Legislative Council Panel on Transport
Subcommittee on Matters Relating to Railways

Recent Railway Incidents involving MTR Rail Cracks

Purpose

On 19 January and 10 February 2011, vertical cracks were found respectively in a section of track on the Tung Chung Line near Sunny Bay Station and on the Tsuen Wan Line near Admiralty Station, causing service delays. This paper provides information on the rail crack incidents and subsequent follow-up actions taken by the MTR Corporation Limited (the Corporation).

Rail and Track Design

2. Rails in the MTR network are made of steel. As with any metal, the possibility of cracks developing is a natural phenomenon that will occur.

3. Rails are securely fastened onto track support structures with steel clips which are located two feet apart. Altogether, 2.5 million steel clips hold the MTR network's 820 kilometres of rail securely in place. Even in the event of a vertical crack developing from the rail top to bottom, i.e. breakage, the steel clips will keep the rail firmly in place, preventing movement and ensuring continued safe train operations.

Robust Inspection and Maintenance Regime

4. The Corporation has in place stringent procedures for the inspection and maintenance of rails. Regular inspections, including ultrasonic rail testing, visual inspection and dye penetration test are conducted as part of the routine maintenance regime. The aim is to identify irregularities and rail cracks in their early stages of development so that preventative maintenance or replacement of the rail can be conducted in a timely manner. This serves to minimise the chance of cracks occurring in passenger service hours and causing delays as a result

of temporary repairs having to be carried out.

5. When cracks are found during operation hours, careful inspection and assessment are conducted on site to confirm that safe train operations would not be affected. Temporary repairs would be carried out to reinforce the concerned rail section with steel plates so that trains can resume automatic operations.

6. It should be noted that safety is the Corporation's top consideration and passenger service would be suspended if there is any indication that safe train operations may be compromised. In the two recent rail breakage incidents, safe train operation was maintained throughout.

7. On the Tung Chung Line, visual inspection by patrolmen is conducted once every three days and ultrasonic testing of the rail condition is carried out once every month.

8. On the Tsuen Wan Line, visual inspection occurs once every three days and ultrasonic testing once every two weeks.

9. Compared to similar railways around the world, the Corporation performs one of the most frequent ultrasonic testing of rails, with the frequency for different lines being determined by traffic volume. Other major international railway systems conduct ultrasonic tests at intervals of between 3 and 12 months.

10. The number of vertical cracks from the rail top to the bottom (rail breakages) identified in the MTR heavy rail network between 1 January 2008 and 10 February 2011 total 12. In addition, one vertical crack (rail breakage) has been identified in the Light Rail network and one in the Hung Hom Freight Yard where no passenger-carrying operation is involved (see Annex).

Acceptance Procedures and Criteria for Rails

11. The Corporation adopts the International Standard EN13674 in rail procurement and requires rail manufacturers to implement strict quality control to ensure that specifications are met. The Corporation's

engineers also pay unscheduled visits to factories to inspect quality control documents and witness quality assurance tests. Release certificates will only be issued by the Corporation when it is satisfied that the rails meet the required technical specifications. When the rails are delivered to Hong Kong, MTR staff will conduct further inspection to ensure they are in good condition.

The Incidents

12. It must be re-emphasised that the rail breakage incidents of 19 January and 10 February 2011 did not pose any safety concerns. However, passengers experienced extra travelling times of 2 to 10 minutes when passing over the affected rail sections.

Tung Chung Line Incident on 19 January 2011

13. At 6:46 am on 19 January, MTR maintenance staff investigating a signalling fault on the Tung Chung Line identified a rail breakage measuring 5 mm in width at a section of rail near Sunny Bay Station.

14. As a precaution, the Operations Control Centre instructed trains to pass over the section at a speed of no more than 5 kph. An extra travelling time of 8 to 10 minutes was incurred. Tung Chung Line service between Tsing Yi and Tung Chung stations was maintained at 12 minutes a train (4 and 8 minutes normally) while Airport Express service between Hong Kong and AsiaWorld-Expo stations was operated at 15-minute intervals (12-minute intervals normally). Train service between Hong Kong and Tsing Yi stations was not affected.

15. The Transport Department and Electrical and Mechanical Services Department were notified of the situation.

16. From 7:19 am, trains departing Tsing Yi Station to Sunny Bay Station were routed to use the adjacent track in a bi-directional working to facilitate temporary repair works.

17. Temporary repair works were completed at 8:31 am after maintenance staff applied steel plates to reinforce the rail section in

accordance with procedures. Trains for Tung Chung/AsiaWorld-Expo then resumed running on the Tung Chung/AsiaWorld-Expo-bound track.

18. To ensure safe train operation, speed restriction was applied. An extra travelling time of 2 minutes was incurred but normal service frequency was maintained for the rest of the day. Maintenance staff remained at trackside for continuous monitoring of the track condition until the close of traffic at around 1 am.

19. After the close of train service that night, the affected section of rail was replaced and the Tung Chung Line and Airport Express operated as normal the next day from the start of traffic at around 6 am.

Follow-up Action

20. The ultrasonic testing vehicle tested the concerned section of rail on 29 December 2010 and the most recent visual inspection was conducted on 17 January 2011. No irregularities were identified at the time.

21. The concerned rail was sent to City University of Hong Kong and also to a laboratory in the United States for metallurgical analysis to confirm the cause of the crack. The results have yet to be submitted to the Corporation.

22. The Corporation also arranged a special visual inspection of all rails on the entire Tung Chung Line/Airport Express. Rail conditions were found to be normal.

<u>Tsuen Wan Line Incident on 10 February 2011</u>

23. At 7:37 am on 10 February, a 1mm wide vertical crack from the rail top to bottom (rail breakage) was identified at a section of rail between Admiralty Station and Tsim Sha Tsui Station when MTR maintenance staff were conducting a track inspection after a signalling fault occurred between the two stations.

24. The Operations Control Centre immediately applied a temporary speed restriction of 20kph as a precaution, incurring an extra

travelling time of 4 minutes over the section. Service on the Tsuen Wan Line service was maintained at 3 to 3.5 minutes a train.

25. The Transport Department and Electrical and Mechanical Services Department were promptly informed about the rail breakage and impact to passenger train service.

26. After the morning peak service at 10:21 am, maintenance staff conducted temporary repairs by affixing steel plates to reinforce the relevant rail section. Speed restrictions were lifted and train service on the Tsuen Wan Line resumed normal at 11:32 am.

27. Maintenance staff monitored the performance of the rail throughout the traffic day and after the close of traffic that night, the affected section of rail was replaced.

Follow-up Action

28. Prior to the incident, ultrasonic testing of the relevant track section had been conducted on 5 February while the most recent visual inspection was carried out on 10 February. No irregularities were found at the time.

29. The concerned rail section has been sent to City University of Hong Kong for investigation and analysis and will also be sent to a laboratory in the United States for analysis.

Customer Information Given Under Both Incidents

30. To minimise the inconvenience caused, passengers were notified of the service delays and information on alternative MTR routes through public announcements at relevant MTR stations and trains.

31. Notices were also displayed to update passengers on the revised train service arrangement. Additional staff members were deployed to affected stations to assist passengers, maintain order and direct passenger flow.

Conclusion

32. The Corporation apologises for the inconvenience caused to passengers who were delayed in their journeys due to the recent rail breakage incidents.

33. Given the Corporation's safety first culture and safe design of the track, safe train operations were ensured throughout the two incidents.

34. The root cause of the recent rail breakage incidents will not be available until the Corporation receives the results of the laboratory analytical tests on the relevant rail sections. In the meantime, the Corporation has decided to engage a team of experts on rail technology to conduct a review of the MTR rail inspection and maintenance regime, with particular focus on rail cracks, procurement and quality control, benchmarking with international best practice and make recommendations for practical improvements.

MTR Corporation
February 2011

Annex

MTR Rail Breakage Incidents – 1 January 2008 to 10 February 2011

Heavy Rail

	Date	Time found	Location	Width (mm)	Manufacturer	Age of Rail/Weld	Extra time incurred when trains passing through the affected section (minutes)		Root Cause	Action taken/Improvements
							During the incident	After remedial action taken		
1.	19 Jan 2008	06:09 am	East Rail Line North of Mong Kok East Station (Rail crossing)	5	Balfour Beatty	3 years	2	1	Defective weld joint by manufacturer	Fleet replacement completed in July 2008
2.	19 Mar 2008	06:38 am	East Rail Line South of Fanling Station (Plain rail)	9	PanZhiHua (China)	5 days	3	2	Poor quality welding materials	Lot disposed
3.	18 Nov 2009	05:58 am	East Rail Line North of Tai Wai Station (Stock rail)	9	Balfour Beatty / British Steel/Corus (Tata Group)	17 years	4	1	Impurities inside rail head	Individual case
4.	25 Jan 2010	09:57 am	East Rail Line North of Sheung Shui Station (Rail crossing)	5	Edgar Allen	7 years	0	0	Defective weld joint by manufacturer	Fleet replacement completed in April 2010
5.	13 Feb 2010	02:30 am	East Rail Line North of Sheung Shui Station (Rail crossing)	6	Edgar Allen	7 years	0	0	Defective weld joint by manufacturer	Fleet replacement completed in April 2010
6.	10 Mar 2010	20:25 pm	Kwun Tong Line East of Kwun Tong Station (Plain rail)	2	British Steel/Corus (Tata Group)	16 days	3	1	Weak weld joint (welded on site)	Individual case
7.	15 Jul 2010	02:20 am	Tsuen Wan Line South of Kwai Hing Station (Plain rail)	Slight	British Steel/Corus (Tata Group)	6 months	0	0	Weak weld joint (welded on site)	Individual case
8.	24 Jul 2010	22:07 pm	Kwun Tong Line West of Ngau Tau Kok Station (Switch rail)	Slight	Balfour Beatty / British Steel/Corus (Tata Group)	8 years	7	3	Design deficiency	Design improved

9.	1 Nov 2010	01:35 am	Tsuen Wan Line North of Admiralty Station (Plain rail)	Slight	British Steel/Corus (Tata Group)	4.5 years	2	1	Weak weld joint (welded on site)	Individual case
10.	13 Jan 2011	03:54 am	East Rail Line Near Fo Tan Station (Plain rail)	3	BaoGong(China)	8 years	3	2	Under investigation	To be determined
11.	19 Jan 2011	06:46 am	Tung Chung Line East of Sunny Bay Station (Plain rail)	5	British Steel/Corus (Tata Group)	12 years	10	2	Under investigation	To be determined
12.	10 Feb 2011	07:40 am	Tsuen Wan Line North of Admiralty Station (Plain rail)	1	British Steel/Corus (Tata Group)	4 years	4	0	Under investigation	To be determined

Light Rail

	Date	Time Found	Location	Width (mm)	Manufacturer	Age of Rail	Extra time incurred when trains passing through the affected section (minutes)		Root Cause	Improvement actions
							During the incident	After remedial action taken		
1.	12 Jan 2009	10:40 am	Tuen Mun Ferry Pier Terminus (Switch rail)	2	Kihn	2.5 years	0	0	Defective weld joint by manufacturer	Individual case after fleet check

Freight Yard

	Date	Time Found	Location	Width (mm)	Manufacturer	Age of Rail	Extra time incurred when trains passing through the affected section (minutes)		Root Cause	Improvement actions
							During the incident	After remedial action taken		
1.	24 Nov 2009	10:00 am	Hung Hom Freight Yard (non passenger area) (Plain rail)	Slight	Chinese Mainland	Over 20 years	N/A	N/A	Corrosion at the rail foot	Individual case after fleet check