

“Moving People, Enhancing Lives: SMRT’s Transformation Journey”

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Ladies and Gentlemen,

1. Good morning. Thank you for inviting me to the Congress and for the opportunity to share SMRT’s journey toward rail excellence and in enhancing the commuting experience in Singapore.

SINGAPORE AND SMRT THROUGH THE YEARS

2. At 700 square km, Singapore is slightly smaller than New York City and 2/3 the size of Hong Kong. We have a density of about 7,500 persons living in every square km. Given limited land space and a burgeoning population, work on a Mass Rapid Transit system commenced in 1983.
3. The proposed North-South and East-West Lines were Singapore’s largest infrastructure project then at S\$5 billion. It was extensive debate then whether the project would be viable, given its relatively high cost compared with an all-bus system. Today, the rail network has become an integral part and a symbol of the modern metropolis that is Singapore. Three more lines have since been added: The North-east Line, Circle Line and Downtown Line.
4. By 2030, Singapore intends to double the rail network to 360 km, with 5 more lines added at an estimated cost of S\$60 billion. The target is for 8 in 10 households to be within a 10-minute walk of an MRT station. 200 km of additional sheltered walkways will be built linking to MRT stations and transport interchanges to provide some relief in Singapore’s hot and humid tropical climate. It is envisioned that 85% of all public transport journeys in the country will be completed within an hour, with 75% of all peak hour journeys made on public transport.

5. While the strategic considerations in the early years were about our ability to deliver a large public infrastructure project in a cost-effective and timely manner, today's considerations are more multi-faceted and complex, centered on answering to the needs for greater passenger convenience and mobility. It is in this context that I would like to outline the priorities and challenges faced: (a) renewing the ageing system to meet the increasing demands of a growing population; (b) harnessing technology in operations and maintenance; and (c) shifting from system efficiency to commuter centricity.

RENEWING AN AGEING SYSTEM TO MEET THE INCREASING DEMANDS OF A GROWING POPULATION

6. Multi-year, multi-program renewal works across the network. With population increasing by nearly 20 % over the past 10 years, the rise in ridership has added strain to our ageing infrastructure, both physically and electrically. We are currently mid-way through a massive renewal program on our track, power and signalling systems on about 100 km of track, all within 3 and a half hours of engineering hours at the end of passenger service. It is a phenomenal effort on a live system; and a doctor friend of mine remarked to me that it is like we are doing an open heart surgery on a patient while he is awake, and complaining about the pain. Key projects include:
- a. Sleeper replacement works. Nearly 200,000 timber sleepers are being replaced with concrete ones.
 - b. Signalling system replacement. The signalling system is being changed to a moving block system to accommodate the growing number of trains, and to reduce the peak headway from 120s to 100s.

- c. Third rail replacement. Our ageing third rail system is also being replaced to reduce power-related faults and resultant delays. We are also expanding the power supply from the grid to accommodate the expanded network.

HARNESSING TECHNOLOGY IN OPERATIONS AND MAINTENANCE

- 7. Condition Monitoring. As we renew the network, we are taking advantage of advanced technologies for condition monitoring in order for better predictive maintenance. We also want to design the system to be resilient to failure, and operate it to be quick to recovery. Using sensors and sense-making technologies for condition monitoring has already helped greatly. One example is the deployment of advanced sensors to collect real-time data as trains run daily during commuter service hours. Detection of defective wheels is done through installation of Wheel Impact Load Detection (WILD) system on tracks to measure the vibration of pass-by trains. Misalignment of power distribution system on our tracks and current collection device on our trains is detected through a Linear Variable Distance Transducer (LVDT), and these provide real time information on defects through wireless data transmission. We're studying the feasibility of an Asset Information Management System with predictive capabilities to highlight assets due for replacement in a timely manner.
- 8. Energy saving for cost efficiency. We are upgrading the propulsion systems of our train fleet with Permanent Magnet Synchronous Motors (PMSM). This has proven to cut power consumption by 30%, reduce operating noise levels and improve operating efficiency. This year we are installing solar panels in our trains depot to power it up for all our utility needs.
- 9. Big data analytics for transport planning. Public transport is a key area of focus for Singapore's Smart Nation push. With risk based diagnostics and big data analysis, we can improve the fidelity and value of contingency and routine planning. City planners and transport operators can potentially shift

transport assets to meet real-time needs arising from local surges in commuter demand or a transport disruption. At the micro level, we are also using live video feed analytics to allow commuters to visualise station platform crowdedness or even train car loading from their own handheld devices. Better informed commuters can then make more coordinated, and 'smarter' use of transport networks, with their individual decisions aggregating into greater overall system efficiency.

10. Leveraging on IT to improve operational performance. We recently implemented an Advanced Train Operations Management System, or ATOMS, to enhance operational efficiency. Customised applications are installed in handheld tablets of Train Drivers to enhance information dissemination and reporting.
11. Maintenance Operations Control Centre. To improve rail reliability, SMRT established a Maintenance Operations Control Centre last year. The MOC plays an integral role in real-time maintenance activation and response as it brings maintenance teams from various engineering disciplines under one roof to provide quick and responsive recovery to faults and incidents on trains, railway tracks and in stations.
12. Monitoring system health and predicting failure. SMRT is only the second company in Asia to be certified last year with Level 3 ISO 55001 for asset management. We are moving the maintenance regime from one that relies on fixed OEM-recommended maintenance intervals to one that includes identification, analysis and mitigation of asset failure risks, and where the maintenance work intervals are regularly reviewed based on asset conditions. Such a risk-based predictive maintenance approach will lead to better resource optimisation, reliability and commuter experience.

EVOLVING FROM SYSTEM EFFICIENCY TO COMMUTER-CENTRICITY

13. The need for system efficiency has been the dominant consideration in both design and implementation of our rail lines. But quality is no longer defined by technical and operational KPIs. When we measure rail network performance, we traditionally do so in terms of numbers and statistics, but these mean little to the passenger. They are much less interested in benchmarks and data than in the substantive quality of their travel experience - measured specifically at the time and place that they use the system. Their perspective, not unexpectedly, is shaped more by how far it is to walk to the nearest station, how long the wait time for the next train is, how crowded the trains are, and whether train arrivals are as scheduled.
14. So although we have 180 km of rail network and 140 stations in Singapore, this is an irrelevant statistic for that resident who has to walk 2 km to find the nearest node. Despite a cumulative train distance travelled of nearly twice around the equator each day, this fact is of no significance to that passenger who was late for a job interview because he was on that particular train service that happened to be delayed by more than 5 minutes. Although our average train service availability is more than 99.8%, this is of little comfort when the passenger has to put up with the rush hour crunch on congested trains.
15. Improving rail network performance therefore goes beyond the rationality of operational and maintenance data. While these are still key measures of performance, the issues faced are entwined in the socio-economic well-being of the country, and form part of a national conversation about public transport as a reliable essential service, an affordable public good and a vital ingredient in the city's quest for livability and sustainability.
16. So the focus is very much on the commuter, and much effort has gone into innovations that enhance their traveling experience:

- a. Enhancing commuter touch-points. Station and network designs are now being fundamentally reworked in their architectural design and commuter flow, from what was originally planned 30 years ago. Indeed, demographics and travel patterns would have changed. Much has been done to improve accessibility as a priority. Recognising that commuter safety and security are essential, we demarcated “Care Zones” on our train platforms for passengers with special needs and monitor these zones through closed-circuit television cameras, with emergency telephones also placed nearby. We are revamping in-train display screens to show upcoming station layouts so that commuters can move to desired platform exits more quickly.
- b. Improving passenger information services. To give commuters more real time information on services and delays, so that they can make their own decisions, we rolled out a “traffic light system” to denote station crowdedness, and implemented a system to indicate the current status of revenue service on each of our lines, in addition to Twitter and Facebook to disseminate real-time network information.
- c. Bridging commuter and consumer needs. In enhancing the overall commuting experience, we are developing ideas on the fusion of commuters and consumers seamlessly in a single journey. One can envision a digital engagement ecosystem that brings together travel information, e-commerce, lifestyle services and entertainment which will transform the way consumers travel, shop and live.

CONCLUSION

- 17. These are among the many initiatives that SMRT has embarked on in our efforts to transform – not just in ensuring the sustainability and longevity of the rail network, but also in driving toward rail operational excellence through the better use of advanced technologies, and up-emphasising the needs and quality of experience of the commuter. Thank you.