

**MINISTERIAL STATEMENT BY COORDINATING MINISTER FOR INFRASTRUCTURE
AND MINISTER FOR TRANSPORT MR KHAW BOON WAN ON 7 NOVEMBER 2017,
AT PARLIAMENT HOUSE**

7 OCTOBER 2017 SMRT FLOODING INCIDENT & RELATED ISSUES

Mr Speaker,

Background

1. On 7 October 2017 at 5.14pm, an alert SMRT train captain, Mr Choo Ah Heng, reported flooding on the southbound tunnel tracks between Bishan and Braddell MRT stations. At 5.27pm, the Braddell Station Manager reported the same on the northbound tracks. At 5.30pm, the SMRT Operations Control Centre (OCC) suspended train services on both bounds between Ang Mo Kio and Toa Payoh MRT stations. Although the flooded stretch was only between Bishan and Braddell, services had to be suspended on a longer stretch, up to stations with crossover tracks for the trains to turn around. By 5.38pm, SMRT reported that water at the deepest section of track had risen to almost meet the electrified third rail. The system was designed such that power would have cut off automatically if water levels had risen past the third rail. Nevertheless, as a safety precaution, SMRT cut all traction power to the affected tracks at 5.58pm. All passengers had, by then, been safely de-trained to the station platforms, and no commuters were left in the tunnels.

2. In an unrelated but concurrent incident, train services were suspended in both directions between Marina South Pier and Newton MRT stations from about 5.50pm, when the same train captain who reported the flooding spotted electrical arcing at the trackside between Raffles Place and Marina Bay MRT stations. Electrical arcing occurred because accumulated debris caused a short circuit between an electrified baseplate and a bolt in the ground, which had been left in place after some renewal works in 2003. The short circuit generated sparks and high heat, causing the debris to smoulder. The debris quickly burnt off and the sparks extinguished before the SCDF arrived. However, the service suspension was only lifted at 9.22pm after SMRT completed the necessary safety checks.

3. Although the electrical arcing incident was resolved and services resumed between Marina South Pier and Newton by 9.22pm, it took multiple agencies working through the night to clear the flood waters between Bishan and Braddell MRT stations. These flood waters were up to 1 metre deep and covered 100 metres of tracks on both bounds. Hence, train services between Ang Mo Kio and Newton remained suspended from 5.30pm until the end of scheduled service that day. Despite assistance from PUB and SCDF, the waters could not be cleared for normal train service to begin the next morning. The flood waters were only cleared to a safe level at 11.06am the next day. Train services fully resumed at 1.36pm, after various safety and operational tests and checks to the tracks were completed. This flood incident resulted in a cumulative disruption to service of 14.5 hours – 7 hours on Saturday and 7.5 hours on Sunday. During the service disruptions, free public buses and bridging buses were deployed along the affected stretches. Announcements on services and alternative transport options were made in stations, on-board trains, on SMRT's and LTA's websites, as well as through mainstream and social media channels.

4. The two incidents were unrelated. While there was inconvenience caused to commuters, safety remains our top priority. The SMRT OCC staff did the right thing and handled a difficult situation well. Chief Controller, Mr Tan Kwong Chye, took the decision to detrain the commuters and cut off the traction power to the affected tracks between Bishan and Braddell soon after receiving the first reports of flooding. Train Service Controller, Mr Tan Ming Hui, single-handedly managed both incidents at Bishan and Marina South Pier, ensuring

that train services north of Ang Mo Kio continued to run, and train services south of Newton were resumed as quickly as possible by the same evening. As the flooding incident was much more serious, I will focus on it in my statement.

Investigation Findings

5. The tunnel flooding incident was preventable. It should not have happened. It was not due to any inadequacy in the design of flood protection measures. Neither was it due to an extraordinary storm. It was due to poor maintenance and neglect of duties by the specific SMRT maintenance team responsible for the Bishan storm water sump pump system.

6. MRT tunnels are fully protected against flooding. The primary flood protection measure is the storm water sump pit. As the name implies, its purpose is to collect storm water. The water is then pumped out to external drains, thus preventing it from flowing into and flooding the tunnels. Engineers size the sump pit and pump capacity at each location based on PUB's estimates for potential rainfall, with a huge buffer.

7. Specifically, the Bishan storm water sump pit has a capacity of over 5,000 cubic metres. This is roughly the size of two Olympic-sized swimming pools. In comparison, the total rainfall which was cleared from the tunnels was only about 640 cubic metres. This would have filled 13% of the pit's capacity even if all three pumps were not working. That is plenty of buffer. A properly maintained storm water sump pit should be clean, free of sludge, silt and debris, and empty, in anticipation of the next storm so that it can do its job. It is also not difficult to check if the storm water sump pit is filled up. Any maintenance crew looking through the grating at the top of the storm water sump pit can easily tell whether the pit is full or not. Yet, on the day of the incident, the Bishan storm water sump pit must have been quite full, even before the rain started. As a result, the rain that evening flowed straight into the tunnels, flooding the stretch between the Bishan and Braddell stations. The flood protection system at Bishan has served us well for the last 30 years and is designed with a huge buffer. However, the lack of maintenance, including the failure to check that sub-systems were in working condition, has led to this incident.

8. While investigations by LTA are still on-going, we know now that all three pumps in the Bishan storm water sump pit were functional, as they could be manually activated after the flooding was discovered. Singapore Test Services has also independently verified that each of the five float switches controlling the pump system were functional in themselves. Why these float switches failed to function normally on 7 October is a subject of the on-going LTA investigation.

9. SMRT has completed its own internal investigations. Based on their findings, it appears that the Bishan flood protection system had not been maintained for many months. Such systems need to be maintained quarterly by SMRT, and maintenance records were signed off and submitted for December 2016, March 2017 and June 2017. However, these records do not match any corresponding logs for track access and pump activation. No track access approvals were issued for preventive maintenance of the Bishan portal sump pumps on these dates. Pump logs also showed that the pumps were not activated for these same dates, which is required as part of the maintenance procedures. In other words, the maintenance records may have been falsified.

10. The maintenance team in question comprises a manager, an engineering supervisor and four other crew members. Of these, three have been with SMRT for more than 20 years, including one who was with SMRT for over 28 years. Of the remaining three, one was with SMRT for a little over a year, the other two were with SMRT for six and eight years. The engineering supervisor and four other crew members were directly responsible for maintaining

pumps and other facilities in 15 stations from Sembawang to Dhoby Ghaut stations, while the manager was responsible for supervising and ensuring that the work was done. These six have been suspended and are assisting SMRT's investigation. SMRT is in contact with the National Transport Workers' Union (NTWU), and has assured the unions that these suspended officers will be accorded due process.

11. Apart from Bishan, SMRT has also checked the storm water pump systems at four other tunnel portal locations in Redhill, Kembangan, Lavender and Changi. SMRT found that 2 out of 8 pumps at Kembangan and 3 out of 4 pumps at Lavender were not in serviceable condition. SMRT is currently conducting investigations into the relevant teams responsible for these pumps under the Building and Facilities maintenance group. This group was headed by Vice-President Ng Tek Poo. SMRT has suspended him together with six other managerial staff with respect to their discharge of supervisory responsibilities. The six include his predecessor, a Vice-President who oversaw the unit in charge of maintaining the pump systems prior to May 2017, as well as a Chief Engineer, a Deputy Director, and three Managers.

12. Apart from the Building and Facilities maintenance group, which makes up one-tenth of the total staff strength of SMRT Trains, SMRT has not found any evidence of falsification or wilful dereliction of duties in the core railway maintenance and engineering groups who are responsible for the maintenance of trains, signalling and communications, tracks and trackside equipment and power. Nevertheless, SMRT accepted a union suggestion to declare an amnesty period for workers to come forward with information on poor work practices. This amnesty period closed on 3 November 2017 and will be followed by a series of audits by SMRT's Readiness Inspection teams. As regulator, LTA will also separately assess SMRT's findings on the extent of dereliction of duties and falsification of records.

13. While investigations by LTA will take a few more weeks to complete, the facts of the 7 October incident are not complicated, and the cause of the incident is clear. My Ministry will therefore not be convening a Committee of Inquiry.

Immediate Actions Taken

14. Meanwhile, SMRT and LTA have taken a number of immediate steps. First, SMRT has replaced all existing float switches at the Bishan storm water sump pit. Second, LTA has enhanced the resilience of the flood protection system by replacing the pumps at Bishan with heavier-duty ones capable of handling water with more sediments, and installing additional parallel float switches. Third, a new radar-based sensor system has been added to independently monitor water levels in the storm water sump pit. Fourth, the sump pump control panel has been re-located away from the tracks, to enable easier manual access to pump operations if needed during operating hours. The removal of accumulated sludge, silt and debris in the sump pit is also in progress. For the other portal systems at Kembangan, Lavender and Changi, SMRT has replaced or repaired all the non-serviceable pumps. The float switches were also replaced as a precaution.

15. SMRT will take swift and stern action to root out any improper practices and prevent a recurrence of this incident. First, it has reorganised the unit overseeing the maintenance of the flood protection system. SMRT has replaced the VP of Building and Facilities Mr Ng Tek Poo with Mr Siu Yow Wee, a mechanical engineer within SMRT. Mr Siu is deeply committed and responsible, and I expect him to enforce greater discipline and process controls within his group. Mr Siu will report directly to SMRT's Chief Maintenance Officer. Second, it has increased the frequency of maintenance for flood protection systems from quarterly to monthly. Third, it is tightening its flood recovery plans and intends to strengthen coordination with the SCDF and PUB through regular exercises. Additional emergency equipment such as

portable pumps are also being procured to augment emergency response capabilities. Fourth, it has invited a team of experts from the Taipei Metro to do a thorough and independent review of its operations, to flush out any gaps and recommend improvements in the areas of system management, engineering and maintenance. Last but not least, to develop and cultivate a stronger culture of accountability, ownership and open reporting across the whole organisation, SMRT is strengthening internal processes and staff support. This includes staff rotations and renewal, delayering of reporting chains for tighter management oversight, enhancing the supervision of night works, strengthening training and coaching of supervisors, and aligning the bonuses and incentives of senior supervisors to the performance of their teams and audit results.

16. SMRT's new Chairman has publicly stated that his company has zero tolerance for failures in supervision and diligence over maintenance tasks, and will be undertaking a comprehensive audit of maintenance records and practices to uncover any lapses or impropriety. He has also shared that the Board will review the remuneration of its senior management, from the CEO through the relevant chain of command. This is as it should be. We commend the Chairman for taking these steps and for emphasising that it is the responsibility of management to set the right culture of professionalism and excellence. It begins from the top.

17. At a media conference on 16 Oct 2017, the CEO of SMRT Desmond Kuek commented on some "deep-seated cultural issues" within SMRT. In response to a journalist's query, he referred to a Organisational Climate Survey done by Towers Watson which found 9 in 10 SMRT employees proud of and engaged in their work. On the remaining 1 in 10 employees, he elaborated on the need to strengthen the level of accountability by supervisors, and the degree of ownership and open reporting by staff.

18. I would like to stress that growing the right culture is the responsibility of everyone – from the top leadership to the workers. I will look to the SMRT management to set the right tone of professionalism and excellence, to complement the audit systems that are being put in place. This is the Singapore way. Mr Speaker, workers and management are jointly responsible for the success of their enterprise. When we speak of "culture", we mean the culture of the whole organisation – the values and practices of management, as much as the values and practices of the workers.

19. I am certain of the new SMRT Chairman's determination and sincere efforts to transform the culture of SMRT as a whole. With the support of management and workers across the organisation, I have faith that he will succeed.

Role of LTA

20. Since the incident, I have received questions about the different roles that LTA has played. For the rail network, LTA has three distinct roles: as a regulator, developer and asset owner. Although these roles are separate, they are all geared towards achieving our vision for a well-connected, reliable and efficient rail network.

21. First, as regulator, LTA sets the Operating and Maintenance Performance Standards. It then conducts regular audits of the operators' maintenance regime and on-site inspections to ensure that these standards are complied with. To prioritise its resources, LTA adopts a risk-based approach. It focusses most on the most complex areas where failure could have the most severe impact and damage to the rail network, and on passenger safety. One example is the signalling system which is the central nervous system of our rail network, and is made up of countless interconnected sub-systems located along the tracks, inside the trains,

as well as in the stations, depots and Operations Control Centre. These complex and high-risk systems are where we place the most audit effort and regulatory focus.

22. The anti-flooding systems are considered less risky compared to other core railway systems, because the constructs are simpler, easier to maintain and have ample engineering buffers. Nonetheless, during a recent meeting with SMRT on 29 September 2017, a few days before the tunnel flooding incident happened, LTA had stressed the importance of maintaining tunnel sump pump systems. SMRT subsequently agreed to review and surface a list of pumps requiring replacement to LTA. Unfortunately, the incident occurred before this review could be completed.

23. There has been no shortcoming or lapses in oversight by LTA staff in the present regulatory framework. Going forward, I have asked LTA to partner SMRT, and to set up a new Joint Readiness Inspection team to supplement SMRT's own internal audit system. At SMRT Chairman Seah Moon Ming's request, ST Kinetics has released Dr Richard Kwok to head SMRT's augmented audit team. Dr Kwok, who was Executive Vice-President and Chief Technology Officer of ST Kinetics, will start work with SMRT on 18 December. His team will report directly to the SMRT Board's Audit and Risk Committee. He will also jointly head with LTA the Joint Readiness Inspection team which will report to the LTA and SMRT Joint Board Technical Committee. The tighter audit system will help to identify any deficiencies, so that they can be addressed early before faults occur.

24. However, no regulatory oversight can fully guard against intentional efforts to hide mistakes and negligence. Our operators' efforts to create the right organisational culture of professionalism, excellence and discipline are therefore important and complement the audit systems in place.

25. Second, as developer, LTA is responsible for ensuring that our transport infrastructure is appropriately designed with the right specifications. In developing rail lines, LTA undertakes structured engineering reviews and system assurance assessments, including Failure Mode, Effects and Criticality Analysis, to ensure reliability and safety. In this case, the design and construction of our MRT infrastructure has incorporated ample flood-resistant specifications and redundancies. This includes station entrances which are built at least one meter above prevailing flood levels, as well as the provision of ample pump capacity and holding tanks in close consultation with PUB. These specifications are more stringent than those for other building developments. For existing infrastructure, flood barriers have been retrofitted at older MRT station entrances, such as at Tanjong Pagar and Orchard, to protect these underground stations from the risk of flash floods. LTA also works closely with PUB to review the flood protection requirements from time to time, to take into account the impact of climate change and unforeseen weather events on our built-up environment.

26. Third, when the North-South and East-West Lines transitioned to the New Rail Financing Framework in October 2016, LTA took over the ownership of all rail operating assets, and became an asset owner. As part of the asset transfer, LTA will assess the condition of the assets while Ernst and Young was engaged to perform due diligence on their Net Book Value. Payment to SMRT is contingent on the requirement that the condition of the operating assets should befit their age. This process takes several years to complete. LTA has prioritised the condition assessment of critical or high-value operating assets such as the trains and signalling system first, with the rest, including the Bishan storm water sump pumps, slated to commence later this year.

27. There is also a fourth and unspoken role for LTA, which I have emphasised since I joined the Ministry. That is to cultivate a relationship between LTA and the rail operators founded on trust and constructive collaboration towards a common mission of providing

reliable rail transport as an essential public service. This is especially important now, when our two oldest MRT lines, the North-South and East-West Lines, are undergoing major renewals. There needs to be a relationship of trust at all levels so that information and ideas are openly, candidly and freely shared and exchanged. In fact, this helps LTA perform its role as a regulator more effectively as its investigations into any disruptions must always be fair-minded and thorough – having considered all factors like the age of the assets, the effects of weather, design and other extenuating circumstances. Penalties will be imposed if they are warranted, but at the same time, they must be calibrated reasonably to ensure fairness and accountability. Such a regulator-regulatee relationship engenders both respect and trust, and is critical in our journey towards higher rail reliability.

Beyond the Flooding Incident

28. Looking beyond the North-South Line flooding incident, we remain focused on our larger mission to raise train reliability and to meet the high standards demanded by our commuters. This is a multi-year effort, involving many critical elements, including replacing ageing assets, investing in engineering skills and manpower, as well as exploiting technology for more effective maintenance.

29. In the past two years, we have strengthened scheduled maintenance based on the criticality, usage and age of the systems. We have also begun to go beyond preventive maintenance to predictive maintenance. Working with LTA, the rail operators are using real-time condition monitoring and data analytics to track maintenance logs, detect and rectify potential faults before they occur. This is the next major leap in our efforts to improve rail reliability.

30. As I have told this House before, our maintenance ramp-up in the last two years is producing results. The metric for measuring train reliability is the Mean Kilometres Between Failure of more than five minutes, or MKBF. For our MRT network, it has improved significantly from 133,000 train-km in 2015 to 425,000 train-km this year. For years, it could not even reach 100,000 train-km. That is how far we have come. The improvement is real and significant and is experienced by all the 5 MRT lines, including the oldest North-South and East-West Lines.

31. But I know the commuters, especially those using the North-South Line regularly, do not feel so. The MKBF improvements are not what they felt they had experienced. And I understand why, because we do have problems with the change of the signalling system, although they were expected. But other disruptions both in the past, and now the flooding on October 7, have made commuters lose faith. Actually, the problems are being resolved one by one. Not long ago, we had people jumping from platforms, we put a stop to that with platform screens. We used to have all kinds of third rail problems, now no more because we changed it out. We had lots of sleeper related problems, now less so as we also changed it out. The signalling system has to be changed, and we have turned the corner for the North-South Line. The same is with flooding, it will not recur. As we keep going in this direction, there will be a major improvement in experience in the near future.

32. To sustain the progress we are making, asset renewal works on our oldest lines must be completed as soon as possible. In the short term, this may cause disruption to commuters such as during the implementation of re-signalling on the North-South Line. When these asset renewal works are progressively completed, and as new rail lines open, they will translate into significant improvements in the resilience of our rail network and commuter experience. Our aim to cross an MKBF of 1 million train-km by 2020 is within our grasp.

33. This is despite many challenges, a major one being the limited engineering hours available to us to do so many things each day. Rail operators, and especially SMRT, have to

perform both scheduled and corrective maintenance work, but also the implementation of numerous asset renewal works such as the re-signalling project for the North-South and East-West Lines, within the few hours every night when trains are not running. The punishing schedule takes its toll on the workers, and forces the operators to prioritise between many urgent and important tasks. So far, we have only been able to shorten train operating hours marginally, for example on some Sundays, to provide more time for the operators to do their job.

34. In September this year, I shared with this House on urgent plans to renew the six core components of the North-South and East-West Lines. These are the sleepers, third rail, signalling system, power supply, track circuits and first-generation trains. We are about halfway through this multi-year journey, with our destination in 2024.

35. Metros elsewhere have the option to close down an entire line. We do not. Closing a major rail line like the North-South and East-West Lines to expedite these renewal works would certainly help us get to our destination sooner. Until all these key ageing systems are replaced or renewed, the North-South and East-West Lines remain at risk of major disruptions, even with diligent maintenance. We will continue to minimise such a risk and strive for faster service recovery when disruptions occur. But we also need to speed up the renewal of ageing assets.

36. The limited engineering hours is a significant obstacle to achieving this. I have asked LTA to work with SMRT to see how we can squeeze out more engineering hours for the team. For the re-sleeping project, we shortened operating hours marginally on Sundays. That was a great help. Given the scale of outstanding asset replacement programmes, we will need many more extended engineering hours, perhaps even on weekdays. Line closures will of course inconvenience commuters. I seek commuters' understanding and patience should we decide to do so. I hope to get Members' support for such a programme.

Conclusion

37. In summary, the October 7 incident should not have happened. The SMRT team responsible for maintaining the Bishan storm water sump pit had neglected their duties, falsified records and failed us. SMRT management has accepted full responsibility over this sad episode.

38. We have worked hard to improve train reliability and made significant progress. I have interacted with many SMRT staff working on the signalling system, power, trains and track maintenance. They are committed to the goal and are determined to regain the trust and confidence of our commuters. I know they are just as upset as me that some of their colleagues in charge of maintaining the tunnel portal sump pits have failed us and pushed us back in this multi-year journey. I share their disappointment and also embarrassment, deeply. But we are determined to get back on our feet, back to our work, and soldier on.

39. I am confident that the new SMRT Chairman will be able to turnaround the company, and that we can catch up with the best metros in the world in terms of service reliability. The heavy-lifting has to be done by SMRT. But they will not be alone. The resources of LTA and MOT will be there to support them. Other agencies, especially PUB, DSTA, DSO and GovTech, have offered their expertise to help us in this journey. I am grateful for their assistance. This gives me confidence that we can complete this job of raising train reliability. I have not changed my target of achieving an MKBF of 1 million train-km by 2020. We just have to lean in, redouble our efforts and work smarter.

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