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

Project Management Expert Report

Prepared for

MTR Corporation Limited

Instructed by

Mayer Brown

Prepared by

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4 January 2019

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APPENDICES

1. INTRODUCTION

1.1 APPOINTMENT

1. I, Steve Huyghe, am the Chairman and Founder of CORE International Consulting ("CORE") headquartered in Atlanta, Georgia, USA, with regional locations in Asia and the Middle East. CORE is a global construction management firm that specializes in construction disputes and construction project advisory services.

2. I am a construction professional and have been appointed by Mayer Brown, on behalf of MTR Corporation Limited. ("MTRCL"), to review and assess certain works[1] performed as part of the Shatin to Central Link Project, in Works Contract 1112, for the Track Slab, i.e., the EWL slab and Diaphragm Wall at the Hung Hom Station Extension ("Project"), which work is the subject of the Commission of Inquiry ("CoI") that was established on 10 July 2018.

3. By the letter dated 27 July 2018 from Lo & Lo to MTRCL ("Letter"),[2] the Commission asked MTRCL to provide witness statements in response to the 21 questions concerning MTRCL's corporate structure, its governance, its project management and other systems, and the construction processes required by Contract 1112, among other things.

4. Specifically, I have been appointed as MTRCL's project management[3] expert to provide an opinion, on behalf of MTRCL, on Question ("Q") 19, Q20, and Q21 of the Letter. I have summarized my instructions below:

> **Q19** In relation to paragraph (b) of the Terms of Reference, provide your comments on sub-paragraphs (i) and (ii), in particular, identify any aspects of non-compliance, inadequacies and deficiencies.
>
> **Q20** In the light of your response to foregoing paragraph, and in relation to paragraph (c) of the Terms of Reference, describe and explain, from the perspective of a project manager in a large scale project involving multiple parties and stakeholders, and the only operator of Hong Kong's railway system serving the general public, the suitable measures which could be taken in the future to

[1] Project Management procedures, rebar fixing regarding coupler installation/rebar installations at the top of the Diaphragm Wall/possible concrete leakage and honeycombing issues.

[2] Lo & Lo's letter to MTRCL dated 27 July 2018 [B1/B47-B64] .

[3] The term *"project management"* is loosely used herein. My instructions specified that my expert evidence should also encompass commenting on MTRCL's supervision system, quality assurance and quality control system, risk management system, site supervision and control system and processes, internal and external reporting and communications system, and any other related systems, processes and practices, and the implementation thereof, as set out in §(b)(i) of the ToR.

promote public safety and assurance on quality of works. Please provide relevant basis and authorities in support of your reply.

Q21 Explain and confirm whether, if such "suitable measures" as identified in paragraph 20 above had been in place at the material times, the incidents of Defective Steel Works and matters which gave rise to this Inquiry could have been avoided. Please provide relevant basis and authorities in support of your reply.

5. Based on my experience in the provision of construction and construction management services, the issues identified in my instructions above are within my field of expertise.

6. I understand my expert report will be submitted to the CoI, and I may be required to appear in person to give evidence. If required, my evidence will be subject to the procedural requirements described in the CoI's Opening Address[4], and the CoI's Rules of Practice and Procedure.

7. My opinions are to be based on the project management documents disclosed in the CoI Bundles that I have been provided with and a review of factual evidence of all witnesses (including all the hearing transcripts up to 19 December 2018). No intentional attempt has been made to provide any independent, factual analysis or any subjective determinations.

8. I have viewed the CoI's *"Site Visit Power Point Slides"* and selected Project photos. I have also conducted a site visit on 3 January 2019.

9. I will focus on the project management procedures, the allegations regarding rebar connections in the EWL slab, and the change from coupler connections to through-bars at the top portion of the East Diaphragm Walls.

1.2 PERSONAL AND CORPORATE DETAILS

10. I, Steve Huyghe, am the author of this report. I have been assisted by two construction professionals, Tsang Wong and Ronald Smith, who have worked under my direction. I have written this report and prepared the evaluations contained within it, and all of the expert opinions offered are my own.

[4] CoI's Opening Address - §32 [OS/1/10]

11. I hold a Civil Engineering and Construction Management Bachelor of Science Degree from Purdue University and am a licensed Class A General Contractor (inactive status). I possess 50 years of experience in construction, having spent 23 years as a licensed General Contractor where I served as project engineer, project superintendent, head of scheduling, construction manager, and President of one of the largest mechanical general contracting companies located in the United States.

12. As a general contractor, I have constructed large projects such as Infrastructure, Oil Refineries, Gas and Oil Pipelines, Chemical Plants, Water and Wastewater Treatment Facilities, Uranium Recovery Plants, and other heavy civil and mechanical industrial projects.

13. I was also a partner in a formwork/rebar company where we provided labor for the installation of formwork and rebar placement. We handled both vertical and horizontal formwork and rebar installations in the State of Florida, USA for 8 years. We employed our own staff of superintendents, carpenters, ironworkers and laborers and owned our own equipment. I was involved in the oversight of the formwork and rebar installations, including the use of couplers. The couplers installed on the projects where we performed the rebar installations were grout-filled couplers and sheer-screwed coupler sleeves.

14. Next, I have spent over 27 years providing project advisory and dispute resolution services, including expert testimony. My construction experience has allowed me to analyze large, complex projects located in Mexico, Saudi Arabia, Mongolia, the Philippines, Hong Kong, Lebanon, Taiwan, Guam, Puerto Rico, Australia, India, Brazil, Thailand, New Zealand, the Bahamas, and 26 of the states within the United States.

15. Regarding the construction of transit and rail projects, shown below is a brief description of some of the more relevant construction management and dispute resolution services I have provided on projects similar to this Project.

16. For New York City Transit ("NYCT"), I assisted the head of NYCT Design and Construction for over 10 years on monitoring the progress of the work and resolving disputes on all subway station civil work, tunneling, electrical, and mechanical renovations. Often times I analyzed the due diligence performed by the general contractor and the sub-contractors based on the NYCT's procedural management guidelines. In addition, I often assessed the delays and disruptions caused by these entities.

17. Also, for the NYCT, I conducted project management work sessions for over 5 years, training 350 NYCT resident engineers who were responsible for overseeing all of the NYCT design and construction projects. This included instructing the NYCT's resident engineers on how to implement the applicable project management and quality control procedures. I also conducted site visits to test and determine whether the projects were being properly managed and to verify that all inspection and tracking systems were in place.

18. On the Tren Urbano Light Rail Project in Puerto Rico, I worked for Siemens Transportation during the design and construction phases of this mass transit project. This project involved the design and construction of 8 subway stations, platforms, and included all rail work installations. Siemens was contractually obliged to help review and amend the existing project management and quality control procedures being used by the Puerto Rico Transit Authority. Siemens was contracted to help create new procedures and specifications not only for the design and construction of the Tren Urbano Light Rail project, but also for all future expansions. I assisted Siemens in its efforts and analyzed the progress of the work while assisting in the implementation of the new practices being established.

19. For the Kajima Corporation, I worked on the new underground Los Angeles Red and Green Line Subway Stations, platforms, and tunnels, providing progress monitoring services and dispute resolution services. My work included evaluating Kajima's adherence to all the Los Angeles Mass Transit Authority's inspection and quality control procedures.

20. For the Government of Lebanon, I assessed the due diligence of the contractor's performance and also provided monitoring and dispute resolution services for the delays to the construction of the Lebanon Highway running from Beirut to Damascus. This project included the construction of the highest concrete viaduct ever built in the Middle East.

21. For the Departments of Transportation for the states of North Carolina, South Carolina, and Arizona, I and my staff evaluated the project management services being provided by the contractors, monitored progress and resolved ongoing disputes during the design and construction phase of heavy highway and bridge work for over five years.

22. I lived in Hong Kong from 2010 to 2014 and during this timeframe worked for the Government of Hong Kong as their construction expert in evaluating the due diligence of the work performed by the contractor, and the delays/disruptions claims on the Lai Chi Kok Viaduct Project.

23. Currently, I am working on the Route 91 project, the largest infrastructure highway project constructed in Southern California.

24. Since 1989, I have provided expert testimony regarding such issues as the standard of care provided by owners, construction managers and general contractors pertaining to the performance of these parties. I also testify to delay, disruption, labor productivity, quantum, construction means and methods. I have appeared in venues such as ICSID, ICC, LIAC and DIAC arbitrations in New York, Paris, Dubai, London, Mexico City, Guam, and Puerto Rico.

25. I have also testified in State and Federal Courts in the United States in Virginia, Florida, California, Colorado, Utah, and Texas, and participated as an expert in numerous mediations. I have acted as co-mediator on construction disputes for complex construction-related issues.

26. In addition, I performed evaluations of the project management services provided and the construction of a US$22 billion project in Saudi Arabia where I, and my team, facilitated the settlement of over US$900 million worth of claims. I was involved in the assessment of the construction management services provided by Jacobs, Foster Wheeler, and Fluor. Also, I provided the analysis of the work performed by international contractors including Technimont (Italy), Larsen & Toubro (India), Daewoo (Korea), El Seif (Saudi Arabia), Tekfin (Turkey), Sinopec (China) and JGC (Japan).

27. I have been an adjunct professor at Purdue University in Indiana, and Southern Polytech University in Georgia, and have taught courses in Construction Management. I have also provided Project Management Training to the US Air Force, the NYCT Authority, and the New York City Department of Environmental Protection.

28. I have lectured on Scheduling and Project Management on numerous occasions, three of the latest being the 2018 Construction Super-Conference in the US, the Hong Kong Society of Construction Law, and the Project Management Institute Global Conference held in Bahrain in January 2015.

29. I have published many articles on construction-related issues and been published in Wiley Law. Also, I have written a book on construction entitled *"Construction – The Perfect Storm"* that has been published and released. The book on construction is being used by many

universities in the United States, such as Columbia University in New York in their Master Program in Construction Management.

30. I am a licensed general contractor (inactive), and a practicing member of the Academy of Experts, the Royal Institution of Chartered Surveyors, the Association of General Contractors, the Association of Cost Engineers, and the Construction Management Association of America. I have included a copy of my Curriculum Vitae and those of the CORE staff members who assisted me in preparing this report in Appendix A.

1.3 DISCLAIMER

31. I understand that this report will be made available to the CoI. This report has been prepared solely for that purpose. Neither I, nor CORE, accepts or assumes responsibility for any other purpose, or to any other person to whom this report is shown, or into whose hands it may come save where expressly agreed by my prior consent in writing. I reserve my right to review any additional data and/or information provided by any party in relation to this dispute and, if necessary, revisit and possibly amend my analyses, opinions, and reports.

1.4 STATEMENT OF INDEPENDENCE

32. I have no conflict of interest with regards to providing an independent opinion in this matter.

1.5 PRINCIPAL AREAS OF FOCUS

33. Based upon my understanding of the main issues in contention and the statements made in MTRCL's Opening Statement [OS/5/1-20], there are two principal areas that I focus upon in this report. They are:

i. Non-conformity issues regarding rebar/coupler connections at the EWL slab; and

ii. The change from coupler connections to through-bars at the upper portion of the East Diaphragm Walls and the EWL slab.

1.6 PARTIES INVOLVED

34. In Appendix B, I have identified the various parties and provided a brief description of the roles each played during the design and construction of the Project.

35. In my report, I will be referring to the parties that have contractual obligations relative to project management procedures. Specifically, the parties that provide project oversight, perform inspections, provide quality control, and prepare and file project records and documentation.

36. I paid particular attention to the contractual requirements relating to the flow of information between these various entities. A project of this size and complexity must implement standards, protocols, and procedures to communicate and ensure the work is completed as specified and in a timely manner. Even with such checks and balances in place, maintaining complete control is not always possible because of the number of parties involved and the synergy required on large, complex construction projects.

1.7 GLOSSARY AND ABBREVIATIONS

37. Throughout this report, I will use the glossary of abbreviations and defined terms as set out in Appendix C. They are aligned with the abbreviations used in the Witness Statements of MTRCL.

1.8 STRUCTURE OF REPORT

38. To assist the Commission in reviewing this report, I have organized the structure of my report, as far as practical, to align with Mr. Steve Rowsell's Expert Report ("Rowsell") [ER1/1-90].

39. First, I thought it may be helpful to identify topics that Rowsell covers in his report that fall outside of my current instructions.

40. I understand my duty is to assist the Commission in relation to the project management issues. I thus will address issues that fall within my expertise and based upon the instructions given by my Instructing Solicitors, Mayer Brown.

41. Rowsell offers certain opinions and recommendations primarily from a procurement and contract strategy perspective (i.e. NEC4, Target Cost, partnering) and also in relation to project governance (i.e. leadership, sponsorship, stakeholder engagement). Based on my

review of the evidence from a project management perspective, the form of contract between MTRCL and Leighton does not appear relevant to the quality and supervision issues that are at the heart of this dispute. Therefore, I have not addressed the foregoing as a topic in my report.

42. Rowsell comments in Part 2 of his Expert Report on the extent and adequacy of the monitoring and control mechanism of the Government and the implementation thereof [ER1/68-78]. I have not included references within my report to issues pertaining to the Government; specifically, the Government's use of Pypun as the Monitoring and Verification Consultant (MVC) and the PMP as it was submitted to the Government for the granting of the IoE.

43. I understand that Rowsell is also requested to provide opinions with regard to: (a) the impact of the IoE in relation to MTRCL/Leighton seeking approval of design/detail changes; and (b) the potential implications of the use of the Target Cost Contract. These additional issues are also outside of my instructions. I will therefore refrain from commenting.

44. Section 1 sets out the background, basis and structure of this Report.

45. In Section 2, I discuss the adequacy of MTRCL's project management systems, including both the PIMS and BD requirements. My focus is on explaining the MTRCL's obligations along with the pertinent procedures and processes.

46. In Section 3, I respond to the specific issues identified in the Rowsell Report by way of comparing his opinions to MTRCL's fulfillment of its obligations and implementation of established processes.

47. In Section 4, I present my recommendations on procedures based on my experience and current actions taken by MTRCL. Also included is a comparison of my recommendation to those made in T&T's Interim Report dated October 2018 ("T&T Report") [B17/B24421-B24475] and the Rowsell Report. I find it interesting that a common thread runs through all of our recommendations and we have identified many of the same issues. Also, MTRCL has already implemented or begun to implement many of these recommendations and will also implement some recommendations in due course.

1.9 EXECUTIVE SUMMARY

1.9.1 Project Management Systems

48. So far as the MTRCL project management systems and plans are concerned:

- My research and subsequent evaluations of each of these project management systems and plans are detailed below in the body of my report, and I have footnoted below where they can be located.

- The various project management documents and procedures I evaluated include the following:

  a. Project Management Plan (PMP)[5]
  b. Project Integrated Management System (PIMS)[6]
  c. Site Supervision Plan (SSP)[7]
  d. Quality Supervision Plan (QSP)[8]
  e. Inspection and Test Plan (ITP)[9]

49. Chart A is included below:

[5] See Section 2.4 of this Report.
[6] See Section 2.5 of this Report.
[7] See Section 3.4.3 of this Report.
[8] See Section 3.4.3 of this Report.
[9] See Section 2.5.2 of this Report.

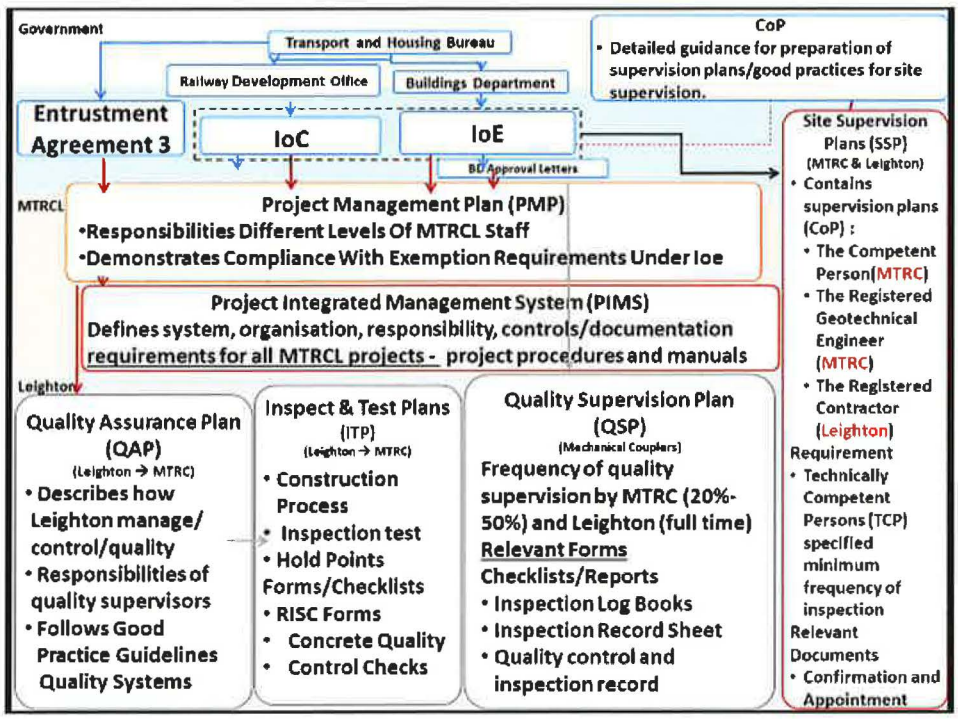

Chart A - Relationship between various Project Management Procedures

50. Chart A:

- Depicts graphically, on a very high and general level, the contractual relationships and the parties associated with the preparation and application of the various project management systems.

- Contains a very summary listing of the relevant information contained within each project management system or plan.

- Describes and compares procedures and plans from a project management perspective and displays how the multiple management procedures and plans were structured to provide the Contract 1112 works with the proper:

  a. construction management;
  b. site supervision; and
  c. quality control.

- Shows that parallel procedures exist between the MTRCL and Leighton obligations, both on a personnel and functional level, and as further considered below in the body of my report.

51. My conclusion is that:

- the above project management procedures and plans were satisfactory; and
- included the necessary processes and practices to provide the proper project management, administration, inspections, and supervision of the Project.

52. It bears emphasis that:

- MTRCL's PIMS was created to generally address *all* the projects developed and constructed by MTRCL;
- Such fact needs to be considered when the PIMS is used to locate certain information for a specific project;
- I have not read any testimony from MTRCL's staff that they had any difficulty in using PIMS on Contract 1112.

53. As is common in my experience for sizeable project management plans, there is inevitably room for improvement, and additional modifications can and in my opinion should be made.

1.9.2 Project Management Execution

54. My evaluation of the execution of the above project management systems and plans by both MTRCL and Leighton leads me to conclude that both parties did not implement properly, or at all, with certain project management procedures. Specifically:

- EWL Slab
    a. The Record Sheets that were to be prepared and executed by both Leighton and MTRCL under the QSP requirements for recording the inspections of the rebar/coupler installations at the EWL slab were not provided, which omission should have been recognised by both parties and properly implemented;

b. Other documents such as the RISC forms and Hold Point Inspections for rebar fixing and pre-pour check were put into place, but the Record Sheets such as those that were kept for the construction of the Diaphragm Wall which should have been prepared and jointly executed by both Leighton and MTRCL for the EWL slab were not;

c. Even though MTRCL and Leighton provided proper and continuous supervision and inspections of the rebar/coupler installations that were required of them, defective rebar couplers were still identified in what appears to me from the testimony to be a small number of instances, albeit that such testimony indicates that in all but one case the defective rebar/couplers were detected and corrected immediately;

d. The exception is that there was testimony regarding 3 defective rebar/couplers that may have been encased in concrete, which leads me to question the execution of the RISC forms and the Hold Point inspections (which from my review of the RISC forms I conclude were prepared for the 32 bays at the EWL slab for rebar fixing inspections and pre-pour inspections).

- Change in Connection Detail –

e. Neither Leighton nor MTRCL's CM and/or DM teams followed the correct procedures for managing constructability issues related to the revisions to the top portion of the Diaphragm Wall, the EWL slab, and the OTE slab;

f. Chart B below shows both the planned (in blue) and actual (in red) procedures for handling design revisions when a TQ was raised regarding a design modification and required action:

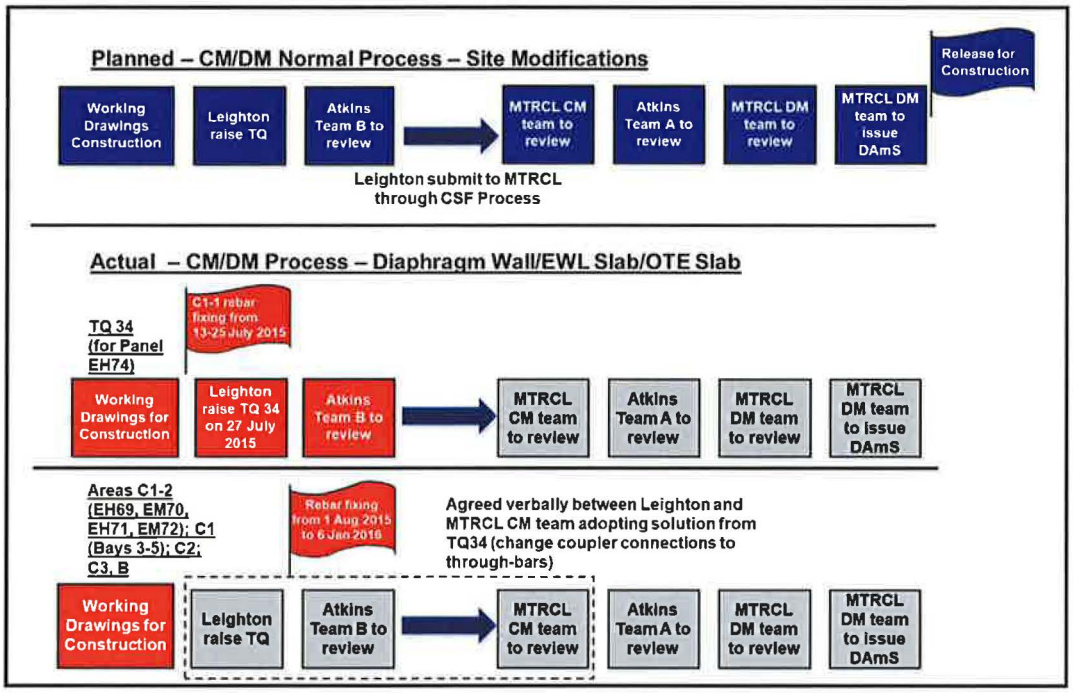

CHART B – Standard vs Actual Procedures for Design Revisions

g. The relevant procedures should have been as follows:

- ✓ Leighton had to raise the TQ, and Atkins' Team B (Leighton's designer) was to review the same;
- ✓ In the event that the TQ was acceptable, Leighton had to submit it as Contractor's Submission (CSF process) to MTRCL;
- ✓ MTRCL's CM team then had to review it, and if it considered it acceptable, the CM team should have passed the Contractor's submission to the DM team and Atkins' Team A for further review;
- ✓ In the event that Atkins' Team A and the DM team concluded that the Contractor's submission was acceptable then, if necessary, the DM team would issue a DAmS (or revised working drawing) to Leighton for construction purposes.

h. The issue concerning the lowering the Diaphragm Wall was identified in TQ 34, which was issued on 27 July 2015, but the as-built records indicate that the process of lowering the Diaphragm Wall at panel EH74 to replace the

coupler connections with through bars commenced even before TQ 34 was submitted;

i. In these circumstances I conclude that there appears to have been a breakdown in communications between Leighton and MTRCL's CM and DM teams, a matter which I consider further in the body of my report at Section 3.6;

j. In the event, it is clear that it was decided to use this same revised construction process at the other areas of the EWL slab (i.e. Areas C1-2 (EH69, EM70, EH71, EM72); C1 (Bays 3-5); C2; C3, B), and the construction work proceeded in the same manner as for EH74 albeit that the process to follow through with the CM/DM design coordination did not occur;

k. In summary, I conclude that the necessary supervision and inspections of the construction works in question were conducted by both Leighton and MTRCL as required under the various project management procedures[10] but, unfortunately, the necessary record keeping such as that required by the QSP was lacking as the correct procedures as set out above were not followed.

1.9.3 Proposed Recommendations

55. I also was instructed to provide any recommendations to MTRCL as a result of my evaluation that may help mitigate or prohibit the types of problems that have occurred on the Project. I have included these recommendations at the end of my report in Section 4.

56. In Section 4 of my report, I have made specific recommendations in terms of how PIMS can and should be improved. I have also provided a comparison of my recommendations with the same type of recommendations proposed by both Rowsell and T&T from which it can be seen at a glance that there are many common themes between us. In order to provide the Commission with a preliminary insight into the results of my exercise as set out in my comparison table (i.e. Table 3), I have inserted below the contents of just one set of comparison (i.e. Item 1 of Table 3).

[10] I have identified particular issues with supervision and inspections in Section 3.4 of this Report.

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
1	Overall MTRCL	Often it is helpful to assess the procedures / processes that are actually occurring on the Project by the specific categories of personnel and compare this with the procedures/processes as stipulated in the PIMS and BD requirements. One may find that they are quite different, and/or one may be able to improve the manner the work is being monitored and inspected.	§183: 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.	**PP6 [B17/B24442, B24444]**: Introduce yearly review of PIMS by the review panel and capture feedback from those on site regularly to drive 'bottom up' improvements. **PC2 [B17/B24452, B24453]**: Re-skill and re-assign SIOW/IOW/CEs with QA focus to support. **PC4 [B17/B24431, B24452-B24453]**: Site competence: define levels of competency required, monitor and report: - Establish competency matrix to address requirements in the CoP - Conduct competency assessment for all applicable project staff - Provide training to bridge competency gap as required **PC6 [B17/B24431, B24452,B24453]**: Site quality alerts and toolbox talks – communicate and share knowledge regarding high impact or recurring NCRs. **PP7 [B17/B24442, B24444]** :Reporting to be expanded to capture other quality and conformity issues such as requests for information, design change requests, and field change requests. Other positive reporting to be implemented such as Requests for Inspection planned vs held, Audits planned vs held, 'hold points' planned vs passed.	• Survey of staff on PIMS usage planned for Feb 2019 [PP5 [1]] • Full review of PIMSs planned in 2019 [PP5] • The new digital supervision and reporting system noted in PP6 is being developed in stages throughout Q1 to Q3 2019 to provide dashboard reporting facilities to capture KPIs for monitoring of quality on site. Scope and range of KPIs is under review by the team as referred to in PP6 [PP7] • New enhanced training has commenced for site supervision teams [PC2] • Matrix developed for levels of individual staff competence as required by the CoP [PC4] • Competency assessment of staff and retraining as required planned for 2019 [PC4] • Quality Alert template prepared for introduction once new digital reporting system for NCRs goes 'live' in Q1 2019 [PC6]

[1] All the references to the relevant codes PP1-PP14, OR1-OR3, CC1-CC8, PC1-7, QP1-QP4 and TT1-TT2 in square brackets in the last column in the above Table 3 refer to those actions taken by MTRCL in the last column of Appendix A to MTRCL's memo dated 4 January 2019 and titled *"T&T's Interim Report dated October 2018"* which is in Appendix D hereto

57. It also bears emphasis that MTRCL has already started to implement new procedures based on recommendations by T&T, or is making preparations to implement T&T recommendations. Again, these recommendations are essentially the same recommendations that Roswell and I have proposed in our reports[11]. In particular, it should be noted that the primary focus of the recommendations is directed at the establishment of a centralised quality control platform as well as keeping the applicable documents and records in an organised and electronic fashion, together with MTRCL's procedures for dealing with the NCR process.

58. It is my opinion that once the proposed recommendations are implemented, the prospects of the same problems occurring on other projects will be minimised, if not eliminated.

2. ADEQUACY OF MTRCL'S PROJECT MANAGEMENT SYSTEM AND OTHER SYSTEMS

2.1 INTRODUCTION TO MTRCL'S OVERALL OBLIGATION

59. The numerous project management procedures, including MTRCL's PIMS, the BD's Site Supervision Plan (SSP) and the Quality Supervision Plan for coupler installation (QSP) were established to oversee, monitor and inspect the work to be performed. These project

[11] See Section 4 and Table 3 of this Report.

management procedures are comprehensive and include the necessary procedures and practices to develop, monitor and construct the Project.

60. Figure 1 provides an illustration of the organization of the various project management systems and the key personnel.

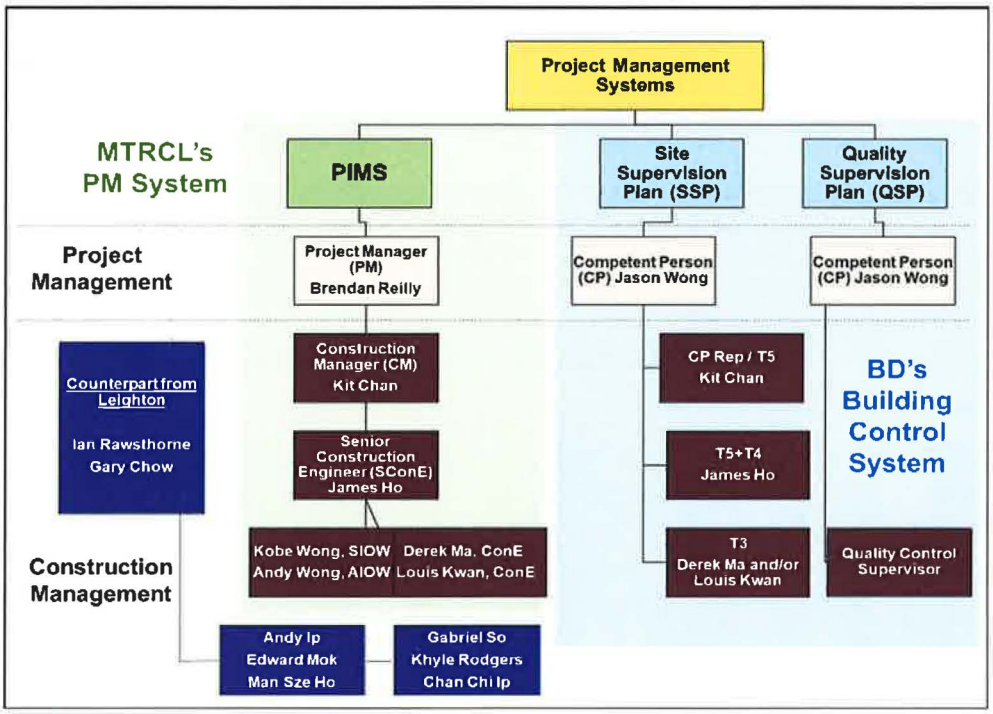

Figure 1. Overview of Project Management Systems.

61. Please note that there are two parallel MTRCL Project Management Systems, namely the PIMS and the BD's Building Control Systems (i.e. the SSP and QSP), which are shown both on a personnel and functional level. In addition, Figure 1 shows Leighton's relevant personnel involving in construction management. Figure 1 also depicts how the structure for construction management, site supervision and quality control should provide dual assurances for proper monitoring and oversight of the works.

62. The organizational structure established by MTRCL and Leighton properly reflects the various project management systems required for the Project. However, as I will discuss in further detail in Section 3.4 below, both MTRCL and Leighton failed in some instances to comply with certain specified documentation procedures and controls. For example, the Record Sheets required under the QSP regime for the inspection of the couplers should have been prepared, executed, and signed-off by Leighton and MTRCL. Leighton should have

followed the contractual requirements for record keeping, and MTRCL should also have been aware of the same, and made sure that Leighton followed through with its implementation; regrettably this did not occur.

63. Inevitably, there is always room for improvement in the management of large scale and complex construction projects. This is an ongoing and pressing topic in the global construction industry.

64. I agree with Rowsell, as referred to throughout the sections of his report that MTRCL's overall obligations to the Government are set out in the EA3, IoE, PMP, PIMS and BD's SSP. Rowsell did not mention the QSP requirement under MTRCL's overall obligations in his report. The QSP requirement is set out in the BD's Acceptance Letters[12]. This refers to MTRCL's obligation in relation to the quality supervision for coupler installation.

65. As I mention earlier, I am not instructed to address issues in relation to the use of a Target Cost Contract.

2.2 OBLIGATIONS UNDER THE EA3

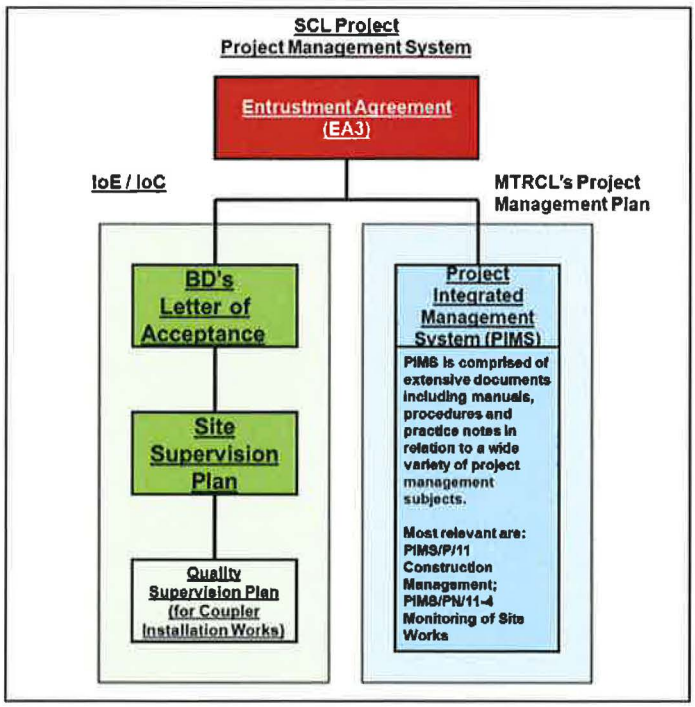

Figure 2. MTRCL's Project Management Obligations.
[Note: There are other relevant PIMS documents which I will discuss in this report]

[12] BD letter [B5/TS30876-TS30902]. The Acceptance Letters refer to BD's acceptance of the plans submitted by MTRCL for consultation. Ho Hon Kit Statement §28 [WS2/H2176] and Lok Pui Fai Statement §5 [WS2/H2189]

66. Figure 2 graphically depicts how the Project under the EA3 is segregated into the IoE/IoC (i.e. SSP/QSP) and the PMP (i.e. PIMS).

67. I agree with Rowsell[13] that the EA3 Clause 4.6(C) sets out MTRCL's obligations in terms of project management. I believe it to be more of a legal matter to interpret and comment on the individual clauses that Rowsell has cited. Therefore, I do not go into detail or offer my opinions with regard to the legal interpretation of the EA3.

2.3 OBLIGATIONS UNDER THE INSTRUMENT OF EXEMPTION AND INSTRUMENT OF COMPLIANCE

68. I agree with Rowsell regarding MTRCL's obligations under the IoE's conditions and the reference schedule [ER1/15-18] Hung Hom Station Compound is listed as Category 2 in the Reference Schedule of the IoE. Therefore, the expansion of the HUH Station, including the concerned Diaphragm Walls and platforms slabs under Contract 1112, is only subject to the IoE [WS2/H2112], not the IoC.

2.4 MTRCL'S OBLIGATIONS UNDER THE PMP

69. The purpose of the PMP is to demonstrate that MTRCL's project management process is compliant with the IoE exemption [H7/H2220-H2233] requirements. The PMP outlines the scope of the works for the Project; and in general terms explains how MTRCL plans to manage the design and construction and outlines the responsibilities of the MTRCL's project management team staff, and is in compliance with the exceptions under the IoE.

70. The PMP sets out several key management and procedural requirements, which I summarize in Table 1 below:

Table 1. Summary of PMP's Procedural Requirements.

Requirements	Highlights
i. Statutory Requirements (Section 4 of the PMP)	IoE / IoC sets out the actions to be taken by MTRCL before the commencement of and during the construction works. It also notes the role of CPs to coordinate the works, to reflect the current standards for project management and to have better control and monitoring arrangements for the Project.

[13] Rowsell Report, page 10 (f) [ER1/10].

Requirements	Highlights
ii. The Management System (i.e. PIMS) and the Project Management Teams (Section 5 of the PMP)	Sets out the basis for deploying *"Project Integrated Management System"* ("PIMS"). The project management team structure, roles and responsibilities of key personnel are defined.
iii. Design Management and Assurance Process (Section 6 of the PMP)	Sets out the design compliance requirements. Consultation submission will be required for deviations from the Government standards.
iv. Management of Civil Engineering Works including issues pertaining to supervision, site inspections, site records, quality audits and NCR (Section 7 of the PMP)	Sets out list of works contracts. All civil engineering works will be carried out under the direct supervision of MTRCL's site supervision staff in accordance with established procedures. Mention of Hold Points and RISC to be followed. Supervision is to be carried out according to CoP[14]. If a non-conformity arises, such should be dealt with according to the CoP as necessary.
v. Statutory Submission Procedures (Section 9 of the PMP)	Consultation shall apply to all civil engineering works constructed under the IoE and IoC, particularly the structural design and construction sequence of the SCL and related works that may affect existing or proposed nearby private buildings / structures (excluding railway premises). Typical documents that are subject to consultation are listed, including the civil and structural plan, the temporary works and excavation method statement, the design report, and the as-built records.

71. The PMP is regularly reviewed and updated by MTRCL and should include any changes in key personnel assignments as well as MTRCL's project management procedures. MTRCL submitted revised versions of the PMP to the BD and relevant Government departments throughout the design and construction of the Project.

72. I note that Version E of the PMP (issued in March 2015) [H7/H2369-H2504] was in effect at the time when the EWL slab was constructed. BD's representative, Mr. Ho Hon Kit (Assistant Director/New Buildings 2), confirmed in his Witness Statement that Version E of the PMP "*was the applicable version at the material time of the construction of the Diaphragm Walls and platform slabs at the HUH Extension.*" [H2170]. Based on the

[14] Full name: Code of Practice for Site Supervision 2009 by the BD [B5/B2676-B2795].

evidence, especially from the Government's witnesses, there does not appear to be a concern regarding the adequacy of the PMP.

73. Rowsell states in §21 [ER1/19], "*In my opinion, the PMP is lacking in certain respects in relation to the application of generic procedures to Contract 1112 and does not provide clear direction to those responsible for implementing the procedures.*"

74. In my view, the intent of the PMP is to explain to the Government how MTRCL is going to manage the Project and satisfy the statutory requirements. The PMP was not intended to be a comprehensive *"contract level"* document providing detailed guidance on contracts administration or project controls strategy. Instead, the PMP is a *"program-level"* document, which was planned to be broadly applicable to the entire Project. Therefore, in my opinion, the PMP, albeit somewhat general in nature, was suitable for its intended usage and applied to the whole Project.

2.5 MTRCL'S PROJECT INTEGRATED MANAGEMENT SYSTEM

75. It is important to point out that the PIMS was used to manage and encompass all of the various MTRCL railway projects[15]. So, in my view, the PIMS was not and is not intended to be a project specific document.

76. Before considering the points made by Rowsell, I wish in the following paragraphs to draw the attention of the Commission to the many commendable aspects of the PIMS.

77. First, the PIMS undergoes periodic internal review and external audits to ensure it stays up to date to serve its purpose in the management of railway projects. Rowsell correctly notes that there are regular external audits carried out by accreditation bodies on the PIMS[16]. In fact, MTRCL's senior management also regularly review the procedures, making recommendations and updating the PIMS process[17] .

78. For example, a PIMS Steering Group ("PIMSSG") was established and chaired by the Projects Director or his delegate, with members including the General Managers of the Projects Division, the Head of Project Engineering and the Project Quality Manager. The

[15] Carl Wu Statement §9, 10 [WS2/B472].
[16] § 26 of Rowsell Report [ER1/22].
[17] Carl Wu Statement §20, 24 [WS2/B475, B476].

purpose is to track the progress of the PIMS program. The group meets each year to review and improve the effectiveness of the PIMS processes.[18]

79. The PIMSSG meetings focus on quality performance issues, PIMS implementation, auditing, and lessons learned[19]. The PIMSSG provides oversight ensuring the effective deployment of the PIMS for effectively managing the successful delivery of railway projects[20]. Also, as stated in the testimony by MTRCL's CK Yeung [T31/110:4–126:1], MTRCL regularly carries out internal quality audits, self-quality audits and contractor quality audits.

80. In my opinion, the PIMS plays an integral role in the project management provided by MTRCL. The PIMS systems provide practical project management procedure guidance with regards to design and construction management, project controls, organization structure, MTRCL management systems, various project oversight requirements and proper documentation. In relation to the issues of defective steel works and change in connection detail, I reviewed the relevant PIMS under Design Management, Construction Management and Project Information Management.

81. It is structured to cover the responsibilities and guidelines for all levels of the MTRCL staff to follow. Frontline MTRCL staff members receive induction training when they join the corporation. I understand the PIMS documentation is maintained on MTRCL's intranet intending to make it accessible to the Projects Division staff, promoting collaboration and efficient dissemination of information internally. Updated versions of a particular PIMS document are circulated to all staff by email and were also included in each project's monthly progress report[21].

82. Rowsell expresses his concern that there are over 150 plus PIMS documents and that staff "*have to refer a wide range of documents in order to get the full picture.*" [22]. I have reviewed the PIMS and share Rowsell's view that there are a multitude of documents that make up the PIMS and there always are ways to improve upon project documentation.

83. However, as previously mentioned, the PIMS project management system is not intended to be project-specific as it is organized by the relevant categories of work. For example, the frontline construction engineer and site inspection staff generally refer to the construction

[18] Carl Wu Statement §20 [WS2/B475].
[19] Carl Wu Statement §20 [WS2/B475].
[20] Carl Wu Statement §37 [WS2/B478].
[21] Carl Wu Statement §38 [WS2/B479].
[22] §30 of Rowsell Report [ER1/24].

management (PIMS P/11), project monitoring (PIMS PN/11-4), and other practice notes under the Construction Management category. There always are some issues that may need cross-references to other categories; however, this is the norm when dealing with any all-inclusive set of management documents.

84. An effective project management system takes time to introduce and implement, and moreover, it must have real world utilization for testing and continuous enhancement. It appears to me that PIMS has been a recognized and proven system used in managing railway projects based on continuous internal review efforts and external audits, developed with the benefit of more than 20 years of proven track record in the delivery of railway projects [23]. To make any significant changes would require a lot of thought and new training protocols would also be required [24].

85. If the PIMS are written to be project-specific as Rowsell suggests[25], my opinion is that MTRCL's project staff that are familiar with PIMS may not be able to laterally transfer their prior knowledge and experience on its usage from one project to another. However, I can see the benefit of preparing project management documents to be as project specific as possible. In Section 4 of my report, I identify the actual work in progress by MTRCL to specifically address this issue.

86. In addition, I felt it may be helpful to examine the specific components of PIMS that are relevant to construction management quality control.

87. The PIMS includes the following key processes:

i. Hold Point;
ii. Inspection and Test Plan ("ITP");
iii. Site surveillance;
iv. RISC Form; and
v. Non-Conformance Report ("NCR").

[23] Carl We Statement §9-§10 [WS2/472].
[24] See Table 3 below.
[25] §29 of Rowsell Report [ER1/24].

2.5.1 Hold Point

88. The PIMS Practice Note PN/11-4 Monitoring of Site Works sets out Quality Hold Points ("QHP") and Quality Control Points ("QCP").[26] The QHP (also simply known as a Hold Point) is *"a point in time when a notice of permission, consent, or no objection by the Engineer[27] is required, or an approval or consent by a Relevant Authority or Utility Undertaker is required before the Contractor can commence, proceed with, or terminate an activity"*[28]. The QCP is *"a point in time when a notice or other document is to be submitted to the Engineer[29] before the Contractor can commence, proceed with, or terminate an activity."*

89. In short, under Contract 1112, Leighton cannot proceed with any succeeding work activity (e.g. installation or concreting) beyond the hold point unless the work, progressed up to the hold point, is inspected and found satisfactory, and a permission/consent to proceed is given by MTRCL's ConEs/IOWs.

90. The PN/11-4 Monitoring of Site Works lists out typical hold points, including inspecting track slab starter bars, reinforcement placement before and after concreting, and placing of concrete to each pour for structures[30].

91. The PIMS practice note PN/11-4 provides further that *"the SConE / SIOW shall exercise professional judgment on the extent and level of inspection needed for the works. The QHPs/QCPs requirements for the same category of operation may vary, depending on the specific location, quantity of work, and the performance of the contractor on similar work previously inspected."*[31]

92. Rowsell stated that "*PIMS procedures do not appear to be fully aligned with the Conditions of Contract. For example, PIMS sets out the need for Hold Points in relation to activities where the Contractor may not proceed but the contract sets out that no work may be covered up without the consent of the Engineer.*"[32].

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[26] PIMS/PN/11-4/A4 Monitoring of Site Works §3.1 and 3.2 respectively [B3/B1582].
[27] As from my understanding, *"the Engineer"* here refers to MTRCL which carries a contractual role under works contracts.
[28] PIMS/PN/11-4/A4 Monitoring of Site Works §3.1 [B3/B1582].
[29] PIMS/PN/11-4/A4 Monitoring of Site Works §3.1 [B3/B1582].
[30] PIMS/PN/11-4/A4 Monitoring of Site Works, Exhibit 7.2. Examples cited are listed under Items 26 and 29 [B3/B1595-B1608].
[31] PIMS/PN/11-4/A4 §5.1.1 c [B3/B1582].
[32] §31 of Rowsell Report [ER1/24].

93. The specifications for Contract 1112 reflect the requirements of having *"Hold Points"*. For the reinforcement works [33], the Contractor shall allow the Engineer (i.e. MTRCL) to inspect the completed reinforcement before carrying out any further work, including erecting formwork adjacent to reinforcement. This requirement appears to correspond to the Rebar Fixing Hold Point inspections for the EWL slab works.

94. For placement of concrete, the Materials and Workmanship (M&W) Specification states that *"(1) All formwork and reinforcement contained in it shall be clean and free from standing water immediately before the placing of the concrete; (2) Concrete shall not be placed in any part of the structure until the Engineer's Approval to proceed has been obtained"* [34]. This appears to correspond to the Pre-Pour Hold Point inspection before concreting for EWL slab works.

95. The requirement for these two hold points is critical. The rebar fixing hold point ensures the reinforcement is properly fixed. The pre-pour check hold point ensures the formwork, embedment, and stability is acceptable in total before concrete is cast.

2.5.2 Inspection and Test Plan ("ITP")

96. I note that Rowsell has not offered any opinion on the requirements, provision or execution of the ITPs.

97. Inspection of works is a critical component of the successful completion of any project. The purpose of inspections and tests is to ensure that the constructed works meet the specifications. Under Contract 1112, GS Clause G9.2.3, it is Leighton's responsibility to submit ITPs for MTRCL's review and approval.

98. The requirements for the ITP are set forth in the General Specification of the Works Contract[35], which requires Leighton to submit the ITP to MTRCL for approval at least four weeks prior to the commencement of the related works. The ITP included and identified, at a minimum, the following:

(i) The sequence of inspection / testing activities;

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[33] Materials and Workmanship Specification for Civil Engineering Works, Clause 10.36 Inspection of Reinforcement [G8/G6515].
[34] Materials and Workmanship Specification for Civil Engineering Works, Clause 11.84 (3) Concrete Placing: General [C3/C3824].
[35] General Specifications for Civil Engineering Works, Section 9, Clause G9.2.3 [C3/C2107].

(ii) The inspection / testing requirement of either activities or materials;

(iii) The acceptance criteria or relevant specification;

(iv) The level of inspection required, including the provision for witnessing by the Engineer or the Engineer's Representative;

(v) Any certification requirements or records to be kept; and

(vi) Records of any non-conformance identified during inspection or testing.

99. The PIMS/P/11/A3 §10.1.1 Construction Management provides, that the SConE shall ensure that the Contractor supervises and inspects the site works in compliance with the contract requirements. To achieve that, the SConE shall ensure that the ITP is submitted, reviewed, and agreed prior to the commencement of the related works [B3/B1391].

100. The PIMS procedure PIMS/PN/11-4 requires the ITP to contain appropriate QHP and QCP for critical activities.

101. The details of each ITP (including the discipline of works, the extent of activities, quality hold point, and quality control point requirements)[36] should be agreed in advance by the Contractor and the SConE/SIOW. The ITPs should be prepared progressively to suit the site progress, and they are to be made available to the SIOW to facilitate the inspections[37].

102. I believe the ITP does address the construction process, the inspection submissions and test descriptions, and is appropriate. However, I will address the execution of the inspections and documentation later in my report.

2.5.3 Site Surveillance

103. One of the objectives of the PIMS Construction Management procedure is to have early detection and correction of errors or defective works.[38] This goal relies on close site supervision of the Contractor's works by the construction management ("CM") team. In that regard, §10.1.3 of PIMS/P/11 Construction Management provides that *"all members of the construction team shall carry out regular site surveillance and identify any concerns as early as possible for resolution with the contractor, particularly with respect to any safety hazards that may have arisen and any working practices that are considered unsafe or likely to result in non-conforming work"* [B3/B1391].

[36] The PIMS procedure PIMS/PN/11-4 requires the ITP to contain appropriate QHP and QCP for critical activities.
[37] PIMS/PN/11-4/A4 Monitoring of Site Works §5.1 [B3/B1582-B1584].
[38] PIMS/P/11//A3 §10b [B3/B1391].

104. The practice note PN/11-4 (§ 5.7.1) further requires that the site inspection teams carry out site surveillance of the Contractor's site works on a day to day basis [B3/B1588]. The intention is to identify and even rectify the site issues before the formal inspection of the works. The SIOW and SConE should continually review the activities to ensure all critical areas proceed forward as specified.

105. PN/11-4 Monitoring of Site Works §5.7.4 states that *"If it is identified that works are not in compliance with the Contract requirements or the agreed Contractor's submissions this should be addressed with the Contractor immediately. Activities that continue to be undertaken incorrectly should be raised to the SConE / MTRCL'S CM for resolution with the Contractor."* [B3/B1588].

106. I discuss the details regarding to site surveillance, monitoring and inspections in Section 3.4.

2.5.4 RISC Form

107. RISC is the abbreviation for Request for Inspection / Survey Check. This is a standardized form / process that both the Contractor and MTRCL use regarding requests for inspection, testing, or the survey check of site works. The RISC form template is incorporated within the Works Contract, and the procedure for processing RISC forms is set out in §5.1.2 of PIMS practice note PIMS/PN/11-4 Monitoring of Site Works [B3/B1583].

108. The PIMS practice note PN/11-4 (§ 5.1.2(e)) requires that, when completing an inspection / check, the status of acceptance should be clearly identified on the RISC form [B3/B1583]. If the site inspection team considers there is a need for any adverse comments on the site work, they should indicate clearly on the RISC if re-submission by the Contractor is required. It is recommended in the PIMS[39] that re-submission is only necessary for works with significant interface with other work activities, or where remedial actions cannot be completed within a reasonable period of time.

109. Where there are significant adverse comments, § 5.1.2(g) of practice note PN11-4 provides that the SIOW should review with the SConE whether an NCR should be issued, the relevant criteria for which are discussed further in the next section.

[39] PIMS/PN/11-4/A4 Monitoring of Site Works, §5.1.2 (f) [B3/B1583-B1584].

110. Please refer to sections 3.4.3 and 3.4.4 for my comments regarding Rowsell and my opinions regarding the RISC forms and the inspection process.

2.5.5 Non-Conforming Works / Non-Conformance Report ("NCR")

111. I note that there are separate provisions for the issue of a NCR under the PIMS system and for a report of a *"non-conformity"* under the BD's CoP. The PIMS NCR appears to deal with quality-related non-conformance, while BD's non-conformity report focuses on safety-related non-conformance that may cause imminent danger. Further, the former is a contract administration process between MTRCL and the Contractor; the latter is a statutory process between MTRCL and BD, with emphasis on safety.

112. Aidan Rooney of MTRCL makes it clear that "*MTRCL's NCRs are distinct from the Non-Conformity and Rectification Report as required by BD*" [40]. In this section, I focus on the Works NCR process under the PIMS. In Section [3.5], I deal with the non-conformity report under the BD's requirement.

113. With regard to non-conforming work, the PIMS procedure [41] states that "*the construction team and the contractor's staff may, during the course of the works, identify materials and workmanship that does not meet the required specification.*". Timely rectification of non-conforming works is needed to avoid any impact on future progress or the ultimate quality of the completed works. Resolution of NCRs and corresponding remedial works needs to be closely monitored [42].

114. The PIMS/PN/11-4 Monitoring of Site Works sets out detailed guidance for raising a contract-level works NCR [43].

115. Exhibit 7.9 of the Guidelines for Raising Contract-level Works NCR of PN/11-4 provides the following definition of Works NCR:

> "*A Works NCR is to report nonconforming product which does not fulfill that specified requirements of a contract. The nonconforming product shall be dealt with before proceeding to the next stage of work or before covering up. A Works NCR is raised where the nonconforming product*

[40] Aidan Rooney Statement §63 [WS2/B202].
[41] PIMS/P/11/A3 Construction Management, §10.3.1 [B3/B1392].
[42] PIMS/P/11/A3 Construction Management, §10.3.1 [B3/B1392].
[43] Exhibit 7.9/1 of PIMS/PN/11-4/A4 Monitoring of Site Works [B3/B1615].

> *is significant and that corrective and preventive actions are required to prevent recurrence of similar nature.*" [B3/B1615]

116. These Guidelines further provide that a Works NCR should not be raised for "*Minor defects reported in routine inspections.*". PIMS/PN11-4, Exhibit 7.9 also requires the MTRCL's CM team to encourage contractors to raise their own Works NCR in accordance with their own QA/QC procedures, while the MTRCL's CM team is to maintain oversight on NCRs[44].

117. To facilitate the NCR process, Exhibit 7.9/2 of PN/11-4 notes that each Works NCR shall include corrective and preventive actions appropriate to the Works NCR. All actions should be accompanied with a target completion date. The MTRCL's CM team should monitor the close-out of NCRs and maintain records supporting the due completion of the corrective and preventive actions. The MTRCL's CM shall regularly review the Works NCR with the Contractor [B3/B1616].

118. It appears to me that the process of putting the corrective and preventive plans would involve some evaluations, assessments and investigations of the causation of defects.

119. Therefore, the PIMS itself does provide processes and guidance to MTRCL staff. MTRCL's Aidan Rooney provides his management perspective that the PIMS are not meant to be prescriptive or supplant the professional judgement of the MTRCL staff. The PIMS allows MTRCL staff to exercise flexibility to suit the project's needs and address circumstances required on site[45].

3. SPECIFIC ISSUES RELATING TO MTRCL PROJECT MANAGEMENT PROCEDURES

120. I agree with Rowsell's overall view that it requires extensive experience, tremendous resources, orchestrated efforts and commitment in delivering major projects. I am also impressed with MTRCL's proven track record in delivering many major railway projects, including the Airport Express Line, the Tseung Kwan O Line, the Disneyland Resort Line, the West Island Line, the Kwun Tong Line Extension, and the South Island Line, and the most recently opened Express Rail Link which was constructed using the concession approach.

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[44] PIMS/PN/11-4/A4 Monitoring of Site Works, Exhibit 7.9 §4 [B3/B1615].
[45] Aidan Rooney Statement §57 [WS2/B201].

121. Contract 1112 is considered to be one of the most complex projects in the entire Project. As MTRCL's TM Lee states, *"In my view, it's [the Project] as complicated as building Crossrail in London. It's not just building a new line, it involves modifying existing three lines, 30 stations, big modification, most of them undertaken at night-time, and in the last five years my team managed to maintain operating service for the passengers, without even five minutes' hiccup."* [T32/16:12-18:18].

122. Set out in the following sections are my opinions on seven specific issues that Rowsell has identified. However, issues relating to procurement and contract management (i.e., Issues A, C and G) are not within the scope of my instructions.

3.1 ISSUE A: CONSEQUENCES OF ADOPTING A TARGET COST CONTRACT

123. Based on my instructions, I am not asked to evaluate issues pertaining to Target Cost Contracts. In addition, based upon my evaluation of the factual evidence, the concerned project management issues in relation to the defective steel bars at the EWL slab connections and change in connection detail do not appear to be related to the contract strategy or cost aspect of the works contract. As such, I offer no comment to Rowsell's observations [ER1/34-37].

3.2 ISSUE B: PRODUCTION OF AS-BUILT DRAWINGS

124. Rowsell opines that the updating of as-built drawings during the course of construction is normal practice and should have been monitored by MTRCL, and that photographs (albeit helpful) are not sufficient[46].

125. Regarding "*as-built drawings*", as Rowsell points out [ER1/38], that it is Leighton's responsibility to prepare the as-built drawings[47].

126. Rowsell also refers to Exhibit 7.15 of the PIMS Practice Note *"Monitoring of Site Works"*, which provides that the ConE and SIOW are required to ensure that the "*as-built*" records are prepared as a continuous operation as construction proceeds[48]. This Exhibit refers to the schedule of regular construction records to be maintained across MTRCL's CM and site

[46] §49 and §52 of Rowsell Report [ER1/40-42].
[47] G15.4.1, G15.4.2 of the General Specifications [C3/C2131]; Y8 of Particular Specifications Appendix Y [C4/C2842].
[48] §46 of Rowsell Report [ER1/38-39].

inspectorate teams. More importantly, Exhibit 7.15 cited here refers to "*as-built records*" – it does not simply refer to "*as-built drawings*."

127. The "*as-built records*" cover a much wider spectrum, including information such as material submissions (i.e. mill certificates), test reports (i.e. concrete cube strength tests) and drawings. In this regard, the preparation of the as-built records had been commenced. Louis Kwan explained that the as-built submissions were being prepared in phases; the as-built submissions for the EWL slab started as early as February 2017 with various as-built materials submissions[49] [T29/105:12–108:13].

128. In fact, there is another PIMS practice note that sets out the process of preparing as-built drawings. PIMS/PN/09-5 Production and Management of Drawings, Section 5.5 provides that DM/CM shall agree the lists of as-built drawings and the submission programme with MTRCL's Operations Division.

129. The essential drawings shall be completed as the highest priority for Operations Division to take over the completed project. The civil general arrangement drawings shall be completed within 2 months of the appropriate structure completion and track access date (Degree 1 date in the civil contract). Civil as-built drawings other than general arrangement drawings (i.e. layout plans) may be completed later, but no later than the contract completion date [50]. Further, the draft as-built drawings shall be reviewed by the site staff to ensure that all changes made on site have been incorporated. Staged completion of as-built drawings may be proposed and be agreed between MTRCL's project management team and Operations Division[51].

130. With the benefit of past experience, MTRCL's senior management understand the obligation to prepare the as-built drawings. Philco Wong (MTRCL's Projects Director) states that it would take time to prepare as-built drawings and that they have to wait for the final construction stage to occur because they need to consolidate all previous documentation. One has to wait for everything to be done and assume that there will not be any changes. It would typically take three to four months before the project completion to complete the as-built drawings [T32/121:9-123:5].

[49] Contained in MTRCL's Technical Submissions bundle
[50] §5.5.1 a) of PIMS/PN/09-5 Production and Management of Drawings.
[51] §5.5.2 of PIMS/PN/09-5 Production and Management of Drawings.

131. TM Lee (General Manager of the Project) also notes that MTRCL has built many projects for which they capture all the amendments they have done during the construction period, and then close to the completion of the project they submit the "whole thing" (i.e. the as-built records) to BD. That's a normal, usual process [T32/38:15-39:3].

132. As I pointed out previously and Rowsell concurs, it is Leighton's responsibility to prepare the as-built drawings and submit them to MTRCL. Atkins' John Blackwood confirms that Atkins' Team B was instructed by Leighton on 12 June 2018 to assist Leighton in the preparation of the as-built amendment drawing [T33/78:1-7].

133. Therefore, based on the above evidence, the preparation of as-built drawings is ongoing, and Contract 1112 has yet to achieve the Project completion date. In this regard, the preparation of as-built drawings appears to be following the established protocols. The necessary follow up, coordination and tracking of these as-built records/drawings, as always, needs to be expedited.

Challenges in Preparing the EWL Slab As-Built Drawings

134. I will address the project management issues relating to the connection detail design change process when I respond to Rowsell in Section 3.6. In this Section, I will focus on the as-built drawing aspect.

135. Abundant testimony has been offered regarding the amendment of the connection details from coupler connection to through-bars adjoining the EWL slab, the top portion of the Diaphragm Walls and the OTE slab. Working drawings for the connection details are yet to be updated and photographic records have been used by Leighton's to assist in ascertaining the as-built details.

136. John Blackwood of Atkins states that the provision of updated working drawings incorporating most site changes would make the as-built drawing production process much easier [T33/77:16–25]. MTRCL's TM Lee also admits that there is a shortfall in relying on photographs, and perhaps memories of staff, to ascertain the as-built condition [T32/42:10-22].

137. However, from a construction perspective, there are other records apart from photographs available that may assist in ascertaining this as-built information.

138. It is Leighton's responsibility to prepare the as-built drawings as work progressed and areas of work were completed. In doing so, Leighton would need to coordinate with, or be assisted by, its rebar fixing sub-contractor Fang Sheung, as Fang Sheung maintained the detailed shop drawings. In fact, Fang Sheung actually used the shop drawings to prepare rebar materials and for construction installation. Based on the cross-examination by the Commission's Counsel, Pun Wai Shan explains how he took Leighton's instruction (i.e. use of through-bars) and prepared the simplified shop drawings for construction [T12/66:6-78:19]. The shop drawings were complex and technical [E282-E872]. Pun explained the details before the Commission. The Commission's Counsel comments that "*Sir, I could go through a whole series of these, but I think we've now got the hang of it, how it works, and how the through-bars are shown on these drawings.*" [T12/72:19-21]. It is, indeed, an important piece of record for the preparation of as-built drawings. Further there was information issued by way of TQs, RFIs, DAmS, or field adjustments to suit site conditions. These could all be used for preparing the as-built drawings. MTRCL engineers will then review the as-built drawings submitted by Leighton.

139. Photographic records are important and useful construction records. They are used for documenting and validating the completion or status of certain work activities. The use of photographs or videos is always helpful if they are taken of work in progress, dated and the actual location is noted. They should become part and parcel of the overall as-built record. However, the photographic records are not intended to replace the as-built drawings.

3.3 ISSUE C: ATKINS' ROLES IN SUPPORTING MTRCL AND LEIGHTON

140. Rowsell's observations are focused on Atkins' dual roles in Contract 1112 – Team A as MTRCL's detailed design consultant and Team B as Leighton's temporary works designer - and Rowsell concludes that this contract management arrangement may pose a real or perceived conflict of interest [ER1/42-47]. From a contract management perspective, his points are valid.

141. As set out in Section 1 (i.e. the introduction section of my report), my focus is on defective rebar/coupler installations and the change in connection detail issues. The defective rebar/coupler installations do not appear to be related to the dual role of Atkins' Team A and Team B.

142. Regarding the change in connection detail, the key project management issue appears to center around communication and coordination among related parties or teams, which I will discuss in further detail in Section 3.6 under Issue F (Design Submissions and Application of the BO Consultation Provisions).

143. Rowsell's review on this issue based upon his contract and procurement expertise is correct [ER1/42-47]. In my experience, that is not a good practice for the same design firm to provide services to the owner and to also represent the contractor in making design revisions or modifications. This is particularly the case where the two teams comprise some of the same staff members, as I understand happened in this instance.

3.4 ISSUE D: LEVELS OF SITE SUPERVISION & RECORD KEEPING

3.4.1 Supervision Terminology (Rowsell Report, §77) [ER1/52]

144. Rowsell observes that the terminology used in relation to supervision activities can be confusing[52]. However, based on the evidence, it appears that frontline personnel from both MTRCL and Leighton responsible for site supervision understood the terminology such as site surveillance, site supervision, informal inspection, and formal inspection. There does not appear to be any significant issues arising from the difference in the terminology. I believe the supervision staff were aware of their responsibilities, albeit that they might not be well-versed in the fine distinctions in terms of responsibility under different site supervision systems, especially those contained in the SSP and QSP.

145. MTRCL's site inspectorate team is responsible for site surveillance, site monitoring and site supervision and informal inspection. It is also responsible for formal site inspection (i.e. RISC inspection / Hold Point inspection), except the EWL slab rebar fixing inspection which falls into MTRCL's construction engineer team's duty.

146. From Leighton's side, site supervision team is engaged in site monitoring and supervision. The site supervision team managed the sub-contract or the labour resources needed to drive the actual progress and delivery of the work. It would also ensure that the work was done in a safe and reasonable manner. It is the responsibility of Leighton's construction engineering team to ensure that the work had been done correctly and as was required by the

[52] §77 of Rowsell Report [ER1/52]. The terminology includes supervision; superintendence; surveillance; inspection; watching; observing; examining; attending; and witnessing.

drawings and the specifications, including making formal and informal inspections of the EWL slab works [T18/73:2-74:21].

3.4.2 Full Time and Continuous Supervision (Rowsell Report, §78) [ER1/52-53]

147. Rowsell sets out his view on full-time and continuous supervision under the QSP requirement. He states that "*a Contractor's supervisor needs to be present at all times where mechanical coupler works are underway.*"[53] He further notes that "*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 task.*" [54] .

148. Based on the factual evidence, I agree with Rowsell's opinion that the obligation with regard to *"full time and continuous supervision"* needs precise definition[55].

149. The meaning of *"continuous supervision"* as used in the QSP for coupler installations [H9/H3903] is ambiguous and could be substantially clarified by using a definition typical in the industry for construction management. My understanding of the definition regarding to continuous supervision is as follows.

150. Based on my experience from an industry practitioner's perspective, *"continuous supervision"* generally means being on-site (including physically at the site or working from the site project office) and being dedicated full time on the designated project. There are many tasks to be performed by supervisors other than on-site inspection. Many meetings are conducted, paperwork is generated, coordination with various parties is needed, and a host of other activities are required that makes up the time when supervisors are on-site. Generally, supervision on major projects involves a supervisor who is assisted in his supervisory functions by various subordinate staff. Qualified construction supervisors know how to schedule their time to allow for the necessary site inspections checking for defective work and/or quality control.

151. Construction experience dictates *"when"* and *'how"* much time is required for site inspections based on the nature and the progress of the work being performed. In other words, inspections will be necessary when the lower level of rebar fixing is being installed and inspectors schedule their day to be on-site viewing the work.

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[53] §78 of Rowsell Report [ER1/52].
[54] §78 of Rowsell Report [ER1/53].
[55] §78 of Rowsell Report [ER1/52].

152. Supervisors and inspectors do not watch every installation as long as they schedule their inspections properly and can verify that the work is being installed properly. The same process goes for the upper level of rebar/coupler installation. In addition, experienced construction personnel are aware of both the contractor's inspection process and those being performed by MTRCL; therefore, the inspection process is a collective effort on a project of this size and scope.

153. Consequently, the statement *"full-time and continuous supervision"* means being on the project full-time and continually inspecting the work, as necessary. When one is on a project daily and makes one's inspection rounds, one becomes familiar with the foremen and their crews along with the nature of the work being installed. Therefore, proper oversight is established through a good working relationship with field staff that does not interrupt the sub-contractors work or interfere with the contractual chain of communication.

154. Good supervisors and inspectors quickly begin to realize how long it takes to put in the bottom layers of steel and top layers of steel at the EWL slabs and when they will need to return to continually inspect the work. Most of the time spent installing the rebar in concrete slabs, such as these, is not taken up with the coupler installations, but in the actual installation of the bulk of the rebar stretching horizontally. In addition, the inspector has to look at the type of rebar being installed, rebar spacing, cleaning of formwork and safety related issues.

155. I note Leighton's Raymond Brewster says that they have the staff there full time, but they do not necessarily stand over the works 100% of the day [T23/29:23-30:7]. He considers that it is a matter of common sense, as opposed to a strict interpretation of the contract words and asserts that the construction profession is *"a very practical profession"* [T23:31:10-23]. Leighton's Stephen Lumb also explains his view of *"full time and continuous supervision"*. According to Lumb *"full time"* means that they are on site full time. *"Continuous"* means the normal method of inspection and supervision prevalent in Hong Kong, and certainly does not mean *"man-marking"* everyone who is screwing in a bar. He does not think it has ever been read like that in the Hong Kong construction industry, as it would be impractical for someone to stand over the screwing in process and would require ten times the number of supervisors [T25/57:3-58:13].

156. Based on my construction experience and my opinion as set out in §147-152) above, I agree with both Raymond Brewster and Stephen Lumb with regard to their views on full-time continuous supervision.

3.4.3 Obligations under SSP / QSP (Rowsell Report, §79) [ER1/53]

157. With regard to site supervision and record keeping, Rowsell states, "*evidence has been provided by witnesses from the Contractor that they were unaware of the SSP and/or the QSP.*" [ER1/53]. While he identifies the requirements under the SSP and QSP regimes, these systems along with the PIMS are different in terms of the intent and level of site supervision and record keeping.

158. It appears that Rowsell relies on Louis Kwan's evidence[56] when addressing the supervision issue. Based on the factual evidence, Louis Kwan was a construction engineer. Site supervision was only part of his duty. Under MTRCL's PIMS, it is the site inspectorate team's (i.e., SIOW, IOW, AIOW, WS) responsibility to provide site surveillance and supervision. I will discuss the site supervision duty performed by MTRCL's Kobe Wong and his site inspectorate team in order to give a wider, and perhaps clearer, perspective on the actual site supervision and record keeping processes.

159. Regarding the obligations under SSP and QSP, it is Rowsell's opinion that Leighton was unaware of the SSP and/or the QSP. Rowsell also sets out that he would expect MTRCL to have checked or alerted Leighton regarding to the SSP/QSP supervisory requirements[57]. Regarding these observations, I discuss below some additional factual evidence on site supervision that may be helpful.

SSP

160. MTRCL submitted several SSPs for works in relation to the relevant EWL slab work areas (Areas B and C). These SSPs cover both MTRCL (under CP and RGE streams) and Leighton (under AS of RC stream).

161. Both MTRCL and Leighton satisfy BD's site supervision requirements under the SSP regime.

[56] §81 of Rowsell Report [ER1/54]
[57] §79 of Rowsell Report [ER1/53].

162. Leighton's Raymond Brewster confirms that he had several AS representatives and TCPs under his supervision in compiling BD's SSP requirements [T23/2:3-5:6]. Leighton is a Registered General Building Contractor under BD, and its Authorized Signatory has a duty in maintaining statutory requirements.

QSP – Quality Supervision Plan

163. Regarding the QSP, Leighton's Raymond Brewster admits that he was not aware of the specific requirements in relation to the inspection of the installation of the coupler works set out in the QSP and cannot recall seeing the QSP [T23/8:8-9:24]. As such, he did not appoint a quality control supervisor with T3 qualifications to supervise the coupler works [T23/9:25-10:8].

164. Leighton's Raymond Brewster also stated he would not expect his site supervision team and construction engineering team to be aware of the QSP; he was working with their own quality management plan and it provided facilities for checking reinforcement through RISC forms and pre-pour checks [T23/10:9-11:22]. Leighton has its own set of quality control plans and if there was a requirement for specialist plans, that would be inserted. In this case, the requirement for coupler supervision is already dealt with through Leighton's pre-pour concrete checks. Everything to do with couplers in the QSP was already provided within Leighton's standard quality control mechanisms and procedures [T23/13:15-14:16].

165. It is worth noting that Leighton had experience installing couplers at the Diaphragm Walls in the same Contract 1112. During the execution of the Diaphragm Walls, Leighton kept the proper Record Sheets/Inspection Logs for the Diaphragm Walls which followed the BD's QSP requirements. Leighton, however, did not maintain contemporaneous coupler Record Sheets for the EWL slab construction. Despite the same QSP requirements being applicable to both the Diaphragm Walls and the EWL slabs, Leighton was only aware of the QSP requirements for the Diaphragm Walls.

166. Leighton's coupler inspections were conducted by Edward Mok. Leighton's Edward Mok worked on the EWL slab team from August 2015 to 2016. He attended the training sessions by BOSA in relation to coupler installation and inspection. In fact, he attended the training twice. One was in 2013 for the Diaphragm Walls construction and another was before the EWL slab works [T21/18:25-19:10].

167. Based on Leighton's witness statements, Edward Mok and Man Sze Ho were responsible for checking the coupler installation in their routine inspections. Edward Mok confirms that, "*In these informal inspections ..., we would check coupler connections, ... When checking the connections between rebars and couplers, I looked to ensure rebars are properly screwed in (at most you might see one or two threads as the rest would be screwed into the coupler)*" [WS1/C8111]. In Man Sze Ho's statement, he says "*During my routine informal inspections ... I would visually inspect the connections between rebars and couplers ...*" [WS1/C20662].

168. Regarding inspection records, Raymond Brewster states further that there was no prescribed coupler inspection form and that Leighton recorded the inspections using its pre-pour inspections and RISC forms, which is consistent with the BD Acceptance Letter requirement that Leighton devise its own checklists [T23/38:20-39:17].

169. It appears that the RISC checks, when executed and documented properly, were comprehensive, albeit sometimes late. The RISC checks process seems to follow a systematic approach for inspecting the work. The inspections were witnessed by Leighton, properly documented, and not performed in a haphazard or random fashion. In other words, if the routine inspections had failed to identify other possible instances of defective connections, the performance of the RISC inspections was another avenue to spot any defective construction[58].

170. Yet, as a matter of fact, the RISC forms do not have a separate category for couplers which would have been included in the Record Sheets that both MTRCL and Leighton did not provide or execute.

171. Based on witness testimony from Leighton's management, they essentially state that they relied on the RISC inspections as a backstop to compensate for any inadequacies in routine inspection. They relied on the RISC and pre-pour check as part of their quality management plan, and contended that these encompass the BD Acceptance Letter quality requirements [T23:22-26].

172. However, this does not excuse the fact that Leighton and MTRCL should have been aware of the QSP requirements.

[58] With the exception of the three defective rebar/couplers which were encased in concrete being spotted by Andy Wong – Andy Wong Statement §34 [WS2/B455].

QSP Implementation by MTRCL

173. On the MTRCL side, Kobe Wong, who was a qualified T3 TCP under the RGE stream and who also attended BOSA training for coupler installation and inspection, states that MTRCL's team of IOWs was on site full-time and inspected more than the requisite 20/50% of coupler splicing assemblies for the EWL slab. Kobe Wong confirms that he "*had conducted routine site surveillance in respect of more than 50% of the couplers in the EWL slab, but there were no written records as such.*" [59].

174. Kobe Wong further states that:

> "*I did in fact direct those IOWs/AIOWs (e.g. Mr Tommy Leong) to look at the coupler installation when carrying out routine site surveillance in respect of the rebar fixing works for the EWL slab. As for the photos which I had personally taken, I can confirm that I also carried out routine site surveillance in respect of the coupler installations for the EWL slab in the areas/bays shown.*" [60].

175. When Kobe Wong (who served as the Quality Control Supervisor under the QSP during the Diaphragm Wall construction) started on the EWL slab, he asked Leighton whether there were similar inspection records as for the Diaphragm Wall. Leighton responded that there was no requirement for such records on the EWL slab [T29/128:9-129:7].

176. Kobe Wong also was told by his senior, Dick Kung, that he was not required to sign the EWL slab coupler inspection records [T30/5:6-20, T30/9:17-10:11]. Kobe Wong later learned in 2017 that this was not the case, when he saw the letter to the BD dated 12 August 2013 enclosing the QSP [H9/H4262-H4280] [T30/1:13-4:10].

177. Kobe Wong confirms that the contemporaneous inspection log book (for coupler installation at the EWL track slab) was not maintained by Leighton during the construction. Kobe Wong says that "*Record Sheets* [61] *of the coupler splicing assemblies were not prepared or maintained contemporaneously by LCAL for the EWL slab*" [62]. The required log book was only kept for the Diaphragm Wall construction.

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[59] Kobe Wong Statement §54 [WS2/B434].
[60] Kobe Wong Statement §60 [WS2/B435].
[61] Record Sheets is used per QSP format (Kobe Wong §42) [WS2/B431].
[62] Kobe Wong §46 [WS2/B432].

178. When the EWL slab construction commenced in July 2015, it appears that MTRCL's construction management team failed to instruct its site inspectors of their responsibility to receive these Record Sheets for the EWL slab construction and co-sign their acceptance. Both Leighton and MTRCL are responsible for this omission. Setting aside the missing records and log book discussed above, other evidence exists that addresses the quality of the coupler installations. Routine site surveillance was, indeed, in place. It appears from the evidence of the MTRCL's Kobe Wong [T29/125:24-126:15, T29/127:10-16, T30/8:11-16] and Andy Wong [T30/142:18-22] that they inspected the works, including the coupler splicing assemblies. These site inspections identified instances of rebar/coupler defects and the site staff ensured that these matters were remedied quickly. Plus, hold point inspections for rebar fixing and prior to concreting were in place.

179. On most large construction projects that I have carried out, it has been my practice to request my superintendents and inspectors to keep a personal log book/diary that records specific information of inspections they conducted, or notes regarding possible problems and remedial work. I understand that the site inspection team kept the site diary on a daily basis. I have seen the MTRCL site diary from August to December 2015 [SD5707-SD7042], namely, the time of the EWL slab rebar fixing. There were a number of work areas at the site. The site inspectors recorded the major daily activities that had happened at each work area. The site inspectors also recorded the labor resources and plant and machinery deployed on site. I consider the site diary is reasonably detailed. Kobe Wong confirms that there is a site diary system and everyone in the inspector team has contributed to the site diary [T29/70:17-24].

180. As a general comment, the various management systems (MTRCL's PIMS and BD's SSP/QSP) together make for a very wide-ranging system of overseeing and monitoring the work, and the manuals often identify finite lines of responsibilities. But project staff members appear to have conducted their inspection and supervision duties based on their collective experience, regardless of whether there was any stated procedure to be followed. As I mentioned previously, it is often the case that, frontline staff members understand their duties and provide the necessary supervision, irrespective of the specific system or applicable procedure.

181. Notwithstanding the above, in my view, MTRCL should have followed the QSP requirements regarding the logging and execution of Record Sheets of coupler installation inspections.

3.4.4 Rebar Fixing Inspection (Rowsell Report, §82-84) [ER1/54-55]

182. Rowsell states [63] that "*the inspections of any layers of reinforcement should have been recorded in a suitable format to confirm that the inspection was undertaken and those records maintained in the site office.*". I agree with this statement.

183. However, Rowsell mainly relies upon Louis Kwan's evidence in formulating his position. He states[64], "*The procedure for undertaking inspections described by Louis Kwan (a construction engineer of MTRCL) in his evidence does not appear to me to be well controlled.*" [ER1/54].

184. Rowsell also comments [65] that *"it would not be reasonable to expect to carry out more than one inspection of the same elements of work with different members of the Engineer's and/or CP team.*". In §83, Rowsell raises the timing of the inspections (i.e., bottom and top mats rebar fixing inspections) and the pertinent inspection records [ER1/55]. In my view, there is considerable factual evidence in relation to Rowsell's comments on the inspection process, which I set out below.

185. It is important to point out that these informal layer by layer inspections were part of a wider system of routine inspection carried out by both MTRCL and Leighton personnel and also involved formal RISC inspections at hold points.

186. The Area B and Area C EWL concrete slabs were three metres thick and made up of layers of rebars at the top and the bottom of the slabs. The construction sequence of rebar fixing was from the bottom layer to the top layer.

187. Leighton's Edward Mok mentions that the method of inspection of rebars was a visual inspection by standing directly over the installation. Routine inspection was on a layer-by-layer basis. There was no separate sign off for each layer of rebar inspections, so both layers were signed off together on the rebar RISC form and the pre-pour RISC form. Leighton also had a cast in place checklist which they attached to the pre-pour RISC form so the whole inspection was recorded. As Edward Mok carried out the routine inspections himself, he was able to sign the cast in place checklist [T21/18:7-18, 19:12-22:7].

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[63] §83 Rowsell Report [ER1/55].
[64] §82 Rowsell Report [ER1/54].
[65] §82 Rowsell Report [ER1/55].

188. Leighton's Man Sze Ho confirms that he inspected the installation of a layer, then went away and came back later in the day for a further inspection. This *"layer-by-layer"* inspection approach was workable to him as he indicated that only one to one and a half layers of rebar could be installed in a single day and he would not miss two to three layers being installed when he returned later in the day for inspection [T22/36:10-37:23, 51:9-52:8].

189. All the layer-by-layer rebar inspections were combined and included in the RISC formal inspection. If the inspection (by MTRC) of the bottom mat was satisfactory, they would proceed to install the top mat [T21/22:8-24:14]. in my opinion, because the bottom layer of steel could not be inspected after the installation of the upper level, there should have been sign-off inspections for each level.

190. The layer-by-layer checking was not part of the hold point inspections , but part of the day-to-day routine surveillance activities.

191. MTRCL's Kobe Wong [66] (SIOW) also noticed that Leighton would typically request MTRCL's ConE to inspect the bottom layer of the rebar installation at an early stage, and then the ConE would subsequently return to inspect the top layer of rebars. The IOWs were on site full-time and carried out site surveillance as the rebars were being fixed layer-by-layer, as did Leighton's site engineers, adding another level of quality control supervision.

192. MTRCL's Louis Kwan [67] (ConE II) further notes that *"if the top layers had already been completed, it would be difficult to visually inspect the bottom layers.*". Therefore, when Louis Kwan carried out the RISC inspections, he first inspected the bottom layers of rebars (prior to the start of fixing top layers of rebars). He then returned for a second inspection once the fixing of the top layers of rebars were being installed and completed. This was a sensible approach in carrying out the RISC inspections.

193. Louis Kwan says (§50) [WS2/B389] that, for the bays he inspected, he is confident that the top and bottom layers of bars had been inspected on a spot-checking basis in order to ensure that they had been properly fixed before he signed the RISC forms. Louis Kwan [68] says that he carried out and signed-off the rebar fixing RISC inspections for the EWL slab works in Areas B and C (except for Bays C3-2 and C3-3 for which inspections were carried out by Jeff Cheung). Louis Kwan signed off the RISC forms based on the safety and integrity of

[66] Kobe Wong Statement §25.2 [WS2/B425].
[67] Louis Kwan 1st Statement §48 [WS2/B388].
[68] Louis Kwan §24 [WS2/B381].

the rebar structures from an engineering perspective and the compliance of the rebar fixing works with the working drawings issued in August / September 2015.

194. According to the evidence of MTRCL's Louis Kwan [69] (ConE II), the rebar fixing works under his watch were inspected on site before Leighton was permitted to progress beyond the hold-point to the next stage of the works. MTRCL's Kobe Wong [70] also confirms and notes that "*there were no circumstances where the works proceeded beyond a hold point without any prior inspection / permission from MTRC.*".

195. Nonetheless, MTRCL's Louis Kwan [71] would observe the conditions of the coupler connections when he was inspecting the top and bottom layers of the rebars. As part of his inspection, he would perform spot checks to ensure that the rebars were properly fixed. Occasionally, he spot-checked the coupler splicing connections with assistance from the workers on site, by unscrewing certain installed starter bars from couplers, exposing the threaded end of those bars, and then re-screwing them back into the couplers.

196. Andy Wong confirms that during his surveillance, he would pay attention as to whether the rebars were properly screwed into the couplers and he would physically touch and push them to see if they were aligned or stable. He would try to get very close to the rebar/coupler to conduct a visual inspection of the steel fixing work [T30/131:15-24]. If there was insufficient connection, then the rebar would not be stable or would not be aligned [T30/142:10-17].

197. Andy Wong confirms that if couplers were being connected, he would watch the rebar being screwed into the couplers as part of his daily duties [T30/142:18-22].

198. The current ITP only requires one RISC form for rebar fixing inspection for each bay. It is common ground that, in Areas B and C, the majority portion of the EWL concrete slab is 3m thick and contains bottom and top mats of reinforcement. Once the top mat of the reinforcement is fixed, one could not conduct an adequate inspection of the bottom mat of steel due to steel congestion, stringer connections and the physical depth of the works (i.e. 3m deep).

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[69] Louis Kwan 1st Statement §61 [WS2/B397].
[70] Kobe Wong §40 [WS2/B431].
[71] Louis Kwan Statement §58 [WS2/B396].

199. Thus, the ITP needs to reflect both the physical structure and construction sequencing, and establish further inspection points, as appropriate. This can be achieved by a constructability review that could be performed by MTRCL's CM team. This entails identifying the sequence of work activities based on accessibility and spatial constraints. Constructability reviews are used to establish inspection protocols for work that, due to sequencing, requires staged inspections.

200. With regards to the inspections of rebar installation patterns, as a licensed general contractor, I always establish an inspection procedure based on the sequence of the installations, complexity and construction logic. In other words, rebar inspections are not a *"one size fits all"* application. With regard to Contract 1112, I consider the inspection of the bottom mat would require a separate inspection and a sign off procedure followed by the same inspection of the top mat. This would be not only with regards to the rebar/coupler installations but, due to their size, spacing and placement requirements, all the rebar in the EWL slabs.

3.5 ISSUE E: SITE SUPERVISION – NON-CONFORMANCE REPORTS

201. Rowsell[72] identifies the provision of non-conformance reports under BD's CoP, MTRCL's PIMS, Contract 1112 specifications, and Leighton's guidelines and QAP. My view is that although the provision is related to non-conformance, the provision under each regime is different and serves different purposes which a is a factor that needs to be taken into consideration [73].

3.5.1 BD's Non-conformance and PIMS' NCR (Rowsell Report, §94-95) [ER1/58-59]

202. Rowsell considers that there is a lack of alignment in the non-conformance reporting among different documents[74]. He further expresses his position that all non-conformances should be reported[75]. I have tried to provide further information regarding the NCR process below.

203. Table 2 sets out the definition of NCR under BD's CoP and MTRCL's PIMS.

[72] §90 of Rowsell Report [ER1/57].
[73] See recommendation in Table 3 below.
[74] §94 of Rowsell Report [ER1/58].
[75] §95 of Rowsell Report [ER1/58-59].

Table 2. Definitions of NCR.

BD's TM/CoP's Definition	MTRCL's PIMS Definition[76]
"A situation where the conditions on site, the methods or measures adopted, or the completed works do not conform to the provisions of this Technical Memorandum, or the Code of Practice, or the Supervision Plan or supplementary documents such as the approved plans, method statements or statements of precautionary and protective measures." [B5/B2803]	*"A Works NCR is to report a nonconforming product which does not fulfil the specified requirements of a contract. The nonconforming product shall be dealt with before proceeding to the next stage of work or before covering up. A Works NCR is raised where the nonconforming product is significant and that corrective and preventive actions are required to prevent recurrence of similar nature."* [B3/B1660]

204. Based on the above definitions, BD's definition of non-conformity is primarily focused on the safety aspect and deals with imminent danger. MTRCL's definition under PIMS relates to quality of work issues that may lead to significant impacts on the finished works. This is part of the contract administration process between MTRCL and Leighton. Aidan Rooney (MTRCL's General Manager, SCL Civil – NSL) makes it clear that *"MTRCL's NCRs are distinct from the Non-Conformity and Rectification Report as required by BD."* [77]. Therefore, it is my view that there is no *"overarching requirements"* as Rowsell [78] has stated in relation to the issuance of NCRs.

205. Exhibit 7.9 Guidelines for Raising Contract-level Works NCR of PIMS/PN/11-4/A4 Monitoring of Site Works provides the definition of Works NCR, which Rowsell[79] also acknowledges. But that same guideline also provides that a Works NCR should not be raised for *"Minor defects reported in routine inspections"*.

206. PIMS/PN11-4/A4 Exhibit 7.9 [B3/B1615-B1616] also requires MTRCL's CM team to encourage contractors to raise their own Works NCR in accordance with their own QA/QC procedures, while the MTRCL's CM team is required to maintain oversight on the NCR process.

207. In addition, MTRCL's CK Yeung, Senior Quality Assurance Engineer, also shares his perspective on NCR and non-conformance. He says:

[76] PIMS/PN/11-4/A4, Exhibit 7.9 §1 [B3/B1615].
[77] Aidan Rooney Statement §63 [WS2/B202].
[78] §94 Rowsell Report [ER1/58].
[79] §90 Rowsell Report [ER1/57].

"Significant works NCR requires root cause analyses in order to understand the root cause of the NCR, and then you have to take corrective action, meaning you have to correct the process, and then you have to take preventive actions to prevent recurrence, and this is for significant works NCR.As for minor defects, maybe within half a day or with making very little effort, you will be able to mend it, but minor defects are many and they will not attract NCRs. Usually, minor defects are dealt with by RISC forms." [T31/105:6-16]

"*Non-conformance means it does not comply with certain requirement, so it is non-compliance or non-conformance, and we [QA of MTRCL] are talking about works non-compliance, meaning that they do not follow specifications.*" [T31/106:2-6]

208. In this regard, for a defect that warrants the issuance of an NCR, some time and effort for rectification is required and, importantly, the defect should normally arise from a finished/final product (where the process could not simply be reversed and fixed). In contrast, non-conformance issues that are rectified immediately on-site following the specified procedure may not warrant the issuance of an NCR.

209. For Contract 1112, to examine what type of non-conformance would be warranted for MTRCL to issue a contract level Works NCR, I have reviewed Appendix 2 of Kit Chan's witness statement [80], which provides a list of MTRCL's NCRs for the EWL slab work. Those NCRs are primarily related to non-conforming products and generally require the formulation of a corrective plan and time to implement such a plan on-site, which aligns with the PIMS NCR guideline.

210. With regards to the defective installation of a rebar/coupler, this must be rectified immediately as the horizontal rebar ties to the rebar connected to the coupler. In other words, the majority of the time spent placing the rebar in the EWL slab involves the placement of the horizontal steel at both the lower and upper level. If the defective rebar/couplers were not immediately rectified, all critical work would come to a halt. Therefore, the issuing of an NCR may help prevent any further incident, and I agree with that logic. However, the defective rebar/couplers needed to be immediately remedied if the pouring of these slabs was to stay on schedule.

211. Based on my construction experience, with regard to the issuance of NCRs, if defective work was identified at any given point during an inspection, if it could not be remedied in one work day, then an NCR should be issued. If the defective work pertained to any embedment

[80] Appendix 2 of Kit Chan Statement [B1/B298-B308].

in the rebar, or defective rebar installation, the remedial work should take place that same day, even if overtime was required.

212. Any NCR that is received should be logged and tracked, and should not be taken lightly and requires the proper investigation and implementation of corrective measures. As a licensed general contractor, I was always concerned about possible allegations of defective work which might give rise to liability issues and, since my company basically self-performed our own work, I had strict procedures in place regarding any possible non-conformant installations. I agree with the process of identifying any defective work and having it rectified immediately.

213. If an NCR was issued, I also made sure that the tradesman responsible for installing the defective work understood what was wrong with their work, that the defective work was corrected and that they understood unequivocally that it was not to happen again; and, if the defective work occurred again, they were relieved of their duties immediately.

214. My experience as an owner of a formwork/rebar company and a licensed general contractor is that the detection of any defective rebar/coupler installation is not to be taken lightly and must be rectified immediately. When defective rebar installations are identified, the contractor should be notified and the foreman for the rebar sub-contractor should have been instructed to correct this defective installation. In addition, a strong reprimand should be administered to the workers responsible and an instruction to never again duplicate such defective rebar/coupler installation should be issued.

215. Having said that, it is the general contractor's obligation to confront its sub-contractors regarding *"any"* defective work. MTRCL should not approach Leighton's sub-contractors, but when one has identified cutting rebar, this deserved investigation. Cutting the threads of rebar in a manner to be able to then thread it into a coupler is not an easy task. One must know how to cut the *"valley of the thread"*, such that it could screw into a coupler. This operation would not go unnoticed on site. I believe that when Leighton became aware of the cutting of the rebar, they should have taken further action.

216. In my view, it would have been appropriate for MTRCL, at a minimum, to have raised these non-conformances with Leighton in the context of site and management meetings (at least at the occurrence of the third incident), in order to ensure both MTRCL's CM team and Leighton were fully aware of the situation.

217. I believe it is worth mentioning that due to the defective rebar/coupler issue, it is easy to use hindsight and zero in on this issue. However, if one places oneself back in time on-site when the rebar/coupler incidents occurred, there were many other work activities going on each day. Based on the number of incidents and the intermittent timing between when these incidents occurred, being a month or more, one may understand why *"at the time"* if the defective rebar/coupler installations were immediately rectified, it may not have been a major issue on one's mind.

3.5.2 NCR in relation to Incident Response (Rowsell Report, §96-98) [ER1/59-60]

218. Rowsell sets out his view that an NCR should have been issued for all defective rebar incidents [ER1/59-60]. I have provided below a chronology of events that occurred for each incident in an effort to understand the actions taken by MTRCL in response to each incident.

First Incident

219. The first incident occurred in August or September 2015 and was discovered during the routine site surveillance by MTRCL's Kobe Wong (still IOW at that time). Kobe Wong[81] states in his witness statement that he noticed one or two non-compliant threaded rebars. He immediately contacted Leighton. The problem was rectified later in the day and he witnessed the rectification being performed to his satisfaction.

220. Kobe Wong[82] states that he did not inform his colleagues, and, in addition, he would only report quality matters to the SIOW or other parties if they could not be resolved on site. From my review of the witness statements and succeeding testimony, Kobe Wong was the only MTRCL person who was aware of this defective rebar/coupler issue.

221. Kobe Wong's response followed the PIMS practice note PIMS/PN/11-4/A6 § 5.7.1 [B3/B1679], which requires the issue to be identified and remedied promptly and prior to the formal inspection of the Works. The installation of rebar/couplers are works in progress, rather than a defective final product.

[81] Kobe Wong Statement §70 [WS2/B438-B439].
[82] Kobe Wong Statement §73 [WS2/B440].

Second Incident

222. The second incident appears to have taken place about 2 months later in October or November 2015. Kobe Wong [83] states that the facts were very similar to the first incident, as it only involved one or two non-compliant rebar/coupler connections. Kobe Wong[84] also states that he did not know who was responsible for cutting the rebar threaded ends. Although, on this occasion, he did not personally oversee the rectification process, Kobe Wong states that he returned in the evening to inspect the new rebar and couplers and found the corrections of the work to be compliant. As with the first incident, Kobe Wong did not mention the incident back at the site office, report it to other parties in meetings or escalate the incident to his immediate superiors, as the issue was resolved immediately on site.

223. Kobe Wong [85] notes that "*the incidents were infrequent and temporally distant from each other.*". It had been at least a month or two between the times that Kobe Wong noticed the first incident to the second. Kobe Wong had been conducting inspections and had not noticed any defective rebar/coupler installations during this time frame, so it may not have been, in his view, a regularly occurring field related problem.

224. I believe, at a minimum, Kobe Wong should have alerted Leighton's Construction Manager and all of his MTRCL co-workers performing the inspections.

Third Incident

225. The third incident occurred on 15 December 2015, about a month later. Andy Wong (AIOW) noticed 2 cut ends of threaded rebars lying on the surface of fixed steel bars at Area C3 bay 2. He called his superior, Kobe Wong (SIOW), who told him to follow up with Leighton to ensure the problems were rectified, which did occur. Kobe Wong [86] tells us that, following the call with Andy Wong, he identified on site five rebars with the threaded ends trimmed down which had not been properly installed into couplers. Kobe Wong saw a wire cutter on the ground nearby. He checked other rebar installations in the area and considered those to be compliant. As with the other rebar cutting incidents, he says he did not know who was responsible for trimming the rebars.

[83] Kobe Wong Statement §74 [WS2/B439].
[84] Kobe Wong Statement §75 [WS2/B440].
[85] Kobe Wong Statement §74.1 [WS2/B439].
[86] Kobe Wong Statement §78 [WS2/B440].

226. Kobe Wong [87] asked Andy Wong (AIOW) to stay on site to oversee the rectification work and Andy Wong complied. As Andy Wong did not report any problems with resolving the incident, Kobe Wong understood that the non-conformance had been rectified.

227. On his return to the office that same evening, Kobe Wong [88] states he sent an email to the Leighton team (addressed to the Construction Manager, General Superintendent, Site Agent, Site Engineer, and Site Supervisor) to report the matter. He also copied in the IOW and the ConE teams. The email reported that five bars were wire cut and were not properly screwed in. The email concluded, *"Please strengthen your internal quality check and keep high level of quality control for these issues."*.

228. As this was the third recurrent incident over several months and, even though each incident had occurred intermittently with few defective rebar/couple connections, it is my view that Kobe Wong should have brought the incident to the attention of the wider Leighton team, requested an NCR be issued, and also alerted his immediate superiors within MTRCL. The apparent purpose of Kobe Wong's email was to record that rectification had taken place and also to remind Leighton to tighten up its supervision on site to prevent further occurrences.

229. Leighton's team issued NCR 157 to Fang Sheung on 18 December 2015. The issue of Leighton's NCR 157 aligns with the PIMS NCR guidance in which *"the MTRCL'S CM team should encourage contractors raising their own Works NCR in accordance with their own QA/QC procedure."*. Again, that is in line with the PIMS requirements to encourage contractors to issue their own NCRs. It is sound practice for general contractors to issue NCRs regarding defective work.

230. MTRCL's Construction Manager, Kit Chan, sent to SConE James Ho a copy of Leighton's letter to Fang Sheung in respect of NCR 157 (James Ho §36). James Ho then spoke to Leighton's Construction Manager, Gary Chow, and James Ho states that Leighton would discuss and resolve the issue with Fang Sheung (§37). He also asked Kobe Wong to monitor the situation (§37) [WS2/B332-B333].

231. The non-conformance issue was rectified immediately on site, and Leighton sent Fang Sheung NCR 157. At that point in time, this non-conforming rebar issue appears to have

[87] Kobe Wong Statement §81 [WS2/B441].
[88] Kobe Wong Statement §82 [WS2/B441].

been a workmanship and quality issue. In fact, NCR 157 notes it as a workmanship and personnel issue.

232. PIMS/PN/11-4/A4 Monitoring of Site Works §5.7.4 states *"if it is identified that works are not in compliance with the Contract requirements or the agreed Contractor's submissions this should be addressed with the Contractor immediately. Activities that continue to be undertaken incorrectly should be raised to the SConE / MTRCL'S CM for resolution with the Contractor."* [B3/B1588].

233. Once James Ho was informed about the third incident, he took follow up action by communicating with Leighton's Gary Chow (Construction Manager) and Kobe Wong (SIOW). This was in line with PIMS/PN/11-4 §5.7.4.

Fourth and Fifth Incidents

234. The fourth and fifth incidents appear to have happened around the same time as the third incident (i.e. 15 December 2015). Leighton's NCR 157 was issued on 18 December 2015. Kobe Wong states there were only a very small number of non-compliant rebars, and the issues were immediately rectified on site during routine site surveillance prior to hold point inspections.

235. The number of non-compliant rebars identified in the fourth and fifth incidents were also similar to the first two incidents, and the extent of the third incident (five rebars) was an exceptional case.

236. However, there was testimony by Andy Wong [89] where 3 defective rebar/coupler installations were covered in concrete. Andy Wong notes that *"at the time when I [Andy] noticed that the steel bars were not properly connected, concreting works of that Bay had already commenced."*.

237. Andy Wong's statement [90] notes that there was a situation where 3 steel bars in the lower part of the top reinforcement layer could not be rectified and concreting had proceeded. This situation should have been detected during the RISC hold point inspection.

[89] Andy Wong's comment about deficient coupler connections embedded in concrete.
[90] Andy Wong Witness Statement - §34 [WS2/B455].

238. Defective rebar/coupler installations were identified over a 5-month period. All five incidents entailed a minor number of defective rebar/coupler connections that were corrected (albeit for one incident) immediately before concrete was poured. It seems reasonable for MTRCL to have concluded that all defective couplers were discovered before concreting, although I note that Andy Wong states he had seen three-defective rebar/coupler installations being covered with concrete. Again, I would have expected that at the time these defective rebar/coupler installations were identified that there would have been detailed discussions held between Leighton's and Fang Sheung. Man Sze Ho testified that after the third rebar/coupler incident that Leighton's had a brief meeting with Fang Sheung to remind them of their duties in connection with the couplers [T22/13:4-16:24].

239. My construction experience has been that once an ironworker/rebar fixer becomes familiar with the rebar installation pattern, the placement becomes straightforward. The worker's acquired familiarity with the coupler/rebar connections at the bottom and top mats and the installation should have helped them improve their efficiency in performing the work. I believe that most tradesmen are dedicated to their trade and will make sure that they and the workers around them are installing the rebars correctly. If defective installations are pointed out to them, corrective measures are taken and training or guidance is given to the workers so that the problem is not repeated.

3.6 ISSUE F: DESIGN SUBMISSIONS AND APPLICATION OF THE BO CONSULTATION PROVISIONS

240. Rowsell sets out his opinions that there was a communication issue between MTRCL's design management ("DM") and MTRCL'S CM teams in relation to the issue of the change in connection details [91].

241. I agree with Rowsell in that the communication process between MTRCL's DM and MTRCL'S CM teams was lacking and should be strengthened. I also agree with Rowsell's view that the procedures for design submissions are "*complicated and rather confused.*" [92].

242. Rowsell provides a high-level summary of the evolution of the change in connection detail and he makes his observations and opinions thereafter [ER1/61-64]. In principle, I agree

[91] §103-§105 of Rowsell Report [ER1/63].
[92] §101 of Rowsell Report [ER1/61].

with his overall summary but, given there are a number of details which are relevant to the design development.

243. The issue whether the design submission was a major or minor change, or one that had IoE exemption status, appears to be a legal matter. That falls outside my remit. In the following paragraphs I will focus my discussion on the management process aspects.

244. I view the change in connection detail as a constructability issue. Constructability reviews are a common exercise on large, complex infrastructure projects. At the basic level, the constructability review undertakes to identify any potential design clashes before they are encountered during the course of construction. On a deeper level, the constructability review needs to determine whether there may be better construction means and methods to adopt, so that the safety and quality of the work can be maintained while minimizing additional cost and delays to the construction schedule.

245. In this context, it was Leighton's prime responsibility to overcome construction issues relating to slab rebar configurations and the difficulties in tying in the rebar with cast-in couplers inside the Diaphragm Walls. Leighton, along with its designer Atkins' Team B, came up with an alternative plan to deal with coupler alignment issues by using thousands of drill-in dowel bars. Drilling in these anchors would take a significant amount of time, and Leighton should have considered the timeframe to install these anchors. MTRCL's CM team, also being concerned regarding works progress, was correct to question whether there was an alternative construction method which could achieve the same objective without putting the schedule at such risk.

246. In construction management, on-site modifications to the works often are necessary to accommodate site conditions or existing structures, in this instance the Diaphragm Walls. I continue to lay out the facts regarding this connection change.

MONOLITHIC CONSTRUCTION

247. Based on Kit Chan's understanding, the new design requirement came from Atkins' Team A in or around late July 2015, providing that the EWL slab, Diaphragm Walls, and OTE were to be cast monolithically [T26/41:6-8].

248. In Kit Chan's view, there appears to have been a number of relevant considerations [T26/41:20-42:3]:

i. The DM team is fully aware that there is a new requirement, which is that the three elements (EWL, Diaphragm Wall and OTE) must be cast monolithically;
ii. The changes are minor; and
iii. The DM team can submit a design consultation in relation to these changes at any time before the BA-14 submission.

249. Kit Chan mentions that:

"I was under the impression that they [design management] knew that that second change has come from the recommendation in the permanent works design report..... That monolithic requirement has come from that permanent works design report. I got the impression that if they want to make the change, they will do in due course." [T26/46:11-47:2].

250. However, I note that MTRCL's Andy Leung, in his testimony, expresses a view that there was miscommunication between MTRCL's DM team and CM team, in that the DM team was not aware of the change in connection detail (i.e. the second change) [T26/3:24-4:21].

251. In terms of the management process, there were communications and discussions circulating around MTRCL's CM and DM teams, Leighton, and Atkins about construction methods and the casting of the EWL / OTE slabs. The ambiguity appears to be centered around the different definitions of the terms of being used, including *"cast together"*, *"cast concurrently"*, and *"monolithic"*. Apparently, MTRCL's CM team and Leighton appeared to share the same understanding, while MTRCL's DM team did not.

252. In construction terminology, the term *"monolithic pour"* is generally understood as concrete in a specified area being cast all at one time, in one concrete pour. Kit Chan's consideration of trimming down a certain portion of the Diaphragm Wall was based on construction means, methods, and sequences, and does not appear to be *"design-driven"*, but a constructability issue. At the end of the process, the general arrangement of the permanent works of the EWL slab, the Diaphragm Walls, and the OTE slabs all remained as originally intended.

CHANGE TO THROUGH-BARS

253. It is common that constructability issues arise in the field, and they often require well-researched decisions to correct existing conditions. In this regard, when MTRCL's CM team

realized that the cast-in couplers in the Diaphragm Walls could not align with the EWL slab, they proceeded to research options and came up with solutions that could address the site issues [T26/51:6-52:12].

254. It ultimately was decided to go back to the original construction detail, which was approved in 2013, and which comprised two layers of uniformly spaced top rebar for the EWL slab connected to couplers located inside the top portion of the Diaphragm Walls [T26/39:22-40:7]. Instead of using couplers, the connections were changed to through-bars.

255. In fact, whether to use coupler connection or through-bars is a matter of construction detail. They are both a means of splicing. However, Leighton did not submit any formal proposals or revised drawings to MTRCL incorporating the change in the connection detail.

256. As MTRCL's Kit Chan stated in his testimony, there were other pressing issues to deal with at that time, such as ground settlement and underpinning [T26/53:17-21]. Leighton's Monthly Reports (July to September 2015) confirm that these were the major activities ongoing at that time.

257. MTRCL's Kit Chan considered that the change in the connection detail was relatively minor, because its implications involved less risk compared with other concurrent works that were susceptible to ground movement and required fortification. In addition, he considered that the results deriving from the change did not deviate from the original approved design intent.

258. It is of utmost importance for MTRCL to maintain safety, regardless of changes initiated for any reason whatsoever. It is notable that, contemporaneously, based on the evidence I have seen so far, and subject to the engineering experts' opinions, there was no criticism with regard to the safety or structural integrity resulting from the change to the top of the east Diaphragm Wall.

259. The key issue as it pertains to project management is the communication / coordination between MTRCL's CM and DM teams, so that the DM team could be kept informed of design change development and have the opportunity of deciding whether the associated changes should go through the BD consultative submission process at that point in time.

260. The role of the DM team was to liaise with MTRCL's detailed design consultant, Atkins (Team A), and prepare design submissions to the BD.

261. There were regular communications between MTRCL's DM and CM teams. They would communicate with regard to Leighton's design change proposals and hold weekly DM / CM co-ordination meetings [T25/105:1-25]. However, there could have been more meaningful communication with regard to the change in connection detail.

262. The key aspect of MTRCL's DM/ CM co-ordination meetings was, as MTRCL's Andy Leung says, "*if the construction management team had any queries for the design management team, they would be raised at the meetings, and if we [design management] had submissions to require the contractor to submit as soon as possible, that would also be raised at such meetings.*" [T25/106:15-19].

ADMINISTRATION OF CONTRACTOR'S DESIGN

263. The change in connection detail was in fact perceived as Leighton's alternative design. The Particular Specifications PS 7.1 and 7.6 [C3/C2209, 2217] under Contract 1112 require Leighton to submit an alternative design proposal for approval, and to prepare all submissions necessary for the consulting and obtaining the approval from the BD.

264. PIMS/P/11/A3 (Construction Management) §6.3.2 provides that:

> *"SDME shall review any alternative designs proposed by the Contractor ensuring that they comply with the Contract, are adequate, can be constructed and maintained safely, and meet all statutory requirements, Project Definition Documents, Specification and system requirements."* [B3/B1384].

265. Further, PIMS/P/11/A3 §8.1.3 provides that:

> *"To improve the information flow between the Contractor and Project team, workshops and similar such meetings will be established. The SDME shall ensure that drawings and amendments are issued, updated and maintained regularly and in a controlled manner."* [B3/B1386].

266. However, based on my evaluation to date, Leighton did not initiate this process. There was no alternative design proposal formally submitted by Leighton at the time of the works, nor were there revised working drawings showing through-bars instead of coupler connection details.

267. This was despite the email dated 19 October 2015 from MTRCL's Andy Leung (DM) to Leighton (with MTRCL's Kit Chan copied in), which reminded Leighton that formal proposals for all changes initiated by Leighton (e.g. by its TQs to Atkins' Team B) had to be submitted to MTRCL, otherwise such changes could not be incorporated into revised drawings.

268. Explicitly, MTRCL's Kit Chan notes, at §53 of his witness statement [WS2/B281], that:

> *"LCAL/Atkins Team B should have submitted proposal for change in permanent works design to the Design Management Team and Atkins Team A for their review and approval, who would then issue working drawings for construction to Leighton. On this occasion, they failed to do so."*

269. Construction is a dynamic process. There are innumerable issues that must be dealt with on a daily basis. During this project, there appears to have been a miscommunication between MTRCL's DM and CM teams. [T25/135:4-135:4]

270. It appears that if MTRCL's DM / CM team had clarified the revision at issue with each other, this whole issue may have been avoided. There were venues available for MTRCL's DM / CM teams to communicate, such as through MTRCL's DM / CM weekly co-ordination meetings.

271. Irrespective of the difference between MTRCL's DM and CM teams, both teams were expecting Leighton to submit formal alternative design proposals for all changes made to the works. However, despite various prompts, Leighton did not submit anything for the change in connection detail, and so no revised working drawings to reflect this change were issued at the time. As a result, the changes now have to be directly incorporated into the prospective final amendment submissions to the BD.

272. As noted previously, in field operations it is common to modify the works to deal with site conditions. The basis of doing so is dependent upon the CM (or resident engineering) team's background, experience, and professional judgement. However, one area that can be strengthened is the documentation. Changes that have been made must be clearly documented so that working drawings are prepared and can be reflected in the subsequent as-built drawings.

273. There was a breakdown of communication between Leighton and MTRCL's CM and DM teams. The necessary procedures should have been followed.

274. It is suggested that MTRCL's DM and CM teams establish a requisite internal communication procedure to review any potential change and to deliberate proposed construction methods, regardless of any perception that it is a major / minor issue. Such communication would better address the kind of situation presented by the coupler / through-bar issue

Inspection

275. Rowsell raises his questions as to the inspection process given the connection modifications were yet to be proceeded based on the contract procedures[93]. And Rowsell holds his view that without approval, the relevant work should not go beyond the hold point inspection[94].

276. From an actual works implementation perspective, the level of site supervision and conducting inspections remained the same regardless of the changes. As discussed above, there were three operations to effect the change in connection details:

i. Trimming down the top portion of Diaphragm Wall;
ii. Removing couplers and replacing with through-bars; and
iii. Casting concrete at the EWL slab, the Diaphragm Wall, and the OTE slab monolithically.

277. In carrying out the RISC inspections, MTRCL's Louis Kwan was aware of the agreement within the CM team that the change in construction detail at the top of the Diaphragm Wall was considered acceptable at that time. His colleague, James Ho, had also discussed the changed details (from couplers to through-bars) with the ConEs and confirmed that his ConE and IOW teams were aware of the changes.

278. MTRCL's Louis Kwan (ConE) says that he conducted regular site surveillance as part of his ConE duties. He describes at §55-§61 of his statement [WS2/B392-B397] how he conducted the hold point inspections visually. He would base them on:

[93] §106-§108 of Rowsell Report [ER1/63-64].
[94] §108 of Rowsell Report [ER1/64].

i. Reference to the working drawings:
   a. the spacing of rebars with a tape measure;
   b. the number of rows / layers of rebars;
   c. the lap length of the lapped rebars; and
   d. the diameter of the rebars used,

ii. Engineering experience and professional judgement; and

iii. Spot-checking.

279. MTRCL's Louis Kwan's supervisor James Ho, SConE, agreed with Louis Kwan's approach in carrying out the RISC inspections based on the original working drawings, while also adhering to the agreed change in construction details (save that coupler connections were no longer necessary even though they were shown on the drawings).

280. For each operation, MTRCL's site inspection teams were there to supervise the process. The IOWs and ConEs inspected the works according to the ITP and RISC inspection processes (i.e. rebar fixing hold point and pre-cast hold point). There was no evidence suggesting that the change in connection details made any material difference to the supervision and inspection procedures. The overall EWL slab reinforcement arrangement (size and spacing) generally remained unchanged, except for the connection detail.

RECOMMENDATION ON CHANGE IN CONNECTION DETAIL

281. Leighton should have submitted its alternative design proposal to MTRCL for review and acceptance. MTRCL's CM team should first review Leighton's alternative design proposal and if it finds it acceptable, the proposal should be passed to MTRCL's DM team for acceptance and submission to the BD for consultation. Upon acceptance by BD, MTRCL's DM team should then incorporate it into the permanent works design changes and issue the revised working drawings to Leighton. MTRCL's CM team should have ensured that the required design change process is followed before allowing Leighton to proceed with the changes on site.

282. As a recommendation, MTRCL's DM and CM teams should continue to use the coordination meeting as a venue to communicate MTRCL DM / CM issues but to record by way of meeting minutes the key follow-up actions. Engineering and design are often dynamic processes, and they do not stop once the relevant drawing has been issued. Often

during construction, design changes have to be made in order to adapt to site conditions. In this regard, MTRCL's CM team can consider maintaining change logs to document areas / details for which the drawings need to be modified when deviations occur. The logs can then be shared with MTRCL's DM team on a regular basis (such as in the coordination meeting) so that MTRCL's DM team is kept aware of the issues that are occurring and/or the changes that are being made on-site.

283. One thing I have found with regards to *"design"* is that many individuals think of design as a "*work product*". They believe that once they receive the final design drawings, they have the final work product. This is incorrect. Design is not a *"work product"*. It is an "*ongoing process*" because the design is not completed until the project is completed. No design is ever 100% complete and must take into consideration everything that will be encountered during the course of construction.

284. The Project Manager should also actively participate in MTRCL's DM / CM co-ordination process. As detailed above, MTRCL's DM team is responsible for MTRCL's BD submissions, and they hold professional responsibility in ensuring the drawings are properly approved. MTRCL's CM team, on the other hand, is responsible for construction project execution and management. They need to progress the project safely, while meeting the specified quality level and controlling the cost and schedule. MTRCL's CM team works closely with the contractor on a daily basis. As such, it is essential that the Project Manager provides the oversight of the process and implements decisions on such issues as are typically presented during the construction process, such as this coupler / rebar deviation.

3.7 ISSUE G: COMMERCIAL SETTLEMENT PROCEDURES

285. Rowsell offers his opinions with regards to the sub-contract commercial settlement procedures, and specifically Rowsell refers to the sub-contract between Leighton and China Technology (the formwork and concreting sub-contractor) [ER1/64-67]. The issue does not appear to be related to the defective rebar connection and the change in connection detail. The defective steel rebar connection in question arises from the rebar fixing works carried out by another sub-contractor, Fang Sheung. The change in connection detail was a DM / CM issue which did not involve works sub-contractors. The evidence heard by the Commission does not appear to involve detailed particulars of the sub-contract commercial management. In this regard, I do not understand the opinion offered by Rowsell that states

"*this indicate a weakness in MTRCL's project management, control and reporting systems.*"[95]

286. It is a widely-adopted industry practice and norm that employers (or the project manager, as is MTRCL's role in the Project) would not interfere on sub-contract issues. It is only usually when job safety is at stake, work quality is sub-standard, work progress is affected, or the main contractor unreasonably withholds sub-contractor payments, that the employer becomes involved in sub-contractor issues.

287. It is rare for an employer to step in to a sub-contract commercial settlement. The commercial management of sub-contractors is entirely the contractor's own responsibility. The employer may become involved in the process if the main contractor elects to pass through the sub-contractor's claims to the employer. Even then, the employer would evaluate the main contractor's claim under the normal contract administration procedures.

4. RECOMMENDATIONS AND CURRENT ACTIONS TAKEN BY MTRCL

288. As part of my instructions, I was asked to provide recommendations that may assist MTRCL in the future in terms of improving the quality of the work performed on MTRCL's projects. In addition, I was also asked whether any recommendations that I made may have avoided the problems experienced on the Project. Set out in Table 3 is a list of my recommendations.

289. As I mentioned in my report, I have read the T&T report and Rowsell's report, both of which included the same type of recommendations as my own. In these circumstances, I considered that it might be helpful to the CoI if I set out in just one comparative table all three sets of recommendations (Table 3). Table 3 also identifies the actions taken or to be implemented by MTRCL so far as the T&T recommendations are concerned in the column entitled *"Actions already taken by MTRCL to this date"*.

290. Most of the recommendations referred to above are directed at the establishment of a centralised quality control platform as well as keeping the applicable documents and records in an organised and electronic fashion, together with MTRCL's procedures for dealing with the NCR process.

[95] §116 of Rowsell Report [ER1/66].

291. It is my opinion that once the proposed recommendations are implemented, the prospects of the same problems occurring on other projects will be minimised, if not eliminated.

Table 3 - Summary of the Project Management Recommendations

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
1	Overall MTRCL	Often it is helpful to assess the procedures / processes that are actually occurring on the Project by the specific categories of personnel and compare this with the procedures/processes as stipulated in the PIMS and BD requirements. One may find that they are quite different, and/or one may be able to improve the manner the work is being monitored and inspected.	**§153**: Consider ways of improving closer working between different groups within the project organization 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.	**PP5 [B17/B24442, B24444]:** Introduce yearly review of PIMS by the review panel and capture feedback from those on site regularly to drive 'bottom up' improvements. **PC2 [B17/B24452, B24453]:** Re-skill and re-assign SIOW/IOW/CEs with QA focus to support. **PC4 [B17/B24431, B24452-B24453]:** Site competence: define levels of competency required, monitor and report: - Establish competency matrix to address requirements in the CoP - Conduct competency assessment for all applicable project staff - Provide training to bridge competency gap as required **PC6 [B17/B24431, B24452,B24453]:** Site quality alerts and toolbox talks – communicate and share knowledge regarding high impact or recurring NCRs. **PP7 [B17/B24442, B24444]:** Reporting to be expanded to capture	• Survey of staff on PIMS usage planned for Feb 2019 [PP5 [96]] • Full review of PIMSs planned in 2019 [PP5] • The new digital supervision and reporting system noted in PP6 is being developed in stages throughout Q1 to Q3 2019 to provide dashboard reporting facilities to capture KPIs for monitoring of quality on site. Scope and range of KPIs is under review by the team as referred to in PP6 [PP7] • New enhanced training has commenced for site supervision teams [PC2] • Matrix developed for levels of individual staff competence as required by the CoP [PC4] • Competency assessment of staff and retraining as required planned for 2019 [PC4] • Quality Alert template prepared for introduction once new digital reporting system for NCRs goes 'live' in Q1 2019 [PC6]

[96] All the references to the relevant codes PP1-PP14, OR1-OR3, CC1-CC8, PC1-7, QP1-QP4 and TT1-TT2 in square brackets in the last column in the above Table 3 refer to those actions taken by MTRCL in the last column of Appendix A to MTRCL's memo dated 4 January 2019 and titled *"T&T's Interim Report dated October 2018"* which is in Appendix D hereto

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
				other quality and conformity issues such as requests for information, design change requests, and field change requests. Other positive reporting to be implemented such as Requests for Inspection planned vs held, Audits planned vs held, 'hold points' planned vs passed. b	
2	BD's CoP	Definitions such as *"continuous supervision"* needs to be clarified and put in simple terms so all parties have a clear understanding of what is required of them.	**§171:** 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.		.
3	Design/BD	Review the communications (flow of information) between any Contractor's design team, MTRCL's DM team, MTRCL's CM team and the B make sure there is a clear understanding of any design revision/submission when issues in the field may arise.	**§155:** 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. **§169:** Review the liaison arrangements between the Contractor's design team, the BA and MTRCL's design and construction management teams to ensure that there is common understanding of submission	**QP1 [B17/B24454, B24455]:** Implement BIM strategy to capture asset data – it is recommended to plan what level of quality related certification is required and verify its integrity. **TT1 [B17/B24431, B24456]:** Introduce digitalised data capture of NCR, RISC, Field Change Requests, etc. with asset data aligned to BIM strategy. **PP4 [B17/B24442, B24444]:** Simplified guidance and flow charts in English & Chinese for onsite monitoring procedures and the proposed new NCR procedure.	• Common Data Environment (CDE) for BIM went 'live' in December 2018 and will be used as data management tool in future Projects [QP1] • Contracts awarded for new digital reporting and supervision system to cover on site communication, workflow and supervision, including RISC and NCR processes [PP6]. • Digital Systems chosen should be capable of being developed to link with BIM strategy for future Projects [TT1] • Site training and development of digital management systems ongoing [QP3] • Digital systems trialed on the site and are being refined to go 'live' in stages from Q1 2019 [PP6]

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
			requirements and that all parties are aware of design issues and the forward programme of potential submissions. **§190**: 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. **§196**: Develop and implement the use of BIM as a collaboration tool.	Digital forms to be in both English & Chinese. **PP6 [B17/B24442, B24444]:** Inspection records to be captured digitally (including photographic records) and held centrally by a reporting team independent of the delivery team to allow analysis of inspections and positive reporting. **PP10 [B17/B24431, B24443, B24444]:** There to be one central NCR database, managed by MTRCL (to include MTRCL, Form B, and contractor NCRs) **PP11 [B17/B24443, B24444]:** All contractors and sub-contractors to have access to the NCR database and empowered to raise NCRs. **PP12 [B24443, B24444]:** This database to be maintained centrally and independently of the delivery team to maintain governance and traceability. **QP3 [B17/B24454, B24455]:** ITPs to be more specific about what the contractor will be checking and how. MTRCL role is to check that it is being done and that correct releases of design are referred to, all RFIs are cross referenced, and that the ITP includes any field change requests	• Translation of PIMs into Chinese commenced with most frequently used procedures having been issued. Target to complete in 2019 [PP4] • The new digital system is 'cloud' based and centrally monitored [PP6] • System referred to in PP10 being managed by the PMO to provide independence from Site Project Management Team [PP12]

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4	SSP	QA/QC should have its own unit organizational reporting structure which is separate from the CM team. Contractors should have their own QC functions and their personnel and MTRCL needs to have procedures in place regarding the reporting and handling of QC issues. A stand-alone PIMS policy on Quality Control Procedures is required.	Not specifically covered by Rowsell recommendations, but related to e.g. **§153:** 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.	**OR1 [B17/B24431, B24447]:** Strengthen the quality assurance role - increase the number of staff responsible for project quality assurance, and re-train others, i.e. providing confidence that the contractor will continue to deliver the defined quality standards by reviewing and monitoring their processes, staff capability and methodology **OR2 [B17/B24431, B24447, B24448]:** Those members of the MTRCL delivery team who have specific duties for quality and safety under the terms of the CoP should have a formal and independent reporting line as a fundamental part of the Quality System **OR3 [B17/B24431, B24447, B24448]:** Quality to have representation and reporting independently at Board level to those responsible for delivery to introduce strong 'checks & balances' strengthening the governance and confidence in the delivery team. **PC3 [B17/B24452, B24453]:** Raise the profile of the quality manager as a professional with specific training and potentially look at chartership programme **PP1 [B17/B24431, B24441, B24444]:** The 'Project Integrated	• Paper prepared for approval by MTRCL's Executive to re-organise quality management team structure to enhance performance and independence [OR1] • Paper to MTRCL's Executive including a new senior management position to lead Quality Section [PC3] • QA team size being enlarged for future Projects [OR1] • Independent QA team under the control of Engineering Division being developed [OR2 & OR3] • MTRCL's Executive has approved the transfer of the QA Team to the Engineering Division and the strengthening of the team's resources with qualified seconded staff in lieu of formal permanent staff recruitment [OR1]

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
				Management Policy' (PIMS/MAN/001/A4) to be re-written to make Quality Policy clear and succinct. This new Project Integrated Management Policy to be signed by the Board to underpin commitment to management principles and behaviours. **PP3 [B24431, B24442, B24444]:** A specific Project Quality Management Plan document to be written to act as a guide to the quality expectations within PIMS.	
5	SSP	With regards to the QSP, I recommend conducting periodic work sessions to remind the project management team and frontline staff of their supervision obligations. Often new staff members are brought on board, staff members are promoted and the needs for inspections can escalate. Quarterly work sessions help to keep everyone up to date and gives staff members a chance to ask questions.	**§188:** 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.	**PC1 [B17/B24452, B24453]:** Introduce specific training for quality management starting with the existing training available for 'Self Audits' **PC2 [B17/B24452, B24453]:** Re-skill and re-assign SIOW/IOW/CEs with QA focus to support CoP **PC4 [B17/B24431, B24452, B24453]:** Site competence: define levels of competency required, monitor and report: - Establish competency matrix to address requirements in the CoP - Conduct competency assessment for all applicable project staff -Provide training to bridge competency gap as required	• New enhanced training has commenced for site supervision teams [PC1 & PC2] • Matrix developed for levels of individual staff competence as required by the CoP [PC4] • Competency assessment of staff and retraining as required planned for 2019 [PC4] • Mandatory E-training for existing and new staff has commenced [PC5] • Quality Alert template prepared for introduction once new digital reporting system for NCRs goes 'live' in Q1 2019 [PC6]

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
				PC5 [B17/B24452, B24453]: Mandatory quality training on induction (supported by new quality management plan) **PC6 [B17/B24431, B24452-B24453]:** Site quality alerts and toolbox talks – communicate and share knowledge regarding high impact or recurring NCRs.	
6	PIMS	All parties need to understand what inspection forms for what work activities are required to track critical installations and who is the signatory. Also, where the records are to be kept and distributed.	**§170:** 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. **§171:** 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.	**PP6 [B17/B24442, B24444]:** Inspections records to be captured digitally (including photographic records) and held centrally by a reporting team independent of the delivery team to allow analysis of inspections and positive reporting. **PC1 [B17/B24452, B24453]:** Introduce specific training for quality management starting with the existing training available for 'Self Audits' **PC2 [B17/B24452, B24453]:** Re-skill and re-assign SIOW/IOW/CEs with QA focus to support CoP **PC4 [B17/B24431, B24452,B24453]:** Site competence: define levels of competency required, monitor and report	• Contracts awarded for new digital reporting and supervision system to cover on site communication, workflow and supervision, including RISC and NCR processes [PP6]. • Systems trialed on the site and are being refined to go 'live' in stages from Q1 2019 [PP6] • The new digital system is 'cloud' based and centrally monitored [PP6] • New enhanced training has commenced for site supervision teams [PC1] • Competency assessment of staff and retraining as required planned for 2019 [PC4] • Mandatory E-training for existing and new staff has commenced [PC5] • The new digital supervision and reporting system noted in PP6 is being developed in stages throughout Q1 to Q3 2019 to provide dashboard reporting facilities to capture KPIs for monitoring of quality on site. Scope and range of KPIs is under review by the team as referred to in PP6 [PP7] • Ongoing action for site training and development of digital management systems [QP3]

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			§173: 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.	- Establish competency matrix to address requirements in the CoP - Conduct competency assessment for all applicable project staff - Provide training to bridge competency gap as required **PC5 [B17/B24452, B24453]:** Mandatory quality training on induction (supported by new quality management plan) **PP7 [B17/B24442, B24444]:** Reporting to be expanded to capture other quality and conformity issues such as requests for information, design change requests, and field change requests. Other positive reporting to be implemented such as Requests for Inspection planned vs held, audits planned vs held, 'hold points' planned vs passed. **QP3 [B17/B24454, B24455]:** ITPs to be more specific about what the contractor will be checking and how. MTRCL role is to check that it is being done and that correct releases of design are referred to, all RFIs are cross referenced, and that the ITP includes any field change requests	• 2-month rolling activities, including hold points, introduced into agendas for regular CM and SConE site meetings [QP2]

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				QP2 [B17/B24454, B24455]: Readiness reviews – forward planning meetings and readiness approaching critical/hold points to be established as 'business as usual' for construction management team	
7	PIMS	Daily, I recommend that a record be kept of the supervisors working in any particular area and the services they are providing.	**§174**: 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. **§175:** 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. **§176:** Ensure that records are kept to support the possible application of the contractual disallowable cost provisions. **§191:** Clarify and maintain site records to support the delivery of the contractual requirements for the prompt recording of as-built dimensions and details.	**PP7 [B17/B24442, B24444]:** Reporting to be expanded to capture other quality and conformity issues such as requests for information, design change requests, and field change requests. Other positive reporting to be implemented such as Requests for Inspection planned vs held, audits planned vs held, 'hold points' planned vs passed **PP14 [B17/B24431, B24444, B24444]:** Positive reporting of site checks and routine observations by digitalised site diaries **TT1 [B17/B24431, B24456]:** Introduce digitalised data capture of NCR, RISC, Field Change Requests etc. with asset data aligned to BIM strategy **TT2 [B17/B24431, B24456]:** Short term data capture solutions to support long term strategy	• The new digital supervision and reporting system noted in PP6 is being developed in stages throughout Q1 to Q3 2019 to provide dashboard reporting facilities to capture KPIs for monitoring of quality on site. Scope and range of KPIs is under review by the team as referred to in PP6 [PP7] • Digital diary introduction planned as phase 2 of the monitoring tool referred to in PP6 and will be trialed in Q2 2019 [PP14] • Systems chosen should be capable of being developed to link with BIM strategy for future Projects [TT1 & TT2]

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8	PIMS	Establish "set" requirements defining what defective work requires an NCR. Develop a better protocol to notify the Contractor to issue an NCR when identified. Make sure all MTRCL staff understand for what work and when an NCR is to be generated. Have set procedures for following up, in a timely, manner to resolve the NCR.	**§178**: Review current guidance on NCRs to ensure that there is clarity and consistency on when non-conformance reports should be issued. **§179**: Encourage a culture that treats non-conformance reporting in a similar way to "near-miss" reporting on health and safety so that lessons learnt drives continuous improvement. **§180:** Maintain a single NCR database across all parties which is accessible to all supervisors and inspectors to allow recurrent issues to be readily identified. **§181:** Review and enhance the NCR close-out procedures including effective monitoring arrangements.	**PP6 [B17/B24442, B24444]:** Inspection records to be captured digitally (including photographic records) and held centrally by a reporting team independent of the delivery team to allow analysis of inspections and positive reporting **PP8 [B17/B24431, B24443, B24444]:** NCRs to be re-categorised to capture lower less 'significant' defects **PP9 [B17/B24431, B24443, B24444]:** If the rework needs tracking - it is an NCR. **PP10 [B17/B24431, B24443-B24444]:** There to be one central NCR database, managed by MTRCL (to include MTRCL, Form B, and contractor NCRs) **PP11 [B17/B24443, B24444]:** All contractors and sub-contractors to have access to the NCR database and empowered to raise NCRs. **PP12 [B17/B24443, B24444]:** This database to be maintained centrally and independently of the delivery team to maintain governance and traceability **PP13 [B17/B24443,B24444]:** MTRCL to be the party to close out the NCR once the contractor has	• Contracts awarded for new digital reporting and supervision system to cover on site communication, workflow and supervision, including RISC and NCR processes [PP6]. • NCR categorizations have been redefined and being incorporated into digital reporting and monitoring workflows as noted in PP6 in Q1 2019 [PP8 & PP9]. • Digital infrastructure for central control NCR database in place to go live once actions referred to in PP6 completed [PP10]. • System referred to in PP10 will be accessible at appropriate contractor levels to suit the work being undertaken (with confidentiality restrictions as necessary) [PP11]. • System referred to in PP10 being managed by the PMO to provide independence from Site Project Management Team [PP12]. • System referred to in PP6 allows MTRCL an oversight on all NCRs to ensure NCRs raised by Contractors are being adequately addressed [PP13]. • New NCR process and workflows being trialed for introduction in Q1 2019 – see comments against PP6, PP10 & PP13 [CC5] • Quality Alert template prepared for introduction once new digital reporting system for NCRs goes 'live' in Q1 2019 [PC6] • Systems chosen should be capable of being developed to link with BIM strategy for future Projects [TT1 & TT2]

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				provided sufficient evidence for its satisfactory completion **CC5 [B17/B24431, B24450, B24451]:** Introduce a provision which requires the contractor to notify all NCRs, including that of his supply chain, before the employer's team does and incentivises the contractor to do so. **PC6 [B17/B24431, B24452-B24453]:** Site quality alerts and toolbox talks – communicate and share knowledge regarding high impact or recurring NCRs. **TT1 [B17/B24431, B24456]:** Introduce digitalised data capture of NCR, RISC, Field Change Requests etc. with asset data aligned to BIM strategy. **TT2 [B17/B24431, B24456]:** Short term data capture solutions to support long term strategy	
9	PMP	Consideration may be given to preparing a cross-referencing system between the PMP and the PIMS to help identify the roles and responsibilities of the various staff members.	**§182:** Review and improve the detailed content of Project Management Plans, 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	**PP1 [B17/B24431, B24441, B24444]:** The 'Project Integrated Management Policy' (PIMS/MAN/001/A4) to be re-written to make Quality Policy clear and succinct. This new Project Integrated Management Policy to be signed by the board to underpin	• PIMS Policy revision drafted for MTRCL's Executive approval – action continues [PP1] • A quick reference guide for staff on PIMS documentation is under preparation – action continues [PP2] • Long term action (in relation to a specific Project Quality Management Plan document to be written to act as a guide to the quality

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			refer to other documents for details of project specific requirements.	commitment to management principles and behaviours **PP2 [B17/B24442, B24444]:** PIMS requires simplifying in regards to Project Quality Management to allow access and ease of use for all MTRCL employees and to provide a 'Golden Thread of Quality from Board to Site' **PP3 [B17/B24442, B24444]:** A specific Project Quality Management Plan document to be written to act as a guide to the quality expectations within PIMS	expectations within PIMS) planned to commence in 2019 [PP3]
10	PIMS	Review the PIMS manuals and identify any broad language that can be converted into more project specific information.	**§184:** 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. **§186:** 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 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. **§187:**	**PP2 [B17/B24442, B24444]:** PIMS requires simplifying in regards to Project Quality Management to allow access and ease of use for all MTRCL employees and to provide a 'Golden Thread of Quality from Board to Site'. **PP4 [B17/B24442, B24444]:** Simplified guidance and flow charts in English & Chinese for onsite monitoring procedures and the proposed new NCR procedure. Digital forms to be in both English & Chinese. **PP5 [B17/B24442, B24444]:** Introduce yearly review of PIMS by the review panel and capture feedback from those on site	• A quick reference guide for staff on PIMS documentation is under preparation – action continues [PP2] • NCR categorizations have been redefined and NCR reporting procedure has been amended [PP4] • Translation of PIMS into Chinese commenced with most frequently used procedures being issued first. Target to complete in 2019 [PP4] • Survey of staff on PIMS usage planned for Feb 2019 [PP5] • Full review of PIMS planned in 2019 [PP5]

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			Review and refresh the older PIMS manuals which date back as far as 2008. **§189:** Highlight the aspects of PIMS manuals which need to be converted from generic advice into project specific proposals.	regularly to drive 'bottom up' improvements	
11	PIMS	IOWs team to perform all inspections (bottom mat); if certain components require engineer's inspection, then add on as (top mat) inspection. This minimizes confusion on the boundary of inspection (i.e. who checks what) and prevents dual protection on critical components. Also, constructability reviews to be conducted to identify work categories that may require separate sign offs. In this instance regarding to the EWL slab, both the bottom may and top mat should have been signed off.	**§173:** 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. **§195:** 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.	**PC3 [B17/B24452, B24453]:** Raise the profile of the quality manager as a professional with specific training and potentially look at chartership programme **QP3 [B17/B24454, B24455]:** ITPs to be more specific about what the contractor will be checking and how. MTRCL role is to check that it is being done and that correct releases of design are referred to, all RFIs are cross referenced, and that the ITP includes any field change requests **QP4 [B17/B24431, B24454, B24455]:** Application of schedule as a tool – include hold points and quality control points in a Work Breakdown Structure (WBS) and 'set-up' template. The MTRCL schedule to show MTRCL interface points and include audit calendar as key dates on the schedule, audits on MTRCL team, self-audits and contractor audits	• Paper to MTRCL's Executive referred to in OR1 includes a new senior management position to lead Quality Section [PC3] • Ongoing action for site training and development of digital management systems [QP3] • Ongoing action in relation to application of schedule as a tool – include hold points and quality control points in a Work Breakdown Structure (WBS) and 'set-up' template. The MTRCL schedule to show MTRCL interface points and include audit calendar as key dates on the schedule, audits on MTRCL team, self-audits and contractor audits [QP4]

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12	PIMS	Maintain brief inspection log book for informal inspections performed under site surveillance; this log will not serve to duplicate the site diary, which records site activities, progress and issues	**§174:** 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. **§175:** 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. **§176:** Ensure that records are kept to support the possible application of the contractual disallowable cost provisions. **§191:** Clarify and maintain site records to support the delivery of the contractual requirements for the prompt recording of as-built dimensions and details.	**PP7 [B17/B24442, B24444]:** Reporting to be expanded to capture other quality and conformity issues such as requests for information, design change requests, and field change requests. Other positive reporting to be implemented such as Requests for Inspection planned vs held, audits planned vs held, 'hold points' planned vs passed **PP14 [B17/B24431, B24443-B24444]:** Positive reporting of site checks and routine observations by digitalised site diaries	• The new digital supervision and reporting system noted in PP6 is being developed in stages throughout Q1 to Q3 2019 to provide dashboard reporting facilities to capture KPIs for monitoring of quality on site. Scope and range of KPIs is under review by the team as referred to in PP6 [PP7] • Digital diary introduction planned as phase 2 of the monitoring tool referred to in PP6 and will be trialed in Q2 2019 [PP14]
13	ITP	I agree with T&T's suggestion that the ITPs, QA/QC, and inspection requirements be passed through to all sub-contractors. It would be the sub-contractor's responsibility to prepare the necessary NCRs, as well as to inspect and identify any non-compliant work based on their own internal standards and requirements. In addition, MTRCL currently does not have a centralized database for NCRs; such a database, if adopted, would	**§195:** 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. **§180:** Maintain a single NCR database across all parties which is accessible to all supervisors and inspectors to allow recurrent issues to be readily identified.	**PP7 [B17/B24442, B24444]:** Reporting to be expanded to capture other quality and conformity issues such as requests for information, design change requests, and field change requests. Other positive reporting to be implemented such as Requests for Inspection planned vs held, audits planned vs held, 'hold points' planned vs passed **PP8 [B17/B24431, B24443,B24444]:** NCRs to be re-	• The new digital supervision and reporting system noted in PP6 is being developed in stages throughout Q1 to Q3 2019 to provide dashboard reporting facilities to capture KPIs for monitoring of quality on site. Scope and range of KPIs is under review by the team as referred to in PP6 [PP7] • NCR categorizations has been redefined and being incorporated into digital reporting and monitoring workflows as noted in PP6 in Q1 2019 [PP8 & PP9] • System referred to in PP10 will be accessible at appropriate contractor levels to suit the

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		assist in substantiating closures and governance.	**§181:** Review and enhance the NCR close-out procedures including effective monitoring arrangements.	categorised to capture lower less 'significant' defects **PP9 [B17/B24431, B24443-B24444]:** If the rework needs tracking - it is an NCR. **PP11 [B17/B24443-B24444]:,** All contractors and sub-contractors to have access to the NCR database and empowered to raise NCRs. **PP12 [B17/B24443-B24444]:** This database to be maintained centrally and independently of the delivery team to maintain governance and traceability. **PP13 [B17/B24443-B24444]:** MTRCL to be the party to close out the NCR once the contractor has provided sufficient evidence for its satisfactory completion **CC5 [B17/B24431, B24450, B24451]:** Introduce a provision which requires the contractor to notify all NCRs, including that of his supply chain, before the employer's team does and incentivises the contractor to do so. **CC7 [B17/B24450, B24451]:** Consider introducing provisions which require the contractor to include requirements to strengthen quality performance in any	work being undertaken (with confidentiality restrictions as necessary) [PP11] • System referred to in PP10 being managed by the PMO to provide independence from Site Project Management Team [PP12] • System referred to in PP6 allows MTRCL an oversight on all NCRs to ensure NCRs raised by Contractors are being adequately addressed [PP13] • New NCR process and workflows being trialed for introduction in Q1 2019 – see comments against PP6, PP10 & PP13 [CC5] • Ongoing action for site training and development of digital management systems [QP3]

Item	Management System	Huyghe Recommendation	Corresponding Rowsell Recommendations	Corresponding T&T's Recommendations	Actions already taken by MTRCL to this date to address T&T's Recommendations
				subcontracts, such as: - to use the MTRCL NCR central register and to do so will require a web-based digitalised system; - incentivisation scheme at sub-contract level for quality performance with clear KPIs; - use of collaborative form of contract; and - capturing cost of rework. **QP3 [B17/B24454, B24455]:** ITPs to be more specific about what the contractor will be checking and how. MTRCL role is to check that it is being done and that correct releases of design are referred to, all RFIs are cross referenced, and that the ITP includes any field change requests	

Expert's Declaration

I, STEVE HUYGHE DECLARE THAT:

1. I declare and confirm that I have read the Code of Conduct for Expert Witnesses as set out in Appendix D to the Rules of High Court, Cap. 4A and agree to be bound by it. I understand that my duty in providing this written report and giving evidence is to assist the Commission. I confirm that I have complied and will continue to comply with my duty.

2. I know of no conflict of interests of any kind, other than any which I have disclosed in my report.

3. I do not consider that any interest which I have disclosed affects my suitability as an expert witness on any issues on which I have given evidence.

4. I will advise the Commission if, between the date of my report and the hearing of the Commission, there is any change in circumstances which affect my opinion above.

5. I have exercised reasonable care and skill in order to be accurate and complete in preparing this report.

6. I have endeavoured to include in my report those matters, of which I have knowledge or of which I have been made aware, that might adversely affect the validity of my opinion. I have clearly stated any qualifications to my opinion.

7. I have not, without forming an independent view, included or excluded anything which has been suggested to me by others, including my instructing solicitors.

8. I will notify those instructing me immediately and confirm in writing if, for any reason, my existing report requires any correction or qualification.

9. I understand that:

   (a) my report will form the evidence to be given under oath or affirmation;

(b) questions may be put to me in writing for the purposes of clarifying my report and that my answers shall be treated as part of my report and covered by my statement of truth;

(c) the Commission may at any stage direct a discussion to take place between the experts for the purpose of identifying and discussing the issues to be investigated under the Terms of Reference, where possible reaching an agreed opinion on those issues and identifying what action, if any, may be taken to resolve any of the outstanding issues between the parties;

(d) the Commission may direct that following a discussion between the experts that a statement should be prepared showing those issues which are agreed, and those issues which are not agreed, together with a summary of the reasons for disagreeing;

(e) I may be required to attend the hearing of the Commission to be cross-examined on my report by Counsel of other party/parties;

(f) I am likely to be the subject of public adverse criticism by the Chairman and Commissioners of the Commission if the Commission concludes that I have not taken reasonable care in trying to meet the standards set out above.

Statement of Truth

I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. I believe that the opinions expressed in this report are honestly held.

Steve Huyghe

4 January 2019