

CONNECT

NOVEMBER 2018

A PUBLICATION BY THE LAND TRANSPORT AUTHORITY

WHERE **TRANSPORT, TECH**
AND TOMORROW MEET



**GROUND
FREEZING
MOMENTS**

**SMART
MOVES**
WALKING AND CYCLING
WITH EASE



THE MANY
FACES OF
OUR
TRAINS

#THANKYOU PTWORKERS

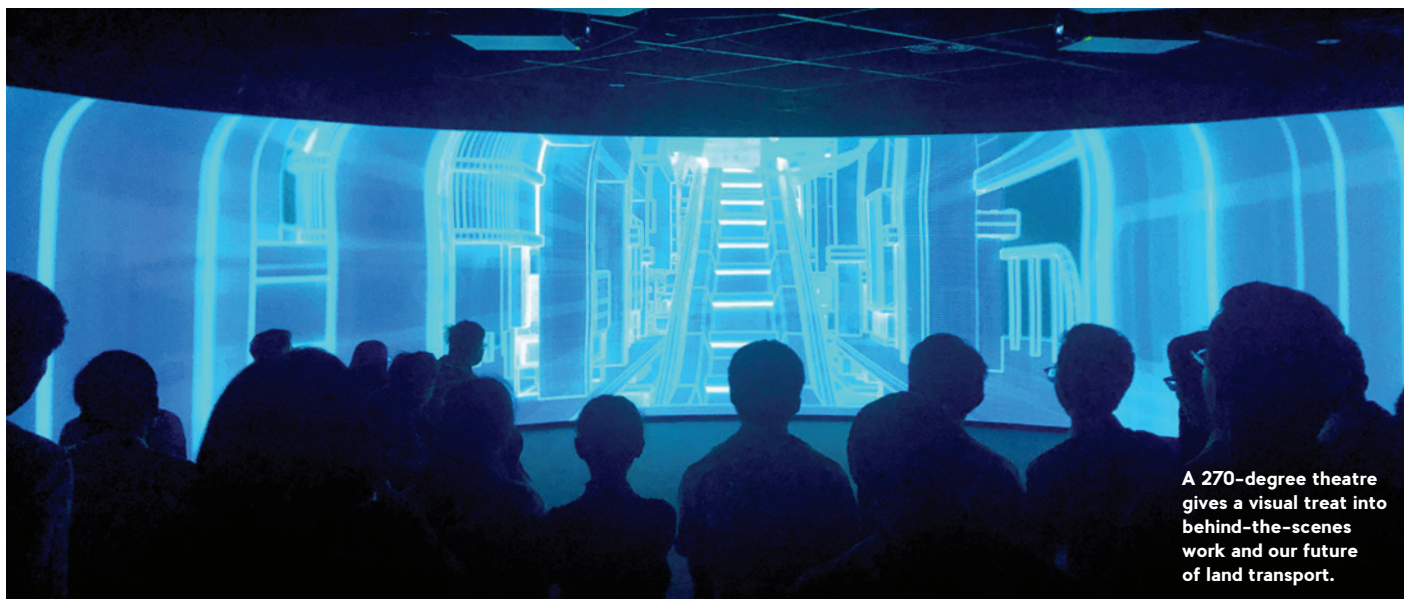
READ & WIN

STAND A CHANCE TO WIN PRIZES WORTH \$40!



IN THE WORKS
FEATURES THAT EXCITE YOU

WHERE TRANSPORT, TECH AND TOMORROW MEET



A 270-degree theatre gives a visual treat into behind-the-scenes work and our future of land transport.

What will public transport look like in the future? The Land Transport Authority (LTA)'s newly-opened SG Mobility Gallery gives us a glimpse of where we are headed.

If we could gaze into a crystal ball, what would transport in the future look like? Maybe we could call for a bus on demand through a mobile app. Or pass through fare gates without fishing out our travel cards. Or even fix track defects using remote technology.

Sound exciting? Well, it is! Now, you can experience scenes from the future landscape of our transport system at the SG Mobility Gallery, which was recently launched by Prime Minister Lee Hsien Loong on 19 September.



Prime Minister Lee Hsien Loong at the SG Mobility Gallery launch.

Located at the LTA office at Hampshire Road, the interactive gallery features immersive exhibits to give you a feel of what transport of the future will look like.

The seven exhibition zones will enable you to experience the many facets of our land transport system. You can find out how LTA uses technology to plan, design and build our transport system – all while ensuring it is efficient, smart and inclusive!

Check out a bus with three doors for smoother and quicker boarding, and which has wireless charging and WiFi capabilities. An MRT gantry that opens automatically using radio frequency identification (RFID) technology without the need to “tap” your fare card. See for yourself how seniors can “instruct”

traffic lights to give them more time to cross the road with a quick tap of a card.



**SINGAPORE
MOBILITY
GALLERY**



Marcus Lee (centre) with (left to right) **Chua Lin Thiam**, **Eugene Lin**, **Darius Chew** and **Chow Wai Ngai**, who are part of the core team behind the gallery design.

FUTURE FAST FORWARD

"We hope the new gallery will entice people about the future of land transport, and inspire the next generation of transport workers who are excited about LTA's use of innovation and cutting-edge technology," said Marcus Lee, who is Director of Customer Engagement and Strategy, and leads the team who designed the gallery.

"Some people think that working in land transport means only working on roads, or in tunnels. In fact, we have a wide range of experts working in LTA, from planners and designers, to architects and data scientists - all jobs in the realms of science, technology, engineering and mathematics. The new gallery also showcases our digital capabilities."

Marcus and his team had the Herculean task of translating the highly technical work that LTA engineers do into concepts that the average man on the street can relate to. For instance, Marcus and his team wanted the track repair VR game to be as realistic as possible, so close collaboration with the Rolling Stock team was required.

"We worked closely with other departments, so that we can convey the essence of what a track

repair technician actually does," he explained. "The exhibits are made to be as realistic and representative as possible."

REALISTIC, EXPERIENTIAL LEARNING

Put on virtual reality (VR) headsets and get teleported into the bus driver's seat or into a train depot as a rail technician. Immerse yourself in a game presented on large, bright digital touchscreens and put your skills to the test in the role of a city planner.



A 270-degree theatre gives a panoramic view into work that goes on behind the scenes, such as maintenance that goes on underground, and which is usually out of sight and therefore out of mind.

Parents will be happy to know that there are exhibits for children too. They can try their hand at spotting the differences between two images, such as cyclists with, and without, helmets on, to help them understand safe, appropriate behaviour on our roads and pavements.

The new SG Mobility Gallery is also designed to be self guided. "We wanted a non-linear experience, where there is no prescribed way to explore the gallery," said Marcus. "A lot of the experience is gamified, so we want visitors to be able to play and discover at their own time and pace."

If you visit with a group of friends, you can challenge each other to see who would be a better planner or a better bus captain.

You can visit the SG Mobility Gallery from Mondays to Fridays, from 9.30am to 5pm, as well as on Saturday mornings for pre-arranged community visits. Admission is free.



THE SEVEN ZONES OF DISCOVERY



ZONE 1: LAND TRANSPORT HERO ACADEMY

Say hi to the gallery's virtual host Jamie, and be introduced to the unsung heroes who play critical roles in land transport.



ZONE 2: MOVING SINGAPORE

Immerse yourself in a multiplayer game as a land transport operations centre executive and manage congestion along our roads.



ZONE 3: CONNECTED TOWNS OF TOMORROW

Test your skills as a city planner and plan our transport system amidst our land constraints and high population density.



ZONE 7: CHANGING GALLERY & KNACKSTOP SHOP

Share your aspirations, thoughts and stories about our land transport system on a pledge wall. Don't forget to bring a keepsake home from Knackstop too!



ZONE 4: FUTURE MOBILITY

See how transport and technology meet with exhibits on a future concept bus, smart lamp posts and hands-free ticketing system.



ZONE 5: FUTURE FORWARD

A 270-degree projection panorama takes you on a behind-the-scenes tour of Singapore's future land transport system.



ZONE 6: EXPERIENCE ZONE

Put on VR headsets and experience the role of our public transport workers, including a bus driver and a rail technician.

HEAR WHAT GALLERY GOERS HAVE TO SAY



Students getting hands on experience at city planning.

Lawrence Caisip, 18, Ngee Ann Polytechnic student

"I study engineering science, and maybe in the future, I can find solutions and develop new technology that would positively help our public transport."

Teoh Yu Xi, 11, Bukit Panjang Primary School student

"Sometimes, my father drives me to school in the morning. But there are days when I tell my father that I can walk instead."

Tan Guan Heng, teacher

"The young generation can learn how they can contribute to creating a car-lite environment. Doing so is a good way for them to perhaps influence their parents who drive, to also change their mindsets."

BUT WAIT, NEXT STOP, KNACKSTOP

Co-located with the SG Mobility Gallery, LTA's very own creative merchandise store – Knackstop – offers a myriad of collectibles that are inspired by Singapore's public transport. Bring home our iconic bus buzzer keychain or a Downtown Line train made from mini blocks. You can also get your hands on various stationery featuring our Thoughtful Bunch who personify gracious commuting behaviour! Net sales proceeds go towards charity to help those with transport needs, so shop good and do good today!

#DidYouKnow

The Knackstop logo colours are those of our MRT lines while the 'O' is depicted by the familiar bus stopping belt in our buses!





A simple **Hi** or **THANK YOU** goes a long way



A simple 'hello' or 'thank you' goes a long way to make anyone's day. Let's celebrate and recognise our unsung heroes who have been working tirelessly to get you from place to place, safely and reliably – every single day.

From commuter-facing bus drivers to train maintenance engineers working behind the scenes on graveyard shifts, public transport (PT) workers are at the heart of Singapore's transport system.

It takes tremendous effort and coordination from every team member to ensure that buses and trains run smoothly.

Their efforts have not gone unnoticed.

In recognition of their exemplary acts of service to the public, 445 outstanding bus and rail staff, and taxi drivers, were conferred the annual Transport Gold Award at an event graced by President Halimah Yacob at the Istana on 1 November.

APPRECIATION MOVEMENT

Earlier, Senior Parliamentary Secretary for Transport Baey Yam Keng launched the month-long campaign on 21 October.

Along with leaders from the National Transport Workers' Union (NTWU) and representatives from the Land Transport Authority (LTA), Ministry of Transport (MOT) and the transport operators, SPS Baey was at Tampines MRT Station and Bus Interchange to give out tissue packs that came with a reminder to be appreciative of public transport workers.

For commuters who are a little shy and less vocal, they can say thank you online by using the hashtag

#THANKYOUPTWORKERS



President Halimah Yacob with the 25 winners of the Outstanding Award – the highest accolade for providing exemplary service to commuters.

Public transport operators, in partnership with retail companies, have also been organising various events to "pamper" their employees – from providing free bread and coffee, to discounts on food and beverage items.

COMMUTERS SAY THANKS

Azli Bin Zainol has nothing but praise for the bus captains who have been enthusiastically assisting his wheelchair-bound mother.



AT THE SITE



Senior Parliamentary Secretary for Transport Baey Yam Keng launching the campaign with leaders and representatives from NTWU, LTA, MOT and public transport operators

"Our bus captains are very good! They always help to extend the ramps so that it will be easier for me to push my mother on board the buses," beamed Azli, who shared that some even come down to help him.

"They also never fail to make sure we are okay, and give us a bright smile."

AZLI BIN ZAINOL
BUS PASSENGER

Sometimes, it is the bus captains who take the lead in showing their appreciation to passengers.

Among them is Doreen Chan who has been touched by several bus captains who greet her as she boards. "Some of the bus captains will always greet me in the morning, saying 'Good morning' and 'Have a nice day'," she shared.

Besides the frontline public transport crew, we should also keep in mind the many others who work behind



the scenes and overnight to maintain the buses and trains.

"I would like to thank those engineers and technicians who work throughout the night to ensure that train services run smoothly the next day. It's a very tiring and thankless job because no one is there to see them," said Ong You Yuan.

So the next time you meet a public transport worker, say hello or simply smile because a little appreciation goes a long way!

Spread the love and show your appreciation publicly on your social media platforms using the **#ThankYouPTWorkers** hashtag!

Join us in appreciating our Public Transport Workers

WHAT ARE SOME OF YOUR MEMORABLE EXPERIENCES WITH OUR PUBLIC TRANSPORT WORKERS?

Share your stories on Facebook or Instagram using the #ThankYouPTWorkers hashtag! Psst! Don't forget to look out for our tribute video on LTA's YouTube and Facebook pages.



Did you know that more than 22,000 public transport workers work tirelessly and behind the scenes to make our daily commutes safe and reliable? Watch this heartwarming video that showcases these unsung heroes and ignite your sense of appreciation towards them! Scan the QR code to watch it now!



GROUND FREEZING MOMENTS



An engineering feat is taking place 40 metres under Marina Bay Station, where giant ice walls are helping engineers to safely excavate tunnels for the Thomson-East Coast Line (TEL). Find out how this cool technology works.

When LTA engineers were tasked to build not one, but two tunnels – stacked on top of each other – that go beneath two operational lines at Marina Bay station, it was a monumental construction challenge.

They had to ensure any excavation work would not impact the existing Circle Line (CCL) and North-South Line (NSL) tunnels above.

The engineers also faced difficulties in stabilising the hard and sandy soil layers deep underground using conventional cement grouting processes.

As if that was not enough, there was the threat of ground water seeping through too. With all these constraints and considerations, how were they going to excavate the tunnels?

They considered the usual tunnelling methods, but these would not work, especially since there were also rows of existing concrete piles supporting the NSL

tunnels. An innovative tunnelling plan was eventually devised, involving ice – lots of it.

For the first time, LTA used ground freezing during the construction of an MRT tunnel in Singapore. This technology enabled engineers to build huge frozen ice walls to support the construction of a 43-metre stretch of the upcoming TEL tunnels.



WHY GROUND FREEZING?

It boils down to the type of hard, sandy soil that lies deep under Marina Bay Station. With large amounts of groundwater flowing through highly permeable old alluvium clay, it is tough to stabilise the soil.

“We conducted multiple site investigations and soil checks to determine the best method to stabilise the ground, and ground freezing has proven to be best.”

NG KEE NAM

LTA'S GROUP DIRECTOR FOR TEL AND CROSS ISLAND LINE (CIVIL).

By freezing the soil, ground water is unable to seep in. This enhances the structural integrity of the two operational train lines above the new TEL during tunnel excavation works, as the surrounding earth will be stabilised.

COMBATING WATER WITH ICE

The freezing process began in March this year, and 1.8-metre thick ice walls were fully formed within two months.

Once the ground was frozen, the TEL that heads to Woodlands could be safely constructed.

“We maintained this wall for three months, for all the workers to complete the excavation. Throughout the period, we tracked the temperatures continuously,” Kee Nam shared.

The tunnel was subsequently carved and lined with spray concrete before the freezing system was turned off in August.

After that, the upper tunnel for the east-bound TEL will be constructed. As the soft clayey soil at the upper tunnel level can be effectively treated with cement grout, ground freezing is not necessary.

ADVANCED COMPUTER MODELLING

Just like freezing water in ice cube trays, the volume of water in the ground will expand when frozen and contract when thawed. This exerts physical stress that can potentially affect the structural integrity of the two operational train lines – NSL and CCL – above.

“To tackle that challenge, we send a lot of samples for tests – we freeze the samples, and we work out the ratio of the frost, heave and thaw shrinkage,” said Kee Nam.

“From there, we can implement mitigation measures to control excessive movement of the ground.”

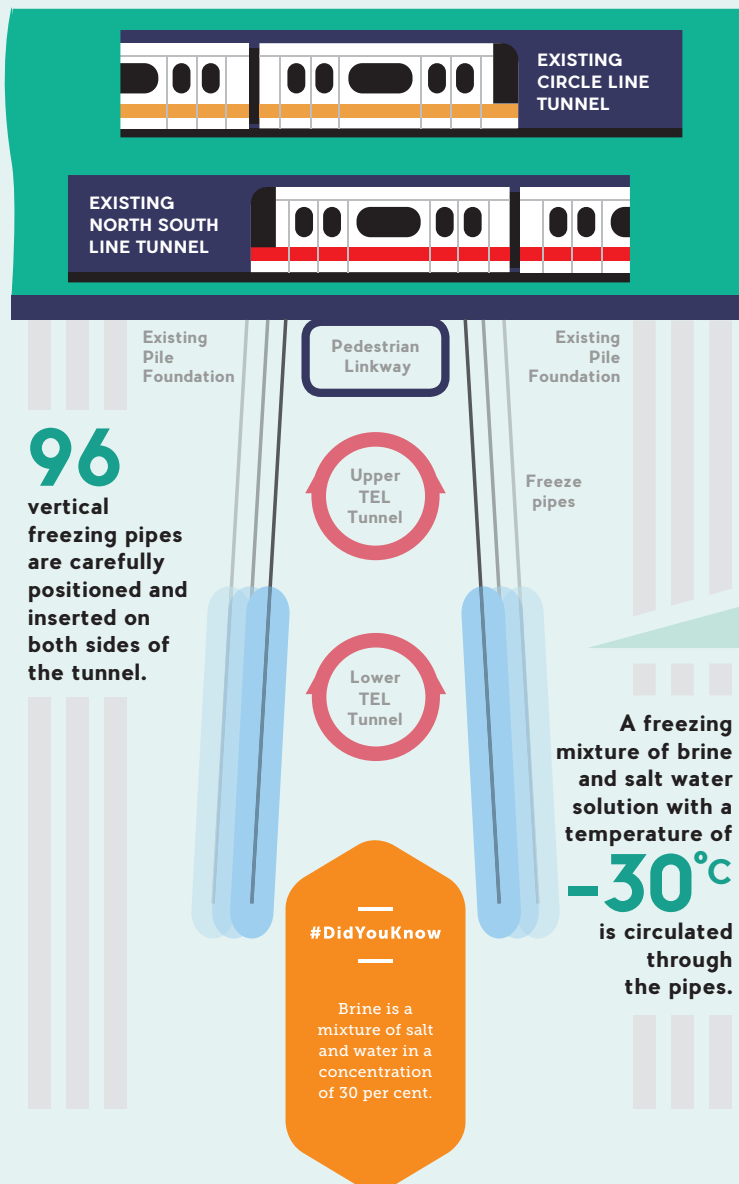
For the engineering team working on this project, it was indeed a delightful ‘freezing’ experience!



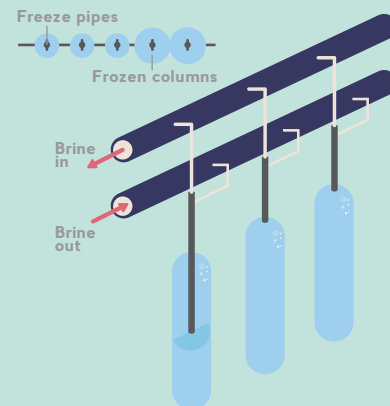


HOW DOES GROUND FREEZING WORK?

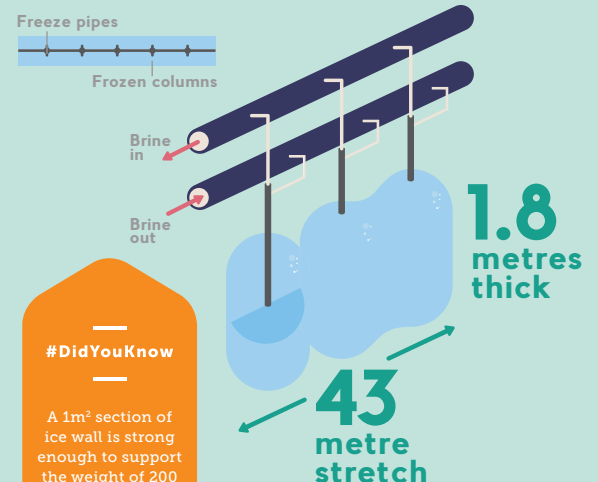
CROSS SECTION OF GROUND FREEZING SITE



ICE COLUMNS GROW AROUND THE PIPES.



THESE MERGE TO FORM A CONTINUOUS WALL.



WITHIN TWO MONTHS, A PAIR OF ICE WALLS FORM UNDERGROUND.



3D TEMPERATURE MONITORING

With real-time data from 80 temperature sensors within 20 temperature monitoring pipes, the team can precisely determine the thickness of the ice walls that have formed.



SAFE MINING WORKS

As the walls are now impermeable to large amounts of groundwater flows, workers can safely begin mining works.



Smart Moves

WALKING AND CYCLING WITH EASE

Waiting for the bus to take you to the nearest MRT station? You may want to hop on a bike or tighten your shoe laces for a walk instead! Let's see how walking or cycling can help us to have a more comfortable commute.

Step out of your house, and you could be greeted by sweltering heat or torrential rain. This is Singapore, after all. Walking or cycling to your destination is probably the furthest thing from your mind. After all, who wants to be soaked to the skin?

But not to worry, as our sheltered walkways, cycling paths and infrastructural enhancements can make walking and cycling pleasant and viable options, even in our tropical weather.

SUNDAY - 10AM:
SHELTER FROM THE STORM



The sound of rain pelting against the window awakens you. Groan, you'd much rather sleep in but you've already made plans to meet friends for brunch at the neighbourhood mall.

You contemplate taking a taxi instead of hopping on the feeder bus service so that your new shoes won't get wet. Then you remember that the new sheltered walkway from your block now connects you all the way to the bus stop. Hurray! You're at the mall in 15 minutes, all ready to feast with your friends.

That's right: we've built over 200km of additional sheltered walkways over the last four years under the Walk2Ride programme which connects commuters from nearby amenities to public transport nodes within a 400m radius.



Sheltered Walkways



MONDAY. 6PM: FASTER ON YOUR FEET

As the workday comes to a close, you feel like chasing away the remaining Monday blues with a drink and some tasty titbits. Where can you head to, fast?

You check our Walking Train Map (WTM), a handy guide showing the walking time between MRT stations on different lines nearby. The WTM shows that it is only a 5-minute walk from your office at Raffles Place to that hipster Telok Ayer café you have been reading so much about. This is going to save you 18 minutes, compared to taking the MRT, which would take you 23 minutes! Cheers to walking!



WALKING TRAIN MAP







TUESDAY. 7AM: BETTER ACCESSIBILITY FOR SENIORS

Aunty Lucy, your long-time neighbour, pops by to ask your mum if she'd like to go to the new seniors' exercise park across the street. She says that crossing the road is now easier and stress-free as they do not have to rush. At signalled pedestrian crossings fitted with Green Man + technology, all they have to do is tap their senior concession card to get up to 13 more seconds of green man time.

She is also happy about the lift that has been installed at the pedestrian overhead bridge to the market, saving her a tiring climb up the stairs. So convenient!

There will be 47 more bridges with lift access by end-2018, and another 27 by 2021.

 MRT STATIONS	 TRAVEL TIME* (Mins)	 WALKING TIME* (Mins)	 TIME SAVED* (Mins)
Telok Ayer → Raffles Place	23	5	18
Downtown → Raffles Place	22	7	15
Chinatown → Raffles Place	24	11	13
Esplanade → City Hall	17	5	12
Tanjong Pagar → Telok Ayer	20	8	12





THURSDAY. 5PM: SAFER PATHWAYS

While you are on your way to run errands, a youth on a personal mobility device (PMD) speedily scoots past you - he is not wearing a helmet. Thankfully, an Active Mobility Enforcement Officer stops him and gently, but firmly, reminds him about riding safely and responsibly. Here's to safer path sharing for everyone!

The officer also encourages the PMD user to sign up for the **Safe Riding Programme**, a 90-minute complimentary workshop that equips cyclists and PMD users with the knowledge and skills to ride safely. Find out more about the **Active Mobility Act**, which will include more stringent speed limits in 2019.

FRIDAY. 8PM: A FUTURE ON TWO WHEELS

It's time to unwind at the end of the work week, and your colleagues suggest going to Bencoolen Street for dinner. Emerging from the train station, you are amazed by the changes you see.

The whole area has been revitalised with more spaces dedicated to pedestrian walkways and cycling paths, paving the way to a car-lite future. Cheers to more options!

Cycling will increasingly be more popular for first-mile, last-mile connectivity and intra-town travel, as we have been expanding Singapore's cycling networks and infrastructure.

The 13km Bedok Cycling Network and the 15km Jurong Lake District Cycling Network are among the two latest additions.

Cyclists can also look forward to dedicated cycling lanes on the upcoming North-South Corridor, connecting towns in the North to the city centre. Upcoming estates such as Tengah Car-free Town will also feature more dedicated cycling and walking pathways.

SATURDAY. 9AM: A WALKING AND CYCLING ADVENTURE

Blue skies beckon, and off you go on a trek across the park connectors and cycling paths. You alternate between walking and cycling, taking in the sights from Marina Bay to the National Stadium.

A warm breeze brushes your face as you cycle, and when the heat gets too intense, you seek solace under a covered walkway - which you used as a shelter from a storm just a week ago.

The growing facilities and infrastructure available are indeed a promising start to a future of more walking and cycling!



WEDNESDAY. 8AM: SILVER ZONES

Walking to the MRT station in the morning, you notice a familiar woman standing at the road divider. It's Auntie Lucy!

You wait for the green man to light up before approaching her. She appreciates the two-stage crossing feature, where a road divider enables her to wait safely until the green man flashes again. You notice signs nearby indicating that this is a special silver zone - encouraging drivers to slow down for the elderly.

As part of the Silver Zone initiative, roads are made safer for the elderly through measures such as a reduced 40km/h speed limit where possible, narrowing roads at crossings to get cars to slow down, and converting sections of roads into community spaces for walking and sitting.

There are 15 Silver Zones now, with a goal to have 35 by 2020.



Walk & Cycle





ON THE MOVE COMMUTERS WHO LOVE TO TRAVEL

THE MANY FACES OF OUR TRAINS

Do all our MRT trains look alike to you? Look closer. Since the first MRT began operations in 1987, there have been more than 10 models of trains on our rail network. Here are some fun facts of six train models. See if you can spot the differences on your next commute!



KAWASAKI HEAVY INDUSTRIES C151 (KHI)

Entered service: 1987
Singapore's oldest and the first-generation trains for the NSEWL. Between 2014 and 2015, they were upgraded with the Communications-Based Train Control (CBTC) signalling system to reduce intervals between train arrivals.



KAWASAKI HEAVY INDUSTRIES & NIPPON SHARYO C751B (KNS)

Entered service: 2000
These trains were the first to have visual passenger information systems installed in the cars.



ALSTOM METROPOLIS C751A

Entered service: 2003
The electricity to power these trains are supplied overhead – a feature unique to the NEL.



ALSTOM METROPOLIS C830C

Entered service: 2015
This train is 70m, as long as 2.5 basketball courts. And it weighs around 120 tonnes – the equivalent of 22 adult Asian elephants!



BOMBARDIER MOVIA C951

Entered service: 2013
Made up of high-capacity aluminium car bodies, these trains are 90% recyclable at the end of their life cycle!

Entered service: 2019
The first in Singapore to feature five doors on each side of the train car. The extra door will improve passenger flow, ensuring smoother and quicker boarding and disembarking.

KAWASAKI HEAVY INDUSTRIES & CSR QINGDAO SIFANG T251



Photo credits: Train models C151, C751B, C951 and C830C: SGTTrains

CONNECT

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READ & WIN!

JUST ANSWER 3 SIMPLE QUESTIONS

Stand to win a set of 4 limited-edition Circle Line NETS FlashPay cards worth \$40!

1. The Land Transport Authority has opened a new gallery showcasing exhibits on what the future of transport would look like. What is the name of the gallery?

2. What is the technology used to stabilise the earth 40 metres under Marina Bay Station?

3. Name one way you can show appreciation to our public transport workers.

Email your answers to connect@lta.gov.sg by 30 Nov 2018, and include your name and NRIC with the subject "Connect Nov 2018". The winners will be notified via email. Good luck!

Note: Your email address will automatically be subscribed to Connect when you participate in this contest.

Congratulations to the winners of our Aug 2018 Read & Win Quiz:

1. Ng Swee Choon
2. Jane Han
3. Charlton Lim

Public Consultation on the
**LAND TRANSPORT
MASTER PLAN**

2040

**SHARE YOUR IDEAS TO MAKE YOUR
COMMUTING EXPERIENCE BETTER.
HELP US SHAPE THE FUTURE
OF LAND TRANSPORT!**



Do you have some thoughts to improve our land transport system? Participate in our e-survey and send us your comments on our Land Transport Master Plan, which will shape our transport network for 2040 and beyond. Here are three broad areas we are looking at:

How might we make

**WALK
CYCLE
RIDE**

your preferred
way to travel?



How might we improve the

**QUALITY
OF LIVING**

for all Singaporeans through
our land transport system?



How might we make

WALK CYCLE RIDE
easier and more

**INCLUSIVE
FOR ALL?**



Join the Land Transport Master Plan 2040 conversation from now till 31 December 2018. Click [here](#) or scan the QR code now.

