

**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**

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**WITNESS STATEMENT OF BRETT BUCKLAND**

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I, BRETT BUCKLAND, of 39/F Sun Hung Kai Centre, 30 Harbour Road, Hong Kong, say as follows:

1. I am a Senior Site Agent of Leighton Contractors (Asia) Limited (“**Leighton**”), the main contractor for the Hung Hom Station Extension contract (Contract SCL 1112) (the “**Project**”) under the Shatin-Central rail link project. The project manager for the Project is MTR Corporation Limited (“**MTRCL**”).
2. I make this statement in response to Lo & Lo’s letter dated 10<sup>th</sup> August 2018 (“**Letter of 10<sup>th</sup> August 2018**”).
3. 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, information and belief.

**My experience and role on the Project**

4. I am a qualified Civil Engineer. I have 20 years of experience in engineering and construction. I joined Leighton in 2009.
5. I commenced working on the Project in March 2013. Up to 31<sup>st</sup> May 2015, I was the manager of the design engineering team for the Project. After that, I continued managing a section of the team, reporting to the Chief Engineer up until approximately early to mid-November 2015, after which I transferred to the

commercial team for the Project. I worked on matters relating to the design for the connection between the East West Line platform slab (“EWL Slab”), the eastern diaphragm wall and the slab for the Over Track Exhaust duct (“OTE Slab”).

### **Response to Request of Letter of 10<sup>th</sup> August 2018**

6. The relevant text from the Letter of 10<sup>th</sup> August 2018 is as follows:

*“The Commission requires your client, as the main contractor responsible for the construction of the diaphragm walls, to explain and confirm whether your client has carried out the alleged deviation of the as-built conditions from the BD’s approval plans and caused the top of the completed diaphragm walls to be demolished. If so, please explain the reasons for the deviation and why approval of such deviation had not been sought from the BD. Your client should explain how such deviation may affect the structure, integrity and safety of the diaphragm walls and platform slabs. Please also comment on the allegations and matters raised in the Government Press Conference and the MTRCL Press Conference in relation to the diaphragm walls. Authorities relied on by your client should be provided.”*

7. I understand that the Letter of 10<sup>th</sup> August 2018 refers to the use of continuous reinforcement bars (i.e. not connected by couplers) to connect the EWL Slab, the eastern diaphragm wall and the OTE Slab (the “Change”). As explained below, this represented a change in construction detail (not design) as the reinforcement bars were originally intended to be connected using couplers but were replaced with continuous reinforcement bars. Ultimately, this represented a better, more robust design. Couplers were only used in the original design because the construction sequence did not allow for continuous reinforcement bars to be adopted (i.e. as the diaphragm wall needed to be constructed before the EWL Slab and OTE Slab).
8. As many people were involved in the events relating to the Change, there is no one person at Leighton with direct knowledge of all these events. I am able to assist

the Commission because I managed the design engineering team for the Project at the time.

9. At the outset, there are three key points that the Commission should appreciate:
  - (a) only MTRCL dealt with the Buildings Department (“BD”) in relation to changes of the permanent works;
  - (b) The Change amounts to a modification of detail not of design. It did not require BD’s prior consultation or acceptance; and
  - (c) In any event, the Change was notified to MTRCL. In turn, MTRCL notified the Change to, and it was accepted by, BD.
  
10. I set out below:
  - (a) an explanation of the responsibilities of MTRCL and Leighton in relation to design changes;
  - (b) an explanation of why the Change was made (including a chronology of key events) and how Leighton discharged its duties in relation to the Change; and
  - (c) my views on why the works undertaken to implement the Change are safe.

### **Responsibilities in Relation to Design Changes**

11. I set out below a summary of the way in which the parties dealt with any change in the design of the permanent works.
  
12. The design of the permanent works for the Project was performed by MTRCL’s Detailed Design Consultant (“DDC”) (Atkins). Atkins was responsible for updating the drawings relating to the design of the permanent works.

13. The works that Leighton are carrying out on the Project are exempt from the usual requirements of the Building Ordinance under the Instrument of Exemption (the “IoE”) (numbered LCAL.R1.145 in the Index of Documents disclosed to the Commission (the “Index”).<sup>1</sup> It follows that there was no requirement to obtain approval from BD in relation to a change in the design of the works (e.g. such as the Change). The only obligation in relation to a change in the design of the works is to consult with BD.

14. BD describes its approval process for buildings that are subject to the usual requirements of the Building Ordinance in Practice Note for Authorised Persons PNAP ADM-19 (numbered LCAL.R6.06 in the Index). Sections 17 and 18 of Practice Note for Authorised Persons PNAP ADM-19 state:

*“Minor Amendments*

*17. With regard to building works for which consent has been given, the requirement for prior approval and consent for all subsequent amendments may affect the progress of construction.*

*18. Subject to a modification of regulation 33(1) of the Building (Administration) Regulations (B(A)R) being granted by the Building Authority (BA) under section 42(1) of the BO, prior approval and consent to minor amendments of building, superstructure and drainage works, for which the first consent has already been given, would not be required except for the amendments described in Appendix G.”*

15. This means that if BD has already approved and consented to the design for the construction of a structure, any minor changes do not need to be re-submitted to

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<sup>1</sup> Please refer to Section P2 of Particular Specification which states that the IoE applies to the Project.

BD before being implemented unless they are covered by Appendix G of Practice Note for Authorised Persons PNAP ADM-19.

16. Appendix G of Practice Note for Authorised Persons PNAP ADM-19 relevantly provides that minor amendments which affect the overall stability of the building are not permitted to be deferred in their submission to BD (i.e. BD's prior approval or consent is required).
17. As the works for the Project are exempt under the IoE, the requirements of the BO and Practice Note for Authorised Persons PNAP ADM-19 do not apply to the works relating to the Change. In any event, even if there was an obligation to obtain BD's approval for any change in the works (which there is not because of the IoE), there is no obligation to seek BD's prior approval or consent to a change in detail that does not affect the overall stability of a structure.
18. MTRCL was principally responsible for determining whether any change to the works required consultation with BD. If consultation was necessary, MTRCL was responsible for consulting with BD in relation to any such change. In this context, MTRCL handled all dealings with BD. Leighton did not communicate with BD directly in relation to any such change.<sup>2</sup> As noted below, MTRCL discharged this obligation to consult with BD in relation to the Change.
19. Leighton assisted MTRCL in discharging its obligation (if any were to arise) to consult with BD by providing relevant submissions to MTRCL. As part of this process, Leighton engaged Atkins to perform temporary works design analysis and prepare submissions to be sent to MTRCL.<sup>3</sup> Leighton engaged Atkins in 2013 and continued to use them in this capacity.

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<sup>2</sup>The only exception is that Leighton attended meetings between MTRCL and BD on temporary works aspects.

<sup>3</sup> Typically, the same group of people at Atkins acted as MTRCL's DDC and also for Leighton.

20. The primary mechanism by which Leighton provided submissions to MTRCL was in the form of Temporary Works Design Submissions. The type of submission was, and continued to be, sent to MTRCL using a Contractor's Submission Form ("CSF"). Under a CSF, Leighton would seek approval from MTRCL if it was necessary to depart from the original design of the permanent works. Leighton always understood, and continues to operate on the understanding, that it can proceed with any proposed variation once it is approved by MTRCL. This reflects the fact that MTRCL is the Competent Person under the IoE.

### **Explanation and Chronology of the Change**

21. Leighton has prepared a detailed chronology of the key events that relate to the Change (produced and marked **Exhibit "BB-1"**).<sup>4</sup> I confirm that this chronology is accurate. For convenience, I set out below a summary of the relevant events in relation to, and an explanation of the need for, the Change.
22. The original design for the connection between the relevant parts of the EWL Slab, the diaphragm wall and the OTE Slab consisted of two rows of reinforcement bars from the EWL Slab and one row of reinforcement bars from the OTE Slab.<sup>5</sup> These were intended to be connected to couplers cast into the diaphragm wall. The reinforcement bars from the EWL Slab and the OTE Slab were intended to connect with L-shaped bars in the diaphragm wall (which would be bent so that they ran vertically down into the diaphragm wall). The L-shaped bars in the diaphragm wall were intended to provide anchorage. This is reflected in the diagrams produced and marked **Exhibit "BB-2"**. Please refer to the first set of diagrams in Exhibit BB-2.

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<sup>4</sup> A copy of the relevant correspondence exchanged between the parties (as referred to in the chronology at Exhibit "BB-1") have been disclosed to the Commission.

<sup>5</sup> See drawing numbered 1112-W-HUH-ATK-606A Detail E, which has been disclosed to the Commission and is included in document numbered LCAL.R1.193 in the Index.

23. In my experience, it is typical that designers do not give full consideration to the construction methods that are used for reinforcement details. As a result, these details often need to be adjusted as part of the construction process. This is what happened in relation to the Change. In particular, the original design did not take into account the need to insert a 300 millimetre diameter tremie pipe down between the reinforcement bars that were intended to be installed in the diaphragm wall in order to allow concrete to be poured properly.
24. It was therefore necessary to create space in between the reinforcement bars for the tremie pipe (along with sonic test and interface coring reservation pipes) to be inserted down into the diaphragm walls. In order to do so, the reinforcement bars in the diaphragm wall needed to be re-arranged. This is shown in the second set of diagrams in Exhibit "BB-2".
25. Leighton worked with MTRCL and Atkins in relation to this change in detail. Both parties were fully aware of these issues and the solutions that were adopted.<sup>6</sup> MTRCL submitted this change to BD for consultation and it was accepted by BD.<sup>7</sup> In addition, MTRCL supervised the construction of these works (as it did for all works on the Project).
26. In this context, Leighton was considering the construction method and sequence for constructing the EWL Slab, including the interface between the EWL Slab, the diaphragm wall and the OTE Slab. As a result, and in light of the issues that were raised with Atkins by way of Technical Queries ("TQ")<sup>8</sup> numbered 33 and 34

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<sup>6</sup> Please refer to items #004-16, #004-11, #006-1, #004-9, #013-01 to #013-24 in the chronology set out in Exhibit "BB-1".

<sup>7</sup> Please refer to items #013-27 and #013-28 in the chronology set out in Exhibit "BB-1".

<sup>8</sup> Technical Queries are documents which raise requests for clarification from Atkins. They are the primary means by which Leighton seeks Atkins input before making a submission to MTRCL regarding a design change.

(produced and marked **Exhibit “BB-3”**), Leighton concluded that it would be appropriate to adopt the Change in the relevant areas.<sup>9</sup>

27. On or around 20 July 2015, Leighton proposed to MTRCL that the Change be made in Areas C1 and C2 by issuing a submission numbered “1112 CSF LCA DEM 000147” (numbered LCAL.17.02 in the Index) (the “**First Submission**”).<sup>10</sup> The Change (as explained at Section 6.2 of the First Submission) contained the following elements:
- (a) The top of the diaphragm wall would be trimmed to the lowest level of the top reinforcement bars in the relevant part of the EWL Slab (a minimum of 420mm below the top level of EWL Slab);<sup>11</sup>
  - (b) The top reinforcement bars in the relevant part of the EWL Slab would be connected to the corresponding reinforcement bars in the OTE Slab to achieve full tension laps. That is, continuous reinforcement bars would be used to connect the EWL Slab, the eastern diaphragm wall and the OTE Slab; and
  - (c) The EWL Slab and the OTE Slab would be cast concurrently (aka - monolithically) as part of a single concrete pour.<sup>12</sup>
28. This use of continuous bars effectively replaced bars that would otherwise have been connected by couplers. This change is shown in the third set of diagrams in Exhibit “BB-2”.

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<sup>9</sup> This decision was made by Leighton’s construction engineering team after consultation with MTRCL.

<sup>10</sup> Please refer to item #-010-9 in the chronology set out in Exhibit “BB-1”.

<sup>11</sup> This was in addition to the contractual requirement to break down the top one metre of the as-constructed diaphragm wall in any event.

<sup>12</sup> This was how the relevant works were constructed. The only exception is that for Bay C1-1, the EWL Slab and diaphragm wall were poured together and then a separate concrete pour was completed for the OTE Slab. This approach was approved by the MTRCL’s Registered Structural Engineer (as nominated under the IoE). Please refer to item #005-14 in the chronology set out in Exhibit “BB-1”.



29. The Code of Practice for Structural Use of Concrete 2013 (numbered LCAL.R6.05 in the Index), as prepared by BD, allows for the use of either continuous reinforcement bars (as connected by lapping) or reinforcement bars connected by couplers (i.e. one can be substituted for the other).<sup>13</sup> That is, the choice between either continuous reinforcement bars or reinforcement bars connected by couplers is left up to the construction contractor as a minor matter of “detail”. It is not a change in “design”.
30. The Change satisfied the applicable structural performance requirements and also ensured uniform reinforcement spacing from the EWL Slab across the diaphragm wall to the OTE Slab. It did not affect the overall stability of the structure (as per the accepted drawings).<sup>14</sup>
31. In fact, the reinforcement that was installed in the as built works is an improvement on the reinforcement detail set out in the original design. This is because more horizontal, straight rebars were used to connect the EWL Slab, the eastern diaphragm wall and the OTE Slab. This improvement to the reinforcement detail is shown in the third set of diagrams in Exhibit BB-2.
32. On 27 July 2015, Leighton issued TQ-33<sup>15</sup> to seek clarification from Atkins regarding the anchorage bars for the EWL Slab that were intended to be installed in the OTE Slab. Leighton noted that due to the geometry of the OTE Slab and the diaphragm wall there was inadequate space to achieve the required anchorage length without bending the reinforcement bars to form L-shaped bars (which could not be effectively installed due to their geometry). As part of its response, Atkins advised that the EWL Slab and the OTE Slab should be cast monolithically (i.e.

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<sup>13</sup> Please refer to Section 8.7 of the Code of Practice for Structural Use of Concrete 2013.

<sup>14</sup> It follows that (as noted at paragraph 13 above), even if the IoE does not apply to the works (which it does), there was no obligation to obtain BD’s prior acceptance of this change in detail before construction (i.e. the change from reinforcement bars connected by couplers to continuous reinforcement bars).

<sup>15</sup> Please refer to item #005-9 and #005-11 in the chronology set out in Exhibit “BB-1”.

cast together, as recommended under Practice Note for Authorised Persons PNAP APP-68 (numbered LCAL.R6.07 in the Index)).

33. On 27 July 2015, Leighton issued TQ-34<sup>16</sup> to seek Atkin's advice on how to address the fact that the couplers cast into the diaphragm wall that were intended to be connected to the reinforcement bars in the EWL Slab were out of tolerance (i.e. cast in a position which is outside of the intended area). Leighton proposed trimming off the top portion of the diaphragm wall and replacing the couplers and connected bars in the diaphragm wall with continuous reinforcement bars that would run from the EWL Slab through the diaphragm wall into the OTE Slab.<sup>17</sup> Atkins responded by stating: "*No adverse comment*".<sup>18</sup>
34. On 29 July 2015, MTRCL submitted a copy of the First Submission to BD.<sup>19</sup>
35. On 8 December 2015, BD provided in principle acceptance of the First Submission.<sup>20</sup>
36. On 21 March 2016, Leighton proposed to MTRCL that the Change be made in Area C3 by issuing a submission numbered "1112 CSF LCA DEM 000302" (numbered LCAL.R17.02 in the Index) (the "**Second Submission**").<sup>21</sup>
37. On 23 March 2016, MTRCL submitted a copy of the Second Submission to BD.<sup>22</sup>
38. On 28 April 2016, BD provided in principle acceptance of the Second Submission.<sup>23</sup>

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<sup>16</sup> Please refer to item #005-10 in the chronology set out in Exhibit "BB-1".

<sup>17</sup> The only exception is that a single row of couplers were used to connect the top row of the reinforcement bars in the OTE Slab (at Bay C1-1) to the corresponding bars running from the EWL Slab. Please refer to the diagram in TQ-34 at Exhibit "BB-#" for a graphical representation.

<sup>18</sup> Please refer to items #005-12 in the chronology set out in Exhibit "BB-1".

<sup>19</sup> Please refer to item #005-13 in the chronology set out in Exhibit "BB-1".

<sup>20</sup> Please refer to item #010-11 in the chronology set out in Exhibit "BB-1".

<sup>21</sup> Please refer to item #010-12 in the chronology set out in Exhibit "BB-1".

<sup>22</sup> Please refer to item #010-13 in the chronology set out in Exhibit "BB-1".

<sup>23</sup> Please refer to item #010-14 in the chronology set out in Exhibit "BB-1".

39. In this context, Leighton raised the Change with MTRCL and understood that BD was consulted and accepted it.
40. Leighton proceeded to construct the relevant works at Bays C1-1 and C1-2 by replacing the top row of reinforcement bars connected by couplers with continuous reinforcement bars. For the other bays in Area C1, C2 and C3, all top layers of reinforcement connected by couplers were replaced with continuous reinforcement bars.
41. In addition, MTRCL was fully aware of and supervised the construction of the works performed in relation to the Change. Any suggestion that Leighton acted without approval in relation to the Change is without merit.

**The relevant works are safe**

42. The key aspect of the Change was the replacement of reinforcement bars connected by couplers with continuous reinforcement bars. As noted at paragraph 28 above, this did not affect the overall stability of the structures. Reinforcement bars that are connected by couplers serve the same purpose as continuous reinforcement bars.<sup>24</sup> Couplers only need to be used in order to connect reinforcement bars that are pre-cast in concrete with reinforcement bars that will be subsequently installed into an adjoining concrete structure (i.e. to connect reinforcement bars at a construction joint). There is no reason to doubt the safety of the works undertaken to implement the Change, especially because of the use of continuous reinforcement bars rather than bars connected by couplers.
43. My view is further confirmed by the fact that the Change removed most of the construction joints between the EWL Slab, the eastern diaphragm wall and the OTE Slab by allowing for the connection of these structures to be cast monolithically (i.e. as part of single concrete pour). This change is shown in the final set of diagrams

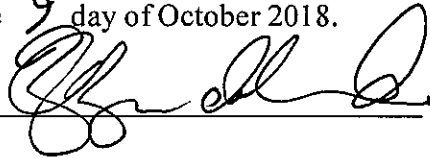
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<sup>24</sup> Please refer to Section 8.7 of the Code of Practice for Structural Use of Concrete 2013.

in Exhibit “BB-2”. Construction joints are potential points of weakness in a concrete structure. It is therefore better to minimise construction joints where possible.

44. In my opinion, the works undertaken to implement the Change are safe and structurally sound. I reach this conclusion because:
- (a) The works satisfy all relevant requirements of the reinforcement under the accepted drawings;
  - (b) There is no adverse change to the reinforcement details under the accepted design;
  - (c) There is no change in the load path of the reinforcement;
  - (d) There is no adverse change in the size, number, spacing or anchorage of the reinforcement bars;
  - (e) The EWL Slab and the OTE Slab were cast monolithically;<sup>25</sup> and
  - (f) The as-constructed details do not affect the stability of the structure.<sup>26</sup>

Dated the 9<sup>th</sup> day of October 2018.

Signed: 

Brett Buckland

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<sup>25</sup> Subject to footnote 10.

<sup>26</sup> See paragraphs 28 to 30 above.