

## 新聞稿

### Press Release

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#### **MTR Fully Implementing Improvement Actions following Train Incident on Tseung Kwan O Line**

The MTR Corporation published today (3 February 2023) the investigation report on the Tseung Kwan O Line incident which took place on 5 December 2022. The report concludes that the incident was caused by the detachment of a collar for holding the energy absorption device in a secured position within the semi-permanent coupler assembly of the train's sixth car, resulting in the device dislodging internally. After inspecting the energy absorption devices removed from inter-car coupler assemblies of the same type, the Corporation is implementing the improvement actions recommended in the report, such as adding extra security to collars of the same type for the train fleet by the end of this month, requiring the supplier to progressively replace the incident type energy absorption device with an enhanced design, and exploring the adoption of technology to monitor the device.

In the morning of 5 December 2022, a North Point-bound Tseung Kwan O Line train approaching Tseung Kwan O Station was brought to a stop by the fault-protection mechanism because an abnormal extension of the gangway between the sixth and seventh cars was detected. Service between Tiu Keng Leng and Po Lam/LOHAS Park stations was suspended and resumed around noon on the day.

The Corporation is greatly concerned about the incident and an Investigation Panel with external experts was set up to identify the cause of the incident and make recommendations for improvement.

The investigation revealed that a collar for holding the energy absorption device in a secured position within the semi-permanent coupler assembly of the train's sixth car was unscrewed from its assembly, causing the device to dislodge internally and the gangway between the train cars to extend abnormally. The gangway between the two train cars remained connected when the incident took place, and there was no misalignment of the train from the rail. The Panel concluded that the most credible cause of the detachment of the collar was the ineffective application of Loctite adhesive on its screw thread at its original build, thus the collar could not be locked in place permanently and eventually unscrewed itself over years of operation. As some of the inter-car coupler assemblies on MTR trains use the same type of energy absorption device, the Corporation has removed them for inspection and no loosened collars were found. This is the first identified case in the fleet.

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The Corporation has established maintenance regimes with inspections of the coupler assembly during routine preventive maintenance and scheduled periodic overhauls. As the energy absorption device is of a proprietary nature, its overhaul servicing has been carried out by the Original Equipment Manufacturer (OEM) at an interval of about 9 years. The last overhaul servicing of the incident energy absorption device was completed in 2018 with no abnormality reported. The Panel considered that the Corporation had arranged the overhaul of the energy absorption device by the OEM in accordance with the specified requirements of the coupler assembly supplier.

“We are implementing the improvement actions recommended by the Panel for the Tseung Kwan O Line incident, including adding extra security to the collar by installing two additional lock pins as per OEM’s advice, requiring the coupler assembly supplier to progressively replace the incident type energy absorption device with a design without the need of a separate collar, and exploring with the supplier the use of tools, such as technology, to monitor the operation of the device between overhauls for appropriate preventive maintenance. The Corporation will consider following up with the responsible party regarding the most credible cause of the incident as per the contract,” said Dr Tony Lee, Operations Director of MTR Corporation.

The Panel considered that both the overall handling of the incident and service recovery afterwards were smooth and orderly. With the assistance of staff, passengers on the incident train were guided onto the track and walked safely to a platform at Tseung Kwan O Station. The Corporation will enhance the dissemination of passenger information at stations and review the route arrangements for the MTR free shuttle bus during incidents based on the recommendations of the Panel.

“Railway safety has always been the top priority of the MTR Corporation. The comprehensive review on asset management currently being undertaken will identify areas that require enhancements to ensure that the Corporation can continuously provide safe, reliable and efficient railway service to passengers,” Dr Tony Lee added.

The detailed findings of the investigation are set out in the Appendix.

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## About MTR Corporation

To Keep Cities Moving, MTR makes encounters happen and rendezvous for a more connected tomorrow. As a recognised world-class operator of sustainable rail transport services, we are a leader in safety, reliability, customer service and efficiency.

MTR has extensive end-to-end railway expertise with more than 40 years of railway projects experience from design to planning and construction through to commissioning, maintenance and operations. Going beyond railway delivery and operation, MTR also creates and manages dynamic communities around its network through seamless integration of rail, commercial and property development.

With more than 40,000 dedicated staff\*, MTR carries over 13 million passenger journeys worldwide every weekday in Hong Kong, the United Kingdom, Sweden, Australia and Mainland China. Together, we Go Smart and Go Beyond.

For more information about MTR Corporation, please visit [www.mtr.com.hk](http://www.mtr.com.hk).

\*includes our subsidiaries, associates and joint ventures in Hong Kong and worldwide

## **Executive Summary**

On 5 December 2022 (Monday) at around 08:29 hours, a Tseung Kwan O Line (TKL) passenger train from LOHAS Park Station (LHP) approaching Tseung Kwan O Station (TKO) was brought to a stop at about 70 metres from TKO Platform 2 as the abnormal extension of the sixth and seventh cars' gangway triggered the associated fault-protection mechanism and the automatic application of the emergency brake. Station staff reported the abnormal extension of gangway and passengers were then arranged to detrain using the front-end detrainment ramp of the train and walk to TKO Platform 2 with the assistance of staff. The incident led to a service suspension between Tiu Keng Leng Station (TIK) and Po Lam Station (POA) / LHP, and service gradually resumed at 12:33 hours.

An Investigation Panel ("the Panel") with external specialists, SNC-Lavalin Rail & Transit Limited and Professor Lawrence Wu of the City University of Hong Kong was established to investigate the cause of the incident and make recommendations to prevent recurrence.

The investigation concluded that the energy absorption device of the semi-permanent coupler assembly of the sixth car dislodged from its internal mechanism, resulting in the gangway between the sixth and seventh cars of the train being extended abnormally. The collar for holding the energy absorption device in a secured position was unscrewed from its cylinder assembly and hence the incident device dislodged internally. By design, the collar was screwed and secured onto its cylinder assembly permanently for life by its locking mechanism, i.e. appropriate tightening torque, and Loctite adhesive on screw thread with two lock pins. Given that the collar is secured by the locking mechanism, it needs huge torque to unscrew it. However, such torque should not be experienced during train operation or be applied on the collar during maintenance.

Immediate inspection on the coupler assembly with the same type of energy absorption devices on other MTR trains based on the suggested methodology of the coupler assembly supplier was completed after the

incident. The supplier confirmed the safe operation of similar installations on other trains.

To further assure the integrity of the energy absorption device of the same type currently used in inter-car coupler assemblies for connecting train cars for train operation, removal of these devices from the inter-car coupler assemblies for fleet inspection as per the advice of the device's Original Equipment Manufacturer (OEM) was completed in January 2023. No loosened collar was found in the fleet inspection.

The Corporation has established maintenance regimes with inspections of the coupler assembly during routine preventive maintenance and scheduled periodic overhaul of coupler assembly. Due to proprietary nature, the overhaul servicing of the energy absorption device was carried out by the OEM. The last overhaul servicing of the incident device by OEM was carried out in 2018, i.e. about 4 years ago, with the next overhaul servicing targeted to be carried out in around 5 years' time based on the scheduled overhaul interval of around 9 years which was within the requirement of 10 years as recommended by the OEM. No abnormality was reported in the last overhaul servicing record.

The Panel is of the view that the operating environment in MTR is in line with the design intent of the incident energy absorption device based on in-service measurement results, and its overhaul by the OEM had been arranged by the Corporation in accordance with the specified requirements of the coupler assembly supplier.

Investigation with the external specialists concluded that the most credible cause of the detachment of the collar was due to ineffective application of the Loctite adhesive on its screw thread at its original build, as evidenced from the subsequent chemical analysis of the residuals left on the collar. As a result, the locking mechanism was weakened and eventually failed to withstand the rotation force acting on it during train operation over the years. The other possible factors including usage, maintenance arrangements, and overhaul process by OEM were considered not contributory to the incident.

Regarding the overall incident handling and recovery, the Panel considered that they were smooth and orderly. With the assistance of

staff on site, about 1,500 passengers were guided to descend onto the track from the train and walk to TKO Platform 2 in a safe and orderly manner.

The Panel made the following recommendations for preventing the recurrence of similar incident:

- a. Install two additional lock pins on the existing collar for the fleet as per the advice of the device's OEM to give extra security before fleet-wide replacing them with an enhanced one-piece cylinder design without collar. <by end of February 2023>
- b. Require the supplier to replace the incident type energy absorption devices designed with collar by an enhanced one-piece cylinder design without collar. <by Q1 2025>
- c. Explore tools with the coupler assembly supplier to monitor the performance of the energy absorption device, including application of technology. <by mid 2024>
- d. Enhance passenger information dissemination at stations through QR Code <by March 2023> and conduct review for enhancing MTR Free Shuttle Bus (S-bus) route arrangements during incident, with due consideration of connecting to alternative train routes and other modes of transportation <by June 2023>.

## **1. Introduction**

- 1.1 On 5 December 2022 (Monday) at around 08:29 hours, a North Point (NOP)-bound passenger train on the TKL from LHP was brought to a stop at about 70 metres from TKO Platform 2 by the train's emergency brake. Station staff later reported that the gangway between the sixth and seventh cars of the train was extended abnormally. Passengers were arranged to detrain using the front-end detrainment ramp of the train and walk to TKO Platform 2 with the assistance of staff. The incident led to a service suspension between TIK and POA / LHP, and service gradually resumed at 12:33 hours. A total of 244 minutes of service suspension was recorded for the incident.

## **2. The Investigation Panel**

- 2.1 The Corporation was greatly concerned about the incident and therefore set up an Investigation Panel ("the Panel") with external specialists, SNC-Lavalin Rail & Transit Limited and Professor Lawrence Wu of the City University of Hong Kong, to identify the cause of the incident and make recommendations to prevent any future recurrence.

## **3. The Incident**

- 3.1 At around 08:29 hours on 5 December 2022 (Monday), a NOP-bound train on TKL was brought to a stop at about 70 metres from TKO Platform 2 due to the abnormal extension of the sixth and seventh cars' gangway which triggered the associated fault-protection mechanism and hence the application of the emergency brake. The Operations Control Centre (OCC) arranged station staff to descend onto the track from TKO and proceed to the train to assist, and staff later reported the abnormal extension of the gangway to OCC.
- 3.2 TKL train service between TIK and POA / LHP was suspended as a result while train service between NOP and TIK was maintained. S-bus services were arranged.

- 3.3 Detrainment was arranged using the front-end detrainment ramp of the train. With the assistance of staff on site, about 1,500 passengers were guided to descend onto the track and walk to TKO Platform 2 within a few minutes. Two passengers on the incident train felt unwell and they were conveyed to the platform by Fire Services Department personnel, among them was a pregnant passenger who was sent to Tseung Kwan O Hospital and discharged on the same day.
- 3.4 Site check confirmed the coupler assembly and gangway of the sixth and seventh cars of the train remained connected and there was no misalignment of the train from the rail. To facilitate the incident train to return to Tseung Kwan O Depot (TKD), the train was separated into two sections at the sixth and seventh cars by the maintenance team after detrainment.
- 3.5 An assisting non-passenger train was arranged to couple with the rear two cars of the incident train and departed from the incident site at 11:39 hours for TKD. The other six cars left the site for TKD with its own power at 12:09 hours. After all eight cars of the incident train arrived at TKD, train service on TKL resumed gradually at 12:33 hours.

## **4. Cause of the Incident**

- 4.1 Investigation revealed that the energy absorption device of the semi-permanent coupler assembly of the sixth car dislodged from its internal mechanism, resulting in abnormal extension of the gangway between the sixth and seventh cars, triggering the associated fault-protection mechanism and hence the application of the emergency brake.
- 4.2 Post incident inspection on the incident device revealed that its collar was detached from its cylinder assembly. Extensive investigation with the coupler assembly supplier and the OEM of the energy absorption device was conducted with the support from the external specialists. It was concluded that the most credible cause of the detachment of the collar was due to ineffective application of the Loctite adhesive on its screw thread at its original build, as evidenced from the subsequent chemical analysis of the residuals left on the collar. As a result, the locking mechanism was weakened and eventually failed to withstand the

rotation force acting on it during train operation over the years.

## **5. Immediate Follow-up after the Incident**

- 5.1 Immediate inspection on the coupler assembly with the same type of energy absorption devices on other MTR trains based on the coupler assembly supplier's suggested methodology was completed after the incident. The supplier confirmed the safe operation of similar installations on other trains. The inspection regime will continue until the incident type energy absorption devices designed with collar are replaced by an enhanced one-piece cylinder design (without collar) by Q1 2025.
- 5.2 To further assure the integrity of the energy absorption devices of the same type currently used in inter-car coupler assemblies for connecting train cars for train operation, removal of these energy absorption devices from the inter-car coupler assemblies (634 nos.) for inspection for the fleet as per the advice of the device's OEM was completed in January 2023. No loosened collar was found in the fleet inspection. The removal of devices from inter-car coupler assemblies for inspection will be carried out every 2 years until the incident type energy absorption devices designed with collar are replaced by an enhanced one-piece cylinder design (without collar).
- 5.3 The fleet inspection of other energy absorption devices with collar which are not used for inter-car connection (78 nos.) will be completed by end of February 2023.

## **6. The Incident Energy Absorption Device**

### Usage

- 6.1 This type of energy absorption device within the coupler assembly was first introduced by train supplier on CAF-trains for the Tung Chung Line (TCL) and Airport Express in 1998, and similar device was also provided subsequently on K-trains and C-trains of urban lines, as well as K-trains of TCL. There are currently a total of 758 nos. in the MTR network, of which 634 nos. with collar are

fitted in the inter-car coupler assemblies, while the remaining 124 nos.<sup>1</sup> are fitted at the front-end of the trains.

- 6.2 While the train is in motion, the energy absorption device within the coupler assembly extends and retracts to absorb the energy arising from normal operation of the train to give a smooth ride.
- 6.3 The external specialist, SNC-Lavalin Rail & Transit Limited has reviewed the in-service measurement results with the design characteristic and confirmed the operating environment in MTR is in line with the design intent.

#### Material and manufacture

- 6.4 This type of energy absorption device has its collar secured with its cylinder assembly to hold the device in a secured position. The collar is screwed and secured permanently for life onto its cylinder assembly by its locking mechanism including (a) application of appropriate tightening torque, (b) use of two lock pins, and (c) the use of Loctite adhesive on screw thread. Among the MTR train fleet, some of the energy absorption devices on CAF-trains use one-piece cylinder design without collar.
- 6.5 By design, the collar was screwed and secured in place permanently for life onto its assembly by its locking mechanism. It needs huge torque to unscrew it and such torque should not be experienced during train operation or be applied on the collar during maintenance.

#### Maintenance arrangements by the Corporation

- 6.6 The Corporation has established maintenance regimes with inspections of the coupler assembly during routine preventive maintenance and scheduled periodic overhaul of coupler assembly.
- 6.7 The energy absorption device is completely housed inside the coupler assembly. Due to its proprietary nature, the overhaul servicing of the device was carried out by the OEM and it is

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<sup>1</sup> Among the 124 nos. fitted at the front-end of the trains, 78 nos. are designed with collar and 46 nos. are of one-piece cylinder design without collar.

maintenance-free between overhauls as stated by the OEM in the maintenance manual. To certify that the overhaul servicing on the device had been duly completed, the OEM had provided test certificate for each energy absorption device to confirm that its energy absorption performance was in line with specification, after their overhaul servicing.

- 6.8 There was no abnormality reported in the last overhaul servicing record of the incident device. The last overhaul servicing was conducted by the OEM in 2018, i.e. about 4 years ago, with the next overhaul servicing targeted to be carried out in around 5 years' time based on the scheduled overhaul interval of around 9 years which was within the requirement of 10 years as recommended by the OEM. The Panel considered that the Corporation had arranged the overhaul servicing of the incident energy absorption device by the OEM in accordance with the specified requirements of the coupler assembly supplier.

#### Overhaul process by OEM

- 6.9 As for the overhaul servicing undertaken by the OEM, the OEM confirmed that the collar would not be disturbed during the overhaul process and the investigation did not find any abnormality on the overhaul servicing.
- 6.10 The energy absorption device had undergone a visual inspection after it was removed from the coupler assembly and then intact sent to OEM for overhaul servicing, and a set of materials was renewed during overhaul. The device overhaul was completed with a functional test and a certificate was issued by the OEM to confirm that its energy absorption performance was in line with specification and ready for re-assembly back onto the coupler assembly.
- 6.11 Despite the fact that the overhaul is a proprietary service, the Corporation will enhance its regular inspection with audits on the quality control at factory as an on-going arrangement.

## Failure analysis

- 6.12 Based on the evidence obtained and the support from the external specialists, the cause of the detachment of the collar from the cylinder assembly internally was due to ineffective application of the Loctite adhesive on its screw thread at its original build, as evidenced from the subsequent chemical analysis of the residuals left on the collar. As a result, the locking mechanism was weakened and eventually failed to withstand the rotation force acting on it during train operation over the years.
- 6.13 The other possible factors including usage, maintenance arrangements, and overhaul process by OEM were considered not contributory to the incident.

## **7. Incident Handling**

- 7.1 During the incident, TKL train service between TIK and POA / LHP was suspended while train service between NOP and TIK was maintained at 5-minute intervals. According to the established plan, S-bus service route TKL3 was arranged to operate between TIK and POA (stopping at TKO, LHP and Hang Hau Station enroute) in both directions, and route D4 was arranged to operate between LHP and TIK in both directions. Both S-bus routes operated until 13:00 hours. A total of 247 bus trips were operated with about 15,000 passengers carried.
- 7.2 Information on service arrangements was disseminated via various channels including in-station and in-train Public Announcements, Passenger Information Display System at stations, Traffic News on MTR Mobile and through the media. Over 180 additional staff were deployed to strategic locations at stations and S-bus stops to provide customer caring to the affected passengers and assist in station passenger flow management and S-bus operation.
- 7.3 The Panel considered that overall incident handling and recovery were smooth and orderly. With TKL providing key railway connectivity for districts in Tseung Kwan O, a review to look into potential enhancement of S-bus route arrangements for TKL in the event of major service disruption was recommended, with due consideration of connecting to alternative railway routes and other

modes of transportation. Potential enhancement of passenger information dissemination on alternative transport for passengers in the affected stations should also be explored.

## **8. Conclusion**

- 8.1 The Panel concluded that the incident was caused by the detachment of the collar of the incident energy absorption device from its cylinder assembly internally, resulting in the device dislodging from its internal mechanism. Investigation with the external specialists concluded that the cause of the detachment of the collar was due to ineffective application of the Loctite adhesive on its screw thread at its original build, as evidenced from the subsequent chemical analysis of the residuals left on the collar. As a result, the locking mechanism was weakened and eventually failed to withstand the rotation force acting on it during train operation over the years. The other possible factors including usage, maintenance arrangements, and overhaul process by OEM were considered not contributory to the incident.
- 8.2 After the incident, immediate inspection on the coupler assembly with the same type of energy absorption devices based on the coupler assembly supplier's suggested methodology was completed, followed by the removal of the devices fitted in inter-car coupler assemblies for inspection for the fleet as per OEM's advice to further assure integrity. No loosened collar was found on any energy absorption device used in inter-car coupler assemblies during the fleet inspection.
- 8.3 The Panel is of the view that the operating environment in MTR is in line with the design intent of the incident energy absorption device based on in-service measurement results.
- 8.4 The Panel also noted that the Corporation had arranged the overhaul servicing of the incident energy absorption device by the OEM in accordance with the specified requirements of the coupler assembly supplier and OEM, and the OEM had provided test certificate for each energy absorption device after overhaul servicing to confirm that its energy absorption performance was in line with specification.
- 8.5 At the outbreak of the incident, the train was brought to a stop due

to the abnormal extension of the sixth and seventh cars' gangway, triggering the associated fault-protection mechanism and hence the application of the emergency brake. Regarding incident handling, the Panel considered that it was conducted in an effective manner and passengers on the incident train were guided to TKO Platform 2 in a safe and orderly manner.

## **9. Recommendations and Follow-up Actions**

9.1 The Panel made the following recommendations for preventing the recurrence of similar incident:

- a. Install two additional lock pins on the existing collar for the fleet as per the advice of the device's OEM to give extra security before fleet-wide replacing them with an enhanced one-piece cylinder design without collar. <by end of February 2023>
- b. Require the supplier to replace the incident type energy absorption devices designed with collar by an enhanced one-piece cylinder design without collar. <by Q1 2025>
- c. Explore with the coupler assembly supplier on tools to monitor the performance of the energy absorption device, including application of technology. <by mid 2024>
- d. Enhance passenger information dissemination at stations through QR Code <by March 2023> and conduct review for enhancing S-bus route arrangements during incident, with due consideration of connecting to alternative train routes and other modes of transportation <by June 2023>.

## Annex – Illustration of the Energy Absorption Device

