved the physical opening up of the station box structure at numerous points. There were two essential purposes for this test. The first was, by way of physical examination, to come to some certainty as to the true extent of the severing of threads from rebars. The second was to verify the ‘as constructed’ condition of the connections between the platform slabs and the diaphragm walls where there was an absence of verifying documentation.

252. The five independent structural engineering experts, in their agreed expert memorandum of 18 December 2018 (written after testing pursuant to the Holistic Proposal had commenced) were of the unanimous opinion that the test – in part at least – was unnecessary. In this regard, they wrote:

“In terms of the current opening-up regime, all agreed, based on the “redundancy” of the couplers in the bottom of the EWL slab, that further opening-up was unnecessary. Focus should be directed to the top of the East diaphragm wall to verify the as-built drawings and the details which are of structural significance.”

253. As it was, the opening-up works, which had started on 10 December 2018, continued as originally planned. In respect of the tests, MTRCL has provided inspection records to the Commission on a daily basis. In addition, the Highways Department has posted these inspection results on to its website. The public has therefore been kept informed of the progress of the Holistic Proposal.

254. In respect of rebars inserted into couplers, in order to avoid having to dig them out of the concrete, that is, to ensure non-destructive testing, they have

been measured using an ultrasonic measuring system: a ‘phased array ultrasonic test’ (‘PAUT’). As the Commission understands it, the test has been founded on the basis that 10-11 threads, that is, between 40 to 44 millimetres (‘mm’) in length, should be inserted into a coupler in order to secure full engagement. However, leaving room for error, it was decided that the tests should be based on a minimum engagement length of 37 mm.

255. The on-going results of the tests have given rise to a possible new concern. It is a concern that was not in any way a focus of attention in the early days of the Commission hearings. According to the PAUT measurements, a number of rebars embedded into couplers were found not to have the “minimum” engagement length of 37 mm.

256. The accuracy of these measurements, however, was placed into doubt when on 29 January 2019 – the Commission’s last day of hearing – it was informed that the police, in order to advance their own investigations, had physically lifted four of the coupler connections from the concrete in order to measure. These physical measurements indicated that the rebars were more fully engaged than shown in the PAUT measurements. The following simple table illustrates the contrast; the comparative measurements, calculated in millimetres, are:

<b>PAUT measurements</b>	<b>Physical measurements</b>
33.98	39
28.79	40
34.91	40
29.65	40

257. The physical measurements, if they are proved to be accurate, show that each of the PAUT measurements (which show insufficient engagement) are wrong. To the contrary, all four rebars were adequately engaged.

258. As a result of this discrepancy, as the Commission understands it, PAUT measuring under the Holistic Proposal has been suspended until the accuracy of the measuring device can be assured. At the date of submission of this interim report, it is not certain when the measuring will recommence.

259. There is, however, a further area of uncertainty, one which is focused on the required minimum embedded length to ensure safety.

260. Rebars that are found to have a shorter engagement length than 36 mm do not meet BOSA requirements. However, that does not mean that rebars that have a shorter engagement length than 36 mm are not strong enough to satisfy performance requirements.

261. In this regard, on 21 November 2018 a series of destructive tests to failure were carried out on bar couplers that had differing percentages of threads engaged.<sup>32</sup> However, it appears only one rebar sample was tested at each engagement length and the validity of the test has therefore been called into question.

***Testing the integrity of coupler assemblies with rebars fully engaged and only partially engaged***

262. At the end of January 2019, MTRCL submitted coupler assemblies test proposals to the Government. The purpose was to test the strength of couplers assembled with rebars that are fully engaged and – at different lengths<sup>33</sup> – only partially engaged<sup>34</sup>. The test proposals included static tensile tests and measurement of permanent elongation. It was agreed that each laboratory would test nine samples with one end fully engaged and the other end partially engaged for each engagement length.

263. Tests were conducted on 18 February 2019. Preliminary test results were provided to the Commission. The involved parties were also given the preliminary test results by the solicitors for the Commission. Professor Don McQuillan, the Commission's independent structural engineering expert, was given a short period of time to consider the preliminary results. He confirmed that the results did not alter his previous opinion and he still considered the affected structures to be safe.

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<sup>32</sup> The tests were carried out at the CASTCO Testing Centre.

<sup>33</sup> The different lengths are 6, 7 and 8 full threads (i.e. 28 mm, 32 mm and 36 mm engagement lengths).

<sup>34</sup> The tests were to be carried out at the MTRCL laboratory and also by Geotechnics & Concrete Engineering Hong Kong Limited, both being accredited laboratories.

264. The Commission, however, has not received the final results. Nor has it had an opportunity to enable the other independent expert witnesses, who have given such invaluable assistance to it, to have an opportunity to consider the results.

265. In the result, while the Commission would obviously have taken these recent preliminary results into account if, in the opinion of Professor McQuillan, they raised any doubts as to previous opinions confidently held, it has not for the purposes of this interim report taken them into account. Nevertheless, they do not cause the Commission to have any concerns.



## Chapter 8

### **How effective was the supervision & inspection of the coupler installations?**

#### ***General site supervision***

266. As far as general supervision of the works in progress was concerned, both MTRCL and Leighton had supervisors on site. In respect of Contract 1112, in order to ensure adequate levels of supervision, there were a number of site supervision plans. These set out the grades of the technically competent persons permitted to carry out supervision and laid down the minimum frequency and level of site visits.

267. To give an indication of the level of supervision, Leighton's records show that its technically competent persons were appropriately qualified and conducted site visits at or about the required frequency. Leighton, it appears, had some 50 site supervision and engineering staff involved in supervision work during the period of construction.

#### ***'Hold point' inspections***

268. In addition to general supervision, there were formal inspections at particular points in the construction process, these points being called 'hold points'. Under the Contract, Leighton could not proceed with any succeeding work beyond a 'hold point' until the work completed up to that time had been formally inspected and found satisfactory. The 'hold point' inspections – being related to the quality of the construction completed to date – were conducted by engineers from both MTRCL and Leighton;

- a. With respect to the steel reinforcement works, when the bottom mat of the steel reinforcement had been completed, there would be an informal inspection. If the work was found to be satisfactory, the top mat of reinforcement works would be installed. Upon completion of all the steel reinforcement, the first formal – 'hold point' – inspection

would take place<sup>35</sup>. The results of that inspection would be contained in a Request for Inspection, Survey and Check ('RISC') form.

- b. If the steel reinforcement works were found to be satisfactory, the formwork would be completed and the works cleared of debris and of any standing water. Thereafter, a second 'hold point' inspection would be conducted with the results being contained in a second RISC form.
- c. Only at that point could concreting proceed.

### ***The Quality Supervision Plan***

269. The Commission's concerns, however, do not relate so much to the supervision requirements or the formal 'hold point' inspections<sup>36</sup>. Its concerns relate instead to an enhanced regime of supervision and inspection that was accepted by MTRCL and Leighton for the Contract concerning the installation of couplers. This more rigorous regime was made part of the construction conditions by the Buildings Department. The regime was part of an approved quality supervision plan (the 'QSP'). [REDACTED]

270. The QSP was made part of the construction conditions by the Buildings Department in terms of letters dated 25 February 2013 and 25 June 2014. These letters (addressed to MTRCL as project manager) set down special requirements to ensure an appropriate level of supervision of the installation of rebars into couplers. The requirements appeared under the following heading:

"The following conditions on Mechanical Couplers for Steel Reinforcing Bars *for Ductility Requirement* are ..." [emphasis added].

271. During the course of closing submissions, counsel for Leighton made a submission to the Commission that, to the best of the Commission's

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<sup>35</sup> Before the Commission, concerns were expressed as to the fact that the inspection of the bottom mat of steel reinforcement did not itself constitute a 'hold point' inspection.

<sup>36</sup> The Commission has, however, adopted the recommendations of Steve Rowsell, the independent project management expert, to bring more clarity and effectiveness to such matters.

recollection, had not been raised in any way during the course of evidence. The submission was to the effect that the QSP did *not* apply to supervision of the installation of couplers into, first, the platform slabs and, second, the horizontal couplers in the diaphragm walls: these falling under Leighton’s supervisory responsibilities. As it was put by counsel for Leighton, as all the experts agreed that there was no requirement for ductility couplers – even though in fact ductility couplers were used – there was no obligation on the part of Leighton to comply with the enhanced regime in the QSP.

272. Counsel for Leighton accepted that there was conflicting evidence as to whether the horizontal couplers in the diaphragm walls were subject to a ductility requirement. However, it was argued that the best view, based on a detailed examination of working drawings and the like, was that they were not subject to any such requirement. In any event, said counsel, there was no doubt that the couplers installed in the EWL and NSL slabs were not subject to a ductility requirement. This had not been challenged by any of the parties.

273. [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED] No documents were put before the Commission showing that the issue had been debated with the Buildings Department. In the event of uncertainty, there should have been on-going technical dialogue to resolve such uncertainty.

274. Certainly, MTRCL does not appear to have had knowledge at the relevant time of any clear and open decision made by Leighton, its contractor, that the QSP would not apply. By way of illustration, when Carl Wu prepared his report of 8 February 2017 – that report requiring him to examine the construction records related to the installation of couplers for the EWL platform slab – he was of the view that Leighton were subject to the enhanced regime under the QSP. Indeed, in the course of evidence, he made reference to the fact that he had sought confirmation (for the purposes of his report) that Leighton’s

records demonstrated full-time T3<sup>37</sup> supervision of the installation works as per the requirements of the Buildings Department.

275. More directly to point, the version of the QSP submitted to the Buildings Department on 12 August 2013, prepared by, and bearing Leighton's logo, was in no way qualified or restricted in its application simply to the reinforced steel cages for the diaphragm walls. That submission confirms that it relates to the installation of 'Type II – Seisplisce Standard Ductility Couplers' and confirms that quality control supervisors will be responsible for carrying out 'full-time and continuous' supervision of the splicing assemblies on site.

276. On any ordinary reading, therefore, in August 2013 Leighton itself understood that it was subject to the enhanced regime once it had been approved. [REDACTED]

277. What then was the enhanced regime [REDACTED]?

278. In terms of the QSP, MTRCL was to assign a Quality Control Supervisor while Leighton was to assign a Quality Control Co-ordinator. [REDACTED]

279. In terms of the QSP, the names and qualifications of supervising personnel representing both MTRCL and Leighton had to be recorded in an inspection logbook along with relevant details of inspections: date, time, items inspected and the like. More importantly, however, for the purposes of this report, was the requirement that there should be an independent checklist (the 'QSP checklist') for on site assembly of the couplers. This independent checklist was set out in the QSP as Appendix B. The specimen form required

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<sup>37</sup> The QSP provided, among other provisions, that: the minimum qualification and experience of the quality control supervisors/co-ordinators were to be the same as grade T3 TCP as stipulated in the Code of Practice for Site Supervision.

[REDACTED]

that every installation should be identified and that a number of specific matters should be confirmed, for example, whether the coupler had been cleared of foreign material, whether the threads on the rebars had also been cleared of foreign material, whether in respect of each installation the rebars had been fully screwed and fitted.

280. As to the critical issue of the thoroughness of supervision, that is, the time to be spent supervising the installation of rebars into couplers, the Buildings Department laid down the following requirement:

“Frequency of quality supervision, which should be at least 20% of the splicing assemblies by [MTRCL] and full-time continuous supervision by [Leighton] of the mechanical coupler works.<sup>39</sup>”

281. During the course of the inquiry, there was considerable debate as to the meaning and effect of the requirement given to Leighton (as the contractor) of ensuring ‘full-time and continuous supervision’.

282. Stephen Lumb, Leighton’s Head of Engineering, understood ‘full-time supervision’ to mean simply that the person carrying out the supervision must be fully engaged on the project as opposed to working there part-time. As to the phrase ‘continuous supervision’, he understood that to mean no more than a normal daily supervision and inspection regime. In his opinion, it certainly did not mean the need for “man-marking”.

283. [REDACTED]

284. Steve Rowsell, the Commission’s independent expert witness on matters of project management, gave a very different interpretation to the one that Stephen Lumb had advanced. [REDACTED]

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<sup>39</sup> Although not of direct relevance, it should be stated that the QSP required that, in respect of couplers to be used at the top of a pile or transfer plate, the frequency of quality supervision by MTRCL should be at least 50% of the splicing assemblies and, on Leighton’s part, should remain as full-time continuous supervision.

In his expert report, by way of a preamble Steve Rowsell made the following observation<sup>40</sup>:

“In my opinion, I consider that where formal obligations are imposed on a project management or a contracting organisation then there needs to be precise definitions and consistency of terminology. For example, on this contract there is a requirement that the quality supervision should be full-time and continuous supervision by the Contractor of the mechanical coupler works. It is likely that this requirement was included because it was recognised that it would be a technically difficult process with a high risk of problems being encountered.”

285. Steve Rowsell said that, in his opinion, the interpretation of the requirement for full-time and continuous supervision meant that Leighton’s supervisor:

“... needs to be present at all times where mechanical coupler works are underway. The objective being to ensure that the work is done properly in accordance with the specifications and any problems are resolved without delay. It does not have to be the same supervisor for the whole of the working day but continuous supervision has to be provided for the full-time that work is underway.”

286. Steve Rowsell continued:

“In my opinion, the obligation requires a supervisor to be present at the site of work activity rather than for example, being present elsewhere on site or in the site office carrying out other tasks. The General Specification requires that the works shall be arranged so that the works are supervised at a minimum ratio of one supervisor to no more than 10 workers. Therefore, if the number of workers involved in the coupler works is greater than 10 then there should be more than one supervisor in attendance.”

287. That interpretation was not adhered to by Leighton. Nor did Leighton seek clarification from the Buildings Department as to the intended meaning of the phrase “full time, continuous supervision”.

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<sup>40</sup> Paragraph 78 of the report

288. ██████████ in respect of Leighton's compliance with the QSP, ██████████ a significant number of Leighton staff (whose responsibilities included site supervision and inspection) were never informed of the existence of the QSP or of its contents.

289. ██████████ Kevin Harman, who at the time was Leighton's Quality and Environmental Manager, testified that he was not aware of the QSP. The following exchange needs no elaboration:

Q. So you mean at the time when you were quality manager of Leighton you did not have any knowledge as to whether there is a QSP with supervision and inspection requirements applicable to the coupling works on the EWL slab?

A. I don't remember any.

290. Nor did Raymond Brewster, Leighton's Group Pre-Contracts Manager, have any recollection of the QSP. In an exchange with the Chairman, he made it clear that, in his view, Leighton's own quality control procedures were more than sufficient. The QSP was therefore, in practical terms, superfluous:

Q. So in respect of couplers, you are saying effectively that anything that the QSP to which you have been referred, anything that was concerned there with couplers would already have been part and parcel of your standard quality control mechanisms and procedures?

A: Yes, that's what I'm saying.

291. But, of course, the enhanced regime of supervision set down in the QSP was *not* already part and parcel of Leighton's standard quality control mechanisms. It required more. Elsewhere, Raymond Brewster said that he would not have expected his Leighton engineers to have knowledge of the QSP:

"... I wouldn't expect necessarily those field people, the site engineers, to actually be aware of the QSP, if we were working with our own quality management plan, and that plan ... also provides facilities for checking reinforcements through RISC forms and also the pre-pour check."

292. Chan Chi Ip, a Leighton site supervisor, when asked what he knew of the QSP, said that he had never dealt with the document. Other site supervisors gave evidence to like effect.

293. Nor can it be said that, in practice, Leighton staff, whether they knew of the QSP or not, carried out full-time and continuous supervision. Edward Mok, one of the Leighton engineers, gave evidence that, while on and off he would walk past the location where rebars were being installed into couplers, there was no one assigned or stationed at that location to watch every coupler being connected.

294. At this juncture, the Commission also notes that the Leighton engineers involved in the inspection process did not all hold a grade T3 TCP qualification as required under the QSP regime.

295. [REDACTED]

296. [REDACTED] In his final submissions, counsel for the Government observed that, as project manager, Leighton's deficiencies were also those of MTRCL which had been paid HK\$8 billion as a project management fee. The staff of MTRCL had their own supervision and inspection obligations. [REDACTED]

297. In this regard, Steve Rowsell commented:

“In relation to the requirements for approved resources for site supervision and their technical competence as set out in the [Site Supervision Plan (the ‘SSP’)], evidence has been provided by witnesses from the Contractor [Leighton] that they were unaware of the SSP and/or the QSP. This included the Contractor's Construction Manager. Without the knowledge of the requirements it was clearly impossible to ensure that the requirements for supervision set out in these



documents were being delivered. I would have expected the MTRCL supervisory and inspection teams to have identified that the Contractor was working in ignorance of those key supervision documents. I would have expected the MTRCL teams to have checked that the levels of the Contractor's supervisory resource met the requirements in terms of numbers set out in the General Specification and also met the approved named resources and requirements for technical competence set out in the SSP and QSP."

298. [REDACTED]  
[REDACTED]  
[REDACTED]

299. Strangely, it is apparent that detailed log records were kept in respect of coupler installations during the construction of the diaphragm walls. But that compliance fell away during the construction of the EWL platform slab.

300. Kobe Wong Chi Chiu, a Senior Inspector of Works with MTRCL, testified that he had served as the Quality Control Supervisor for MTRCL when the diaphragm walls had been constructed. During that time, log book records had been kept. However, when the EWL platform slab was under construction and he was conducting supervision, he came to discover that no records pursuant to the QSP were being kept.

***Were the standard forms nevertheless sufficient?***

301. On behalf of MTRCL and Leighton, it was submitted that the well-tried RISC forms and pre-pour checklists were in fact sufficient evidence that coupler installation works had been fully supervised and inspected. In the course of his evidence, Aidan Rooney, at the time MTRCL's General Manager, said that his company's engineers and inspectors "checked 100% and verified that through signing off of the RISC forms". While individuals may not have checked more than 40% or 50%, he was confident that the team as a whole would always manage a 100% check. Aidan Rooney had great confidence in his team of engineers and inspectors. The Commission [REDACTED]  
[REDACTED] has the following concerns:

- a. The formal ‘hold point’ inspections were only conducted after all the coupler installation work had been completed and were essentially visual inspections. In such circumstances, it was accepted that if, for example, the threads of a rebar had been cut and then inserted into a coupler, that would not be detected.
- b. There was also the difficulty that these ‘hold point’ inspections were not fully documented. Only the inspection of the top mat was recorded in the RISC form. There were no specific records indicating when or by whom the inspection of the bottom mat had been carried out.
- c. The extent of inspection was also open to question. Kwan Pak Hei, Louis (‘Louis Kwan’), a construction engineer with MTRCL whose primary role was to inspect the site works during the construction of the EWL platform slab, said that he did not specifically inspect the all-important couplers. It was put to him by the Chairman that, as he was responsible for checking the top and bottom mats of the platform slabs, did he not also check the coupler connections into the diaphragm wall. His answer was: “Formally, I was not assigned to check the couplers”. The Chairman then asked that, presuming another inspector inspected the couplers, did that inspector complete his own RISC form? Louis Kwan replied: “From the records that we have got so far, I do not think so.”
- d. During the course of final submissions, counsel for the Government submitted that the fact that, after May 2018, MTRCL and Leighton had both engaged in the compilation of retrospective record sheets for the coupler installations was itself an indication that they must have been aware of the need, at the time that the installation work was done, to compile full and accurate contemporaneous records. Clearly, that had not been done.

### ***The creation of retrospective records***

302. On 15 June 2018, following the media reports that had first been published in May 2018, MTRCL submitted a report to the Government – the *Report of the SCL Contract – Review of the EWL Slab Construction* (the ‘June Report’). The June Report was clearly intended to allay public concerns in

respect of the manner of construction of the station box structure, more particularly in respect of the anchoring of the EWL platform slab by way of coupler connections. It did not achieve this end.

303. The June Report was compiled under considerable pressures of time. It dealt with matters that had occurred some two to three years earlier. However, it contained a fundamental error in respect of a matter of fundamental importance. In the June Report, among other things, it was said that, in accordance with the design accepted by the Buildings Department, the total number of couplers connecting the EWL platform slab to the east and west diaphragm walls numbered approximately 23,500. It was further said that relevant inspection forms indicated that the work of coupler connection had been found to be acceptable with no anomaly.

304. However, those who contributed to the June Report – probably because they had no knowledge of it – had neglected to take into account the fact of the second design change: the ‘second change’. This ‘second change’ (which is explained earlier in this report in Chapter 4) had resulted in the trimming down of the top portion of the east diaphragm wall between gridlines 22 and 40 and, critically, the replacement of couplers with ‘through bars’. The result of this change was that the number of couplers connecting the EWL platform slab to the east and west diaphragm walls were materially *less* than 23,500.

305. More than that, the assertion made in the June Report that the relevant inspection forms had demonstrated that the work of coupler connection had been acceptable with no anomaly had to be materially wrong. As it was put during the course of the Commission hearings: what a portion of those records showed was that couplers that did not exist had nevertheless been correctly installed.

306. The Commission does not consider it necessary to seek to unravel the exact history of how the errors came into being. Suffice to say that a number of personnel were involved. For the purposes of this report, the Commission considers the following to be sufficient.

307. In light of the media reports that came out in May 2018, both Leighton and MTRCL prepared checklists that were almost the same as each other.

308. Concerning MTRCL, it appears that it was asked by the Government to conduct a search of its records concerning coupler installation. Although MTRCL staff were able to confirm that they had conducted routine site surveillance in respect of 50% or more of the coupler installations, and while they had a collection of site photographs, they did not have contemporaneous detailed written records.

309. An exercise was undertaken to compile a spreadsheet based on the photographs. In order to provide more detail, a summary was then prepared but apparently for 'internal records purposes' only.

310. This summary in some manner was then converted into a series of individual purported checklists which, in respect of each and every diaphragm wall panel, contained certain drawings and more particularly a checklist of installation of rebars into couplers. In each form – essentially mirroring the QSP checklist – were a series of six references, for example: 'couplers fully screwed and fitted'; 'has coupler been cleared of foreign material?'; 'has thread been cleared of foreign material?'. These purported checklists bore the heading 'Checklist for on-site assembly of EWL Slab to D-wall/slab couplers'.

311. It is important to note that these checklists also contained details of whether each installation had been satisfactory or not: by way of illustration – 'satisfactory/not satisfactory'. The legend at the foot of the checklist directed: 'cross out as appropriate'. This was done on each checklist.

312. [REDACTED]

313. Although at the foot of each checklist there was an endorsement saying that the form served as a retrospective record of coupler installations, regrettably, at some point in the preparation of these checklists, false assumptions took the place of fact. The false assumptions were that couplers had been correctly installed when no couplers had been installed at all.

314. [REDACTED]

[REDACTED]

315. [REDACTED]

316. [REDACTED]

317. When he testified before the Commission, the former Projects Director of MTRCL, Dr Philco Wong, made the observation that these retrospective records “should not have been created. No one should ever do anything like that”. [REDACTED]

318. What must be emphasised, however, is that at or about the same time Leighton also prepared very similar records containing the same false assumptions as to the installation of couplers. It should also be said that Leighton’s records effectively mirrored the requirements of the QSP checklist. [REDACTED]

319. The Leighton checklists bore slightly different headings: ‘As-Built For on Site Assembly of EWL Slab to D-Wall/Slab Couplers’. They did not bear any endorsement to the effect that they constituted retrospective records.

320. The Leighton forms, however, were not signed and appear to bear dates that relate directly to the appropriate RISC forms. Indeed, each of these checklists was attached to a RISC form.

321. The RISC forms with their attached checklists were produced to the Buildings Department, the Railways Development Office and PYPUN for inspection. They were submitted to MTRCL on 13 June 2018.

322. In the course of his closing submissions to the commission, counsel for the Government spoke in blunt terms of the exercises described above. He said:

“What MTRCL and Leighton ought to have done was to come clean at first opportunity about the lack of contemporaneous records, rather than engage in the creation of misleading and confusing retrospective checklists. Such practice is wholly unacceptable and represents extremely poor project management.”

323. 

## Chapter 9

### Is the structure safe?

324. As the Commission has earlier observed, its first and fundamental mandate has been to determine whether the diaphragm walls and connecting platform slabs – as now built – are structurally sound, that is, whether they are safe for future use by the public.

325. For the reasons already set out, while the Commission has found that there were isolated and sporadic incidents of failing securely to install rebars into couplers, it is satisfied that this was not a widespread nor systematic failure. In the result, two key questions remain:

- a. Is the change to the top of the east diaphragm wall and EWL platform slab where it connects with the over track exhaust ('OTE') slab safe?
- b. Is the EWL platform slab effectively and safely connected to the diaphragm walls?

326. To assist it in answering these questions, the Commission has received invaluable assistance from five independent engineering experts. They are:

- a. Professor Don McQuillan, senior vice president of the Institution of Structural Engineers and a visiting professor of engineering design at Queen's University Belfast – appointed by the Commission. Professor McQuillan has over 40 years experience in practical structural engineering.
- b. Professor Francis T K Au, a chartered structural engineer and Head of the Department of Civil Engineering at the University of Hong Kong – engaged by the Government. Professor Au has nearly 40 years experience, the vast majority of which has been in teaching and research in structural engineering.

- c. Dr Mike Glover OBE, a chartered structural engineer and an Arup Fellow – engaged by MTRCL. Dr Glover has almost 50 years experience in major infrastructure and building projects, including the new HSBC building in Hong Kong in the late 1970s and early 1980s, the Channel Tunnel Rail Link in the United Kingdom (1995-2007) and the new Queensferry Bridge in Scotland (2007-2017).
- d. Dr Albert T Yeung, a chartered civil and geotechnical engineer and an Associate Professor in the Department of Civil Engineering at the University of Hong Kong – engaged by China Technology. Dr Yeung has more than 30 years experience as a geotechnical and pavement engineer.
- e. Mr Nick Southward, a chartered structural engineer, a director of Tony Gee and Partners LLP and managing director, Tony Gee (Asia) Limited – engaged by Leighton. Nick Southward has 30 years experience in the design of bridges and viaducts for railways and roads in Hong Kong, the Middle East, Asia, Australia and the United Kingdom.

327. It is to be noted that Leighton further instructed COWI UK Limited ('COWI')<sup>41</sup> to undertake an independent structural analysis and assessment of the connection of the EWL platform slab to the diaphragm walls.

328. After all factual evidence had been given, the independent engineering experts gave evidence to the Commission over five days from 14 to 18 January 2019.

### ***The agreed expert memorandum***

329. Following visits to Hung Hom Station Extension site, the independent experts met together on 18 December 2018 to discuss all relevant issues relating to the structural integrity of the station box structure. Also present at that meeting was Colin Wade, a colleague of Dr Glover's from Arup.

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<sup>41</sup> COWI is a firm of consulting engineers engaged by Leighton to undertake an independent structural analysis and assessment of the diaphragm walls and platform slab construction works at the Hung Hom station for the purposes of the Commission of Inquiry.



330. It is today a well accepted practice, when a number of independent expert witnesses are to testify in proceedings, for those experts to come together as peers to discuss the matters in respect of which they are briefed and, if possible, to reach an agreed opinion.

331. In the present instance, there was an open discussion which took place over a period of four hours or so. The contents of the discussion were without prejudice and accordingly no minutes were taken. Again, this is accepted practice.

332. The agreed and signed memorandum – the Joint Statement – is attached to this report as Annexure E. In essence, all of the independent experts agreed on all matters, save only that:

- a. Professor Au had reservations regarding the internal stresses at the top-of-wall construction joint relating to the changed construction detail. However, notwithstanding this reservation, all of the experts (including Professor Au) agreed that this would not be problematic as far as the structural integrity of the station box structure is concerned.
- b. Nick Southward was unable to comment on the implications of any of the miscellaneous defects but this was purely on the basis that it was beyond his terms of brief.

333. On 22 December 2018, a few days after the joint meeting of experts, Professor Au had some further comments that he set out in a note to the Commission. In this regard, the Commission notes that in essence Professor Au's comments relate to his view that further structural calculations should be carried out in order to justify the views that he and the other experts expressed and agreed at the meeting.

334. The contents of the Joint Statement are discussed below.

### *General Code requirements*

335. The first topic in the Joint Statement relates to the Code requirements for reinforcement concrete design in Hong Kong<sup>42</sup> (the ‘Code’).

336. Dr Glover explained to the Commission that early in his career he had been involved in assisting the Cement & Concrete Association in drafting the first limit state code for reinforced concrete, which was published in 1972 as CP110. The Hong Kong Code is a direct descendant from this.

337. Dr Glover went on to explain to the Commission the reasons for not requiring ductility couplers. He told the Commission that Hong Kong is not a high seismic area – it is accepted to be an area of low to moderate seismicity. And, in any case, to assume that a substantial rigid box sitting in the ground (which is the case with the Hung Hom Station box) would be seismically sensitive would be incorrect. Dr Glover pointed out that similar underground structures across the world had survived earthquakes without significant distress. In any event, the Commission understands that Leighton did actually use ductile couplers on the Hung Hom Station project, as their additional cost was insignificant.

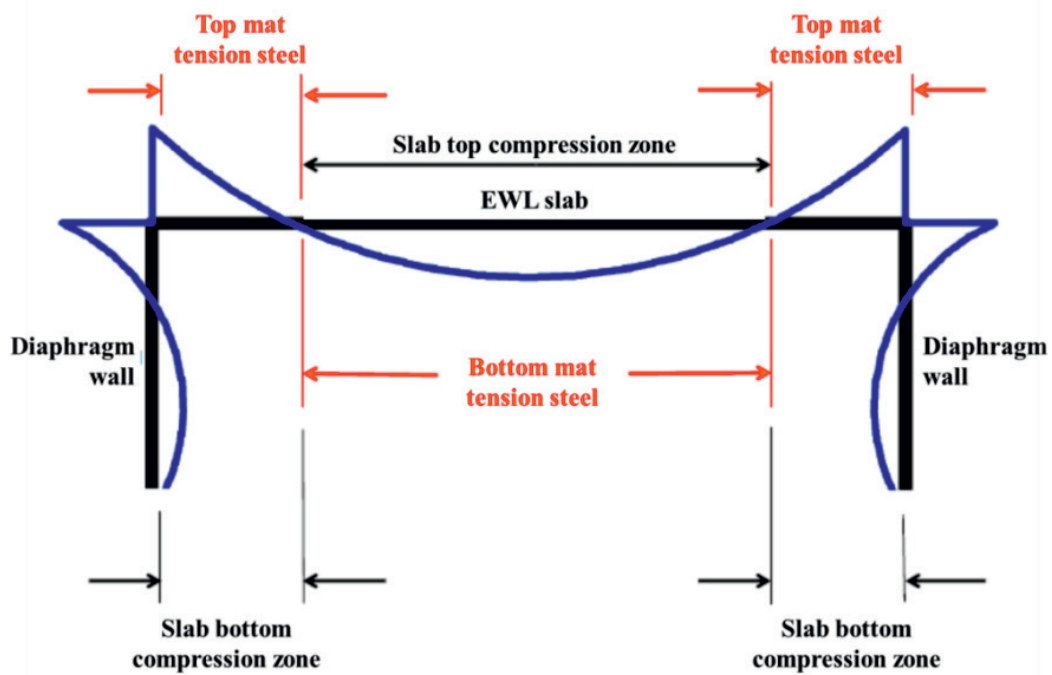
338. During the inquiry the Commission heard evidence as to why ‘permanent elongation’ and ‘cyclic tension and compression’ tests, which are needed for couplers that may be used in certain circumstances, were of no relevance to the particular circumstances of the Hung Hom Station structure.

339. Professor McQuillan explained to the Commission how the forces operated on the EWL slab and why the interface between the slab and the diaphragm wall would always be in tension at the top of the slab and would always be in compression at the bottom of the slab. He illustrated this with a diagram – Diagram 11 – which appears below.

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<sup>42</sup> *Code of Practice for Structural Use of Concrete 2004*

**Diagram 11**



340. The Commission was advised by the experts that, in order to comply with the Code, the amount of reinforcement steel in the bottom of the EWL platform slab needed to be at least equivalent to 50% of the reinforcement steel in the top of the slab.

341. The independent experts agreed as follows:

*“All agreed there was no requirement for ductility couplers.*

*All agreed that an amount equivalent to 50% of the top tensile steel was required in the bottom of the EWL slab to be carried through in the D-wall. i.e. less than 50% of the bottom steel at the interface was required for Code compliance.”*

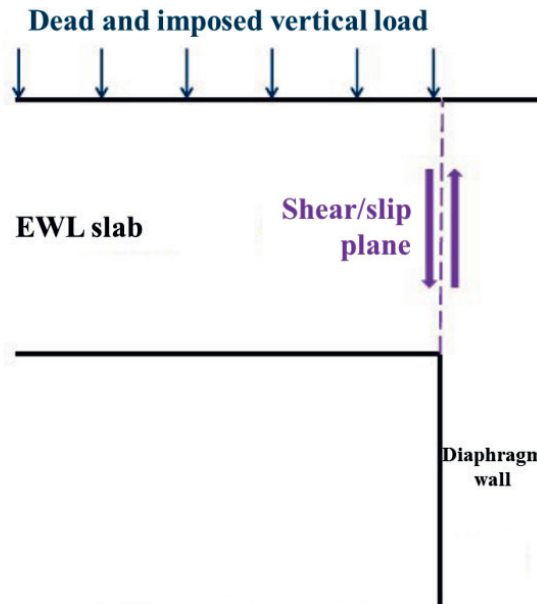
### ***Bottom mat reinforcement in EWL platform slab***

342. The second topic in the Joint Statement relates to the steel reinforcement in the bottom mat of the EWL platform slab.

343. This point was addressed by Professor McQuillan as discussed above and is further illustrated by two additional diagrams he provided in his expert report. They appear below as Diagrams 12 and 13. Professor McQuillan described how the shear key (an indentation formed in the edge of the

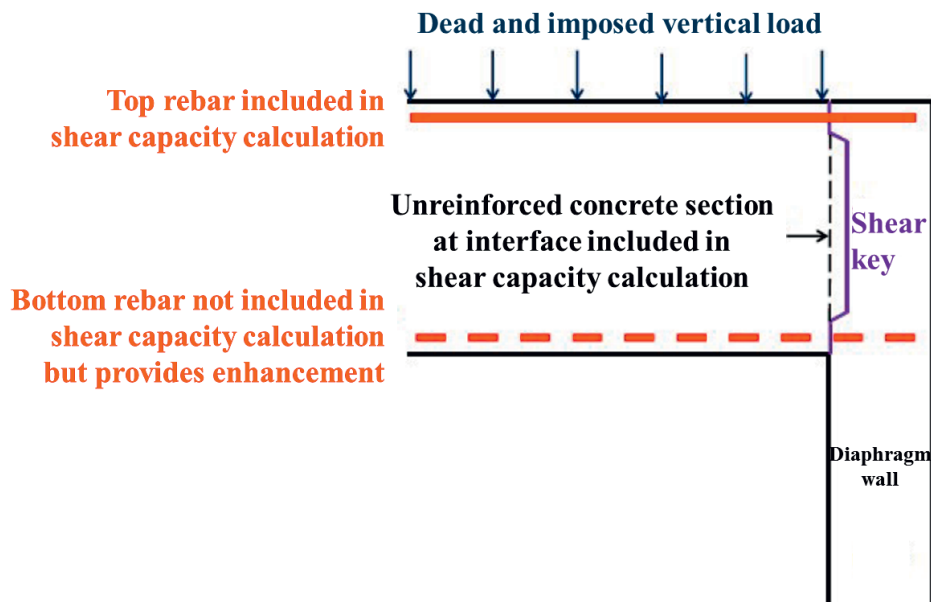
diaphragm wall) resists shear forces at the interface between the slab and the diaphragm wall.

**Diagram 12**



Under vertical load interface becomes a shear/slip plane

**Diagram 13**



Shear/slip resistance provided by top rebar and unreinforced concrete section

344. The independent experts agreed as follows:

*“All agreed that irrespective of the code requirement the EWL slab does not, in theory, rely on steel at the interface, at the bottom, for flexure and shear capacity.”*

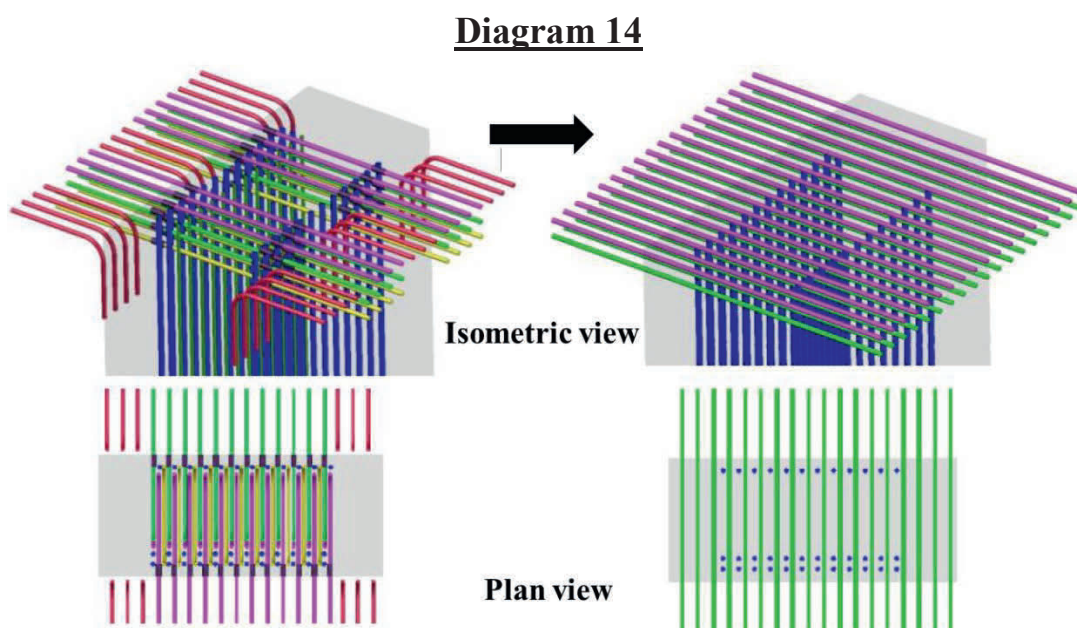
### ***Change to top of the east diaphragm wall***

345. The third topic in the Joint Statement relates to the change to the detail that took place with regard to the top of the east diaphragm wall.

346. The independent experts advised the Commission that cutting down of a diaphragm wall is normal construction practice, not dissimilar to the cutting down of the top of a pile when forming a pile-cap, or cutting into a diaphragm wall to form an indentation or shear key.

347. The experts also advised the Commission that a change from couplers to through bars would have no adverse structural implications. Indeed they advised that it would actually create a superior detail, as (1) it would remove a potential point of weaknesses (if any of the coupler assemblies should in any way be incorrectly connected), and (2) it would result in more reinforcement steel being provided across the top of the diaphragm wall connecting into the slabs either side.

348. Nick Southward explained to the Commission how the change resulted in additional reinforcement being provided. He illustrated this with a diagram which appears below



349. The independent experts agreed as follows:

*“The cutting-down of a D-wall is a normal part of the construction process with the methodology governed by the specification and is analogous to the construction of a shear key.*

*All agreed that the change from couplers to through bars in the top of the east D-wall was a better detail and provided more steel across the interface (subject to a review of the internal stresses at the top-of-wall construction joint relating to the “first change” and its rebar detailing). Notwithstanding, all agreed the outcome would not show the construction joint to be problematic.”*

350. The phrase in brackets, “*subject to a review of the internal stresses at the top-of-wall construction joint relating to the “first change” and its rebar detailing*”, is a reference to the reservation expressed by Professor Au at the joint meeting. This was explored extensively in the inquiry and the Commission notes that three of the independent structural experts – Professor McQuillan, Dr Glover and Nick Southward – consider that a review of the internal stresses is unnecessary, which they explained to the satisfaction of the Commission. The experts did however agree that carrying out such a review, which the Commission understands to be a numerical checking exercise, would remove any residual doubt in this area. Dr Yeung expressed no view on this matter, presumably because it was outside his expertise.

351. In any event, Professor Au advised the Commission that the review of the internal stresses could be carried out in a very short period of time, just a few days, provided it was done or supervised by someone of his expertise. The Commission understands that such a review has not yet been completed.

### ***Miscellaneous defects***

352. The fourth topic in the Joint Statement relates to miscellaneous workmanship defects reported, such as ‘spalling’ and ‘voiding’ of concrete (referred to as ‘honeycombing’), gaps, misaligned shear links, etc.

353. The independent experts explained to the Commission that the workmanship defects of spalling and honeycombing were not uncommon on construction sites, particularly where there are such deep slabs with such

congested reinforcement. They were of no structural significance provided that local repairs were made to replace the missing cover to the reinforcement. The Commission understands that such repairs are already being carried out, or at least are planned.

354. Similarly, the experts explained to the Commission that the few instances of misaligned shear links, that is the steel linking the upper mat of rebars to the bottom mat, would have no detrimental effect on the shear capacity of the thick platform slabs.

355. The independent experts agreed as follows:

*“All agreed (except Nick Southward (not part of his brief)) that miscellaneous workmanship issues e.g. spalling, voiding, gaps etc. were all repairable.*

*The main discussion related to misaligned shear links. All agreed this was of no structural significance in the context of the slab rebar.”*

### ***Load testing***

356. The fifth and penultimate topic in the Joint Statement relates to the load test that had been proposed as part of the Holistic Proposal.

357. The independent experts explained to the Commission that load testing the as built structure was inappropriate as (1) any deflection from a load test of this thick structure would be virtually undetectable, and (2) the structure had already experienced its worst (i.e. largest) loading conditions during the construction process when it was supported in its temporary condition.<sup>43</sup> Now that the box structure has been completed, together with internal walls propping between the bottom (NSL) slab and the top (EWL) slab, the current loads on the structure are significantly less than they were during construction.

358. In addition, the experts advised the Commission that train and passenger operations would add only a small amount of load to the structures, less than 10%, and that most of this load would be transferred directly into the

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<sup>43</sup> The Commission heard that the most severe loading case occurred when the EWL platform slab had been cast and before the NSL platform slab was cast. The NSL slab acts as a permanent strut between the diaphragm walls.

diaphragm walls, which are more or less directly under the track positions.

359. The Commission further notes that the experts considered long-term monitoring of the structure to be a preferable way of allaying any residual concerns of the public with respect to safety.

360. The independent experts agreed as follows:

*“All agreed that a load test was unnecessary because it would yield no meaningful result and long-term monitoring would be a better approach to allay public concerns.”*

### ***Opening up***

361. The sixth and final topic in the Joint Statement relates to the opening up strategy, which by that time was underway as part of the Holistic Proposal.

362. The independent experts advised the Commission that the design of the platform slabs was “conservative” and provided a high degree of under-utilisation as compared to that required to properly withstand the loads incurred by the structure. The experts also refer to this under-utilisation as “redundancy” or “spare capacity”.

363. Atkins, Arup and COWI all agreed that there is at least 40% spare capacity at the top mat of the EWL platform slab.

364. The Commission does not regard the partial redundancy of the reinforcement as being a criticism of the designers, Atkins. On the contrary, the Commission fully understands why it is prudent for a designer to specify reinforcement strictly in accordance with the Code, even in circumstances where conditions requiring such reinforcement may not apply. Under the particular circumstances that the Commission is faced with at the Hung Hom Station SCL project, having a prudent, conservative design has proved beneficial.

365. The independent experts explained to the Commission that, because the bottom level reinforcement in the EWL slab at the connection with the diaphragm walls is not required to take tensile load and is only provided for



Code compliance, 50% of the coupler connections have no structural significance at all. As the Commission understands it, in other words up to 50% of the coupler connections in the bottom of the EWL platform slab could be sub-standard without affecting structural integrity.

366. The Commission notes that the independent experts were of the opinion that the opening-up at the bottom of the EWL slab was unnecessary and furthermore caused a hazard to workers, which could be avoided. The Commission further notes that the independent experts were of the opinion that invasive investigation – that is opening-up – of the diaphragm walls and the NSL slab should also be reviewed as they saw little value in it continuing.

367. Finally, the experts considered the proposed non-destructive testing (PAUT) to be, in their words, “inaccurate, time consuming and inappropriate”. The Commission notes that the inaccuracy of the results was demonstrated subsequently when the police checked the actual length of threaded section of rebars and found serious discrepancies with the PAUT results.

368. The independent experts agreed as follows:

*“In terms of the current opening-up regime all agreed, based on the “redundancy” of the couplers in the bottom of the EWL slab, that further opening-up was unnecessary. Focus should be directed to the top of the east D-wall to verify the as-built drawings and the details which are of structural significance.*

*Moreover, it was noted during the site inspection that the EWL soffit slab openings were creating safety hazards for the staff on-site.*

*Also the decision to expose the third and fourth layers of rebar is impractical and will cause major disruption to the slabs.*

*All agreed that the GPR NDT [non-destructive testing] was inaccurate, time consuming and inappropriate when opening-up has to be carried out anyway.*

*All agreed that invasive investigation of the D-walls and NSL slab should also be reviewed.”*

369. The subject of partial engagement of threaded bar into couplers was explored with the independent experts during the inquiry. Professor McQuillan, Dr Glover and Nick Southward shared the view that partial engagement of coupler assemblies, as revealed to date in the results of the opening-up exercise, will not affect the structural integrity of the platform slabs. The Commission accepts this expert opinion, noting that the extent of the partial engagement problem is very limited and, in the view of the Commission, not sufficient to question the integrity of the structure.

***Summary of key considerations when assessing structural safety***

370. On hearing all of the expert evidence, and after receiving closing submissions from counsel for all the involved parties, the Commission has reached the view that the following considerations impact the answer to the question as to whether the structure is safe.

371. Firstly, the preponderance of expert evidence was that there is no safety related issue in relation to the changed detail at the top of the east diaphragm wall.

372. Secondly, all the evidence before the Commission shows that there is significant redundancy in the structure.

373. Thirdly, due to the change in detail at the top of the east diaphragm wall – with over 80% of the couplers in Areas B and C having been replaced by through bars – the actual number of couplers subjected to tensile forces has been reduced to a relatively small number. Through bars are now taking the tensile forces and so, for the large part of the EWL platform slab, any defective coupler connections would have no structural significance.

374. Fourthly, as the connection between the bottom of the EWL platform slab and the diaphragm walls is always in compression, the couplers there have no structural significance. Again therefore, any defective coupler connections at the bottom of the EWL platform slab are of no structural consequence.

375. Fifthly, defects such as honeycombing are not matters of safety and can all be repaired.

376. Sixthly, the Hung Hom Station box structure – the diaphragm walls and the two platform slabs – have been in place for over two years (in the case of some parts, up to four years) and there are no signs whatsoever of distress which would give rise to any safety concerns. Furthermore, the structure has already sustained its most severe loading conditions – that is during the construction stages in 2015 and 2016.

377. Finally the opening-up exercise has not revealed anything of concern in relation to structural safety.

### ***Looking to the conclusions of the independent experts***

378. In his expert report, Dr Mike Glover, an internationally respected engineer, had no concerns as to the safety of the station box structure. Among other observations, he said:

“It is evident so far as I am concerned that the structure of the station box has large degrees of redundancy and robustness and, consequently, a comfortable margin of safety which supports my opinion that the *structure is safe for its intended lifespan.*”[emphasis added]

“The structure of the Hung Hom station box shows no signs of distress, cracking or distortion to indicate that it has been overstressed during the critical construction stage... The future operation loads and the extra supports provided by the NSL loadbearing columns and walls represent a more benign loading environment, which provides yet further confidence in the safety of the existing construction.”<sup>44</sup>

379. Nick Southward in his expert report said:

“There is a significant amount of structural redundancy in the design of the station box structure and such redundancy means that the limited amount of couplers with threaded lengths less than the minimum do not pose any concern for the overall structural safety and integrity of the station box structure.”<sup>45</sup>

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<sup>44</sup> See page 13 & page 16 of Dr Mike Glover’s report

<sup>45</sup> See page 6 of Mr Nick Southward’s report

380. Professor Don McQuillan, the independent expert engaged by the Commission, observed first:

“It follows therefore that for the EWL slab to function structurally and safely, no bottom couplers are required i.e. they could all be defective. It also follows that to be code-compliant, up to 50% of the coupled connections could be defective.”<sup>46</sup>

381. He further observed:

“In conclusion, on the basis of all the evidence available, I am satisfied and in no doubt that the structural integrity of the EWL slab has not been compromised as a result of changes of detail and sub-standard workmanship incidents, and that there are no safety issues or concerns... The same opinion applies in respect of the D-walls and lower NSL slab.”<sup>47</sup>

### ***Conclusions with regard to structural safety***

382. The Commission notes that counsel for the Government has stated: “It is premature to form a view on the question of whether the as built Station Box Structure is structurally safe”.<sup>48</sup> The Commission disagrees.

383. On a consideration of all the evidence, especially that of the independent structural engineering experts, the Commission is confident that the station box structure (that is, the Hung Hom Station Extension diaphragm wall and platform slab construction works) are safe.

384. Further, the Commission finds that no rebuilding or strengthening of the diaphragm walls or the platform slabs to be necessary.

385. Additional confidence could be obtained by carrying out a finite element analysis to examine internal stresses at the connections between the diaphragm walls and the platform slabs as constructed. However three of the independent structural experts consider this to be unnecessary, save that it would remove any residual doubt in this area. The Commission is not

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<sup>46</sup> See page 39 of Professor Don McQuillan’s report

<sup>47</sup> See page 49 of Professor Don McQuillan’s report

<sup>48</sup> Section D3 of the closing submission by counsel for the Government

recommending this as being necessary.

386. The Commission accepts the advice provided to it by the independent structural engineering experts that the east and west diaphragm walls and EWL and NSL platform slabs should be instrumented to detect movement during the operational phase of the station. Instrumentation should be by means of fibre optics or other approved measures. Movements should be monitored and reported to the Government.

387. The Commission notes however that the independent structural engineering experts predict that any movement of the station structure will be extremely low, if indeed any movement occurs at all.

388. The Commission further notes the expert advice that such low level of movement will have no impact on the safe operation of the railway.

389. As has been addressed in Chapter 8, the Commission has found a number of deficiencies in the oversight and inspection regimes employed on the SCL Project. Notwithstanding these deficiencies, the Commission has found that safety of the completed structure has not been compromised on this occasion.

390. In short, the Commission finds that the Hung Hom Station Extension diaphragm wall and platform slab construction works are safe.

### ***Recommendations on measures with a view to promoting public safety***

391. Pursuant to section (c) of its original Terms of Reference, the Commission is required to make recommendations on suitable measures with a view, firstly to promoting public safety, and secondly to promoting assurance on quality of works. With regard to the first part, namely promoting public safety, the Commission recommends as follows:

The Commission recommends ongoing monitoring of the station structure during operation of the station, so as to provide reassurance to the public. However, the Commission notes the advice it has received that it is unlikely that any significant movement will occur.

392. The Commission will set out its recommendations in relation to promoting assurance on quality of works in Chapter 11.

## Chapter 10

### Reviewing adequacy of MTRCL's & Government's management systems

393. In addition to its inquiry into the facts and circumstances surrounding the construction of the station box structure and whether it is fit for purpose, the Commission has been required to conduct a review of the adequacy of the relevant management systems of MTRCL (as project manager) and the Government (as ultimate owner of the entire SCL project). The Commission has also been required to make recommendations in respect of any measures it considers suitable with a view to promoting public safety and assurance of quality of works.

394. In this interim report, the Commission has focused particularly on matters that, going forward, may well have a direct bearing on the safety and fitness for purpose of the ongoing construction works. In its final report, the Commission may broaden its scope to address further matters relating to due compliance by the parties with their respective obligations under the relevant contractual and regulatory regimes.

395. In reaching its determinations, the Commission received the assistance of two independent experts in matters of project management:

- a. Steve Rowsell was appointed as the independent expert to the Commission. Steve Rowsell, a current member of the Institution of Civil Engineers' Procurement Panel, has worked for over 40 years in the public and private sectors on major infrastructure projects in both the highways and rail sectors. He has served as Head of Procurement on the UK£15 billion Crossrail railway project in London and is a Director of the consultancy, Rowsell Wright Limited.
- b. Steve Huyghe was engaged by MTRCL as an independent expert. Steve Huyghe is the founder and Chairman of CORE international Consulting LLC, based in Atlanta, Georgia. Before taking up the role of a consultant, Steve Huyghe held senior positions in the construction of major international projects including oil refineries, chemical and steel plants and large-scale infrastructure construction projects.

396. Of further assistance to the Commission is the fact that both independent experts were able to meet and reach a large degree of consensus in respect of the principal matters that have emerged during the Commission hearings.

397. The Commission has also taken note of the fact that Turner & Townsend, a leading management consultancy, has carried out a review to assist MTRCL in updating and improving its management systems. The recommendations of the Turner & Townsend review align substantially with the recommendations made by the two independent experts. It is understood that MTRCL has established an implementation group to take forward the Turner & Townsend recommendations: a clear indication, in the opinion of the Commission, of the desire to achieve continuous improvement in its management processes.

398. In conducting its review, the Commission has taken account of the following matters which it considers to be of material importance.

#### ***A. MTRCL***

##### ***Supervision and inspection of reinforcement bars and couplers***

399. On the basis of evidence presented to it during the hearings, the Commission has found that Leighton was obliged to provide ‘full-time and continuous’ supervision of the coupler assembly process. The general specification required a minimum ratio of one supervisor to no more than 10 workers.

400. In this regard, the Commission has concluded that Leighton was required to provide one supervisor at the location on site at all times when coupler installation was being carried out. By contrast, MTRCL was obliged to supervise at least 20% of the coupler assemblies. MTRCL sought to fulfil this obligation by having a continuous presence on site to undertake its supervision duties.

401. On completion of the reinforcement installation and prior to concreting, both Leighton and MTRCL were required to inspect the reinforcement and sign off that the work had been satisfactorily completed. ‘Sign off’ was by means of



a completed Request for Inspection, Survey and Check ('RISC') form. This inspection was a 'hold point', meaning that work could not proceed beyond that point until the inspection had been satisfactorily completed.

402. On the part of MTRCL, in respect of the EWL platform slab, the Commission found that there was a lack of clarity in respect of the designated responsibility for formal inspections and for maintaining records.

403. During the course of the inquiry, both MTRCL and Leighton placed high reliance on the RISC form as being a primary contemporaneous record. However, during the inquiry, the veracity of some of these forms was shown to be questionable, particularly in respect of the date and time that the inspections were meant to have taken place. In the opinion of the Commission, at best, the process for completing the RISC forms was less than systematic.

#### ***Disparate documentation***

404. One of the matters that caused the Commission concern, and which was identified by both independent expert witnesses, was that the obligations of the various parties operating on site appeared to be contained in a variety of disparate documents. In the result, engineers and others working on site were not always fully aware of the obligations which they must meet.

#### ***MTRCL's senior leadership of the SCL Project***

405. The Commission notes that MTRCL appointed three General Managers to collectively oversee the SCL project with just one of the three having direct accountability within MTRCL for overall management of the project. The other two General Managers had reporting line relationships – marked as 'dotted line' relationships – with MTRCL's Projects Director. In the view of the Commission, these 'dotted line' relationships at senior level can lead to a blurring of accountabilities and should be avoided.

406. At material periods during the project, one of the General Managers was nominated as the 'Competent Person' under the Buildings Ordinance while another was responsible for supervising the works. The Ordinance, however, requires the Competent Person to be responsible for supervising the works.

407. In the view of the Commission, split accountabilities of this kind at senior level may have contributed to some of MTRCL's project management issues that arose during the SCL Project.

### ***'Non-conformance' reporting***

408. The project management systems of both MTRCL and Leighton prescribe a system for reporting substandard works requiring the use of 'Non-conformance' reports ('NCR's). The accepted practice is that it is unnecessary to issue an NCR if the defective work that has been identified is able to be corrected and signed off on the same day. Both project management experts agreed with this practice. However, they recommended that all site supervision and construction engineering teams should be made aware of the defective work so that they are put on notice to be watchful for repeat occurrences. In the event that similar defective work occurs again, an NCR should then be issued.

409. While this practice may be the pragmatic way forward, the Commission believes that, if used properly, NCRs can provide valuable learning points on construction sites and facilitate continuous improvement through the proper investigation and implementation of corrective measures. For example, of particular relevance to this report, the opportunity to learn from the first identified incidents of the cutting of threads from rebars was lost because the matter was not reported, by way of an NCR or by any other means.

410. In the view of the Commission, MTRCL's system of non-conformance reporting requires a full review which should include a review of the process of 'closing out' (in respect of which evidence was put before the Commission of unacceptable delay).

### ***The role of Atkins***

411. Atkins was responsible for preparation of the engineering designs for construction of the diaphragm walls and construction of both the EWL and NSL platform slabs plus interlocking ancillary works (such as the OTE slab).

412. As noted earlier in this report, Atkins was engaged by both MTRCL and Leighton. It was first engaged by MTRCL as a detailed design consultant in January 2010. Later, in April 2012, it was engaged by Leighton as a

technical adviser, taking up work in this regard a year later. In an attempt to address concerns as to any conflict of interest, Atkins set up two teams: Team A for MTRCL and Team B for Leighton.

413. During the course of the hearings, it was initially asserted that Atkins kept both teams independent of each other with no conflict of interest. However, both the project director and design team leader were the same persons for Team A and Team B. More than that, Justin Taylor, Leighton's risk manager, said that, as he saw it, the same people at Atkins were handling the work for MTRCL and Leighton and there was no effective difference in the teams. In the end, John Blackwood, a director of Atkins, accepted that "in retrospect, it probably would have been better to have totally separate people in two teams".

414. During the course of the Commission hearings no actual conflict of interest was identified but the potential for such conflict was real. As pointed out by Steve Rowsell, with Team A and Team B under the same leadership, there was the risk that Team A may be reluctant to identify faults in designs approved by Team B or may not review submissions from Team B as thoroughly as they might otherwise have done.

415. The Commission is of the view that it is not good practice for the same design firm to provide services both to the employer, in this case MTRCL, and the contractor, in this case Leighton. As illustrated, such an arrangement carries with it the immediate potential of both real and perceived conflict of interest.

416. The Commission further notes that Atkins was not required to have a presence on site under either of its arrangements. One of the risks associated with this absence from site is that the designer is given little opportunity to ensure that its design intent is properly implemented in the works. The Commission agrees with the project management experts that it is desirable, if not essential, for a designer to have a presence on site. The Commission believes that this should be considered for all future rail infrastructure projects.

417. During the course of the hearings, issues going to ambiguity of instructions arose. Whether such ambiguity existed or not, the Commission is strongly of the view that the presence of a designer on site will quickly resolve any lack of clarity in the designer's design intent.

*‘As built’ records*

418. In all projects, MTRCL is obliged to submit ‘as built’ records and ‘as built’ drawings to the Government. ‘As built’ records comprise a wide spectrum of documents. In addition to the ‘as built’ drawings themselves, they include submissions as to particular materials, test certificates and construction records (such as technical queries, request for information and photographs).

419. In accordance with its own ‘Project Integrated Management System’ (‘PIMS’), MTRCL’s construction engineers and inspectors of works are required to ensure that ‘as built’ records are prepared as a continuous operation as construction proceeds. This requires the contemporaneous recording of what has been built. This requirement is in addition to records confirming quality: contemporaneous records demonstrating that the works have been built correctly.

420. Although it was a suggestion made by some witnesses who testified before the Commission, it is not a sustainable argument to say that the keeping of contemporaneous records need not be a priority on a busy construction site. Indeed, in respect of a busy site, the Commission considers it to be all the more important to keep contemporaneous records.

421. [REDACTED]

422. In the view of the Commission, the reason why records as to quality assurance must be produced contemporaneously with the inspection of the works is to demonstrate traceability and compliance; it must constitute verification by those who witnessed the works and/or carried out the inspections. This is a fundamental principle of quality assurance.

423. Moreover, site photographs, while no doubt they may have their uses, cannot in themselves constitute acceptable records going to quality assurance. They should only be used to support properly prepared quality records. Photographs may show that particular works were being carried out on a

particular day but they cannot demonstrate that such works were properly inspected.

424. The General Specification, forming part of Leighton's contract with MTRCL, requires that Leighton should produce 'as built' records and 'as built' drawings on a progressive basis, submitting them to MTRCL.

425. While the timing obligations of formal submissions may be in question, the Commission is in no doubt that MTRCL and its contractor, Leighton, had a clear obligation to provide them.

### ***Adoption of technology***

426. The Commission is aware of the fact that digital, hand-held devices are used extensively on construction sites around the world to capture the results of quality inspections and for tracking defects. It was surprising therefore to discover during the course of the hearings that MTRCL, together with its contractors and subcontractors, did not appear to make use of technology for systematic data capture on site, especially for producing contemporaneous records of quality inspections. The Commission heard from a number of witnesses that records of inspection were not immediately recorded on site but were recorded later on paper in the site office: on occasions, only being recorded much later, if at all. In respect of the use of technology on site, MTRCL appears to have 'fallen behind the curve'.

427. The Commission notes however that the use of technology on site has been addressed by MTRCL's consultants, Turner & Townsend and steps are being taken to implement the recommendations that have been made by the consultants.

### ***Building Information Modelling***

428. Building Information Modelling ('BIM') has not been used on the SCL project. Indeed, it appears that BIM has hardly been used on any MTRCL projects. However, Steve Rowsell, the Commission's independent expert, recommended that MTRCL should develop and implement the use of BIM as a collaboration tool. In addition, MTRCL's management consultant, Turner & Townsend, make reference to BIM in their review and the Commission has

been informed that MTRCL is progressing the development of BIM for future projects.

429. What therefore is BIM and, in the view of the Commission, what benefits will it provide in future Hong Kong infrastructure projects?

430. BIM is a process. A software model of the asset is developed and shared within a common data environment thereby increasing transparency between the parties. BIM provides clarity regarding the asset requirements at each phase of the project life cycle. Data from all parties is linked. The project is thereby kept on schedule and on budget. It may even be said that BIM is becoming part of the DNA of future construction.<sup>49</sup> Experience in the use of BIM demonstrates that significant savings of time and cost can be achieved, predominantly by reducing wasted or duplicated effort.

431. BIM has been widely adopted in the United Kingdom, Europe and North America. In 2012, the Government of the United Kingdom mandated that BIM be used on all publicly procured projects from April 2016. Many private sector clients in the United Kingdom have followed suit and BIM is progressively becoming the norm for designing, implementing and maintaining building and infrastructure assets across the United Kingdom and parts of Europe. The Commission notes that similar government mandates have been introduced in Finland (2007), Norway (2008), USA (2008), Singapore (2014) and France (2017). Germany will follow in 2020.

432. The Hong Kong construction community is already aware of the benefits of BIM. In the Chief Executive's 2018 Policy Address it was stated that the Government has established a "HK\$1 billion Construction Innovation and Technology Fund to encourage wider adoption of innovative technologies and stimulate the provision of cutting-edge solutions".<sup>50</sup> Further, the Government's *Budget Measures for 2018-2019* states that starting this year, the Government will adopt BIM technology in the design and construction of major government capital works projects.<sup>51</sup>

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<sup>49</sup> AIM Group, Hong Kong

<sup>50</sup> See paragraph 145 of that address

<sup>51</sup> See paragraph 113 of the Budget Measures statement

433. The Commission also notes that the Secretary for Development issued Technical Circular (Works) number 7/2017 in December 2017 setting out the requirement to use BIM technology in all capital works projects with estimated costs greater than HK\$30 million, this to take effect from 1 January 2018.

434. The Commission is not therefore recommending a technological process that is unknown in Hong Kong or of no interest to the construction industry here. In the context of this report, however, and looking forward, it is a development to be encouraged.

### *Communication*

435. As mentioned earlier in this report, in respect of the second design change – the ‘the second change’ – to a portion of the top of the east diaphragm wall, the modifications went ahead on the basis of a fundamental misunderstanding between MTRCL’s design management and construction management teams. Having considered the dynamics of the incident, Steve Rowsell commented as follows in his report:

“The opinion I have formed is that the contractual procedures had at this stage broken down and the position reached could be described as build and design (rather than design and build). I do understand the pressures that can develop on site during construction and the need to maintain programme but there always comes a stage where either the Contractor or the Engineer (or jointly, particularly in a partnering environment) should halt construction activity to ensure that approved designs are clear, procedures have been followed and are being implemented in practice.”

436. The Commission agrees with these observations. It notes, however, that the misunderstanding may have been aggravated by the absence of the designer from site, a matter emphasised above.

437. The Commission recognises that there can be breakdowns in communication in the best managed organisations. The independent expert witnesses have, however, suggested that one way of materially improving communications, including communications within a single organisation, is by the adoption and use of BIM.

### *Site entry/exit systems and procedures*

438. Under Contract 1112, Leighton was responsible for maintaining site security and in that regard implementing a secure entry and exit system. The Commission understands that its purpose was to provide a record of who was on site at any given time and also to provide a record for the payment of workers.

439. During the course of the inquiry, however, it became very apparent to the Commission that the system could not be relied upon. People – including casual visitors – came and went without the security system making any record.

440. As Steve Rowsell pointed out, an accurate record of site attendances is essential in order to support payments to the contractor under the ‘target cost’ contract model employed on the SCL project.

### ***B. Government***

#### ***Government’s sponsorship of rail enhancement projects***

441. During the course of the hearings, the Commission could not fail to take note of the very large number of Government bureaux, departments, offices, committees and other sundry bodies involved in rail enhancement projects. In respect of the SCL Project, the various bureaux and departments with a role to play have included the following: Transport and Housing Bureau, Highways Department, Buildings Department and Development Bureau. In addition, MTRCL has been required to consult with numerous other Government bodies including Geotechnical Engineering Office, Civil Engineering and Development Department, Drainage Services Department, Water Supplies Department, Architectural Services Department, Antiquities and Monuments Office, Leisure and Cultural Services Department and Housing Department. Even this extended list may not be complete.

442. Steve Rowsell suggested that, in respect of a project which the Government is funding, it could ensure greater efficiency, greater cost effectiveness and savings in time if there was a single point of responsibility within the Government for administering the Government’s agreement with MTRCL, more especially to oversee and manage internal Government



consultations. The Commission believes there is much strength in Steve Rowsell's recommendation.

443. In the course of closing submissions, counsel for the Government said that it was the Railway Development Office ('RDO') within the Highways Department which served as the single point of contact for overall administrative coordination. However, counsel went on to say that, if considered necessary, the Government was prepared to instil further clarity into its lines of communication and reporting. The Commission believes this should be done.

444. Indeed, the Commission goes further. It believes that the Government should critically address the way in which it executes its multiple roles in relation to railway enhancement projects and that active consideration should be given to creating an overall Government 'sponsor' role<sup>52</sup> for all individual projects. The sponsor must command authority and take responsibility for the project on behalf of the Government. Steve Rowsell, the project management expert appointed by the Commission, also recommended that the Government should address its project sponsorship arrangements.<sup>53</sup>

445. In this regard, the Commission respectfully suggests that the Government might wish to look to the experience of its counterparts elsewhere in the world, for example, in the United Kingdom where a number of major rail infrastructure projects have been funded (wholly or partly) and sponsored by the central Government.

446. Finally, it is to be emphasised that, in the view of the Commission, the skill sets required for effective sponsorship of projects are not the same as that required for effective project management.

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<sup>52</sup> Sponsorship of a project, programme or portfolio is an important senior management role. The project sponsor is the individual (often a manager, executive or senior officer) with overall accountability for the project. The sponsor is accountable for ensuring that the work is governed effectively and delivers the objectives that meet the identified needs. The project sponsor is primarily concerned with ensuring that the project delivers the agreed benefits. It is normal on a large, complex project for the project sponsor to be supported by a sponsorship team. [From: The Association for Project Management (APM), *Body of Knowledge*]

<sup>53</sup> Also included in paragraph 6 of Annexure F

### ***Monitoring and verification***

447. PYPUN's scope as the Monitoring and Verification ('M&V') consultant was to focus on cost, programme and public safety. Mr Mak Yu Man of PYPUN explained to the Commission that by 'public safety' in the context of PYPUN's scope, this referred to "the risk of accidents involving neighbouring residents ... and not quality or integrity of the permanent works constructed". It appears to be disputed between PYPUN and RDO as to whether PYPUN had any obligation in relation to monitoring quality.

448. The Commission found the performance of PYPUN to be disappointing. By way of example, whilst PYPUN's contract required them to be proactive, the Commission found little evidence of them being so. By further example, the Commission heard that 'surprise checks' needed to be scheduled in advance with MTRCL and Leighton, purportedly due to site security and access constraints. The Commission questions, what sort of surprise was that?

449. In the view of the Commission, the contribution of the M&V consultant – with quarterly scheduled monitoring visits of very limited duration – is questionable.

450. In his report, Steve Rowsell, as the Commission's independent expert, has made a number of recommendations in regard to the role of the M&V consultant. The Commission is pleased to note that the Government has agreed to take these recommendations forward.

### ***Looking to a more collaborative culture***

451. Finally, and more fundamentally, the Commission is of the view that there is in Hong Kong considerable scope for creating a more collaborative culture between the Government, MTRCL and contractors with the object of achieving more successful project outcomes. The Government should take a leading role if such a change is to take place.

452. By way of example, the Commission believes that there would be great value in the Buildings Department working much more closely with MTRCL

and its designers and contractors in order to facilitate dialogue on all engineering matters.

453. The Commission has taken note of the progress that is being made across the world in changing the internal culture of the construction industry from one that has been essentially adversarial (with low levels of trust between the parties) to one that is becoming more collaborative (with higher levels of trust and mutual respect). This change is recognised as progressively resulting in the reduction of project delay and budget overruns.

454. Key enablers of this change have been the introduction of new contract forms such as NEC3 and NEC4<sup>54</sup> and the introduction also of collaborative initiatives such as partnering and alliancing. The introduction of BIM has also made a significant contribution to improving trust and performance on project delivery.

455. Steve Rowsell, the Commission's expert, advocated the establishment of a Senior Leadership Forum, comprising the Government, MTRCL and its contractors in order to "monitor working relationships and cultural aspects of service delivery and to agree ways of developing collaborative working". He went on to suggest that it should include leaders of the major sub-contractors. The Commission supports this suggestion.

456. In summary, the Commission can do no better than employ the words of Dr Glover, the independent expert on structural engineering engaged by MTRCL, who has headed a great many major infrastructure projects. He stressed the importance of all parties working together to achieve a successful project outcome. As he put it: "Get everybody to see the flag on the hill."

457. Finally, the Commission is of the view that the Hong Kong construction industry has much progress to make in becoming more collaborative. The Commission is further of the view that the Government can

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<sup>54</sup> The New Engineering Contract (NEC) is a suite of contracts created by the Institution of Civil Engineers. NEC3 is a family of contracts unique in offering a complete end-to-end project management solution for the entire project life-cycle; from planning, defining legal relationships and procuring of works, all the way through to project completion, management and beyond. NEC4 builds on NEC3, providing improved flexibility, clarity and ease of use, thereby enabling the delivery of projects on time, on budget and to the highest standards.

and should take a leading role to make this beneficial change happen, through its effective sponsorship of major infrastructure projects.

## Chapter 11

### **Recommendations in respect of promoting public safety and promoting assurance on quality of works**

458. Pursuant to section (c) of its Terms of Reference, the Commission is required to make recommendations on suitable measures with a view, firstly to promoting public safety, and secondly to promoting assurance on quality of works.

#### ***Promoting public safety***

459. With regard to the first part, namely promoting public safety, the Commission has recommended ongoing monitoring of the station structure during operation of the station, so as to provide reassurance to the public. This has been addressed earlier in this report, in Chapter 9 – ‘Is the structure safe?’.

460. The Commission accepts the advice provided to it by independent structural engineering experts that the east and west diaphragm walls and EWL and NSL platform slabs should be instrumented to detect movement during the operational phase of the station. Instrumentation should be by means of fibre optics or other approved measures. Movements should be monitored and reported to the Government.

461. However the independent structural engineering experts predict that any movement of the station structure will be extremely low, if indeed any movement occurs at all.

462. The Commission further notes the expert advice that such low level of movement will have no impact on the safe operation of the railway.

#### ***Promoting assurance on quality of works***

463. With regard to the second part, namely promoting assurance on quality of works, the Commission sets out its recommendations below.

464. Relevant aspects of MTRCL's project management and supervision system, quality assurance and quality control system, risk management system, site supervision and control system and processes, system on reporting to Government, system and processes for communication internally and with various stakeholders, and other related systems, processes and practices, and the implementation thereof, have been addressed in Chapter 10 above.

465. Additionally, the extent and adequacy of the monitoring and control mechanisms of the Government, and the implementation thereof, have also been addressed in Chapter 10 above.

### ***Project management and supervision***

466. The Commission adopts without reservation all the recommendations set out in Part 3 of the expert report of Mr Steve Rowsell, the independent project management expert appointed by the Commission. Mr Rowsell's recommendations are set out in paragraphs 150 to 200 of his expert report, and are replicated in **Annexure F** of this report. These include matters to be addressed by both MTRCL and the Government.

467. The Commission observes that MTRCL places a high reliance on its PIMS, which MTRCL notes has served it well over more than two decades. However, a record of past success cannot be a guarantee of future performance. The Commission is of the opinion that substantial change to PIMS is warranted.

468. In this regard, the Commission welcomes MTRCL's commitment to adopt in full the recommendations of its consultant, Turner & Townsend, and notes that progress is already being made in implementing those recommendations.

469. The Commission recommends that MTRCL expedites its adoption of BIM technology for new capital projects within its portfolio.

470. The Commission recommends that for future rail infrastructure projects the designer should have a site presence so as to assist in ensuring that the design intent is implemented in the works.

## ***Leadership***

471. The Commission recommends the closer involvement of senior leaders of all parties – Government, MTRCL and contractors – working collaboratively to achieve a quality outcome. This would involve senior leaders being more visible to the workforce and taking a lead role in communicating key messages throughout their respective organisations.

472. Without limitation to other aspects of the Turner & Townsend report, the Commission particularly welcomes the recommended leadership focus on a ‘quality culture’ within MTRCL and the enhanced scope of MTRCL’s Board level Capital Works Committee to oversee also the quality of the works within its capital programme.

## ***Competence***

473. The Commission recommends that both MTRCL and the Government should review the ‘Competence’<sup>55</sup> requirements for personnel engaged in project management and project sponsorship roles in their respective organisations.

474. The Commission recognises, that even when employing competent people, human nature means that errors may still occur. Effective measures must therefore be in place to reduce the risk of failure, be it by mistake, incompetence or malicious act. The Commission recommends that MTRCL and the Government respectively should review their checks and procedures to ensure the ongoing competence of their project-related staff.

## ***Governance***

475. The Commission recommends that the Government should critically address the way in which it executes its multiple roles in relation to railway enhancement projects. Of particular concern is Government’s role as ‘client’ or ‘sponsor’ of railway projects. The sponsor organisation must provide both authority and responsibility for the project.

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<sup>55</sup> ‘Competence’ can be defined as the combination of training, skills, experience and knowledge that a person has and their ability to apply them in performing a task effectively. Factors such as attitude and physical ability can also affect someone’s competence. [*In plain sight: assuring the whole-life safety of infrastructure*, The Institution of Civil Engineers, 2018]

476. The Commission recommends that for future railway enhancement projects a Project Board should be established to provide strategic direction. The Project Board might comprise appropriate Government officials as board members, supported by external non-executive members from specialist backgrounds who could bring experience of best practice from the wider industry so as to provide strategic advice.

477. The Commission recommends that consideration be given as to whether it is appropriate for rail projects to remain within the portfolio of Director of Highways, or whether a new distinct Director of Rail Development role should be established.

478. The Commission further recommends that consideration should be given as to the appropriateness of the ‘Concession’ model for future projects entrusted by the Government to be project managed by MTRCL, or whether the Government should revert to the previously used ‘Ownership’ model. Alternatively, consideration might be given to the creation of a Special Purpose Vehicle (‘SPV’) approach, with a dedicated Board and delivery organisation, as has been employed on major rail infrastructure projects in the United Kingdom<sup>56</sup>.

### ***Follow-up assurance***

479. Finally, the Commission recommends that a follow-up audit be conducted, 12 months following the date of this interim report, to provide assurance to the Chief Executive that the recommended measures herein have been properly implemented and/or satisfactory progress towards their implementation is being made.

480. Given that the recommendations in this report are for action by both MTRCL and the Government, this audit should be carried out independently of the Government.

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<sup>56</sup> Crossrail Limited and HS2 Limited



## Chapter 12

### The Commission's determinations

481. While recognising this to be an interim report, the Commission has nevertheless reached the following determinations in respect of the diaphragm wall and platform slab construction works at the Hung Hom Station Extension –

- (1) the Commission finds that the Hung Hom Station Extension diaphragm wall and platform slab construction works were not executed in accordance with Contract No. 1112 in material respects.

However, notwithstanding this determination,

- (2) the Commission finds that the Hung Hom Station Extension diaphragm wall and platform slab construction works are safe.

The Terms of Reference

In respect of the diaphragm wall and platform slab construction works at the Hung Hom Station Extension under the MTR Corporation Limited ('MTRCL')'s Contract No. 1112 ('Contract') of the Shatin to Central Link Project,

- (a)
  - (i) to inquire into the facts and circumstances surrounding the steel reinforcement fixing works, including but not limited to those works at locations that have given rise to extensive public concern about their safety since May 2018;
  - (ii) to inquire into the facts and circumstances surrounding any other works which raise concerns about public safety; and
  - (iii) to ascertain whether the works in (i) and (ii) above were executed in accordance with the Contract. If not, the reasons therefor and whether steps for rectification have been taken;
- (b) to review, in the light of (a) above,
  - (i) the adequacy of the relevant aspects of MTRCL's project management and supervision system, quality assurance and quality control system, risk management system, site supervision and control system and processes, system on reporting to Government, system and processes for communication internally and with various stakeholders, and any other related systems, processes and practices, and the implementation thereof; and
  - (ii) the extent and adequacy of the monitoring and control mechanisms of the Government, and the implementation thereof; and
- (c) in the light of (b) above, to make recommendations on suitable measures with a view to promoting public safety and assurance on quality of works.

**Rules of Procedure and Practice**

**COMMISSION OF INQUIRY  
INTO THE DIAPHRAGM WALL AND  
PLATFORM SLAB CONSTRUCTION  
WORKS AT THE  
HUNG HOM STATION EXTENSION UNDER  
THE SHATIN TO CENTRAL LINK  
PROJECT**

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**Rules of Procedure and Practice**

(made at the Preliminary Hearing on 24 September 2018)

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1. The Commission's proceedings will address the matters set out in its Terms of Reference stipulated in the Gazette Notice No. 5166 dated 13 July 2018.
2. Parties permitted to participate and/or be legally represented at the Inquiry will be referred to hereinafter as "the involved parties" or "involved party".

**I. General**

**Public hearings**

3. Unless otherwise directed, the hearings of the Inquiry will be open to the public.

**Prohibition on photograph, audio/video recordings without the authorisation of the Commission**

4. Without the authorisation of the Commission, no photographs may be taken or audio/video recordings made in the Hearing Room, the hearing transmission gallery, hall area or any other areas in the former Tsuen Wan Law Courts Building ('the Building') used for the purposes of this Inquiry.

**Language**

5. The proceedings will be conducted in English, although witnesses may give their evidence in any language or dialect of their own choice. Testimony given in a language other than English will be translated into English. The Commission will provide simultaneous interpretation services when appropriate.

**Access to documents**

6. The Secretariat of the Commission has compiled, and will update regularly, an index of documents and materials provided to the Commission for the purposes of the Inquiry. Any involved party who wishes to gain access to such documents or materials may apply in writing to the Secretariat of the Commission. At its discretion, the Commission shall determine whether or not, when and to what extent access may be permitted, and what conditions, if any, should be imposed upon the grant of such access. Given that access may be restricted and conditions may be imposed, documents and materials provided to an involved party shall not be disclosed or disseminated to

other involved parties or unrelated persons without the consent in writing of the Commission.

7. If access is permitted to any involved party, only soft copies of the documents and materials to which access has been permitted by the Commission will be provided. The cost of obtaining such copies shall be borne by the party obtaining such copies.

Use of materials provided by the Commission

8. All materials supplied by the Commission to any of the involved parties shall be used only for the purposes of the Inquiry. Public dissemination of any of such materials shall not be allowed until and unless they have been adduced as evidence and expressly referred to in the Inquiry.

**II. Standing**

Written witness statements

9. Insofar as not already provided, the involved parties and other parties or individuals who have been directed by the Commission to provide written statements shall provide such statements by the date specified by the Commission, subject to applications for extension of time as approved by the Commission.
10. Any involved party who wishes to provide responsive written statement(s) to a statement provided by another involved party, other

party or individuals, shall apply in writing to the Commission within 14 days from the date when soft copies of the documents and materials are provided under paragraph 7 above, and a draft of its proposed responsive written statement(s) shall be provided to the Commission with the application. Unless directed by the Commission, any further written statement(s) which is not responsive in nature will not be permitted.

11. Any involved party who wishes to adduce expert evidence on any issue relevant to the Inquiry must make an application to do so on reasonable notice to the Commission, and any such application shall be made to the Commission through its solicitors and accompanied by the provision of 3 copies of the written report signed by the expert concerned together with a soft copy. If the Commission grants any such application, it will give directions as to when the expert is required to be called to give evidence at the Substantive Hearing. The Commission will not grant any such application if it is not satisfied that the evidence to be tendered is independent expert evidence.

The participation and legal representation of other parties

12. Any party (apart from the involved parties), who wishes to (1) participate in the Inquiry (if leave to participate has not yet been granted by the Commission); (2) call any witnesses; and/or (3) adduce any witness statements and/or materials for the purposes of the Inquiry, shall apply in writing to the Commission within 7 days from today (ie. by Tuesday, 2 October 2018).

13. If the Commission decides that an application referred to in paragraph 10 above be granted, the party in question shall (unless otherwise directed by the Commission) provide the witness statement(s) of the witness(es) to be called and/or material(s) to the Commission within such period as the Commission may consider appropriate.

### **III. The hearing procedure**

#### Opening addresses

14. Counsel for the Commission may make a written and oral opening address. Counsel for the involved parties may make their own opening addresses provided an application to do so (enclosing a written opening address which should not be longer than **20** pages and provided in font size 14 with single spacing and no footnotes other than for document references) has been made within 21 days from today (ie. by Monday, 15 October 2018). If the Commission accedes to such application, the oral addresses will be made immediately after the address of Counsel for the Commission. The Commission may determine the sequence and length of such oral addresses.

#### Evidence

15. The Commission notes that section 4(1) of the Commissions of Inquiry Ordinance, Cap. 86 provides that in conducting the Inquiry, it may:

*“(a) receive and consider any material whether by way of oral evidence, written statements, documents or otherwise, notwithstanding that such material would not be admissible as evidence in civil or criminal proceedings.”*

The examination of witnesses

16. Oral evidence will be given under oath or affirmation.
17. The procedure by which the Commission will receive oral evidence is as follows:
  - (1) The Commission shall determine the sequence in which oral evidence be given in the Inquiry.
  - (2) Counsel for the Commission will lead the evidence of witnesses called by the Commission; Counsel for any involved party may apply to the Commission for leave to question a particular witness and the Commission will determine the sequence of cross examination by those Counsel whose application for cross examination has been granted; Counsel for the Commission may re-examine the witness.
  - (3) Unless otherwise directed by the Commission, Counsel for an involved party may lead the evidence of witnesses who testify on behalf of such a party, after which Counsel for the Commission may question such witness. Thereafter, Counsel for other involved parties may apply to the Commission for leave to question such witness and the Commission will determine the sequence of cross examination by those Counsel whose application for cross examination has been granted. Finally, Counsel for the involved party leading the evidence of the witness may re-examine such witness.



## Annexure B

- (4) Unless otherwise directed by the Commission, insofar as any witness wishes to adopt his or her witness statement as his or her evidence (with or without modification or elaboration), the contents of his or her witness statement are to be read out either by the witness or by his or her counsel.
- (5) At any stage of the Inquiry the Commission may ask questions of any witness.
- (6) The Commission may give directions to each party limiting the length of examination of witnesses and submissions.
- (7) The Commission shall inform all involved parties as and when the witness statements and/or expert reports of the witnesses to be called by the Commission become available.
- (8) The Commission may recall any person who has given oral evidence to answer further questions.

“Witnesses” referred to above shall include factual and expert witnesses.

### Closing addresses

18. Counsel for the Commission and Counsel for the involved parties may make written and oral closing addresses. The Commission may determine the sequence and length (both written and oral) of such addresses.

The Substantive Hearing

19. The Substantive Hearing of the Inquiry shall commence on 22 October 2018 at 10 am in the Building.
20. The Substantive Hearing shall, subject to any adjournments that the Commission may consider necessary from time to time, continue until 16 November 2018 and shall resume from 26 November 2018 until 21 December 2018 (on a provisional basis).
21. Unless otherwise directed, the Substantive Hearing will be held from 10 am to 1 pm and from 2.30 pm to 5 pm every weekday. The Commission may consider the Substantive Hearing being held on Saturday mornings during the periods mentioned in paragraphs 19 and 20 above.
22. There will be a Real-time Transcript Streaming ('Transcend') of the Substantive Hearing. Any applications for subscriptions to Transcend should be made in writing to the Secretariat of the Commission within 14 days of today (ie. by Monday, 8 October 2018), stating how many subscriptions are required and undertaking to pay the costs thereof. To view the real-time transcript during the Substantive Hearing, subscribers will need to use their own laptops or notebook computers and make arrangement with the service provider directly.
23. An electronic bundle has been and continues to be prepared for use at the Substantive Hearing. This will be managed by the Secretariat. All involved parties should be able to read pages in the electronic bundle

during the course of the Substantive Hearing on monitors provided by the Secretariat.

24. Seating arrangements in the Hearing Room during the course of the Substantive Hearing will be determined by the Secretariat on a day to day basis. Seating for Counsel and Solicitors for the Commission will be fixed throughout the Substantive Hearing but the representatives of the involved parties will be allocated seats depending upon the witness giving evidence, those parties who have been granted leave to cross-examine the witness and any other factors that the Secretariat deems relevant. The Commission expects the parties' representatives to fully co-operate with each other in respect of the seating arrangements in the Hearing Room. Within 7 days of today (ie. by Tuesday, 2 October 2018), each involved party should nominate a single contact person and send his/her name, post title, name of firm, telephone number and email address to the Secretariat. The Secretariat will compile a contact list and use the list for disseminating messages in relation to seating and other hearing arrangements during the course of the Substantive Hearing.
25. At the discretion and determination of the Commission, each involved party may, subject to availability, be allocated a lockable room within the Building for its use for the duration of the Substantive Hearing.

**List of witnesses**

***Factual witnesses***

	<b>Date</b>	<b>Factual witness</b>	<b>Position held in organisation at the material time</b>
1.	23-24 October 2018	Mr Jean-Christophe, Jacques-Olivier Gillard	Director of Intrafor Hong Kong Limited
2.	24 October 2018	Mr Wong Yiu Mo	Steel bar fixer of Hung Choi Engineering Company Limited ('Hung Choi')
3.	24-25 October 2018	Mr Ian But Ho Yin	Assistant Foreman of China Technology Corporation Limited ('China Technology')
4.	25 October 2018	Mr Thomas Ngai Lai Chi	Superintendent of China Technology
5.	25-26 October 2018	Mr Li Run Chao	Assistant Foreman of China Technology
6.	29 October 2018	Mr Chu Ka Kam	Foreman of China Technology
7.	29 October 2018- 2 November 2018 5 November 2018	Mr Jason Poon Chuk Hung	Managing Director of China Technology
8.	5 November 2018	Mr Chui Tim Choi	Director of Hung Choi
9.	6-7 November 2018	Mr Pun Wai Shan	Sole Proprietor of Fang Sheung Construction Company ('Fang Sheung')
10.	7-9 November 2018 12 November 2018	Mr Joe Cheung Chiu Fung	Site Foreman of Fang Sheung
11.	8 November 2018	Mr Malcolm Plummer	Project Director of Leighton Contractors (Asia) Limited ('Leighton')
12.	9 November 2018	Mr Khyle Rodgers	Superintendent of Leighton
13.	12 November 2018	Mr Karl Speed	General Manager of Leighton

## Annexure C

	<b>Date</b>	<b>Factual witness</b>	<b>Position held in organisation at the material time</b>
14.	13 November 2018	Mr Law Chi Keung	Construction Worker of Rankine Engineering Company Limited ('Rankine Engineering')
15.	13 November 2018	Mr Ho Hiu Tung	Construction Worker of Rankine Engineering
16.	13 November 2018	Ms Emily Cho	Site Clerk of Leighton
17.	13 November 2018	Mr Ngai Chun Kit	Quality Surveyor Manager of China Technology
18.	13-14 November 2018	Mr Anthony Zervaas	Project Director of Leighton
19.	14 November 2018	Mr Ian Rawsthorne	Project Manager of Leighton
20.	14-15 November 2018	Mr Gabriel So	Superintendent / General Superintendent of Leighton
21.	15 November 2018	Mr Chan Chi Ip	Site Supervisor of Leighton
22.	15 November 2018	Mr Joe Tam	Construction Manager of Leighton
23.	15 November 2018	Mr Gary Chow	Construction Manager of Leighton
24.	16 November 2018	Mr Joe Leung	Site Agent of Leighton
25.	16 November 2018	Mr Andy Ip	Sub Agent of Leighton
26.	26 November 2018	Mr Edward Mok	Graduate Engineer of Leighton
27.	27 November 2018	Mr Man Sze Ho	Assistant Engineer of Leighton
28.	27-28 November 2018	Mr Raymond Brewster	Group Pre-Contracts Manager of Leighton
29.	28-29 November 2018	Mr Brett Buckland	Senior Site Agent of Leighton
30.	29 November 2018	Mr Justin Taylor	Risk Manager / Revenue Recovery Manager of Leighton
31.	29-30 November 2018	Mr Stephen Lumb	Head of Engineering of Leighton

## Annexure C

	<b>Date</b>	<b>Factual witness</b>	<b>Position held in organisation at the material time</b>
32.	30 November 2018	Mr Clement Ngai Yum Keung	Chief Design Manager – SCL / Head of Project Engineering of MTR Corporation Limited ('MTRCL')
33.	30 November 2018 3 December 2018	Mr Andy Leung Fok Veng	Design Manager – SCL of MTRCL
34.	3 December 2018	Mr Kit Chan Kit Lam	Construction Manager – SCL Civil of MTRCL
35.	3 - 4 December 2018	Mr James Ho Ho Pong	Senior Construction Engineer – Civil of MTRCL
36.	4 December 2018	Mr Derek Ma Ming Ching	Construction Engineer I – Civil of MTRCL
37.	5 December 2018	Mr Aidan Gerald Rooney	General Manager – SCL Civil – NSL / General Manager – SCL Civil – EWL / Acting General Manager – SCL Civil – EWL of MTRCL
38.	5-6 December 2018	Mr Louis Kwan Pak Hei	Construction Engineer II – Civil of MTRCL
39.	6-7 December 2018	Mr Kobe Wong Chi Chiu	Senior Inspector of Works II (Civil) / Inspector of Works (Civil) of MTRCL
40.	7 December 2018	Mr Andy Wong Kai Wing	Assistant Inspector of Works – Civil of MTRCL
41.	10 December 2018	Mr Michael Fu Yin Chit	Construction Manager – SCL Civil of MTRCL
42.	10 December 2018	Mr Carl Wu Ka Wah	Co-ordination Manager – SCL of MTRCL
43.	10 December 2018	Mr Yeung Chi Kin	Senior Quality Assurance Engineer of MTRCL
44.	10 December 2018	Mr Jason Wong Chi Chung	General Manager – SCL Civil EWL / General Manager – SCL Civil – EWL & PMO of MTRCL

## Annexure C

	<b>Date</b>	<b>Factual witness</b>	<b>Position held in organisation at the material time</b>
45.	10-11 December 2018	Mr Lee Tze Man	General Manager – SCL / Head of E&M Construction of MTRCL
46.	11 December 2018	Mr Raymond Au Koon Shan	Principal Contracts Administration Manager – SCL of MTRCL
47.	11 December 2018	Dr Philco Wong Nai Keung	Projects Director of MTRCL
48.	11 December 2018	Mr Lincoln Leong Kwok Kuen	Chief Executive Officer of MTRCL
49.	12 December 2018	Prof Frederick Ma Si Hang	Non-Executive Chairman of MTRCL
50.	12 December 2018	Mr John Blackwood	Director of Transport of Atkins China Limited (‘Atkins’)
51.	12 December 2018	Mr Wilson Sung Chi Man	Technical Director (Structure) of Atkins
52.	13 December 2018	Mr Lee Wan Cheung	Structural Team Leader (Team A) of Atkins
53.	13 December 2018	Mr Mak Yu Man	Project Manager of PYPUN-KD & Associates Limited (‘PYPUN’)
54.	14 December 2018	Mr Yueng Wai Hung	Director and Leader – Building Submission Review & Compliance Team of PYPUN
55.	14 December 2018	Mr Daniel Chung Kum Wah	Director of Highways, Highways Department (‘HyD’)
56.	17 December 2018	Mr Frank Chan Fan	Secretary for Transport and Housing, Transport and Housing Bureau (‘THB’)
57.	17 December 2018	Mr Ralph Li Tsz Wai	Chief Engineer of Railway Development Office (‘RDO’), HyD / Assistant Secretary (Transport) 7A of THB

## Annexure C

	<b>Date</b>	<b>Factual witness</b>	<b>Position held in organisation at the material time</b>
58.	17 December 2018	Mr Jonathan Leung Man Ho	Government Engineer / Chief Engineer of RDO, HyD
59.	17 December 2018	Mr Paulino Lim	Sale Marketing Manager of BOSA Technology (Hong Kong) Limited
60.	17 December 2018	Dr Robert William McCrae	Design Team Leader (Team A) / Project Manager (Team B) of Atkins
61.	18 December 2018	Mr Kevin Harman	Quality and Environmental Manager of Leighton
62.	18 December 2018	Mr Humphrey Ho Hon Kit	Assistant Director / New Buildings 2 of Buildings Department ('BD')
63.	18 December 2018	Mr Francis Chau Siu Hei	Deputy Secretary for Development (Works) 3 of Development Bureau
64.	18 December 2018	Dr Cheung Tin Cheung	Director of Buildings, BD
65.	19 December 2018	Mr Andrew Lok Pui Fai	Senior Structural Engineer of BD

### *Expert witnesses*

	<b>Date</b>	<b>Expert witness</b>	<b>Position</b>
66.	10 January 2019	Mr Steve Huyghe	Independent project management expert engaged by MTRCL / Chairman & Founder of CORE International Consulting, LLC
67.	10 January 2019	Mr Steve Rowsell	Independent project management expert engaged by the Commission / Director of Rowsell Wright Limited



## Annexure C

	<b>Date</b>	<b>Expert witness</b>	<b>Position</b>
68.	14-15 January 2019	Professor Francis T K Au	Independent structural engineering expert engaged by the Government / Professor and Head, Department of Civil Engineering of the University of Hong Kong
69.	15-16 January 2019	Dr Albert T Yeung	Independent structural engineering expert engaged by China Technology / Associate Professor, Department of Civil Engineering of the University of Hong Kong
70.	16-17 January 2019	Mr Nick Southward	Independent structural engineering expert engaged by Leighton / Executive Director of Tony Gee and Partners LLP and Managing Director of Tony Gee (Asia) Limited
71.	17-18 January 2019	Dr Mike Glover	Independent structural engineering expert engaged by MTRCL / Arup Fellow
72.	18 January 2019	Professor Don McQuillan	Independent structural engineering expert engaged by the Commission / Director of RPS Consulting Engineers

An extract from the transcript of Day 8

Page 105	Page 107
<p>1 through-bars or did you volunteer those photographs?  2 What happened about through-bars?  3 A. I haven't finished giving a statement to the police.  4 I actually arranged with the police to give a statement  5 every week. At that time, for the list of structural  6 problems for the Hung Hom Station, I remember  7 I identified five to seven, and I gave a separate  8 statement for each problem. The first one was on bar  9 cutting. The second one was on indiscriminate revision  10 of drawings. And these photos were after we submitted  11 the indiscriminately revised drawings and then the  12 police had to find evidence to show that they did not do  13 the works in accordance with the drawings.  14 Q. Okay. Understood.  15 Then, from number 39 to the end, we have put in  16 chronological order the 11 photographs that you supplied  17 with your witness statement on Sunday, last Sunday, four  18 photographs of which we had obviously received on the  19 Friday, and that's what we've done.  20 So this is a record of all the photographs that you  21 have supplied to the Commission to date.  22 Now, Mr Poon --  23 A. So there are 39 photos; right?  24 Q. That's right. There they all are, all here, recorded  25 here, and they are all part of the evidence, the</p>	<p>1 might be stuck here, but there's no reason why  2 presumably you can't, with my permission, instruct your  3 employees to start looking again, if that's what you  4 want them to do.  5 But I give you the opportunity to provide the  6 Commission with any other photograph that is about bar  7 cutting or shortening.  8 With that, Mr Poon -- you can comment if you want --  9 A. Why should there be a limit? Why should there be a  10 limit?  11 Q. Because, Mr Poon, this process has got to be brought to  12 an end at some point, and two and a half weeks seems to  13 me, as we stand here today, a fairly generous period,  14 given the opportunities that we know that you have had,  15 and indeed have taken historically over the last few  16 months.  17 A. Then I quite disagree. If you allow me to submit all  18 the photos relating to structural problems which  19 I discovered during my review, I will do so, even if it  20 means working overnight. If you limit me to only  21 cutting of rebars and if there are problems identified  22 which I cannot submit to the Commission, then I object.  23 Q. You can object if you like. The offer I'm making you,  24 Mr Poon, is in relation to photographs relating to bar  25 cutting and shortening, which is frankly the primary</p>
<p>Page 106</p> <p>1 documents that have been submitted to the Commission.  2 What weight one pays to any particular photograph will  3 be a matter for debate in due course, but they are all  4 recorded here; they are all in the documents.  5 Now, let me tell you this. I'm going to invite  6 you -- we are going to be here for a number of weeks.  7 I'm going to invite you, Mr Poon, if you wish -- you  8 don't have to accept the offer --  9 CHAIRMAN: I'm sorry, I do apologise. Something has gone  10 wrong here. There we are.  11 I can't hear you, sorry.  12 MR PENNICOTT: I'll start again. Mr Poon, we are going to  13 be here for a number of weeks, and I'm going to invite  14 you to do this. If you wish -- you don't have to take  15 up my invitation, but if you would like you -- in the  16 next two weeks, approximately, let's say to 16 November,  17 which is the date we are going to have a short break  18 from this hearing -- up to 16 November, we give you the  19 opportunity to go away, look at your photographs again,  20 if you wish, and provide us with any photograph which is  21 to do with bar cutting, no other subject, just bar  22 cutting; all right? That's an invitation I grant to  23 you, I give to you, if you wish to take it up.  24 So you've got two and a half weeks to think about  25 that. I appreciate that the next couple of days you</p>	<p>Page 108</p> <p>1 reason we are all here.  2 CHAIRMAN: I would also add, Mr Poon, that this is an open  3 invitation from counsel for the Commission. It means  4 you don't have to seek permission. You can put them all  5 together. You can explain their provenance in the  6 correct way, as will be directed by counsel, and they  7 come before us for consideration.  8 If you should find other photographs which you  9 consider to be compelling, then no doubt your counsel  10 can make an application to put them before the  11 Commission, and the Commission will consider its  12 position. But those other photographs would have to be  13 compelling.  14 WITNESS: I will consider it.  15 MR PENNICOTT: Okay. You do that, and of course that may  16 require you to come back.  17 CHAIRMAN: You can consider it, Mr Poon. This is not  18 a bargaining shop; all right? You've been told what is  19 open to you, and that ends it, on that particular  20 matter.  21 MR PENNICOTT: Thank you, sir.  22 CHAIRMAN: Those are directions from counsel, supported by  23 this Commission.  24 Yes, you have completed now, Mr Pennicott?  25 MR PENNICOTT: I have, sir. That will be an appropriate</p>

The Agreed Expert Memorandum

APPENDIX XI

Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project

Ann. XI - Agreed Expert Memorandum signed on 18 December 2018

**Transcript**

Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project

Meeting of Experts                      Tuesday 18 December 2018

At Tsuen Wan Court                      11:00

Present:

For C.O.I.	Don McQuillan instructed by Lo & Lo
MTRCL	Mike Glover                      instructed by Mayer Brown
	Colin Wade
LCAL	Nick Southward instructed by O'Melveny
Chinat	Albert Yeung instructed by Lim & Lok
Government	Francis Au instructed by D.O.J.

Purpose: To discuss "without prejudice" relevant issues and, if possible, to list for the benefit of the Commission, items of agreement and disagreement.

1. General Code requirements

- All agreed there was no requirement for ductility couplers.
- All agreed that an amount equivalent to 50% of the top tensile steel was required in the bottom of the EWL slab to be carried through in the D-wall, i.e. less than 50% of the bottom steel at the interface was required for Code compliance.

**Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project**

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2. All agreed that irrespective of the code requirement the EWL slab does not, in theory, rely on steel at the interface, at the bottom, for flexure and shear capacity.
3. The cutting-down of a D-wall is a normal part of the construction process with the methodology governed by the specification and is analogous to the construction of a shear key.

All agreed that the change from couplers to through bars in the top of the cast D-wall was a better detail and provided more steel across the interface (subject to a review of the internal stresses at the top-of-wall construction joint relating to the "first change" and its rebar detailing). Notwithstanding, all agreed the outcome would not show the construction joint to be problematic.

4. All agreed except Nick Southward (not part of his brief) that miscellaneous workmanship issues eg spalling, voiding, gaps etc. were all repairable.

The main discussion related to mis-aligned shear links. All agreed this was of no structural significance in the context of the slab rebar.

5. All agreed that a load test was unnecessary because it would yield no meaningful result and long-term monitoring would be a better approach to allay public safety concerns.

**Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project**

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6. In terms of the current opening-up regime all agreed, based on the "redundancy" of the couplers in the bottom of the EWL slab, that further opening-up was unnecessary. Focus should be directed to the top of the east D-wall to verify the as-built drawings and the details which are of structural significance.

Moreover, it was noted during the site inspection that the EWL soffit slab openings were creating safety hazards for the staff on-site.

Also the decision to expose the third and fourth layers of rebar is impractical and will cause major disruption to the slabs.

All agreed that the GPR NDT was inaccurate, time consuming and inappropriate when opening-up has to be carried out anyway.

All agreed that invasive investigation of the D-walls and NSL slab should also be reviewed.

Mike Glover [signed]

Colin Wade [signed]

Nick Southward [signed]

Albert T Yeung [signed]

Francis T.K. Au [signed]

Don McQuillan [signed]

Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project

Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project

Meeting of Experts Tuesday 13 December 2018

Kt Tsuan Wan Court 11:30

Present:

DOT C.O.I	Don McQuinnan instructed by Lo & Lo
MTREL	Mike Glover } instructed by Mayer Brown
	Colin Wade }
LEAL	Wick Southwood instructed by O'Mahony
Christ	Albert Young instructed by Lin & Lok
Government	Francis Au instructed by D.O.J.

Purpose: to discuss "without prejudice" relevant issues and, if possible, to list for the benefit of the Commission, items of agreement and disagreements

1. General Code Requirements.

- All agreed there was no requirement for ductility couplers.
- Au agreed that <sup>an amount of</sup> ~~steel~~ ~~was~~ ~~to~~ ~~be~~ ~~carried~~ ~~across~~ ~~the~~ ~~width~~ ~~of~~ ~~the~~ ~~top~~ ~~of~~ ~~the~~ ~~slab~~ ~~into~~ ~~the~~ ~~support~~ ~~equivalent~~ ~~to~~ ~~50%~~ ~~of~~ ~~the~~ ~~top~~ ~~length~~ ~~of~~ ~~the~~ ~~steel~~ ~~was~~ ~~required~~ ~~in~~ ~~the~~ ~~bottom~~ ~~of~~ ~~the~~ ~~slab~~

Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works  
at the Hung Hom Station Extension under the Shatin to Central Link Project

2  
The slab stays to be carried through in the D-wall.  
i.e. less than 50% of the bottom steel at the  
interface was repaired for Code compliance.

All agreed that

2. Inexpensive if the code requirement the slab  
slab does not, in theory, rely on ~~the~~  
steel at the interface, at the bottom, for  
flexure and shear capacity.

3. The cutting-down of a D-wall is a normal  
part of the construction process with the  
methodology governed by the specifications and  
is analogous to the construction of a Shear  
Key.

All agreed that the change from couplers  
to through bars in the top of the cast  
D-wall was a better detail and provided  
more steel across the interface (subject to  
a review of the internal stresses at the  
top-of-wall construction joint relating to  
the "first change" and its rebar detailing).  
Nonwithstanding, all agreed the outcome  
would not show the construction joint to  
be problematic.

except Nick Southwood (not part of his brief)

4. All agreed that miscellaneous workmanship  
issues eg, spalling, voiding, gaps etc  
were ~~all~~ repairable.

The main discussion related to mis-aligned  
shear links. All agreed this was of no  
structural significance in the context of the  
slab rebar.

Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works at the Hung Hom Station Extension under the Shatin to Central Link Project

because it would yield no meaningful results

5. All agreed that a Load Test was unnecessary and long-term monitoring would be a better approach to allay public safety concerns.

6. In terms of the current opening-up regime all agreed, based on the "redundancy" of the concrete in the bottom of the EWL slab, that further opening-up was unnecessary. Focus should be directed to the top of the cast in-situ wall to verify the as-built drawings and the details which are of structural significance.

Moreover, it was noted during the site inspection that the EWL soffits/slab openings were creating safety hazards for the staff on-site.

Also the decision to expose the third and fourth layers of ~~cast~~ rebar is impractical and will cause major disruption to the slabs.

All agreed that the GAR NDT was inaccurate, time consuming and inappropriate when opening-up has to be carried out anyway.

All agreed ~~there was~~ that invasive investigations of the D-wall and NSL slab should also be reviewed.



Commission of Inquiry into the Diaphragm Wall and Platform Slab Construction Works  
at the Hung Hom Station Extension under the Shatin to Central Link Project

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Mike Glover

M. Glover

COLIN WADE

Colin Wade

NICK SALTHERS

Nick Salters

Albert T. Young

Albert T. Young

FRANCIS T.K. AU

Francis T.K. Au

SEN M. SULLIVAN

Sen M. Sullivan

**Recommendations of Mr Steve Rowsell on strengthening systems for supervision, monitoring, control and management**

***Leadership***

1. Strengthen the involvement of senior leaders in all parties in establishing appropriate behaviours across the organisations to support a collaborative approach in the delivery of the project. Leadership roles should be developed in line with the principles set out in ISO9001:2015 and would involve senior leaders being more visible to the workforce and in them taking a lead role in communicating key messages throughout the organisations.
2. To support collaborative working on projects, establish a cross-party Senior Leadership Forum to monitor working relationships and cultural aspects of service delivery and to agree ways of developing collaborative working.

***MTRCL organisation***

3. Consider ways of improving closer working between different groups within the project organisation to avoid the risk of silo-working in which information and knowledge is not shared. Consider the effectiveness of existing communication arrangements between the teams and throughout the organisation. Review information databases and systems to ensure that there is a single source of the true position which is accessible as appropriate to all people.
4. Review and clarify MTRCL roles and responsibilities in relation to the provisions and requirements of the Conditions of Contract. In particular ensure that the position of Engineer to the Contract is understood and that roles and responsibilities respect the need for the Engineer to act impartially in the administration of the contract. The role of the Engineer needs to be integrated and compatible with the roles of others in MTRCL who have responsibilities for delivering obligations under the Entrustment Agreements.

## **Annexure F**

5. Review arrangements for managing relationships with stakeholders to ensure that there is clarity on responsibilities and clear lines of communications particularly with Government Departments. Arrangements should be set out in a Stakeholder Management Plan which is accessible by all involved in the project delivery.

### ***Government related enhancements***

6. Review how Government organises itself for the management of its interests in the railway project. The structure needs to take account of the requirement for MTRCL to consult ten or more different Government Departments as part of its responsibilities for delivering the project. Whilst the Agreement with MTRCL is signed by the Secretary for Transport and Housing on behalf of the Hong Kong SAR Government, there would appear to be scope for improving the Government's project sponsorship arrangements to provide greater clarity in communication and reporting lines and more efficient project controls.

7. In relation to the Buildings Ordinance and consultation, the current structure of documents setting out requirements is quite complex and not easy to follow. It would be helpful for Government to pull together the provisions into a clearer and more precise description of the requirements and responsibilities.

8. Consider extending the role of the M&V Consultant ('M&V') to provide a wider "eyes and ears" role to help protect Government's interests in the delivery of the project. The role should also provide high level monitoring of the operation of the project quality assurance systems as well as the current role in monitoring cost and programme issues. The M&V role could be developed into a Government's Project Representative role that works more closely within the MTRCL organisation to monitor performance and to identify emerging issues.

9. Consider options for working arrangement in which Government staff would be integrated within MTRCL teams on a regular basis, say one day a fortnight, to help ensure a common understanding of requirements, improve communications, undertake joint forward planning and to resolve issues more efficiently.

## **Annexure F**

10. Review the attendance at the Project Supervision Committee ('PSC') to ensure that it is operating as intended, as a high-level committee focusing on strategic issues and performance. Ensure that the reporting arrangements to PSC are providing the Committee with reliable performance data which will allow substantive issues relating to time, cost and quality to be identified and acted upon.

11. Review the Buildings Department's Code of Practice ('CoP') to give clarity on the definition of supervision, record keeping requirements and non-conformance reporting. Terminology such as "continuous and full time supervision" requires further explanation. It would also be desirable for the Buildings Department's CoP to set out requirements of the communication of the supervision plan and associated obligations. The overall supervisory arrangements should provide an adequate role for the designer to give assurance that the intent of the design is delivered in the construction of the Works.

12. Develop a conflicts of interest policy appropriate and applicable to projects of this nature. Allocate responsibility for administering the policy to the Project Coordination Meeting ('PCM') or other committee as appropriate.

13. Review the lump sum contractual arrangement used to employ the M&V consultant and consider options which may provide a more effective incentive to be proactive in the execution of its duties.

14. Clarify in M&V consultants' briefs clearer requirements in relations to site audits and surprise checks.

15. Ensure that companies appointed to M&V roles have access to the necessary levels of resource if the level of monitoring by the M&V consultant has to be increased due to concerns about poor performance.

16. Consider the option of recovering M&V audit costs [from the defaulting party] if poor performance by the contracting parties results in additional audits being required above that normally required.

***Design submissions, Buildings Department's consultation procedures and changes***

17. Review the wording of the Particular Specification in relation alternative works design proposals to ensure that the process and terminology is aligned with the contract conditions.

18. Ensure that construction method statements are in place based on the latest approved designs before construction commences.

19. Review the liaison arrangements between the Contractor's design team, the Building Authority ('BA') and MTRCL's design and construction management teams to ensure that there is common understanding of submission requirements and that all parties are aware of design issues and the forward programme of potential submissions.

***Supervision requirements***

20. Review the significant number of various documents which set out supervision requirements and guidance with the aim of rationalising the documents to a more manageable and readable number. Ideally, it would be better to have all supervision requirements and responsibilities pulled together into a single Supervision Manual made accessible to all involved in the supervision and inspection procedures and such Supervision Manual should be translated into the Chinese language which workers are familiar with. There is evidence before the Commission that there might not be any Chinese version of the Site Supervision Plan ('SSP') and the provisions of the SSP were not explained to site supervisors.

21. Develop a clear definition of supervision for the purposes of contractual obligations and adopt a consistent approach to terminology throughout the documentation. The requirements need to be specific about the information that needs to be recorded and certified.

22. To deliver best value for money and to make best use of resources, the frequency of supervision and inspections should be flexible and reactive to the compliance and performance of work with

## **Annexure F**

requirements. Demonstration of consistently high-quality work should allow supervision requirements to be reduced with confidence being maintained by less frequent supervision supported by self-certification and audits.

23. Review the requirements for formally defined hold-points in relation to the contract provisions for not covering-up work without inspection. Clarify whether inspection certificates apply to both hold-points and pre-covering up inspections. In the evidence given before the Commission, there seems to be confusion and misunderstanding over the requirements to keep contemporaneous inspection records and RISC forms.

24. Review options for the use of the latest technological applications and tools, such as tablets or smartphones, to support the efficient effective recording of site records.

25. Ensure that there are procedures in place to record who are undertaking supervision duties on a daily basis and that supervisors have the required level of competence.

26. Ensure that records are kept to support the possible application of the contractual disallowable cost provisions.

### ***Site entry / exit systems and records***

27. Review the adequacy of existing entry / exit site staff recording system in relation to: knowing who is on site; supporting the payment of people under the commercial model; knowing who undertook work inspections and who certified work; and helping to confirm that the required level of supervision and the numbers supervisors to workers is provided.

### ***Non-conformance reporting***

28. Review current guidance on non-conformance reports ('NCRs') to ensure that there is clarity and consistency on when NCRs should be issued.

## **Annexure F**

29. Encourage a culture that treats non-conformance reporting in a similar way to “near-miss” reporting on health and safety so that lessons learnt drive continuous improvement.

30. Maintain a single NCR database across all parties, which is accessible to all supervisors and inspectors to allow recurrent issues to be readily identified.

31. Review and enhance the NCR close-out procedures including effective monitoring arrangements.

### ***Project Management Plans***

32. Review and improve the detailed content of Project Management Plans (‘PMPs’) to make them more comprehensive and relevant to the project by translating generic guidance into project specific requirements. The Plan should minimise the need to cross refer to other documents for details of project specific requirements.

33. Consider including an introductory section in PMPs setting out MTRCL’s corporate policies and the project strategic objectives to help steer the development of the project.

34. It would be desirable to be more specific about which PIMS manuals are applicable to a project and job roles rather than just including a long list of all PIMS documents.

35. Consider including in the PMP: proposals for partnering arrangements and initiatives; checklists for sub-contract approval procedures, including revisions to subcontract terms and arrangements; and commercial management procedures, including the settlement of sub-contract final accounts.

### ***PIMS manuals***

36. Review PIMS procedures, and update as necessary, to ensure alignment of project management guidance and procedures with contractual procedures. As part of this, highlight in the manuals the

## **Annexure F**

aspects of the guidance which need to be assessed for the specific circumstances of a project and translated into project-specific guidance in the PMP.

37. Review and refresh the older PIMS manuals which date back as far as 2008.

38. Review training on PIMS and contract procedures, including ongoing refresher training and the coverage of any updates to the procedures. Where appropriate, consider integrated training sessions with the Contractor to ensure a common understanding of requirements.

39. Highlight the aspects of PIMS manuals which need to be converted from generic advice into project specific proposals.

### ***As built drawings***

40. Review the current documents setting out requirements for as built drawings to ensure that there is consistency and clarity on roles, responsibilities and procedures. Pull together responsibilities and procedures associated with as built drawings in the PMP.

41. Clarify and maintain site records to support the delivery of the contractual requirements for the prompt recording of as built dimensions and details.

42. Rigorous monitoring of as built drawing production to be introduced and progress reported as part of the monthly progress to PSC.

### ***Partnering / collaborative working***

43. Review and clarify the procedures for the submission and acceptance of working method statements.

44. Introduce the standard use of an industry standard collaborative form of contract such as NEC4.

45. Review options for more integrated and co-located working



between the parties to achieve greater transparency of issues, better forward planning and joint risk management.

46. Develop and implement the use of BIM as a collaboration tool.

***Commercial issues***

47. Review the procedures for the approval of sub-contracts and any subsequent revisions that change the conditions and/or prices.

48. Review the arrangements for the commercial settlements of sub-contracts to include a stage for MTRCL to verify and accept that proposed settlements are in line with the approved sub-contract terms and conditions.

49. Review and rationalise the provisions for disallowable cost and consider incorporating works not undertaken in accordance with approved plans and procedures as a disallowable cost. This would be achieved by the use of the NEC contract.

***Turner & Townsend review of MTRCL procedures***

50. It is understood that MTRCL has already established an implementation group to take forward the Turner & Townsend recommendations. That is considered to be a positive indication of MTRCL's desire to learn lessons and achieve continuous improvement.