Legislative Council Panel on Transport
Subcommittee on Matters Relating to Railways

Retrofitting of Automatic Platform Gates on the East Rail Line

Purpose

This paper aims to present the results and conclusions of the technical studies regarding the retrofitting of automatic platform gates (APGs) on the East Rail Line (EAL).

Background

2. All MTR train platforms have been designed and built to international standards. Supplemented with additional safety warning devices and measures as well as regular educational activities on platform safety, a safe travelling environment is provided for MTR passengers.

3. While international standards do not require APGs for safe railway operations and APGs are not installed in most of the world's railways, voices in the Hong Kong community have, for a variety of reasons, requested APGs to be retrofitted in the MTR platforms that currently do not have them.

4. Work is now in progress to install APGs at eight at-grade and above-ground stations on the Kwun Tong, Tsuen Wan and Island Lines.

5. Regarding the retrofitting of APGs at EAL stations, technical studies have been conducted with a view to identifying feasible solutions. However, the studies reveal that retrofitting of APGs at EAL stations poses particularly difficult challenges. They include -

(a) safety risk associated with wide platform gaps;

(b) limitations of existing signalling system;

(c) limitations of existing trains; and

(d) limitations of platform structures.

Safety risk associated with wide platform gaps and the trial of mechanical gap fillers

6. Platform gaps are required in safe train operations to prevent trains in motion from hitting the platform when arriving and departing a station. Because of the need to cater for different types of trains operating on EAL including intercity trains from the Mainland China, the gap at stations where the platform is built in a curve is comparatively wider. The installation of APGs at these platforms would hide the wider gaps from passengers' view, creating a serious safety risk. Therefore, the wider gaps at curved platforms must be resolved as a pre-requisite to installation of APGs.

7. In 2007, pre-merger KCRC began to examine the feasibility of using mechanical gap fillers (MGFs) to mitigate the safety risk at curved platforms, appointing a supplier to develop MGFs for trial at Lo Wu Station.

8. After the merger, the Corporation took over the project and carried out a trial in three phases to test the use of MGFs during passenger service at Lo Wu Station. The third phase trial of 98 MGFs fitted in the curved sections of the four platforms of Lo Wu Station was completed at the end of 2009.

9. Outside Hong Kong, MGFs have only been used in an indoor environment. These indoor designs have been adapted for the trial at Lo Wu Station. However, they were found to stall and jam persistently in adverse weather, and the trial had to be suspended during typhoons.

10. Even looking only at the data collected during the better weather days, the results were not encouraging -

(a) Poor availability

The 98 MGFs tested at Lo Wu Station did not come out for an accumulative 189 minutes per day, which is 17 times worse than requirement.

(b) Poor reliability

A fault occurred every 9,601 cycles compared to the target of once every 300,000 cycles, which is 30 times below target.

(c) High number of failures

During the trial at Lo Wu Station, 6.1 failures occurred each day. If MGFs were installed at all EAL platforms with wider gaps, this would mean an average of 89 failures per day. During the trial, extra staff were deployed to rectify failures to minimise delay. In normal operation, greater service delays would be expected. For instance, the current 5-minute delays on EAL are about 3 per week on average. This could become over 100 per week with the above number of MGF failures.

11. MGFs that perform poorly would be an added safety hazard to regular MTR passengers who face high risk of stepping into the platform gap when a MGF fails as they would be expecting the MGF to be available and not pay heed to the platform gap.

12. Due to limitations of the existing EAL signalling system, the operation of MGFs at stations will also add an extra 15 seconds to the time required to open and close train doors. This will mean longer dwell times at stations, which in turn will mean longer journey times and a reduction of about 2 train journeys per hour during peak periods. According to the results of a passenger survey conducted by the MTR in November 2009, of 1,735 passengers interviewed, 62% said that they would not accept a reduction of 2 train journeys per hour to accommodate installation of MGFs as they do not want to wait longer for trains.

13. It is concluded that the MGF system in its current form is not suitable for use on EAL as it will adversely affect passenger safety, train service reliability and passenger service levels (e.g. the impact of longer dwell time alone is equivalent to a reduction of 2 train journeys per hour during peak hours). In fact, there are only a limited number of MGF suppliers in the market and none of them supplies an outdoor version.

14. Another option being considered is to modify the shape of the trains (wider car body and narrower ends) to reduce platform gaps. However, the changes to the train structure will be very significant, much

like rebuilding the trains, and it may pose a high risk of causing structural damage to the trains.

Limitations of existing signalling system

15. The existing EAL signalling system is not able to interface smoothly with additional operational systems and equipment such as MGFs and APGs. It cannot achieve the required stopping accuracy necessary after APGs are installed and it is not always able to detect an APG which is not completely closed.

16. Longer processing time would be required for the existing signalling system to control the operation of any additional system or equipment like MGFs and APGs, leading to longer station dwell times, longer journey times and a lowering of the existing level of EAL service.

17. In addition, EAL trains are currently not required to stop with a high degree of accuracy. Passengers are able to board or alight safely as long as the full length of a train is berthed within the platform area.

18. The installation of MGFs and APGs would require trains to be stopped at more precise marks to ensure train doors are aligned with the positions of MGFs and APGs. The existing EAL signalling system is not designed for such accuracy, which means should MGFs and APGs be retrofitted, when trains miss designated stopping marks, they would have to be moved backward or forward to the correct position before doors can be opened for passengers to safely board and alight. Inaccurate stopping of trains would cause intolerable service delays that would occur on a daily basis.

19. Due to limitations of the existing EAL signalling system, the existing signalling system is not always able to detect an APG which is not completely closed and hence stopping the train from entering or leaving the platform. This is a safety risk that can be resolved by a new signalling system.

20. It is concluded that if APGs are to be installed on EAL, the existing signalling system would have to be replaced altogether to ensure safe train operations and for existing passenger service levels to be maintained. Given the major changes involved, upgrading the signalling

system to achieve the same would be akin to replacing the entire signalling system and hence would not be sensible. From design to procurement to installation, testing and commissioning, the replacement of a signalling system would require about seven years.

Limitations of existing trains

21. As mentioned in paragraph 18 above, the installation of APGs would require trains to stop more accurately at platforms. Other than a more sophisticated signalling system, train motoring and braking systems suitable for use with APGs would also be required.

22. Existing EAL trains are not equipped with such motoring and braking systems. If the current fleet is to be refurbished to add motoring and braking systems suitable for use with APGs, the additional stress will impact on the structural integrity of the train cars and reduce their asset life. Even though further structural enhancement may be possible, there would still be a high risk of causing structural damage to the trains.

23. Even if the equipment retrofitting and further structural enhancement were possible, the existing trains would only be in use for one to two years before they are replaced by new trains of a different specification purchased for the planned Shatin to Central Link (SCL) project.

24. The design, procurement, production, testing and commissioning of new trains would take about six years.

25. Given that new trains will be required for the planned SCL project, major modification of / rebuilding the existing trains is not recommended due to the high risk and high costs involved.

Limitations of platform structure

26. Existing EAL station platforms are not designed to take on any additional loading. If APGs are to be installed, substantial modification will be necessary to strengthen the platform structure to support safe APG operation.

27. Consideration must also be given to the impact that APGs would have on the circulation of air on EAL platforms, which are currently non-enclosed. Preliminary studies show that existing station ventilation will have to be improved to maintain a comparable environment as before the installation of APGs for passengers waiting for trains on platforms.

Retrofitting APGs as a standalone project at EAL stations

28. Based on the results of technical studies regarding the retrofitting of APGs at EAL stations, the following are required to ensure passenger safety, reliable train service and maintenance of current service levels -

(a) development of a highly-reliable MGF design or platform gap solution suitable for use under Hong Kong's adverse weather conditions to satisfactorily resolve the safety issue of wide platform gap;

(b) a new signalling system;

(c) a train fleet with motoring and braking systems suitable for use with APGs; and

(d) modifications to station platform structure and ventilation systems.

29. Assuming that all of the above are possible, and notwithstanding costs, it is expected that the retrofitting of APGs at EAL stations will take about 10 years to complete. About 8½ years will be needed to procure and replace the signalling system and the train fleet with the first APGs being operational at the same time, and the retrofitting of APGs at all the stations will need about 1½ years. In particular, retrofitting work can only be carried out in a small window of three to four hours overnight so as not to affect normal passenger train service during the day.

30. However, the new signalling system and new trains required for retrofitting of APGs will, in the Corporation's view, also be available under the SCL Project currently under planning. Synergy can be identified through integrating the APG and SCL projects while large amounts of redundancy and wastage would be incurred if the two were implemented separately.

APGs to be retrofitted at straight platforms first

31. Given the constraints posed by wide gaps at curved platforms, the feasibility of retrofitting APGs at straight platforms first had been considered.

32. However, the signalling system and train requirements as mentioned in paragraphs 15 to 25 above would remain the same to ensure safe and reliable train operations. Preliminary assessment shows that it will require slightly less than 10 years before APGs can be operational on all straight platforms. In addition, a significant amount of work on platforms and APGs will be abortive as they will have to be dismantled and disposed of when SCL begins construction.

Synergy for retrofitting of APGs in tandem with SCL Project

33. The 17-km SCL Project comprises two sections, namely the East-West Line (EWL) and the North-South Line (NSL). NSL is a 6-km extension of the EAL from the Hung Hom Station across the harbour to the Admiralty Station, forming the North-South rail corridor.

34. For NSL, the following are being planned -

(a) new platform configuration at EAL stations as service will be provided by 9-car trains as opposed to the existing 12-car trains. This will help to eliminate the wide platform gap issue as trains calling in at stations with curved platforms can berth in the straighter part of the platforms under the new configuration;

(b) new trains will be designed with a wider body which will help overcome the wide platform gap problem;

(c) a new signalling system will be installed to operate a more frequent service to make up for the capacity lost by using 9-car rather than 12-car trains; and

(d) new trains equipped with motoring and braking systems suitable for use with APGs will be purchased.

35. The Corporation is of the opinion that the NSL provisions will facilitate the retrofitting of APGs at EAL stations.

36. Once the SCL Project is given the go-ahead, the NSL completion date is forecast to be in 2020, similar to the APG standalone project timeframe.

37. Both projects require substantial work to be done on EAL platforms. If they are undertaken separately, it is almost certain that work will overlap at sites, causing delay to one project or the other, or once one has finished work on a particular platform, the other may go in to dismantle what has just been installed, creating waste and abortive work. As such, there is merit in integrating the APG and NSL works.

38. In conclusion, retrofitting APGs at EAL stations in tandem with the construction of the SCL is a logical solution to addressing the APG issue given the substantial work on EAL platforms that both projects require and the waste and abortive work that would be created if the projects are pursued separately.

Conclusion

39. Retrofitting APGs at EAL stations must be considered in the context of ensuring passenger safety, reliable train operations and the maintenance of current service levels.

40. To this end, the following would be required -

(a) development of a highly-reliable MGF design or platform gap solution suitable for use under Hong Kong's adverse weather conditions to satisfactorily resolve the safety issue of wide platform gap;

(b) a new signalling system to ensure safe and reliable train operations as well as frequent service;

(c) a new train fleet with motoring and braking systems suitable for use with APGs to ensure reliable and frequent train services; and

(d) modifications to station platform structure and ventilation systems.

41. The Corporation considers that the wide platform gap issue at curved platforms could be resolved and the new signalling system, new

trains and platform modifications required could all be provided when the SCL Project's NSL is constructed.

42. Retrofitting APGs at EAL stations in tandem with the construction of the SCL is the logical solution to addressing the APG issue. The Corporation considers that this is the best way forward for the APG project.

MTR Corporation
January 2011