

DRIVERLESS MASS RAPID SYSTEM

A GEM *that* PRIZES SAFETY



above:

Interior design of the NEL train cabins

left:

L-R: Lee Beng Hooi, Tan Lye Seng, Tan Yong Peow, Kok Yen Hui, Hong Kim Hong and Fang Han Xin

Engineers are our unsung heroes who make intricate calculations to solve complex problems that impact our daily lives. They build bridges, roads, skyscrapers, airplanes, ships and almost everything else – with safety as their top priority. Nothing gets past them if, in their analysis and estimation, it poses a risk to lives.

The North East MRT line opened in June 2003, more than two years after it was completed and six years after construction began. It was the world's first heavy-rail rapid transit line to be fully automated and engineers had to ensure that it would be trouble free when it started transporting commuters.

In a tight labour environment where automation was the future, the North East line was earmarked to show the way as the first driverless train in Singapore. The entire system comprised state-of-the-art technology, from the main control room to the trains, tracks, tunnels and all the stations on the line.

Octopus in the system

“You only have to take a look at the Integrated Supervisory Control System of the North East Line, dubbed ‘the octopus’,” says Hong Kim Hong, principal project manager of communications at Land Transport Authority. “It is at the Operations Control Centre and connected to all equipment and in real-time.”

The ISCS is wired to, among others, the signalling, communications, fire-detection and environmental control, and integrates them onto a common platform to monitor and manage them.

“In the past, these functioned independently,” says Tay Yeow Hiong, assistant vice-president of power and electrical services at SBS Transit, operators of the line. “But this proved to be challenging at times as a smooth running of the railway line requires input from all of these things. With the migration to an integrated system that can be accessed by a central command, all operations become seamless.”

The North East Line was setting new benchmarks, and engineers from LTA and SBS Transit, as well as their vendors, the Building And Construction Authority and Urban Redevelopment Authority teamed up for this complex project.

“We discussed extensively on every detail till we reached a consensus,” recalls Kim Hong, who was senior project engineer of communications system at the time. “As this was going to be the first automated mass rapid transit system in the world, we had to be bold in trying new things and eschewing the tendency to stick to existing processes or technologies. So we had plenty of lively discussions.”

A bold signal

Despite the many challenges, the senior management was firm on adopting new ideas and technologies for this project. “That’s the key to its success,” says Kim Hong.

But anticipating possible issues that a driverless train would face was more challenging for engineers, says Kok Yen

“The NEL’s signalling structure is the backbone of the driverless system and at the time was unique among all the MRT lines.”



Hui, LTA’s deputy director of signalling, communications and platform screen doors. “Getting the train to move automatically was not the difficult part. The challenge was in creating troubleshooting processes for different situations.”

Without drivers to control the trains, the signalling system had to feed essential information to all parties including control, the communications, power and rolling stock.

“The NEL’s signalling structure is the backbone of the driverless system and at the time was unique among all the MRT lines,” Yen Hui, who was the project manager for signalling, points out. “It packs a slew of innovative engineering features such as safe headway, accurate arrival time and an automated wake-up call where trains conduct a health check on the systems they are equipped with.”

The intricate project took a relatively long time to complete because the design of some components required changes when they were about to be implemented.

“Changes had to be made and because the project involved so many ‘firsts’, we didn’t have any reference point or case studies to tap on,” explains Yeow Hiong, the project’s works coordinator and senior depot supervisor for rolling stock at the time. “We had to keep up with technology, especially on something like the North East Line, which masses of people would be using. New technology adds 10 to 20 years to the system’s lifespan.”

Other engineering innovations on the North East line include the IAGO, a wave-guide radio communication system that allows trains to receive uninterrupted information from the OCC. The system allows engineers to track the trains at all times and control their speeds – unlike in the past where this was fixed based on each segment on the route.

Staying the course

Yen Hui says she did not feel strained or frustrated during the two years of testing of the North East Line prior to its launch. The intrepid engineer confronted difficult problems head on, determined to find solutions because, she says, this is in the profession’s DNA.

More importantly, despite the delay in rolling out the service, she has peace of mind that the system is safe and robust for the many commuters riding on the North East line daily.

“We work 12 to 14 hours a day, we get our hands dirty, and the environment is generally uncomfortable – no air-conditioning, no plush office chairs,” says Yen Hui, who has been an engineer for more than two decades. “But without engineers, nothing gets moving. We help to change people’s lives.”

Yeow Hiong, who was a fresh graduate when she worked on the North East Line project, says more credit should be given to engineers for the work they do. “Most tend to think of us in terms of fixing broken things and not in developing things for people to use and enjoy. For the North East Line, a lot of effort was put into troubleshooting the operation of the new driverless system, with many rounds of checks to ensure that the new technologies used were functioning as they were supposed to.”

“Being an engineer has trained us to analyse, pay attention to details and solve problems to implement the cutting-edge technologies for the North East Line and move the project to its operational stage,” says Yeow Hiong. “It’s the impact engineers have on everyday lives that I find most fulfilling. I helped develop something that everyone gets to enjoy. That knowledge alone gives me immense satisfaction.”



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Driverless trains can follow more closely to the planned schedule compared to human operated ones

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