

**Legislative Council Panel on Transport
Subcommittee on Matters Relating to Railways**

Final Report of Expert Adviser Team on Shatin to Central Link Project

The Expert Adviser Team (EA Team) for the Shatin-to-Central Link (SCL) Project submitted its Final Report to the Transport and Housing Bureau (THB) in December 2020¹. As mentioned in the paper (reference CB(4)453/20-21(04)) submitted to the Legislative Council Subcommittee on Matters Relating to Railways in January 2021, the report set out the observations and recommendations on the SCL project with a view to improving the standard of railway projects and the construction industry in Hong Kong.

2. We agree with the recommendations put forward by the EA Team in the Final Report, and have firmed up their implementation via Highways Department (HyD), MTR Corporation Limited (MTRCL) and other relevant departments. These include quality assurance for the Hung Hom Station Extension (HUH) and other SCL stations, improvements to project management and design of railway projects, and enhancement of settlement monitoring and control, etc.. These recommendations are applicable to the SCL project and future railway projects. A summary of the Final Report and the Government's response (i.e. Annex 5 of LegCo paper CB(4)453/20-21(04)) are given in **Annex**.

The progress for implementing the recommendations in the Final Report

3. Section 12 of the Final Report summarises a total of 42 recommendations put forward by the EA Team; covering those relating to the quality assurance of HUH (9 items) and other SCL stations (3 items), design-related issues (8 items), settlement issues (10 items), project management (11

¹ The Final Report was uploaded onto the THB website.

items) and application of experience learnt from the SCL Project to other works projects (1 item). The progress for implementing the recommendations in the report is as follows:-

- (1) Quality assurance of HUH: HyD completed the analysis on the structural integrity of the connection between the slab of the East West Corridor and the east diaphragm-wall, checked the design of the HUH in accordance with the New Works Design Standard Manual (NWDSM) (including seismic design requirements), and documented the checking approach and findings. HyD and MTRCL finalised the details of long-term monitoring for HUH, including measures for mitigating and controlling seepage and corrosion. The long-term monitoring commenced in March 2021. HyD and MTRCL will continue to finalise the details of additional undertaking of quality assurance for implementation by the first half of this year.
- (2) Quality assurance for other SCL stations: MTRCL confirmed with HyD that the design of other SCL stations was in compliance with the requirements and procedures of seismic design as stipulated in the NWDSM. In the formulation of maintenance plan and monitoring measures for relevant stations, MTRCL employed an independent engineer to carry out additional structural analysis with due regard to the inadequacy of site records and possible impact. HyD and MTRCL will continue to finalise the details of additional quality assurance and strive to achieve implementation by the first half of this year.
- (3) Design-related matters: the recommendations are mainly applicable to future railway projects. HyD plans to take a more proactive role in the implementation of new railway projects, and strengthen the monitoring effort starting from

the design stage of the project implementation cycle. Apart from the design checking conducted by the statutory authorities and other Government departments, the scope of design checking will cover other key and high risk design elements (including structural, electrical and mechanical engineering and signalling systems). The scope of audit will be intensified to cover cost-effectiveness, buildability and various aspects. In addition, MTRCL has set up three lines of defence to ensure that the design can meet the quality standards.

- (4) Settlement matters: Most of the recommendations on settlement issues were implemented through the Enhanced Mechanism provided on 28 September 2018. The Government would ensure MTRCL comply with the Enhanced Mechanism and the approved monitoring and control plans rigorously. As regards the remaining recommendations, the Government will refine the Enhanced Mechanism according to these recommendations for application to future railway projects, and the review by relevant government departments and MTRCL is underway.
- (5) Project management: On the enhancement of MTRCL's project management system and the Government's monitoring system, some of the improvement measures had been implemented partly by the Government since identification of the problems and partly as the follow-up actions of the Final Report by the Commission of Inquiry into the Construction Works at and near the Hung Hom Station Extension under the SCL Project. As far as SCL Project is concerned, the Government had implemented a series of measures to closely monitor the project management procedures, including deploying Government officials on site to strengthen the communication amongst the concerned parties, carrying out surprise checks and random checks on

works progress, procedures and quality, conducting more site inspections and audits by the Monitoring and Verification Consultant employed by HyD. As regards other recommendations on project management, the Government unveiled a series of measures to enhance the monitoring and control strategy, and proposed the establishment of the Railways Department in the fiscal year 2022-23 for full implementation of the enhance monitoring and control strategy that encompasses the entire project cycle before the new railway projects progressively enter into the construction stage in 2023.

Continual Monitoring

4. THB will continue monitoring the implementation of the EA Team's recommendations by the relevant Government departments and MTRCL, and review their effectiveness.

**Transport and Housing Bureau
Highways Department
April 2021**

The Shatin to Central Link Project
Expert Adviser Team Final Report
Summary of Report and the Government's Responses
(i.e. Annex 5 of LegCo paper CB(4)453/20-21(04))

The Expert Adviser Team (“EA Team”) for the Shatin-to-Central Link (“SCL”) Project, comprising the former Director of Civil Engineering, Dr Lau Ching-kwong, former Director of Buildings, Mr. Hui Siu-wai and former Head of Geotechnical Engineering Office, Mr. Wong Hok-ning, was established on 15 August 2018. The role of the EA Team was to conduct an overall review of the project management system of MTR Corporation Limited (“MTRCL”), and recommend additional management and monitoring measures to be undertaken by MTRCL and government departments as appropriate, in taking forward the SCL Project. The EA Team advised on the most pragmatic methodology for MTRCL to ascertain the structural safety and the as-built condition of the platform slabs and diaphragm walls of Hung Hom Station Extension (HUH), considered further investigations necessary in relation to the construction of key structures in all stations of the SCL Project, and advised on any other matters relevant to the works of the SCL Project.

THE INTERIM REPORT

2. The EA Team submitted its interim report in October 2018 which set out the initial observations and views of the EA Team on the steel bar connection works in the East West Line platform slab and the diaphragm walls at the HUH site, as well as the settlement-related issues at the Exhibition Centre Station (EXC) and To Kwa Wan Station (TKW) sites. The EA Team made 16 preliminary recommendations in the interim report, amongst which, nine were related to the HUH works, four were on settlement issues, and the remaining three were about project management issues in general. These recommendations have all been properly implemented.

THE FINAL REPORT

3. The EA Team submitted its Final Report to the THB in December 2020 which set out the observations and recommendations of the EA Team on the SCL project with a view to continually improving the project management of railway projects and the construction industry in Hong Kong.

4. The Final Report summarized the work of the EA Team since its establishment including (i) review of the irregularities in the construction works, the safety and compliance of the built structure, long term monitoring and the relevant design issues of the HUH; (ii) audit and assessment of other SCL Stations; (iii) audit of the monitoring and control of the impact of the SCL works on nearby structures and public facilities; and (iv) review of the project management of railway projects. The EA Team has discharged its duties with the completion of the Final Report.

EA TEAM'S OBSERVATIONS AND RECOMMENDATIONS

Irregularities in the construction works, the safety and compliance of the built structure, long term monitoring and the relevant design issues of the HUH

5. During the course of the investigation of the Commission of Inquiry into the Construction Works at and near the HUH under the Shatin to Central Link Project ("Commission"), the EA Team carried out substantial amount of investigation work. Part of the EA Team's work, including the EA Team's views and comments in the Holistic Assessment and Verification Study of the HUH, was applied during the Commission's inquiry. The EA Team considered the irregularities found in the HUH structure uncommon in major construction projects in Hong Kong. There were also anomalies in site supervision and control, particularly in the hold point inspection process and the keeping of contemporaneous site records. In July 2019, MTRCL issued the "Holistic Assessment Report" and

"Verification Report", assessing the nature and extent of the construction irregularities in the Hung Hom Site, for devising code compliant remedial works. The two reports were accepted by the Government and submitted to the Commission for scrutiny.

6. Given the above, the EA Team noticed that there were three areas of public concern in the quality and structural integrity of the built structure, as follows:

- (i) On structural safety, after lengthy discussions during the Inquiry, the Commission concluded that, with the implementation of suitable measures, the station box structure would be safe and fit for purpose. The EA Team agreed with the Commission's conclusion.
- (ii) On code compliance, while both the Government and MTRCL agreed that the works should comply with the codes to meet good engineering practice and statutory requirements, the EA Team noted that MTRCL had updated the design criteria in determining the scope of the remedial works. Whilst the EA Team did not object to the adoption of the updated design criteria and agreed that the structures could comply with the code requirement after implementation of the remedial works, the EA Team pointed out that the update of design criteria involved a reduction in design loadings; the structural reserve capacity; and the capability of the structures to cope with unforeseen circumstances arising from alteration works in the future. Noting that most of the remedial works under the proposed suitable measures had been implemented, the EA Team suggested that MTRCL and HyD should expedite and complete follow-up actions about water seepage, corrosion, long-term monitoring and additional undertaking of quality assurance.

- (iii) On contract compliance, the EA Team pointed out that, prima facie, there was a gap between the completed works and the requirements under the Entrustment Agreements; and recommended the Government and MTRCL to follow up the matters.

Long-term Monitoring

7. To ensure the long term performance of the built structure in Hung Hom Site, the EA Team recommended the introduction of a suitable long-term monitoring programme for continuously checking structural conditions; evaluating structural performance; and devising maintenance and repair works that might be required for the upkeep of structural conditions. Advising on the possible scope and consideration of the long-term monitoring, the EA Team suggested MTRCL and HyD finalize the monitoring programme for implementation.

Design Related Issues

8. The Commission noted the significant spare capacity in the original design of the HUH structure could help offset the reduction in structural capacity arising from construction irregularities. The EA Team spot-checked the original design of the East West Line (EWL) slab at representative locations. It was found that, as the main re-bars had been over-provided, there was significant spare capacity of the structures in most sampled locations.

9. The EA Team considered that, in respect of the detailed design of the works, although significant spare capacity of structures could help mitigate the adverse consequences of construction irregularities, it could also affect cost and buildability. The EA Team recommended MTRCL to review the relevant practices and provisions about cost-effectiveness in project delivery. HyD should also strengthen the management of future Government railway projects constructed by MTRCL, so that, in respect of

tight project cost control, these projects are at least on a par with Government's public works projects.

10. As regards the employment of consultants, the EA Team noted that the Detailed Design Consultant, Atkins, employed by MTRCL was also engaged by the contractor as the design consultant for the HUH under Contract 1112. The EA Team considered that this arrangement might arise potential conflict of interest. Noting that the same arrangement was adopted by MTRCL in other SCL sites, the EA Team suggested MTRCL take more concrete actions to prohibit such arrangement in future railway projects.

11. On design checking, the Government's design checking undertaken by the Building Authority or HyD has only covered the compliance with the Concrete Code and not the MTRCL's New Works Design Standard Manual (NWDSM), such as design life, seismic design approach and procedures, etc. The EA Team recommended that HyD should check whether the design of HUH had complied with the requirements of NWDSM and explore the possibility of coordinating the checking of the compliance with the requirements under law and the NWDSM in the future.

12. In determining whether couplers should be used, the EA Team considered that defective coupler connections would have dire consequences in respect of structural integrity. Hence, the EA Team recommended that couplers should be used judiciously, with due consideration given to buildability and implementation of effective site supervision and control.

Audit and Assessment of Other SCL Stations

13. In view of the situation of HUH, in order to ascertain if there are other irregularities in the construction of the key structures in the SCL Project, the EA Team supervised a "health-checking" assessment

undertaken by MTRCL and HyD for the other SCL stations. The assessment included an internal audit by MTRCL's consultant and an independent audit by HyD's Monitoring and Verification ("M&V") Consultant.

14. The EA Team noted that the findings of the two audits were consistent. While there were major construction irregularities with significant impact on structural safety identified in both audits, the audit findings revealed that there were deficiencies of varying degree in construction control and record-keeping for these SCL stations. Therefore, the EA Team advised MTRCL to address the issues on site supervision and control as revealed in the audits by enhancing maintenance arrangement and making additional undertaking on quality assurance for the relevant stations.

Settlement Audit

15. On the advice of the EA Team, HyD, BD and MTRCL implemented a new "monitoring and announcement mechanism for the impact of railway works to nearby structures and public facilities" ("*Enhanced Mechanism*") on 28 September 2018. The EA Team stated in its Interim Report that it would conduct audits of selected cases in the SCL Project (including cases before and after the implementation of the Enhanced Mechanism) to assess the effectiveness of the monitoring and control system.

16. The EA Team conducted a settlement audit covering 17 selected monitoring points at or near TKW, EXC and the Fleet Arcade. The focus of the audit was to review the contemporary records of the site activities in relation to the exceedance of the *Alarm Level* and the response actions taken in the implementation of the Alert-Action-Alarm ("AAA") mechanism.

17. The audit results showed that, before the implementation of the

Enhanced Mechanism, there were a total of 23 incidents of exceedance of the *Alarm Level* at the 17 selected monitoring points. There were non-compliances with the requirement to suspend works in case of exceedances; and there was no revision to the *Alarm Level*. Although MTRCL had implemented other precautionary and mitigation measures according to the AAA mechanism, the EA Team considered those measures insufficient to replace the need for the suspension of the works.

18. After the implementation of the *Enhanced Mechanism*, the AAA Levels in EXC had been revised and approved. Since then, as reported by MTRCL, there has been no exceedance of the *Alarm Level* in the monitoring points of EXC.

19. The EA Team advised that the setting of the *Alarm Level* (i.e. the threshold limit for suspension of works) should be realistic, consistent with the predicted ground response, and acceptable with proper justifications. Moreover, the requirements to suspend the works in case of exceedance of the *Alarm Level* should be rigorously followed. In addition, the works should not be resumed without an applicable and accepted AAA mechanism being in place. The EA Team also recommended that the relevant Government departments should proactively and resolutely ensure MTRCL has taken the response actions specified in the accepted monitoring and control plan.

20. Furthermore, the EA Team suggested that, in the formulation and implementation of the monitoring and control system, damage to buildings and properties should be avoided in addition to safety assurance. There should also be enhanced coordination for tackling circumstances involving the impact on facilities affected by multiples projects. Besides, for tunneling works, consideration should be given to the possible recess in the response of ground and building settlements. Lastly, the EA Team advised MTRCL and the relevant Government departments to learn from experience, and enhance the *Enhanced Mechanism* for application in future railway projects.

Project Management

21. On the advice of its independent project management expert, the Commission made comprehensive recommendations on project management issues of the SCL Project. The EA Team shared similar views in the review of the HUH and with regard to the observations made about other aspects of the SCL Project. In particular, the EA Team recommended that MTRCL and HyD should review and follow up on complying with the design and works requirements, keeping timely and traceable site records, conducting effective audits, and probing into the underlying causes.

Lessons Learnt in the SCL Project

22. The EA Team recommended that relevant works departments should stay vigilant in respect of the lessons learnt from the SCL Project; and review any improvement to project management and delivery.

THE GOVERNMENT'S RESPONSES

23. The Government expressed sincere gratitude to the EA Team for their sterling work and valuable advice on the SCL Project in the past two years, as well as their contribution in compiling the final report as a detailed record.

24. Section 12 of the Final Report includes a summary of recommendations put forward by the EA Team. Amongst which, 9 items relate to the quality assurance of HUH, 3 items relate to quality assurance for other SCL stations, 8 items relate to design-related issues, 10 items relate to settlement issues, 11 items relate to project management issues and 1 item relate to the application of experience learnt from the SCL Project to other works projects.

25. The Government agreed with the recommendations put forward by the EA Team in the Final Report. Implementation of the recommendations related to the SCL project as set out in the Final Report is under way. For the other recommendations which were related to MTRCL's project management system, the Government's monitoring measures, and future railway projects, the Government will follow up with MTRCL for implementation in future railway projects. The implementation details of the recommendations are as follows.

26. Regarding the quality assurance of HUH, HyD completed the analysis on the structural integrity of the connection between the EWL slab and the east diaphragm-wall, checked the design of the HUH in accordance with the NWDSM (including seismic design requirements), and documented the checking approach and findings. MTRCL and HyD will continue to finalise the details of water seepage, corrosion, long-term monitoring, and additional undertaking of quality assurance. The target is to implement them by the first half of this year.

27. Regarding the quality assurance for other SCL stations, MTRCL confirmed with HyD that the design of other SCL station complied with the requirements and procedures of seismic design as stipulated in the NWDSM. MTRCL employed an independent engineer to carry out additional structural analysis in formulating maintenance plans and monitoring measures relating to the stations, and with regard to the inadequacy of site records and possible impact. MTRCL and HyD will continue to finalise the details of additional undertaking for quality assurance targeting to implement by the first half of this year.

28. The recommendations on design issues are mainly applicable to future railway projects; MTRCL and HyD will consider the recommendations in detail for implementation in future railway projects.

29. Most of the recommendations on settlement issues had been implemented through the Enhanced Mechanism put in force on 28

September 2018. The Government would ensure MTRCL to rigorously comply with the Enhanced Mechanism and the approved monitoring and control plans. The remaining recommendations are mainly applicable to the future railway projects. The Government will refine the Enhanced Mechanism according to these recommendations for implementation in future railway projects.

30. The recommendations on project management covered the enhancement of MTRCL's project management system and the Government's monitoring measures, part of which had been implemented and completed through improvement measures implemented by the Government and the follow-up actions given in the Final Report by the Commission. For SCL Project, the Government had implemented a series of measures for closely monitoring the project management procedures. These measures included deploying Government officials on site to strengthen the communications between the concerned parties, carrying out surprise checks and random checks on works progress, procedures and quality. Moreover, the M&V consultant employed by HyD, had conducted more site supervisions and audits. As regards the recommendations on other aspects of project management, the Government proposed a series of measures to enhance monitoring and control strategy, including the establishment of a new department for matters relating to railways. The Government will follow up with MTRCL for implementation in future railway projects.

31. THB will continue monitoring the relevant Government departments and MTRCL in the implementation of the EA Team's recommendations, and review their effectiveness.

Transport and Housing Bureau
Highways Department
February 2021