

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

**Construction and Commissioning of the
Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong
Express Rail Link**

INTRODUCTION

On 15 April 2014, MTR Corporation (“the Corporation”), after a careful review of the remaining project challenges, announced a revised schedule for completion of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (“XRL”) project. Under the revised schedule, the target for opening of the XRL for passenger service will be by the end of 2017.

2. On 23 April 2014, the Chairman of the Legislative Council (“LegCo”) Subcommittee on Matters Relating to Railways (“the Subcommittee”) requested the Corporation to provide further information on i) the critical elements of the delay, ii) the latest assessment on the delay’s impact on the construction programme and budget, iii) the Corporation’s reporting mechanism to Government and iv) the claims mechanism between the Corporation and the Government. This paper is intended to provide information on the points requested by the Subcommittee, the chronology of recent events, and to respond to questions raised by the public about the progress of the XRL construction works.

3. It is important to begin this review by apologising because the Corporation did not provide the Government, LegCo and the public with an updated assessment of the achievable completion date for the XRL project until April of this year. Indeed, the challenges of this project and the mitigation measures that the Corporation has implemented to meet ongoing challenges should have been better communicated throughout the progress of the project. The Corporation regrets the delay in making public the need for a revised programme.

EXECUTIVE SUMMARY

4. The Corporation recognises the strategic importance of the XRL project to the Hong Kong community and regrets that the opening date has had to be changed due to delays caused by the many challenges the Projects team has faced during construction of the rail link.

5. Events leading to programme delays and cost impacts are not unusual in large and complex construction projects. It is for the project management team to find ways to mitigate such delays and seek to keep construction costs within the original budget. The Corporation's Projects Team has, in fact, faced many such project challenges over the years and successfully been able to implement remedial measures to mitigate their impact.

6. XRL is, indeed, such a complex and challenging project. The challenges have been apparent from day one and a variety of delay-recovery measures have been in place since the early stages of the project. In overcoming the difficulties that have arisen over the course of the project, both those expected and those unforeseen, the MTR Projects team has focused its best efforts on developing workable solutions, seeking to recover programme delays and to also keep the project on budget. Many of those measures have yielded positive results.

7. Having been able to recover some delays in this project, as well as the professional judgement of the team leaders based on past successful experience with other major railway projects, the team became overly confident about the effectiveness of such mitigation measures in making up for project delays. In fact, the Projects team communication to the MTR Board and the Government continued for some time to say that the project was achievable by the end of 2015. This communication was still made in the face of overwhelming evidence from the cumulative delays across a number of contracts which indicated it was not so achievable.

8. In spite of the best efforts of the Projects team, the cumulative effect of project delays in three critical locations - the West Kowloon Terminus ("WKT") site ("Contract 810A"), the Yuen Long tunnel section between Tsat Sing Kong and Tai Kong Po ("Contract 823A") and the

cross-boundary tunnel section (“Contract 826”) – combined to make it necessary for the Corporation to put forth a revised schedule for project completion. (For details of the critical challenges facing the XRL project see paragraphs 21-46.)

9. The Corporation regrets creating a misunderstanding through its 15 April 2014 announcement of the revised construction programme that the delay was caused primarily by the damage caused to a Tunnel Boring Machine (“TBM”) in the Yuen Long tunnel section. While this was a contributing factor, it was only one of several factors that are delaying the opening of XRL until the end of 2017.

10. The Corporation has reviewed the circumstances leading up to the 15 April 2014 announcement and the reasons why delays in the project and the potential implications of these delays on the overall project cost were not communicated earlier. This document highlights when the impact of issues encountered in Contracts 810A, 823A and 826 were recognised as having potential impact on the overall project schedule. It also highlights proposals made for a partial opening of the XRL facilities to enable train operations to start in 2015 as originally scheduled. Discussions held with Government and other events immediately leading up to the 15 April 2014 announcement on the revised programme are set out in paragraph 52.

11. While much work remains to be carried out, the revised construction programme put forward provides a realistic timeline for the delivery of the XRL project and the inauguration of passenger operations by the end of 2017. (For details on the overall progress of the XRL project see paragraphs 55-65.)

12. Going forward, the Corporation is committed to strengthening its project management processes to ensure that any delays, difficulties or challenges related to the revised construction programme, and any impact on costs, are highlighted in a timely manner and addressed accordingly.

13. The Corporation will adopt a more open and transparent reporting system to ensure that Government, the Subcommittee, and members of the public are kept fully informed about project developments such as the progress of works, any delays encountered, and proposed measures to

address those delays, the consequences of delays that cannot be recovered, and the latest financial position for the project. In relation to this, the Corporation will make available key underlying documentation in a data room for access by LegCo Members during the life of the project. Details of the documentation to be included in the data room are attached at Annex 15.

14. The Board of the MTR Corporation has established a Committee, composed entirely of independent non-executive directors, to conduct a thorough review into the Corporation's project management regime in relation to the XRL project. The committee is also authorised to appoint independent external consultants and experts to assist in its review.

15. The Corporation appreciates that, in light of the extended construction programme, there are concerns about whether additional funding will be required under the Entrustment Agreement between the Corporation and Government. The original project budget was HK\$65 billion (out of total Finance Committee approved funding of HK\$66.8 billion), which included a contingency amount of HK\$5.4 billion. As at 31 March 2014, there was still HK\$3.749 billion remaining in contingency funds. (For more details on costs of XRL project see paragraphs 66-86.)

16. From time to time, the Corporation conducts an internal review of potential future events and changes and their likely cost effect under different scenarios. One such early review predicted the final cost to complete to be around HK\$68.4 billion and such internal review found its way into the media recently. This is our best estimate at this moment in time. We are reviewing in detail the final projected cost based on the revised programme of passenger service by the end of 2017. However, based on the information available and the analysis done to date, we do not anticipate that the updated assessment will differ significantly from HK\$68.4 billion. We expect to have this review completed by July for presentation to the Board of the Corporation and Government.

17. Going forward, the Corporation will continue to keep the costs of the project to the minimum necessary to deliver it in line with the revised

programme and the Corporation confirms that it will stand by its responsibilities under the Entrustment Agreement.

18. The Corporation is committed to serving the people of Hong Kong. It will address the critical challenges facing the XRL project, keep costs to a minimum and deliver this strategic rail corridor by the end of 2017 as part of its responsibility to meet the transportation requirements of the Hong Kong community.

PROGRAMME DELAY

19. The overall progress achievement of XRL as of 31 March 2014 was 56%. Out of the 42 major contracts (contract sums greater than HK\$50 million) awarded for the XRL project (Annex 2), 16 are civil works contracts which are key in setting the pace towards project completion. While each contract has experienced varying degrees of difficulty, the works of 4 Contracts (803A, 803B, 803C, 803D) have been completed while 9 (810B, 811A, 811B, 820, 821, 822, 823B, 824, 825) are progressing satisfactorily. The progress of the latter can be tracked in Annexes 3-11.

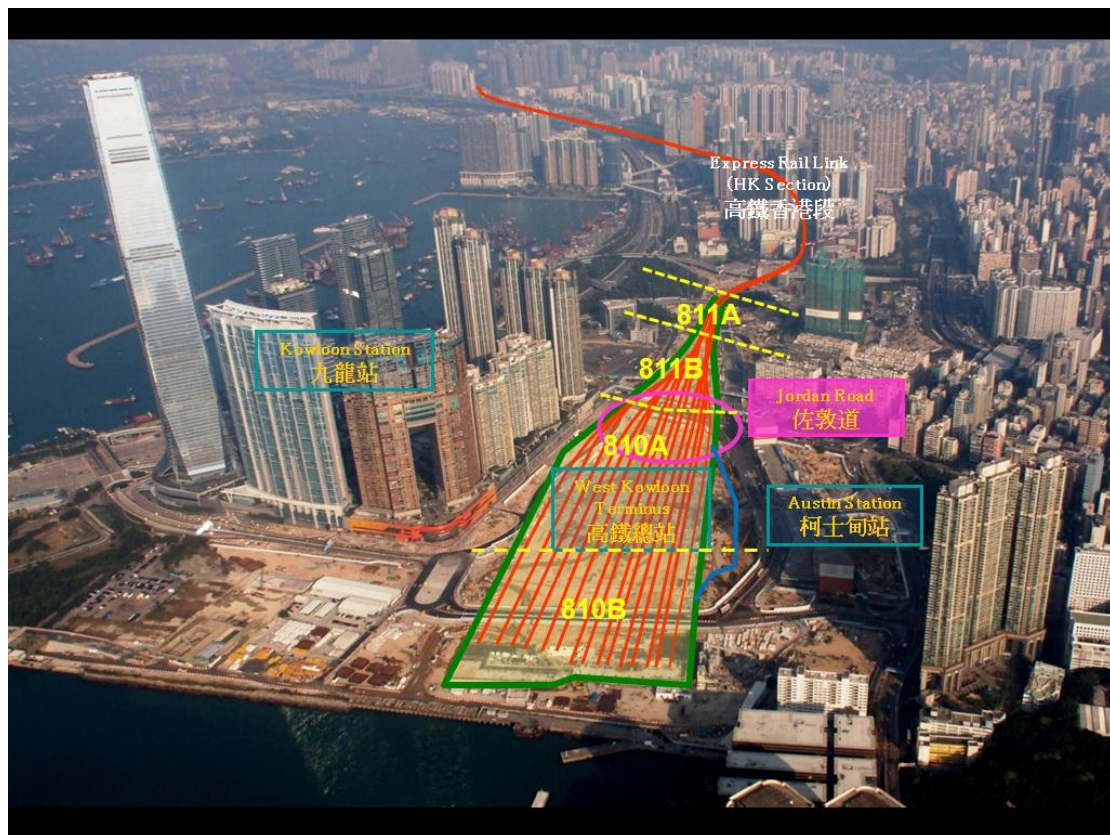
20. However, the way in which the Corporation overcomes the particularly difficult challenges faced in three specific locations is critical to the successful completion of XRL. These locations are the West Kowloon Terminus station north (Contract 810A), the Yuen Long tunnel section between Tsat Sing Kong and Tai Kong Po (Contract 823A) and the cross-boundary tunnel section (Contract 826). The following sections of this paper provide a summary of the challenges faced in these three critical areas along with the actions being taken by the Corporation and contractors to address those challenges. (Details of each of these three contracts are set out in Annexes 12-14.)

Contract 810A - West Kowloon Terminus Station North

21. Construction of WKT has faced significant challenges and delays since the commencement of works which have affected the overall progress of the XRL project. WKT is divided into four major civil works construction contracts covering the approach tunnels at the north end of

the terminus which lead to the main running tunnels, and the terminus building itself.

22. WKT lies within the reclamation area of land bounded by Kowloon Station on the west, Austin Station on the east and Victoria Harbour on the south. It is traversed by several trunk roads including Austin Road West, Lin Cheung Road and Jordan Road. The associated works also include the underground reconstruction of Austin Road West and Lin Cheung Road to produce a traffic-free piazza to the south of the terminus.



Aerial view of WKT showing how works on the four contracts (811A, 811B, 810A and 810B) are divided at the site.

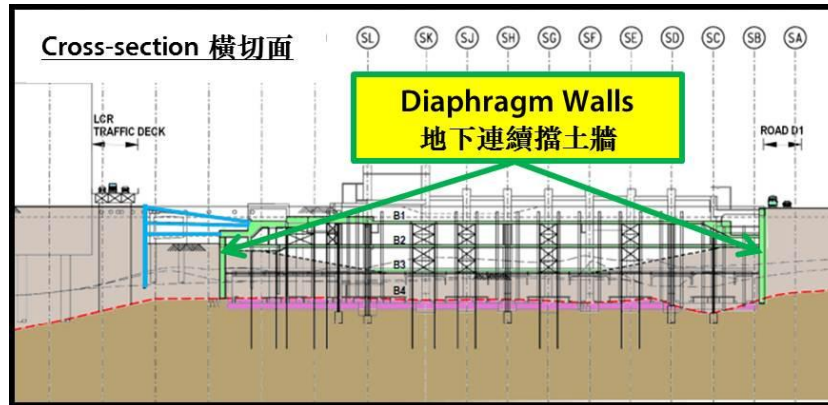
23. Occupying an area of 11 hectares, WKT is a large, four-storey underground structure with the lowest level located 30 metres below ground. The terminus building will house 15 platforms serving both long-haul and short-haul high-speed train services, passenger departure and arrival halls and a ticketing hall. The main public area of the terminus incorporates a large atrium with a steel-framed glazed roof structure.

24. The presence of operating railway lines, high rise buildings and busy main roads add to the complexity of the engineering challenges being posed. Delays have occurred from the commencement of works, but in conjunction with its contractors, the Corporation developed measures to overcome these delays. For the most part, they were not simple cases of just increasing resources to boost production output, as it was recognised that labour resources were already limited. The measures involved redesigning and resequencing the works, with some works being carried out concurrently. This process was conducted in accordance with the usual practice of other major construction projects undertaken by the Corporation.

25. One challenging area of the WKT works is the north top-down area of the terminus where the 15 tracks merge towards the two running tunnels (in Contracts 810A and 811B). This area lies beneath the yet to be reinstated Jordan Road where construction of the terminus requires the slab at B1 level to be completed first to act as a solid strut between the completed diaphragm walls, and serve to prevent unacceptable ground settlement, before excavation can continue below. Owing to the interdependency of works and the complexity of interfaces between the adjacent contracts, delays to the Contract 811B works caused delays to Contract 810A accessing the site to construct the north top-down part of the terminus building.

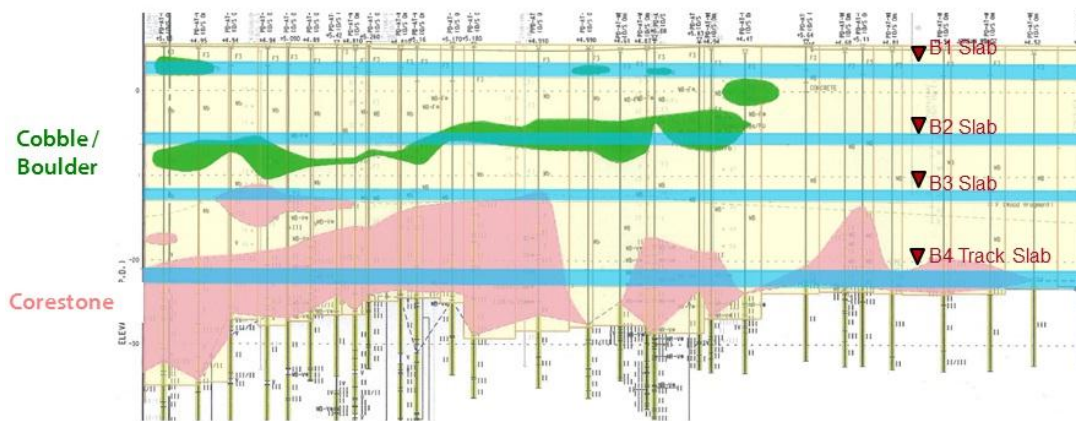
26. The following factors have caused delay to the progress of the Contract 811B works, which have in turn impacted the progress of the Contract 810A works:

- (a) A diaphragm wall prevents ground settlement outside the works site, provides groundwater cut-off and ensures the safety of nearby facilities. The diaphragm wall has to be secured into firm ground before excavation and terminus construction can begin. WKT has such a diaphragm wall around its entire perimeter.



Cross-section showing diaphragm wall construction at WKT.
Diaphragm wall marked in green.

- (b) Before construction commenced, site investigation work was carried out at the WKT site at various stages between 2008 and 2009. Information from over 600 drillholes was obtained and samples were collected at an average spacing of 14.4 metres which not only complies with Government guidelines, but also represents a spacing that is closer than industry norm. However, access was not available to certain areas during site investigation such as Jordan Road, the public transport interchange between Austin and Kowloon Stations and the central portion of City Golf Club before site possession (while work had been conducted at other parts of the Club). Site investigation was not conducted on the busy roads and public transport interchange because it would involve partial closure of the public facilities and great inconvenience to the public. In addition, a wide range of utilities were located directly beneath Jordan Road. As a result, the extent of the ground difficulties was not known before the possession of these areas.
- (c) The construction of the diaphragm wall was one of the first major works to be undertaken, but completion of the diaphragm wall was delayed for more than a year because of difficult ground conditions including uncharted large boulders, corestones and uneven bedrock in the Jordan Road area.



Difficult ground conditions in WKT.

- (d) Contract 811B experienced delay to the diaphragm walling to the north of Jordan Road which affected the date which they could divert Jordan Road northwards, to allow them to complete the terminus perimeter diaphragm wall.
- (e) To mitigate the effect of this delay, the Corporation instructed 811B to divert Jordan Road southwards - this was done in February 2012. Contract 811B then had access to most of the remaining diaphragm wall panels in Jordan Road, but not all. The Jordan Road was eventually diverted northwards in September 2012, allowing Contract 811B access to all of the remaining panels.
- (f) These remaining diaphragm wall panel works were affected by delays due to unforeseen rock and utilities in the Jordan Road area. This had a knock-on effect to handing over of the north top-down works areas to Contract 810A and in particular, the Works Area 13.61, which was only handed over to Contract 810A in November 2013.
- (g) The maintenance and diversion of complex underground utilities proved to be very challenging and time-consuming. Although the public utilities (power cables, lighting cables, telecommunications cables, water and gas pipes, storm and drainage services etc.) were charted and therefore known to exist in the WKT work site, the configuration, the spread, the

alignment of and the slack within the utilities and the locations of the utilities joints as well as the interrelationship between the services could not be identified until the Corporation took possession of the site for construction.

- (h) In the location of Jordan Road, the utilities had to be diverted in parallel with the diversion of Jordan Road itself to enable the Corporation to construct the diaphragm walls. In many cases, there was limited room to divert the utilities, which had to be handled with care to ensure the diversions did not disrupt services to nearby buildings.



Excavation exposed complex and congested underground utilities beneath Jordan Road.

27. In addition to the delays to Contract 810A caused by delayed access to the site, Contract 810A has experienced further substantial delay to the planned programme and sequence of the works. Those delays have resulted from, among other things:

- (a) unforeseen ground conditions;
- (b) design changes to the roof, design development and other design changes; and
- (c) other miscellaneous delaying events.

28. The Engineer's Representative has advised the Contractor that it has an entitlement of 259 days of extension time to the Contract 810A works as a result of 12 notified delaying events assessed up to 31 March 2013. The Contractor has made additional claims relating to the period following 31 March 2013 that are currently being assessed.

29. While one part of the 810A works area has been excavated down to the B4 level and that part of the terminus structure is being built using the bottom-up method, the north top-down area of the site still requires the removal of approximately 78,000 cubic metres of fresh bedrock, out of 100,000 cubic metres of rock, to reach B4 level.

30. The Corporation has been trying to recover various delays at WKT through mitigation measures. Measures implemented in Contract 810A included adopting an additional bored piling method to install steel columns in the north top-down area, adding temporary socketed H-piles to advance construction of critical plant rooms at the B3 level, putting in additional socketed H-piles and bored piles to accelerate the construction of parts of the core structure, adding steel struts to facilitate roof erection, and building additional struts across the B2 slab opening to provide earlier lateral support. However, these measures still could not help the Corporation catch up with the overall project delay.

31. Going forward, the Corporation has developed a plan to provide early access in phases at the north top-down area by prioritising critical areas for Designated Contractors in particular, the Electrical & Mechanical ("E&M") contractors, such that services installation can start as soon as possible and be carried out concurrently with the civil works. The Corporation is also working with the contractors to deliver the XRL project according to a more realistic construction programme, by improving excavation rates through alternative construction methods and by setting an achievable monthly concrete work production rate of 20,000 cubic metres.

32. WKT is programmed to complete all major structural works by December 2016 so the project will be ready for passenger service by the end of 2017. The Corporation will report on the excavation rate, concrete

production and any resequencing of works in its next update to the Subcommittee.

33. There are other potential measures to further accelerate the WKT programme:

- (a) the Corporation is in discussion with respective Government departments for a proposal to completely close Lin Cheung Road northbound between Austin Road West and Jordan Road to allow more work fronts to be established for the construction of the Lin Cheung Road Underpass. To ensure adequate traffic capacity is maintained, existing traffic will be redirected around Nga Cheung Road to the west of Kowloon Station. Nearby residents will be consulted on this temporary traffic management scheme; and
- (b) another option being explored is the use of blasting to break apart the bedrock in the north top-down area of the terminus. Blasting as a replacement for mechanical excavation will directly speed up works progress. Before blasting is possible, the Corporation has to apply for a blasting permit from the relevant Government departments as well as consult local stakeholders. The Corporation is now engaged in the pre-application process. In the event that such application is approved, the Corporation will seek to minimise any associated disturbance to surrounding residents.

34. The revised construction programme does not rely on either of these further enhancements.

35. As reported in the meeting of the Subcommittee in November 2013, the civil works for XRL are now reaching the peak period. The project currently employs around 8,500 construction workers and technical/professional staff, some 1,500 less than the 10,000 estimated to be required. The demand for skilled labour in the E&M contracts is also expected to increase. Considering the five railway projects currently under construction, as well as other major projects in Hong Kong, the current labour supply is, to say the least, tight. The Corporation believes

that an adequate supply of skilled labour will certainly help to reinforce timely delivery and, in that regime, the Corporation has and will continue to work closely with the Government and the construction industry on various measures to facilitate any justified applications for the Supplementary Labour Scheme. It should, however, be noted that the revised 2017 programme assumes that the current labour situation will continue throughout the project.

Contract 823A - Yuen Long Tunnel Section

36. This contract is at the location of the former Choi Yuen Tsuen. Site access was delayed at the beginning of the project due to land resumption problems. Landowners and other interested parties strongly objected to the land being resumed and as a result, the land resumption process took significantly longer than originally anticipated resulting in a delay from November 2010 to May 2011. This also restricted the amount and extent of site investigation works that could be carried out prior to this contract being tendered.

37. Higher than originally anticipated rock head levels, as set out in the Geotechnical Baseline Report, were encountered by the Contractor. As a result of the higher rock head levels, the Contractor was required to carry out modified temporary works design and construction works to the tunnels access shaft. This resulted in delays between October 2012 and April 2013.

38. While the original contract scope was to use only one TBM, it became necessary to deploy a second TBM to mitigate the delay and the Corporation instructed the contractor to procure the machine accordingly.

39. Even with the second TBM, the contractor continued to experience difficulties in recovering the time lost. This was due to several reasons including site constraints affecting the volume of tunnel spoil that could be removed from site and mechanical problems with the TBMs.

40. In order to mitigate the problems concerning land resumption and higher than expected rock head levels, the Corporation executed Supplementary Agreement No.1 with the Contractor. This agreement sets out numerous measures to mitigate and recover delays.

41. A further setback was experienced on 30 March 2014, when the black rainstorm washed a substantial amount of soil from a 4 metre high slope inside the construction site of the adjacent Contract 823B which was under the management of the contractor and not the Government Civil Engineering and Development Department. As such, the landslide was not reported by the Government after the storm. Soil and debris from the slope blocked the drains at the site and damaged the 400 millimetre flood protection barrier at the section of cut-and-cover tunnel which had worked effectively in previous black rainstorms. As a result, rain water and debris overflowed into the cut-and-cover tunnel. Electric pumps were installed in the water tight tunnel to control groundwater seepage and rainwater from the open topped construction shaft. The pumps are not designed to cope with any massive floodwater inflows such as those that breached the damaged flood barrier. The severe adverse weather conditions caused disruption to the contractor's (and not CLP's) power distribution system, with the pumps inoperable for about 30 minutes which exacerbated the flooding condition. However, even with the pumps in continuous operation they would not have prevented the flooding to the tunnels. The flood water from the 823B cut-and-cover tunnel then continued to flow into the substantially bored TBM tunnel in Contract 823A, submerging the TBM. The TBM is not designed to withstand water ingress flowing in from behind the TBM. The flood rendered it inoperable. The TBM requires extensive replacement of its electronic and electrical components before it can resume operations.



The flooded TBM with damaged components inside the Yuen Long tunnel.

42. The Corporation, the contractor and the TBM supplier have explored different options to complete excavation of the remaining 52 metres of the concerned tunnel. The latest assessment indicates that the most viable solution would be to repair the TBM in-situ. To date, there are some 2,000 components that need to be replaced. The inspection is still ongoing. It is also noted that some of the components will take up to five months to be manufactured and supplied. Placement of orders has commenced and preparation for the repair works has also started. It is expected the damaged TBM will be able to resume full operation after repair and testing in December 2014.

43. In spite of the flood protection measures that were in place, they were clearly not adequate to withstand the severity of the black rainstorm on 30 March. Therefore flood protection has been enhanced including erection of a temporary flood wall between the Contracts 823A and 823B tunnels, strengthening of the existing flood control system and installation of robust flood boards at the concerned area.

44. Additional measures to improve TBM operations will also be implemented including replacing the current compressed air man-lock from a single compartment to a double compartment to allow more efficient maintenance and replacement of the cutters, and installing a more robust (shaft type screw conveyor) spoil removal system. One new cutterface has been procured to cater for the difficult ground conditions encountered in the first tunnel drive.

Contract 826 - Cross-Boundary Tunnel Section

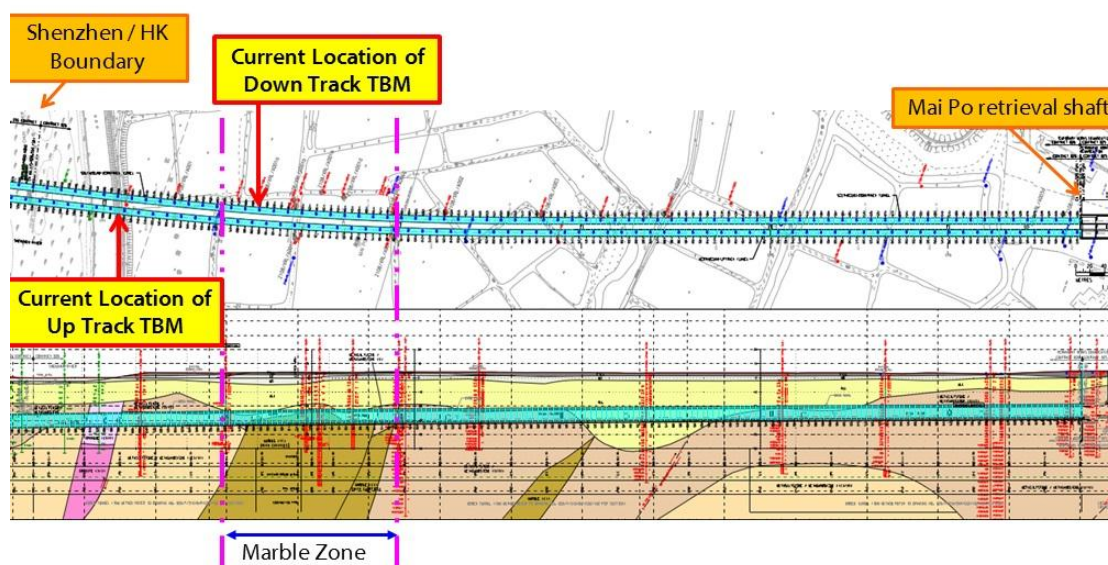


Cross-boundary tunnel section runs through protected area.

45. The complex geology in the cross-boundary tunnel section of the XRL requires the Corporation to ensure the contractor to proceed with extreme care. The TBM for this section started its drive in Shenzhen. Only upon reaching the boundary do the tunnelling works come under the management and supervision of the Hong Kong Section as Contract 826. Due to construction difficulties encountered on the Shenzhen side, the down track and up track TBMs arrived at the Hong Kong boundary fourteen and a half months later than originally scheduled, crossing from Huanggang in November 2013 and March 2014 respectively.

46. Along the Hong Kong alignment in the Mai Po area, a 200-metre section of bedrock in the marble formation is known to contain cavities. Owing to access constraints at the ground surface by the presence of fish ponds and the wetland preservation area under the Ramsar Convention on Wetland Treaty, the Corporation has not been able to obtain detailed

information about the exact location and extent of these cavities from conventional site investigation methods. To ensure the safe operation of the TBM, the location of the cavities has to be ascertained during construction by probing ahead in the tunnel face before entering into the marble formation. If cavities are encountered, the TBM operation has to stop and the cavities filled by cement based grout before the TBM can resume its drive forward. Due to the requirement of probing ahead of the TBM to test for the presence of cavities, to ensure safe operations, the time required to bore through the marble zone will be more than double that typically needed to bore through ordinary rock mass without cavities. As such, when the construction programme was set, more time was reserved for excavation work in the marble zone. However, the late arrival of the TBMs has eliminated much of the buffer time that had been built into the programme, leaving little allowance to handle any unforeseen event which may arise.



Marble zone is ahead in the TBM drive in the cross-boundary section.

CHRONOLOGY OF KEY DEVELOPMENTS

47. As indicated in this section of this document, the Board of the Corporation was only advised on 16 April of this year that the delays encountered in Contracts 810A, 826 and 823A made it clear that a 2015 completion schedule could not be met.

48. An objective review of the various contract delays and inability of the contractors to increase output to the necessary level during the last quarter of 2013 or earlier in 2014 would indicate that an earlier announcement of the delay in project implementation was necessary. The Corporation must stress that it never intended to withhold any facts about the state of the project. Over the past few years, the Corporation's Projects team has been trying its very best to mitigate delays with the aim to deliver the XRL project on time and within budget.

49. Two questions that have been raised publicly are when did the Corporation become aware of the seriousness of the delays and whether there has been any late disclosure of such delay. Events leading to programme delays and cost impacts are not unusual in construction projects of this scale, particularly large complicated projects. It is for project management to find ways to mitigate such delays and keep construction costs within the original budget. From the Corporation's experience on previous projects and throughout the XRL project there have been a number of events and unforeseen circumstances leading to potential programme and cost adjustments. However in most of these cases, through active project management, the Corporation was able to mitigate such events or circumstances thereby maintaining the original programme.

50. However with the passage of time, it became clear that in the case of three contracts, namely 810A, 823A and 826, despite efforts by the Corporation, measures to recover delay could still not bring the programme back to the original forecast.

51. We have investigated the circumstances and history leading up to the announcement of the delay to the XRL programme with a focus on, but not limited to, the three contracts previously highlighted.

52. A chronology of the key developments are summarised below:

- (a) In **February 2013**, it was highlighted by the Projects Director to the Corporation's Audit Committee that, whilst there were significant delays with tunneling works on XRL, good progress was still being made despite the challenges being faced. Hence,

the XRL project was progressing reasonably well for a 2015 opening and on budget.

- (b) Starting back in **March 2013**, the Projects Programme team highlighted two contracts, 810A and 826, which were significantly behind schedule but which at that time would still not have impacted a programme to open XRL by the end of 2015. On 7 March 2013, the Projects Director confirmed to the MTR Board that all projects were on target from both a cost and time perspective.
- (c) A workshop was held with the contractor of 810A on **17 April 2013** to analyse progress and measures to recover delays – in that meeting the contractor estimated a completion date for WKT of June 2016. Instructions at or shortly after the meeting were given to Project Managers and the contractor to find solutions to bring the WKT programme back to 2015 completion.
- (d) In **June 2013**, an internal update programme (using known risks at end April 2013) was produced by the Projects Programme team showing that an end 2015 date for opening of service was still possible but based on a Minimum Operating Requirement (MOR) approach. The Corporation's Projects Team had commenced work on this proposal from the end of March 2013. This approach would still provide a passenger service in 2015 but would have the following differences from a full opening – running six tracks as opposed to 15 at WKT and delaying certain non-essential construction works while running two-cross-boundary tunnels. Without the MOR approach the entire project would not be expected to complete until September 2016.
- (e) The update programme incorporating MOR was then presented to members of MTR's Executive on **13 July 2013** together with a best estimate cost of XRL of HK\$65.1 billion. The presentation was agreed. On 31 July 2013, it was mentioned at an Executive Committee meeting that the project continued to experience challenges but the budget and completion date were still expected to be met.

- (f) At the Corporation's Audit Committee meeting on **14 August 2013**, the Projects Director reported that the XRL project was on time and on budget although there would still be multiple challenges to overcome and delay recovery measures to be undertaken.
- (g) At the **29 August 2013** Project Supervision Committee ("PSC") meeting, the Chairman expressed concerns about the difference between the actual progress and planned progress of the project, especially the progress of the WKT works.
- (h) The Projects team gave the same MOR presentation to members of the Railway Development Office of the Highways Department (RDO) on **13 September 2013**. Members of Highways and RDO raised a number of concerns on MOR as the basis of opening in December 2015 but there was no agreement nor disagreement on the MOR proposal. In addition, there was detailed discussion regarding a material delay in pouring concrete which had delayed Contract 810A.
- (i) Progress for the three contracts – 810A, 826 and 823A remained behind the updated and revised timetable. This was further compounded by the delay mentioned above and further delays in tunnel progress under Contract 826 on the Shenzhen side. Furthermore progress in Contract 823 started causing concerns from **October 2013** which were highlighted to key members of the Projects team.
- (j) In **October 2013** formal MTR proposals relating to MOR were presented to the contractor for WKT and the contractor was requested to respond with a project plan for end 2015 completion based on such MOR proposals. At the MTR Executive Committee meeting on 24 October 2013 it was noted by the Projects Director that critical delays were being experienced in certain contracts which had a significant impact on the overall project timetable, although it was confirmed that the XRL project would remain on time (for MOR) and on budget.

- (k) Commencing **November 2013**, the key contracts remained at low productivity and the Projects Director asked the relevant Projects Managers to review and confirm whether there were any serious doubts about the achievability of the current timetable. On 8 November 2013 a meeting was held between Transport and Housing Bureau (THB) and senior Projects team members to update THB on (i) Contract 826; and (ii) MOR revisions. The revised time schedule for Contract 826 indicated that this contract could not be completed in time for track construction and testing prior to end 2015. The programme presentation given was the same one as given to the members of Executive in July 2013 showing the possibility of MOR opening in 2015 (but not updated for contract delays since April 2013).
- (l) In programme updates during the month of **November 2013** it was highlighted to senior Projects team members that, in particular, Contracts 810A, 823A and 826 continued to face critical challenges and were not achieving production rates required to meet an opening by end 2015.
- (m) On **21 November 2013**, a telephone call followed by a meeting took place between senior THB officials and senior MTR management team members. At that meeting MTR told THB that opening XRL under an 'extended' MOR concept in 2015 was still possible. Such 'extended' MOR would be based on the original MOR proposal plus the use of one tunnel (rather than two) across the boundary section running in bi-directional format (with the aim of delivering the second tunnel at a later point in time). THB significantly questioned this 'extended' MOR and did not agree to it.
- (n) At the Subcommittee meeting of **22 November 2013**, there was no mention of MOR nor 'extended' MOR but there was some discussion regarding the contract delays and that various measures were adopted to catch up on the schedule. It was confirmed that construction of XRL would be completed by 2015 and WKT would be ready for service with elementary reception

facilities. The Government also responded it would take generally 6 to 9 months for Testing and Commissioning.

- (o) At the PSC meeting held on **29 November 2013**, the Corporation explained, in response to a query from the Chairman, that they had developed a roadmap towards the proposed MOR scenario.
- (p) On **10 December 2013** at the Board meeting of MTR, the Project progress, mitigation and recovery plans were discussed and the Projects Director confirmed that the project would be completed prior to the end of 2015.
- (q) In a Corporation internal **December 2013** programme update for WKT for the Projects Team, it was indicated that WKT would not open for 2015 even on an MOR basis.
- (r) In **January 2014** based on the progress of work at WKT and other internal MTR project assessments, internal project management projections estimated completion of works at 2016.
- (s) At the **24 January 2014** PSC meeting, the Chairman enquired about the confidence level in the proposed MOR in 2015. The Corporation responded that they would review the overall programme situation and update the Government in April 2014.
- (t) In **February 2014**, an informal indication from the 810A contractor to the Corporation's Projects Team indicated that, according to the contractor's calculation, even with the Corporation's proposed MOR, there would be no track access until June 2016. In the same month, in discussions with the Corporation's Audit Committee, no concerns were raised by the Projects Director in relation to the 2015 opening date for the XRL project.
- (u) During **March 2014**, delays in contracts remained a serious concern to the extent that a briefing was proposed by the Projects Director to MTR Executive Committee for early April 2014 regarding the expected timetable for revenue operation of the

project in 2017. At the same time, an initial internal assessment of cost indicated a project budget of around HK\$68.4 billion on such timetable which subsequently found its way into the media.

- (v) On **30 March 2014**, the Black Rainstorm caused serious flooding to the Yuen Long tunnel causing damage to the 823A TBM resulting in further delay on that contract.
- (w) On **31 March 2014**, the contractor for WKT formally reported to the Corporation that the MOR proposal submitted to it in October 2013 in their view indicated MOR completion in 2017. The MTR Projects Director indicated the whole project should be reassessed without MOR.
- (x) On **12 April 2014**, the revised programme and cost was presented to members of the MTR's Executive Committee. Immediately thereafter on **15 April 2014**, the announcement of the delay was made public.
- (y) On **16 April 2014**, the Corporation's Board was appraised of the situation.

PROJECT MANAGEMENT

53. The XRL project is extremely complex and challenging. Due to various circumstances and challenges encountered since the start of construction works, delay recovery measures have been necessary at all stages. These measures have included introducing additional resources, resequencing works and arranging for works to be carried out concurrently among contracts.

54. Active project management in many cases has resulted in the successful mitigation of challenges that could have created some very significant delays. Examples include (further detailed in [Annex 1](#)):

Contract 823A	
Issue	Late site possession
Possible Delay	5 months
Mitigation	Asked contractor to provide a second TBM from Japan
Result	Recovered the delay caused by late site possession
Contract 802	
Issue	Deformed H-shaped piles obstructed TBM drive
Possible Delay	21 months
Mitigation	Adopted different extraction method – “Rotator and Wedge”
Result	Mitigated delay to overall programme
Contract 811B	
Issue	Construction of diaphragm wall under Jordan Road
Possible Delay	6 months
Mitigation	Asked contractor to implement an additional stage in Temporary Traffic Management Scheme
Result	Diaphragm wall construction at northern section of WKT started 6 months earlier

MOVING FORWARD

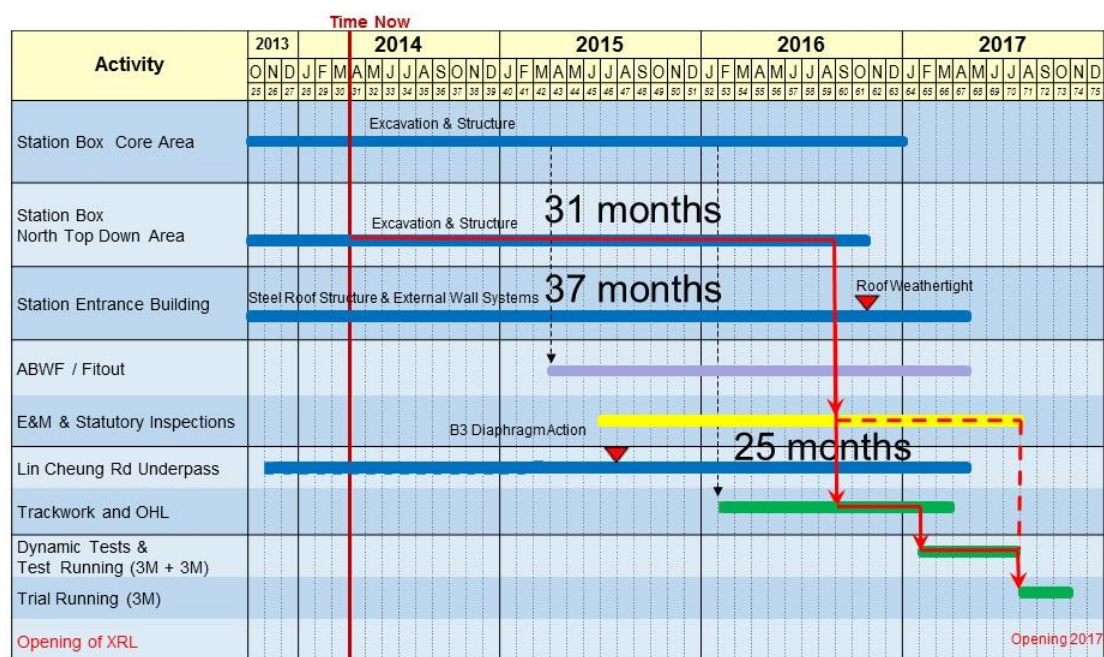
55. While much work remains to be carried out, the revised construction programme put forward provides a realistic timeline for the delivery of the XRL project and the inauguration of passenger operations by the end of 2017. Contracts 810A, 823A, and to a lesser extent 826, are critical determinants to the opening by the end of 2017. The revised programmes of these three contracts are explained in detail in the following section.

Contract 810A – West Kowloon Terminus

56. Contract 810A at the northern section of WKT is expected to achieve completion of major structural works including the core area and the north top-down area station box in December 2016. The construction of the Lin Cheung Road Underpass and the roof steel structure and

external wall systems of the Station Entrance Building are expected to be completed in April 2017. However, completion of the Lin Cheung Road Underpass and the Station Entrance Building in April 2017 is independent and not linked to the testing and commissioning of the railway systems.

57. The critical path for this contract is driven by completion of the north top-down structure for installation of trackwork, overhead lines and other track related E&M systems as well as completion of critical E&M plant rooms for railway systems installation, testing and commissioning and statutory inspections. These works are critical to allowing the commencement of the full Testing and Commissioning period originally planned to prove the railway system is safe and reliable for passenger service. Testing and Commissioning includes 3 months of dynamic tests, 3 months of test running and 3 months of trial running when the trains run according to a schedule.



Contract 810A programme to completion.

Contract 823A – Yuen Long Tunnel Section

58. For Contract 823A, the operation of the TBM in the northern part of the down track tunnel has been suspended since the March 2014 flooding incident. The TBM is expected to resume full operations in December 2014. It will take about 1 month to finish excavating the remaining 52 metres of tunnel. The southern section of the down track

tunnel is expected to be completed around May 2014. Track laying will commence in the down track tunnel in phases after substantial completion of cross passages, walkway and tunnel invert works.

59. After completion of the down track tunnel drives, the TBMs will be re-assembled at the launching shafts for the northern and southern up track drives. The two TBMs are expected to break through the southern and northern sections of the up track tunnel in May 2015 and February 2016 respectively. Therefore the up track tunnel will be ready for track laying in two phases, by August 2015 and September 2016.

60. The Contract 823A tunnel section is a mix of soft and hard rock and the assumed excavation rates are based on actual rates achieved for the adjacent down track tunnels.

		Tunnel Breakthrough	Tunnel Complete For Track Laying	Overhead Line Energisation Ready for T&C
North Tunnel	Down Track	Jan 15	Jul 15	Feb 16
	Up Track	Feb 16	Sep 16	Dec 16
South Tunnel	Down Track	May 14	Sep 14	Feb 16
	Up Track	May 15	Aug 15	Dec 16

Contract 823A programme to completion.

Contract 826 – Cross-Boundary Tunnel Section

61. The tunnel alignment for Contract 826 needs to bore through a 200 metre marble zone. The programme assumes the TBMs will achieve 60 metres per month when boring through the marble zone to allow for additional probing and grouting works envisaged and a rate of 160 metres per month in other ground conditions. The two TBMs are expected to break through at the Mai Po TBM receiving shaft in February 2015 and May 2015 respectively with track laying commencing in September 2015 after completion of cross passages, walkways and tunnel invert works.

62. Both Contract 826 tunnel construction works are scheduled to be completed in advance of the 823A up track tunnel and therefore have programme buffers to accommodate any worse-than-expected ground conditions.

	Tunnel Breakthrough	Tunnel Complete For Track Laying	Overhead Line Energisation Ready for T&C
Down Track	Feb 15	Sep 15	Feb 16
Up Track	May 15	Sep 15	Dec 16

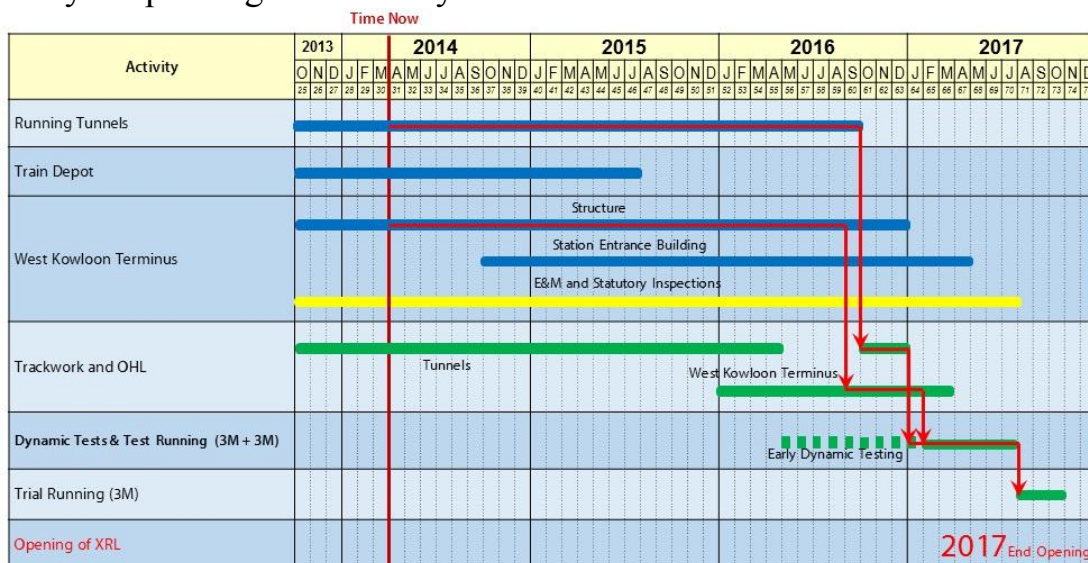
Contract 826 programme to completion.

Overall

63. In terms of the overall XRL programme, an opening by the end of 2017 is considered realistic and achievable. The majority of the contracts contain programme buffers with West Kowloon Terminus Contract 810A and the Tunnel Contract 823A remaining the most challenging.

64. The entire down track tunnel of XRL and the up track tunnel from Shek Kong to Nam Cheong will be completed and ready for advance initial dynamic testing of the rolling stock and signalling systems within the second quarter of 2016. This initial dynamic testing period of some 8 months will enhance the safety and reliability proving of the railway related systems prior to commencement of full testing and commissioning in early 2017.

65. Full trial running is scheduled to commence in August 2017 and ready for passenger service by the end of 2017.



XRL project programme to completion.

COST

LegCo Approved Funding

66. Funding for the design and site investigation in relation to the XRL project was approved by the Finance Committee of LegCo on 4 July 2008 in the total amount of HK\$2.783 billion.

67. Out of this amount, a sum of HK\$2.581 billion was allocated by the Government to the Corporation to carry out the necessary design and site investigation activities for the XRL project in accordance with an “Entrustment Agreement for the Design and Site Investigation in Relation to the Express Rail Link” dated 24 November 2008.

68. Funding for the construction of the XRL project was approved by the Finance Committee of LegCo on 16 January 2010 in the total amount of HK\$66.818 billion (i.e. excluding the HK\$2.581 billion referred to at paragraph 67). A summary is provided below.

Railway Works Budget

Construction Costs	HK\$43.615B
Project Management	HK\$3.261B
Contingency*	HK\$4.446B
Railway Works Total	HK\$51.322B

Non - Railway Works Budget

Construction Related	HK\$9.137B
Project Management	HK\$0.699B
Contingency*	HK\$0.954B
Non Railway Works Total	HK\$10.79B

Monitoring & Government Facilities	HK\$0.333B
Escalation	HK\$4,373B

Total Budget Approved by LegCo	HK\$66.818B
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* Total contingency = HK\$4.446B + HK\$0.954B = HK\$5.4B

Budget Allocation for Construction

69. Out of this amount, a sum of HK\$65 billion was allocated by the Government to the Corporation to carry out the construction and commissioning of the XRL project in accordance with an “Entrustment Agreement for the Construction and Commissioning of the XRL” dated 26 January 2010.

70. The remaining HK\$1.818 billion was retained by Government for project monitoring, Government facilities and other works associated with the project that are not the responsibility of the Corporation. These funds remain under the control and management of the Government.

Procurement / Budget / Cost Control

71. The Corporation has a set of procedures that provide a control and governance framework for procurement, contracts administration and cost control across all of its projects. These procedures have been developed over a period of 30 years based upon international practice and experience from previous Hong Kong railway projects.

72. Procurement is conducted via open prequalification of tenderers on a worldwide basis, under a transparent and objective system, which complies with the World Trade Organisation Agreement on Government Procurement (WTO GPA). For contracts which exceed the equivalent of 0.2% of the Corporation's net assets in value, in accordance with the Corporation's Tender Board terms of reference, contract award is subject to the approval of the Corporation's Board of Directors.

73. Contracts administration is carried out in accordance with the provisions of the respective procedures and the terms of the respective contracts. The control of expenditure under awarded contracts is carried out by the Corporation's Project Control Group ("PCG") within powers delegated by the Executive Committee.

Initial Project Control Total

74. In accordance with the Corporation's Project Cost Control Procedure, the cost estimate for the XRL construction works, based on the design at the time of funding approval, was reconciled against the budget of HK\$65 billion (the "Initial Project Control Total"), with all costs expressed as money-of-the-day values (MOD). This has provided the basis for all cost control and financial reporting related to the project.

75. Under this procedure, where a contract is awarded at an amount less than the estimated budget for that contract, surplus funds are returned to contingency, or vice versa. Where additional funding is required under an awarded contract, for example due to unforeseen physical conditions artificial obstructions or design changes, funding is drawn from contingency.

Current Budget Status

76. A total of 42 major contracts (contract sum greater than HK\$50 million) have been awarded up to March 2014, with a total awarded contract sum of HK\$44.630 billion.

77. The total awarded contract sum reflects procurement savings, which were in part achieved through competition created by the Corporation's open international tender process. These procurement

savings are retained within the project budget as contingency to cover potential additional costs due to unforeseen events which are not the responsibility of the contractor under the Corporation's Conditions of Contract.

78. The measures taken by the Corporation to manage and mitigate the impact of the challenges experienced on the XRL project, including buying an additional tunnel boring machine and adopting a new method to extract the deformed H-piles, have had a significant cost effect. All additional expenditure has been approved, tracked and monitored in accordance with the Corporation's Project Cost Control Procedures and funded out of the contingency budget.

79. As at March 2014, the remaining contingency within the approved budget of HK\$65 billion is HK\$3.749 billion. This contingency remains available to cover the cost of future events, which are not known or which have not been allowed for to date.

Cost to Complete

80. From time to time the Corporation will conduct a review of potential future events and their cost effect under different scenarios to predict whether the remaining contingency is likely to be adequate.

81. The internal working paper which found its way into the media (Forecast Outturn Cost Position of XRL Project as at March 2014 (Draft) 10 March 2014) was the result of one such review. This work, as an ongoing exercise that is subject to validation, was subsequently further developed to show a Base Case cost to complete of around HK\$68.4 billion (i.e. HK\$3.4 billion in excess of the Corporation's allocated budget of HK\$65 billion).

82. This assessment needs to be further updated based on the revised programme for the XRL, which is summarised at paragraph 65. An updated assessment of the cost to complete will be provided once this exercise has been completed. The Corporation anticipates this assessment will be completed in July 2014 for presentation to the Board of the Corporation and Government. It should be noted however that this assessment will still only be an estimate given that it relies on a

prediction of future events and the fact that a large proportion of costs are yet to be incurred.

83. As at today therefore, whilst it is considered unlikely that the project can be delivered within the original project budget of HK\$65 billion, the updated assessment may differ from HK\$68.4 billion. However based on the information available and the analysis done to date, it is considered that the updated assessment will not differ significantly from this amount.

84. Assuming that the updated assessment will show that the cost of the project is likely to exceed the original project budget of HK\$65 billion, the Corporation will formally notify Government in accordance with the Entrustment Agreement, including the estimated amount by which the budget will be exceeded. The Corporation will also estimate the date by which the money will be required to be available.

85. Going forward, the Corporation will continue to keep the costs of the project to the minimum necessary to deliver it in line with the revised programme. The Corporation will continue to monitor the estimated cost to complete of the project and to manage any changes to this in accordance with the Corporation's Project Cost Control Procedure and, as in relation to the programme, will provide updates of its assessment of the cost to complete to Government and the Subcommittee on a regular basis going forward.

86. Whilst the Entrustment Agreement provides that the Government will be responsible for funding the construction cost of the project, the Corporation does have a number of obligations to the Government under the Entrustment Agreement, including a number of skill and care warranties. The Corporation confirms that it will continue to meet its obligations under the Entrustment Agreement.

PROJECT REPORTING

87. A reporting mechanism has been set up between the Corporation and the Government to ensure timely reporting and transparency of

information. The Corporation has been working closely with the Railway Development Office (“RDO”) under the Highways Department, which was tasked by the Government to co-ordinate among various government departments on all matters relating to railway development including the construction of new railway projects. RDO takes up the role to oversee the implementation and delivery of the XRL project.

88. The Director of Highways, acting as the controlling officer, leads a high-level inter-departmental Project Supervision Committee with meetings held monthly between the Corporation and related Government departments to closely review the project including its progress and cost control. PSC also serves as the decisive authority to steer any matters that would affect the progress of XRL.

89. At the project execution level, the Corporation also invites RDO representatives to attend the monthly project progress meeting chaired by the General Manager of the XRL project for discussion on any major site and project issues. The Corporation’s PCG monitors the project’s cost control. Weekly PCG meetings are held to which representatives from RDO are invited to attend and participate in the review and approval of any cost changes delegated by the Corporation’s Executive Committee.

90. Implementation of the XRL works is also subject to regular audits by an independent consultant appointed by the Government whose role is to monitor and verify the design, construction works and costs undertaken by the Corporation at all stages of the project from design, construction to testing & commissioning.

91. The Corporation also provides regular reporting to LegCo and the public. Half-yearly reports are made to the Subcommittee on Matters Relating to Railways at six-month intervals which cover the latest progress update of the construction works for XRL and its financial situation.

92. Within the Corporation, the XRL project is the subject of regular reporting by the Projects Team to the Executive Committee, the Board and the Audit Committee.

CONCLUSION

93. Project communications will be enhanced to keep Government, LegCo, and the public fully informed of the progress of construction works, difficulties encountered and their related mitigation measures, as well as the project's financial position and other issues that may be of concern to the community. This reporting will be supplemented by the documentation to be included in the XRL project data room.

94. A thorough review of the Corporation's project management regime in relation to the XRL project will be conducted by a committee of independent non-executive directors who will be assisted by independent external consultants to provide an objective, third-party perspective.

95. The Corporation is committed to serving the people of Hong Kong. It will address the critical challenges facing the XRL project, and make the best use of public resources to continue to keep costs to a minimum as it takes the project towards completion.

96. The Corporation will make every effort to complete the project in accordance with the revised programme and it looks forward to delivering this strategic rail infrastructure for passenger service by the end of 2017 for the benefit of the whole Hong Kong community.

MTR Corporation

May 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the "XRL Project") and anything stated in this report is without prejudice to any of MTR Corporation Limited's legal or contractual rights in respect of the XRL Project.

Successful Delay Recovery Measures in XRL Project

Active project management in many cases has resulted in the successful mitigation of some very significant delays that might have occurred. Examples include the following:

Contract 823A	
Issue	Late site possession
Possible Delay	5 months
Mitigation	Asked contractor to provide a second TBM from Japan
Result	Recovered the delay caused by late site possession

Later than expected handover to the site in Yuen Long for the Contract 823A tunnelling works and construction of the Shek Kong Stabling Sidings and Emergency Rescue Siding under Contract 823B put the start of works back 5 months. While one tunnel boring machine (“TBM”) was originally planned for the tunnelling works under Contract 823A, the Corporation immediately instructed the contractor to purchase a second TBM from Japan with the objective of recovering the delay in site handover. The effect of this delay, including the additional TBM, resulted in an additional cost of HK\$390 million.



The second TBM was launched in March 2013 to catch up with delays in the Yuen Long tunnel section.

Contract 802	
Issue	Deformed H-shaped piles obstructed TBM drive
Possible Delay	21 months
Mitigation	Adopted different extraction method – “Rotator and Wedge”
Result	Mitigated delay to overall programme

Prolonged works of an additional 21 months occurred under Contract 802 due to complications in the removal of about 300 H-shaped piles at the Nam Cheong Station site. The piles were not related to XRL works, having been put in several years earlier. During the removal process, the piles were found to be deformed. As a result, the normal extraction method could not be deployed. A different “Rotator and Wedge” extraction method had to be adopted and new equipment brought in. The effect of this delay, including the additional plant and machinery required to remove the deformed piles, resulted in an additional cost of HK\$483 million. Through re-sequencing of works, the project team was able to mitigate the delay and stay close enough to the works programme schedule such that it has not caused a delay to the overall programme.



Deformed piles removed at Nam Cheong Station site.

Contract 811B	
Issue	Construction of diaphragm wall under Jordan Road
Possible Delay	6 months
Mitigation	Asked contractor to implement an additional stage in Temporary Traffic Management Scheme
Result	Diaphragm wall construction at northern section of WKT started 6 months earlier

In Contract 811B, the Corporation asked the Contractor to introduce an additional stage in its proposed Temporary Traffic Management Scheme to divert the existing Jordan Road southwards, and the implementation of this additional traffic diversion in February 2012 enabled the construction of the remaining diaphragm wall panels that were to be built at the northern part of WKT to start 6 months earlier. This measure reduced the criticality of the originally planned northwards diversion to allow completion of the WKT perimeter diaphragm wall underneath the existing Jordan Road.



An additional traffic diversion enabled construction of diaphragm wall to start 6 months earlier in Contract 811B.

Annex 2

XRL Awarded Contracts over HK\$50 Million (Up to March 14)

Contract	Appointed Contractor	Contract Sum (HK\$ million)
802 Nam Cheong Property Foundation Removal	Hsin Chong Construction Company Limited	334
803A West Kowloon Terminus Diaphragm Wall (Site A)	Bachy Soletanche Group Limited	461
803B West Kowloon Terminus Piles (Site A - North)	Tysan Foundation Limited	497
803C West Kowloon Terminus Piles (Site A - South)	VIBRO - Chun Wo Joint Venture	321
803D West Kowloon Terminus Diaphragm Wall and Piles (WKCD)	Bachy Soletanche Group Ltd.	819
805 Sham Mong Road Obstruction Removal	Paul Y. Construction Company Limited	160
810A West Kowloon Terminus Station (North)	Leighton - Gammon Joint Venture	8,910
810B West Kowloon Terminus Station (South)	Laing O'Rourke - Hsin Chong - Paul Y. Joint	3,321

	Venture	
811A WKT Approach Tunnel (North)	Bachy Soletanche - Laing O'Rourke Joint Venture	1,040
811B WKT Approach Tunnel (South)	Gammon - Leighton Joint venture	2,883
815A Supply of Metal Doors and Frames including Ironmongery	The Jardine Engineering Corporation Limited	99
815F Public Toilet Fit-Out Works	Wan Chung Construction Co., Ltd.	53
820 Mei Lai Road to Hoi Ting Road Tunnels	Dragages - Bouygues Joint Venture	3,669
821 Shek Yam to Mei Lai Road Tunnels	Dragages - Bouygues Joint Venture	1,384
822 Tse Uk Tsuen to Shek Yam Tunnels	Leighton Contractors (Asia) Limited	3,235
823A Tai Kong Po to Tse Uk Tsuen Tunnels	Maeda - China State Joint Venture	1,502
823B Shek Kong Stabling Sidings and Emergency Rescue Siding	Maeda - China State Joint Venture	3,218
824 Ngau Tam Mei to Tai Kong Po Tunnels	Kier - Kaden - OSSA Joint Venture	1,515
825 Mai Po to Ngau	Penta-Ocean Construction	1,684

Tam Mei Tunnels	Co., Ltd.	
826 Huanggang to Mai Po Tunnels	CRCC - Hsin Chong - CRCC 15th Bureau Joint Venture	1,691
816A West Kowloon Terminus Building – Environmental Control System)	Shinryo Corporation	783
816B West Kowloon Terminus Building – Building Services Control System)	Johnson Controls Hong Kong Limited	60
816C West Kowloon Terminus Building – Electrical Installation)	Shinryo Corporation	550
816D West Kowloon Terminus Building – Fire Services, Plumbing & Drainage)	Leighton - Chubb E&M Joint Venture	664
830 Trackwork and Overhead Line System	Chun Wo - CRGL - QR Joint Venture	1,169
840 Rolling Stock	CSR Qingdao Sifang Co. Ltd.	1,744
841A Signalling System - Trackside Equipment	Beijing HollySys Co. Ltd.	308
841B Signalling System - Trainborne Equipment	Beijing HollySys Co. Ltd.	182
842A (Mainland E&M	Guangzhou-Shenzhen-Hong	94

Interface Modification Works)	Kong Passenger Dedicated Line Co. Ltd	
843 Tunnel Environmental Control System	GAS Joint Venture	260
844 11kV Power Distribution	CLP Power Hong Kong Limited	89
846 Trackside Auxiliaries	Shinryo Corporation	295
847 Lifts	Kone Elevator (HK) Ltd.	175
848 Escalators and Moving Walkways	Thyssen Krupp Elevator (HK) Ltd.	91
849 Radio Communications System	GTECH - CIC Joint Venture	244
850 Passenger Mobile Communications System	Comba Telecom Limited	105
851 Fixed Communications System	Siemens Ltd.	273
852 Ticketing System	Nuctech Company Limited	166
853 Main Control System	Beijing HollySys Co. Ltd.	66
855 Building Services for Tunnel	ATAL Engineering Ltd.	297

Ventilation Buildings and Emergency Rescue Siding		
856 Building Services for Shek Kong Stabling Sidings	ATAL Engineering Ltd.	140
861A Locomotives & Flat Wagons	Jiangsu KTK Locomotive & Rolling Stock Co. Ltd.	78
Total Number: 42	Total Awarded Amount:	44,630

**REPORT TO LEGISLATIVE COUNCIL PANEL ON
TRANSPORT SUBCOMMITTEE ON MATTERS RELATING TO
RAILWAYS**

**CONSTRUCTION AND COMMISSIONING OF THE HONG
KONG SECTION OF THE GUANGZHOU-SHENZHEN-HONG
EXPRESS RAIL LINK**

MTR CORPORATION LIMITED

EXPRESS RAIL LINK

CONTRACT 810B WEST KOWLOON TERMINUS SOUTH

LAING O'ROURKE – HSIN CHONG – PAUL Y JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the "XRL Project") and anything stated in this report is without prejudice to any of MTR Corporation Limited's legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

- 1.1 The Contract was awarded to Laing O'Rourke-Hsin Chong-Paul Y JV in January 2011 on 17 January 2011. The works include:
- (a) excavation of the southern section of the WKT station box and the initial excavation within the main station north terminus area,
 - (b) construction of the southern section of the WKT structure (a four-level basement structure),
 - (c) Austin Road West underpass and a noise mitigation deck.

In addition to this significant additional work has been instructed for the construction of the transfer and ground floor slabs of the West Kowloon Cultural District (WKCD) interface works and the associated changes required to the WKT sea water cooling intake facilities.

Progress and Delay Events

- 1.2 The terminus structure is constructed within a diaphragm wall cofferdam, installed by an advance works foundation contractor. The works interface directly with the WKCD and design changes to these facilities have caused frequent changes to the construction to accommodate their requirements. The contractor has been advised of an entitlement to Extension of Time (EoT) of up to 491 days and of the Employer's intention to recover delay through the implementation of Delay Recovery Measures. The anticipated completion date for the Whole of the Works is currently the end of December 2015. Overall completion at 31 March 2014 is 57.7%.
- 1.3 The main civil works are targeted for substantial completion around the end of 2014, excluding the WKCD interfacing works at B1 and G/F levels. Excavation is progressing and the only area remaining after May 2014 will be the southern area adjacent to the diaphragm wall where a significant amount of rock is present.
- 1.4 Access for E&M contractors commenced in March 2013 and deliveries have commenced for the chillers, large diameter pipework, electrical equipment and CLP equipment. Transformers

will be delivered at the end of April 2014. However, large areas remain to be completed and handed over to the E&M contractors.

- 1.5 WKCD is impacting significantly on the WKT works and in particular the request for the redesign of the slab at basement level B1. The resultant reduction in the depth of the slab necessitated substantial structural re-design and statutory resubmissions to BD. The Contractor was prevented from pouring the B1 non-core slab until the design was approved and consent granted. The WKCD Authority's future development above Contract 810B works imposes substantial constraints on construction.
- 1.6 Contract 810B is also required to co-ordinate with Designated Contract 810A in the design of the demarcation wall TWS9a/9b. Due to the award of Designated Contract 810A later than originally scheduled, Contract 810B's design of the demarcation wall was delayed resulting in some considerable delay to the installation of demarcation walls.
- 1.7 Higher than predicted movements in diaphragm wall panels in the Designated Contract 810A area, affected the Contractor's works due to their close proximity and were subject to a work suspension order as a safety precaution. As a consequence, the Contractor was prevented from progressing his excavation in the northern core area until two months later than the originally scheduled date of November 2012.

Delay Recovery Measures

- 1.8 The constraints on this site have restricted the Contractor's options in respect of delay recovery measures. The Contractor has considered various options to mitigate delays wherever opportunities have been identified. Examples of these measures include:
 - a. Installation of additional access ramps to provide extra capacity for spoil removal
 - b. Changing to 'system formwork' to provide reduced turnaround times and increased mobility

- c. Changes to reinforcement design of slabs to facilitate early removal of back propping
- d. Re-sequencing of works and traffic management arrangements to obtain earlier access

Programme

- 1.9 The main structural works continue to be in delay according to the master programme.
- 1.10 A continuous interface with both the WKCD and the Designated Contract 810A will continue to affect those common areas requiring close management by both the Corporation's and Contractor's site teams.
- 1.11 The priority remains the granting of access to the E&M contractors and building services installers. Whilst access commenced in March 2013, the focus on achieving phased access as rooms and plant areas come available will be maximized as the structural works progress.
- 1.12 The experience from the past year will continue to be exploited in order to minimize the installation programmes of the follow-on contractors so far as is safe and practicable.

**REPORT TO LEGISLATIVE COUNCIL PANEL ON
TRANSPORT SUBCOMMITTEE ON MATTERS RELATING TO
RAILWAYS**

**CONSTRUCTION AND COMMISSIONING OF THE HONG
KONG SECTION OF THE GUANGZHOU-SHENZHEN-HONG
EXPRESS RAIL LINK**

MTR CORPORATION LIMITED

EXPRESS RAIL LINK

**CONTRACT 811A WEST KOWLOON TERMINUS
APPROACH TUNNEL (NORTH)**

BACHY SOLETANCHE – LAING O’ROURKE JOINT VENTURE

2 MAY 2014

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1.0 SUMMARY

Scope

- 1.1 The West Kowloon Terminus includes the cut and cover approach tunnel Contract 811A, one of the four main civil contracts and four foundation contracts. Contract 811A will construct a 302m long cut-and-cover tunnel linking Contract 820 to the North with Contract 811B to the South, a temporary retrieval TBM shaft, the Mongkok West Ventilation Building (MKV)) plus, demolition of existing road bridges and provision of two replacement bridges. There is a complex interface with the operating West Rail Line (WRL). Where the XRL alignment passes beneath the WRL tunnels their existing foundations will be transferred to the new XRL tunnel box.

Progress and Delay Events

- 1.2 Contract 811A was awarded to Bachy Soletanche – Laing O’Rourke Joint Venture on 3 May 2010 with completion scheduled for 10 May 2015. Due to additional instructed requirements this was extended to 31 December 2015. Although there has been some slippage to the Contract 811A programme, it is targeted to complete in line with the revised master programme. There is approximately 3 weeks delay to the MKV but re-sequencing of the works is under review to ensure achievement of the Degree 1 date. Actual overall completion at 31 March 2014 is 81.9%.
- 1.3 The major Contract 811A challenges involved: exposing and underpinning the WRL - an operating railway tunnel, formation of a 30 metre deep cofferdam with only 5 metre clearance to the CLP Lai Cheung Road Substation and working within limited headroom conditions adjacent to existing over-bridges.
- 1.4 Following a Value Engineering (VE) workshop between MTR Corporation and the 811A Contractor a detailed analysis of all technical issues for the reuse of existing WRL barrettes was done. By connecting the XRL tunnel structure to the eight existing WRL barrettes, the introduction of a transfer slab and installation of three bored piles, and enlarging the diameters of six adjacent bored piles to jointly support the XRL tunnel structure, a programme saving of 6.5 weeks to the critical path was achieved. This also increased programme certainty for Contract 811A as the construction risks

and difficulties were substantially reduced, as were risks of structural damage to the WRL operating tunnel.

- 1.5 Further VE was carried out in respect of re-assessing the thickness of the XRL base slab at the crossover area. At around 3 metre thickness it was required to act as a transfer structure to distribute the loads of both the WRL and XRL tunnels onto the foundations. The Corporation's team reviewed the approved design in an effort to mitigate time, costs and construction risks. In the event, 2 weeks was removed on the critical path and the slab thickness was reduced by 1 metre. Simultaneously, a review of the backfill sequencing North of WRL was performed. By de-linking (from a programme perspective) construction of the MKV from the relief jacking operation the MKV was commenced 2 months earlier.
- 1.6 Contract 811A has faced other significant challenges in carrying out the works in close proximity to existing infrastructure such as major highways and bridge structures. In what should have been bulk excavation for the cut and cover tunnels, they have encountered numerous uncharted obstructions, mainly remnants from previous construction activity that were abandoned, but not recorded. The Contractor has proceeded diligently, working during non-traffic hours in the case of those obstructions adjacent to the WRL, to remove these artificial obstructions whilst minimising delays to its Completion Obligations.

Delay Recovery Measures

- 1.7 Contract 811A has, and continues to work collaboratively with the Corporation's management team. Where required, amendments to the proposed works have been instructed by means of Engineer's Instructions (EI) in order not to delay implementation of recovery actions. Where the Contractor considers that he has entitlement to additional costs, then in accordance with the Contract, claims notifications have been lodged. These will be considered in line with the Contract provisions and will be agreed with the Contractor's team where entitlement exists.
- 1.8 The Contractor has demonstrated a willingness to take the initiative, as evidenced by its decision to construct a computerized building information model of the MKV. This has been done at its own cost in a concerted effort to rationalize the design of what was a

complex structure with a view to accelerating construction of the building.

Programme

- 1.9 Despite the challenges of working adjacent to live railway tunnels and highways, as well as in old reclamation areas, the Contractor has successfully worked to overcome those challenges and has readily adopted alternative designs and modified construction practices in order to keep the contract on programme.
- 1.10 Evidence of just how successful this has proved can be seen by the current state of progress on this Contract, with current completion running at 81.9% and only approximately 3 weeks of delay against the Revised Master Programme.

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**CONTRACT 811B - WEST KOWLOON TERMINUS
APPROACH TUNNEL (SOUTH)**

GAMMON LEIGHTON JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the "XRL Project") and anything stated in this report is without prejudice to any of MTR Corporation Limited's legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

1.1 West Kowloon Terminus, (WKT) is being delivered by four main civil contracts and four foundation contracts (completed), including Contract 811B. The Works include:

- (a) construction of a 600m long cut and cover tunnel,
- (b) three new footbridges,
- (c) a public transport interchange (PTI) and
- (d) West Kowloon Plant Building (WKP).

Progress and Delay Events

1.2 Contract 811B was awarded to Gammon Leighton Joint Venture on 13 Aug 2010 with the specified contractual completion date for the whole of the works by 10 May 2015. The cut and cover tunnel is formed within a diaphragm wall cofferdam, the construction of which was severely impacted by numerous uncharted obstructions that were significantly more than stated in the Geotechnical Baseline Report (GBR). Follow-on activities for the main sections of the project have suffered consequential delays arising from these events. Further, delays due to abandoned utilities within the Jordan Road area and the abandoned typhoon shelter breakwater were greater than anticipated. Actual overall Contract completion at 31 March 2014 was 46.7%.

1.3 Substantial delays, the majority of which are linked to construction of the diaphragm walls forming the cofferdam and arising from unforeseen ground conditions, including high rock head and core stones were encountered. The Contractor has been advised of an entitlement to 449 days Extension of Time (EoT) for delays arising from these combined events.

1.4 At the Engineer's request, Contract 811B submitted his Delay Recovery programme, "APR7A" which he has been working to and monitoring progress against since October 2013. There has been some further slippage against the programme (APR7A) but

the Contractor has recently issued a working programme which is being used to monitor the works on site. The planned activities are now being achieved and excavation rates have improved at the north end of the approach tunnel. One area of the tunnel box structure has slipped and additional resources are being deployed to resolve this. Excavation is approximately 60% complete and the base slab construction is being cast progressively as formation comes available.

- 1.5 West Kowloon Plant Building (WKP) is more critical as this area is highly congested and continual monitoring of production rates to ensure target completion dates are achieved is being applied.

Delay Recovery Measures

- 1.6 The variable rock head levels around the perimeter of the cofferdam would have required excessive rock excavation based upon the original founding criteria. A revised set of founding level criteria, coupled with modifications to the permanent works design has enabled the level of the panels to be raised thereby reducing the amount of rock excavation with a consequential reduction to the panel installation programme.
- 1.7 Where the cofferdam is constructed beneath the existing Jordan Road (JOR) the original plan allowed for switching of JOR to a temporary alignment on top of the completed panels, allowing those panels within the existing alignment of JOR to be constructed. Delays to the north section diaphragm walls, as a result of core stones, would have substantially increased the programme activity if this plan was adhered to. Instead a southern temporary diversion of JOR was instructed, enabling concurrent diaphragm wall construction activity within the JOR area and recovering 190 days of delay.
- 1.8 Jordan Road is a major utility corridor with substantial services laid in the road and footpaths. Over time these have been overlaid many times resulting in a complicated array of abandoned and live services with inadequate slack or space for slewing or movement. To overcome the utility conditions and uncharted obstructions at the JOR area, an extensive utilities hanging scheme was implemented to protect and manage these fixtures and to facilitate the obstruction removal whilst recovering delay to the B1 slab.

- 1.9 The Contractor has taken numerous other delay recovery actions to deal with the difficulties encountered whilst carrying out these works in this highly congested corridor. The Contractor is maintaining efforts to mitigate delays on an ongoing basis and as circumstances demand. As excavation progresses the frequency of delay events and obstacles is anticipated to reduce and further slippage on the revised completion obligations will be substantially minimised.

Programme

- 1.10 This Contract has been confronted by a large number of unforeseen and unexpected events ranging from ground conditions to artificial obstructions and incorrect and incomplete records of existing services and structures.
- 1.11 The Contractor has been systematically working through these as they have encountered them and has worked closely with the Corporation's management team to re-sequence and amend construction activities wherever practical.

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CONTRACT 820 MEI LAI ROAD to HOI TING ROAD TUNNELS

DRAGAGES-BOUYGUES JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the "XRL Project") and anything stated in this report is without prejudice to any of MTR Corporation Limited's legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

- 1.1 Contract 820 was awarded to Dragages-Bouygues Joint Venture on 12 May 2010. The works involve construction of 9 km of twin bored tunnels, including 14 cross passages, between Mei Lai Road and Hoi Ting Road, a ventilation building, a 160 metres long, 33 metres deep Tunnel Boring Machine (“TBM”) launch shaft and cut and cover tunnels for the cross over tracks. In addition, the scope includes the foundation and structural works for a new housing development, plus advance piling works for three Government proposed footbridges. Contractual completion date for the Whole of the Works is 10 May 2015.

Progress and Delay Events

- 1.2 Three of the tunnel bores, including concrete lining, are now complete, with access provided to follow-on Designated Contractors. Overall completion of Contract 820 is 81% as at 31 March 2014. The fourth tunnel bore is 13% complete, the cut and cover tunnel is 34% complete and Ventilation Building No. 7 is 88% complete.
- 1.3 Contract 820 includes substantial enabling works to facilitate construction of the twin running tunnels. These involve the removal of around 120 existing piles supporting live and abandoned facilities obstructing the path of the TBM. Advance ground treatment, required to protect structural integrity of adjacent buildings and structures along Sham Mong Road, Hoi Wang Road and Tai Kok Tsui, and were done ahead of tunnel boring.
- 1.4 Protection measures for the ‘live’ MTR Tsuen Wan Line tunnels were also necessary as the XRL tunnels were bored across the existing line and in close proximity to the tunnels invert. The Contractor provided its own alternative engineering solution for the advanced protection measures necessary to satisfy the Operation Division Railway Protection Team. All activities were planned and executed with precision, in accordance with stringent protection requirements necessary to ensure the safety and structural integrity of the Tsuen Wan line.

- 1.5 The Down Track (DT) and Up Track (UT) bored tunnels are constructed by four separate TBM drives, all commencing from the central launch shaft, two driven south towards Yaumatei and two driven north towards Kwai Chung.
- 1.6 The original construction sequence was frustrated by delays experienced under Contract 802 advance works contract where difficulties in extracting old H piles installed many years earlier, but now in the path of the XRL tunnels, were proceeding behind programme. Actions by the Contract 820 Contractor to revise the proposed sequence of tunneling, thereby avoiding the potential delays arising from the 802 works, were implemented at an early stage. This pre-emptive and proactive approach involving substantive modifications to the TBM manufacture was able to protect Contract 820's construction programme from uncertainties arising from Contract 802 advanced works.
- 1.7 Once tunneling had commenced on the South Down Track the TBM encountered unforeseen obstructions impeding the TBM advance. Twenty one abandoned H-piles in Hoi Wang Road (North), subsequently identified as remnants of works by Civil Engineering Development Department, as well as isolated steel obstructions within Contract 802's site were encountered at separate times on this tunnel bore. The TBM cannot bore through such obstructions without incurring damage to the cutter heads. Consequently, the TBM had to be halted whilst specialist compressed air contractors were brought in to carry out the manual cutting and removal of abandoned piles. Removal of these unforeseen obstructions stopped TBM progress for 7 months in the case of the H-piles, and a further 11 weeks for the Contract 802 site obstructions.

Delay Recovery Measures

- 1.8 Delay recovery measures on Contract 820 have been proactively managed by the Corporation and the Contractor working in close cooperation throughout this contract. Timely notifications in the event of difficulties encountered coupled with a good degree of technical competence on the Contractor's side has resulted in timely resolution of challenges.

- 1.9 Generally, all measures to overcome delays and obstacles have been negotiated between the Corporation and the Contract 820 Contractor and were formalized under an Engineer's Instruction. Subsequently, these have been combined by incorporating them into a Supplementary Agreement to ensure the contractual entitlements are agreed and correctly recorded and the Contract Completion Obligations are reset.
- 1.10 Currently, 3 Supplementary Agreements have been signed with the Contractor and endorsed through MTR's own internal control procedures.
- 1.11 The Contractor has worked, and continues to work, closely with the Contract 821 contractor to the North and the Contract 811A contractor to the South. The Contract 820 TBMs require reception chambers to enable TBM dismantling at the end of the tunnel drives. The Contract 820 Contractor has negotiated the transfer of these reception chamber works into its contract to prevent any knock-on delaying effects as a consequence of Contract 820 delays.

Programme

- 1.12 The linear construction sequence for tunneling means unforeseen obstructions inevitably result in irrecoverable delays to progress. Prompt actions by the Contractor have, minimized these delays so far as is practicable.
- 1.13 The fourth and final tunnel drive, the South Up track, continues, with breakthrough currently planned for October 2014 after which works to complete Degree 1 will follow.

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CONTRACT 821 – SHEK YAM TO MEI LAI TUNNELS

DRAGAGES-BOUYGUES JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

- 1.1 Contract 821 was awarded to Dragages–Bouygues Joint Venture on 12 July 2010.
- 1.2 The works comprise:
 - (a) construction of 3.6 km of main running tunnels from Shek Yam to the Mei Lai Road;
 - (b) the Kwai Chung Ventilation Building (KCVB); and
 - (c) a combined ventilation and vehicular access adit (KCVA) extending between the ventilation building and the main tunnels are also included.
- 1.3 Works commenced in July 2010.

Progress and Delay Events

- 1.4 Tunnel breakthrough to Contract 822 was on 1 March 2013. The tunnel lining for the main tunnel, including partition walls and walkways are 100% complete. Access to the drill and blast (D&B) section of the main running tunnel for Designated Contractors (DC's) for rail, electrical and mechanical installation works was achieved on 21 July 2013, and access to the remaining tunnel boring machine (TBM) drive will be achieved in May 2014. The KCVA structural works were completed on 28 March 2014, although early access for the DC has been available since 2 April 2013. The civil and ABWF works in the KCVB were completed on 31 October 2013 in line with the Completion Obligations. The non-critical external road and landscaping works will be completed by May 2014. At March 2014 over 99% of the structural works are complete.
- 1.5 Construction has involved commencing excavation at the Kwai Chung Vent Adit (KCVA) Portal, completing the adit to the junction with the main running tunnels (MRT) followed by excavation simultaneously northwards and southwards, followed

up by lining and internal structures works. At the southern boundary, Contract 821 constructed a receiving chamber for the Contract 820 TBM, which originally extended 660 metre into Contract 821's tunnel.

- 1.6 The actual construction works have generally followed this sequence. However, Contract 821's Contractor, recognising that the bifurcation works were significant, excavated two separate bypasses, the North Bypass and the South Bypass, either side of the junction of KCVA and the running tunnels. Further, increasing the extent of the Contract 820 TBM Works to 860 metres has reduced the amount of (slower) drill and blast works by about 200 metres, reducing risk on the MRT South excavation and the TBM chamber preparation works.
- 1.7 Works by the follow-on contractors for rail installation and electrical and mechanical installation works are now advancing in line with the programme. All non-critical outstanding works not impacting the Designated Contractors will be completed by end of May 2014.

Delay Recovery Measures

- 1.8 No Delay Recovery Measures have been instructed under contract 821.
- 1.9 Where the contractor has faced challenges relating to completion of Degree 1 works in the tunnels, or with Completion Obligations in respect of the ventilation buildings, he has taken action to negotiate a phased handover of access so as to minimise the delay to follow-on contractors such as track laying and overhead line and building services installation.
- 1.10 The Contract 821 Contractor has, in order to secure the achievement of Completion Obligations in the tunnel section, borne the cost of excavating two temporary by-pass tunnels of nearly 100 metres each, in order to minimise risks to his spoil removal activities.
- 1.11 Similarly, Contract 821 has worked cooperatively with the adjacent Contract 820 team to re-sequence works at the contract interface and modified the location of the bi-furcation chamber and agreeing to a larger extent of TBM tunnelling by the Contract 820 TBM

beyond the contract interface. This has facilitated the mitigation of delays caused by the re-sequencing of the Contract 820 TBM drive and permitted track laying at an earlier date to the northern section of Contract 821 tunnels.

Programme

- 1.12 Impacts to the Contract 821 programme have been resolved in the Supplementary Agreement No.1.
- 1.13 All substantial structural works under Contract 821 are complete.

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CONTRACT 822 TSE UK TSUEN to SHEK YAM TUNNELS

LEIGHTON CONTRACTORS (ASIA) LIMITED

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

- 1.1 Contract 822 was awarded to Leighton Contractors (Asia) Limited in March 2010. It comprises the main running tunnels and associated ventilation and access structures between Tse Uk Tsuen in Kam Tin and Shek Yam (SY) in Kwai Chung. The Works include:
- (a) a 7.6 km drill & blast main tunnel beneath Tai Mo Shan;
 - (b) a deep ventilation shaft;
 - (c) ventilation and access adits; and
 - (d) ventilation buildings at Pat Heung (PH) and Shing Mun.
- 1.2 The Contract also includes a temporary barging point at Tsing Chau Tsai for spoil disposal, plus construction of two temporary explosive storage magazines, at Tai Shu Ha and So Kwun Wat.

Progress and Delay Events

- 1.3 Works construction have generally followed the original planned sequence, but with some exceptions due to accessibility constraints linked to the conservation area (CA) at Pat Heung and encroachment by the tunnel works into the CA.
- 1.4 The main running tunnels were excavated from both ends and breakthrough was achieved on the 1 March 2014. Drilling and blast excavation are now 100% complete. The main tunnel lining is continuing with around 95% complete and all tunnel internal works to Degree 1 by September 2014. The Pat Heung Vent Building (PHVB) is complete, and the majority of the Shing Mun Shaft and Vent Building will be completed within 3Q2014. The Building Services installation contractors will be granted access progressively to the Shing Mun Vent Building structure from week 35/2014. During this phase the remaining structural works within the Shing Mun Shaft and Vent Building will continue in parallel to the fit-out and building services works. Overall completion is 88.3% at the end of March 2014.
- 1.5 The majority of delays have occurred in the main tunnel excavation and

Shing Mun Shaft. For the main running tunnel these arise primarily from Conservation Area (CA) encroachment, restricted blasting times, ground & groundwater inflow exceeding Geotechnical Baseline Report (GBR) indications, and the Contractor's inefficiencies at not achieving planned excavation progress and lining rates.

- 1.6 At the Shing Mun Vent Building (SMVB) & Shing Mun Shaft,(SMS) delays have arisen due to a combination of ground conditions, additional tree transplanting, design variations and delays arising from inefficient working.
- 1.7 Three areas still causing programme concerns include the main tunnel lining junctions, the PHVAA completion and Shing Mun Shaft due to recent Slipform-related delays. Mitigation measures are being implemented or are undergoing development to overcome these delays.

Delay Recovery Measures

- 1.8 Combined efforts by Corporation and the Contractor to mitigate all delays have been made in critical areas. For example, construction of a temporary adit was instructed connecting the PHVA to the PHVAA and allowing PHVAA excavation to progress without waiting for the approval and issue of the variation to the Environmental Permit (VEP).
- 1.9 At the Shing Mun Vent Building and Shaft work site the proximity of a densely populated public housing estate presented a challenge to carrying out noisy drill and blast works while minimizing noise and dust nuisance to the stakeholders. The Contractor decided to construct a large noise enclosure completely containing the Shing Mun Construction site. This permitted 24 hour working, whilst containing dust and noise nuisance. As a further demonstration of environmental consideration the enclosure has been partially painted green to blend in with the natural hill slope behind it.
- 1.10 To mitigate tunnel lining delays, whilst also expediting the provision of access to the track laying contractor it was proposed to add one extra Type M and associated wall and (overhead vent duct) shutters which it was estimated could recover over 100 Days delay.
- 1.11 Overall, the Contractor has taken initiatives including: optimization of

spoil removal logistics to neighbouring XRL barging points, pursuing rates of concreting via extended working hours (CNPs), carrying out design modifications for use of precast elements, using specialized concreting plant, such as slipform pavers, and reducing impacts on excavation works affected by blasting times, via close communication/notifications with nearby residents.

Programme

- 1.12 The works remain in delay against the master programme and in the particular locations highlighted above. Mitigation measures are continuing to limit any further slippage and initiatives to allow joint working in the tunnels by the follow-on contractor (track and overhead lines) are being trialled.
- 1.13 Similarly, on the ventilation building at Pat Heung phased handover of rooms is being implemented to advance access for the E&M contractors.

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**CONTRACT 823B SHEK KONG STABLING SIDINGS AND
EMERGENCY RESCUE SIDING**

MAEDA – CHINA STATE JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

- 1.1 Contract 823B was awarded to Maeda-China State Joint Venture (the ‘Contractor’) in October 2010 and includes
- (a) the construction of the Emergency Rescue Siding (ERS), cut and cover tunnels to the north and south of the ERS;
 - (b) the approach tunnels for the SSS; and
 - (c) the shunting tunnel plus the Shek Kong Stabling Sidings (SSS) all located at Kam Tin Valley and the former village of Choi Yuen Tsuen.
- 1.2 Two tunnel ventilation plant buildings located at either end of the ERS are also included within Contract 823B. The SSS provides at grade stabling sidings and running maintenance tracks facilitating routine inspection to trains, including train washing facilities. Several maintenance buildings within the SSS site will support infrastructure maintenance for the line.

Progress and Delay Events

- 1.3 Structural works to all the buildings in the SSS are complete. The North Plant Building is 64.8% complete and the South Plant Building is 68.8% complete. Access to the whole of running tunnel (1.2km) was given to the Permanent Way and Over Head Line contractor on 8 April 2014 whilst 75% of the track area at the SSS has been handed over for track laying. The Approach tunnel is scheduled to be completed by early June 2014. Actual overall completion was 77.5% at 31 March 2014. Substantial completion is programmed for 10 May 2015.
- 1.4 Contract 823B has faced three major delay events not foreseeable at Contract award, namely:
- (a) the possession of Works Areas due to the Choi Yuen Tsuen issue;

(b) unforeseen ground conditions at Tai Lam Fault Zone, and

(c) additional scope to suit revised operation needs instructed during the Contract.

- 1.5 There have been other events during construction that have all impacted upon progress. For instance, the land resumption for the site was eventually completed in May 2011, some five months later than the specified in the Contract. Prior to this, the Contractor was unable to secure the Work Site due to the disruption and demonstration by protestors. Primarily for safety reasons, the Contractor was severely constrained in carrying out its works during this period.
- 1.6 Geotechnical conditions at the Tai Lam Fault Zone and its adjacent areas also created substantial challenges to diaphragm wall, H piles and bulk excavation. Only limited site investigation (SI) works were completed during design stage due to difficulties in gaining access to the land prior to project commencement. Subsequent SI works carried out during construction indicated that geotechnical conditions were far more complex than originally predicted, resulting in the need to amend designs with consequential extension of planned construction durations.
- 1.7 Due to the changes in operational requirements, additional works scopes were instructed as variations to the 823B Contractor including:
- (a) the OCC (Operation Control Centre);
 - (b) Floor Wheel Lathe system at the SSS; and
 - (c) substantial additional noise barriers,
- 1.8 As these were instructed during the construction phase they resulted in the need to grant further time under the Contract to the Contractor for him to complete. The impact of all these events has affected access dates to the Designated and Interfacing Contracts who are responsible for installing the railway system and building services installations required for operation and commissioning the railway.

Delay Recovery Measures

- 1.9 The handover of the works site has been the single biggest delaying event on Contract 823B and is entirely beyond the control of the Corporation or the Contractor. However, the two parties have worked closely to re-assess the Completion Obligations under the Contract and in recognition of this a Supplementary Agreement (SA No.1) was approved by the Corporation and was executed on 10 January 2013. The agreed measures to mitigate the delays have included:
- (a) overtime working;
 - (b) increased plant for diaphragm wall construction;
 - (c) H-pile and SI works.
- 1.10 Further, alternative construction methods have been implemented which increase the extent of formwork and temporary works requirements envisaged in the original tender submission. There have been no specific instructions issued by the Corporation relating to delay recovery measures since the issue of SA No.1. The Contractor is, however, working diligently to implement any instructed variations within the contractual Completion Obligations.
- 1.11 Whilst carrying out the works the Contractor has encountered complex geological conditions which have affected the original designs, in particular the bearing strata beneath the tunnels have required increased amounts of reinforcing steel to be installed. All such adverse geological conditions have been logged by the 823B Contractor and assessment in accordance with the Contract will be carried out by the Corporation in due course. Any entitlements under the Contract will be advised to the Contractor once assessment, in accordance with the Conditions of Contract, have been completed by the Engineer's Representative the 823B Contractor will be notified formally.

Programme

- 1.12 As at April 2014, overall progress of the Contract 823B works were 33 weeks behind the date shown in the revised Master Programme and included in the SA No.1. This is due to a combination of further instructed works additional to the original scope, changes in the design of the works arising from changed geological conditions and also (in the Corporation's view) due to under performance by the Contractor's labour force.

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CONTRACT 824 NGAU TAM MEI TO TAI KONG PO TUNNELS

KIER KADEN OSSA JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

1.1 Contract 824 was awarded to Kier-Kaden-Ossa Joint Venture (the “Contractor”) in August 2010 and includes:

- (a) construction of 2.3 km twin bored single track tunnels in rock, with cross passages, between Ngau Tam Mei and the Tai Kong Po;
- (b) a tunnel crossover approximately 350 metres long;
- (c) a ventilation building at Ngau Tam Mei Ventilation Building (NTV); and
- (d) the Tai Kong Po Plant Building (TKP).

1.2 Major temporary works include:

- (a) widening of sections of Chi Ho Road and Kong Tai Road;
- (b) a temporary barging facility at Lung Kwu Sheung Tan; and
- (c) operation of an explosive magazine at Tai Shu Ha.

Progress and Delaying Events

1.3. Both running tunnels are still under construction, with the remaining section from the TKP bifurcation to Cross Passage 16 (CP16) remaining. The tunnels and crossover cavern from NTM shaft to CP16 is complete. Overall contract completion at 31 March 2014 is 59.7%.

1.3 Tunnels are being excavated using drill and blast methods. Two shafts, one at Ngau Tam Mei shaft, the other at Tai Kong Po shaft, were constructed to provide access for the start of tunnel blasting which at tender time, was envisaged as being constructed 50/50 from the NTM and TKP sides.

1.4 At Ngau Tam Mei shaft, commencement of site clearance works was

delayed due to the late identification of underground utilities and issue of the Tree Removal Application (“TRA”). The Contractor considered there could be a programme advantage by adapting his alternative design and this was agreed. Unfortunately, statutory approvals under the Instrument of Compliance (IoC) took longer to complete than anticipated and in the event, delays did occur.

- 1.5 Unforeseen ground conditions contributed to further delays to shaft excavation at both Ngau Tam Mei and Tai Kong Po including, unexpected amounts of cobbles, boulders and core stones all affecting excavation rates. Other factors such as high water inflows, late procurement of the Blasting License from Mines Division and discharge water not meeting the Discharge License requirements contributed to delays.
- 1.6 Tunnel excavation commenced at NTM and TKP shafts. At NTM, the crossover cavern has experienced high water inflows and substantial grouting works have been required. Re-sequencing of excavation to suit the geological conditions has been implemented but an inevitable knock-on delay to commencement of NTV permanent building works has occurred.
- 1.7 At the TKP shaft tunnels comparatively poor rock quality was experienced at the initial sections from the TKP shaft, requiring installation of temporary steel ribs to provide support at the weakest zones. Excavation of the bifurcation tunnels is now complete. The running tunnels to NTM near CP16 are progressing steadily to achieve tunnel breakthrough on both tunnels.
- 1.8 The Corporation considers that the contractor has suffered continuously from insufficient resources including plant, equipment and manpower, combined with inadequate supervision, poor planning and frequent plant/equipment break downs which combined have contributed to delays on both tunnel excavations and tunnel lining works. In addition, Labour Department suspended a section of tunnel works following a fatal accident that occurred on 17 September 2013.
- 1.9 NTM access roads have been delayed due to stakeholder complaints and objections from local villagers. Relocation of the new access roads to within the Contractor’s existing site facilities at Ngau Tam Mei site has caused disruption, as the Contractor now needs to relocate his installations before construction can commence. At TKP villager’s

complaints on compensation for alleged building damage from the works has disrupted the completion of the Chi Ho Road and the TKP Access Road has been redesigned to avoid working outside the villagers property.

Delay Recovery Measures

- 1.10 In order to achieve 24 hour working for spoil removal, the Contractor has constructed a temporary Second Access Shaft (SAS) with a noise enclosure next to the TKP shaft. This SAS has also allowed early commencement of tunnel excavation as it was completed before the TKP shaft.
- 1.11 Currently, two tunnel lining formworks systems (D/T and U/T) are being employed. Further formwork systems are being fabricated in China and are targeted to be delivered to the site in early May 2014 facilitating the accelerated progress to lining of the running tunnels.
- 1.12 To mitigate delays from the late start of the TKP shaft permanent works, the Corporation held workshops with the Contractor to redesign the TKP building to reduce its original completion period. The redesign effort included converting internal non-load bearing concrete walls to block work walls to simplify construction works.
- 1.13 The Contractor stopped the tunnel excavation at CP16 from the NTM side in October 2013 removing a severe constraint to constructing the ventilation building due to delays to the tunneling excavation. All remaining tunnel excavation is now be progressed from the TKP shaft end.

Programme

- 1.14 Despite the implementation of delay recovery measures and re-sequencing initiatives, the contractor remains in delay against the original Master Programme.

**REPORT TO LEGISLATIVE COUNCIL PANEL ON
TRANSPORT SUBCOMMITTEE ON MATTERS RELATING TO
RAILWAYS**

**CONSTRUCTION AND COMMISSIONING OF THE HONG KONG
SECTION OF THE GUANGZHOU-SHENZHEN-HONG EXPRESS
RAIL LINK**

MTR CORPORATION LIMITED

EXPRESS RAIL LINK

CONTRACT 825 MAI PO to NGAU TAM MEI TUNNELS

PENTA OCEAN CONSTRUCTION COMPANY LIMITED

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1.0 SUMMARY

Scope

- 1.1 Contract 825 was awarded to Penta Ocean Construction Limited. Works commenced on 1 February 2010. Contract 825 – Mai Po to Ngau Tam Mei Tunnels will construct:
- (a) twin 2.4km running tunnels between Mai Po and Ngau Tam Mei Ventilation Buildings,
 - (b) the Mai Po Ventilation Building,
 - (c) a TBM launch shaft,
 - (d) tunnel cross passages
 - (e) other associated surface related external works.

Progress and Delaying Events

- 1.2 Excavation of the Down Track is complete. Track laying access for the Down Track tunnel will commence end of May 2014. Up Track TBM breakthrough is expected at end of July 2014. Track access will be the end of November 2014. Overall contract completion to the end of March 2014 is currently 85.03%.
- 1.3 During TBM launch shaft and Down Track tunnel excavation the contractor encountered several challenges that impacted upon planned rates of progress. These include:
- (a) unsatisfactory pumping test results on the launch shaft,
 - (b) unforeseen ground conditions along the Down track tunnel;
 - (c) delays arising from the formation of a sinkhole above the Down Track tunnel.
- 1.4 To mitigate the risk to TBM mining at the adverse ground zones, the tunnel mining mechanism was adjusted with the use of thickened

bentonite. Recognising the potential for knock-on delays from using only one TBM, the Contractor proposed an additional machine for construction of the 2nd tunnel (the Up Track tunnel) in Sept 2012. This 2nd TBM was commissioned in Jul 2013, and was also equipped with the modified cutter head set up to facilitate excavation through the difficult ground conditions encountered by the first TBM drive.

- 1.5 Contract 825 has incurred delays to both tunnel drives, as a consequence of unforeseen physical ground conditions and artificial obstructions along the alignment. Although slowing the advance of the TBM drive, the contractor has succeeded in progressing without adverse impact on the permanent works. All adverse conditions have been logged with the Corporation's site team and, where entitlement exists, claims for the delay and additional cost have been lodged. These are under review by the parties and any entitlement will be assessed in accordance with the Contract.
- 1.6 The Engineer has issued instructions throughout the course of the works. For example, on the Mai Po Ventilation Building, delays to the completion of the structural works have been incurred as a consequence of instructed variations. However, these are not the sole cause of the delays and any entitlement to delay and additional costs will be assessed by the Engineer under the Contract.

Delay Recovery Measures

- 1.7 Contract 825 has encountered numerous challenges not foreseen at Contract award. The Contractor has worked collaboratively and proactively with the Corporation's team to overcome those challenges.
- 1.8 Several delay mitigation initiatives have been implemented, the procurement of a second TBM being the most substantial measure, to overcome delays.
- 1.9 Simultaneously, measures to facilitate access to the tunnels for track laying contractors and for delivery of equipment by other E&M contractors have also been taken, including two temporary openings in both Up and Down tracks cut and cover section to facilitate delivery of rail welding sets for the track laying contractor, eliminating knock on delays from Contract 825.

- 1.10 In response to poor ground conditions, modification of the permanent Works design, as in the case of relocating Cross Passage CP14 and CP13, has been carried to pre-empt further delays.

Programme

- 1.11 Despite taking delay recovery measures the Contractor has sustained delays to some of the Contract Completion Obligations.
- 1.12 However, the Contractor has proactively facilitated access to follow-on contractors in order to mitigate delays to the overall project completion and these measures are continuing.

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RAILWAYS**

**CONSTRUCTION AND COMMISSIONING OF THE HONG KONG
SECTION OF THE GUANGZHOU-SHENZHEN-HONG KONG
EXPRESS RAIL LINK**

MTR CORPORATION LIMITED

EXPRESS RAIL LINK

CONTRACT 810A – WEST KOWLOON TERMINUS NORTH

LEIGHTON GAMMON JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1 EXECUTIVE SUMMARY

Contract 810A

- 1.1 In October 2011, MTR Corporation Limited (the “Corporation”) awarded Contract 810A to Leighton Gammon Joint Venture (the “Contractor”).
- 1.2 Contract 810A relates to works for the construction of the West Kowloon Terminus Station North, which forms part of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (“Express Rail Link”).
- 1.3 Contract 810A is by far the largest civil contract on the West Kowloon Terminus, and also the most complex.

Scope of works under Contract 810A

- 1.4 The works to be completed under Contract 810A include both railway-related works and non-railway-related works as listed below.
- 1.5 The major railway-related works under Contract 810A include the following:
 - (a) Excavation for northern portion of West Kowloon Terminus;
 - (b) West Kowloon Terminus structures (northern portion, approximate length 400m) and West Kowloon Terminus up ramp to Road D1;
 - (c) Station Entrance Building;
 - (d) Footbridges 1, 2 and 5;
 - (e) Pedestrian Link to Footbridge 5;
 - (f) two subways connecting West Kowloon Terminus station to Austin Station and Kowloon Station Development and associated modification works at the connections;
 - (g) all builder’s works associated with Building Services and Systemwide Electrical and Mechanical Engineering

Designated Contracts;

- (h) Architectural Builder's Works and Finishes works in West Kowloon Terminus station, including those with the adjacent Contracts 810B and 811B;
- (i) hard landscape for West Kowloon Terminus, including the deck on Austin Road West Underpass in Designated Contract 810B;
- (j) signage in carpark and access ramp in Designated Contract 810B;
- (k) Safety and Warning Signs in West Kowloon Terminus Back of House Areas;
- (l) supply and delivery of Maintenance Access Platforms; and
- (m) Footbridge 6.

1.6 The major non-railway-related works under Contract 810A include the following:

- (a) Lin Cheung Road, Road D1A(S) and Road D1 (Road D1 known as "Wui Man Road") and associated works;
- (b) Lin Cheung Road Underpass;
- (c) Noise barriers along Lin Cheung Road and Road D1A(S);
- (d) Footbridge 3;
- (e) Electrical and Mechanical Engineering works for the full Lin Cheung Road /Austin Road West Underpass system including the sections constructed by the adjacent Contracts 811B and 810B;
- (f) diversion of Utilities Services and laying of water mains, drains and sewers;
- (g) Covered walkways to Austin Station, Elements and Kowloon Station Subway; and
- (h) Government accommodation Architectural Builder's Works and Finishes fit-out works.

Estimated completion date

- 1.7 Contract 810A states that the Contractor is to complete the whole of the Works by May 2015.
- 1.8 The Corporation, based on the most recent Contractor's programme forecast (as at April 2014), currently estimates that the whole of the Works under Contract 810A will be completed by mid-2017.

Current overall Contract status

- 1.9 Below is a summary of the Contract 810A status as at 31 March 2014:
 - (a) Time Elapsed = 68.6%
 - (b) Master Programme Planned Completion = 86.8%
 - (c) Delay Recovery Measures Rev. 2 Programme Planned Completion = 38.8%
 - (d) Actual Completion at 31 March 2014 = 22.4%
- 1.10 A substantial section of the Contract 810A south core (built bottom-up from B4 level) has been completed up to ground floor. The sequence of works now dictates connection with the two external diaphragm walls to the east and west sides. This will be achieved progressively during quarters 2 and 3 of 2014. This will allow the remainder of the Contract 810A south core structure to be completed.
- 1.11 The critical area of the Contract 810A structure is the north top-down section interfacing with the approach tunnel structure of Contract 811B. Here the top slab of the terminus has been substantially completed between the diaphragm walls, and excavation down to the next slab levels will commence. This is the area with a significant volume of rock to be removed below the B3 level.
- 1.12 Steelwork fabrication for the station entrance building roof is in progress in both Mainland China and Thailand. There have been fabrication delays within the Mainland and to date the overall status of fabrication stands at approximately 30%.

- 1.13 Procurement of all the fit-out materials has continued and these will in the main be stored ready for use when areas of the structure can be made available.

Delays encountered on Contract 810A

- 1.14 Delays have been encountered from the award of Contract 810A. Substantial delay has impacted the planned programme and sequence of Contract 810A. The delay has in turn affected the access dates to the Designated and Interfacing Contracts which are necessary to complete the West Kowloon Terminus such that it is ready for operation.
- 1.15 The Engineer's Representative has advised the Contractor that it has entitlement of 259 days extension of time to the Contract 810A works as a result of 12 notified delaying events assessed up to 31 March 2013. The Contractor has made additional claims relating to the period following 31 March 2013 that are currently under assessment.
- 1.16 The delays to the Contract 810A works have resulted from, amongst other things:
- (a) delays to initial access to the site due in part to the delays encountered under Contract 811B;
 - (b) unforeseen ground conditions;
 - (c) design changes to the roof, design development and other design changes; and
 - (d) other miscellaneous delaying events.
- 1.17 The main delays to the Contract 810A works relate to three critical paths within the contract:
- (a) North Top-Down area;
 - (b) Station Entrance Building; and
 - (c) Lin Cheung Road.
- 1.18 Examples of the delays for each of the three critical paths, together with the delay recovery measures implemented, are set out in this report.

2 CONTRACT AND PROGRAMME ASSESSMENTS

April 2013 – Delay Recovery Measures programme

- 2.1 In April 2013, at the request of the Corporation, representatives of the Contractor gave a presentation to senior management of the Corporation and Contractor. At the presentation, the Contractor:
- (a) described how and when Contract 810A was estimated for completion, taking into account the delays encountered and the status of the Contract; and
 - (b) presented the Delay Recovery Measures DRM2 programme, which relied on the implementation of various delay recovery measures to expedite critical areas of construction and recover delay.
- 2.2 The DRM2 programme demonstrated that civil works could be completed to allow track access progressively from May to September 2015, with the completion of the whole of the Contract 810A works in mid-2016.
- 2.3 The Contractor formally submitted the DRM2 programme in June 2013.

May to July 2013 – Programme review

- 2.4 Between May and July 2013, the Corporation’s planners undertook a review of the Contractor’s DRM2 programme. In carrying out this review, the Corporation considered what was required to maintain a 2015 opening of the railway.
- 2.5 During the review, the Corporation considered the concept of opening the railway with “Minimal Operating Requirements”. The concept started from the premise that, whilst not all the West Kowloon Terminus facilities and surrounding infrastructure could be delivered within 2015 as intended, the railway could still be opened.

July 2013 to March 2014 – Minimum Operating Requirements exercise and programme assessment

- 2.6 In the second half of 2013, the Corporation undertook a Minimum Operating Requirements exercise to assess the criticality of individual elements of the West Kowloon Terminus and undertake an assessment of:

- (a) what a reasonable and realistic programme to completion would show;
 - (b) what elements of the works would not be complete within 2015; and
 - (c) whether the West Kowloon Terminus could be ready for opening within 2015 with the elements of works outstanding.
- 2.7 Designers, E&M Engineers and Corporation planners, together with the Contractor, undertook the Minimum Operating Requirements exercise.
- 2.8 In addition, during the second half of 2013, the Corporation (as a result of further challenges and notably lower-than-planned productivity compared against previous programmes, including DRM2):
- (a) made an assessment that the further slippage would push track access in the north top-down area towards the end of 2015. Even with the implementation of available mitigations, the ongoing challenges render the completion dates given in the April 2013 presentation unachievable; and
 - (b) requested a revised programme to complete (in parallel with the Minimum Operating Requirements exercise, which itself couldn't have accounted for recently identified challenges).

March to April 2014 – Revised Completion Expectations

- 2.9 On 31 March 2014, the Contractor presented the results of the Minimum Operating Requirements exercise (although the completion dates for the station box were made available late February). The exercise identified that:
- (a) completion of the Contractor's works was now estimated to be completed end of March 2017;
 - (b) tracks 4 to 9 were estimated to be ready for Revenue Operation by end September 2017; and
 - (c) all tracks were estimated to be ready for Revenue Operation by December 2017.
- 2.10 On 7 April 2014, the Contractor presented an updated programme

for completion of the whole of the works (DRM rev 2B) to the Corporation.

- 2.11 Both the Minimum Operating Requirements and DRM2B programmes showed significant slippage beyond the dates presented in April 2013. This reflected the effects of various delaying events and took account of lower than previously planned production rates. At this point, the remaining durations were considered insufficient to recover the additional slippage.

3 MAIN CAUSES OF DELAY / DELAY RECOVERY MEASURES

Initial access to the site

- 3.1 There were delays to the diaphragm walling to the north of Jordan Road which affected the date which the contractor for Contract 811B could divert the road northwards. To mitigate the effect, the Corporation instructed the 811B contractor to divert Jordan Road southwards - this was done in February 2012. The 811B contractor then had access to most of the remaining diaphragm wall panels in Jordan Road, but not all. These remaining panels had delays due to unforeseen rock and utilities within the ex-Jordan Road area. The Jordan Road was diverted northwards in September 2012, allowing the 811B contractor to access to all of the remaining panels. These too were affected by delays due to unforeseen rock and utilities.
- 3.2 This all had a knock-on effect to handing over of the north top-down area to 810A and in particular, the Works Area 13.61, which was only handed over to 810A in November 2013.

Design issues

- 3.3 Design changes and development of design have impacted Contract 810A.
- 3.4 In the initial stages of the contract works, there were changes to the roof as a result of the very complex nature of the design. These have been resolved for a considerable time and the main issues now revolve around the Contractor's erection methodology and its temporary works designs.
- 3.5 Design concerns on the main reinforced concrete structure have arisen from changes to temporary works that rely on the permanent works designs, missing information and coordination between the

various design disciplines. These are being closely controlled and teams are working ahead of the Contractor to prevent delay to construction activities.

North Top-Down Area

- 3.6 In the Engineer's programme, there was a period from July 2012 to December 2013 (Track Access Completion Obligation 4.4A week 52/13) for the structural works in the north top-down area.
- 3.7 In the Contractor's master programme, there was an incorrect assumption (Access to Works Area 13.61 shown in July 2012, 5 months early) and faulty logic which would have caused a delay to this Track Access date.
- 3.8 Added to this there were major delay events which include:
 - (a) Extension of Time Claim 033: Delayed Possession of Works Areas (including Works Area 13.61);
 - (b) effects of Engineer's Instruction 120: Demolition of Jordan Road Southern Diversion; and
 - (c) Supporting and slewing of existing cables / utilities.
- 3.9 This would then have delayed further the Track Access date.
- 3.10 At 31 March 2013, the reported actual delay to Contract 810A was 341 days. An entitlement to 259 days Extension of Time has since been acknowledged by the Corporation for the period up to 31 March 2013. This included an entitlement to an Extension of Time against Completion Obligations in the north top-down area of 291 days.
- 3.11 On 17 April 2013, the Contractor presented the Delay Recovery Measures DRM2 programme, which showed a revised completion date for the north top down area of June 2016.
- 3.12 Since 1 April 2013, there have been further major delaying events which include:
 - (a) Extension of Time Claim 043: Delayed Access to Works Area 13.61 (continued);

- (b) Extension of Time Claim 058: Unforeseen Conditions - existing pipe (and other non-notified obstructions encountered);
 - (c) Extension of Time Claim 061: Suspension of Concrete Works due to Coupler Issues; and
 - (d) issues related to changes in design for temporary or permanent works.
- 3.13 The application of Delay Recovery Measures in the north top-down area included Delay Recovery Measure 004. The benefits of Delay Recovery Measure 004 are minor at the B4 level, comprising increased working space and maneuverability in areas with cruciforms versus those areas formerly with bracing. However, it will provide a faster excavation down to B4 as layer-by-layer excavation and bracing is not required.
- 3.14 An additional future Delay Recovery Measure is to excavation continuously, rather than wait for Nondestructive Testing weld tests on bracing layer-by-layer. This will also speed up excavation to B4 level.
- 3.15 The greater benefits of Delay Recovery Measure 004 are at B3 level, where non-structural walls and Degree 1 works can commence after casting of the B3 slab and can continue whilst excavating below to B4. This means it is not required to wait for the excavation to B4, casting B4 and bottom-up columns B4 to B3 and B3 to B2, and the removal of temporary stanchions and bracing.
- 3.16 Delay Recovery Measure 004 in fact caused some further delay to the commencement of B1 slab works in the area, partially offset by the faster excavation down to B4. Overall, this may have delayed further the Track Access date, but will provide earlier access to B3 E&M rooms which will benefit the overall commissioning of the station.
- 3.17 The Contractor's subsequent performance and programmes show reduction in planned productivity in the north top-down area, which will further delay the Track Access date.
- 3.18 In April 2014, the Contractor presented the Delay Recovery Measure DRM2B programme, which showed a revised completion date of mid-2017. This programme takes account of the delay

encountered, Delay Recovery Measures applied to-date and the more realistic production rates for works yet to be completed.

- 3.19 There are additional future envisaged steps to expedite and Delay Recovery Measures under consideration in the north top-down area. These further enhancements include:
- (a) reduced raking struts B3 to B4;
 - (b) observational monitoring (and appropriate soil parameter modelling);
 - (c) muck-shifting via Contact 811B;
 - (d) vertical mucking-out via mole-holes;
 - (e) intermediate excavation to move berms northwards;
 - (f) simplification of top-down column rebar / cruciform details;
 - (g) reducing staggered laps and formation of Construction Joints;
 - (h) changes to pile cap sequence and details;
 - (i) reduced numbers of layers of rebar;
 - (j) B3 flat slabs to eliminate column-drops; and
 - (k) thinner B4 slab where resting on rock.
- 3.20 In order to speed up the rock removal, a proposal to use blasting below the constructed concrete slabs is also being progressed with the statutory authorities.
- 3.21 The DRM2B programme does not rely upon the further enhancements listed above.

Station Entrance Building

- 3.22 The Engineer's design of the Station Entrance Building comprises the full design of the permanent structural steelwork and the architectural envelope which defines the spatial layout of the External Wall System. The External Wall System is a design and build element for the Contractor to complete, while the Engineer provides the design intent for the External Wall System and the in-service design wind load.

- 3.23 Overall, the Contractor has the responsibility to provide the erection method and erection analysis, fabrication and site erection for the Station Entrance Building works.
- 3.24 The Contractor has submitted 12 notifications of delay. Ten of these are related to the Engineer's design changes to the permanent structural steelwork that have delayed the completion of shop drawings, erection phase analysis and the fabrication of the structural steel work. The Contractor's claims include:
- (a) Extension of Time Claim 810A/018: Mega Column Head Alignment; and
 - (b) Extension of Time Claim 810A/030: Design Changes to the Roof Structural Steel.
- 3.25 There have been several Delay Recovery Measures implemented which, whilst not all directly involving the Station Entrance Building itself, will facilitate earlier erection of key elements and de-propping of the Station Entrance Building. These include:
- (a) Delay Recovery Measure 020: Strutting Action B4/5 to B3 for Wind Loading
 - (b) Delay Recovery Measure 023: Commencement of Fabrication of Mega Column Heads prior to Completion of Erection Phase Analysis and Additional Working Hours in the Fabrication Yards.
- 3.26 The Corporation has acknowledged that the Contractor has an Extension of Time entitlement against Completion Obligations in this area of 307 days for the period up to 31 March 2013.
- 3.27 The Contractor's DRM2B programme shows a longer than previously planned erection sequence for the Station Entrance Building, and these periods are now considered within the realistic construction programme.

Lin Cheung Road

- 3.28 The scope for the permanent traffic scheme around the West Kowloon Terminus includes a three level traffic underpass for Lin Cheung Road between the terminus box structure and the existing Kowloon Station development. The existing Lin Cheung Road currently sits on a temporary traffic deck, and construction of the

permanent works is to be completed below this deck.

- 3.29 The excavation and temporary works support system for this section of work is dependent on the temporary works for the Contract 810A core structure achieving diaphragm action between the east and west diaphragm walls.
- 3.30 There has been significant delay to the works within the Contract 810A footprint and this has impacted the commencement of the works for Lin Cheung Road. Added to this there are specific major delay events which include:
- (a) Extension of Time Claim 810A/002: Additional Socketted H-piles;
 - (b) Extension of Time Claim 810A/032: Unforeseen Physical Obstruction at Lin Cheung Road; and
 - (c) Extension of Time Claim 810A/039: Additional Ground Strengthening Works Adjacent to Diaphragm Wall.
- 3.31 The Corporation has acknowledged that the Contractor has an Extension of Time entitlement against Completion Obligations in this area of 279 days for the period up to 31 March 2013.
- 3.32 To reduce the time to complete the works, further enhancements are being explored. These include the following:
- (a) Closing Lin Cheung Road (northbound) and diverting the traffic around the Kowloon Station development. This would significantly improve construction access and greatly improve the efficiency of work.
 - (b) The Contractor is reviewing the temporary works excavation and lateral support system for the Lin Cheung Road excavation to try and reduce the scope of temporary work, again reducing the time required in this area.
- 3.33 Neither of these further enhancements has been taken into account in the revised construction programme.

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**CONSTRUCTION AND COMMISSIONING OF THE HONG
KONG SECTION OF THE GUANGZHOU-SHENZHEN-HONG
KONG EXPRESS RAIL LINK**

MTR CORPORATION LIMITED

EXPRESS RAIL LINK

**CONTRACT 823A – TAI KONG PO TO TSE UK TSUEN
TUNNELS**

MAEDA - CHINA STATE JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1 EXECUTIVE SUMMARY

Contract 823A

- 1.1 On 12 July 2010, MTR Corporation Limited (the “Corporation”) and the Maeda-China State Joint Venture (the “Contractor”) executed Contract 823A.
- 1.2 Contract 823A concerns the construction of tunnels between Tai Kong Po and Tse Uk Tsuen in the New Territories. The tunnels form part of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (“Express Rail Link”).

Scope of works under Contract 823A

- 1.3 The Contractor’s scope of works under Contract 823A includes the construction of two sections of twin tunnels with cross passages. The approximate length of the tunnels is:
 - (a) 1,050 metres for the northernmost tunnels (“North Tunnels”); and
 - (b) 590 metres for the southernmost tunnels (“South Tunnels”).
- 1.4 The scope of works also includes ancillary and temporary works required for the construction of the tunnels.
- 1.5 In order to construct the tunnels, the Contractor is required to, among other things:
 - (a) excavate shafts to enable the launch of a custom-built Tunnel Boring Machine; and
 - (b) excavate the North and South Tunnels using the Tunnel Boring Machine. In total, there are four tunnel “drives” – two for each set of twin tunnels.

Estimated completion date

- 1.6 Contract 823A states that the Contractor is to complete the whole of the works by 10 May 2015.

- 1.7 The Corporation, based on the most recent Contractor's programme forecast (11 April 2014), currently estimates that the whole of the works under Contract 823A will be completed by July 2017.

Current overall Contract status

- 1.8 The current status of the North Tunnels based on the most recent Contractor's programme forecast drives is as follows:

- (a) The first drive is 93% complete (410/440 rings) and is estimated to be completed to Degree 1 by July 2015.
- (b) The second drive is estimated to complete by September 2016 to Degree 1.

- 1.9 The current status of the South Tunnels drives is as follows:

- (a) The first drive is 89% excavated (189/213 rings) and is estimated to complete to Degree 1 by September 2014.
- (b) The second drive is estimated to complete by August 2015 to Degree 1.

Main causes of delays

- 1.10 Contract 823A experienced progressive delays from the commencement of the Contract. The main causes of the delays include:

- (a) delays in obtaining access to the site due to land resumption issues;
- (b) unforeseen ground conditions (higher than anticipated rock head levels);
- (c) poor performance of the Tunnel Boring Machines;
- (d) air and slurry leakages;
- (e) a sinkhole;
- (f) restrictions on working hours in the South Tunnels; and

- (g) a Black Rainstorm, which caused flooding to the North Tunnel and damage to a Tunnel Boring Machine.

Delay mitigation and recovery measures

- 1.11 Throughout the progress of Contract 823A, the Corporation has taken active steps to mitigate and recover delays to the extent possible. Those steps have included:
- (a) execution of a Supplementary Agreement with the Contractor prescribing numerous delay recovery measures, including the addition of a second Tunnel Boring Machine to accelerate the works;
 - (b) regular reviews by the Engineer's Representative's construction team of possible mitigation measures to reduce delay and the subsequent updating of the working programme in order to closely monitor and manage delay; and
 - (c) actively exploring options to resolve issues arising from damage to the Tunnel Boring Machine which occurred during the Black Rainstorm.

2 MAIN CAUSES OF DELAY

2.1 Below are summaries of the main causes of delay.

Land resumption

2.2 In order to undertake the Contract 823A works, it was necessary to compulsorily resume several Lots of land in Hong Kong.

2.3 Landowners and other interested parties strongly objected to the land being resumed. Lengthy negotiations with the landowners were required. As a result, the land resumption process took significantly longer than originally anticipated.

2.4 The land resumption delays occurred during the period between November 2010 and May 2011.

2.5 The Contractor claimed that the prolonged land resumption process caused delays to the Contract 823A works because:

- (a) the works areas were handed over on a piecemeal basis; and
- (b) the Contractor was unable to access the works areas until the land resumption was complete.

2.6 The Engineer's Representative carried out a detailed assessment of the Contractor's delay claims in relation to the land resumption. The Engineer's Representative determined that the Contractor had an entitlement to an extension of time. Combined with the delays referred to under the heading **Unforeseen ground conditions** below, the Contractor was awarded an extension of time in a combined award of 307 days to completion of the works under Contract 823A.

Unforeseen ground conditions (Rock head levels)

- 2.7 The Contractor has claimed that, in excavating the North and South Tunnel shafts, it encountered rock head levels that were than higher than anticipated in the Geotechnical Baseline Report.
- 2.8 The Contractor claimed that the higher rock head levels resulted in delays to the excavation of the shafts, because:
- (a) the Contractor was required to redesign the diaphragm walls of the shafts;
 - (b) as a result of the redesign of the diaphragm walls, the Contractor was required to undertake additional construction work; and
 - (c) the hard rock meant that the excavation took longer than anticipated.
- 2.9 The unforeseen ground condition delays occurred during the period between October 2012 and April 2013.
- 2.10 The Engineer's Representative carried out a detailed assessment of the Contractor's delay claims in relation to the unforeseen ground conditions. The Engineer's Representative determined that in accordance with Contract 823A the Contractor had an entitlement to an extension of time of 307 days (as referred to above).

Poor performance of the Tunnel Boring Machines

- 2.11 Excavation by both Tunnel Boring Machines of the North and South Tunnels has failed to achieve the planned rate of advancement.
- 2.12 Examples of issues regarding the Tunnel Boring Machines that have caused delay include the following:
- (a) **Site constraints:** As a result of site spatial and logistical constraints, the Contractor revised his sequence for launching the Tunnel Boring Machine which required him to set up and operate the Tunnel Boring Machine in sequential stages. This resulted in a number of technical stoppages that resulted in delay to the full Tunnel Boring Machine operation and delayed the planned advance rate.

- (b) **Wear and tear of disc cutters:** Excessive wear and tear of the disc cutters of the Tunnel Boring Machine resulted in repeated shutdowns to carry out repairs and maintenance.
 - (c) **High temperatures at cutter head:** The geometry of the cutter head and arrangement of the disc cutters generated slow discharge of excavated material causing high temperatures to be generated at the cutter head of the Tunnel Boring Machine. Maintenance work to the cutters then took additional time whilst the equipment was allowed to cool.
 - (d) **Screw conveyor:** Issues concerning the selection of the screw conveyor type resulting in blockages and damage to the screw conveyor.
 - (e) **Back-up cars:** Poorly-designed back-up cars leading to twisted frames, and failure of the running wheels of the back-up cars caused significant plant breakdown. Subsequently, these were modified by the manufacturer to overcome the deficiencies.
- 2.13 A second Tunnel Boring Machine purchased and utilized by the Contractor experienced many of the same issues as the first Tunnel Boring Machine.
- 2.14 The delays due to poor performance of the Tunnel Boring Machines have occurred at various times from February 2013 to the present.

Air and Slurry leakages

- 2.15 The Contractor experienced delay due to substantial air and slurry leakage in the South Tunnels between 13 November and 1 December 2013. Leakage comes from the cutter head, which is under pressure and seeps through fissures and voids in the surrounding ground.

Sinkhole

- 2.16 On 16 February 2014, a sinkhole in the South Tunnels led to a requirement to carry out backfilling work. In order to prevent

reoccurrence of a similar issue, the Contractor undertook ground improvement works. The Tunnel Boring Machine in the South Tunnels did not operate during the period of the works, namely between 21 February to 16 March 2014. This caused delays to the excavation during that period.

Restrictions on working hours in the South Tunnels

- 2.17 It has not been possible to obtain a Construction Noise Permit to allow work in the South Tunnels to proceed on a 24-hour basis. Accordingly, the Contractor has been restricted to working between 07:00 to 19:00 hours each day.

Black Rainstorm

- 2.18 On 30 March 2014, a Black Rainstorm and a series of connected failures resulted in flood waters entering the downtrack North Tunnels. The Tunnel Boring Machine was inundated.
- 2.19 Among other things, the flooding damaged the electrical systems of the Tunnel Boring Machine. As a result, the Tunnel Boring Machine is not currently operating. This has impacted the progress of the North Tunnels works.
- 2.20 The following measures were in place to prevent flooding of the tunnel:
- (a) **Drainage:** The slopes surrounding the site included surface water drainage channels that were designed to drain water away from the slopes.
 - (b) **Parapet wall:** A diaphragm wall incorporating a 1.2m high parapet wall, constructed around the whole Emergency Rescue Station Box.
 - (c) **Pumps:** 14 pumps in the station box and the tunnels were rated to deal with rainwater falling directly into the structure from above and groundwater.
- 2.21 Despite the above measures, floods in the North Tunnels occurred due to a combination of the following:
- (a) **Drainage:** The drainage slopes failed, causing blockage to the

surface water drainage channels. This led to overtopping of the drain and flooding to the adjacent areas within the Contract 823 site.

- (b) **Parapet wall:** As at 30 March 2014, works to the Emergency Rescue Station box were being carried out. A section of the diaphragm parapet wall had been removed to facilitate the works. Whilst temporary flood bunds were erected, these were overwhelmed by the volume of water spilling from the breach in the site drainage. Water was able to cascade into the Emergency Rescue Station and into the downtrack North Tunnel.
- (c) **Pumps:** There was a local site power failure during the rainstorm which affected the operation of the pumps. However, power supply was quickly recovered and this did not contribute to the flooding of the tunnels

3 DELAY MITIGATION AND RECOVERY MEASURES

- 3.1 The Corporation has taken a number of measures to mitigate and recover delays on Contract 823A as far as possible, including as set out below.

Supplementary Agreement No.1

- 3.2 On 10 January 2013, the Corporation and the Contractor executed Supplementary Agreement No. 1, which sets out numerous measures to mitigate and recover delays experienced up to and including 30 November 2012. Those delays included delays caused by the prolonged land resumption process and higher than anticipated rock head levels.
- 3.3 The most significant delay recovery measure was the purchase and utilization of a second Tunnel Boring Machine for the works. This enabled the simultaneous driving of both the North and South Tunnels. It was originally anticipated that only one Tunnel Boring Machine would be used to complete the works.
- 3.4 Other delay recovery measures included:
 - (a) overtime working;

- (b) additional site supervision; and
- (c) re-sequencing of the works and the procurement of additional earthworks lateral support equipment and formwork materials in an effort to increase the number of available work fronts.

Regular reviews and progress meetings

3.5 The Corporation's construction team:

- (a) conducts regular reviews of possible mitigation measures to reduce the effects of delay;
- (b) regularly updates of the working programme in order to monitor and manage delay; and
- (c) holds daily progress meetings with the Contractor's senior staff to discuss problems associated with the daily tunnel production and how these problems can be resolved or mitigated.

3.6 The Corporation and Contractor hold regular meetings to discuss strategies to speed up the progress of the works and mitigate delays. Those meetings include meetings at the highest level between the Corporation's Project Director and the Contractor's Board members.

Project management

3.7 The Corporation identified what it considered to be weaknesses in the performance of the Contractor's site management team.

3.8 Following a period during which the Contractor's performance failed to demonstrate any marked improvement, and in order to improve the management of the project, the Corporation:

- (a) took steps to replace the Contractor's Project Director, Project Manager and Engineering Manager; and
- (b) proposed to the Contractor that he employ an experienced superintendent, foremen and seek technical support from the Tunnel Boring Machine supplier (Hitachi). The Contractor took action in support of this proposal.

Reduction of delay impact on Contract 824

- 3.9 Delays to the completion of the North Tunnels have the potential to cause consequential delay to Contract 824. The Contractor has taken the following steps to mitigate any potential impact on Contract 824:
- (a) De-linking (from a programming perspective) the Tunnel Boring Machine for the North Tunnels from the Tai Kong Po plant building and tunnels.
 - (b) Directing the 824 Contractor to construct a niche at the Tai Kong Po Shaft (up-track Tunnel breakthrough area) (Engineer's Instruction 107). This will enable the Tunnel Boring Machine to be dismantled within the niche preventing obstruction to the tunnel internal structural works.

Black rainstorm

- 3.10 The Corporation, the Contractor and the Tunnel Boring Machine supplier have been working intensively to assess the extent of the damage and determine the appropriate course of action to recover operation of the damaged Tunnel Boring Machine as soon as possible. It is currently estimated that the Tunnel Boring Machine will be repaired by the end of June 2014. Following procurement, installation of new parts and testing and commissioning it is expected that the TBM will be able to resume full operation in December 2014

**REPORT TO LEGISLATIVE COUNCIL PANEL ON
TRANSPORT SUBCOMMITTEE ON MATTERS RELATING TO
RAILWAYS**

**CONSTRUCTION AND COMMISSIONING OF THE HONG
KONG SECTION OF THE GUANGZHOU-SHENZHEN-HONG
KONG EXPRESS RAIL LINK**

MTR CORPORATION LIMITED

EXPRESS RAIL LINK

CONTRACT 826 – HUANGGANG TO MAI PO TUNNELS

CRCC-HSIN CHONG-CRCC 15TH BUREAU JOINT VENTURE

2 MAY 2014

This report has been prepared by MTR Corporation Limited for the purpose of reporting to the Legislative Council Panel Transport Subcommittee on Matters Relating to Railways in relation to the construction and commissioning of the Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (the “XRL Project”) and anything stated in this report is without prejudice to any of MTR Corporation Limited’s legal or contractual rights in respect of the XRL Project.

1 EXECUTIVE SUMMARY

Contract 826

1.1 On 15 March 2010, the Corporation and China Railway Construction Corporation-Hsin Chong-China Railway 15th Bureau Group Joint Venture (the “Contractor”) executed Contract 826 to construct the Mai Po to Huanggang Park section of the Express Rail Link for the Contract Sum of HK\$1.7 Billion. CRCC and Hsin Chong are constructing the Hong Kong section and CRCC 15th Bureau, the Mainland section.

Scope of works under Contract 826

- 1.2 The Contractor’s scope of works under Contract 826 includes:
- (a) provision of two Tunnel Boring Machines for construction of two cross border tunnels from Huanggang to the Boundary to be undertaken by the Mainland contractor. The Up Track tunnel is 1864 metres long and the Down Track tunnel is 1856 metres long;
 - (b) construction of twin tunnels from the Boundary to Mai Po ventilation building shaft using the same Tunnel Boring Machines in (a). The Up Track tunnel is 1482 metres and the Down Track Tunnel is 1478 metres.
 - (c) six cross passages on the Hong Kong side.

Estimated completion date

- 1.3 Contract 826 requires the contractual completion of the whole of the works by 10 May 2015.
- 1.4 The Corporation currently estimates that the Degree 1 completion

for the tunnels will be completed by December 2015. The reasons for this delayed completion are due to a combination of events, details of which are set out below.

Main causes of delay

1.5 The works under Contract 826 are complicated by the cross boundary nature of the contract, with the direct interconnection to the tunnels on the Mainland side that connects with the national high speed network at Futian. The Mainland works have experienced progressive delays from the start both at the works site located in Shenzhen and in the tunnels between the Huanggang Shaft and the Boundary. The main delays include:

- (a) slow progress with excavation and construction of the Huanggang shaft due to ground conditions;
- (b) a fatal reinforcement collapse during construction of the Huanggang Cavern;
- (c) delayed assembly and launching of both Tunnel Boring Machines;
- (d) lower than planned Tunnel Boring Machine excavation production rates.
- (e) unavailability of experienced operatives to drive the tunneling machines.

Delay mitigation and recovery measures

1.6 Since the award of Contract 826, the Corporation has taken active steps in an effort to mitigate and recover delays to the Mainland works, within the constraints and particularly, the absence of a defined contractual relationship and the circumstances that were encountered at the cross boundary location. For the Hong Kong section of the works the Corporation has reviewed the construction

planning and methodologies in an effort to shorten activity durations. These steps have included instructing:

- (a) concurrent construction of the cross passages with tunnels;
- (b) completing ground treatment works as an alternative to installation of a steel bulkhead at the Mai Po reception shaft;
- (c) concurrent tunnel invert and walkway construction.

1.7 In the Mainland, the Corporation has worked closely with the Mainland contractor to facilitate the progress of the works and has been successful in achieving a number of improvements including:

- (a) acquisition of additional land at the Huanggang Park site to alleviate pressures on work areas by the competing contractors from the Hong Kong bound tunnels and the Futian bound Mainland tunnel;
- (b) reducing the length of the launch cavern to bring forward the commencement of the tunnel boring machine operations,
- (c) modifying the structural form of the cavern from tapered lining to stepped lining, reducing the time spent in re-configuring the formwork and shutters;
- (d) negotiating access to the northern section of the cavern (reserved for the Mainland north tunnel drive Tunnel Boring Machine) to facilitate earlier assembly of the first tunnel boring machine;
- (e) establishing the Tunnel Advisory Panel to facilitate close coordination between GSG and its contractor working on the cross border tunnel section, and;
- (f) establishing a cross border working group and a Coordination Group to facilitate communication between respective statutory authorities on either side of the Boundary.

2 MAIN CAUSES OF DELAY

Huanggang shaft excavation

2.1 The Huanggang shaft was delayed by four months. The shaft was eventually completed at the end of March 2011. This delay was caused by a combination of the following:

- (a) lack of experienced manpower resources;
- (b) the lifting capacity of the gantry crane installed at the main access shaft; and
- (c) limitation on supplies of explosives for blasting works during PRC National Meetings and during the Lunar New Year period.

Huanggang cavern excavation

2.2 On 1 December 2011, during drilling and blasting of the Huanggang cavern there was a reinforcement collapse causing two fatalities and fourteen injuries to workers. As a result, the works were suspended for 40 days. However, works fully resumed on 10 January 2012.

Slow tunneling progress

2.4 Delays have occurred to the progress of tunneling works on the Hong Kong sections of the tunnels. These delays were incurred by a combination of the following:

- (a) Tunnel Boring Machines stopped and not excavating due to insufficient operating manpower resources, causing intermittent delays;

- (b) Slow progress due to compressed air leakage from the tunnels causing bubbles to appear in a fish pond in the RAMSAR Conservation Area and giving rise to tunnel face stability concerns;
- (c) Delays due to the Contractor providing insufficient plant and labour resources; compared with planned resources;
- (d) slow progress while a booster pump was installed in the UP Track tunnel; and
- (e) delays due to uncharted marble zones in the Mai Po area, requiring remedial ground treatment.

3 DELAY MITIGATION AND RECOVERY MEASURES

3.1 The Corporation has taken a number of measures to mitigate and recover the impacts to the Contract 826 arising from the works being carried out in the Mainland section, to the extent possible, including as set out below.

Ensuring efficient Tunnel Boring Machine operation

3.2 Two slurry TBMs were provided by the Contractor for use by the Mainland contractor for construction of the Mainland section of the cross border tunnels between Huanggang shaft in Shenzhen to the Boundary. To ensure close cooperation and coordination between both sides of the Boundary, the Corporation established a Tunnel Advisory Panel meeting weekly to monitor Tunnel Boring Machine operations and maintenance works. The panel's primary objective was to monitor and facilitate, to the extent possible, that the Tunnel Boring Machines remained in a serviceable condition to enable continual progress during construction of (initially) the Mainland tunnels.

Management of Boundary Crossing Issues

- 3.3 A unique challenge affecting Contract 826 related to the movement of plant, materials and workers across the Boundary. The Corporation, with the help of Hong Kong Highways Department's Railway Development Office and their counterpart in Shenzhen established a cross border working group and a coordination group. These groups established cross border construction working arrangements covering cross border permit control, customs arrangements, spoil disposal and quarantine, emergency rescue, public order and buffer zone arrangements.

Huanggang Shaft Constraints

- 3.4 One of the biggest challenges has been the limited space of Huanggang shaft, which is required to accommodate both the Contractor's Tunnel Boring Machine (which is 13.2 metres in diameter), and the pair of Tunnel Boring Machines provided by the Corporation (both 9.9 metres in diameter). To overcome the problem with limited space, three additional gantry cranes and a high speed gantry crane have been installed over the shaft opening to facilitate and expedite segment and material delivery. In addition, a custom made portal crane at the base of the shaft and interlinked service tracks has helped to resolve some of the logistical issues within the cavern.

Restricted working space at Huanggang Park

- 3.5 Working space at Huanggang Park shaft site was a major constraint to progress of the Works. The Corporation's construction management team spent months assisting the Contractor to acquire

additional works areas from the Huanggang Park. This has proved extremely helpful and has greatly eased competing interests for use of the limited available space at site, in particular, during the period when the 13.2 metre diameter Tunnel Boring Machine and associated slurry treatment plant were being assembled.

Spoil disposal

- 3.6 With the only tunnel access at the Huanggang shaft, spoil disposal to a Shenzhen authorised reception facility was constrained by a single exit point. Quarantine rules limiting spoil importation, in addition to quotas for Tunnel Boring Machine spoil disposal in Shenzhen, makes spoil disposal critical to the progress of tunneling works. In response to this constraint, the Corporation convened high level meetings with the Shenzhen Municipal Government following which it was agreed that disposal sites at Bujiwo (步九窩) and Fuyong (福永) could be assigned to receive the tunnel spoil arising from the Hong Kong section of the cross border tunnel. The two reception sites have sufficient capacity for all of Contract 826's spoil.

Tunnel Boring Machine equipped with probe drills

- 3.7 Uncertainties and risks associated with boring through the known marble zones remain. However, due to access constraints only a limited number of ground investigation boreholes have been carried out. In addition, some boreholes have not been able to be bored directly along the tunnel alignment due to the presence of a (environmentally protected) fish pond bund at ground level. Grouting has also not been permitted in this area.

- 3.8 In response to those difficulties, the Contract 826 Tunnel Boring Machines have been equipped with 360o probe drills which are able to probe ahead of the Tunnel Boring Machine by up to 40 metres. This enables the ground to be investigated ahead of tunneling works and any ground treatment measures carried out before ground problems are encountered.
- 3.9 However, tunneling in the marble zone continues to be of concern and when these zones are encountered they have the potential to significantly delay tunneling works. This is because these zones typically require the halting of the tunnel boring machine in order for extensive grouting works to be carried out before the tunnel boring machine can restart excavation activity.

4 PROGRAMME STATUS

- 4.1 Prior to the first Tunnel Boring Machine arriving at the Boundary, the progress of the Mainland section of tunnel works was monitored against the agreed arrival dates of Tunnel Boring Machines to the Boundary and reported to the RDO during the Corporation's Monthly Progress Briefing.
- 4.2 The first tunnel boring machine finally arrived (the Down-track TBM) arrived at the Boundary on 27 November 2013. Progress of tunnelling in the Hong Kong section by the 826 Contractor at the end of March 2014 saw 232 metres out of a total of 1478 metres completed, equivalent to 15.7%. The Up Track tunnel boring machine finally arrived at the Boundary on 12 March 2014, some 14.5 months later than originally agreed at the commencement of works on the Mainland side.
- 4.3 Both tunnel drives are now progressing towards the Mai Po shaft on the Hong Kong side of the Boundary. Progress has been

monitored closely, now that control is under the provisions of Contract 826.

Express Rail Link (XRL) Project Data Room Document List

Public documents

1. MTR Corporation Limited (MTR) press releases/statements regarding the XRL project
2. Presentations/papers to the Legislative Council Panel on Transport Subcommittee on Matters Relating to Railways (RSC)
3. Minutes of RSC meetings

Government-related documents

1. Project progress reports (to Railway Development Office of the Highways Department of Government (RDO))
2. XRL design/construction cost reports (to RDO)
3. Project Supervision Committee papers/presentations/minutes
4. XRL Project Control Group papers/presentations/minutes
5. Ad hoc programming presentations by MTR to RDO

Other MTR documents

1. Project progress and cost reports/presentations to MTR's Executive Committee and relevant minutes
2. XRL project costs scenario planning reports
3. Geotechnical baseline reports for individual contracts

Contractor-related documents

1. Contracts and Supplementary Agreements with relevant contractors
2. Engineer's instructions (for variations)
3. Contractors' progress reports/minutes of progress meetings

Note – Subject to applicable contractual confidentiality provisions. Further, some commercially sensitive information may be redacted