

**For information
on 9 April 2021**

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

Progress Update on Upgrading Signalling System for Railway Lines

This paper briefs the subcommittee on the progress of upgrading the signalling system of seven railway lines and measures taken to manage passenger flow by the MTR Corporation Limited (“MTRCL”).

Background

2. The MTRCL is committed to improving railway network to meet passenger demand, and providing reliable and efficient railway services, whilst ensuring the safety of passengers and the railway system. The Corporation had invested \$3.3 billion to replace the signalling systems of seven railway lines (Tsuen Wan Line, Island Line, Kwun Tong Line, Tseung Kwan O Line, Disneyland Resort Line, Tung Chung Line and the Airport Express). The project is in progress. Upon completion, it is expected that the overall capacity can be increased by about 10%.

Signalling System Upgrading Project for Railway Lines

3. After the incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019, the MTRCL has been urging the contractor to implement various improvement measures. The contractor has also replaced the concerned software design and development team. The new software design and development team has completed development of the verification procedures of the new signalling system software and confirmed the relevant processes and detailed requirements. They have started works for the next phase step-by-step, i.e. to develop software works instructions, specifications and testing framework in accordance with the latest procedures and itemised requirements which are more comprehensive and stringent. Following that will be the testing and confirmation of software performance item-by-item, to ensure that the software is safe and reliable. For the sake of safety, the software verification and rectification process needs to follow every detailed requirement of the new software development process and work

instructions. The level of complexity of this technical task is comparable to re-creating a new software.

4. Upon the completion of the software verification and rectification for the new signalling system, the MTRCL will conduct repeated testing. Only upon the certification by the consultants appointed respectively by the MTRCL and the contractor, and with the endorsement of the Electrical and Mechanical Services Department would the MTRCL then consider resuming on-site train testing in an incremental manner. The on-site train tests will commence with testing with one train, then multiple trains, and gradually to the whole line.

5. As the MTRCL has all along emphasised, the technical works of the signalling system upgrading is extremely complex. The relevant installation, review, verification and testing work must be conducted in a stringent and gradual manner. At the same time, the Corporation has all along monitored the progress of the project. Since early 2020, the world has been hard hit by the COVID-19 pandemic. Progress of some works has no doubt been affected. The contractor pointed out that for this signalling system upgrading project, the software review works have to be carried out on-site in the software testing laboratory in Toronto, Canada. The local outbreak and measures to contain the pandemic, such as city closure, has severely affected the work progress. Moreover, taking reference from the experience of the recent signalling system upgrading project on East Rail Line, the MTRCL has reviewed the signalling system upgrading work of Tsuen Wan Line and other railway lines and has decided to strengthen the relevant work of software review and testing. In view of the above, we believe that the target to complete the replacement of signalling system on Tsuen Wan Line in 2023, as estimated last year, is highly challenging. The MTRCL is urging the contractor to follow-up at full speed, and to make every effort to recover the delay whilst ensuring that safety and reliability would not be compromised. Such measures include enhancing independent verification work, allocating more resources and reviewing the work-flow etc. in order to increase the efficiency of the relevant work.

6. The subsequent signalling system upgrading works for Island Line, Kwun Tong Line and Tseung Kwan O Line, especially regarding the software aspect, can only be fully commenced after taking into account the experience in Tsuen Wan Line. Our estimate at this moment is that the new signalling system of Island Line would commence service in about a year and a half the earliest following the launch of the new signalling system on Tsuen Wan Line, while the new signalling system on Kwun Tong

Line and Tseung Kwan O Line will commence service in around two years the earliest after the new system on Island Line is launched. As for Tung Chung Line, Disneyland Resort Line and Airport Express, the signalling system upgrading works require re-planning to tie in with the Tung Chung Line Extension project. The relevant systems would be entirely replaced only after the completion of the Tung Chung Line Extension project. Please refer to Annex 1 for details of the latest progress of the signalling system upgrading work on the various railway lines.

7. The MTRCL attaches great importance to this mega complicated signalling system upgrading project. The Corporation is prudently and carefully proceeding with every task of the software verification and rectification work as planned. While there is uncertainty over the completion time, the Corporation would continue to review the project programme based on actual progress and risk assessment. The team will also keep drawing on experience of relevant work and review the risk assessment at every stage of work, to ensure that the new signalling system is safe and reliable.

8. Before the completion of the signalling system upgrading project, the MTRCL will continue to follow its comprehensive and stringent railway asset management system to repair and maintain the existing relevant railway assets, to ensure that they are kept in safe and good condition at all times in order to ensure railway safety.

Enhancing passenger flow control and travelling experience

9. The MTRCL understands the public's concerns on the implementation of the signalling system upgrading project in order to enhance the overall capacity. Besides following up on the upgrading project at full speed, the MTRCL will continue to closely monitor the patronage of various railway lines, and adjust train service as appropriate, strengthen passenger flow control measures, and improve the station layout in light of changes in patronage, in order to enhance the passengers' travelling experience.

10. Impacted by the COVID-19 pandemic, various social-distancing measures have been taken by the Government and in workplaces that keep people working at home while face-to-face classes are suspended. The number of people commuting to work and schools has dropped, resulting in a substantial reduction in MTR's patronage. The pandemic has also restricted locals from visiting abroad, and Mainland and overseas visitors from coming to Hong Kong, leading to a sharp decrease in the patronage

using cross-border services¹ including East Rail Line and Airport Express by over 90% and around 80% respectively. As compared to 2019, the MTR total patronage in 2020 dropped by more than 600 million (i.e. more than 30%). Amongst the local railway lines, the patronage drop of Tung Chung Line, Island Line and Tsuen Wan Line² was relatively more significant. For details of the various statistics of heavy rail in 2020, please refer to Annex 2. The MTRCL has been maintaining the headway of normal train service in peak hours during the pandemic while making adjustment to services during non-peak hours according to actual situation and the pandemic development.

11. The MTRCL has been taking various passenger flow control measures at concourses and platforms of stations that are busy at certain period of time. They include -

- (a) **Increasing short-haul special trips:** The MTRCL arranges short-haul trips based on actual demand to run between busy stations to increase capacity (mostly during the busiest period in the morning peak hours), if there is such room under the scheduled train services and for safe running of additional trains. Examples include trips from Tai Po Market to Hung Hom on East Rail Line; Tin Shui Wai to Hung Hom on West Rail Line, North Point to Kennedy Town on Island Line, as well as Diamond Hill to Whampoa on Kwun Tong Line. During the evening peak, special trips will also be suitably and flexibly arranged from Admiralty to Chai Wan according to actual situation to ease the flow of passengers;
- (b) **Re-layout of station concourse to increase station space:** The MTRCL is working on the revised layout plan of concourse of certain stations in order to smoothen the passenger flow. Amongst others, the Customer Service Centre at Tseung Kwan O Station was relocated in early March 2021. The ticket gates in the area will be repositioned in the second quarter this year to

¹ Following the implementation of measures to contain the outbreak of COVID-19, services at Lo Wu and Lok Ma Chau Stations on East Rail Line have been suspended since 4 February 2020. The Guangzhou-Shenzhen-Hong Kong Express Rail Link (Hong Kong section) and Intercity Through Train services have also been suspended since 30 January 2020.

² As compared with 2019, the average loading of Tung Chung Line, Island Line and Tsuen Wan Line (calculated based on per hour per direction during the busiest hour in the morning for critical links and 4 standing persons per square meter (ppsm)) in 2020 has dropped by 20%, 17% and 14% respectively.

help improve station passenger flow and alleviate congestion during peak hours. The construction of an additional exit and widening of existing staircases at the Hung Hom-bound platform of Sheung Shui Station is also underway to improve passenger flow. Such re-layout work is expected to be completed by the second quarter of 2021 and the second half of 2022 respectively. For Kwun Tong Station, new staircase and lift connecting station concourse and platform are being retrofitted in order to ease and alleviate passenger congestion at the bottleneck of people entering the platform from the concourse during peak hours. The relevant work is expected to be completed in the fourth quarter of 2023; and

- (c) **Utilising onsite crowd control measures and MTR Mobile:** Station staff will implement measures such as suspending the operations of certain ticket gates or escalators where necessary to achieve better crowd control at stations. The MTRCL has also launched various personalised functions, such as “Waiting Time Indicator”, in the MTR Mobile application to help passengers better plan their journeys. The “Waiting Time Indicator” function currently covers Admiralty and North Point Stations, and will be extended to another five major interchange stations (Kowloon Tong, Tai Wai, Mong Kok, Prince Edward and Yau Tong Stations) within this year, facilitating passengers to better plan their journeys with real-time information.

Conclusion

12. The MTRCL will continue to work in tandem with the Government’s overall transport infrastructure development strategy by improving the railway system, train service operation management as well as future railway development, to continue to provide passengers with reliable, safe and efficient railway services.

MTRCL
April 2021

**Latest Progress of
Signalling System Upgrading on Railway Lines**

Railway line	Latest progress
Tsuen Wan Line	Installation of station and main trackside signalling equipment completed. Train test suspended due to the incident on 18 March 2019. Currently conducting comprehensive review through development of the verification procedures of the new signalling system software and confirmation of the relevant processes and detailed requirements, in order to ensure that the software is safe and reliable.
Island Line Line	Installation of station and main trackside hardware signalling equipment and static tests already completed.
Kwun Tong Line	Completed over 90% of the relevant hardware installation works including signalling equipment at signalling equipment rooms in various stations and at trackside area (e.g. uninterrupted power supply, power supply equipment cubicles, electronic equipment cubicles, tags, WiFi access points, new wires and new relays, etc.). Signalling equipment installation tests and static tests are being conducted during non-traffic hours at night.
Tseung Kwan O Line	The relevant hardware installation works has already commenced, including signalling equipment room and equipment at trackside area (e.g. uninterrupted power supply, power supply equipment cubicles, electronic equipment cubicles, tags, WiFi access points, new wires and new relays, etc.).
Tung Chung Line, Disneyland Resort Line and Airport Express	To tie in with the Tung Chung Line Extension project, the relevant systems would be entirely replaced only after the completion of the Tung Chung Line Extension project.

Annex 2**2020 Statistics for the Heavy Rail System
(per hour per direction in the busiest hour in the morning for critical links) (Note 1)**

		East Rail Line	West Rail Line	Tuen Ma Line Phase 1 (Note 2)	Tseung Kwan O Line	Island Line	South Island Line	Kwun Tong Line	Tsuen Wan Line	Disneyland Resort Line	Tracks sharing at some sections	
											Tung Chung Line	Airport Express
1.	Design capacity (6 ppsm)(a)	101 000	64 000	45 900	85 000	85 000	27 000	85 000	85 000	10 800	66 000 (Note 3)	10 000 (Note 3)
2.	Maximum carrying capacity when train frequency is maximised (6 ppsm)(b)	90 000	56 200	45 900	67 600	80 000	27 000	71 400	75 000	9 600	45 000	4 800
3.	Existing carrying capacity (6 ppsm)(c)	71 200	56 200	45 900	67 600	80 000	16 800	71 400	75 000	4 300	42 500	3 200
4.	Difference between (a) and (b) (Note 4)	11 000	7 800	0	17 400	5 000	0	13 600	10 000	1 200	21 000	5 200
5.	Difference between (b) and (c) (Note 5)	18 800	0	0	0	0	10 200	0	0	5 300	2 500	1 600

		East Rail Line	West Rail Line	Tuen Ma Line Phase 1 (Note 2)	Tseung Kwan O Line	Island Line	South Island Line	Kwun Tong Line	Tsuen Wan Line	Disneyland Resort Line	Tracks sharing at some sections	
											Tung Chung Line	Airport Express
6.	Current patronage (d)	36 900	33 500	17 100	42 200	46 000	8 300	44 000	49 500	1 800	22 300	900
7.	Current loading (1) (6 ppsm) [(d)/(c)] { } critical link	52% {Tai Wai to Kowloon Tong}	60% {Kam Sheung Road to Tsuen Wan West}	37% {Che Kung Temple to Tai Wai}	62% {Yau Tong to Quarry Bay}	58% {Tin Hau to Causeway Bay}	49% {Admiralty to Ocean Park}	62% {Shek Kip Mei to Prince Edward}	66% {Yau Ma Tei to Jordan}	42% {Sunny Bay to Disneyland}	52% {Kowloon to Hong Kong}	28% (Note 7)
8.	Current loading (2) (4 ppsm) [(d)/(c)÷71.2%] (Note 6) (For the critical links mentioned in item (7))	73%	84%	52%	88%	81%	69%	87%	93%	59%	74%	
9.	Loading in the first half of 2019 (4 ppsm) (Note 8)	87%	99%	N/A (Note 2)	98%	98%	75%	97%	107%	38%	94%	46%

Note 1: In view of the impact of the pandemic on patronage in 2020, the figures tabulated above are based on data obtained in those months when the pandemic was relatively eased.

- Note 2: Tuen Ma Line Phase 1 (TMLP1) commenced service in February 2020 and the then Ma On Shan Line has since then become part of TMLP1.
- Note 3: As Airport Express and Tung Chung Line share tracks at some sections, the overall design capacity of the railway lines are affected by train service pattern.
- Note 4: Reasons accounting for the difference include: platform screen doors and automatic platform gates increase the dwell time of trains at each platform by about 10 seconds; train turnaround times for the East Rail Line and the West Rail Line have lengthened after extension of the West Rail Line to Hung Hom Station in 2009.
- Note 5: The difference is because the service frequency has not yet been increased to the maximum level that the signalling system permits.
- Note 6: For a typical heavy rail train operating in the urban area, there are 340 seats and 2 160 standees under a passenger density level of 6 ppsm, adding up to a total carrying capacity of about 2 500 per train. Under a passenger density level of 4 ppsm, the number of seats (340) will remain unchanged while the number of standees will be reduced to 1 440, adding up to a total carrying capacity of about 1 780 per train. Hence, the carrying capacity under a passenger density level of 4 ppsm is 71.2% of that of 6 ppsm.
- Note 7: The design of Airport Express is based on seat provision and the passenger density level in terms of the number of standees does not apply. The figures are calculated based on design carrying capacity.
- Note 8: Loading figures refer to the data for the first half of 2019 as data in the second half of the year was affected by public order events.