

**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 SUNG CHI MAN

FOR

ATKINS CHINA LIMITED

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

1. I am currently the Head of Structures (Asia Pacific) which is a department of Atkins China Limited ("**Atkins**"). I joined Atkins in July 2017. My role is to manage the structural department of Atkins and provide technical support and services to the projects. This includes building projects, civil engineering projects (including railway projects) on which Atkins is involved.
2. I am a chartered structural engineer and registered structural engineer ("**RSE**"). I have a degree in civil and structural engineering from Hong Kong University of Science and Technology. I became a chartered structural engineer in 2010 and RSE in 2016. I have 21 years of experience in design and construction, having worked in Hong Kong for AECOM, Ove Arup, Meinhardt and currently Atkins. I enclose my CV in attachment **WS-1**.
3. I became involved in the Hung Hom Station Extension under the Shatin to Central Link Project (the "**Project**") in June 2018. My role is to assist the contractor ("**Leighton**") as Team B in providing structural design support as required.
4. I have prepared this witness statement to address each of the Commission's requests as set out in Lo & Lo's letters dated 2 October 2018 [**J1-J9**], 15 October 2018 [**J1-J12**] and 17 November 2018. I have only responded to requests 2, 3 and 4 as set out in the Commissions' letter of 2 October 2018 [**J1-J9**].
5. Unless otherwise stated, the facts stated herein are within my personal knowledge and are true. Where the facts and matters stated herein are not within my own

knowledge, they are based on the stated sources and are true to the best of my knowledge.

Request 2 – Alleged Cutting of Rebars

6. 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."*
7. I only became involved in the Project in June 2018, by which time the alleged cutting would have already happened. Therefore, I have no knowledge of the alleged cutting of threaded steel bars and existence of a gap at threaded steel bar / coupler connection for D-walls to slab and slab to slab during the construction period on site.

Rectification and Remedial measures

8. 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."*
9. I cannot comment on whether rectification and remedial measures have been actually carried out on site as this would have been before I was involved in the Project.
10. As regards what rectification and remedial measures should have been taken by Leighton and / or other sub-contractors if threaded steel bars within the 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, I have read the witness statement of Mr. Blackwood at paragraphs 42 to 44 and I agree with the comments stated there.

Knowledge of Cutting of Threaded Steel Bars and Existence of Gap without Rectification

11. 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."*
12. I have read the witness statement of Mr. Blackwood at paragraph 46 and I agree with the contents stated there. I only became involved in the Project in June 2018, by which time the alleged cutting would have already happened. Therefore, I have no

knowledge of any cutting of threaded steel bars and 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

13. 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."*
14. I have reviewed the MTRCL Report on SCL Contract 1112 – Review of the EWL Slab Construction (the "**MTRCL Report**") dated 15 June 2018 [B1-B46] which may 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.
15. Having reviewed the MTRCL Report and the evidence of other witnesses, particularly those from China Technology, I understand it is alleged that a number of reinforcement bars have been cut, forming gaps within the threaded steel bar / coupler connection.
16. I consider that any cutting of 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.
17. However, without understanding the scope, extent and distribution of the shortening and cutting of the steel bars of EWL / NSL Slabs and the existence of a gap at threaded steel bar / coupler connections for D-walls to slab and slab to slab, it is not possible for me to comment on quality, safety and integrity of the D-walls and EWL / NSL Slabs.
18. In my experience, the design would need to comply with the Building Ordinance, Building Regulations, Code of Practice, Design Standard Manual ("**DSM**"), and Practice Note for Authorised Person ("**PNAP**"). These design requirements and the requirement from MTRCL require a critical load combination which provided a load factor to design the structure to a design life of 120 years as opposed to the normal design life of 50 years. These factors mean that there would be an increased factor of safety for the design of the structure.

19. I consider that the structural integrity of the EWL / NSL Slab could still be maintained even if some reinforcement bars have been cut and gaps left, depending on detailed structural analysis and a better understanding of the location and frequency of cut reinforcing bars and gaps at couplers. In my experience, different utilisation occurs at different areas and not up to full capacity which means that there is a buffer in capacity.

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

20. 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."*
21. I consider that the structural performance of the slab to D-wall and slab to slab connections relies upon the composite action of the reinforced concrete and splice joint detail between D-wall and slab.
22. Depending on the extent of the cutting of threaded steel bars and the existence of a gap at threaded steel bar / coupler connections for D-walls to slab and slab to slab, it could affect the design intent. However, as stated above in paragraph 18, due to the relevant factors of safety, it may be possible for the structure to function as originally intended depending on the extent and distribution of cut reinforcement bars or gaps at couplers.

Request 3 – Alleged Change of Connection Details between EWL Slab and East D-walls

Atkins' Role and Participation in the Process

23. Request 3(a) from the Commission: *"Explain and describe Your Company's role and participation in this deviation in connection details."*
24. I have no knowledge of this issue as I was not involved in the Project at that time.

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

25. Request 3(b) from the Commission: *"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."

26. I assume this "deviation" refers to the construction detail enclosed in Lo & Lo's letter of 2 October 2018 (Enclosure 1, page 1 and Enclosure 1 page 2). In my experience, the design principles do not change as it is a substitution of couplers for straight through reinforcement bars which would not change the behaviour of the joint connection between D-wall and slab. However, I understand there was also a change to the as-built D-wall, and this would normally be a minor amendment which for a non-Instrument of Exemption ("IoE") project should normally be submitted to BD for approval and consent. However, as the Project had an IoE, provided that the structural stability was not affected, consent would not be required and it would be normal to consult with BD as to the change and it would be at the discretion of the CP when this amendment submission would be submitted.
27. If BD approval was required, then Leighton with the assistance of Team B would prepare an amendment submission and submit to MTRCL's Construction Management Team and then to MTRCL's Design Management Team, who would then submit this to Team A for review. Team A would review the submission and advise any changes and then prepare the submission to BD.
28. I was not involved in the Project at this time, however, the role my company would normally play in seeking approval from BD for an IoE project such as Contract No. 1112 would be to review the structural stability, advise on technical aspects of the design of the change and prepare the amendment on behalf of Leighton via Team B and review the amendment submission on behalf of MTRCL via Team A. The amendment submission would be submitted by MTRCL via the Competent Person ("CP") to BD.

Effect of the Alleged Deviation in Connection Details

29. Request 3(c) from the Commission: *"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."*
30. I consider that the deviation does not change the design intent as the design principles do not change as it remains a fixed joint and the change of couplers for straight through reinforcement bars does not change structural stability and / or the behaviour of the joint connection between D-wall and slab.

As-built Connection Details

31. Request 3(d) from the Commission: *"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."*
32. In June 2018, Team B was requested by Leighton to assist in the preparation of the as-built elements of the EWL and NSL slabs in Areas A, B and C.
33. From the period of June 2018 until the date of this statement, Leighton has progressively provided marked-up drawings for Team B to prepare the as-built drawings. The process is ongoing.
34. On 8 and 9 November 2018, Team B issued draft as-built drawings on HUH Areas B and C, EWL and NSL design detail final design amendment to Leighton.
35. I understand that these draft drawings are now produced in the Joint Statement by Leighton and MTRCL on 16 November 2018 [B25480-B25689] and contain a number of different details (or types) for the connection to the D-wall and slab [B25515-B25516].

Request 4 – Presentation to Professor David A Nethercot

36. 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."*
37. I refer to Mr. Blackwood's witness statement at paragraphs 109 to 110.
38. Although I was not involved in the original design as Head of Structure for Atkins, I attended the presentation to Professor Nethercot on 12 July 2018 together with Mr.

Blackwood and Mr. Shumin Wu. During this presentation, I presented the overall structural design scheme as set out in PowerPoint slides 13 to 18.

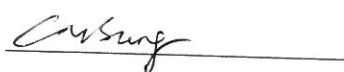
- 38.1.1 Slide 13 - Modelling Approach, which introduced the overall structural design approach.
- 38.1.2 Slide 14 - Step 1: SAP2000 Slab Model, which explained the modelling approach of SAP2000 models which were prepared to stimulate the slab stiffness with openings.
- 38.1.3 Slide 15 - Step 2: PLAXIS Analysis, which explained the adoption of the corresponding slab stiffness which were input into Plaxis to analyse the structural behaviour of D-wall and extract the bending moment of the EWL slab and D-walls.
- 38.1.4 Slide 16 - Step 3: SAFE Model, which explained the final step to input the moment from Plaxis model into the SAFE model to analyse the EWL slab.
- 38.1.5 Slide 17 - Load Case, which explained the permanent load cases for Area C and the load combination in ULS considering different load cases.
- 38.1.6 Slide 18 - Critical Load Case. This identified the critical load case which provided for $1.4 \times (\text{Soil} + \text{water Load}) + 1.4 \times \text{Dead Load} + 1.6 \times \text{Live Load}$. The design was based upon the soil and water load and Dead Load dominating the bending moment of the joint connection between D-wall and EWL/NSL slabs which resulted in more than 90% of the design moment in Area B and C.

39. I did not take any notes for the presentation.

Close

40. 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 3 December 2018



Sung Chi Man