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

WITNESS STATEMENT OF JOHN BLACKWOOD

FOR

ATKINS CHINA LIMITED

I, John Blackwood, of 13th Floor, Wharf T&T Centre, Harbour City, Tsim Sha Tsui, Kowloon, Hong Kong, do say as follows:

- 1. I am the Director of Transport of Atkins China Limited ("Atkins"). Atkins is part of SNC-Lavalin Atkins, one of the world's most respected engineering and project management consultancies. Our business in Asia Pacific covers energy, infrastructure, transportation (rail, roads and aviation) and urban development, predominantly in Greater China and with a network of offices across Singapore, Malaysia, Vietnam, India and Australia. We employ over 1200 people in the Asia Pacific Region. In July 2017, SNC-Lavalin acquired Atkins. SNC-Lavalin is a global fully integrated professional services and project management company and a major player in the ownership of infrastructure, SNC-Lavalin now employs over 50,000 employees in more than 50 countries. They provide comprehensive end-to-end project solutions – including capital investment, consulting, design, engineering, construction, sustaining capital and operations and maintenance.
- 2. I joined Atkins in 1981 and I have held a range of positions for Atkins in Hong Kong since then. I became a Director in 2003. I have a Bachelor of Science degree in Civil Engineering from Strathclyde University in Glasgow, Scotland. I am a member of the Institution of Civil Engineers in the United Kingdom. My principal area of expertise is in the planning and study of new railway lines and I have led a number of studies for rail lines to Southern District, West Rail, Shatin to Central Line, North Island Line, South Island Line and East Kowloon Line for MTR Corporation Limited ("MTRCL"), Kowloon-Canton Railway Corporation ("KCRC"), private sector and international clients.
- 3. In my role, I am in charge of the transport sector of Atkins in Asia Pacific which includes projects in Hong Kong, Singapore, Malaysia and Australia. These include railway projects such as the Shatin to Central Link Hung Hom Station Extension Contract 1112 project (the "**Project**"). I am responsible for overseeing the

management of the projects and coordinating with sectors of Atkins, which will provide resources when necessary. However, I was not involved in the direct management of the Project. I was previously the Design Team Leader for Atkins on Consultancy Agreement No. NEX/2202 for the Preliminary Design of the Shatin to Central Link Cross Harbour Section, for what is now known as the North South Line to take East Rail across the Harbour to Hong Kong Island which includes Hung Hom Station. As explained above, I have experience in Hong Kong railway projects for both MTRCL and KCRC. That work includes working as project director on a number of projects such as Tsuen Wan West Station and Approach Tunnels (Consultancy No. DD300), West Island Line (Consultancy No. C703) and South Island Line (Consultancy No. C903). Consequently, I have a long history of working with MTRCL and understand their approach to the delivery of new rail lines. My CV is attached as **JB-1**.

- 4. Atkins works for clients such as the Hong Kong SAR Government ("Government") and MTRCL to provide detailed design for large infrastructure projects. Atkins also supports main contractors on design and build projects as their designer and frequently we provide specialist services to support temporary works design for contractors on their projects. Members of the Design Engineering Services Sector of Atkins are experienced in the process of getting approvals for projects from the Buildings Department ("BD") of the Government. For a client such as MTRCL, this process commences during the design phase and before the appointment of contractors.
- 5. As an experienced design consultancy, Atkins is acutely aware of the responsibilities to ensure compliance with the necessary statutory processes. Atkins also recognises that certain members of our staff (for example, those who are taking on the role of registered structural engineers ("RSE") and registered geotechnical engineers ("RGE")), as part of process, have personal liabilities and therefore it is important that Atkins ensures their protection by providing them with any necessary technical support.
- 6. I am authorised to make this witness statement by Atkins and have prepared it to assist the Commission of Inquiry (the "Commission") in my role as a Director of Atkins, as the Director of Transport and as Project Director on both Shatin to Central Link (SCL) Consultancy Agreement No. C1106 Detailed Design for Hung Hom Station and Associated Tunnels ("Contract C1106) [B7652-B8218] and Consultancy Agreement for the Temporary Works Design of Shatin to Central Link Hung Hom Station and Stabling Sidings Contract No. 1112 ("Contract 1112") [J16-J54]. My knowledge of the Project dates back more than 10 years and therefore I am in a position to assist the Commission from my own personal knowledge on aspects of the project, in addition to providing evidence based upon Atkins' corporate involvement.

- This witness statement has been prepared to address each of the Commission's requests as set out in Lo & Lo's letters dated 2 October 2018 [J1-J9] and 15 October 2018 [J10-J12].
- 8. In my Project Director roles in Contract C1106 and Contract 1112, by necessity I did not have day-to-day direct involvement in the Project, but where I am able to assist the Commission with detail within my personal knowledge I have done so. I have reviewed the relevant files and have produced certain items which are attached as exhibits to this witness statement. Also, I have had opportunity of reading the witness statement of my colleague Mr. Robert McCrae and certain other witness statements provided to the Commission and a number of the exhibits. Where the facts and matters stated herein are not within my own knowledge or expertise, they are based on stated sources and are true to the best of my knowledge, information and belief.
- 9. Finally, I confirm that both Atkins and myself are willing to fully assist and support the Commission in the exercise of its responsibilities.

Request 1 – Roles and Responsibilities of Atkins and Persons involved in the Design and Construction of the D-walls and the EWL / NSL Slab for Contract 1112

- 10. Request 1(a) from the Commission: "With reference to an Organisation Chart of Your Company, describe and explain the roles and responsibilities of each person in Your Company involved in the **design and construction** of the diaphragm walls and EWL/NSL Slabs for Contract 1112. Identify, with names and job description, the relevant persons on the Organisation Chart and indicate whether such persons are still in the employment of Your Company. If such persons have left Your Company, please provide contact details if such information is available."
- 11. In January 2010, Atkins was appointed by MTRCL as their detailed design consultant in Contract C1106. Contract C1106 was managed by an Atkins team referred to as "Team A". The stages of services, which include Scheme Design, Detailed Design, support during the tender period and the provision of services during the construction phase, are described at Section 1.12.1 of Contract C1106 Scope of Services [B7817-B7822]. I return to the construction phase below at paragraph 14.1.
- 12. From April 2013, Atkins was also retained by Leighton Contractors (Asia) Limited ("Leighton") as their design consultant in Contract 1112. The Commission should note that although Contract 1112 is dated as April 2012, it in fact commenced in April 2013. This appointment was approved by MTRCL. Contract 1112 was managed by an Atkins team referred to as "Team B". The scope of the services is described at Schedule 2 of Contract 1112 [J46-J48]. This scope has been extended to include over 200 items of additional works. These items include a number of different instructions

to support on the preparation of the as-built drawings for the D-walls, preparations of Contractor's submissions for slabs in Areas A, B and C to cover all temporary load cases and reporting on the remedial solution for missing U-bars in addition to responding to a range of technical queries. Most recently Team B was instructed as an additional service to assist Leighton in preparation of as-built drawings for various parts of the underground structure including the EWL and NSL slabs. I will return to this, below.

13. The overall construction stage organisation structure is set out in **Figure 1**. This illustrates the responsibility and lines of reporting for Team A and Team B.



Figure 1 : Construction Stage Organisational Structure

- 14. The roles and responsibilities of Team A and Team B are as follows:
 - 14.1 During and after construction, Team A was responsible for delivering services under Contract C1106. Those services included the deliverables set out in Sections 5 and 6 of Deliverables for Services [B7930-B7937 and B7938-B7943]. With the exception of RSE / RGE services (RSE being required for works which were not subject to the Instrument of Exemption), Team A was not required to supervise any of the site works and only relied upon information from MTRCL under Contract C1106.
 - 14.2 During construction, Team B was responsible for providing services as stated in Contract 1112 [J46-J48]. As the Project progressed, Team B was instructed to carry out additional services, such as changing the EWL slab, underpinning to the podium, designing the value engineering alternatives, remedial proposals and supporting the production of as-built drawings ("Additional Services"). For these services, Team B did not have any on-site presence and relied only upon information provided by Leighton.

- 15. I was initially the Project Director for Contract C1106. When Team B was appointed for Contract 1112, I became the Project Director for both contracts. My role and responsibilities as a Project Director are attached as JB-2 to this witness statement.
- 16. As far as I am concerned, there was a need throughout to keep both Team A and Team B independent with no conflicts of interest. It was also recognised that there were advantages in having a central coordination of the teams and for this I was assisted by various people at different times including:
 - 16.1 Mr. Robert McCrae, who was the Design Team Leader for Team A from November 2014 to April 2016 and Project Manager for Team B from May 2014 to April 2016. His roles and responsibilities are attached as JB-2 to this witness statement. Mr. Robert McCrae is still with Atkins but is now based in London, England.
 - 16.2 Mr. Torgeir Rooke, who was the Project Manager for Team B from April 2013 to May 2014 after which Mr. Robert McCrae took over that role. His roles and responsibilities are attached as JB-2 to this witness statement. Mr. Torgeir Rooke is still with Atkins but is now based in Australia.
 - 16.3 Mr. David Wilson, who was the Design Coordinator and Structural Team Leader dedicated to Team B and the point of contact between Atkins and Leighton. His roles and responsibilities are attached as **JB-2** to this witness statement. Mr. David Wilson is no longer with Atkins although I believe that he may be in the Philippines.
 - 16.4 Mr. Miller Lui, who was the Geotechnical Team Leader for Team B supporting on the D-wall construction and also the D-wall as-built drawing preparation. Mr. Miller Lui is no longer with Atkins although I believe that he is still in Hong Kong.
 - 16.5 Mr. WC Lee, who was the Structural Team Leader who led Team A Structure Team. Mr. WC Lee is no longer with Atkins although I believe that he is still in Hong Kong.
 - 16.6 Mr. Edward Tse, who was the Structural Engineer with a responsibility for the production of documentation to support Team B submissions. He also fulfilled a similar role on Team A as well as supporting the Team A structural team leader. He is no longer with Atkins although I believe that he is still in Hong Kong.
 - 16.7 Mr. CK Chan who was the RSE and is no longer with Atkins although I believe that he is still in Hong Kong.

- 16.8 I was also assisted by other staff in Team A and Team B (see paragraph19), however many of the staff have since left the company.
- 16.9 Since 15 October 2018 and in the time available, as the Commission will understand, Atkins has endeavoured to identify the factual witnesses who and exhibits which would be of most help to the Commission. There have been restrictions, by necessity, on what has been possible due to staff having left the company. However, I am satisfied that we have been able to respond to the Commission's requests with the material available. To the extent that we identify further material which is necessary to supplement the evidence provided, I will arrange for this to be provided to the Commission.
- The organisation charts of Atkins and the transport sector are attached as JB-3 and JB-4.
- 18. In the period since the commencement of the detailed design and subsequent construction stage (and support to Leighton), Team A and Team B have changed significantly in response to the needs of the Project at that time and also ongoing staffing changes as people have joined and left our company. It is estimated that approximately 300 people from Atkins alone have worked on the Project at one time or another during the construction stage.
- 19. In responding to the request for information on our staffing and organisation, we have focused on the year 2015 during which the EWL slab was constructed (i.e. 30 May 2015 to 28 December 2015). Further, we have focused on staff with a role to play in supporting the construction of the structure, i.e. our management, structural and geotechnical teams. The organisation charts of Team A and Team B at that time are attached as **Figures 2, 3 and 4** in **JB-5**.
- 20. **Figure 2** shows the Team A organisation as at October 2015. Key features were:
 - 20.1 Project Director myself;
 - 20.2 Design Team Leader Mr. Robert McCrae;
 - 20.3 Design Liaison Representatives included architectural;
 - 20.4 The tunnel team work was primarily related to Contract No. 1111; and
 - 20.5 Building Services was not shown because this work was carried out under Contract 1173 and services were not required post contract award.
- 21. In particular, **Figure 3** shows the Team B organisation at the end of 2014. It reflects the multi-discipline team assembled to support Leighton and the nature of the work

being carried out for them. Key personnel included myself (Project Director), Mr. McCrae (Project Manager), Mr. Wilson (Design Coordinator and Civil/Structural Team Leader) and Mr. Lui (Geotechnical Team Leader).

- 22. **Figure 4** shows the Team B organisation in October 2015. At this time, the works being carried out / instructed by Leighton were primarily for the structure. I remained as Project Director with overall responsibility for delivery of the services. Mr. McCrae retained a commercial responsibility for agreeing variations with Leighton, but was not shown on the organisation chart. Mr. Wilson retained the role as both the Design Coordinator and Structural Team Leader dedicated to Team B. Other than Mr. McCrae the key staff remained as identified above.
- 23. Several witnesses comment in their statements on the Team A and Team B arrangements and the personnel in each of them see for example Mr. Brett Buckland WS paragraphs 21-44 [C20805-C20811], Mr. Justin Taylor WS2 paragraphs 10-11 [C24380-C24371] and Mr. Leung, Fok Veng WS paragraphs 11-13, 16(a), (c), 18, 20-21 [B241-B245]. From Atkins' perspective, Team A and Team B were separate and had separate responsibilities. While by necessity there was some overlap in personnel in the teams, I believe that Atkins' personnel were aware of and observed their Team A and Team B responsibilities respectively.
- 24. As construction progressed on site, the scope of services for both Teams A and B increased as well as the need for interfacing between the two teams. Services being carried out by Team B for Leighton extended beyond the originally envisaged end date of December 2013 and during the course of the consultancy had increased by over 400% with respect to the original consultancy value.
- 25. By 2015, when the consultancy for Team B works peaked, the volume of work carried out in that year alone was double the original consultancy value and more than 145 Atkins staff were involved in one form or another in providing services. The nature of the services also changed in response to changing works on site. In addition to temporary works design for underpinning of the podium there were requirements to support Leighton on issues that affected the permanent works design such as changed works sequences impacting the permanent works, and the provision of remedial works solutions as well as as-built submissions for the D-walls.
- 26. In summary, I believe that the following is relevant:
 - 26.1 The intention was that there would be separate design teams to carry out service for MTRCL (Team A) for permanent works design and Leighton (Team B) initially for temporary works design although it was understood that Team B could discuss design principles with Team A;

- 26.2 Atkins' personnel were aware of and observed their Team A and Team B responsibilities respectively;
- 26.3 Where changes occurred that affected the permanent works, Leighton required Team B to develop the required proposal for the change for formal submission by Leighton to MTRCL. This would then be submitted by MTRCL's Design Management Team to Team A for review and comment;
- 26.4 Contract 1112 and Atkins' work scope for Leighton evolved into a more extensive role in response to changing circumstances on site and as a result there were certain Atkins personnel who were part of both Team A and Team B; and
- 26.5 I am satisfied however that the intent of the process set out at paragraph 60 remained substantially the same and it should be recognised that ultimately Team A retained the overall responsibility for the permanent works design.

Preparing As-built Drawings of the D-wall and EWL / NSL Slabs

- 27. Request 1(b) from the Commission: "*Describe and explain Your Company's role and responsibilities in preparing as-built drawings of the diaphragm walls and EWL/NSL Slabs.*"
- 28. The D-walls and EWL and NSL slabs form the primary structure for the underground element of the station. They not only form part of the permanent structure but also had a role to play during the construction of the station as it was constructed using a top-down approach.
- 29. The D-walls retain the external soil and water loads both during and post construction as well as supporting loads from the station structures and those transferred from the podium structure above. The EWL slab in the temporary case is a key part of the ELS system during excavation and construction of the station.
- 30. In late December 2014, as an additional service, Team B was requested by Leighton to assist in the preparation of D-wall as-builts. The work was done in a series of batches and the first batch was submitted to Leighton in January 2015 and the final batch 6 in August 2015.
- 31. The following approach was taken to the D-wall as-built preparation:
 - 31.1 As-built drawings were prepared by Intrafor, Leighton's D-wall subcontractor;

- 31.2 These drawings were issued to Team B for checking to ensure that what was built complied with all Design Amendment Sheets ("DAmS") and approved changes;
- 31.3 Over a period of several months, Team B provided technical support for any amendments required to be submitted to MTRCL. Technical support was provided to issues such as missing U-bars, anchorage into D-wall and relocation of reinforcement;
- 31.4 As the batches of the as-built drawings were completed, Leighton issued them to MTRCL's Construction Team and via the MTRCL's Design Management Team they issued to Team A to review submissions and advise MTRCL to allow them to make submissions to BD to get necessary acceptance to complete the as-built drawings; and
- 31.5 The submission and acceptance process for the D-wall as-builts took over two years and the details are stated in Annex LPF-9 to the witness statement of Lok Pui Fai [H5125-H5157].
- 32. On 12 June 2018, Atkins was approached by Leighton to support them in preparing their as-built drawings for other parts of the station structure, including the EWL slab and the connection to the D-wall. This was an extension of the original scope of services of Contract C1112. I will discuss this further, below.
- 33. In the preparation of the as-built drawings, Team B has to rely upon information provided by Leighton to produce the as-built drawings (for the reason stated above, that is that Atkins had no presence on site overseeing or monitoring construction) to form the final amendment submission.
- 34. If the works have been completed in accordance with the approved design, then asbuilt drawings will be prepared and submitted on that basis. If the works have been amended, then as-built drawings are included in Leighton's submission for approval of any necessary amendments before certification of the as-built drawings. This would then be handled by MTRCL. It would be passed to the MTRCL's Construction Management Team to MTRCL's Design Management Team and then to Team A for review ,comment and to provide support on any necessary submissions to BD.
- 35. Once BD accepts amendments, the as-built drawings can be finalised and be submitted by Leighton to MTRCL and then to Team A to prepare the BA14 as-built drawing submission. This submission would be made via MTRCL and the CP to BD for acceptance.

- 36. To date, Team B has supported Leighton in preparing drawings for areas A, B and C of the Project up to amendment drawing level:
 - 36.1 EWL slab;
 - 36.2 NSL slab; and
 - 36.3 EWL slab to D-wall connections.
- 37. On 19 September 2018, the amendment drawings (ref. H2601-LTR-LCA-DE-004913) relating to Areas B and C relating to EWL and NSL slabs and D-walls to slab connections were submitted by Leighton to MTRCL's Construction Team to confirm that the drawings were a true record of what was constructed [C26491-C26493]. Team A received a copy of these amendment drawings from MTRCL via email on 21 September 2018. The process of finalising the amendment drawings is currently ongoing, but incomplete.

Request 2 – Alleged Cutting of Rebars

- 38. Request 2(a) from the Commission: "*Explain and confirm whether Your Company has any knowledge of the alleged cutting of threaded steel bars and existence of a gap at threaded steel bar/coupler connections for diaphragm walls to slab and slab to slab during construction period on site.*"
- 39. To my understanding, no Atkins personnel from either Team A or Team B has any knowledge of the threaded steel bars being cut at Area C3 (Bays C3-2 and C3-3) and the gaps at the threaded steel bar / coupler connection for D-walls to slab and slab to slab during construction period on site. As noted above, we were not responsible for day-to-day on-site supervision.
- 40. Atkins was not aware of the Non-conformance Report No. 157 from Leighton to MTRCL [B4121-B4132].

Rectification and Remedial Measures

- 41. Request 2(b) from the Commission: "Comment on what rectification and remedial measures should have been taken by Leighton and/or other sub-contractors if threaded steel bars within EWL/NSL Slabs had been cut as alleged and there was a gap at threaded steel bar/coupler connections for diaphragm walls to slab and slab to slab, and explain and confirm whether rectification and remedial measures have been actually carried out on site."
- 42. If threaded steel bars within EWL / NSL slabs had been cut as alleged and there was a gap at threaded steel bar / coupler connections for D-walls to slab and slab to slab,

rectification and remedial measures that should have been taken would normally be determined by Leighton due to their responsibility to construct to the design specifications and drawings. Leighton would be responsible for rectification of any defective works.

- 43. Possible rectification and remedial measures include breaking back the concrete and installing a new couplers for connection to or installing additional drill-in bars to provide an equivalent structural capacity (this would be subject to design checking).
- 44. Where such works are necessary, Team B could be instructed by Leighton to carry out additional services in the form of technical support for the justification of any rectification and remedial works where required. However, to my understanding Atkins personnel are not aware of any such rectification and remedial works that have actually been carried out on site.

Knowledge of Cutting of Threaded Steel Bars and Existence of Gap

- 45. Request 2(c) from the Commission: "Explain and confirm whether Your Company has any knowledge of any cutting of threaded steel bars and existence of a gap at threaded steel bar/coupler connections for diaphragm walls to slab and slab to slab in the as-built structures without any rectification."
- 46. To my understanding, Atkins personnel do not have any knowledge of any cutting of threaded steel bars or the existence of a gap at threaded steel bar / coupler connections for D-walls to slab and slab to slab in the as-built structures without any rectification.

Effects of Cutting of Threaded Steel Bars and Existence of Gap – Quality, Safety and Integrity of the D-walls and EWL / NSL Slabs

- 47. Request 2(d)(i) from the Commission: "On the basis of the evidence given by the witness as extracted above: comment on whether such shortening and cutting of the steel bars of EWL/NSL Slabs and the existence of a gap at threaded steel bar/coupler connections for diaphragm walls to slab and slab to slab would compromise the quality, safety and integrity of the diaphragm walls and EWL/NSL Slabs."
- 48. As I am not a structural engineer, I have responded to this question based on discussions with suitably qualified structural engineers within Atkins' Design and Engineering Services Sector.
- I have been advised that the significance of the gap mentioned in the extract provided in the MTRCL Report on SCL Contract 1112 Review of the EWL Slab Construction ("MTRCL Report") dated 15 June 2018 [B1-B46] would indicate that as a

consequence of the threaded end of the bar having been cut, the resulting length of the bar engaged into the coupler would be too short to achieve the full shear and tensile force capacity required of the coupled reinforcement.

- 50. From reviewing the evidence of other witnesses, particularly those from China Technology, we understand it is alleged that a number of bars have been cut, forming gaps within the threaded steel bar / coupler connection.
- 51. I have also been advised by my colleagues that any cut reinforcement bars or gaps at the couplers will theoretically lead to a reduction in performance of the structure from a quality, safety and integrity aspect from that presented on the design drawings.
- 52. However, it is not possible to comment on whether the functionality of the structure, and particularly the safety aspect, is severely compromised without information or a record of: how many bars have actually been cut or gaps left; where the bars have been cut or missing i.e. top or bottom layers in the slab to D-wall connection; and how they are distributed i.e. if it was 50 bars in a slab pour, whether they are located together or distributed throughout the slab pour and between the top and bottom layers of reinforcement
- 53. In addition to the normal factors of safety adopted in the design of the structure, the actual utilisation of the design capacity provided varies based on the particular location and loading conditions at that location.
- 54. I have been advised that the structure could potentially still perform even if some reinforcement bars have been cut and gaps left. However, this would require detailed analysis and substantiation once there is a better understanding of the location and frequency of cut reinforcing bars and gaps at couplers.

Effects of Cutting of Threaded Steel Bars and Existence of Gap – Original Design Intent of the D-walls and EWL / NSL Slabs

- 55. Request 2(d)(ii) from the Commission: "On the basis of the evidence given by the witness as extracted above: Comment on whether cutting of threaded steel bars and the existence of a gap at threaded steel bar/coupler connections for diaphragm walls to slab and slab to slab would affect the original design intent of the diaphragm walls and EWL/NSL Slabs."
- 56. I have been advised by qualified structural engineers within Atkins' Design and Engineering Services Sector that the structural performance of the slab to D-wall and slab to slab connections relies upon the combined shear and the tension capacity of the reinforcing bars prescribed in the slab during the detailed design work and of the compressive and shear resistance of the concrete surrounding them.

- 57. The design intent was to have the structure be constructed in accordance with the design drawings or approved changes.
- 58. However, as noted above at paragraph 54, it could still be possible for the structure to function as originally intended depending on the extent and distribution of cut reinforcement bars or gaps at couplers.

Alleged Change of Connection Details between EWL Slab and East D-walls

Atkins' Role and Participation in the Process

- 59. Request 3(a) from the Commission: "*Please address the following matters from the perspective of the designer: Explain and describe Your Company's role and participation in this deviation in connection details.*"
- 60. I have explained the scope and roles of Team A and Team B at paragraph 14 above.
- 61. If Leighton had queries or changes to MTRCL working drawings, the process was that Leighton would submit either formal (a) Requests for Information ("RFIs") to MTRCL for any queries on the MTRCL working drawings as developed by Team A; or (b) Contractor Submission Forms ("CSFs") to MTRCL for any Leighton proposals to change the design in any way.
- 62. Once submissions were made to MTRCL, they would be passed to the MTRCL's Design Management Team who would liaise with Team A for their formal review, checking, response and approval of any changes. Once the review was completed by Team A, including any necessary changes to the design in the form of DAmS would be issued by the MTRCL's Design Management Team to the MTRCL Construction Team and then to Leighton. Team A would also be responsible for preparing the consultation submission to BD / GEO for the changes to permanent works as part of the design.
- 63. Based on the incident report of 29 July 2015 on the D-wall reinforcement details, a total of 77 panels along the eastern D-wall of Hung Hom station were constructed to an amended detail which was not submitted to BD for acceptance prior to construction [H5538-H5550]. The changes to the D-wall which included the amended detail have since been accepted by BD on 5 May 2017 [H5157].
- 64. As a consequence of the as-built D-walls, there were two primary problems which required rectification:
 - 64.1 T40-150 U-bars shown in the original design to provide continuity between the front and rear faces of the D-wall had not been provided; and

- 64.2 The as-built reinforcement differs from the design drawing in that the tension reinforcement from the EWL slab has (i) insufficient anchorage (width of the diaphragm wall) and (ii) is not lapped with the D-wall steel.
- 65. Team B assisted Leighton in identifying solutions for the missing U-bars and anchorage issues.
- 66. On 12 May 2015 (email timed at 20:54), a submission titled "Shatin to Central Link (SCL) Contract 1112 Hung Hom Station and Stabling Sidings – Design Report for HUH Station Primary Structure Primary Slabs for Temporary Loadcases Area C BD Consultation Document (Volume 1) [Deliverable No. TWD-004B2]" ("Draft TWD-004B2") submitted to Leighton [C10847]. Draft TWD-004B2 is attached as JB-6.
- 67. Draft TWD-004B2 included the following:
 - 67.1 At paragraph 1.3.5 it contains an explanation of secondary measures for the provision of additional rebar at mid-span due to missing U-bars in the D-wall;
 - 67.2 At Figure 1.4 it included a rebar arrangement which was similar to Enclosure 1, page 2 of Lo & Lo's letter to Atkins dated 2 October 2018 [**J9**]; and
 - 67.3 At paragraph 6.2 it refers to the top of the D-wall being trimmed down and the top rebar of the EWL slab at the diaphragm panel will then be fixed to the top rebar of OTE slab to achieve full tension laps and the EWL slab and OTE slab will be cast concurrently with temporary openings around the existing columns and pile caps.
- 68. Based on Leighton's email dated 23 May 2015 (timed at 8:45), we understand that Team B were requested not to include the details at paragraph 1.3.5 as "not to confuse BD and complicate the issue" and allow the initial bulk excavation to start [C10842]. On 27 May 2015 (timed at 15:01), the approach was discussed and agreed with MTRCL [B24519].
- 69. In paragraph 9 of the witness statement from Mr. Leung Fok Veng, he refers to MTRCL's comments being based on only deleting the missing U-bar remedial works. However, our view is that the detail on Figure 1.4 was relevant to both the missing U-bar and anchorage issues and so could not be separated i.e. it should all be taken out and dealt with elsewhere.
- 70. On 29 May 2015 (email timed at 18:16), Team B submitted an updated Draft TWD-004B2 to Leighton (attached as JB-7). Based on the evidence that I have seen, it does not seem that this submission was formally submitted to MTRCL for comments and then to Team A.

- 71. Draft TWD-004B2 was a temporary works submission for the re-design of the EWL and NSL slab at Area C and was not meant to be for permanent works as Figure 1.4 and the explanation at paragraph 1.3.5 would not have been sufficiently detailed to define what was going to be constructed. However, see my further comments below at paragraphs 98-100.
- 72. On 17 June 2015, an updated version of Draft TWD-004B2 ("**TWD-004B3**") was submitted by Team B to Leighton. TWD-004B3 amended paragraph 1.3.5 and did not include Figure 1.4, but still included paragraph 6.2 of Draft TWD-04B2. In particular, all reference to the notional detail in Figure 1.4 had been removed. TWD-004B3 is attached as **JB-8**. The report was submitted to BD by MTRCL on 29 July 2015 **[B8888].**
- 73. The scope of TWD-004B3 submission under Section 1.3 [**B7272-B7279**] is for temporary load cases and the re-design of the EWL and NSL slab and was not sufficient to provide a change to a permanent works design as it provided insufficient detail despite the fact that Section 6.2 remained. However, see my further comments below at paragraphs 98-100.
- 74. Under paragraph 1.3.5 of TWD-004B3, reference was made to permanent works submission for "*Discussion on Design Amendment Works D-wall [Deliverable No. PWD-059A1]*" ("**PWD-059A1**"), subsequently issued as "*Discussion on Design Amendment Works D-wall [Deliverable No. PWD-059A3]*" ("**PWD-059A3**") [C21765-21799]. This submission addressed the as-built reinforcement to the D-wall and insufficient anchorage for the tension reinforcement of the EWL slab. However, it made no reference to the breaking down of the D-wall.
- 75. On 9 July 2015, Team B prepared PWD-059A3 on behalf of Leighton, which was reviewed and accepted by Team A [C21765-C21798]. As of 9 July 2015, it appears that the solution to the as-built reinforcement to the D-wall and anchorage issues would be resolved through PWD-059A3 assuming it was accepted.
- 76. Key findings from the Conclusion Section of PWD-059A3 is repeated below [C21775]:

"Although the as-built arrangement differs from the original design it can be seen that the original design assumptions remain unchanged. There are two main issues. Anchorage, which can be provided by extending the reinforcement into the OTE duct and re-sequencing the construction so the OTE is in place prior to excavation below the EWL slab. Secondly by demonstrating that cracking cannot form in the section between the OTE soffit and EWL soffit but will form below the EWL soffit. In this case there is sufficient steel at the location to provide for full fixity. However, in order to enhance and or supplement the as-built reinforcement detail, the following additional measures will be implemented;

- Re-distribute approximately 15% of support moment to the mid-span to improve the margin of support connection capacity.
- If required allow additional pre-camber in the construction of the slab to offset deflection thus reducing the effect of any rotation of the slab;

With the above enhancement and full tension anchorage of all the primary tension reinforcement, it is considered the as-built reinforcement connection is in principle still able to fulfil the design fixity requirement at the d-wall / slab connection."

- 77. Appendix F in PWD-0059A3 [C21796-C21798] provided the location of the remedial works and indicative slab / D-wall detail. This was based on couplers for the top steel and did not identify the need to break down the D-wall.
- 78. However, as I will explain below, development of the submission made on 12 August 2015 in response to Technical Query 44 ("TQ 44") from Team B to Leighton showed the intended arrangement for the connection for the EWL slab and Eastern D-wall. That submission was officially made by Leighton to MTRCL on 20 August 2015 [B8242]. The detail was based on the use of couplers. It did not mention that the D-wall was to be broken down. It showed that the OTE slab had to be cast at the same time / monolithically, consistent with what was shown in the working drawings and PWD-059A3.
- 79. On 13 July 2015, Team B issued drawings titled "Permanent Diaphragm Wall RC for Panels" [C20973]. This was supplemented by a further submission on 6 August 2015 for Area C, which included "Typical Diaphragm Wall Connection Detail (East Side Only) Detail –E (EH42-44; EH110-EH115)" as part of TWD-431 B1 which showed as below (TWD-094A initially submitted on 29 June 2015 for Area B was also resubmitted on 6 August 2015 with the same detail):



- 80. On 20 July 2015, Leighton submitted to MTRCL a proposal submission (ref: 1112-CSF-LCA-EM-000147) ("First Submission") [C16282-C17997], which included TWD-004B3 JB-8. This was submitted to Team A on 21 July 2015 for their review. The First Submission showed:
 - 80.1 Opening enlargements and recesses in EWL slab;
 - 80.2 Plant loading on EWL slab;
 - 80.3 Batch 3 & 4 as-built information for the D-wall;
 - 80.4 Justification of RC design for as-built (grid lines 22 to 40) due to missing Ubars (refers to PWD-059A1); and
 - 80.5 Precamber proposals to EWL slab.
- 81. On 27 July 2015, Leighton raised Technical Query 33 ("TQ 33") to Team B [B2986-B2996] regarding OTE wall and EWL 3m slab connection requirement. TQ 33 raised some concerns over the construction of the anchorage into the as-built OTE wall and D-wall, where the width of the OTE outside the eastern limit of the Eastern D-wall was less than 1200mm, due to the difficulty of fixing the L-shaped bars to the couplers.
- 82. On 29 July 2015, a response was made to TQ 33 that reduced the distance from 1200mm to 1100mm [B2997-B2999] and required that the topmost of 3 bars be bent upwards. Following the response of TQ 33, it significantly reduced the number of panels affected to 12 panels. The 12 panels with less than 1100mm are: EH40, EH42, EH43, EH44, EH109, EH110, EH111, EH111A, EH1112, EH113, EH114 and EH115. The 12 panels affected were part of slab pours B1, C3-4, C3-5 and C3-6 concreted on 15 December 2015, 30 November 2015, 24 October 2015 and 7 November 2015 respectively, i.e. some time after TQ 33. The location of these panels is attached as JB-9, together with the offset distances available.
- 83. As indicated on the drawings issued by Leighton [C26494-C26495] as-built drawings, it should be noted that panels EH40 and EH44, which used couplers and had less than 1100mm to the outer edge of the OTE were constructed without using the alternative straight bar detail. A number of other panels were constructed using couplers. There were no subsequent queries by Leighton on TQ 33 after the response was issued.
- 84. On 27 July 2015, Leighton raised Technical Query 34 ("TQ 34") to Team B [B12527-B12528] regarding the misalignment between rebar at EWL slab and couplers at panel EH74 of the Eastern wall.
- 85. TQ 34 was raised in response to a construction problem on panel EH74 where the top layer of reinforcement had been incorrectly located. The proposal for this panel was to

break out the D-wall to just below this bar and replace with a straight through bar with a coupler on the OTE side of the D-wall. This would be concreted at the same time as the adjacent EWL slab and OTE.

- 86. On 29 July 2015, this detail was confirmed by Team B as acceptable [B12527-12528] and returned to Leighton. I believe that Leighton then in turn submitted to MTRCL. However, Team A was not instructed to include this detail in a subsequent BD submission.
- 87. I have learned subsequently (in 2018 following requests for preparation of the as-built drawings) that the upper part of the D-wall was broken out in a series of works commencing in August 2015. I will return to this below.
- On 30 July 2015, PWD-059A3 was submitted to BD by MTRCL [B7322-B7358]. It was accepted by BD on 17 September 2015 [B261].
- 89. On 12 August 2015 (email timed at 19:07 attached as JB-10), Team B provided their response to TQ 44 to Leighton in a submission which included drawings from the 6 August 2015 submission showing the reinforcement details for the connection to the D-wall based on multiple layers of couplers and the need to construct the OTE slab at the same time as the EWL slab. The approved details of this are at [J8]. Leighton subsequently submitted these drawings including these details to MTRCL on 20 August 2015. The response to TQ 44 is attached as JB-11.
 - 89.1 TQ44 response by LCAL is divided into 5 items i.e.;
 - Missing U bars;
 - T25 instead of T40 U bars in top of d-wall;
 - Missing shear key;
 - D-wall starter bar arrangement not compliant; and
 - Reinforcement arrangement EWL to OTE.
 - 89.2 Response contains PWD-059A3, EWL slab calculations, EWL slab RC drawings, GA drawings.
- 90. MTRCL in turn passed this submission to Team A to review. The drawings were subsequently used as the basis of the advanced DAmS 310 issued on 26 August 2015 by the MTRCL's Design Management Team to their Construction Team [B250]. The details shown on these drawings for the connection [B7428] were consistent with the detail identified on Enclosure 1, page 1 in Lo & Lo's letter dated 2 October 2018 [J8].

- 91. The information on these drawings was used as the basis of the submission to BD on4 November 2015 to obtain approval for the connection details [B8450-B8459].
- 92. Working drawings containing DAmS 310 showing the connection detail was issued on 30 November 2015.
- 93. As far as I am aware, Team B was never subsequently asked to update and provide new proposals nor received any technical queries for construction based on the detail shown on Enclosure 1, page 2 in Lo & Lo's letter dated 2 October 2018 [J9]. No working drawings were prepared by Team A.
- 94. On 8 December 2015, BD accepted the temporary works submission titled "Excavation & Lateral Support Works (Shoring & Bulk Excavation) Grid 22/40 and Grid J/N of Hung Hom Station" but qualified at paragraph 15 of Appendix I of that submission [C18002] that "[i]t is noted that reinforcement details of permanent slab of the station have been included in this temporary works design submission. In order to avoid ambiguity, it is recorded that the said reinforcement details were submitted for information only and you are required to ensure the corresponding permanent station structure submission are fully compatible with this ELS design submission".
- 95. On 21 March 2016, Leighton submitted to MTRCL a proposal submission (ref: 1112-CSF-LCA-DEM-000302) ("Second Submission") [C18006], which included TWD-004C1. MTRCL forwarded this submission to BD on 23 March 2016.
- 96. On 28 April 2016, BD approved the temporary works submission titled "Excavation & Lateral Support Works (Shoring & Bulk Excavation) Grid 22/40 and Grid J/N of Hung Hom Station" but qualified at paragraph 4 of Appendix I of that submission [B7472] that "[i]t is noted that reinforcement details of permanent slab of the station have been included in this temporary works design submission. In order to avoid ambiguity, it is recorded that the said reinforcement details were submitted for information only and you are required to ensure the corresponding permanent station structure submission are fully compatible with this ELS design submission".

Explain and confirm whether such Deviation in Connection Details requires the Expressed Approval of the BD

97. Request 3(b) from the Commission: "Please address the following matters from the perspective of the designer: Explain and confirm whether such deviation in connection details requires the expressed approval of the BD. If it is required, state the procedures and identify the party or parties who should take steps to seek approval from the BD. If approval is not required, explain why not. Explain the role Your Company as the design consultant under Contract No.1112 would play in the procedures for seeking approval from the BD."

- 98. This question refers to procedures regarding BD submissions and is not my personal area of expertise. However, having consulted RSEs of Atkins with relevant experience, I am able to make the following observations on the change:
 - 98.1 It is not a substantial change;
 - 98.2 It does not change the design intent;
 - 98.3 It is common practice to use couplers instead of reinforcement bars and vice versa; and
 - 98.4 It need not necessarily be submitted to BD, but this would be a decision for the competent person ("**CP**") to make.
- 99. Typically, the process on site to address such changed details would be dealt with by TQ or CSF. This could then have been reviewed and assessed and a decision taken on whether it was minor and form part of the Final Amendment submission or a separate submission had to be made to BD. In either case a DAmS or revised working drawing can be issued. The issue in this case is further complicated by the change to the D-wall which would require an amendment submission.
- 100. For statutory submission procedures, for an alternative proposal by Leighton, Leighton (with the assistance of Team B) would typically be required to produce the alternative proposal, submit it to MTRCL's Construction Management Team and then to MTRCL's Design Management Team and then MTRCL would pass the proposal to Team A for comment. Once the proposal is accepted by MTRCL and Team A and where directed by the CP, Team A would prepare the amendment submission to BD. Team A will assign staff to work with Leighton to clear BD comments and get approval from BD.

Effect of the Alleged Deviation in Connection Details

- 101. Request 3(c) from the Commission: "Please address the following matters from the perspective of the designer: Explain whether and how the deviation may affect the design intent of the east diaphragm wall. Comment on the effect of the alleged deviation in connection details on the EWL Slab and East Diaphragm Walls structures themselves and on the overall design scheme."
- 102. This question refers to design and having consulted colleagues of Atkins with relevant experience, we consider that it does not change the design intent as stated at paragraph 98.

As-built Connection Details

- 103. Request 3(d) from the Commission: "Please address the following matters from the perspective of the designer: Explain and confirm with the aid of drawings the as-built connection details between EWL Slab and east diaphragm walls. Provide a set of the relevant as-built drawings. If such as-built drawings are not available, explain why they are not available. Confirm whether it is Your Company's responsibility to provide as-built drawings."
- 104. As noted in paragraph 32 above, Team B were requested by Leighton on 12 June 2018 to assist in the preparation of the as-built elements of the EWL and NSL slabs in Areas A, B and C.
- 105. These as-built drawings have yet to be finalised and are, therefore, not yet available to be provided. As indicated on drawings [C26494-C26495], there are a number of different details (or types) for the connection to the D-wall and slab.
- 106. As part of this process, amendment submissions will be required to be made to BD to obtain acceptance of any changes of the permanent works. Once this process is completed, the as-built drawings would be prepared.

Request 4 – Presentation to Professor David A Nethercot

107. Request from the Commission:

"(a) Explain and describe the contents of the presentation given to Professor David A Nethercot.

(b) Confirm who gave the presentation on behalf of Your Company.

(c) Explain, with the aid of any presentation materials given to Professor David A Nethercot, what is the overall design scheme of the diaphragm walls and EWL/NSL Slabs and the details of the slab/wall connections.

(d) Please produce the relevant paper, notes, power point, slides and/or video of the presentation."

- 108. The contents of the presentation given to Professor David A Nethercot are provided at slides with annotations attached at **JB-12**.
- 109. Together with Mr Wilson Sung (Head of Atkins' Structural Division) and Mr Shumin Wu (Structural Engineer), I gave a presentation on behalf of Atkins to Professor David A Nethercot on 12 July 2018 on the structural design of Hung Hom Station EWL

Platform Structure. The audience included MTRCL representatives and BD personnel. Mr. Wilson Sung presented slides 13 to 18 and I presented the remainder.

110. The overall design scheme of the D-walls and EWL / NSL Slabs and the details of the slab / wall connections are set out on slides with annotations as attached at JB-12. The relevant papers, notes, power point, and slides of the presentation are set out on slides with annotations as attached at JB-12.

Close

111. I trust that the information provided in this witness statement and its exhibits are of assistance to the Commission. I will be pleased to supplement with any additional information which the Commission may find helpful.

Dated 13 November 2018

Blechwood

John Blackwood