

The Shatin to Central Link Project

Interim Report No. 1

Expert Adviser Team
Transport and Housing Bureau

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EXECUTIVE SUMMARY

1. Since late May 2018, reports began to appear in the local media about irregularities in certain construction works of the Shatin to Central Link (“SCL”) Project carried out by the MTR Corporation Limited (“MTRCL”). The alleged defective steel bar connection works in the East West Line (“EWL”) platform slab and diaphragm wall at the Hung Hom Station Extension and the settlement-related issues at the Exhibition Centre Station and To Kwa Wan Station sites have attracted particular concern.

2. On 15 August 2018, the Expert Adviser Team (“EA Team”) comprising three senior retired government officers was established under the Transport and Housing Bureau (“THB”) to provide expert advice in following up the case.

3. Over the past two months, the EA Team has carried out site visits, reviewed relevant documents, and met with MTRCL and the relevant government departments. The EA Team has made 16 preliminary recommendations. These recommendations were discussed in the high-level meetings convened by THB and attended by the EA Team, MTRCL and the relevant government departments.

4. Regarding the load test proposal for the EWL platform slab, MTRCL has been discussing this with the relevant government departments since June 2018. The EA Team considered that the acceptability of the EWL platform slab could hardly be ascertained by the load test alone, particularly as more irregularities have come to light since June 2018. The EA Team is not convinced that the load test can address the structural safety, long-term durability and serviceability of the built structures.

5. The reported irregularities concerning the built structures of the Hung Hom Station Extension are no longer confined to the connections between the EWL platform slab and the eastern diaphragm wall. Other irregularities have been reported or discovered. They include the inconsistencies in records provided by MTRCL, honeycombs and voids in the soffit of the EWL platform slab, and possible issues in the construction of the diaphragm walls. There

is an inevitable concern if similar irregularities also exist in the North South Line ("NSL") platform slab. The EA Team has further suggested MTRCL to review records whether there are other reported or suspected irregularities that might have adverse effects on the structural performance. So far, MTRCL has not provided any information in this regard.

6. All these call for a holistic strategy to be devised by MTRCL for assessing the acceptability of the built structures of the Hung Hom Station Extension. The strategy should encompass a combination of diagnoses, including but not limited to verifying available objective records, physical inspections through opening up the structures, non-destructive tests and load tests. Furthermore, apart from the EWL platform slab, the North South Line platform slab and the diaphragm walls shall also be assessed.

7. Upon discussion, MTRCL have agreed to formulate the required holistic strategy.

8. MTRCL submitted a proposal for the verification of part of the EWL platform slab to the Highways Department on 15 October 2018. The Government considered that the proposal obviously failed to meet the requirement of the holistic assessment strategy described above. The proposal has major technical deficiencies, and it covers neither the NSL platform slab nor the diaphragm walls. MTRCL agreed to enhance this proposal. MTRCL also agreed to formulate the plan for verification of the outstanding portion of the EWL and NSL platform slabs and the diaphragm walls for incorporation into the enhanced proposal to meet the requirement of the holistic assessment strategy. However, MTRCL requested the deadline for submission be extended from end-October to mid-November 2018. The Government urged MTRCL to submit the holistic assessment strategy expeditiously.

9. Regarding the settlement-related issues, the Government has reviewed the monitoring and control system with MTRCL to ensure strict observance of the accepted monitoring plans in the remaining works of the SCL Project. A new mechanism for monitoring and making announcement

for impact of the SCL works on nearby structures and public facilities was promulgated by the Government on 28 September 2018. The EA Team considered that the revision of the Alert-Action-Alarm Levels should be made with full justifications and the number of revisions should also be minimized. EA Team's views were incorporated in drawing up the mechanism.

10. The EA Team shares the concern about the lack of transparency to the affected parties in the previous operation of the monitoring and control system and in the revision of the trigger levels. While the EA Team considers that the new mechanism will improve the situation, its effectiveness will depend on whether the requirements set out therein are thoroughly followed. In the coming months, the EA Team will audit selected cases, including cases before and after implementation of the mechanism, as part of its review of the settlement-related issues in the SCL Project.

11. In the coming months, a large amount of work will need to be carried out for following up the reported irregularities and other issues under review. The EA Team urges MTRCL to take prompt and thorough actions in following up EA Team's recommendations and to maintain a high level of transparency in addressing all relevant issues under review.

SECTION 1 INTRODUCTION

Background

1.1 Since late May 2018, there have been reports in the local media about irregularities in the construction works of the Shatin to Central Link (“SCL”) Project implemented by the MTR Corporation Limited (“MTRCL”). Background of the SCL Project is at *Appendix A*. The reported irregularities include defective connection of reinforcement steel bars at the Hung Hom Station Extension, excavation works exceeding the allowable depth and steel reinforcement cages of the diaphragm wall installed in the wrong direction in Exhibition Centre Station, part of the concrete walls of To Kwa Wan Station not properly constructed, and excessive settlements at the Exhibition Centre Station and To Kwa Wan Station sites.

1.2 In following up the reported irregularities in the Hung Hom Station Extension, Highways Department (“HyD”) considered that the matter might involve criminal elements. On 15 June 2018, HyD referred the case to the Police for follow-up action.

1.3 On 10 July 2018, the Chief Executive in Council appointed the Commission of Inquiry (“Commission”) under the Commissions of Inquiry Ordinance (Cap. 86) to inquire into the steel reinforcement fixing works and any other works which raise concerns about public safety in respect of the diaphragm wall and platform slab construction works at the Hung Hom Station Extension under the SCL Project.

1.4 From a review of the information submitted by MTRCL on 13 July 2018, HyD and Buildings Department (“BD”) have further identified that the information provided by MTRCL about the connection details between the platform slab of the East West Line (“EWL”) and the diaphragm wall of the Hung Hom Station Extension was inconsistent with the design drawings previously accepted by BD. The number of couplers used in connecting the reinforcement steel bars was also inconsistent with the site records previously provided by MTRCL and their Contractor. The observed inconsistencies

were disclosed to the public by the Government in a press conference on 7 August 2018¹.

Establishment of Expert Adviser Team

1.5 On 8 August 2018, the Chief Executive announced the appointment of three senior retired government officers, namely Dr LAU Ching-kwong, Mr HUI Siu-wai and Mr WONG Hok-ning, to form the Expert Adviser Team (“EA Team”) for the SCL Project. The EA Team was formally established by the Transport and Housing Bureau (“THB”) on 15 August 2018. By late August 2018, three senior professional officers were deployed from HyD, BD and Civil Engineering and Development Department respectively to provide technical support to the EA Team.

1.6 The EA Team is tasked to conduct an overall review of the project management system of MTRCL, and recommend additional management and monitoring measures to be undertaken by MTRCL and government departments as appropriate, in taking forward the SCL Project. In particular, the EA Team will provide expert advice on ascertaining the structural safety and as-built condition of the platform slabs and diaphragm walls of the Hung Hom Station Extension, possible measures to ascertain if there are other irregularities in the construction of key structures in the SCL Project, and any other matters relevant to the works of the SCL Project. The Terms of Reference of the EA Team is at *Appendix B*.

1.7 The three expert advisers are appointed for a period of one year. It is intended that the EA Team will complete a final report on the findings in about nine months’ time. Where necessary, interim report(s) may also be submitted.

¹ THB and HyD have reported the case in LC Paper No. CB(4)1514/17-18(01) entitled ‘Incident Relating to Construction of the Platform Slab of Hung Hom Station Extension Works under the Shatin to Central Link Project’ for discussion in the LegCo Panel on Transport on 31 August 2018.

Scope of Interim Report

1.8 This Interim Report was prepared by the EA Team to summarize the progress and outcome of EA Team's work in the first two months since its establishment. The work of the EA Team and its preliminary recommendations made in the period are described in *Section 2* below. There have been major public concerns about the integrity of the built structures in the Hung Hom Station Extension and the settlement-related issues at the Exhibition Centre Station and To Kwa Wan Station sites. An update of the reported irregularities in the built structures in the Hung Hom Station Extension and the assessment strategy is given in *Section 3*, and that of the settlement-related issues is highlighted in *Section 4*. A brief account of key areas of further work to be undertaken by the EA Team is presented in *Section 5*.

1.9 The EA Team hopes that the release of the Interim Report will not only provide updated information from EA Team's perspective on the progress made by the relevant parties but also enhance the transparency and traceability of EA Team's work.

SECTION 2 WORK UNDERTAKEN BY EXPERT ADVISER TEAM

Main Areas of Work

2.1 The main areas of the work undertaken by the EA Team up to the date of this report included:

- (a) meeting the Chief Executive, Secretary for Transport and Housing, Permanent Secretary for Transport and Housing (Transport) and other members of THB, to discuss the role and work of the EA Team;
- (b) meeting, collecting information from, discussing EA Team's observations and exchanging views on issues of concern and areas for improvement with MTRCL and the relevant government departments;
- (c) visiting the Hung Hom Station Extension, Exhibition Centre Station and To Kwa Wan Station sites, for familiarization of the site setting and conditions, inspection of selected parts of the completed works and works under construction, and discussion with members of the site staff;
- (d) reviewing the information collected and feedback obtained, and identifying the lines of enquiry and tasks to be carried out;
- (e) consolidating the progress and observations made, formulating preliminary recommendations, and reporting the findings to THB; and
- (f) participating in high-level meetings held by THB ("Project Meetings") to present EA Team's views and recommendations and to review the progress of the follow-up actions by MTRCL and the relevant government departments.

Preliminary Recommendations

2.2 The EA Team notes the need for tendering timely recommendations throughout the course of its work, instead of withholding the recommendations until the submission of the final report in about nine months' time. This will facilitate the relevant parties to consider follow-up actions in an appropriate and timely manner.

2.3 The EA Team has made a total of 16 preliminary recommendations over this two-month period. The recommendations were submitted to the THB in two batches. The first batch comprised six recommendations, which are itemized as Preliminary Recommendation (“PR”) Nos. 1.1 to 1.6 for easy reference. The second batch contained ten recommendations, which are itemized as PR Nos. 2.1 to 2.10. Before making the recommendations, where circumstances permit, the EA Team would discuss the pertinent observations and considerations leading to the recommendations with MTRCL and the relevant government departments.

2.4 The 16 preliminary recommendations are listed in three groups, viz. (a) General, (b) Hung Hom Station Extension, and (c) Settlement-related Issues in *Appendix C* for easy reference. All the preliminary recommendations were presented and discussed in the Project Meetings held by THB and attended by the EA Team, MTRCL and the relevant government departments.

SECTION 3 HUNG HOM STATION EXTENSION

Works at Hung Hom Station Extension

3.1 Hung Hom Station Extension is one of the ten new or extension of existing stations of the SCL Project. The Hung Hom Station Extension is an underground station to be constructed underneath the existing concourse of Hung Hom Station, under Contract Number 1112 - Hung Hom Station and Stabling Sidings of MTRCL. The contract commenced in March 2013. The civil engineering works were substantially completed in April 2018. The contractor is Leighton Contractors (Asia) Limited (“Leighton”).

3.2 Civil engineering works under the contract mainly comprise the construction of diaphragm walls, an upper platform for the EWL and a lower platform for the North South Line (“NSL”), as well as stabling sidings. A general layout plan of the EWL platform slab and a diagrammatic cross-section of the platform slabs and diaphragm walls of the Hung Hom Station Extension are shown in *Figures 1* and *2* respectively. The diaphragm walls at the western and eastern sides of the station were first constructed, to serve as retaining walls to facilitate the top-down² excavation and construction of the EWL and NSL platform slabs. In other words, the EWL platform slab was constructed to provide part of the required lateral support to the diaphragm walls, before the ground was further excavated to the NSL platform level for the construction of the NSL platform slab. As is the usual practice, the diaphragm walls also serve as the permanent structural walls of the underground station.

3.3 The diaphragm walls and platform slabs of the EWL and NSL are cast-in-situ reinforced concrete structures. Owing to their sizeable lateral dimensions, the diaphragm walls and platform slabs were constructed panel by panel, instead of being cast in one go. Notwithstanding this, since the diaphragm walls and platform slabs are designed as monolithic structures, the steel bars required for reinforcing the concrete needed to continuously go through the structures (i.e. between the diaphragm wall and the platform slab, and between adjoining panels of the platform slabs), except at specific locations where expansion joints were provided between the structures.

² Bottom-up construction method was adopted for the part of the Hung Hom Station Extension underneath the Hong Kong Coliseum.

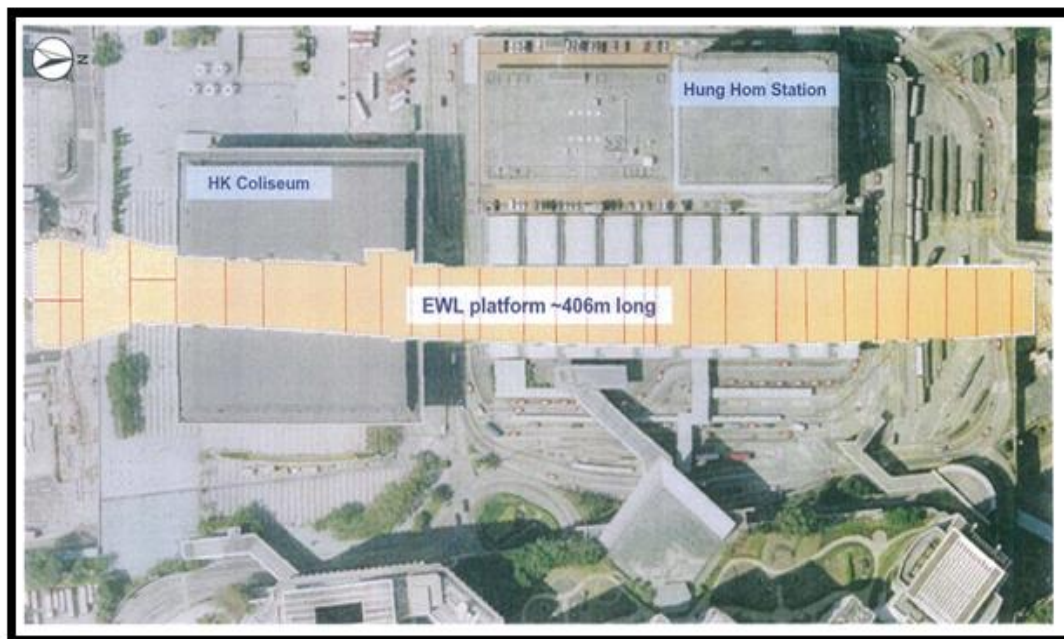


Figure 1 – General layout plan of the EWL platform slab of the Hung Hom Station Extension

(Note: Extracted from MTRCL's report dated 15 June 2018)

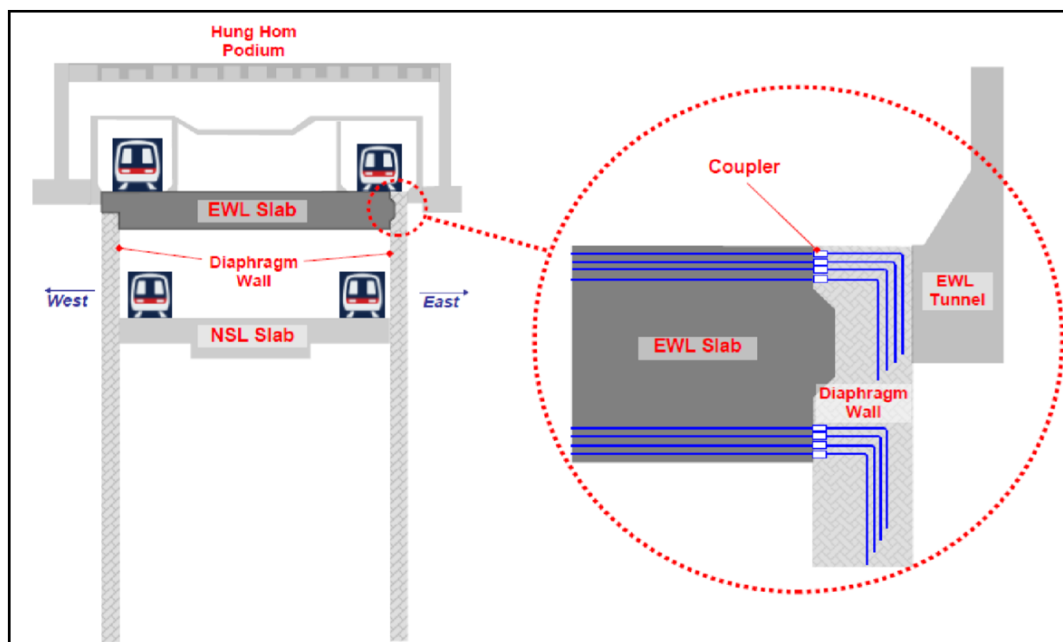


Figure 2 – Diagrammatic cross-section of the platform slabs and diaphragm walls of the Hung Hom Station Extension

(Note: Extracted from MTRCL's report dated 15 June 2018)

3.4 Where two steel bars need to be connected to ensure adequate load transfer, this may either be achieved by lapping the bars for an adequate length, or by threading the ends of two bars and connecting them with a steel coupler (*Figure 3*). According to the design drawings accepted by BD, couplers were adopted for connection between the reinforcement steel bars that went through the diaphragm walls and platform slabs. In addition, couplers were used to connect the vertical reinforcement steel bars within the diaphragm walls.

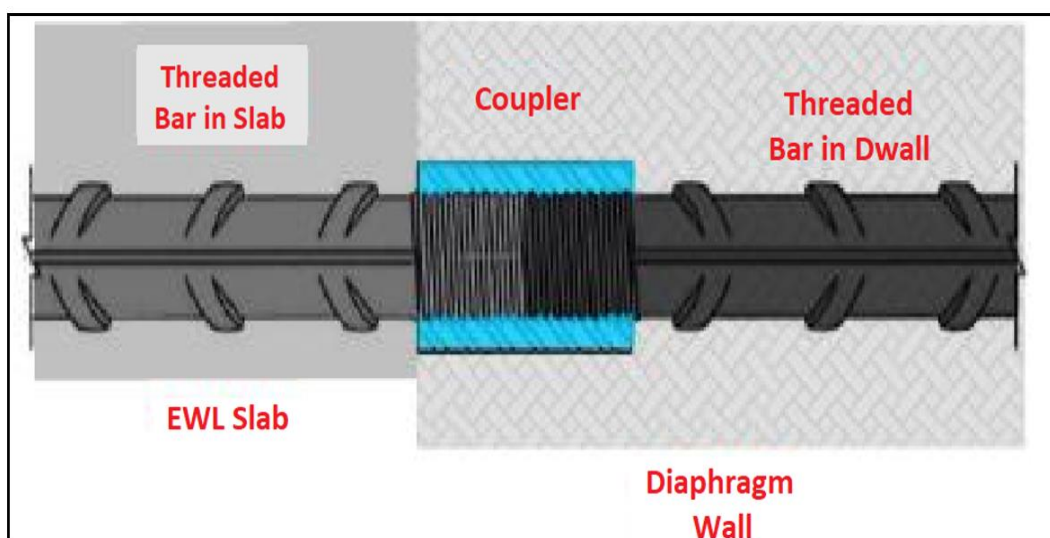


Figure 3 – Typical Coupler Connection

(Note: Extracted from MTRCL's report dated 15 June 2018)

Reported Irregularities Concerning the Built Structures

3.5 In the past few months, reported irregularities concerning the built structures of the Hung Hom Station Extension were revealed, mainly through media reports, reports and information provided by MTRCL, assessments by HyD, and the relevant Panel meetings of the Legislative Council (“LegCo”). These irregularities included:

- (a) improper connection of the reinforcement steel bars between the diaphragm wall and the EWL platform slab, including some of the threaded sections of reinforcement steel bars were cut short, reinforcement steel bars were not fully connected to couplers,

and threaded section of reinforcement steel bars were cut but deceived to be a proper connection³;

- (b) inconsistencies between the information provided by MTRCL (on 13 July 2018) and the design drawing previously accepted by BD regarding the connection of reinforcement steel bars at the interface of the eastern diaphragm wall and the EWL platform slab, in that couplers were no longer used in connecting the top reinforcement steel bars in some of the panels of the EWL platform slab⁴;
- (c) in connection with (b) above, no submission on the design changes was made to the relevant government departments, and the available site records on the number of couplers used in connecting the eastern diaphragm wall and EWL slab does not tally with the information provided by MTRCL⁵;
- (d) improper connection of the vertical steel reinforcement bars within a panel of the diaphragm wall⁶;
- (e) improper connection of reinforcement steel bars at concrete connection joints of the North Approach Tunnels⁷;
- (f) presence of honeycombs and voids in the concrete at parts of the soffits of the EWL platform slab; and
- (g) presence of gap between the top of a column and the soffit of the EWL platform slab, which should be monolithically connected with the column.

³ See Footnote 1 above. Also reported in Apple Daily on 31.5.2018. (<https://hk.news.appledaily.com/local/daily/article/20180531/20406666>)

⁴ See Footnote 1 above.

⁵ See Footnote 1 above.

⁶ Reported in articles which appeared in Hong Kong 01 (香港 01) on 12 July 2018. (https://www.hk01.com/01_偵查/207282/01_獨家-沙中線紅磡站連續牆鋼筋無扭緊-嚴重可倒塌) and 18 July 2018 (<https://www.hk01.com/周報/211541/沙中線-四-沙中線醜聞愈爆愈多-工程哪裡出了錯>)

⁷ Press release issued by MTRCL on 20 March 2018 entitled “Works at Shatin to Central Link Hung Hom North Approach Tunnels”. (http://www.mtr-shatincentrallink.hk/pdf/multimedia-gallery/press/20032018_pr_e.pdf). See also Enclosure III of LC Paper No. CB(4)1151/17-18(05) submitted by THB and HyD to the Subcommittee on Matters Relating to Railways of the LegCo Panel on Transport on 1 June 2018.

3.6 Items (a) to (e) above had come to light before the appointment of the EA Team in mid-August 2018.

3.7 With respect to Item (a) above, MTRCL submitted a report to the Government on 15 June 2018 on the construction of the steel bar fixing works for the EWL platform slab. The report was uploaded to MTRCL's website on the same day for public's information⁸. The report indicated that, based on accounts given by Leighton and MTRCL's site staff, such irregularities were rarely found in the Hung Hom Station Extension. MTRCL's report also noted that "*oral statements made during the interview of one of Leighton's sub-contractors contradict assurances given to us by Leighton*". It transpires that this sub-contractor is China Technology Corporation Limited, which was responsible for concreting and related works, and that the managing director of this sub-contractor said that the extent of the irregularities was much more substantial than that portrayed in MTRCL's report⁹. MTRCL indicated in their report that "*to provide additional assurance to the public over the structural integrity and safety of the EWL platform slab, we have engaged an independent expert to carry out a safety test to confirm the structural safety of the relevant structure*". This 'safety test' is a load test¹⁰.

3.8 Items (b) and (c), which involved possible issues in design amendments, control of site works and reliability of site records, were found by HyD and BD as described in paragraph 1.4 above.

3.9 With respect to Item (d), the verification work is still being carried out by MTRCL to date. Regarding Item (e), MTRCL advised that the

⁸ The report (English version only) can be found at the Shatin to Central Link Project website of MTRCL. (http://www.mtr-shatincentrallink.hk/pdf/multimedia-gallery/report/report_20180614_e.pdf)

⁹ This was made by Mr Jason Poon, Managing Director of China Technology Corporate Limited, in the meeting of the Subcommittee on Matters Relating to Railways of the LegCo Panel on Transport, held on 13 July 2018. See also para. 7 of the paper prepared by the LegCo Secretariat providing background information for the Special Meeting of Panel on Transport held on 31 August 2018. (LC Paper No. CB(4)1514/17-18(03))

¹⁰ Load test is a performance test. Typically, the structure is loaded and its corresponding performance, such as deformation is measured. The test results are then compared with those expected in the design.

irregularities were found by exposing the relevant structure and had been rectified in July 2018.

3.10 Item (f) was reported to HyD by MTRCL on 28 August 2018. Since then, MTRCL have been conducting hammer tests on the soffits of the EWL platform slab to locate areas which may have similar problems for exposing the defective concrete.

3.11 Item (g) was noted by the EA Team in a site visit to the Hung Hom Station Extension on 3 September 2018 while inspecting a part of soffit of the EWL platform slab, where the defective concrete was exposed by MTRCL for assessing the irregularities in Item (f). The full extent of problem could not be assessed due to the obstruction of finishes and building services already installed. MTRCL are carrying out further investigation into the irregularities for both Items (f) and (g).

3.12 The EA Team considered that dealing with the irregularities calls for actions in two different, albeit related aspects that are relevant to the scope of EA Team's work. Firstly, the irregularities could have implications for the integrity and safety of the built structures in the Hung Hom Station Extension. This should be duly addressed to ascertain whether the built structures are acceptable and whether any rectification or remedial works are required. Secondly, the causes for the irregularities should be diagnosed, with a view to identifying areas for improvement in the project management and other relevant aspects.

3.13 Given that the extent and severity of the irregularities are yet to be ascertained and that an in-depth Inquiry will be conducted by the Commission, it is premature for the EA Team to address the second aspect in this Interim Report. As for the first aspect, the salient observations of the EA Team and the progress made by the relevant parties to date are summarized in the ensuing paragraphs.

Assessment of Acceptability of the Built Structures

3.14 Regarding the load test which was intended to be carried out at the EWL platform slab, MTRCL and its independent expert engaged for the task

have been formulating and discussing the load test proposal with HyD and BD since June 2018.

3.15 Following the discovery of Items (b) and (c) described in paragraph 3.5 above, the Government expressed concern that MTRCL should verify all construction records and submit the same to HyD and BD for consideration, before the methodology of the load test could be further studied. MTRCL have been following this up by reviewing the available photographic and other site records on the construction works of the EWL platform slab. The progress of the review has been slow. By late September 2018, MTRCL have only consolidated preliminary findings covering parts of the EWL platform slab for discussion with HyD, BD and the EA Team.

3.16 The EA team concurred with the Government's concern about the importance of verifying what were actually built in the structures. The EA Team noted that as more irregularities in the built structures came to light, the circumstances in the Hung Hom Station Extension were significantly different from those that were perceived when the load test was originally put forward as a possible means of assessing the safety of the EWL platform slab. By now, there are concerns about the uncertainty in what have been built inside the slabs and their connections with the diaphragm walls, and about whether the changes made in the works have been duly designed, checked and accepted before construction. This is further complicated by the recent report of honeycombs and voids in the soffits of the EWL platform slab, the extent of which is still being assessed.

3.17 The EA Team considered that MTRCL and the relevant government departments should critically review the strategy for assessing the acceptability of the works, which should not be confined to conducting load test. Based on the information provided in the load test proposal, the EA Team is not convinced that the structural safety, long-term durability and serviceability of the structures could be adequately assessed by solely conducting the load test. Given the insufficient information on the as-built condition of the platform slabs and the change in circumstances as described above, the load test proposal has apparent deficiencies and should be critically reviewed if it is to be included among other verification measures as part of the assessment strategy.

3.18 The EA Team noted that the NSL platform slab contains similar design and construction details, including the use of couplers in connecting the reinforcement steel bars with the diaphragm wall, as those of the EWL platform slab. There is an inevitable concern about whether similar irregularities in the steel bar connection may exist in the NSL platform slab. The NSL platform slab is designed as a suspended structure, which shall withstand uplift water pressure. Proper connection with the diaphragm walls is critical to its structural stability and integrity. Furthermore, as the platform slabs of the EWL and NSL and the diaphragm walls together form a monolithic structure, defects in any of the three structural components may affect the performance of the whole structure. Hence, the EA Team considered that the assessment should also include the NSL platform slab and the diaphragm walls, and not be confined to the EWL platform slab.

3.19 In this context, the EA Team made its PR Nos. 1.2 and 1.3 (see *Appendix C*) and explained its view in the Project Meeting with MTRCL and the relevant government departments on 7 September 2018. The EA Team was pleased that MTRCL and the relevant government departments, acknowledged in principle the need for opening up the structures to ascertain what have been built and for conducting other necessary supplementary tests to assess the quality of the works, instead of relying solely on the load test.

3.20 To take this consensus forward, upon further discussion with the relevant parties, the EA Team made its PR No. 2.2 which states that:

***PR No. 2.2** The EA Team recommends that MTRCL formulate a holistic strategy for agreement with the relevant government departments for assessing the acceptability of the works in the Hung Hom Station Extension, covering the EWL and NSL platforms slabs and the diaphragm walls. The strategy may include a combination of diagnoses based on the available objective records, physical inspections through opening up the structures, non-destructive tests and load tests, for assessing the acceptability of the structures and for establishing the key parameters that may be required for the design and implementation of any necessary remedial/improvement works.*

3.21 The EA Team considered that the investigation of the honeycombs and voids in the EWL platform slab (see paragraphs 3.26 and 3.27 below) should also form part of the holistic assessment of the acceptability of the built structures. The EA Team has further suggested that MTRCL should review their records to identify whether there were any other reported or suspected irregularities that might have adverse effects on the structural performance, and if so, these should also be included in the holistic assessment. So far, MTRCL has not provided any such information.

3.22 The EA Team noted that MTRCL and the relevant government departments have respectively engaged independent experts and consultants to provide input on the load test. As the assessment strategy will no longer be confined to undertaking the load test, the scope of the work of experts and consultants may have to be expanded accordingly. Consideration should also be given to seeking their timely input in the formulation of the assessment strategy and finalization of the details, to ensure that their advice is given in a holistic and not piece-meal manner. In this connection, the EA Team submitted PR No. 2.3 as follows:

PR No. 2.3 *The EA Team recommends that MTRCL and the relevant government departments consider the need for updating the scope of the work required of their independent experts and consultants, to ensure that the necessary input from the independent experts and consultants in assessing the acceptability of the works in the Hung Hom Station Extension are acquired in a holistic and timely manner.*

3.23 The EA Team welcomed MTRCL and the relevant government departments in expressing their agreement with the recommendations (PR Nos. 2.2 and 2.3) in the Project Meeting of 24 September 2018.

3.24 On 15 October 2018, MTRCL submitted to HyD a proposal to partially open up part of the EWL platform slab for verifying the as-built conditions of the reinforcement steel bars at the interface between the EWL platform slab and the eastern diaphragm wall. The proposal was discussed in the Project Meeting held on 16 October 2018. The EA Team, HyD and BD noted that the proposal had a limited scope, which fell far short of the requirement of a holistic assessment. It was confined to part of the EWL

platform slab and did not cover the NSL platform slab nor the diaphragm walls. The proposal only intended to open 6 locations at the top and 4 locations at the bottom of the platform slab. Furthermore the reliability of the information compiled on the as-built condition on the platform slab was neither verified nor considered and the selection of the number and location of opening-up was without statistical consideration. The proposal has not addressed the other reported irregularities such as the honeycombs and voids in the soffit of the EWL platform slab which exhibited an obvious quality issue with the concrete. Besides, the proposal was based on the assumption that there was no evidence of poor workmanship, and that the EWL platform slab had such a high redundancy in design that its structural capacity was not an issue. However, the validity of the assumptions was not substantiated.

3.25 MTRCL agreed to enhance the proposal. They also explained that the plan for verification of the outstanding portion of the EWL and NSL platform slabs and the diaphragm walls would be formulated and incorporated into the enhanced proposal to meet the requirement of the holistic assessment strategy. However, MTRCL requested the deadline for submission be extended from end-October to mid-November 2018. The Government urged MTRCL to submit the holistic assessment strategy expeditiously.

Review of Immediate Danger and Structural Monitoring

3.26 During the site visit to the Hung Hom Station Extension to appraise the honeycombs and voids discovered in the concrete at the soffits of the EWL platform slab, the EA Team noted the possible site constraints that might hinder thorough and detailed inspections of the platform slabs due to the presence of finishes and building services already installed. In this connection, EA Team put forward PR No. 2.4 as follows:

PR No. 2.4 *The EA Team recommends that MTRCL and the relevant government departments review and update their assessment of any signs of distress and immediate danger in the Hung Hom Station Extension, including the EWL and NSL platform slabs and the diaphragm walls.*

3.27 The EA Team has concern about the effectiveness of the hammer test being undertaken by MTRCL in ascertaining the quality of concrete of the

EWL platform slab. There is also a concern about any similar honeycombs and voids that may also be present in the NSL platform slab. Besides, the bottom face of the NSL platform slab is not accessible for carrying out hammer testing. Furthermore, the presence of gap between a column and the exposed soffit of the EWL platform slab described in paragraph 3.11 above may adversely affect the structural integrity. Hence, PR No. 2.5 was made by the EA Team as follows:

PR No. 2.5 *The EA Team recommends that MTRCL should explore other suitable testing methods to supplement the hammer test to verify the extent and severity of the honeycombing/void condition of the soffits of the EWL slabs. The possibility of presence of similar honeycombs/voids in the NSL platform slabs should be examined. The extent, severity and structural implications of the gaps between the columns and the soffits of the EWL platform slabs should also be assessed.*

3.28 The EA Team noted that MTRCL were procuring an automatic deformation monitoring system (ADMS) for monitoring the EWL platform slab. According to the assessment by MTRCL's independent expert, the maximum deflection of the EWL platform slab may only be in the order of 1mm under test load¹¹. Given the measurement accuracy of the ADMS, using the ADMS alone in monitoring the performance and integrity of the platform slabs might not be effective. Hence, the EA Team recommended the following in its PR No. 2.6:

PR No. 2.6 *MTRCL should consider supplementing the ADMS with other monitoring devices, such as those that could record small structural strains and deformation, to measure and monitor the structural health of the platform slabs and diaphragm walls in the Hung Hom Station Extension.*

3.29 The EA Team noted the concerns of the relevant government departments and welcomed the assurance given by MTRCL that safety should never be compromised, and that if warranted, the relevant parts of the works should be suspended to ensure the safety of the workers.

¹¹ According to the report entitled "Loading Test Proposal for the Platform Structure for the EWL Track Slab of Hung Hom Station" by MTRCL's expert dated 30 August 2018.

SECTION 4 SETTLEMENT-RELATED ISSUES

Prevailing Provision for Controlling Settlement and Other Adverse Impacts

4.1 The SCL Project involves the construction of various underground stations and tunnel sections. The construction works could cause ground movement and settlement, which have potential adverse impacts on the nearby facilities, such as buildings and utilities.

4.2 At the design stage of the project, MTRCL shall assess the effect of the works on the surroundings, prepare drawings and site-specific monitoring plans, and consult the relevant government departments to establish a monitoring system.

4.3 During construction, MTRCL shall conduct regular monitoring in accordance with the accepted monitoring plans. With effective implementation of the monitoring plan, the impacts brought by the works to the surroundings are tracked and assessed, so that suitable response and mitigation actions are taken promptly to contain the impacts within a controllable and acceptable range.

4.4 A three-tier activation system, commonly denoted by MTRCL as Alert-Action-Alarm (“AAA”) Levels, are adopted in the SCL Project. The monitoring parameters (e.g. settlement, tilting and drawdown of groundwater levels), pre-set trigger values of the parameters for each of the AAA Levels, and the response actions to be taken in the event of breaching each of the trigger levels are set out in the accepted monitoring plans. When the highest pre-set trigger level, i.e. Alarm Level, is exceeded, suspension of the construction works is typically specified among other response and mitigation actions to take.

Settlement at Exhibition Centre Station and To Kwa Wan Station Sites

4.5 The Exhibition Centre Station and tunneling works in Wan Chai North involve major underground excavation. According to MTRCL, the construction of permanent works and internal structures of Exhibition Centre Station are in progress. As of August 2018, about 15% of the station remained to be excavated before reaching the final formation level.

4.6 According to the monitoring records compiled by MTRCL, as of August 2018, about 50 settlement monitoring points near the Exhibition Centre Station site have exceeded the pre-set Alarm Level. To allay public concern about possible impacts caused by the construction activities, the excavation works at the Exhibition Centre Station site were suspended temporarily by MTRCL on 10 August 2018. After reviewing the monitoring records and the site condition, the AAA levels of the monitoring points were revised by MTRCL, which were then accepted by HyD and BD. On 28 September 2018, a new mechanism for monitoring and making announcement for impact of the SCL works on nearby structures and public facilities (“mechanism”) was implemented by HyD, BD and MTRCL. The excavation works were resumed on the next day.

4.7 To Kwa Wan Station was built underneath Ma Tau Wai Road. The construction works were commenced in 2012. The excavation works and main structures for the Station have been substantially completed by the end of 2016 and mid-2017 respectively. During the construction period, the settlement recorded at some of the buildings and underground utilities have exceeded the Alarm Level¹².

Measures to Enhance Control and Announcement

4.8 The EA Team was advised of MTRCL’s existing arrangement for joint-survey and spot-checking in settlement monitoring at the Exhibition Centre Station site. The EA Team noted the importance of ensuring the reliability and coherence of the monitoring data, based on which the safety of site works, their effects on the neighborhood and decisions on the required follow-up actions are evaluated. In this connection, the EA Team put forward PR No. 1.4 as follows:

¹² In LC Paper No. CB(4)1504/17-18(04) submitted to the Subcommittee on Matter Relating to Railways of the LegCo Panel on Transport for discussion on 31 August 2018, MTRCL advised that “the settlements of the buildings and underground utilities along the alignment have stabilised since the completion of excavation”. Notwithstanding this, there has been major public concern about damage to buildings and underground utilities suspected to have been caused by the works.

PR No. 1.4 *MTRCL should ensure that effective mechanisms and procedures are put in place to assure the reliability and coherence of the settlement monitoring data at all active construction sites and other sensitive sites of the SCL Project, with account also taken of the latest experience gained by MTRCL from stocktaking the data¹³.*

4.9 The EA Team noted that the AAA Levels stipulated in the accepted monitoring plans include parameters other than recorded settlements, e.g. drawdown of groundwater level. While the attention has so far been focused on the recorded settlements, monitoring the other parameters and taking necessary follow-up actions in accordance with the accepted monitoring plans are pertinent to ensuring public safety and minimizing damage that may arise from the works. The EA Team elaborated its concern in PR No. 2.7 as follows:

PR No. 2.7 *MTRCL and the relevant government departments should ensure that all the monitoring parameters stipulated in the accepted drawings and monitoring plans are duly considered in evaluating whether the AAA Levels are breached, in undertaking the response actions in accordance with the accepted drawings and monitoring plans, and in assessing any other required follow-up actions.*

4.10 The EA Team was given the opportunity to comment on the mechanism for enhancing monitoring and making announcement relating to the AAA Levels before it was finalized and adopted for implementation on 28 September 2018. Two of the major comments made by the EA Team are recapped below.

4.11 Firstly, the EA Team noted that the AAA Levels were normally set with a view to both ensuring safety and avoiding damage to properties. While ascertaining the safety condition is the priority for inspection upon breaching the AAA Levels, the EA Team considered that the inspection should also include the damage aspect. This was stated in PR No. 2.8:

¹³ The review of settlement monitoring data in the SCL Project by MTRCL was reported in LC Paper No. CB(4)1504/17-18(04) for discussion in the Subcommittee on Matters Relating to Railways of the LegCo Panel on Transport on 31 August 2018.

PR No. 2.8 *The EA Team recommends that damage inspection/assessment should be carried out by MTRCL after breaching the Alarm Level, to provide a basis for establishing the need for any mitigation or other follow-up actions and ascertaining the acceptability of resumption of works.*

4.12 Secondly, regarding the revision of the AAA Levels, the EA Team was of the view that the public should be assured that the AAA Levels would only be revised with full justifications. This was stated in PR No. 2.9 below:

PR No. 2.9 *The public should be assured that the AAA Levels will only be revised with full justifications, including the confirmation that it will not result in any safety or undue damage issues and that all practicable control and mitigation actions will be taken. This should be explicitly stated in the proposed mechanism for enhancing notification and reporting relating to the AAA Levels to minimize possible public misunderstanding.*

4.13 The EA Team welcomes the positive response of HyD, BD and MTRCL in taking account of EA Team's recommendations in finalizing the mechanism. The EA Team considers that MTRCL and the relevant government departments should thoroughly follow the principles set out therein, as well as the requirements stipulated in the accepted monitoring plans. This will ensure timely and appropriate actions, including suspension of works in the event of breaching the Alarm Level, are taken to control any further adverse impacts that may be caused by the remaining works of the SCL Project on the nearby facilities.

4.14 The EA Team shares the concern previously expressed by the public about the lack of transparency to the affected parties in the operation of the monitoring system and in the revision of the AAA Levels. The EA Team considers that not only should the revision of the AAA Levels be made with full justifications, the number of revisions should also be minimized. While the EA Team believes that the mechanism will improve the situation, its effectiveness will depend on whether the requirements set out therein are thoroughly followed by the relevant parties.

4.15 The EA Team plans to conduct audits of selected cases in the SCL Project, including cases before and after the implementation of the mechanism, to assess the effectiveness of the monitoring and control system.

4.16 In offering its comments on the mechanism, the EA Team was in the process of reviewing the relevant information on the settlement-related issues. Upon completion of the review and the audits described in paragraph 4.15 above, the EA Team will tender its observations on the lessons learnt and recommendations on areas for improvement. In this respect, EA Team's comments given at this stage on the mechanism are preliminary in nature, and should not be regarded as EA Team's final views on this matter.

SECTION 5 FURTHER WORK

5.1 The EA Team has gone through the initial stage of its work, focusing mainly on familiarization with the project, collection and preliminary analysis of information, and providing expert input to issues that required priority and timely attention. In the months to come before preparation of the Final Report, the EA Team will continue to render its service within the scope of its Terms of Reference.

5.2 The key tasks to be undertaken by the EA Team include:

- (a) follow up the formulation and implementation of the holistic strategy by MTRCL for assessing the acceptability of the built structures in the Hung Hom Station Extension and for establishing the key parameters that may be required for the design and implementation of any necessary remedial and improvement works;
- (b) review the methodology adopted by MTRCL in setting up the AAA Levels and monitoring plans, as well as the actions taken in response to breaching and revision of the AAA Levels in the SCL Project, for identifying any areas for improvement;
- (c) carry out audits on selected settlement cases in the SCL Project;
and
- (d) deal with the other aspects of work as stipulated in the Terms of Reference for the EA Team.

5.3 In the coming months, a large amount of work will need to be carried out for following up the reported irregularities and other issues under review. The EA Team urges MTRCL to take prompt and thorough actions in following up EA Team's recommendations and to maintain a high level of transparency in addressing all relevant issues under review.

APPENDIX A Background of the Shatin to Central Link Project

Shatin to Central Link

1. The Shatin to Central Link (SCL) has a total length of about 17 km. It comprises the following two sections (*Figure A*):

- (a) Tai Wai to Hung Hom Section : This is an extension of the Ma On Shan Line from Tai Wai via Southeast Kowloon to Hung Hom, where it will join the West Rail Line. This Section is denoted as East West Line (EWL) of SCL.
- (b) Hung Hom to Admiralty Section : This is an extension of the East Rail Line from Hung Hom across the Victoria Harbour to Wan Chai North and Admiralty. This Section is denoted as North South Line (NSL) of SCL.

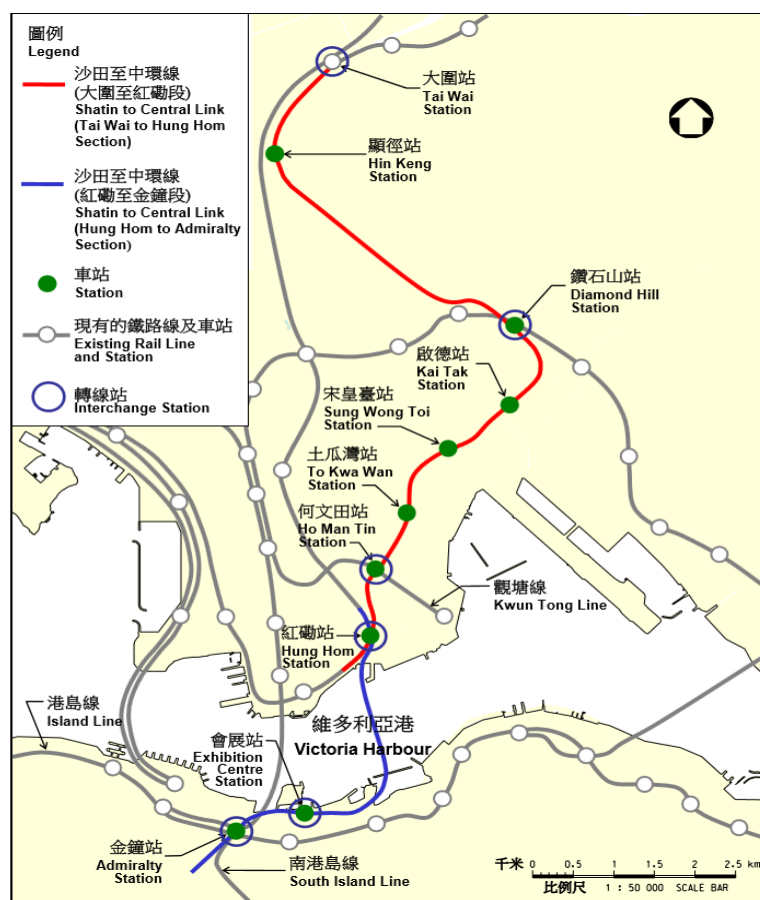


Figure A – Alignment of Shatin to Central Link

(Note: Adapted from HyD's Drawing No. HRWSCL003-SK0465)

2. There are ten stations in SCL. Apart from bringing improvements to the existing Tai Wai Station, the SCL Project also involves construction of new stations or extension of existing stations at Hin Keng, Diamond Hill, Kai Tak, Sung Wong Toi, To Kwa Wan, Ho Man Tin, Hung Hom, Exhibition Centre, and Admiralty.

3. The SCL is implemented under the service concession approach in which the Government funded the construction works and MTRCL were entrusted by the Government to implement the project. The Government and MTRCL signed three Entrustment Agreements¹⁴, pursuant to which MTRCL were entrusted to carry out the site investigation, design, construction, testing and commissioning of the SCL Project. According to the Entrustment Agreements, MTRCL warrant that the entrusted works shall achieve a professional and reasonable level of skill and supervision, including the assurance of quality of the works up to the required standards.

Instrument of Exemption and Instrument of Compliance

4. Depending on the applicability of the Buildings Ordinance (Cap. 123) (“BO”), building works under the SCL Project may fall under the purview of the Building Authority (“BA”) or HyD, subject to the provision of the Instrument of Exemption (“**IoE**”) and Instrument of Compliance (“**IoC**”) respectively, details of which are given in the ensuing paragraphs.

5. Pursuant to the Mass Transit Railway Ordinance (Cap. 556) (“MTRO”), the BA may issue the **IoE** to exempt the MTRCL from part of the requirements under the BO.

6. The expansion of Hung Hom Station and the construction of Sung Wong Toi Station of the SCL Project are within the land leased to the Kowloon-Canton Railway Corporation and the Government land given to the MTRCL as short-term tenancy, respectively. The construction works at these locations are therefore controlled under the BO. With the consideration of

¹⁴ The 1st Entrustment Agreement for the design and site investigation in relation to the SCL was signed on 24 November 2008. The 2nd Entrustment Agreement for advance works relating to the SCL was signed on 17 May 2011. The 3rd Entrustment Agreement for the construction and commissioning of the SCL was signed on 29 May 2012.

the specific nature of building works related to railway construction, the BA, in accordance with Section 54(2) of the MTRO, issued the **IoE** in December 2012 to exempt the MTRCL from several requirements under the BO. The exemption is only limited to those procedures involving the appointment of Authorized Person and Registered Structural Engineers, approval of drawings, and issuing works permits and occupation permits. The **IoE** also stipulates that the MTRCL have to appoint persons possessing the appropriate experience and qualifications to be responsible for works in different aspects, and to establish project management plan for the relevant works. The project management plan implements a set of assurance and management system with the objective to ensure that the management of the building works can attain the requirements not inferior to the standards as required by that of the BO.

7. Pursuant to the provision in Section 41 of the BO, construction works of the SCL project which is located at Government land and unleased land are exempted from the control of the Ordinance. In accordance with the Entrustment Agreements signed between the Government and the MTRCL, the Director of Highways issued the **IoC** requiring the MTRCL to follow the administrative procedures and requirements as stipulated in the Instrument for carrying out building works. The objective is to ensure that the quality of building works to be not inferior to the standards as required by the BO and its subsidiary legislations.

APPENDIX B Terms of Reference of the Expert Adviser Team

Expert Adviser Team for the Shatin to Central Link Project

Terms of Reference

(i) *Overall review*

- (a) To review the Project Integrated Management System (PIMS) of the MTR Corporation Limited (MTRCL) to identify areas for improvement, as well as enhancement in communication and check-and-balances, including, but not limited to, how hold point inspections are to be conducted by MTRCL and/or Government, possible use of smart technology for site supervision;
- (b) to advise on additional management and monitoring measures to be taken by MTRCL and government departments to avoid recurrence of similar incidents in the construction of the remaining parts of the Shatin-to-Central Link (SCL) project, including the platform slabs, approach tunnels and immersed tube in the North South Line from Hung Hom Station to Admiralty Station;

(ii) *Hung Hom Station Extension*

- (a) to advise on the most pragmatic methodology for MTRCL to conduct forensic investigation to ascertain, to the maximum extent possible, what has been built inside the platform slabs and diaphragm walls at Hung Hom Station Extension and how it has been built;
- (b) to review whether the load test to be arranged by MTRCL for the platform slabs at Hung Hom Station Extension could help ascertain (a) above;

- (c) to explore the feasibility of partial opening up of the platform slab, and diaphragm structure to ascertain if the couplers used for connecting reinforcement bars had been properly constructed;
- (d) to identify other potential tests, destructive or non-destructive, and the need for continuous monitoring of structural performance of the diaphragm walls and platform slabs of Hung Hom Station Extension;

(iii) Other Stations of the SCL project

- (a) to advise on possible measures to ascertain if there are other irregularities in the construction of key structures in the SCL project (not limited to Hung Hom Station Extension).

(iv) Any other matters relevant to the works of the SCL Project

Deliverables

The Expert Adviser Team shall submit a final report in about 9 months from the date of establishment and may submit interim report(s) as necessary.

Membership and post titles

- Dr. Lau Ching-kwong, Senior Adviser (SCL)1
- Mr. Hui Siu-wai, Senior Adviser (SCL)2
- Mr. Wong Hok-ning, Senior Adviser (SCL)3

Transport and Housing Bureau
15 August 2018

APPENDIX C Summary of Preliminary Recommendations

| Preliminary Recommendations (PR) | |
|---|---|
| (a) General | |
| 1.1 | The EA Team recommends that the THB arrange regular high-level meetings with the EA Team, MTRCL and other key stakeholders to address EA Team’s recommendations and review the progress of the relevant follow-up actions. |
| 2.1 | The EA Team recommends that the relevant parties report the progress made and actions taken with respect to each of EA Team’s recommendations, for review in the regular Project Meetings held by THB with the EA Team, MTRCL and other key stakeholders. |
| 2.10 | The EA Team recommends that MTRCL examine whether their consultants or other service providers in the Hung Hom Station Extension and in other sites of the SCL Project may have potential conflict of interest, either actual or perceived, and take any necessary actions to ensure that this will not adversely affect, or may be perceived to adversely affect, the management and delivery of the SCL Project. |
| (b) Hung Hom Station Extension | |
| 1.2 | The EA Team recommends that, in consultation with the relevant stakeholders, MTRCL set out the objectives of the load test and any other relevant examination and monitoring work for the EWL platform slabs of Hung Hom Station Extension, and devise a holistic plan for undertaking the test and other work for meeting the objectives. The objectives should include not only verifying the structural safety of the EWL platform slabs, but also its long-term durability and serviceability, and what has been built in its key structural elements. Special attention should be given to those parts without adequate objective evidence of the as-built conditions, and to those parts which were constructed before duly completing the required design amendment and endorsement processes. |

| Preliminary Recommendations (PR) | |
|---|--|
| 1.3 | The EA Team recommends that MTRCL extend the work on collection of objective evidence and other enquiries to also covering the NSL platform slabs of Hung Hom Station Extension, with a view to establishing what has been constructed and agreeing with the relevant stakeholders any necessary testing, examination and monitoring work for the NSL platform slabs. |
| 1.5 | The EA Team recommends that MTRCL compile a comprehensive list of outstanding submissions of design changes that are overdue in the Hung Hom Station Extension and in other sites of the SCL Project. These include those which are required under the Project Management Plan and other provisions of the IOE and IOC, as well as those that are required under the established internal procedures of MTRCL, e.g. the Project Integrated Management System (PIMS). |
| 1.6 | The EA Team recommends that the outstanding submissions should be made as soon as possible, and that MTRCL continue to monitor and update the list of outstanding submissions, and keep the relevant parties, e.g. HyD and BD, informed. |
| 2.2 | The EA Team recommends that MTRCL formulate a holistic strategy for agreement with the relevant government departments for assessing the acceptability of the works in the Hung Hom Station Extension, covering the EWL and NSL platforms slabs and the diaphragm walls. The strategy may include a combination of diagnoses based on the available objective records, physical inspections through opening up the structures, non-destructive tests and load tests, for assessing the acceptability of the structures and for establishing the key parameters that may be required for the design and implementation of any necessary remedial/improvement works. |

| Preliminary Recommendations (PR) | |
|---|---|
| 2.3 | The EA Team recommends that MTRCL and the relevant government departments consider the need for updating the scope of the work required of their independent experts and consultants, to ensure that the necessary input from the independent experts and consultants in assessing the acceptability of the works in the Hung Hom Station Extension are acquired in a holistic and timely manner. |
| 2.4 | The EA Team recommends that MTRCL and the relevant government departments review and update their assessment of any signs of distress and immediate danger in the Hung Hom Station Extension, including the EWL and NSL platform slabs and the diaphragm walls. |
| 2.5 | The EA Team recommends that MTRCL should explore other suitable testing methods to supplement the hammer test to verify the extent and severity of the honeycombing/void condition of the soffits of the EWL slabs. The possibility of presence of similar honeycombs/voids in the NSL platform slabs should be examined. The extent, severity and structural implications of the gaps between the columns and the soffits of the EWL platform slabs should also be assessed. |
| 2.6 | MTRCL should consider supplementing the ADMS with other monitoring devices, such as those that could record small structural strains and deformation, to measure and monitor the structural health of the platform slabs and diaphragm walls in the Hung Hom Station Extension. |
| (c) Settlement-related Issues | |
| 1.4 | MTRCL should ensure that effective mechanisms and procedures are put in place to assure the reliability and coherence of the settlement monitoring data at all active construction sites and other sensitive sites of the SCL Project, with account also taken of the latest experience gained by MTRCL from stocktaking the data. |

| Preliminary Recommendations (PR) | |
|---|---|
| 2.7 | MTRCL and the relevant government departments should ensure that all the monitoring parameters stipulated in the accepted drawings and monitoring plans are duly considered in evaluating whether the AAA Levels are breached, in undertaking the response actions in accordance with the accepted drawings and monitoring plans, and in assessing any other required follow-up actions. |
| 2.8 | The EA Team recommends that damage inspection/assessment should be carried out by MTRCL after breaching the Alarm Level, to provide a basis for establishing the need for any mitigation or other follow-up actions and ascertaining the acceptability of resumption of works. |
| 2.9 | The public should be assured that the AAA Levels will only be revised with full justifications, including the confirmation that it will not result in any safety or undue damage issues and that all practicable control and mitigation actions will be taken. This should be explicitly stated in the proposed mechanism for enhancing notification and reporting relating to the AAA Levels to minimize possible public misunderstanding. |