COMMISSION OF INQUIRY INTO THE CONSTRUCTION WORKS AT AND NEAR THE HUNG HOM STATION EXTENSION UNDER THE SHATIN TO CENTRAL LINK PROJECT

WITNESS STATEMENT OF NG WAI HANG

FOR

MTR CORPORATION LIMITED

I, Ng Wai Hang, of MTR Corporation Limited, MTR Headquarters Building, Telford Plaza, 33 Wai Yip Street, Kowloon Bay, Hong Kong, will say as follows:

1. I am the Lead Project Manager - SCL Civil - NSL of MTR Corporation Limited ("**MTRCL**") for the Shatin to Central Link Project (the "**SCL Project**"). I am duly authorised by MTRCL to make this statement on its behalf.

2. I give this statement based on my personal involvement in Contract No. SCL 1112 since August 2018 and I confirm that this statement is true to the best of my knowledge and belief. There are occasions when I can only speak to matters by reference to MTRCL's documents, in which case I believe the contents of those documents to be true and accurate.

3. I obtained a Bachelor Degree (Applied Science) from the University of Toronto in 1986. I have been a registered Professional Engineer in Canada since 1989 and in Australia since 1994. I have been a member of the Hong Kong Institution of Engineers since 1994 and a member of the Institution of Civil Engineers since 1995. In 1999, I became a Registered Professional Engineer (Civil) in Hong Kong.

4. I joined Kowloon Canton Railway Corporation ("**KCRC**") as a Senior Geotechnical Engineer in 1999. At the merger between KCRC and MTRCL in December 2007, I took up the role of a Resident Engineer. I re-joined MTRCL in 2009 as a Senior Construction Engineer. Since then, I took up various roles over the years, including the role as a Construction Manager

for the Express Rail Link (XRL) Project in 2011 and Project Manager for the SCL Project (Civil - NSL) in 2015. In January 2019, I was appointed to my current position as the Lead Project Manager.

5. My roles and responsibilities include supervising the NSL civil and track work and overhead line contracts between Hung Hom and Admiralty. These works are being carried out by various contractors including Leighton. As a Lead Project Manager, I have the overall responsibility of ensuring that the works are executed safely, are built to the required quality standard and are progressed as expeditiously as possible. It is also my duty to ensure any issues raised by the relevant approval authorities of the Government are addressed and resolved in a timely manner and that project completion can be achieved. I and the core members of the current Projects Team started work on Contract No. SCL 1112 in August 2018. At that time, the works at the Hung Hom Station Extension were largely completed. One of our responsibilities was to address the alleged workmanship issues and missing construction records such that the quality of the works constructed by Leighton could be verified and the station extension accepted by the approval authorities. This task is being performed against the background that the commissioning of the SCL Project is eagerly awaited by the community.

6. I am providing this witness statement regarding MTRCL's Statistical Report for the Original Inquiry ("**COI 1 Stat Report**") and its Statistical Report for the Extended Inquiry ("**COI 2 Stat Report**"), both dated 13 September 2019, in response to the Direction given by the Commission of Inquiry into the Construction Works at and near the Hung Hom Station Extension under the Shatin to Central Link Project (the "**Commission**") through an email dated 21 September 2019 from Messrs. Lo & Lo, Solicitors, who I understand are the solicitors acting for the Commission.

7. I am one of the authors of the Holistic Proposal and the Holistic Report. I also participated in reviewing and editing the Verification Proposal, Verification Report, COI 1 Stat Report and the COI 2 Stat Report. I seldom attended the regular meetings between MTRCL and the Government or the Task Force Group (as defined in paragraph 8 of the COI 1 Stat Report). I only attended such meetings when time permitted or upon the specific request of the Buildings Department ("**BD**") and the Railway Development

Office of the Highways Department ("**RDO**"), which are the approval authorities for the SCL Project, mainly at the initial stage of the implementation of the Holistic Proposal and during the final editing of the Holistic Report. Nonetheless, I had contact via emails and telephone calls with the BD, RDO and Task Force Group members on an as needed basis and I am assisted by other members of the Projects Team, including Mr. Nelson Yeung. I worked closely with the Projects Team to execute the Holistic Proposal and the Verification Proposal, including record verification and site investigation and maintaining overview of the structural assessment conducted by external consultants. I set out in this statement the matters contained in the COI 1 Stat Report and COI 2 Stat Report in respect of which I have personal knowledge and to which I can speak. For other factual matters set out in the COI 1 Stat Report and COI 2 Stat Report, I only have some general knowledge of the same based on the briefings given to me by other members of the Project Team and my review of the relevant documents.

A. MTRCL's role as the Project Manager to deliver a safe operating railway

8. MTRCL has 40 years of railway construction experience. As the Project Manager, MTRCL has been entrusted to bring about the completion of the SCL Project, which includes procuring, coordinating, administering, managing and supervising all necessary design and construction works (and ensuring quality of workmanship and meeting all code, statutory, and contractual requirements). We engage qualified and experienced designers and contractors, including Leighton in Contract No. SCL 1112, to carry out the works in accordance with the contractual and statutory requirements. The works have to be accepted by the approval authorities so that the railway can be put into operation for the use by the general public. It is a primary responsibility of MTRCL and its contractors to comply with all the contractual and the relevant statutory requirements to ensure the structures are safe. If there is any doubt about the safety and quality of the works, we must take the necessary steps to gain assurance that what the contractor has built is safe and is compliant with all the relevant code, statutory and contractual requirements.

B. The purpose of the Holistic and Verification Proposals/Reports: to ensure the SCL Project complies with the code, statutory and contractual requirements

9. In light of the issues concerning workmanship and missing records, MTRCL engaged in many months of discussions and consultations with the relevant approval authorities (i.e. BD and RDO) on how these issues could be resolved, such that the works comply with the relevant codes of practice and statutory and contractual requirements. Both the Holistic Proposal/Report (for Hung Hom Station Extension) and the Verification Proposal/Report (for NAT, SAT and HHS) have been through these discussions and consultations which the approval authorities have accepted. The purpose of the Holistic Proposal/Report and Verification Proposal/Report is to ensure the works comply with the relevant code, statutory and contractual requirements.

10. The following issues were discovered after the hearing of the Original Inquiry in January 2019 and during the course of the implementation of the Holistic Proposal: (i) extent of shear link non-conformity; (ii) water seepage and rebar corrosion; (iii) construction joint at Eastern D-wall and EWL slab connection; and (iv) Area HKC capping beam side coupler connection non-conformity. MTRCL addressed those issues in the Holistic Report. After the Holistic Proposal was accepted by the approval authorities and the proposed works carried out, which included a document review, a site investigation and a structural assessment, we have been able to further confirm that the works are safe for ongoing construction activities. As far as the coupler connections are concerned, the Holistic Report concluded that no remedial works would be required in Areas B and C. As for the current extent of the recommended suitable measures, they were determined based on further investigation undertaken after the hearing of the Original Inquiry in January 2019 concluded.

11. We believe the conclusions reached in the Holistic Report and the Verification Report represent a pragmatic way to take the SCL Project forward and restore public confidence in the Hung Hom Station Extension, Approach Tunnels and Stabling Sidings.

C. MTRCL's involvement in the statistical analysis and advice received from the Government's statistical experts

12. MTRCL's Projects Team collectively prepared the COI 1 Stat Report[1] and the COI 2 Stat Report[2] (the "**Stat Reports**") to provide a factual narrative on how the strength reduction factors adopted in the Holistic [3] and Verification[4] Reports were determined.

13. Statistical analyses were carried out under the Holistic Report to derive reduction factors for the Stage 3 structural assessment to address the issue of coupler connections only. On the other hand, no statistical analysis was carried out under the Verification Report. Instead, the reduction factors under the Verification Report were adopted, in the case of coupler connections, by reference to the outcome of the statistical analysis carried out under the Holistic Report or, in the case of untested rebars, by reference to historical rebar testing records.

14. I understand that the methodologies of the statistical analyses in the Holistic Report were adopted in consultation with the Government and its advisers, but I was not personally involved in the consultation process. I understand from the MTRCL's Projects Team that members of the Projects Team carried out the arithmetic calculations based on the agreed methodologies. The Government's advisers included the Expert Adviser Team and Professor Yin, who is the Head of the Department of Statistics & Actuarial Science of the University of Hong Kong. Professor Yin is the statistical expert for the Government in this Inquiry.

15. Since the initial implementation of the Holistic Proposal, in particular the sampling of coupler connections, MTRCL has been guided by the Government's statistical advisers. As noted in Professor Yin's Report,[5] the sampling methodology was designed, and the random selection was conducted by the Hong Kong University Statistics Team led by him. In view of the guidance received from the Government's advisers, MTRCL did not

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[1] [ER1/11.1]
[2] [ER(COI2)1/3]
[3] [OU5/3229-3350]
[4] [BB16/9952-10000]
[5] See paragraph 2.1 of Professor Yin's expert report.

engage its own statistical expert in the preparation of the Holistic Proposal/Report, the Verification Proposal/Report and the Stat Reports.

16. Members of MTRCL's Projects Team, including myself, are primarily civil engineers. We do not have and do not hold ourselves out as having any expertise in statistics. This could explain why the Task Force Group has previously rejected some analysis proposed by MTRCL as set out in paragraph 42 of the COI 1 Stat Report. While we can assist this Commission with the factual circumstances under which the strength reduction factors were adopted in the Holistic and Verification Reports, we are not in a position to address any expert statistical issues.

17. As noted in the expert report of Professor Yin, he was involved in devising the various aspects of the statistical analyses adopted in the Holistic Report and has given the relevant statistical justifications of the analyses. Consequently, Professor Yin should address any expert statistical issues that may arise from the Holistic Report.

18. As set out at paragraph 15 of the COI 1 Stat Report, broadly speaking the statistical analyses adopted in the Holistic Report include: (i) binomial statistical analysis; and, (ii) Professor Yin's suggested Formula (the "**Formula**").

D. The Formula

19. MTRCL used the Formula to calculate the reduction factor for Areas A and HKC where capping beam details were applied.

E. The binomial analysis

20. The binomial analysis approach was proposed by Arup and accepted by the approval authorities, namely RDO and BD. MTRCL discussed and consulted with the approval authorities on the parameters of the binomial analysis which were eventually adopted in the Holistic Report and accepted by the approval authorities. I understand that the parameters include:

    (1) A confidence level of 95%;

    (2) Samples from EWL and NSL slabs should be treated as two independent families;

(3) A sampling size of at least 84 samples from each of EWL and NSL slabs; and

(4) The acceptance criteria of 37 mm engagement length by PAUT or 40 mm by direct measurement.

F. The acceptance criteria of 37mm engagement length by PAUT and 40 mm engagement length by direct measurement

21. MTRCL has set out the factual circumstances leading to the adoption of 37mm (by PAUT)/40mm (by direct measurement) in paragraphs 34 to 36 of the COI 1 Stat Report. In summary, on 24 December 2018, the Government stated its position in a Press Release[6] that:

(1) According to the information from BOSA the proper installation requirements of a coupler were: (i) there should be a maximum of two full threads exposed; and (ii) the embedded length of the thread of the threaded steel bar inside the coupler should be at least 40 mm in length;

(2) As the allowable measurement tolerance of the PAUT method is 3 mm, readings below 37 mm (i.e. 40mm less the 3 mm tolerance) are regarded as failing to meet the installation requirements; and

(3) While noting MTRCL's position that the engagement of six full threads could provide the design strength, the Government considers that when conducting the structural analysis under Stage 3 of the holistic assessment MTRCL should take into account the technical data provided by BOSA, namely the installation requirements set out above.

22. Between December 2018 and January 2019, a number of meetings were held and attended by representatives of the Government and MTRCL to discuss the acceptance criteria for the binomial analysis although I personally did not attend these meetings. However, on 10 January 2019[7], I received a letter from Mr. Lok Pui Fai of BD, setting out the clarifications on coupler engagement that BD received from BOSA on 7 January 2019, including that the couplers will require around 10 full threads engagement for a correct engagement. The letter asked me to take into consideration BOSA's

[6] [B21/26690]
[7] [H26/45853-45854]

clarifications. After discussions between the Government and MTRCL, some of which I was involved in personally, MTRCL adopted the Government's advice that an engagement length of no less than 40 mm by direct measurement and no less than 37 mm by PAUT was required to ensure acceptance by the approval authorities. Such approval was essential to enable the station to be put into operation.

G. Optimisation of suitable measures

23. I understand that the Commission is interested in the statistical approach and how it was applied to determine the reduction factors for the purpose of assessing the extent, if any, of the suitable measures required for the Hung Hom Station Extension, the Approach Tunnels and the Hung Hom Sidings. I understand that: the statistical analyses address the issue of non-compliant coupler connections and missing records in relation to coupler connections; the statistical approach is not relevant to other parts of the Holistic Report in relation to other non-conformances. My understanding is that after further detailed analysis and design, and subject to acceptance by the approval authorities, the extent of suitable measures for coupler connections recommended in the Holistic Report is expected to be reduced. It follows that if the extent of the suitable measures for coupler connections is reduced, it is anticipated that the statistical approach for coupler connections will be less significant than as originally envisaged in the Holistic Report.

24. As things stand at the moment, there is no change in the suitable measures recommended in the Verification Report for coupler connections in HHS, which were mainly proposed to address the issue of missing construction records.

25. I note the Commission has asked to be kept updated on the design and implementation of the suitable measures. MTRCL will do so and has already provided an initial update. Further updates will be provided on a monthly basis, as requested.

Dated this 23rd day of September 2019

Ng Wai Hang