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Panel on Transport

Subcommittee on Matters Relating to Railways
Meeting on 9 April 2021

Updated background brief on upgrading signalling system
for railway lines

Purpose

This paper provides updated information on the upgrade of signalling system for railway lines. It also summarizes the major views and concerns expressed by members of the Subcommittee on Matters Relating to Railways ("the Subcommittee") during previous discussions on the subject.

Background

2. The MTR Corporation Limited ("MTRCL") has been monitoring the capacity of railway lines under the existing signalling system. To increase capacity and further enhance the overall reliability and efficiency of railway services, MTRCL earlier decided to replace the signalling systems of seven MTR lines (Tsuen Wan Line, Island Line, Kwun Tong Line, Tseung Kwan O Line, Disneyland Resort Line, Tung Chung Line and Airport Express). Upon the completion of the upgrade of signalling systems, the overall capacity of the seven MTR lines can be increased by about 10%. MTRCL is also replacing the signalling system of the East Rail Line to tie in with the operations of the Shatin to Central Link.

3. Replacement of signalling system involves the installation of a large number of new equipment such as optical fibres, cables, equipment at trackside and stations, followed by extensive tests to be rolled out in a progressive manner to achieve safe and smooth operations before the new system comes into service. Tests include switching from the existing signalling system to the new system on test-tracks at depots and on main lines. To minimize impact on train services, on-site tests on main lines are

conducted during non-traffic hours overnight and there are only about two hours available each night for the tests. The Electrical and Mechanical Services Department ("EMSD") will inspect the tests on-site and the new system could only come into operations after obtaining the approval by EMSD.

4. According to MTRCL, any large-scale system upgrade would entail the risks that the system may become unstable during the process with higher risks of service disruption. MTRCL has conducted a comprehensive risk assessment for the signalling upgrading project, including strengthening the manpower for monitoring system stability during switches between the existing and new systems. MTRCL has formulated contingency measures on the basis of the existing contingency mechanism for railway service delays. MTRCL has arranged technical personnel and shuttle buses to stand by and manpower to provide assistance to passengers where appropriate and necessary. The contingency plans formulated by MTRCL in case of disruption of railway services have been agreed with various Government departments including the Police and the Transport Department.

5. According to the original plan, MTRCL commenced the replacement of the signalling system first at Tsuen Wan Line in 2016, and would gradually replace the systems of Island Line, Kwun Tong Line, Tseung Kwan O Line, Disneyland Resort Line, Tung Chung Line and Airport Express. After the incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019, MTRCL suspended all on-site train tests pertinent to the signalling system upgrade programme immediately and set up an Investigation Panel to look into the cause of the incident and to recommend improvement measures. Given the incident and the follow-up actions so required, including the implementation of improvement measures recommended by the Investigation Panel, MTRCL advised that the overall signalling system upgrade programme would be postponed. The latest timetable of signalling upgrade programme provided by MTRCL in June 2020 is set out in **Appendix I**.

Members' major views and concerns

6. Members of the Subcommittee were previously briefed on the progress of upgrading the signalling system for railway lines at its meetings. Members also raised Council questions on relevant matters. Their major views and concerns are summarized in the ensuing paragraphs.

Progress of upgrading the signalling system for railway lines

7. At the Subcommittee meetings on 1 February 2019 and 19 June 2020,

members were deeply concerned about the delay of the signalling upgrade programme. In response to a member's enquiry about the measures to be taken to expedite the replacement of the signalling system of Kwun Tong Line, MTRCL advised that in the interest of time, MTRCL would in parallel prepare for the installation of the relevant basic infrastructure and hardware on other railway lines apart from Tsuen Wan Line. As advised by MTRCL in August 2020, over 70% of the installation works of the signalling system equipment on Kwun Tong Line had been completed. Signalling equipment installation tests and static tests had also been conducted during non-traffic hours at night. While ensuring safety, MTRCL would spare no efforts in completing the signalling upgrade for various lines.

8. Members expressed worries that the congestion situation of railway lines would be aggravated as a result of the delay in the signalling system upgrading programme. They enquired about the interim measures to ease passenger flow of railway lines before the new signalling system commenced service, and also the measures to be taken in the meantime to enhance the existing signalling system.

9. In response, MTRCL advised that prior to the commencement of service of the new signalling system, MTRCL would ensure the safe and smooth operation of the existing signalling system according to the asset management system, so that the current train service could be maintained to meet passenger needs. MTRCL would continue to monitor closely the train capacity and implement relevant measures, including enhancing crowd management, to ease crowdedness during peak hours. Additionally, MTRCL had been offering various fare concessions, including the "Early Bird Discount", to achieve diversion effect. Tuen Ma Line ("TML") Phase 1 was also commissioned in February 2020, providing an alternative for passengers riding on East Rail Line and former Ma On Shan Line to travel to stations along Kwun Tong Line via Diamond Hill Station. MTRCL believed that upon the full opening of TML, the diversion effect would be more significant. The Administration also noted member's concern about the carrying capacity of railway lines and would mobilize other public transport modes to enhance services as and when necessary in order to meet the passenger demand.

Safety issue of the signalling systems

10. The Subcommittee was gravely concerned about the incident on 18 March 2019, in which two MTR trains collided near Central Station on Tsuen Wan Line in the early hours during the testing of the new signalling system. Some members considered that MTRCL had failed to properly supervise its contractor to carry out the simulation tests of the new signalling system. Pointing out that signalling systems were generally operated on the Primary

and Hot-standby Computer Systems (i.e. Computers A and B), members enquired about the reasons for providing a Warm-standby Computer System, i.e. back-up system / Computer C, in the new signalling system.

11. MTRCL advised that to enhance the reliability and availability of the new signalling system, MTRCL had specified in the contract between MTRCL and the signalling system contractor that a back-up sector computer should be provided. As stated in the system specifications of the contract, the Primary, Hot-standby and back-up Computer Systems were identical in terms of functions and safety requirements. MTRCL emphasized that the contractor had the responsibility to ensure the safety of the new signalling system, including the provision of a safe and reliable signalling system for testing.

12. The Administration further advised that as the regulator of railway services in Hong Kong, the Administration concurred that the inclusion of Computer C warranted a comprehensive review. The new signalling system for Tsuen Wan Line would operate on the Primary and Hot-standby Computer Systems upon service commencement, such that train service could be enhanced early. Similar to Tsuen Wan Line, the inclusion of Computer C in the new signalling system of the other six railway lines would be further explored at a later stage. The Administration stressed that Computer C would not be put into passenger service if the system was not safe.

13. Members asked whether and how MTRCL would ensure that the 18 March 2019 incident or similar incident would not occur again in the future.

14. MTRCL advised that as a matter of prudence, it had immediately suspended all the train tests pertinent to the signalling system upgrade programme and conducted in-depth investigation of the incident. MTRCL and EMSD had completed the investigations on the incident in June and July 2019 respectively. EMSD accepted the investigation outcome of the Investigation Panel set up by MTRCL on the cause of the incident, which was the programming error in the software of the new signalling system as a result of multiple implementation errors of the contractor. Details of the respective investigation results and follow-up measures recommended by MTRCL's Investigation Panel and EMSD were set out in the Administration's information paper on the incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019 [LC Paper No. CB(4)1097/18-19(01)].

15. Members were also concerned about the safety of the existing signalling system and asked whether similar incidents would occur on the existing lines. The Administration responded that to ensure the safety of the existing signalling system, EMSD had conducted on-site inspection on the

safety-critical components of the existing signalling system, including the inter-locking functions of the computer-controlled turnouts. The results showed that the existing system continued to operate smoothly. According to MTRCL, the hardware and software of the new signalling system under testing were different from that of the existing signalling system. They were two separate systems. At the time of the incident, scenario testings of the new signalling system were being conducted on Tsuen Wan Line and the existing signalling system was completely segregated. All signalling trackside and trainborne equipment were controlled by the new system at the material time. Hence, MTRCL's Investigation Panel concluded that the incident was not related to the existing signalling system, and incidents of similar nature would not occur to the existing operations.

16. In response to some Members' concern that whether the service disruption of four MTR lines on 16 October 2018 was related to the signalling system upgrading project, the Administration advised that based on the signalling system data records of MTRCL, the incident indeed occurred only after MTRCL had switched the signalling system back to the existing one and had operated normally for some time. Hence, there was no evidence showing correlation between the incident and signalling system upgrading project and its testing.¹

Life expectancy and update of the new signalling system

17. On some members' concerns regarding the life expectancy of the new signalling system, and whether the electronic components of the signalling system would be updated regularly within its overall system life-cycle to keep pace with technological advancements, MTRCL advised that normally a signalling system should have 20 to 30 years' lifetime. It had requested its service contractors to provide adequate technical support to regularly update the parts and software of the signalling system within its overall system life-cycle. In addition, a stringent asset management system was in place to set out appropriate procedures for the maintenance of various components of the railway system, including signalling system equipment. Timely renewal would be arranged in accordance with the functions and performance of the railway components.

¹ MTRCL submitted a report to the Government on 19 December 2018 on its investigation on the incident. The report confirmed that the incident had no correlation with the signalling system upgrading project and its testing. For details, please refer to the press release issued by the Transport and Housing Bureau on 19 December 2018.

Latest development

18. The Administration plans to update the Subcommittee on the progress of upgrading the signalling systems for railway lines at the meeting to be held on 9 April 2021.

Relevant papers

19. A list of relevant papers is in **Appendix II**.

Council Business Division 4
Legislative Council Secretariat
1 April 2021

Timeframe of Expected Completion of New Signalling Systems
(as at June 2020)

Railway Line	Expected Completion
Tsuen Wan Line	Around 2023
Island Line	Around 2024/2025 (about 18 months' time following the launch of the new signalling system on Tsuen Wan Line)
Kwun Tong Line	Around 2026/2027 (within 24 months after the new system on Island Line is launched)
Tseung Kwan O Line	
Tung Chung Line, Disneyland Resort Line and Airport Express	Planning works are in progress to tie in with the Tung Chung Line Extension project

Source: LC Paper No. CB(4)646/19-20(05)

Upgrading signalling system for railway lines

List of relevant papers

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
1 December 2017	Subcommittee on Matters Relating to Railways	Administration's paper on progress on upgrading signalling system for railway lines	CB(4)260/17-18(03) https://www.legco.gov.hk/yr17-18/english/panels/tp/tp_rdp/papers/tp_rdp20171201cb4-260-3-e.pdf
		Minutes of meeting	CB(4)355/18-19 https://www.legco.gov.hk/yr17-18/english/panels/tp/tp_rdp/minutes/rdp20171201.pdf
2 February 2018	Subcommittee on Matters Relating to Railways	Administration's response to the joint letter from Dr Hon KWOK Ka-ki, Hon Jeremy TAM Man-ho, Hon Tanya CHAN and Hon Alvin YEUNG and the letter from Hon LAM Cheuk-ting on the signalling fault of the East Rail Line on 11 January 2018	CB(4)554/17-18(01) https://www.legco.gov.hk/yr17-18/chinese/panels/tp/tp_rdp/papers/tp_rdp20180202cb4-554-1-c.pdf (English version to follow)
9 October 2018*	Subcommittee on Matters Relating to Railways	Letter dated 9 October 2018 from the Administration on "Progress of MTR Railway Services"	CB(4)1612/17-18(01) https://www.legco.gov.hk/yr17-18/chinese/panels/tp/tp_rdp/papers/tp_rdp20181009cb4-1612-1-c.pdf (English version to follow)

*Issue date

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
24 October 2018	Council meeting	Hon Gary FAN Kwok-wai raised a question on the urgent measures to prevent and deal with large-scale disruptions of railway services	https://www.info.gov.hk/gia/general/201810/24/P2018102400409.htm
29 October 2018	Subcommittee on Matters Relating to Railways	Administration paper on service disruption of four MTR lines on 16 October 2018	CB(4)110/18-19(03) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181029cb4-110-3-e.pdf
		Administration's paper on "Services disruption of four MTR lines on 16 October 2018" (follow-up paper)	CB(4)74/19-20(01) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181029cb4-74-1-e.pdf
		Minutes of meeting	CB(4)1116/18-19 https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20181029.pdf
7 December 2018	Subcommittee on Matters Relating to Railways	Administration's response to the letters from Hon Claudia MO and Hon LAM Cheuk-ting requesting to discuss service disruption of several MTR lines on 16 October 2018 due to signalling system faults as set out in LC Paper Nos. CB(4)73/18-19(01)-(02)	CB(4)149/18-19(01) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181207cb4-149-1-e.pdf

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
1 February 2019	Subcommittee on Matters Relating to Railways	Administration's paper on progress on upgrading signalling system for railway lines	CB(4)468/18-19(05) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20190201cb4-468-5-e.pdf
		Minutes of meeting	CB(4)1257/18-19 https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20190201.pdf
29 March 2019	Subcommittee on Matters Relating to Railways	Administration's paper on incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019	CB(4)687/18-19(03) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-687-3-e.pdf
		Letter from Hon Michael TIEN Puk-sun on issues relating to the collision incident of MTR trains during the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)	CB(4)661/18-19(01) https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-661-1-c.pdf
		Joint letter from Dr Hon KWOK Ka-ki, Hon Jeremy TAM Man-ho, Hon Alvin YEUNG, Hon Tanya CHAN and Hon Dennis KWOK Wing-hang on issues relating to the collision incident of MTR trains during	CB(4)661/18-19(02) https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-661-2-c.pdf

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
		the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)	
		Letter from Hon LUK Chung-hung on issues relating to the collision incident of MTR trains during the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)	CB(4)661/18-19(03) https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-661-3-c.pdf
		Letter from Hon Jeremy TAM Man-ho on MTR Automatic Train Protection system (Chinese version only)	CB(4)670/18-19(01) https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/20190329cb4-670-1-c.pdf
		Letter from Hon Charles Peter MOK on issues relating to the collision incident of MTR trains during the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)	CB(4)683/18-19(01) https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/20190329cb4-683-1-c.pdf
		Minutes of meeting	CB(4)1245/18-19 https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20190329.pdf

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
6 December 2019	Subcommittee on Matters Relating to Railways	Information paper on the incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019	CB(4)1097/18-19(01) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp/b4-1097-1-e.pdf
		Joint letter dated 18 July 2019 from Hon Tanya CHAN and Hon Jeremy TAM Man-ho on the investigation result of the incident of MTR car crash (Chinese version only)	CB(4)1124/18-19(01) https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-1124-1-c.pdf
		Letter from Hon Jeremy TAM Man-ho on the collision incident of MTR trains during the testing of new signalling system on Tsuen Wan Line (English version only)	CB(4)940/18-19(01) https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp/b4-940-1-e.pdf
5 May 2020	Subcommittee on Matters Relating to Railways	Administration's response to joint letter from Hon Tanya CHAN and Hon Jeremy TAM Man-ho on the investigation result of the incident of the new signalling system testing on Tsuen Wan Line as set out in LC Paper No. CB(4)1124/18-19(01)	CB(4)497/19-20(01) https://www.legco.gov.hk/yr19-20/english/panels/tp/tp_rdp/papers/tp_rdp/b4-497-1-e.pdf

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
19 June 2020	Subcommittee on Matters Relating to Railways	Administration's paper on progress update on upgrading Signalling System for Railway Lines	CB(4)646/19-20(05) https://www.legco.gov.hk/yr19-20/english/panels/tp/tp_rdp/papers/tp_rdp20200605cb4-646-5-e.pdf
		Administration's paper on Upgrading Signalling System for Railway Lines" (speaking note of the Secretary for Transport and Housing) (Chinese version only)	CB(4)737/19-20(01) https://www.legco.gov.hk/yr19-20/chinese/panels/tp/tp_rdp/papers/tp_rdp20200619cb4-737-1-c.pdf
		Administration's supplementary information on Progress update on Upgrading Signalling System for Railway Lines (follow-up paper)	CB(4)851/19-20(01) https://www.legco.gov.hk/yr19-20/english/panels/tp/tp_rdp/papers/tp_rdp20200619cb4-851-1-e.pdf
		Minutes of meeting	CB(4)915/19-20 https://www.legco.gov.hk/yr19-20/english/panels/tp/tp_rdp/minutes/rdp20200619.pdf
21 October 2020	Council meeting	Hon Michael TIEN raised a question on signalling systems of railways	https://www.info.gov.hk/gia/general/202010/21/P2020102100531.htm
9 December 2020	Council meeting	Hon Michael TIEN raised a question on railway safety	https://www.info.gov.hk/gia/general/202012/09/P2020120900405.htm

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
15 January 2021	Subcommittee on Matters Relating to Railways	Administration's response to letter from Hon Jeremy TAM Man-ho on the collision incident of MTR trains during the testing of new signalling system on Tsuen Wan Line as set out in LC Paper No. CB(4)940/18-19(01) (English version only)	CB(4)692/19-20(01) https://www.legco.gov.hk/yr19-20/english/panels/tp/tp_rdp/papers/tp_rdp/b4-692-1-e.pdf
		Administration's response to the letter from Hon Jeremy TAM Man-ho on MTR Automatic Train Protection system	CB(4)765/19-20(01) https://www.legco.gov.hk/yr19-20/english/panels/tp/tp_rdp/papers/tp_rdp/b4-765-1-e.pdf
		Letter dated 14 September 2020 from Hon Tanya CHAN to the Secretary for Transport and Housing on the incidents of the new signalling system testing on East Rail Line and the Administration's response (Chinese version only)	CB(4)917/19-20(01) and (02) https://www.legco.gov.hk/yr19-20/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-917-1-c.pdf https://www.legco.gov.hk/yr19-20/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-917-2-c.pdf