## 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 FU YIN CHIT FOR MTR CORPORATION LIMITED

I, FU YIN CHIT, of MTR Corporation Limited, MTR Headquarters Building, Telford Plaza,33 Wai Yip Street, Kowloon Bay, Hong Kong, WILL SAY AS FOLLOWS:

- I am the Construction Manager-SCL Civil of the Shatin to Central Link Project (the "SCL Project") of MTR Corporation Limited ("MTRCL"). I am duly authorised by MTRCL to make this statement on its behalf.
- I first joined MTRCL in June 1994 as an Assistant Resident Engineer (Civil) on the Lantau Airport Rail ("LAR") project, and I remained in that position until March 1995. Thereafter:
  - (a) From April 1995 to June 1998, I was a Construction Engineer (Civil) ("ConE") on the LAR project.
  - (b) From July 1998 to December 1998, I was a Senior Construction Engineer (Civil)
     ("SConE") on the LAR project.
  - (c) From January 1999 to August 2002, I was a SConE for the Tseung Kwan O extension project. Thereafter, I left MTRCL and returned in November 2005.
  - (d) From November 2005 to October 2007, I was the Civil Construction Manager on the Shanghai (L9) project.



- (e) From October 2007 to December 2009, I was the Civil Construction Manager on the Shenzhen (L4) project.
- (f) From January 2010 to February 2012, I was the Chief Construction Manager Civil on the Shenzhen (L4) project.
- (g) In March 2012, I was assigned to Contract 1111 of the SCL Project as the Construction Manager – SCL Civil. From 30 May 2016 to this date, I have been the Construction Manager – SCL Civil on Contracts 1111 and 1112.
- 3. I obtained a Bachelor's Degree in Engineering from the University of London, UK in 1983. I have been a member of the Hong Kong Institution of Engineers since August 1993, and I was previously a Chartered Engineer of the Engineer Council, UK, a member of the Institute of Civil Engineers, and a member of the Institution of Engineers, Australia.
- 4. I am providing this witness statement in response to the matters relating to Issues 1 and 2 raised in a letter dated 22 March 2019 titled "Commission of Inquiry into the Construction Works at and near the Hung Hom Station Extension under the Shatin to Central Link Project (Request for Witness Statements – NAT)" (the "NAT Letter") from Messrs. Lo & Lo, who I understand are the solicitors acting for 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 of Inquiry").
- 5. While I am aware of the matters raised in the NAT Letter based on my first-hand observations and personal involvement in the SCL Project, and I confirm that the contents of this statement are 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 due to the lapse of time, in which case I believe the contents of those documents are true and correct.

### Item 1.6: By way of background, describe and explain generally the construction works at NAT, in particular, the rebar fixing and concreting works and describe the timeline for the construction and completion thereof.

- 6. The steps and procedures of the construction works at the North Approach Tunnel ("NAT") (including the rebar fixing and concreting works) are described and explained in paragraph 6 of the "NAT-Method Statement of Permanent Structure Construction of East West Line (EWL) and North South Line (NSL) at North Approach Tunnel (NAT)" (1112-CSF-LCA-CS-000673A) (the "1112 NAT Method Statement") and in the Inspection and Test Plan ("ITP") (1112-CSF-LCA-CS-003280) submitted by the main contractor under Contract 1112, namely Leighton Contractors (Asia) Limited ("Leighton"), to MTRCL. I shall refer to the same for the purpose of this question.
- 7. The NAT consists of: (1) the North South Line ("NSL") tunnel; (2) the East West Line ("EWL") tunnel; and, (3) the shunt neck (the "Shunt Neck") (which connects EWL to the Hung Hom Stabling Sidings ("HHS")). I refer to the brief description and dates of the construction at the 3 Stitch Joints and the Shunt Neck stated in the 2<sup>nd</sup> Stitch Joints Report<sup>1</sup> and the 2<sup>nd</sup> Shunt Neck Report<sup>2</sup>, which were prepared by reference to the site diaries and photographs available at the time. MTRCL's Projects Team is currently reviewing the site diaries, photographs and concrete cube test reports, and will provide a more detailed timeline when it becomes available. To assist the Commission of Inquiry, I set out below a brief timeline for the construction and completion of the stitch joints and the construction joint in issue at NAT under Contract 1112:
  - (a) For the 1111/1112 NSL Stitch Joint (defined below), the rebar fixing works for the track slab were carried out between 5 and 6 July 2017 and the concreting works were done on 8 July 2017. The rebar fixing works for the wall and the roof were carried out between 22 and 25 July 2017 and between 25 and 27 July 2017 respectively, and the concrete pours took place on 28 July 2017 and 2 August 2017 respectively.
  - (b) For the 1112/1112 NSL Stitch Joint (defined below), the rebar fixing works for the track slab were carried out between 29 May 2017 and 6 June 2017, and the concrete pour took place on 7 June 2017. The rebar fixing works for the dividing

<sup>&</sup>lt;sup>1</sup> "Report of Defective Works Identified at Tunnel Stitch Joints at Contract 1112, Shatin to Central Link" dated 26 March 2018

<sup>&</sup>lt;sup>2</sup> "Shunt Neck Connection Report at 1111/1112 Interface of NAT Structure Contract 1112, Shatin to Central Link" dated 26 October 2018

wall and the east wall were carried out between 26 and 29 July 2017 and the concrete pour took place on 2 August 2017. In respect of the west wall, the rebar fixing works were carried out between 26 and 29 July 2017 and the concrete pour took place on 3 August 2017. For the roof, the rebar fixing works were carried out between 27 and 29 July 2017, and the concrete pour took place on 9 September 2017.

- (c) For the 1111/1112 EWL Stitch Joint (defined below), in respect of the track slab and the west walls, the rebar fixing works were carried out between 22 and 24 January 2017 and on 25 January 2017 respectively, and the concrete pours took place on 24 January 2017 and 25 January 2017 respectively. In respect of the east wall at the joint, the rebar fixing works were carried out in around January 2017 and the concrete pour took place in around March 2017. My team and I are verifying the dates and will provide further information when it becomes available.
- (d) For the Shunt Neck, the track slab of Shunt Neck Bay 3 (which was to connect to the track slab of the Shunt Neck under Contract 1111 at the interfacing location) was constructed between 4 January 2017 (the date of the rebar fixing works) and 5 January 2017 (the date of the concrete pour). In respect of the walls of Shunt Neck Bay 3 (which were to connect to the walls of the Shunt Neck under Contract 1111 at the interfacing location), the rebar fixing works were carried out between 13 and 28 February 2017, and the concrete pour took place on 22 March 2017.

## Item 1.6.1: Provide a general layout plan showing the NAT and also reflecting the locations of the Shunt Neck, the 3 Stitch Joints and the construction joint in issue

Item: 1.6.2: Provide simplified sectional drawings of NAT and the Shunt Neck and diagrams illustrating the construction of the 3 Stitch Joints and construction joint concerned

Appendix A shows the general layout of the NAT: (1) the NSL tunnel is shown in pink;
 (2) the EWL tunnel is shown in green; and, (3) the Shunt Neck is shown in blue. At the bottom left corner of the plan there is a dotted line marking the permanent works limit

between Contract 1112 and Contract 1111 (the "1111/1112 Interface"). The section of the NAT that is within Contract 1112 (i.e. to the left of the 1111/1112 Interface) is about 135m long.

9. These tunnels are located at two levels: the NSL is at the lower underground level (the "NSL track level"); and the EWL and the Shunt Neck are at the upper level at-grade (the "EWL track level"). The NSL tunnel is a twin-box underground tunnel structure. The EWL tunnel and the Shunt Neck are open trough tunnel structures. I have prepared simplified sectional drawings (at <u>Appendix B</u>) to illustrate this, and these drawings also show the locations of the 3 stitch joints and the construction joint at the Shunt Neck in issue.

#### Section 1 of Appendix B showing the cross-section of NAT at the 1111/1112 Interface

- (a) Two stitch joints are located at the 1111/1112 Interface one is located at the EWL track level (the "1111/1112 EWL Stitch Joint") and the other one is located at the NSL track level (the "1111/1112 NSL Stitch Joint").
- (b) There is also a connection joint at the Shunt Neck at the 1111/1112 Interface, and this is the construction joint in issue under Issue 2 (the "1111/1112 Shunt Neck Joint").

# Section 2 of Appendix B showing the cross-section of the location at which another stitch joint is located

- (c) The third stitch joint is located within the NSL tunnel structures under Contract 1112 (the "1112/1112 NSL Stitch Joint"). In this witness statement, the "1111/1112 EWL Stitch Joint", the "1111/1112 NSL Stitch Joint" and the "1112/1112 NSL Stitch Joint" are collectively referred to as the "3 Stitch Joints".
- To further identify the locations of the 3 Stitch Joints and the 1111/1112 Shunt Neck Joint, I refer to two other general layout plans at <u>Appendix C</u>.
  - (a) The first general layout plan shows the NAT under Contract 1112 at the NSL track level. It was divided into 7 bays.

- (i) The 1111/1112 NSL Stitch Joint (the orange line on the right) is the connection joint between the NSL tunnel structures under Contract 1112 in NSL Bay 6/7 adjacent to the 1111/1112 Interface (the "1112 NSL Interfacing Tunnel Structures") and the NSL tunnel structures built under Contract 1111 adjacent to the 1111/1112 Interface (the "1111 NSL Interfacing Tunnel Structures").
- (ii) The 1112/1112 NSL Stitch Joint (the orange line on the left) is the connection joint between the NSL tunnel structures built under Contract 1112 in NSL Bay 5 (the "1112 NSL Bay 5 Tunnel Structures") and the NSL tunnel structures built under Contract 1112 in NSL Bay 6/7 (i.e. the 1112 NSL Interfacing Tunnel Structures).
- (b) The second general layout plan shows the NAT under Contract 1112 at the EWL track level. The EWL tunnel structure was divided into 5 bays. The 1111/1112 EWL Stitch Joint (the orange line) was located at the interface between EWL Bay 5 adjacent to the 1111/1112 Interface (the "1112 EWL Interfacing Tunnel Structures") and the EWL tunnel structures under Contract 1111 adjacent to the 1111/1112 Interface (the "1111 EWL Interfacing Tunnel Structures"). The Shunt Neck was divided into 4 bays, and the 1111/1112 Shunt Neck Joint is located also at the 1111/1112 Interface between Shunt Neck Bay 3 and the adjacent Shunt Neck structures under Contract 1111.

Item 1.7: Describe and explain, with reference to the terms of the relevant contract(s), approved plans, drawings, laws and regulations, practice notes, handbooks, guidelines, circulars, industry standards, approved site supervision plan(s) quality supervision plan(s) and quality assurance plan(s), practice, procedures and requirements (the "Requirements, Standards and Practice"):

Item 1.7.1: the steps and procedures involved in the rebar fixing works and concreting works in the construction of the 3 Stitch Joints, in particular, how the 3 Stitch Joints should be constructed and connected (the "SJ Works").

Item 2.8: Describe and explain, with reference to the Requirements, Standards and Practice:

Item 2.8.1: the design and construction requirements of the rebar fixing works and concreting works in the construction of the Shunt Neck Joint (the "SNJ Works"), in particular the connection requirements thereof. Explain the difference in the construction requirements of a stitch joint and a construction joint.

#### Item 2.8.2: the steps and procedures of the SNJ Works.

- (i) Division of responsibilities between GKJV and Leighton at the 1111/1112 Interface
- 11. The 1111/1112 NSL Stitch Joint, the 1111/1112 EWL Stitch Joint and the 1111/1112 Shunt Neck Joint are located at the 1111/1112 Interface. The construction works in respect of these joints therefore required collaboration between the contractor under Contract 1111 (namely, Gammon-Kaden SCL 1111 Joint Venture ("GKJV")) and the contractor under Contract 1112 (namely, Leighton).
- 12. In this respect, the "Interface Requirements Specification Hung Hom North Approach Tunnels (Contract 1111) and Hung Hom Station and Stabling Sidings (Contract 1112)" (the "1111/1112 Interface Requirements Specification") (Appendix Z2 to the Particular Specification in Contract 1112) provided, amongst other things, that "Completion of the tunnel connections will be by Contract 1112" (Clause Z1.6) and Leighton should "complete the stitching joint, including omega seal, rebar and infill concrete, after tunnel backfilling and stabilization of tunnel settlement" (Interface Item 1.4 of Table Z2.1.1). Thus, in short, Leighton was responsible for connecting the tunnel structures at the 1111/1112 Interface (and, hence, the construction of the 1111/1112 NSL Stitch Joint, the 1111/1112 EWL Stitch Joint and the 1111/1112 Shunt Neck Joint).
- 13. The working drawings "NAT Tunnels Interface with Contract 1111 Details" (nos. 1112/W/000/ATK/C11/247 to 249) also show the division of responsibilities between Leighton and GKJV as regards the construction of the stitch joints at the 1111/1112 Interface. Those drawings contained annotations indicating which part of the construction works at the joints should be done by Leighton and which part should be done by GKJV. Further, those parts drawn in a solid black colour were to be performed

by Leighton (as these working drawings were issued to Leighton), and those drawn in a lighter colour were to be performed by GKJV. The connection of the structures was in a solid black colour and, hence, was Leighton's responsibility.

- (ii) Brief description of the steps and procedures involved in the construction of the 3 Stitch Joints
- 14. Under Contract 1112, the steps and procedures involved in the construction of the NAT tunnel structures are set out in the 1112 NAT Method Statement. The connection details and specifications for the construction of the 3 Stitch Joints are set out in, amongst others, the following working drawings:

Drawing	Drawing ref. no.	
General Arrangement Plan NSL Track Level	1112/W/HUH/ATK/C10/A82	
Sheet A82		
General Arrangement Plan EWL Track Level	1112/W/HUH/ATK/C10/E82 <sup>3</sup>	
Sheet E82		
General Arrangement Plan EWL Platform Level	1112/W/HUH/ATK/C10/F82 <sup>4</sup>	
Sheet F82		
NSL NAT & EWL NAT Tunnels Stitch Joint	1112/W/000/ATK/C11/101-102	
Typical Details		
NAT Tunnels Interface with Contract 1111	1112/W/000/ATK/C11/246	
NAT Tunnels Interface with Contract 1111	1112/W/000/ATK/C11/247-	
Details	249 <sup>5</sup>	
Tunnel R.C. Details Sheets 1 and 2	1112/W/000/ATK/C12/076-077	
NAT Tunnel Stitch Joint R.C. Details	1112/W/000/ATK/C12/201	
NAT Tunnel Stitch Joint	1112/W/000/ATK/C12/202	
NSL Tunnels Base Slab R.C. Details Sheet 3	1112/W/352/ATK/C12/303	
NSL Tunnels Roof Slab R.C. Details Sheet 3	1112/W/352/ATK/C12/403	
NSL Tunnels Western Wall R.C. Details Sheet 2	1112/W/352/ATK/C12/452	
NSL Tunnels Eastern Wall R.C. Details Sheet 1-2	1112/W/352/ATK/C12/481-482	

<sup>&</sup>lt;sup>3</sup> Note that certain details were amended by DAmS/1112/C/0390

<sup>&</sup>lt;sup>4</sup> Note that certain details were amended by DAmS/1112/C/0390

<sup>&</sup>lt;sup>5</sup> Note that certain details were amended by DAmS/1112/C/0390

NSL Tunnels Cross Section R.C. Details Sheet 3	1112/W/352/ATK/C12/503
NSL Tunnels Dividing Wall R.C. Details	1112/W/352/ATK/C12/561
EWL Tunnels Base Slabs R.C. Details	1112/W/362/ATK/C12/303
EWL Tunnels Cross Section R.C. Details Sheet 3	1112/W/362/ATK/C12/503
EWL Tunnels Eastern Wall R.C. Details Sheet 1	1112/W/362/ATK/C12/526
EWL Tunnels Western Wall R.C. Details	1112/W/362/ATK/C12/543

15. The diagram below shows the typical details of a stitch joint connecting the external walls of the interfacing tunnel structures at NAT as shown in working drawing no. 1112/W/000/ATK/C11/102.<sup>6</sup> The roof and base slabs follow similar typical details (see their typical details at working drawings nos. 1112/W/000/ATK/C11/101<sup>7</sup>). I will briefly explain the steps and procedures involved in the construction of the 1111/1112 NSL Stitch Joint by reference to it:

#### **Diagram 1: Typical Details of a Stitch Joint (External Walls)**<sup>8</sup>



<sup>&</sup>lt;sup>6</sup> Note that some of the dimensions and details in Diagram 1 had been revised by DAmS/1112/C/0390, but this diagram serves as an illustration of how a stitch joint is typically built.

<sup>&</sup>lt;sup>7</sup> Note, again, some of the dimensions and details in those drawings had been revised by DAmS/1112/C/0390.

<sup>&</sup>lt;sup>8</sup> An enlarged version of Diagram 1 is at <u>Appendix D</u>

- (a) First, GKJV should construct the 1111 NSL Interfacing Tunnel Structures with couplers (with protective caps) fixed at the end of the structure. Note that there should be a collar at the exterior of the structure. GKJV should also install a waterproof membrane at the exterior of the collar and a water stop at the structure. See the <u>vellow</u> parts of the diagram (see <u>Appendix D</u> for an enlarged version of Diagram 1).
- (b) Then, Leighton should construct the 1112 NSL Interfacing Tunnel Structures also with couplers (with protective caps) fixed at the end of the structure. There should also be a collar at the exterior of the structure. Leighton should also install a waterproof membrane at the exterior of the collar and a water stop at the structure. See the <u>green</u> parts of the diagram (see <u>Appendix D</u> for an enlarged version of Diagram 1).
- (c) Upon the construction of the two interfacing tunnel structures as mentioned in (a) and (b) above, the two structures would not be "stitched" together immediately. This is because the "NSL NAT & EWL NAT Tunnels Stitch Joint Typical Details" (drawing no. 1112/W/000/ATK/C11/101) expressly required that "2. The Stitch Joint shall be cast as late as possible in the construction sequence, and preferably after groundwater recharge, to minimise the amount of differential movement after casting. Casting shall not be carried out until after completion of backfilling". Moreover, as mentioned in paragraph 12 above, Interface Item 1.4 of Table Z2.1.1 of the 1111/1112 Interface Requirements Specification required that Leighton should "complete the stitching joint, including omega seal, rebar and infill concrete, after tunnel backfilling and stabilization of tunnel settlement".
- (d) At the stage of construction referred to in sub-paragraph (c) above, the two collars at the exteriors of the structures would serve the purpose of sealing up the space within the tunnel structures (i.e. the red part as shown in Diagram 1) before the two structures were "stitched" together. As there would still be a gap between the collars (through which soil and underground water might seep in after backfilling and the recharging of underground water had occurred), Leighton was required to install an omega seal at the inner intersection of the two collars.

- (e) After the differential movements of the two structures were stabilised, Leighton should:
  - Expose the couplers fixed at the 1111 NSL Interfacing Tunnel Structures and screw rebars (the "1111 rebars") into those couplers;
  - (ii) Expose the couplers fixed at the 1112 NSL Interfacing Tunnel Structures and screw rebars (the "1112 rebars") into those couplers; and
  - (iii) Lap the 1111 rebars with the 1112 rebars at their intersections (and, hence, form what is referred to as a "stitch" joint).

See: the part in <u>red</u> in Diagram 1 above (see <u>Appendix D</u> for an enlarged version of Diagram 1). The black dotted lines therein represent the lapping of the 1111 rebars with the 1112 rebars. To illustrate such lapping more clearly, I have prepared the following diagram, which is the "zoomed-in" version of Diagram 1 above focusing on the red part. Instead of using black dotted lines, <u>bright yellow</u> lines are used to represent the 1111 rebars, and <u>bright green</u> lines are used to represent the 1112 rebars.

#### Diagram 2: lapping between 1111 rebars and 1112 rebars



# **BB73**

- (f) Note that as the NSL tunnel is a twin-box underground tunnel structure, Leighton had to connect:
  - (i) The base slab of the 1111 NSL Interfacing Tunnel Structures and the base slab of the 1112 NSL Interfacing Tunnel Structures;
  - (ii) The external walls of the 1111 NSL Interfacing Tunnel Structures and the external walls of the 1112 NSL Interfacing Tunnel Structures;
  - (iii) The dividing wall of the 1111 NSL Interfacing Tunnel Structures and the dividing wall of the 1112 NSL Interfacing Tunnel Structures; and
  - (iv) The roof slab of the 1111 NSL Interfacing Tunnel Structures and the roof slab of the 1112 NSL Interfacing Tunnel Structures.

The connection details in respect of the base slabs and the roof slabs are similar to those in respect of the external walls (illustrated above in paragraphs (a) to (e)).<sup>9</sup> For the dividing walls, although collars were not required, they still had to be "stitched" together.<sup>10</sup>

- (g) Note that for waterproofing purposes, in addition to the omega seal (which should be installed by Leighton), Leighton should install hydrophilic strips at the stitch joint (see Diagram 1 above). Concrete pouring should take place after the "stitching" of the rebars and the installation of, amongst other things, the waterproofing materials.
- 16. The steps and procedures involved in the construction of the 1111/1112 EWL Stitch Joint were similar, save and except that the EWL tunnel is an open trough aboveground tunnel structure without a dividing wall (as opposed to a twin-box underground tunnel structure as in the case of the NSL tunnel) and, hence, there were no roof slabs and dividing walls to be connected.

<sup>&</sup>lt;sup>9</sup> See their typical details at working drawings nos. 1112/W/000/ATK/C11/101 as referred to in paragraph 15 above

<sup>&</sup>lt;sup>10</sup> See working drawing no. 1112/W/352/ATK/C12/561

17. As to the construction of the 1112/1112 NSL Stitch Joint, the steps and procedures were also similar, save that Leighton was responsible for building both sides of the joint, as both of them fell within the scope of Contract 1112.

#### (iii) The 1111/1112 Shunt Neck Joint - a Construction Joint

- 18. As to the steps and procedures involved in the construction of the tunnel structures under Contract 1112 at the Shunt Neck, as well as the construction of a construction joint, I also refer to paragraph 6 of the 1112 NAT Method Statement. Originally, the joint at the Shunt Neck at the 1111/1112 Interface was designed to be constructed as a stitch joint.<sup>11</sup> However, as stated in paragraph 3.6 of the 2<sup>nd</sup> Shunt Neck Report (also referred to in paragraph 2.3 of the NAT Letter), MTRCL confirmed with GKJV that the stitch joint at the Shunt Neck at the 1111/1112 Interface was no longer required and that a construction joint would be adopted instead.
- 19. At this juncture, it may be helpful to briefly explain the distinction between a construction joint and a stitch joint and why a stitch joint is required in certain circumstances.
  - (a) First of all, normally, where there are two successive placements of concrete, lapped bars or couplers are typically used to create one continuous structure. This kind of joint is called a construction joint.
  - (b) However, if the two placements of concrete to be connected are built on different foundations (e.g. one is founded on piles and the other at grade), or if one of them is constructed well in advance of the other, then the two placements of concrete may have different degrees of settlement or movement. If they are connected by way of a conventional construction joint explained in sub-paragraph (a) above, there would likely be stress/pressure at the joint if and when differential settlement or movement occurs across the joint, and this might result in cracks at the joint.

<sup>&</sup>lt;sup>11</sup> See: working drawing no. 1112/W/000/ATK/C11/246

- (c) A stitch joint may minimise such potential stress/pressure at the joint because, unlike a construction joint (where the two placements of concrete would be connected as they are constructed), at a stitch joint the two placements of concrete would be "stitched" together (as illustrated in Diagrams 1 and 2 above) only when their respective settlements or movements have been stabilised (see paragraph 15(c) above). This method minimises the stress/pressure at the joint and, hence, reduces the risk of cracking.
- 20. A construction joint was constructed at the 1111/1112 Interface at the Shunt Neck. Although I was not involved in the decision as regards the change from stitch joint to construction joint, I note that the interfacing structures under Contract 1111 and the interfacing structures under Contract 1112 were founded on piles and were not subject to any soil overburden pressure.
- 21. In contrast, the 3 Stitch Joints were required for the following reasons:
  - (a) As regards the 1112/1112 NSL Stitch Joint, while the 1112 NSL Bay 5 Tunnel Structures were supported by socket H-piles, the 1112 NSL Interfacing Tunnel Structures were at grade (i.e. end-bearing). In such circumstances, the two tunnel structures should be connected by way of a stitch joint so as to avoid any stress/pressure at the joint as a result of any differential settlements or movements across the joint.
  - (b) As to the two stitch joints at the 1111/1112 Interface, although (1) the 1111 NSL Interfacing Tunnel Structures and the 1112 NSL Tunnel Structures, as well as (2) the 1111 EWL Interfacing Tunnel Structures and the 1112 EWL Interfacing Tunnel Structures, were all at grade (i.e. end-bearing), the tunnel structures under Contract 1111 were to be constructed well ahead of the tunnel structures under Contract 1112. As such, a stitch joint was provided for in the design.

Item 1.7.2: the respective roles and responsibilities of MTRCL and each of the contractors and subcontractors involved in the SJ Works. Identify the contractors and subcontractors involved.

Item 2.8.3: the respective roles and responsibilities of MTRCL and each of the contractors and subcontractors involved in the SNJ Works. Confirm whether the same 2 sub-contractors, Wing Kwong and Hills were respectively responsible for the rebar fixing works and formwork and concreting works. If they are not, please identify the contractors and subcontractors involved. Produce a copy of the relevant subcontracts.

- 22. As the project manager of the SCL Project, MTRCL was responsible for managing the construction of the 3 Stitch Joints and the 1111/1112 Shunt Neck Joint.
- 23. Leighton was the main contractor under Contract 1112 and was involved in the construction of the 3 Stitch Joints and the 1111/1112 Shunt Neck Joint in its capacity as the main contractor under Contract 1112. As far as the steel re-bar fixing and concreting works at the joints are concerned, the division of responsibilities between Leighton and GKJV in the construction of the 1111/1112 NSL Stitch Joint, the 1111/1112 EWL Stitch Joint and the 1111/1112 Shunt Neck Joint have been explained in paragraphs 11 to 13 above.
- 24. Leighton appointed the following subcontractors for the works at the NAT, including the construction of the 3 Stitch Joints and the 1111/1112 Shunt Neck Joint:

Name of sub-contractors	Responsibilities
Wing and Kwong Steel Engineering	Rebar cutting, bending and fixing
Limited ("Wing Kwong")	
Hills Construction Limited ("Hills")	Formwork and Concreting

Item 1.7.4: Please also confirm and explain whether testing and approval were required in respect of the use of such rebars and couplers and if so, describe and explain the testing and approval procedures. Please produce the relevant testing and approval records.

Item 1.13: Confirm whether MTRCL would inspect and check the materials (couplers and rebars) against Requirements, Standards and Practice after such materials were delivered to the site and before they were used for the construction of the 3 Stitch Joints. Item 2.8.5: confirm and explain whether testing and approval were required in respect of the use of such rebars and couplers and if so, describe and explain the testing and approval procedures. Please produce the relevant testing and approval records.

#### Item 2.12: Confirm whether MTRCL would inspect and check the materials (couplers and rebars) against Requirements, Standards and Practice after such materials were delivered to the site and before they were used for the construction of the Shunt Neck Joint.

- 25. MTRCL put in place a quality control system for the use of materials, including rebars and couplers. First, MTRCL required contractors to submit a "Material Related Submission Form"<sup>12</sup> in respect of the type of rebars and couplers that they proposed to use. The "Material Related Submission Form" should set out, among other things, the name and type of the proposed rebar / coupler, the name and address of the proposed supplier, and the proposed location and duration for use. MTRCL would then approve, reject or comment on the proposed use of that type of rebar / coupler by reference to the requisite standard and requirements set out in, amongst other things, the acceptance letter issued by the Railway Development Office ("RDO") and the "Materials and Workmanship Specification for Civil Engineering Works" (D/MTRCL/NW/CIV/M&W/001/A3) ("M&W Specification"). Upon MTRCL's approval, the contractor would place orders with the approved supplier and arrange delivery of the approved rebars / couplers to the site.
- 26. Upon delivery of the rebars and couplers to site, the rebars and couplers should be sampled and tested in accordance with the requirements set out in section 10 of the M&W Specification and the "Construction Standard on carbon steel bars for reinforcement of concrete" ("CS2"). Each batch of rebars and couplers delivered to the site should be sampled in accordance with paragraph 10.14 and Appendix 10.1 of the M&W Specifications. The sample details should be recorded in a Steel Test Request Form ("STR Form"). The specimen of rebars should be tested to determine their yield stress, elongation, tensile strength, bending and re-bending properties and unit mass.<sup>13</sup> On the other hand, each specimen of coupler should be tested as a connected assembly (1 coupler joined to 2 lengths of rebar each 500mm long, which should be of the same

<sup>&</sup>lt;sup>12</sup> Clause 15.3.1 of the General Specification for Civil Engineering Works (D/MTRCL/NW/CIV/GS/001/A5)

<sup>&</sup>lt;sup>13</sup> Paragraphs 10.15(1), 10.16-10.19 of the M&W Specification

type, size and grade as the rebars to which the coupler would be fixed in the construction works) to determine the tensile strength and the slip between the coupler and the bars.<sup>14</sup>

27. In addition to the foregoing, MTRCL should comply with RDO's specific sampling and testing requirements set out in its acceptance letter dated 5 November 2014 ("RDO's Acceptance Letter") (which was issued for the construction work to be carried out at, in amongst other locations, NAT (including the 3 Stitch Joints and the Shunt Neck)).<sup>15</sup> In particular, RDO imposed specific strength test requirements and sampling requirements for mechanical couplers for steel reinforcing bars without ductility requirement.<sup>16</sup> In addition, RDO required MTRCL to submit a copy of the manufacturer's quality assurance scheme <sup>17</sup> prior to the commencement of the mechanical splice works.

#### Item 1.7.3: the rebars and couplers which should be used in the construction of the 3 Stitch Joints

Item 1.10: Explain and describe the couplers and rebars actually ordered and used for the 3 Stitch Joints under Contract 1112 and Contract 1111 and explain whether the water seepages had occurred because the rebars were unconnected to the couplers and they were unconnected because the rebar workers were unable to connect them given that wrong materials have been ordered and used under Contract 1112 for the 3 Stitch Joints.

Item 1.18: Please describe and explain the alleged "defective workmanship issue" [stated in Paragraphs 2.4 -2.5 of the 2nd Stitch Joints Report] and "design issue" [mentioned at the 67th PSC Meeting which took place on 30 May 2018].

<sup>&</sup>lt;sup>14</sup> Paragraphs 10.15(3) and 10.22 of the M&W Specification

<sup>&</sup>lt;sup>15</sup>See, in particular, Appendix II for "Reinforced Concrete Works" and Appendix V for "Mechanical Couplers for Steel Reinforcing Bars without Ductility Requirement"

<sup>&</sup>lt;sup>16</sup> Paragraph 4 of Appendix V of the RDO's Acceptance Letter

<sup>&</sup>lt;sup>17</sup> Paragraph 2 of Appendix V to RDO's Acceptance Letter; the quality assurance scheme should include: (i) quality control documentations relating to the production of the mechanical splices; (ii) sample mill certificates of the constituent materials used to produce the couplers; (iii) description of the process of strength hardening and threading the connecting ends of the steel reinforcing bars; (iv) description of the method of installing the steel reinforcing bars to the couplers; (v) documents to prove that manufacturing of the couplers and the process of strength hardening and threading of the connecting ends of steel reinforcing bars are by a factory or factories with ISO 9001 quality assurance certification; and (vi) test results establishing that the permanent elongation and tensile strength of the splicing assemblies are up to the requisite standard.

Item 2.8.4: the rebars and couplers which should have been used in the construction of the Shunt Neck Joint.

Item 2.9: Explain and describe the couplers and rebars actually ordered and used for the Shunt Neck Joint under Contract 1112 and Contract 1111 and explain whether the crack had occurred because wrong materials have been ordered and used for the rebar fixing works under Contract 1112 for the Shunt Neck Joint.

Item 2.20: Explain and confirm whether MTRCL considers there is any issue and concerns in relation to such rebar fixing work and concrete pouring work.

- 28. The materials that had to be used at the 1111/1112 Interface had been repeatedly discussed during various interface meetings attended by representatives of GKJV, Leighton and MTRCL in particular, representatives of GKJV expressly raised on a number of occasions that it would use Lenton couplers at the 1111/1112 Interface. Given that GKJV used Lenton couplers (which have specific threading requirements) at the 1111/1112 Interface, in order to construct the 1111/1112 NSL Stitch Joint, the 1111/1112 EWL Stitch Joint and the 1111/1112 Shunt Neck Joint, Leighton had to order and use Lenton threaded rebar for connection to the Lenton couplers fixed by GKJV at the interface. I did not personally attend those interface meetings, but I have read the minutes of those meetings recently. I understand that Mr Chan Chun Wai Chris (who attended these meetings) will give evidence in this regard.
- 29. However, as revealed during MTRCL's investigations from February to March 2018 (as set out in the 2<sup>nd</sup> Stitch Joints Report and the 2<sup>nd</sup> Shunt Neck Report), Leighton and/or its subcontractor did not screw rebars into the Lenton couplers fixed by GKJV at the 1111 NSL Interfacing Tunnel Structures, the 1111 EWL Tunnel Structures or the interfacing tunnel structures under Contract 1111 at the Shunt Neck, for the construction of the 1111/1112 NSL Stitch Joint, the 1111/1112 EWL Stitch Joint and the 1111/1112 Shunt Neck Joint respectively. Notably, at the 1111/1112 Shunt Neck Joint, Leighton and/or its sub-contractor simply slotted in (but did not screw) rebars into the couplers fixed by GKJV.
- 30. Even if it were the case that Leighton and/or its sub-contractor were unable to screw the rebars into the couplers given that the wrong materials had been ordered, one would have expected that Leighton and/or its sub-contractors would immediately halt the stitch joints / construction joint works, raise the "mismatch" problem with MTRCL,

and seek to resolve it by placing an order for the right kind of materials. Leighton and its subcontractor, however, did not adopt what surely was the obvious course of action to resolve the "mismatch" problem.

- Moreover, the defective connection problems were identified not only at the joints 31. located at the 1111/1112 Interface (where the couplers were fixed by GKJV and the rebars were to be installed by Leighton and/or its subcontractor), but also at the locations where both the couplers and the rebars were to be installed by Leighton and/or its subcontractor without any involvement of GKJV (and hence there cannot have been any "mismatch" of materials). Such locations include: (1) the "1112 side" of the stitch joints at the interface - in this respect I refer to Diagram 1 and paragraph 15(e)(ii) above, where I explained that in order to construct the stitch joints at the interface. Leighton and/or its subcontractor also had to screw rebars into the couplers that they fixed at the 1112 NSL Interfacing Tunnel Structures and the 1112 EWL Interfacing Tunnel Structures; and (2) the 1112/1112 NSL Stitch Joint - where both sides of the joint had to be constructed by Leighton and/or its subcontractor without any involvement of GKJV. Therefore, regardless of whether there was any "mismatch" of materials, Leighton and/or its sub-contractor still failed to screw threaded rebars into couplers.
- 32. In light of the above, the lack of a proper rebar / coupler connection at the 3 Stitch Joints and at the 1111/1112 Shunt Neck Joint was a defective workmanship issue for which Leighton and/or its sub-contractor were responsible.

# Item 1.25: Describe and explain MTRCL's investigations of Leighton and its contractors on Issue 1. Comment on Leighton and its contractors' role and involvement in causing the defects in the 3 Stitch Joints. Produce correspondence exchanged between MTRCL and Leighton/its contractor on this topic.

33. On 20 July 2018, MTRCL issued a letter to Leighton asking for all details in relation to the defective stitch joints. On 27 July 2018, by another letter, MTRCL requested Leighton to provide information relevant to, amongst other things, the defects at the 3 Stitch Joints, including in particular: a chronology of events; records that demonstrated continuous supervision of the works; relevant as-built records and photographs of the work; relevant reports produced or investigations undertaken; evidence to demonstrate that any irregularities concerning the 3 Stitch Joints had been rectified in accordance with the relevant Specifications of the Contract; assurance as to the safety and integrity of the works; all quality assurance/quality control records, and all RISC forms; a proposal on how Leighton intended to close out the NCRs issued in respect of the 3 Stitch Joints; and a proposal to otherwise demonstrate and provide confidence in the safety and structural integrity of the works concerned. Moreover, MTRCL asked about the details of the actions (if any) taken against the responsible sub-contractor(s) in respect of the defective stitch joints.

34. On 30 July 2018, Leighton replied to MTRCL's letter dated 20 July 2018. However, Leighton only provided information and records regarding the rectification works of the 3 Stitch Joints, but no information regarding the defective stitch joints. On 4 October 2018, Leighton issued its reply letter to MTRCL's letter dated 27 July 2018, together with a batch of documents including, amongst others, (as alleged by Leighton) "All available quality control records and as-built documentation" and "photographs and other contemporaneous evidence to demonstrate that the works were constructed in accordance with the Working drawings and specifications". As regards MTRCL's query concerning the details of actions taken against the responsible sub-contractor(s), it was stated in the letter that Leighton raised an internal non-conformance on 19 March 2018, and that after a meeting with the senior management of Wing Kwong (the rebar fixing sub-contractor responsible for the works at the NAT), "it was decided that Wing and Kwong would not be carrying out any further work on the project, including the remedial work required to rectify the defective stitch joints".

# Item 1.26: Explain the status of the 3 NCRs and whether they have now been closed out on completion of the rectification works.

Item 1.27: Confirm whether other NCRs have been issued in relation to the 3 Stitch Joints and if so, please identify, explain the reason for the NCRs and the nature of the noncompliance and produce a copy of the relevant NCRs. NCRs concerning missing RISC forms and deviations will be covered separately under Issue 3 and should not be addressed under 1.27.

#### Item 2.24.1: Please elaborate and supplement the said reports if there are other matters which should be drawn to the Commission's attention and if there is any further development on the subject, and provide relevant records, documents and photographs in support.

Item 2.24.2: Confirm all defects concerning the Shunt Neck Joint have now been rectified. If rectification works have not been completed, describe the progress and when it is anticipated that such works should be completed.

#### Item 2.27: Explain the status of [NCR 267] and whether it has been closed out.

- 35. The investigations and circumstances leading to the NCRs relating to the 3 Stitch Joints are set out in section 2 of the 2<sup>nd</sup> Stitch Joints Report. In short, I issued on behalf of MTRCL NCR 066 dated 22 December 2017 to Leighton in respect of the problems of water leakage and crack identified at the 1111/1112 NSL Stitch Joint. After MTRCL's investigation in February 2018, which revealed the defective connection issues at the 3 Stitch Joints, I on behalf of MTRCL issued to Leighton NCR 095 dated 9 February 2018 (for the 1111/1112 NSL Stitch Joint and the 1111/1112 EWL Stitch Joint), and NCR 096 dated 14 March 2018 (for 1112/1112 NSL Stitch Joint), in respect of the water leakage, cracks and defective connection problems found at the 3 Stitch Joints.
- 36. The rectification works for the 3 Stitch Joints took place from March to July 2018. I understand that the details in this regard will be provided by Mr Lee Chiu Yee, Jacky in his witness statement. NCR 095, NCR 096 and NCR 066 were eventually closed out on 28 June 2018, 5 September 2018 and 5 September 2018 respectively. I also confirm that no other NCRs have been issued in relation to the 3 Stitch Joints (apart from those issued relating to Issue 3).
- 37. As to the 1111/1112 Shunt Neck Joint, on 30 October 2018 MTRCL submitted the "Remedial Proposal for Shunt Neck Connection at 1111/1112 Interface for NAT Structure" to RDO. By a letter dated 21 December 2018, RDO replied with comments, and MTRCL issued its reply to those comments on 23 April 2019. Remedial works will be carried out once RDO's approval is obtained. I wish to add that as Leighton did not construct the 1111/1112 Shunt Neck Joint in accordance with the working drawings, which constituted a non-conformance on the part of Leighton in addition to the defective workmanship problem (i.e. failing to screw rebars into couplers but simply

slotting rebars into couplers – see paragraphs 3.4 to 3.5 of the 2<sup>nd</sup> Shunt Neck Report), I issued NCR 267 on behalf of MTRCL to Leighton on 30 October 2018. This NCR is expected to be closed out also upon the completion of the remedial works for the 1111/1112 Shunt Neck Joint.

- 38. Finally, I would like to mention the following:
  - (a) Some of the events in question and which form the subject matter of the Commission of Inquiry took place one to two years ago and my recollection of every detail is not therefore perfect.
  - (b) Accordingly, in preparing this witness statement I have reminded myself of the events in question by reference to various hard copy and electronic documents and materials. I understand these materials were retrieved by MTRCL's Legal Department, with the assistance of the MTRCL's external lawyers, Mayer Brown.

Dated 3 May 2019

**FU YIN CHIT** 

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

#### Corrigendum to the Witness Statement of Fu Yin Chit dated 3 May 2019

Page	Paragraph	Content
BB73	15(e)(i)-(iii)	Replace paragraph 15(e)(i)-(iii) with:
		<i>"After the differential movements of the two structures were stabilised:</i>
		(i) GKJV exposed the couplers fixed at the 1111 NSL Interfacing Tunnel Structures and Leighton screwed rebars (the "1111 rebars") into those couplers;
		<ul> <li>(ii) Leighton exposed the couplers fixed at the 1112 NSL Interfacing Tunnel Structures and screwed rebars (the "1112 rebars") into those couplers;</li> </ul>
		(iii) Leighton lapped the 1111 rebars with the 1112 rebars at their intersections (and, hence, form what is referred to as a "stitch" joint)."

