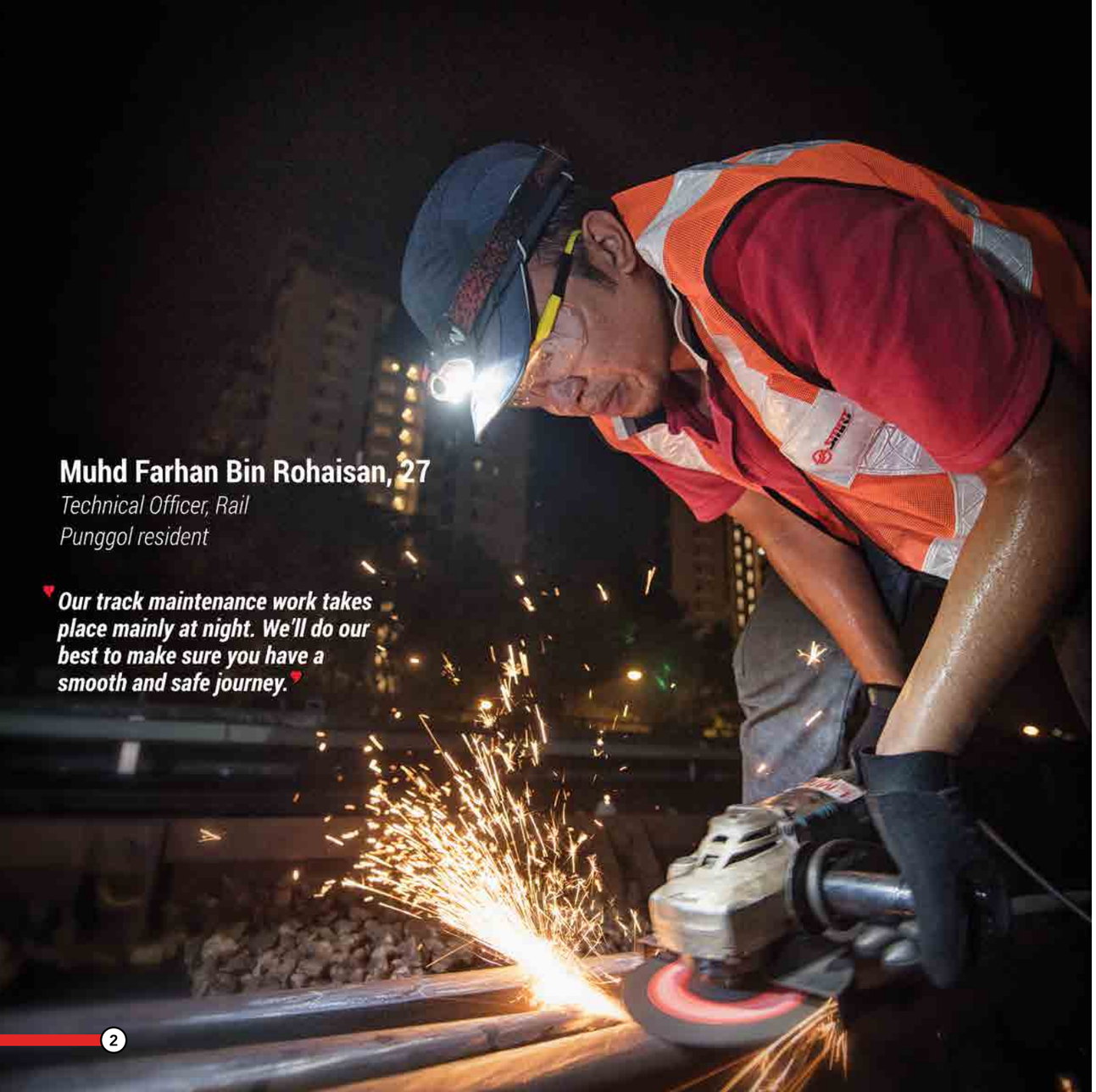
YOUR JOURNEY MATTERS

EDITION 1: OCTOBER 2015

A primer on SMRT's ongoing effort to renew and improve the North-South and East-West Lines



Muhd Farhan Bin Rohaisan, 27
Technical Officer, Rail
Punggol resident

"Our track maintenance work takes place mainly at night. We'll do our best to make sure you have a smooth and safe journey."

INTRODUCTION

A tremendous amount of work is being put into renewing and upgrading the North-South and East-West Lines (NSEWL), Singapore's oldest, longest and most heavily utilised MRT lines. The work takes place every day even as the rail network continues to serve passengers for around 20 hours a day and as the system copes with increased ridership.

The transformation of the NSEWL is a complex engineering project. It represents the first major upgrade for the lines since they started operations in 1987. Indeed, the renewal of the NSEWL is said to be the biggest modernisation project on a "live" MRT system anywhere in the world.

This modernisation effort will lead to an updated and renewed railway system that will allow SMRT to run more trains, carry more passengers and serve our passengers better with faster connections across the MRT network. The multi-year, multi-project effort takes place seven days a week, all-year round. Much of the work takes place away from the public eye in train depots, deep underground in train tunnels or during the early hours of the morning when trains stop running. Progress is made every day to modernise the NSEWL to serve you better.

With just three hours every night for engineering staff to access the track when trains are not running, it is vital for SMRT to prioritise and allocate the engineering hours and resources properly across different projects. Our engineers and contractors maximise the time spent on the track so that attention can be given to the more urgent maintenance and repair tasks as well as to the upgrade and renewal projects.

AT PRESENT, OUR ATTENTION IS FOCUSED ON KEY ENGINEERING PROJECTS SUCH AS:

Re-sleepering NSL
100%

Re-sleepering EWL
10%

Re-signalling NSL
91%

Re-signalling EWL
44%

3rd Rail Replacement EWL
10%

3rd Rail Replacement NSL
0%

Adding New Trains
13%

70% More Engineers since 2012

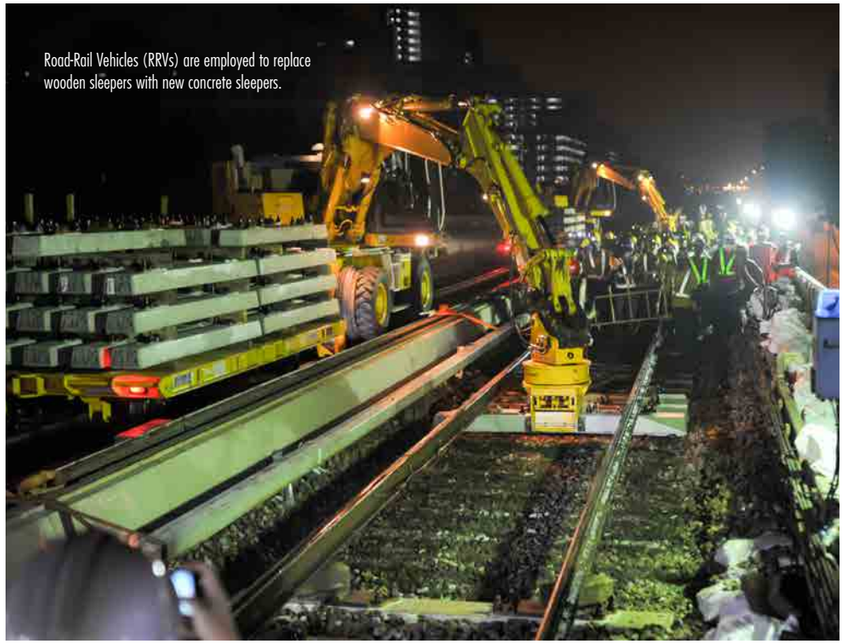
23% More Technicians since 2012

*NSL: North-South Line, EWL: East-West Line

IMPROVING THE NORTH-SOUTH AND EAST-WEST LINES

SMRT is making good progress in its multi-year, multi-project efforts to renew the NSEWL. This marks the biggest transformation of the Lines since they were built in the 1980s. Here's a snapshot of the work-in-progress.

SLEEPER REPLACEMENT
Working closely with the Land Transport Authority (LTA) and rail contractors, the SMRT team achieved a major milestone when we finished replacing wooden sleepers on the North-South Line (NSL) with concrete sleepers in April 2015.



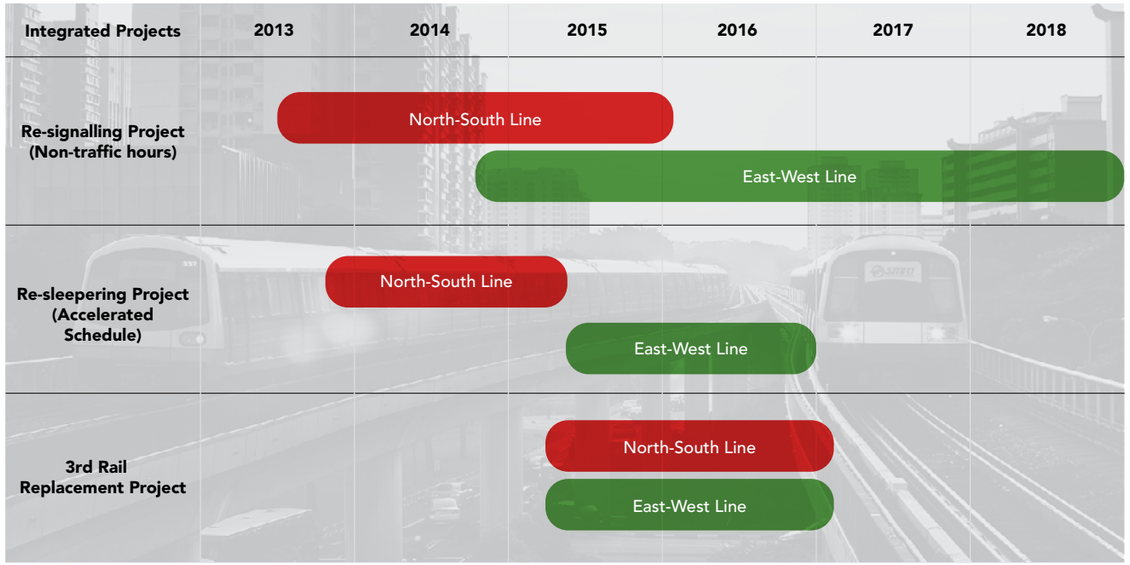
Road-Rail Vehicles (RRVs) are employed to replace wooden sleepers with new concrete sleepers.

The NSEWL were built with wooden sleepers. These sleepers support the rails on which our trains run. Some 188,000 sleepers are nearing the end of their 25-year lifespan. Exposure to the sun and rain over the years, vibration from moving trains and the weight each sleeper has to bear when a train passes over it add to the wear and tear.

By renewing wooden sleepers with concrete sleepers that have a 50-year lifespan, journeys on the NSEWL will be safer and smoother for decades to come. Positive results from the sleeper replacement are already felt on the NSL.

With speed restrictions lifted along major portions of the NSL, passengers arrive at their destination faster. Journey times on the NSL have been reduced by around 10 per cent after the speed restrictions were fully lifted in May 2015.

Wooden sleepers along the East-West Line (EWL) are now being replaced nightly. Steady progress is being made thanks to the experience gained by our engineers while carrying out the NSL sleeper replacement project. When the work is completed by the end of 2016, passengers travelling from Pasir Ris to Joo Koon on the EWL will also experience better train rides.



RE-SIGNALLING

The project is progressing well with 91% of the NSL completed and 44% of the EWL re-signalling work done. We have already started trials to test the new signalling system on the NSL. Re-signalling is expected to be completed on the NSL in 2016 and on the EWL in 2018.

The new signalling system will substantially improve the capacity of the NSEWL to run trains at shorter intervals. This would mean a shorter wait for trains, which would ease congestion at station platforms during peak periods. This capability will be maximised as the train fleet is progressively enlarged by end 2016 to allow more trains to be deployed on the NSEWL. This underlines the importance of coordinating the multi-year, multi-project effort in rail renewal so that the combined benefits of these projects will give you a better journey on the rejuvenated NSEWL.

Under the re-signalling project, the new signalling system supplied by Thales will see one of the most advanced train signalling systems in the world installed on the NSEWL. The current signalling system, which dates back to the 1980s, keeps trains a safe distance from one another by dividing the rail network into fixed segments of track length called blocks, with only one train allowed into each block at any time. These blocks measure between 800m to 1,000m in length. This Fixed Block system protects passengers in one train from other trains operating along the same line.


Maintenance Operations Centre at Bishan Depot

The new signalling system uses advanced communications technology installed on trains to constantly update the traffic management system on the identity, location and speed of every train. The new system, which is more precise than the system it replaces, will lead to better use of the rail network because the footprint for each train, which includes the length of the train and the safety distance in front and behind the train, will be much smaller. This Moving Block system can be imagined as a safety bubble that moves with and protects the train, and will automatically slow down the train when it approaches a train ahead. The safety distance is around 50m, which is a third of the safety distance required using the older system.

This shorter distance will allow us to deploy more trains at shorter intervals on the rail network while maximising safety for passengers. When fully operational, the new system will allow trains to be spaced 100 seconds apart, which is an improvement from the 120 seconds between trains under the current system. The new signalling system is also designed with more redundancies, which makes it more reliable because signal faults are less likely to occur.

THIRD RAIL REPLACEMENT

SMRT passenger trains are powered by electricity supplied by a powered steel rail. This rail is called the Third Rail because it is fixed next to and slightly above the two running rails on which the train wheels travel.

The Third Rail replacement project now being carried out on the NSEWL marks the first network-wide replacement for the 200km-long Lines since SMRT operations began in 1987. The trains draw electricity from the powered rails through Current Collector Devices (CCD) that make

contact with the rail and transfer electricity to the train's electrical system to power machinery such as the train's motor, air-conditioning and lights. Each six-car MRT train has 24 CCD shoes that are in constant contact with the Third Rail when in motion and even when it makes a stop at MRT stations.

Over the years, this constant contact adds to wear and tear of the Third Rail and the brackets that are used to support the weight of this steel rail. If the Third Rail sags due to worn out supports, power faults could occur. The Third Rail replacement project is timely as it will increase the reliability of the electrical system. The work involves turning off the power, unbolting the old Third Rails, replacing them with new ones and re-connecting the rails to the electricity network. We are making steady progress and expect to complete the work in early 2017.

A Siemens C651 train (left) flanked by a Kawasaki Heavy Industries & CSR Qingdao Sifang C151A train in a train maintenance bay. The Siemens C651 trains are the only NSEWL train type painted in a white paint scheme with a red stripe.

UPGRADING OLDER TRAINS

The C151 Kawasaki Heavy Industries (KHI) train entered service in 1987 while the C651 Siemens was introduced in 1994. Although introduced seven years later, SMRT is upgrading the 19 C651 Siemens trains first, as they have logged a higher number of train faults compared to the other train models. SMRT and Singapore Rail Engineering are finalising the proposed improvements for the train design and will proceed with upgrading work and testing of a prototype train in 2016.

When completed in 2018, the upgraded C651 Siemens trains will have new or refurbished train sub-systems such as air conditioning, electric doors, brakes and propulsion systems. These have been the primary causes of delays due to train faults. Upgraded trains will also have sensors that furnish the Train Captain and engineering staff with the train's state of health, thus making it easier to operate and maintain the train. The upgrade will include a makeover that gives our passengers a new-look cabin.

The next series of trains due for an upgrade are the C151 KHI trains. We plan to equip these 66 trains with the same advanced equipment as the soon-to-be upgraded C651 Siemens trains to achieve greater commonality for more efficient fleet management. The new lease of life from these upgrades will result in rejuvenated trains that will serve our passengers with much improved levels of reliability and ride comfort.

A C151B train in the new paint scheme for SMRT trains.

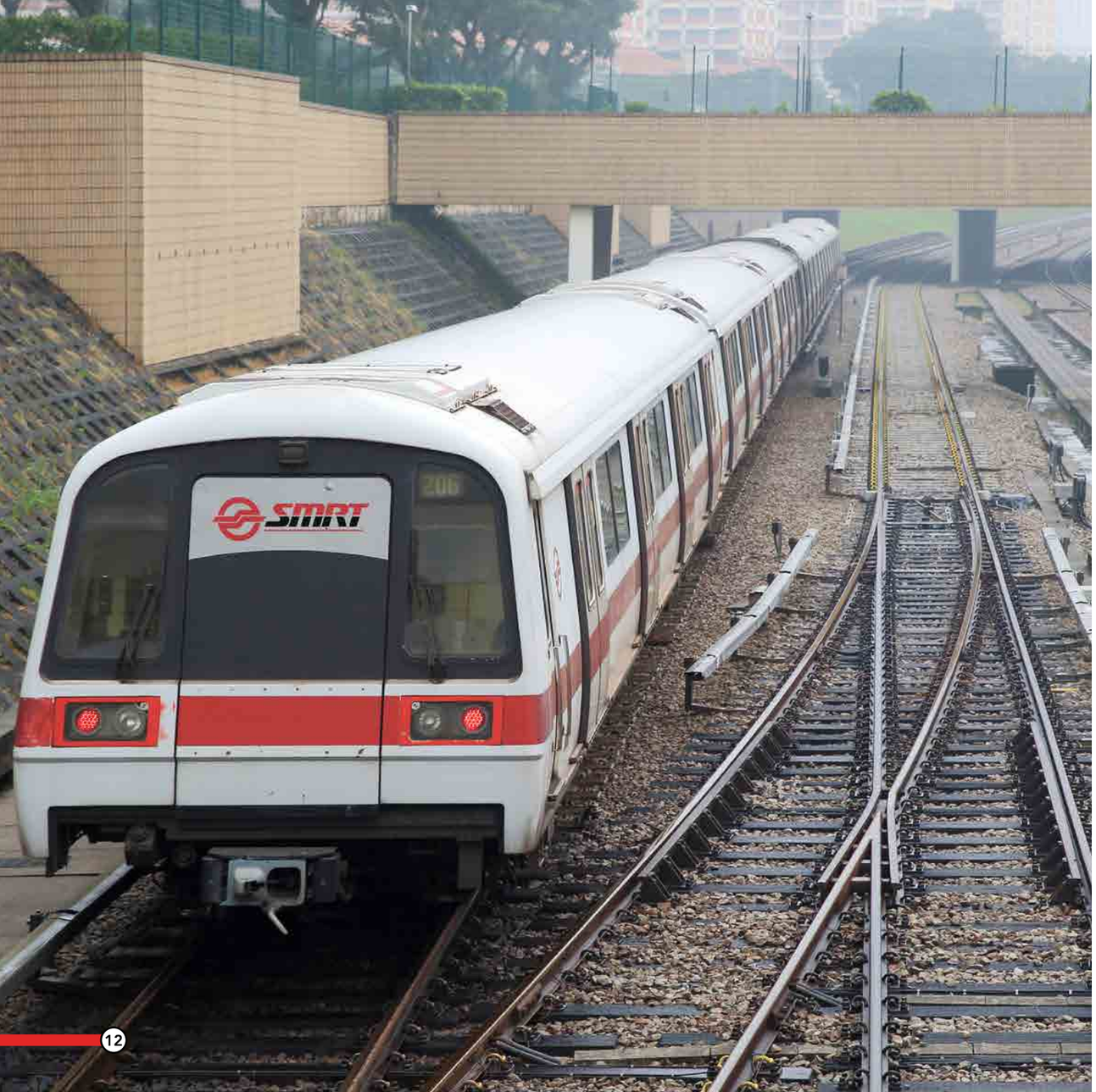
NEW TRAINS INCREASE PASSENGER CAPACITY
Six new C151B trains, part of a fleet of 45 new trains for the NSEWL, have been delivered to Bishan and Tuas Depots where the trains are being fitted out and will be tested extensively. These trains, designed to operate with the new signalling system, will allow more trains to be run on the NSEWL.

Before a new train enters operational service, SMRT's engineering staff will work closely with LTA and the train manufacturer to get the new train ready. It takes about a year to do this. The work involves testing the air-conditioning, automatic doors and sensors, propulsion and brakes, and communication equipment as well as interior fittings like seats, poles and handles. Every item will be rigorously tested before it is certified safe for passenger service.

More new trains are on their way to Singapore and more than half of the 45 trains will be delivered by the middle of 2016.

"Safety, reliability and service excellence are key in our ongoing efforts to improve the system and overall travel experience for our commuters. We have made good progress and are encouraged by the support and understanding of our commuters. We recognise too that clearly there is more to be done, and as quickly as possible. SMRT affirms its continued commitment to serve the needs of our commuters. We are focusing relentlessly on building our engineering and technical capability, strengthening our maintenance and service recovery, as well as upholding the morale and competency of our people."

— Mr Desmond Kuek,
SMRT President and
Group Chief Executive Officer



STRENGTHENING MAINTENANCE SYSTEMS, PROCESSES AND CULTURE

We want to sustain higher levels of reliability, safety, convenience and comfort for our passengers and we will do this by strengthening the way we maintain our rail network and train fleet.

To keep the rail network running safely for 20 hours a day, every day, even as the NSEWL serves increasing ridership, calls for a high standard of engineering excellence. We have a comprehensive, structured maintenance programme to look after the rail network. Our engineering staff step up maintenance checks as railway components reach their end of life. Safety is paramount and we will update maintenance schedules regularly to factor in ageing components that may need to be checked more often and more intensively.

We have introduced more devices to monitor the condition of rail assets and infrastructure. These include fitting trains with cameras for early detection of track faults, placing devices on tracks to check the condition of train wheels as well as installing devices across the network to measure the health of the power supply system. More specialised condition monitoring devices, such as lasers that check track alignment, will be introduced to supervise critical components in the NSEWL.

Our efforts to institute a lifecycle asset management system have been recognised. SMRT is the second metro in Asia to achieve the ISO 55001 standard. It demonstrates to both regulators and other stakeholders that assets are being appropriately maintained whilst short, medium and long term issues and risks are being properly identified and addressed. In addition, independent certification provides evidence of compliance to safety critical systems and procedures. It shows, most importantly, that SMRT is on the right track to achieving better rail reliability.

Another significant step forward is in setting up a new Maintenance Operations Centre (MOC), the first of its kind in the region. Opened in August 2015, it will allow SMRT to better coordinate and provide stronger support to maintenance teams as they respond to rail incidents. The MOC allows rail engineering experts to guide staff attending to faults on our network with more precise technical advice, leading to faster recovery. When fully operational, the MOC will provide a 24/7 health status of each train and of all critical components across the rail network.

REINFORCING OUR ENGINEERING WORKFORCE

To strengthen our repair and maintenance capability, we have substantially reinforced our engineering workforce. Over the last 3 years, SMRT grew the number of Rail Maintenance staff by nearly a quarter (23%). For executive rail engineers alone, the numbers grew by 70%. By 2018, SMRT aims to have more than 400 engineers (a 127% increase from 2011) and more than 2,600 technicians (a 50% jump from 2011). This will complement the enlarged train fleet and will keep the renewed NSEWL network in good working order.

The SMRT Trains Engineering Programme (STEP) and enhanced Career Roadmap was introduced in May 2015 to help us better recruit, retain as well as professionalise our engineering staff. STEP will see our Engineers attain a professional rail engineering chartership awarded by the Institute of Engineers Singapore. The Roadmap underscores SMRT's commitment to develop staff

throughout their careers to their fullest potential to better serve passengers and to cater to growth in the rail industry.

PROVIDING OUTSTANDING CUSTOMER SERVICE

More than two million passenger trips are made on the SMRT rail network every day. Every journey is important to us. As hardware is improved, our commitment to providing quality heartware is no less important.

All NSEWL MRT stations are manned during service hours. Passengers at all our NSEWL stations will find staff close at hand to help from the first train till the last. There are many examples of how SMRT staff have gone the extra mile to help passengers in need. Our station staff receive many notes of thanks for extending a helping hand to passengers who have lost their way along our network or needed help finding lost items.

We constantly improve customer service touch points in our network to better serve our passengers. Since 2014, we have launched programmes such as these to enhance customer service: Care Stickers to identify passengers who would appreciate a seat, Priority Queues at elevators for passengers with needs and Charging Points for passengers requiring a quick charge of their mobile devices. We have received very good feedback for all these programmes.

We continue to expand these initiatives with Escalator Safety announcements, Care Zones which allow station staff to keep an eye on and respond quickly to passengers who need help, and SNAP-REP (Snap and Report) which allows passengers to give quick comments and share pictures via WhatsApp. We value the feedback by our commuters in improving the service quality and travel experience.

"We are confident that when the North-South and East-West Lines are successfully renewed and the range of enhanced maintenance measures are fully implemented, commuters can look forward to a rail network with far better reliability. The task ahead is for SMRT to continue building trust by delivering continual improvements as part of this multi-year reliability enhancement programme."

— Mr Lee Ling Wee,
Managing Director, SMRT Trains

Hong Yoke Kee, 46
Assistant Station Manager, Rail Operations
Mother of two, Serangoon resident

"While it gets crowded at times, I take great joy in meeting our passengers and helping them find their way to their destination."

CONCLUSION

YOUR JOURNEY MATTERS

Our multi-year, multi-project effort to renew and improve the North-South and East-West Lines represents the biggest transformation for Singapore's oldest rail line.

With trains serving passengers for some 20 hours a day, the engineering staff must make the best use of the remaining hours for essential maintenance work as well as projects that will renew the ageing network, which is now in its 28th year of service.

We are careful not to rush these important projects as mistakes can have grave consequences. At the same time, we need to keep the current system going and serve more passengers even as these renewal efforts are taking place. The transformation is making steady progress. Soon, passengers will be able to enjoy smoother, safer rides and faster journeys on a modernised rail network with higher levels of reliability and increased capacity.

We have already achieved much but there is much more that needs to be done.

Meanwhile, please be patient and give us your support, as our team concentrates fully and works diligently and carefully to deliver a rejuvenated NSEWL that Singaporeans will be proud of.

SUMMARY

OF OUR ACHIEVEMENTS RENEWING THE NSEWL TO SERVE YOU BETTER

WE HAVE SUCCESSFULLY REPLACED ALL 96,000 WOODEN SLEEPERS ON THE NORTH-SOUTH LINE

Passengers on the North-South Line enjoy a smoother and safer journey with old wooden sleepers replaced with longer lasting concrete ones. We are now working to replace 92,000 wooden sleepers on the East-West. We are on track to finish this by end 2016.

ON TRACK TO UPSIZE THE NSEWL TRAIN FLEET

The NSEWL train fleet has never been bigger. More than half of the 45 new C151B trains for the NSEWL will be delivered by the middle of 2016. Six have already arrived and will start serving passengers next year.

WE'VE STARTED A BLOG TO KEEP YOU UPDATED

With behind-the-scenes stories and exclusive updates, the SMRT Blog (which we started in March 2015) keeps you informed and updated on progress of the NSEWL modernisation.

RE-SIGNALLING MAKES GOOD PROGRESS

The decades-old signalling system is being replaced by a state-of-the-art train signalling system – one of the most advanced in the world. The re-signalling work on trains, tracks and stations is making good progress with 91% of the North-South Line complete and 44% of East-West Line re-signalling work done. When completed, this project will allow trains to travel closer to one another, which means you will have a shorter time waiting for trains at MRT stations. More frequent train arrivals also reduce congestion. As trains can travel closer to one another, the benefits from the new signalling system will be realised when SMRT's Rail Operations planners have a sufficiently large fleet of trains for daily deployment.

TWITTER FEEDS PROVIDE REAL-TIME TRAVEL UPDATES AND ADVICE

SMRT's Twitter feed is one of the top actives among Twitter users in Singapore. Real-time travel updates via Twitter give travel advice and situation updates during disruptions that take longer to resolve. SMRT Facebook has also been steadily growing its subscriber base.

DRIVING TOWARDS MORE TRAINS PROFESSIONALS

We have doubled the number of engineers since December 2011 and aim to increase this to 400 engineers in March 2018. We are also hiring more technicians and expect to have 2,600 technicians in March 2018. This represents the largest engineering workforce in SMRT's history. The bigger number of trains professionals will be tasked with maintaining SMRT's train network to serve passengers better by keeping reliability, availability and maintainability high.

WE ARE AMONG THE SAFEST METROS IN THE WORLD

As we strive to renew the NSEWL, SMRT ranks among the safest metros in the world. We maintained a zero incident rate for rail service collision and derailment. The passenger injury rate in FY2015 was at an all-time low of 0.004 per million, which compares favourably to the safety threshold of 0.4 per million set by the regulator.

DID YOU KNOW?

Every day, SMRT trains cover a total distance equivalent to 1.5 times round the Equator and carry more than **2 million passengers.**

TRACKING IMPROVEMENTS

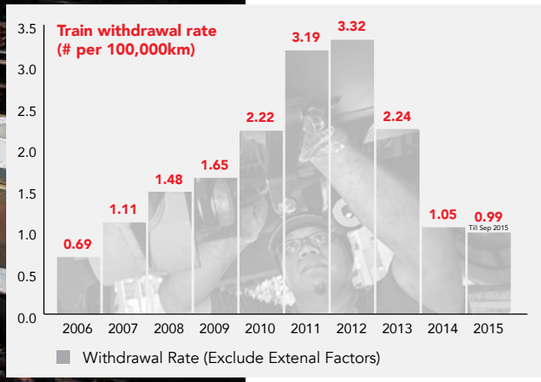
Much progress has been made over the past three years, thanks to significant and sustained efforts to improve train service reliability to serve our commuters better.

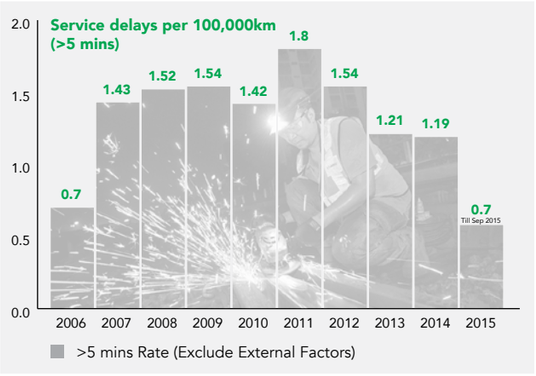
Improvements can be seen from charts showing key performance indicators like NSEWL train withdrawals and delays of more than five minutes.

Our engineering staff achieved these improvements through a number of reliability improvement and modifications on our trains. These include upgrading the propulsion software on KNS trains, the replacement of power supply units on KHI trains and improvements to the signalling system to reduce power and signalling faults.

Efforts to refurbish ageing components on older trains are now underway. SMRT also plans to conduct a mid-life upgrade on its fleet of Siemens trains, which have logged a higher number of train faults compared to other train models.

More can certainly be done. The rise in service disruptions of more than 30 minutes since 2012 is closely monitored. We will bring down this figure as we strive towards higher rail reliability.





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