Legislative Council Panel on Transport
Subcommittee on matters relating to railways

Government's assessment on the investigation reports by KCRC on the West Rail transformer fire incident on 14 February 2007

Purpose

This paper sets out Government's assessment on the investigation reports by the Kowloon-Canton Railway Corporation ("KCRC") on the cause of the West Rail ("WR") voltage transformer fire incident and the handling of the incident.

Background

2. On 14 February 2007 at 9:13 am, when a West Rail train NAC15 travelling at Tai Lam tunnel to Tsuen Wan West Station (TWW), there was an abnormal bang sound from the rear of the train followed by loss of power supply to the train. The incident train driver (ITD) observed through the in-cab CCTV that the train was filled with smoke and decided to immediately apply emergency brake to stop the train. Train NAC15 came to a complete stop at a location 1.5km from TWW.

3. The West Rail Operations Control Centre (WROCC) was notified and applied system hold to stop all trains at platforms. Emergency detrainment of the incident train started at 9:15 am. There were in total some 1,000 affected passengers evacuated. Fire at the voltage transformer on the roof of the sixth car of NAC15 was put out at 10:35 am. After confirming with the Hong Kong Railway Inspectorate (HKRI) that the railway system was in a safe condition for operation, West Rail service resumed at 12:54 pm.

Government's follow-up action and assessment on KCRC's findings on the cause of the defective voltage transformer

4. Following the incident, apart from conducting site inspections, HKRI immediately requested KCRC to conduct fleet check on the integrity of all similar transformers in the KCR train fleet to ensure that other in-service voltage transformers are safe for operation.

5. Moreover, a Government Expert Panel with representatives from the HKRI, Electrical and Mechanical Services Department and Highways Department was set up to review KCRC's investigation results on the root cause and to evaluate remedial measures proposed by KCRC.

KCRC's findings

6. KCRC's investigation findings and assessment are set out in the Corporation's paper. In gist, all possible factors including production, maintenance and external factors have been examined. After thorough examination, two possible causes, namely, workmanship and lightning cannot be totally eliminated as the contributing factors to the failure. KCRC considered that the failure was basically due to hidden production imperfection. When such imperfections are subjected to voltage surge, for example lightning, they may surface and further develop, causing the eventual failure. Tests and monitoring results of other in-service transformers confirmed that the failure was an isolated case.

Government Expert Panel's assessment on KCRC's findings and recommendations

7. The Government Expert Panel employed a three-pronged approach in making its assessment. This included the formulation of necessary interim measures to ensure the safe operation of the in-service voltage transformers, the investigation of the root cause of incident, and assessment on KCRC's long-term improvement measures.

Interim measures

8. In the light that there are other similar voltage transformers in the

KCR fleet, to confirm that such in-service transformers will not pose a fire risk to passengers, HKRI requested KCRC to conduct various tests such as insulation test[1], type test[2] and Dissolved Gas Analysis[3] to verify the healthiness of the in-service voltage transformers.

9. In addition, upon HKRI advice, KCRC has implemented an enhanced monitoring regime to ascertain the condition of the voltage transformers. These include-

(a) intensify the frequency of insulation test from every 3 years to monthly;
(b) use on-board train computer to real-time monitor the transformer voltage level;
(c) check voltage transformer working temperature every 3 days;
(d) check transformer coil integrity by comparing voltage level with other transformer weekly; and
(e) carry out high voltage test in laboratory conditions to prove that the transformers remain fit for purpose.

10. Based on the fact that no abnormality was found in the tests and with the implementation of the enhanced monitoring regime, the Government Expert Panel is satisfied that other in-service voltage transformers are in a healthy condition for safe operation of train.

Causes of the defective voltage transformer

11. The incident transformer was found to have delamination in the coil. After reviewing the production process, testing and monitoring results, the Government Expert Panel considers that the failure of the incident transformer was a random event basically caused by a hidden insulation imperfection introduced at the time of production. The

[1] Insulation Test is a test to check the healthiness of insulation of electrical equipment.
[2] Type Test includes a series of tests required to verify the compliance with the specified requirements for a new type of equipment. Normally, the type test is only done once for any new type of equipment or facilities.
[3] Dissolved Gas Analysis is a test to analyze gas content dissolved in oil sample taken from transformer. The test can be used to give an early indication of abnormal behaviour of transformer.

imperfection, if insignificant, might slip through the production acceptance test and the transformer would still worked within the performance tolerance. However, the imperfection could be surfaced by a voltage surge arising possibly from severe lightning, which triggered subsequent short-circuiting and eventual failure of the transformer.

12. Having reviewed the testing and monitoring results of the remaining transformers, the Government Expert Panel concludes that the incident is an isolated case and does not reveal a systematic problem. The Government Expert Panel also agrees that other WR train equipment has been designed and built to withstand lightning. Under normal condition, all train equipment will be operating safely under lightning condition.

Long-term improvement measures

13. KCRC has proposed to progressively replace the existing voltage transformer with an oil-free and explosion proof type. This type of transformer has no insulation oil and hence non-flammable. In addition, it can withstand a higher voltage surge and is therefore more resistant to lightning events. The Government Expert Panel concurred that the proposed transformer is with a lower fire risk and higher sustainability to lightning.

14. HKRI will follow up with KCRC on the details of the replacement programme. Prior to the completion of the replacement, HKRI will closely monitor KCRC's adherence to the implementation of improvement measures for ensuring the safe operation of the voltage transformers in the railway system. KCRC has also been requested to alert the Government to any abnormalities transpired.

The handling of the incident

KCRC's review results

15. Findings of review carried out by KCRC are detailed in the paper provided by KCRC. In gist, KCRC considers that the incident,

including the rescue and evacuation operations, was in general effectively handled by KCRC. Recommendations have been made for further improvement taking into account the lessons learnt in this incident.

Government's assessment on KCRC's findings and recommendations

16. Meetings between Fire Services Department (FSD), Hong Kong Police Force (Police), Transport Department (TD) and HKRI were held to review the handling of the incident, including the rescue and evacuation operations.

17. The Government is satisfied that KCRC has in general followed established rules and procedures agreed with relevant departments in handling the incident. KCRC has recommended various improvement measures and they are considered appropriate. Nonetheless, there are a number of areas which KCRC should seek to improve. Government's observations in this regard are set out in the ensuing paragraphs.

Fire notification to FSD

18. While the FSD responded immediately upon the receipt of an automatic fire alarm signal from the West Rail Tai Lam Tunnel South Portal at 9:13 am, a fire notification from the West Rail Operations Control Centre (OCC) was not made until 9:17 am. There was a time lapse of about four minutes which had caused some delay to FSD's operational arrangement and resource deployment. KCRC should have reported the confirmed fire to FSD immediately in accordance with the procedures set out in its Contingency Manual. In response to FSD's comments, KCRC has briefed its OCC staff to ensure that FSD is alerted immediately. KCRC will improve OCC's efficiency through experience sharing with FSD's control centre.

Performance of the KCRC's Liaison Officer

19. The officer-in-charge of the FSD initial attending crew arrived at the Chai Wan Kok Ventilation Building at 9:18 am and met KCRC's Liaison Officer (LO). The primary duty of the Company's LO is to confirm that all safety precautions were carried out before allowing rescue parties to gain access to the track. FSD pointed out that the LO

concerned was not equipped with all the necessary information required for performing her duty effectively and this impacted on FSD's operational efficiency. FSD has requested KCRC to ensure that LOs will be provided with the necessary information timely for communication with FSD. KCRC has agreed to FSD's suggestion.

Isolation of traction power

20. The FSD crew arrived at the incident train at 9:45 am and took over the firefighting job from the Incident Train Drive (ITD). Since the West Rail train uses high voltage power supply (25 000 volt AC), it would be unsafe for the firefighting crew to climb onto the roof of the affected carriage to carry out firefighting. Despite repeated requests made by the FSD officer-in-charge to the ITD and the LO to isolate the high voltage traction current, no such confirmation was received until 9:55 am. This caused some delays to the firefighting operation of FSD. FSD has requested KCRC to shorten the process in future. In response to this, KCRC will improve communication with FSD on site such that the reasons for not being able to switch off the traction power immediately could be explained to FSD to enable FSD to prepare and implement appropriate rescue plan.

Assistance provided to passengers

21. Passengers Care Officers (PCOs) were dispatched by KCRC on that day to meet and render assistance to the detrained passengers about 10 minutes after the detrainment had commenced. TD considers that the deployment of the PCOs should be expedited as the physical presence of KCRC staff would be essential to provide immediate assistance and relief to the affected passengers during the evacuation. KCRC has agreed to identify possible improvements such as through reprioritization of duties of PCOs so as to facilitate speedy deployment on site.

Signage inside tunnel

22. To facilitate the evacuation of passengers inside tunnels, FSD has requested KCRC to install additional signs along the tunnel to indicate directions of the stations. KCRC has agreed to the suggestion.

Public education on evacuation

23. Departments concerned consider that public education is an important element in ensuring passengers' knowledge in the essential evacuation procedures in case of railway incidents. FSD has requested and KCRC agrees to, in consultation with FSD, carry out passenger education campaigns focusing on emergency detrainment and tunnel evacuation. In response to HKRI's comments, KCRC has also agreed to conduct more drills involving the public as a means of public education.

Staff training

24. Having reviewed the detrainment arrangement in this incident, FSD has requested KCRC to, in future staff training, stress the importance of taking the following actions before commencing detrainment in a tunnel-

- ensure no other train movement inside the tunnel
- activate the Tunnel Ventilation System
- switch on the tunnel lighting
- switch on the exit signs and
- broadcast the means and direction of evacuation

KCRC has agreed to FSD's recommendation and would emphasize the above procedure in its experience sharing with staff.

Way Forward

25. We note that KCRC has committed to making efforts to further enhance the safety of West Rail and improve the handling of incidents, including the emergency and evacuation operations. We will monitor KCRC's implementation of the improvement measures.

Environment, Transport and Works Bureau
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