"I think the Circle Line does relieve some of the rush hour crush and sometimes, I can even get a seat!"

Donna Lim, shop manager

"My family, my neighbours – we’ve been waiting a long time for the Circle Line. Now we won’t have to travel all the way downtown to get on the East-West Line."

Goh Jin Qiang, Yishun resident

"It’s not just the time-savings. The Circle Line’s seamless transitions in a very comfortable and sheltered environment make using the MRT not just quick, but also pleasant."

Daphne Khong, senior planning officer

"It’s a really beautiful line. I’d even consider it a tourist attraction!"

Reuben Sim, student

"I think the art makes each station special. I really like the artwork for Dakota – it really reflects the history of our area. I feel like I can say it’s ‘my’ station."

Chan Pei Cheng, Dakota resident

"When I’m away, one of the things I miss is the ease, convenience and sheer predictability of our MRT system. The Circle Line has just raised my expectations further. I’m spoilt."

Jack See, underwriter

"When the first MRT lines were being built, my grandfather said he wanted to live long enough to ride the trains. He did – for 14 years. He would have really loved the Circle Line."

Zhang Wei Min, school teacher
“I wanted to be a train driver when I grew up, but that’s not needed now. I think I will be an engineer and build tunnels. Are you building more lines?”
Nur Inisyarah Ahmad Thaha, student, age 7

“After all those years of digging and diversions and dust, the Circle Line is finally here and I must say it’s been worth it. As a Singaporean, I’m proud of it. Thank you, LTA.”
Oon Ah Geok, home-maker

“My children don’t drive. Having the Marymount station makes it a bit easier to visit – and bring my grandchildren too.”
Yap Kam Leng, retiree

THE CIRCLE LINE
LINKING ALL LINES
We are making massive investments in a more comprehensive MRT network. Coupled with improvements in bus services, it will give Singaporeans a convenient and reliable public transport system.

The Circle Line (CCL) has added some 33km to our MRT network. As an orbital line, it will shorten journeys by allowing commuters to transfer to other radial lines, bypassing the busy interchanges in the city centre. Commuters will be able to get to more places and faster.

There is much more to come. From now till 2017, a new section of rail will be added to our MRT network every year. We are investing about $60 billion for both the enhancement of our existing network and further expansion of the rail network from about 176km at present to about 280km in a decade’s time.

I would like to commend the many members of the public who have cooperated to make possible the construction of the Circle Line despite inconveniences, as well as congratulate the Land Transport Authority on this major milestone in our efforts to enhance public transport connectivity. I wish all commuters a safe and comfortable journey.

THARMAN SHANMUGARATNAM
DEPUTY PRIME MINISTER & MINISTER FOR FINANCE AND MINISTER FOR MANPOWER
One of our key strategic thrusts in the Land Transport Master Plan (LTMP) is to provide a quality public transport system. To achieve this, we are committed to intensifying our efforts to improve the public transport system. This includes expanding our MRT network so that more people will have convenient access to the stations. The full opening of the Circle Line brings us a step closer to our vision of a much denser rail network to serve the travel needs of our people.

As we develop the physical hardware of our transport infrastructure by building new rail lines, we must not lose sight of the importance of creating a people-centric transport system. Our public transport system must be inclusive, catering to the diverse needs of our population. This includes ensuring that there is at least one barrier free access to MRT stations, having bicycle parking facilities outside stations where feasible, and integrating MRT stations with surrounding developments. We hope that this will make your journeys more convenient and enjoyable.

While the Land Transport Authority and its partners have worked very hard to build the Circle Line, we must not forget the part played by the people of Singapore. Your patience, understanding and cooperation have been integral to the completion of this line.

I hope you will enjoy the benefits that the Circle Line will bring to you.

LUI TUCK YEW
MINISTER FOR TRANSPORT &
SECOND MINISTER FOR FOREIGN AFFAIRS
The challenges of building the Circle Line were immense. Engineers and crews had to work in heavily built-up areas, facing hazards above and below the surface. Another challenge came from keeping things moving on the surface, while all these were going on below it.

Our engineers and contractors rose to the occasion. They did all they could to keep our public’s world moving. And now, the Circle Line is ready and commuters have a great travel experience awaiting them.

I want to thank our consultants both in engineering and geological services, our designers who created the stations, our contractors, our staff and the thousands of workmen who laboured on the line.

But most of all, thank you, the citizens and residents of Singapore, who gave us the support to let us do the best job we could.

MICHAEL LIM
CHAIRMAN
LAND TRANSPORT AUTHORITY
33.3km long, with 28 stations, run entirely underground with driverless trains, Singapore’s Circle Line is the world’s longest fully-automated underground rapid transit line. This is the story of a nation that pulled together to build it.
On 7 November 1987, a Mass Rapid Transit train of six carriages slid out of Bishan Station on the North-South Line, on the first service run of Singapore’s latest public transport system. A smooth air-conditioned ride; high-tech stations of marble and glass and chrome, tinted by the lights of convenience stores.

Looking ahead for you

Singapore city planners had, as far back as 1967, forecast that the island would need some form of rail-based transport in the city by 1992. The London Underground, which opened in 1863, had clearly demonstrated the importance of such a system in a rapidly developing city.

Mr Chew Hock Yong, LTA’s Chief Executive, said: “You have to remember that this was in the 1960s, when our population was only hovering around the million mark. But it was clear that planners were thinking big back then. Some might have even said they were overly optimistic. Would Singapore really grow that big? Well, thank goodness they were optimistic. The challenge would be tougher now if they had not been.”

Mr Lim Leong Geok was a city planner, transport builder and public transport operator. He was instrumental in building Singapore’s first MRT network, being part of the team that helped to convince the Government to build it. He later helmed the Mass Rapid Transit Corporation and then the Singapore Mass Rapid Transit. He was also founder-director of TransitLink. He died in 2004.

For his invaluable contributions over a career spanning 40 years, from 1959 to 1999, Mr Lim was posthumously awarded LTA’s Distinguished Contribution award.

Dr Yeo Ning Hong, former Minister for Communications said of Mr Lim, who was also the son of war hero Lim Bo Seng: “We were very lucky to have him. He was an extremely able man, an outstanding engineer and manager.”
History was created when workers broke through the wall of the Outram Park MRT worksite, linking it with the Tiong Bahru station a kilometre away. Using giant shield machines, they had sliced through 44,000 cubic metres of earth beneath roads and buildings, emerging from two tunnels at the Outram Park MRT site after traveling a kilometre from the Tiong Bahru station.

The Commemorative Ticket issued on the first day of the MRT’s opening.

Communications Minister Yeo Ning Hong and the tour party in safety hard hats and rubber boots visiting the MRT worksite at Shan Road. This deep shaft and almost 500m of tunnels now link the Toa Payoh and Novena stations.

The first MRT train breaking through the rice-paper shield in a “tunnel” frame.

The pride of Dhoby Ghaut MRT station – a posh circular stairwell lavishly trimmed with stainless steel railings and with a locally-created mobile suspended from the ceiling. The huge mobile sculpture, a “Tantem of music” by local artist Tan Ping Chiang, depicts a range of traditional and modern musical instruments used by the Chinese, Malays, Indians and Eurasians.

Document bearing the signatures on the first MRT contract, which was signed at a brief ceremony by Mr Michael Fam for the MRT Corporation and Dr K Yoshida, vice-president of Tobishima Corporation. The Tobishima-Takenaka contract was for the construction of two bored tunnels running from Toa Payoh to Newton Circus and included the building of two stations, Toa Payoh and Novena.

These three samsui women worked for 4 years on the Bishan station. Their boss gave them the day off and an MRT engineer bought them $3 commemorative tickets to join the throng of Singaporeans who rode the trains on the opening day.
When stored-value cards were first introduced, guides had to be stationed to teach commuters how to use the farecard vending machines.
(Facing page) Two-year-old Jeremy getting assistance from a guide at Yio Chu Kang MRT station with his father, Stanley Wang.

(Top) First Deputy Prime Minister Goh Chok Tong (right) chatting with other passengers on his first MRT train ride between Yio Chu Kang and Toa Payoh.

(Right) The MRT system’s “nerve centre”, or Operation Control Centre (OCC), located in Victoria Street.
Commuters waiting to board the MRT train at Toa Payoh station. The Mass Rapid Transit system was thrown open to the 150,000 people who had bought $3 commemorative tickets for the opening day rides.

(Top) Johor princesses, Tunku Mariam Zahrah and Tunku Besar Zabedah on the MRT train with their two nephews, Tengku Shahrain and Tengku Salehuddin Ismail Iskandar Ibrahim Mahamuddin Shah. It was the first MRT ride for the two princesses, but not for the princesses. The boys later followed their aunt to the front of the train to say hello to the driver.
A newly-married couple waiting to take their first ride on the MRT train on its opening day.
The Mass Rapid Transit system, however, was not an easy sell. One participant in Singapore’s four-year study for the system was a young architect and urban planner named Ong Teng Cheong. He became the system’s greatest advocate. By 1978, Mr Ong Teng Cheong had become Minister for Communications. He convinced the Cabinet that the system would benefit Singapore in the long term.

COULD WE AFFORD IT?
The Mass Rapid Transit system, however, was not an easy sell. One participant in Singapore’s four-year study for the system was a young architect and urban planner named Ong Teng Cheong. He became the system’s greatest advocate. By 1978, Mr Ong Teng Cheong had become Minister for Communications. He convinced the Cabinet that the system would benefit Singapore in the long term.

A LONG TERM INVESTMENT FOR ALL
In 1982, Parliament concluded that a rapid transit system would be better for Singapore in the long run. Construction began on 22 October 1983 at Shan Road, a tunnel shaft located between Toa Payoh and Novena stations.

“The Government has now taken a firm decision to build the MRT,” Mr Ong Teng Cheong said in an interview at the time. “The MRT is much more than a transport investment, and must be viewed in its wider economic perspective. The boost it will provide to long term investors’ confidence, the multiplier effect and how

MRT will lead to the enhancement of the intrinsic value of Singapore’s real estate are spin-offs that cannot be ignored.”

On 12 March 1988, Mr Lee Kuan Yew, then Prime Minister, officially launched the Mass Rapid Transit system. Twenty-one more stations were built, and when the East-West Line finally reached Boon Lay station on 6 July 1990, the original network was truly complete.

LINKING YOU BETTER
The MRT network began as a radial system – lines extending from a single hub like spokes in a wheel. What these spokes needed was a rim – a line that would touch all of them further out and link them all. This orbital line, the Circle Line, was an idea that had already begun to take shape in the early 1990s.

Dr Yeo Ning Hong, then Minister for Communications and Information, said as far back as in the 1980s that such an orbital line would be feasible when Singapore’s population reached 4 million.
How long is each MRT line?

**North-South Line**: 44km

**East-West Line**: 49.7km

**North-East Line**: 20km

**Circle Line**: 33.3km
Mr Mah Bow Tan, who was Transport Minister from 1991 to 1999, elaborated on this in a 2007 speech made for an Urban Renewal Authority corporate seminar. “The Circle Line will link all existing Mass Rapid Transit lines running into the city, greatly enhancing connectivity between suburban areas and reducing journey time for commuters considerably. Commuters travelling from Serangoon to Paya Lebar, for example, will take less than 15 minutes on the Circle Line, compared to about half an hour by bus or MRT today.”

WHAT WORKS BEST FOR YOU?
In the 1990s, the Circle Line was named the Marina Line, planned as a 12-station line starting from Chinatown. Eventually, plans evolved to include these stations: Dhoby Ghaut, Bras Basah, Esplanade, Promenade, Nicoll Highway and Stadium. Part of the Marina Line from Chinatown to Promenade became part of yet another line—the Downtown Line.

Mr Jeremy Yap, Group Director, Policy & Planning, explained why the plans kept changing: “Circumstances change. You get more information, you find some things are perhaps too expensive or not possible. You work out new solutions. The changes are challenging, given the scope of the work involved. But because once the infrastructure is built, it is even harder to change, so if you have to make changes, the planning stage is better!”

Mr Chew Hock Yong, LTA’s Chief Executive said: “The Mass Rapid Transit is a system used in many major cities around the world with large populations. New York, London, Paris, Tokyo – these are cities where trains have benefitted people greatly. Those cities would just stop if the trains did not run. In Singapore, our own MRT system is continually growing to meet our transport needs. We have a system of LRT and feeder buses to make getting to the MRT convenient and a fare system designed to keep the cost to the commuter as low as possible. And as far as possible, we’ve tried to make the experience hassle-free – and maybe even pleasant when it’s not rush hour.”

BALANCING SPEED AND CONVENIENCE
Where a road or train track runs is its “alignment”. As far as possible, LTA tries to avoid acquiring land.

“It is not just the cost of acquiring land. It’s how disruptive it can be to people’s lives and businesses. And what is the objective of an MRT project?”

TRACK TEAM
Over the years, Singapore’s Mass Rapid Transit system has grown in the able hands of a few Ministers for Communications or Ministers for Transport as they have been called since 1999.

1. Mr Ong Teng Cheong (1978–1983). He later became the President of the Republic of Singapore.
2. Dr Yeo Ning Hong (1983–1991)
4. Mr Yeo Cheow Tong (1999–2006)
5. Mr Raymond Lim (2006–2011)
6. Mr Lui Tuck Yew (current)
create convenience. The work is already going to be inconvenient to people, so we really try our best to keep disruption to the minimum,” said Mr Jeremy Yap.

“We had to also find a balance between the number of stations and the speed of travel,” says Mr Choi Chik Cheong, Deputy Director, Content Development & Documentation (former Deputy Director, Strategic Planning).

**WHAT THE CIRCLE LINE BRINGS TO ALL**

The Circle Line is a concrete manifestation of the LTA’s commitment to developing public transport into a choice mode of travel in Singapore. We have newer and better trains, and stations which are barrier-free that are graced with works of art that make the daily commute a little more interesting.

When it is complete, the Circle Line will join with all our existing lines, which will enable many of us to completely bypass the busy city interchanges at Raffles Place, City Hall & Dhoby Ghaut. This will ease the load on those stations, speed up travel for all commuters and breathe life into the newly connected sub-regional centres.

A completed Circle Line will have the effect of making Singapore seem a little bit smaller. When we are able to travel faster, things that used to be far away will seem nearer. Visiting friends and relatives will be that much easier and more pleasurable.

**MICHAEL LIM**
Chairman, Land Transport Authority
In his introduction to the brochure for the opening of Circle Line Stage 3, Bartley to Marymount, May 2009.

**[WE HAD] TO ENSURE THAT THE ALIGNMENT... CAUSED AS LITTLE DISRUPTION AS POSSIBLE...**

Paul Fok

**DESIGNING THE CIRCLE LINE**

“The design team studied the proposed route in great detail and assessed its impact on adjacent developments and infrastructure so as to ensure that the alignment of the line caused as little disruption as possible to all the neighbourhoods and operating MRT system,” says Mr Paul Fok, Group Director, Engineering.

Working closely with land-use agencies such as the Urban Redevelopment Authority (URA) and the Housing and Development Board (HDB), LTA worked out the optimal locations for the stations and to maximise land use potential.

“We want to build stations close to where people live, work or play. But to do that, we cannot avoid some disruption. Unfortunately, we will always face criticism – oh no, LTA is digging yet again. But people need to understand that we think about it very, very carefully before we decide on where to dig and how to dig. We always consider the people affected,” said Madam Neo Bian Hong, Director, Design.

“The Circle Line is a crucial part of the URA’s 1991 Concept Plan. It will provide a way for people to travel around Singapore without having to go through town and at the same time shorten journey times between the regional centres. It will also increase the commercial and employment opportunities of the sub-regional centres,” said Mr Yam Ah Mee, Chief Executive Director of the People’s Association (former Chief Executive of LTA).
DO YOU KNOW

How many trips are taken on the MRT every day?

ANSWER:

An estimated 2 million people use the MRT every day.
With the planning and the design stage complete, the line was carved out into five parts – Circle Line Stage 1 to Circle Line Stage 5 – and tendered out. Construction began in 2003.

The Circle Line was expected to have its first section operational by 2006 and fully opened in 2010. But tragedy struck on 20 April 2004, when the Nicoll Highway collapsed. Rather than build over the collapsed area, the authorities decided on a new alignment of the tunnel. As a result, the Nicoll Highway station was reduced to about two-thirds its original size and moved to a new site about 100m from the highway collapse site. In the end, the opening of the Circle Line was delayed till 2009 and the entire line’s completion by 2011. The cost rose from $6.7 billion to $8 billion.

OVER TO YOU
By 28 May 2009, Stage 3 of the Circle Line, which runs from Bartley to Marymount, was opened. On 17 April 2010, Stages 1 and 2, running from Dhoby Ghaut to Bartley, were opened.

“The opening of the Circle Line underscores the Government’s commitment to improve our public transport capacity and connectivity, so as to make it a choice mode for all. Indeed, even as we are building and opening the Circle Line in phases, there are already plans in the pipeline to further expand the rail network. New lines, such as the Downtown Line, will be progressively added to the rail network to cater for future growth in travel demand. When completed, these rail lines will bring us even closer to our vision of a well-connected and vibrant city of the future,” said Mr Raymond Lim, former Minister for Transport and Second Minister for Foreign Affairs at the Opening of Circle Line Stages 1 and 2.

The last two stages, 4 and 5, were opened on 8 October 2011, a few months ahead of schedule. Completed, the Circle Line is now the world’s longest fully-automated underground metro line.

BUILDING WITH YOUR FUTURE IN MIND
Some stations on the Circle Line were designed as “shell” stations. This meant these stations would not be opened till there was a need for the rail operator to do so. These were Caldecott, Haw Par Villa and Bukit Brown. When the Line opened, Caldecott and Haw Par Villa were also made operational, with only Bukit Brown still a “shell” station.

“When the demand for it comes, or when we anticipate it coming, the ‘shell’ stations will be made ready and the lines will be extended. As far as possible, we have planned and built with an increase in demand in the future,” said Ms Lina Lim, Deputy Group Director, Policy & Planning.

Part of anticipating demand involves listening closely to the people who will be affected by the systems.

“Making our transport system one that is centred on people is an ongoing journey,” said Minister for Transport and Second Minister for Foreign Affairs Lui Tuck Yew in a June 2011 speech. “I am glad that the LTA has made community engagement a priority in recent years. There has been a concerted effort to consult stakeholders like grassroots leaders and commuters through different fora. These efforts must be reinforced and strengthened.”

The five stages of the Circle Line may be completed, but for LTA, the end of the road – or line – always runs beyond the horizon.

“Top” Minister of State for Transport and Finance Mrs Josephine Teo visiting the Land Transport Gallery.

(Facing page) At the 2010 National Day Rally, Prime Minister Lee Hsien Loong spoke of plans to spend S$60 billion over the next decade to double the rail network.
Excavating a 33.3km tunnel is a major challenge in itself. It gets tougher when that tunnel has to be excavated through mixed ground, very close to buildings, pipelines, power cables, gas lines – and connect to other underground stations already in operation.

This chapter traces some of the major challenges that LTA and its contractors faced when building the Circle Line.
DIVIDING THE CIRCLE

The Circle Line is made up of five “stages”.

● Stage 1 is a 5.4km stretch starting from Dhoby Ghaut interchange station and runs through a very congested city shopping district.

● Stage 2 runs 5.6km. It passes five stations and includes the Kim Chuan Depot, which manages the trains of the Circle Line.

● Stage 3 is a 5.7km route that spans a mostly residential district and has two interchanges – Serangoon and Bishan. It also has sections where tunnels must pass very closely to each other.

● Stages 4 is a 5.8km route that passes through residential areas very close to homes.

● Stage 5 runs 6.8km. It comprises five stations and ends at HarbourFront, an interchange station.

DIGGING DEEP

Boring a tunnel is hardly straightforward. Alignment is critical to avoid odd turns for the train. Once a tunnel is built, all the tracks, electrical lines, control cables and equipment for lighting and ventilation are installed.

WORKING THE GROUND

“You have mud, you have clay, loose soil, tightly packed soil – and then you have massive blocks of granite you cannot bore through that easily but must blast through. Singapore really has so many soil types to deal with – all these can occur within a short distance – so you need to be prepared for all eventualities,” explained Mr Samuel McChesney, Senior Project Manager, Circle Line Stage 4.

The problems and risks are many – for all sorts of ground.

THE TUNNEL BORING MACHINE

Almost two storeys high, approximately 6.6m in diameter and with a 10-metre long cylindrical shield, the 430-ton tunnel boring machine (TBM) has a 60-metre long equipment train. The massive beast can excavate the ground at a pace of up to 80mm/min. When a standard length of ground (typically 1.4m) is excavated, concrete segments are erected to form a ring inside the TBM’s shield. As the TBM excavates further, more rings are built to form a tunnel. The TBM shield allows workers within it to build the tunnel ring in safety.
The soil that lies beneath our feet come in all colours and textures. Can you guess which soil type is being described below?

1. Greyish material, with the consistency of toothpaste. Soil improvement is often necessary for deep excavation.

2. Medium dense, to very dense sandy, to hard clayey material that is very abrasive to the TBM’s. This causes rapid wear of the TBM’s ripper teeth on the cutter head.

3. Consists of heavily folded, interbedded layers of sandstone, siltstone and mudstone, with varying degrees of weathering. Weathering can vary dramatically over a short distance and the rocks can be very fractured. As a result, the behaviour of the material during tunnelling can change quickly.

4. The weathering of a rock can vary greatly. Thus, a tunnel face can present weathered material (soil) near the top of the tunnel and fresh, hard granite at the bottom. Tunnelling must be controlled properly so as to avoid settlement of the soil, which can lead to sinkholes.

ANSWER: 3. Old Alluvium
PROBLEMS PILED UP

Since Singapore is a densely built-up area and the MRT line is meant to serve large population centres, the tunnel inevitably had to pass under areas with many buildings. And this ultimately meant lots and lots of piles.

“An important location was below the Bishan MRT Depot. The Depot had to keep running to keep the lines going. They could not stop for us. So we had to do a lot of extra work to put in new piles and transfer the weight of the depot onto these new piles so we could cut the old ones away,” said Mr Tan Kian Thong, Director, Downtown Line Stage 2, Civil Construction Team 2 (former Director, Circle Line Stage 3).

“We also had to tunnel underneath Serangoon North-East Line and we had to do it in such a way that both the station and the road viaduct above the station did not settle,” added Mr Tan.

“At least in those situations, we knew how deep the old piles went. But some, like Jalan Harom Setangkai had no records and others like Pasir Panjang, had piles made of timber of unknown length. At that site, we made really extensive checks before a slurry TBM was brought in and we used stronger tunnel linings so that an old pile could not pierce it. We also relocated the residents,” said Mr Yoshimitsu Aya, Tunnel Manager, Contractor Taisei Corporation.

HOW CLOSE CAN TWO TUNNELS GET?

Between Serangoon Station and Bartley Station are two tunnels that carry trains in opposite directions very close to each other.

“THE DEPOT HAD TO KEEP RUNNING TO KEEP THE LINES GOING. THEY COULD NOT STOP FOR US…”

Tan Kian Thong
Since it was the first time in Singapore that railway tunnels would be dug in such close proximity to each other, researchers from Cambridge University were called in.

**THE STATIONS: EASY ACCESS FOR YOU**

This section takes a look at some of the challenges involved in building underground stations that have to link with the rest of the network, be built under severe constraints and connect with almost every nearby building for easy and sheltered access.

**DHOBY GHAUT: CAISSONS DUG BY HAND**

The central challenge in adding a line to this interchange was carrying out all the work safely without affecting the day-to-day operations of the North-South Line (NSL) and North-East Line (NEL).

“When the NEL was connected to this station, a link underpass was built with a 30-metre-long travelator connecting the NEL station and the NSL station. The new Circle Line station had to be built under this link underpass. To enhance the support of the underpass, we installed seven Caisson piles and then constructed capping beams to form the supporting system,” said Mr Eugene Tan, Construction Manager, Contractor WohHup-Shanghai Tunnel-NCC Joint Venture.

A Caisson pile is a hand-dug large diameter pile. It is a very old method for installing piles, one that is hardly used today thanks to machines like piling rigs. Thus, it took 60 men 9 months to build the seven Caisson piles, deep in the earth below the link underpass. In that period, hundreds of thousands of commuters floated by overhead on the travelator, unaware that far below them, a group of 60 unsung heroes were working to keep them safe.

Mr Tan Cheow Kiak, Deputy Project Manager, Downtown Line Stage 2 (former Senior Project Engineer, Circle Line Stage 1) said: “It’s interesting that we had to revert to a very old method of putting in piles. You put in what is essentially a cylinder in which the men dig down. As you go further, you add sections to the cylinder and when it reaches the required depth, you fill it up. It was tough on the men. The space in the cylinder was cramped, not too many men could dig at the same time. Progress was slow, but this old method worked.”

**ESPLANADE STATION: BUSINESS AS USUAL**

Esplanade Station is beneath Bras Basah Road and Nicoll Highway, serving hotels and shopping malls as well as the Suntec Convention Centre. Its entrances are close to these facilities and one entrance is connected to the CityLink underground mall. On top of that, the works were also carried out near historical buildings like the Raffles Hotel, the former NCO Club and the War Memorial Monument.

“There are hundreds of thousands of shoppers visiting this area everyday and quite a lot of them were foreign visitors. We were building an underground MRT station which is equivalent to the height of a 7-storey HDB building. The works were massive but the demand for us to build it quietly, with no dust or sand in a very tight area was so strong that it became a daily challenge that all of us had to meet,” said Mr Soh Kin Meng, Project Manager, Downtown Line Stage 2, Civil Construction Team 1 (former Senior Project Engineer, Circle Line Stage 1).

They chose a method called a diaphragm wall. This meant placing in retaining walls before excavation, which would reduce ground movements from the removal of large amounts of soil. This method also cuts the amount of noise and vibration affecting nearby buildings.

The station itself was built using the top-down method, meaning that the roof was positioned first after the diaphragm walls were in place. This had the benefit of cutting noise and dust pollution further as activities were all below the roof. It also meant work could continue in bad weather. And with construction activities now shielded by the roof slab, Bras Basah Road and the War Memorial Park were also reinstated early.
“We tried our best to keep the digging out of sight, as the station is situated right beneath the very busy Bras Basah Road and Nicoll Highway. We had no choice but to carry out multiple stages of traffic diversion to facilitate the construction works. It was really inevitable. We could not close roads – that would have caused ridiculous jams stretching to several roads away. It is paramount to plan the sequence of the construction works,” said Mr Randy Cheong Yoke Shen, Project Manager, Down Town Line 2 (former Project Manager, Circle Line Stage 1).

DIVERTING THE TRAFFIC

LTA engineers used computer simulation models and available data to build a picture of the situation. Many LTA departments were consulted. The Traffic Management Department used sophisticated computer models for analysis and a final recommendation was sent to the Minister for Transport for endorsement.

“In the end, we carried out over 10 stages of traffic diversion,” said Mr Quek Chew Chiang, Commercial Director, Contractor WohHup-Shanghai Tunnel-NCC Joint Venture. Said Mr Victor Quek Wei Min, Project Communications Manager: “We kept all businesses informed, held a special exhibition and Q&A session, had site visits too. We used the media to keep the public up to date. We also made it a point to schedule noisy work for weekends.”

“I would like to thank building owners, tenants and passers-by for their assistance and tolerance. I am glad that life went on pretty much as normal while we were building. Tough, but we managed,” said Mr Soh Kin Meng, Project Manager,

The biggest civil engineering challenge at Paya Lebar was the underpinning of two existing East-West Line viaduct piers. It was the first such operation carried out in Singapore on a live, heavy-capacity MRT line.

“To transfer the load of the viaduct to other structures, we used a concrete wall, concrete beam and a jacking system that was very powerful. We could then cut the old piles away and build new piles in more convenient locations to support the viaduct,” said Mr Yap Thiam Hock, Project Manager, Contractor Nishimatsu-Lum Chang Joint Venture.

Many monitoring devices were installed and key engineers would receive an instantaneous alert on their mobile phone whenever alert levels were breached. Spare materials and tools were on standby in case the piles tilted when the piles were cut, and LTA worked out emergency procedures with the Singapore Civil Defence Force. Only then, was the underpinning process allowed to commence.
These flags represent the major nationalities that worked on the Circle Line. Can you recognise these flags?
Laying of trackworks in progress for two tunnels merging at the crossover tunnel box.
(Top) Laying the tracks in the tunnel is manpower-intensive work.
(Right) Construction works for Circle Line next to the existing East-West Line at Paya Lebar station.
(Facing page) Construction workers lowering steel bars into the excavation site.
(Following page) Construction and earth works for the Circle Line project.
Kim Chuan Depot (KCD), at Hougang Avenue 3 and Kim Chuan Road, is the world’s first MRT Depot built specifically for these types of driverless trains. All train movement within this depot can be controlled centrally at the Depot Control Centre.

Capable of stabling up to 77 three-car trains, Kim Chuan Depot is huge – 11 hectares – or the area of 17 soccer pitches. It is 800m long and 160m wide and sits 17m below the surface.

The space savings above ground are immense. At 800m, it is about the same span that the Orchard, Somerset and Dhoby Ghaut stations cover. The width of a road and the malls that flank Orchard Road is about 160m at some points.

“Given the amount of space its operations required, the most practical solution was to locate it underground, so that above ground, the land could still be put to good use. The KCD columns had been designed to cater for future developments, and the new Bartley Road Extension viaduct is also supported by the depot roof. There’s absolutely no waste of space,” said Mr Ng Kee Nam, Deputy Group Director, Rail (Circle & Downtown Lines).

Kim Chuan Depot provides cleaning and maintenance services for all the trains and systems of the Circle Line. It is home to the Operation Control Centre that manages the trains as they run the Circle Line. It has facilities for storage and training, and of course, the Depot Control Centre, which runs the trains in Kim Chuan Depot.

The first major task was the excavation and movement of some 2.16 million cubic metres of earth. Earthworks began in 2001 and the civil contracts later in 2002. Much of the earth that was moved was transported to Pulau Tekong for projects by the Ministry of Defence in 2001 to 2002.

The construction work was complicated at Hougang Ave 3 because of the services – electricity, gas, water, sewerage, communications – in the area. First, boring and piling had to avoid all these services. Mr Tan Kok Jin, Deputy Director of Downtown Line Stage 1 (former Senior Project Manager, Circle Line Stage 2), said they presented a bigger challenge when building underground.

“Services are already a challenge when you build above them, because the piling needs to avoid them. But when you build under them? And cut away the earth that supports them? It’s a different challenge – and not every service line is headed in the same direction when you work in an area as built up as this. You have to work around them practically all over the work site.

“Then, as work went below these services, engineers had to design a system that would support or carry the service cables and pipes so that work could go on beneath them. Even so, working around these essential services provided daily challenges, even after the support structures were built. Soil conditions varied too,” explained Mr Daniel Tay, Construction Manager, Contractor Hee Lian Seng Infrastructure Pte Ltd.
What is the total length of all the tracks in Kim Chuan Depot?

ANSWER: 13km
Across the road from Willyn Ville are some of Holland Village’s shophouses. Business owners have also had to put up with a lot of inconvenience — including having their frontage hidden from view thanks to hoardings.

“But I am quite satisfied with LTA. At least there’s somebody to listen to our complaints and help solve our problems,” said Mr Adam Ng, owner of Joo Ann Foh Colour Service at Holland Village.

Pasir Panjang Station presented engineers with a combination of some of the challenges they had faced at earlier stages.

The station is located along Pasir Panjang Road, 30m below the surface and close to residential areas that comprise houses, low-rise apartment buildings and shophouses. There is also the Pasir Panjang Semi Expressway (PPSE), an elevated viaduct parallel to the station. The viaduct is also very close — just 10m — away from the station site.

“The main challenge we faced here was building a station without adversely affecting the sensitive structures around its periphery, given the challenging soft ground conditions,” said Mr Low Chye Chin, Project Director, Contractor Sembawang Engineers & Constructors Pte Ltd. “In this respect, LTA took proactive measures to protect the surrounding structures instead of allowing the adjacent structures to be susceptible to damage.”

“That’s the nature of the ground. Even the hardest granite can be weathered down to soil. What we’ve built will last decades, generations, but eventually, time and nature will triumph. As engineers, we will have to seek a harmonious union with nature,” Mr Chepurthy Veeresh, Geotechnical Engineer, commented.

The Holland Village station is situated in a bustling business and residential area, and will be a great convenience to residents and party-goers alike when it opens.

“The Holland Village station is safe when it was only 6m away from the edge of the excavation.”

Mr Ow Chun Nam, Director, Contracts 1, Downtown Line Stage 3 (former Director, Circle Line Stage 4), explained the challenges at the Willyn Ville Condominium.

“Willyn Ville was on good ground, but the fact that the excavation would be only 6m away meant that we needed to take as many precautions as possible. We tested the ground, took samples and when the digging began, we watched the walls very, very closely for deflection. Settlement is something that happens naturally — it can happen to any building, especially if it sits on soils like the Jurong Formation sort, which is made up of many types of material. The fact that buildings can have cracks on the ground seems to break up a little — all these are evidence of settlement. It can and does happen over long periods of time and is usually not of much concern. Movements in the earth, like from excavation, can also cause them earlier. And this is where you have to keep a look out for unusually large movements.”

Ms Lim Ai Hua, a resident of Willyn Ville throughout the entire dig period, said LTA did a good job.

“They were very good about keeping us informed and updated on what was happening. The green hoarding was just outside my window and I suppose the fine dust was inevitable. But when the tunnel was being drilled, I heard and felt almost nothing. It was not disturbing at all.”

“In general, I think they always responded promptly to our complaints and did whatever they thought necessary to correct the situation. Of course there were more things we’d have liked them to sort out, but on the whole, they were good about it.”

The new stations will bring more crowds for makan at the food centre and to my shop,” Mr Siow Kee Lin, 66, sundry shop operator at the Old Airport Road Market and Food Centre.

“After the new station opens, my wife and I will be able to get around easier and visit more places. This is afterall, what enjoying our retirement is all about,” Mr Georgie Chng, retiree, Bras Basah resident.

“Can’t wait for the whole Circle Line to open. Currently, I have to change trains at City Hall when I need to head east. Once the whole Circle Line opens, I can just take a train from Marymount to Paya Lebar and then switch to the East-West Line. The journey will be faster and more direct,” Mr Alan Foo, Shunfu resident.

It has taken almost a decade to complete the five stages of the Circle Line, with three years lost because of the disaster at Nicoll Highway. But that loss — of life and of time — taught LTA some very important lessons about safety management. Also, in the course of building the Circle Line, LTA engineers learnt much about working underground in extreme conditions. Whichever in Singapore future lines may go, LTA is ready with their experience and ready to break new ground.
Workers celebrating as the tunnel boring machine made the final breakthrough for the Circle Line. The toughest part is over, but the tracks still have to be laid and electrical works completed.
Excavation works for the construction of the tunnels adjacent to Nicoll Highway on Circle Line Stage 1 were progressing normally when an earth retaining wall used to support the excavation gave way at about 3.30pm on 20 April 2004. The incident site was about 100m from where the Nicoll Highway station now stands, not far from the Merdeka Bridge.
"For most of the men on the ground, there was no warning. The wall gave way and everything started to come down on them," said Mr Heng Chiang Hai, Project Manager, Downtown Line Stage 3, Civil Construction Team 2 (former Deputy Project Manager, Circle Line Stage 1).

The collapse resulted in a major soil subsidence that caused a zone of damage 150m wide and 100m long, and went down 30m, swallowing two construction cranes in the process. The structural slabs of the Merdeka Bridge were also damaged. All six lanes of the Nicoll Highway had to be closed.

“When we surveyed the damage, we were shocked. But we could not stay shocked. We had to act fast to make sure we had evacuated everyone and then prevent further damage,” added Mr Heng.

After rescue operations were ended, the collapsed area near Merdeka Bridge and the Crawford Underpass near Kallang Basin had to be backfilled. This was done urgently to prevent further ground subsidence to nearby buildings. Then the incomplete Nicoll Highway Station excavation site had to be filled.

The closure of Nicoll Highway caused massive traffic disruptions. Merdeka Bridge had to be repaired as soon as possible and by the end of that year, on 4 December, it was fully opened again to traffic.

ALL WORK STOPPED

Works for 16 of the 24 dig sites of the Circle Line were stopped on 24 April by the Ministry of Manpower and the Building and Construction Authority (BCA). The excavation works at the station and the tunnels under the highway were near major buildings such as The Concourse, Golden Mile Tower and Golden Mile Complex. The risk was too great.

The tragedy caused work on the first stage of the Circle Line to be significantly delayed. Instead of opening in 2008, it was opened in 2010. The station was moved about 100m away from the accident site and also reduced in size by a third. Originally, the Nicoll Highway station was to have been the end point of the Bukit Timah Line, but in its new position, it could not.

NO TIME TO GRIEVE

“The collapse itself was a traumatic event for many of us. People had died, including a man who was our colleague and friend, but we also had to quickly find solutions to make sure the damage did not spread,” said Mr Paul Fok, Group Director, Engineering.

“And even though the work had ground to a complete stop, we were not idle. All of us, LTA, BCA, contractors, designers, consultants – we pulled out all the stops and worked round the clock to find solutions. Where would the line run now? Where would the station be? How could we ensure the safety of the buildings and the safety of the area?”

But there was the problem of finding a new alignment for the Circle Line in that area. Initial proposals showed there would be unacceptable risks. The contractor, Nishimatsu Construction, appointed consultants to submit a proposal for new bored tunnels and a new station along a new alignment. Once this was given approval, Nishimatsu appointed all the consultants: Aecom Consultants (formerly Maunsell Consultants), Meindhart Consultants and Ong & Ong Consultants, to design the tunnels and station, which they managed in the tight deadline of a year.
Teams of SCDF officers were mobilised in an exhaustive and dangerous 3-day search for survivors. Sniffer dogs trained to track the scent of human beings and taught to bark when they discover someone also formed part of the search and rescue team.

A RECKONING FOR SOME

There were also major organisational changes after the main contractor, Nishimatsu-Lum Chang Joint Venture, as well as key LTA officers, were found responsible for the collapse by a criminal court. Other contractors and officers were either reprimanded or issued warnings. Together with BCA, LTA formulated stricter safety regulations for the construction of future MRT lines.

“It was not a matter of pointing fingers,” said Mr Lim Bok Ngam, LTA’s Deputy Chief Executive (Infrastructure & Development). “We had to find out how the problem had been allowed to grow and reach that catastrophic point. There were people responsible for it and whether it was our own staff or the contractor’s, people had to be called to account for their actions – or lack of it.”

A BETTER SYSTEM OF CHECKS

To ensure that there was a better system of checks, the contractor was no longer allowed to let its own staff design and supervise temporary works for excavation. These now had to be carried out independently by designers of the consultant.

“The contractor did everything they could to make the situation right,” said Mr Sim Wee Meng, Group Director, Rail (Circle & Downtown Lines). “Our new procedures also separated responsibilities. Things might take longer, there might be a lot more checks and counter checks. But better a delay than another accident, especially one with loss of life.”

The new tunnels were designed by Aecom Consultants, and Tunnel Boring Machines (TBMs) were bought from Japan. The work was supervised by a Japanese senior engineer and a tunnel manager from the United Kingdom. With close supervision from both the contractor team and the qualified person(s) team from Parsons Brinckerhoff, the ground settlement due to the tunnelling work was very low and no damage was caused to the adjacent buildings.

The abandoned tunnels also had to be destroyed. Again, special machines from Japan were used and Japanese teams fully crushed the tunnels so that there would be no obstruction to the TBMs.

To ensure that the ground was properly consolidated to prevent settlement of the bored tunnels over time, perforated vertical drains were installed by the contractor. Further ground improvement works were carried out near tunnel drainage sumps and cross-passages to ensure safety.
MITIGATING THE RISK
One key reason for the Nicoll Highway incident was the faulty monitoring instruments used to measure tunnel wall deflection. LTA, following a recommendation from the Commission of Inquiry, appointed an independent monitoring firm for the job, instead of letting the contractor handle it through its own subcontracted geotechnical firm. Contractors also now have to maintain a comprehensive Risk Register, identifying all hazards and taking mitigation measures.

“Ultimately, everybody – LTA, the contractors, the specialists we brought in – everyone worked really hard to set things right again. The past informs our actions, but we also had to get past that and move ahead,” said Mr Frederick Wong, Group Director, Safety & Contracts.

“We have to ensure that every worker goes home safe, at the end of each day. Building a people-centred land transport system is not just about the needs of our commuters, it’s also about the safety of our builders,” said Mr Lim Bok Ngam, LTA’s Deputy Chief Executive (Infrastructure & Development).

“Yes, it does seem a lot more complicated now. And yes, people can say this is all just lip service,” said Mr Ow Chun Nam, Director, Contracts 1, Downtown Line Stage 3 (former Director, Circle Line Stage 4). “But we know we are serious about it. So do the contractors. We even subject ourselves to external audit. And the safety record of the Circle Line since Nicoll Highway has been improving all the time. That does not come about from mere lip service.”

SAFETY FIRST
A slew of new safety protocols were worked out by LTA and BCA. These are the key changes made with regard to Engineering:

- Right from the start, a Project Safety Review is now used to identify and reduce risks at their source. Once hazards are identified, ways are found to lessen them at the design, construction and handover stages.
- Safety requirements are now set above industry standards. Examples include having at least a double scaffold access for emergency evacuation and at least one man-cage at each excavation area for rescues.

EDUCATE CONTRACTORS AND PROMOTE SAFETY
Now rules were not sufficient. The agencies felt that contractors had to be part of the safety enhancement process as well and motivated to abide by the rules. LTA also opened its practices and records to scrutiny by an external auditor.

- Contractors are now either rewarded or penalised under the Safety Performance Scheme.
- Every six months, contractors meet LTA to discuss issues like safety performance and challenges coming up, planning together to reduce the risks.
- LTA also runs a Construction Safety Management Course – a half-day course for Project Managers and Workplace Safety & Health Officers.

DUPONT AUDIT
LTA worked very hard to improve its safety record, and this shows in the improved safety rating it received following an audit by DuPont Safety Resources. LTA scored 4.07 points out of a maximum of 5.0 points in safety checks conducted in April 2009, placing LTA among the top 5 to 10 percent of organisations worldwide in terms of safety excellence.
On 16 August 2007, after work had resumed on the Circle Line, a 7-metre stretch of two lanes sank about 20cm close to the junction of Telok Blangah Road and Alexandra Road in the evening. BCA immediately stopped the tunnelling and revoked the contractor’s tunnelling permit.

It was the fourth stop-work order issued to the Circle Line that year. Although this slowed down work, the stop-work orders were vital to ensuring the safety of workers and the residents and passers-by in the area. It reflected the strict attitude of the agencies towards safety. There could be no compromises.

“You could say that we were put to the test,” said Mr Rama Venkita, Director, Contracts 2, Downtown Line Stage 3 (former Director, Circle Line Stage 5). “Were all our safety warnings and protocols just talk? Or would we really do everything we said we would do – even if it cost us time and money? Stop-work orders were frustrating. But if you want to maintain a high standard of safety, the alarms need to go off early.”

Challenges are inherent in all massive infrastructural projects, especially if these take place in difficult conditions such as those found underground. However, through good planning and preparation, communicating well with contractors, using top-notch equipment and methods and having uncompromising safety protocols in place, much of the risk may be mitigated.

“We will do whatever it takes to prevent accidents and prepare for emergencies,” said Mr Ng Kee Nam, Deputy Group Director, Rail (Circle & Downtown Lines).

“After Nicoll Highway, we went through our procedures with a fine-toothed comb and put right the loopholes that began the chain of incidents leading to the collapse. We introduced more checks and balances to ensure that standards cannot be bypassed.”

To ensure that the people on the ground always make decisions with safety as top priority, LTA conducts Construction Safety Management courses not just for its officers, but also for contractors, their managers, supervisors and the men doing the building. “Education, repeated often enough, for long enough, eventually becomes culture,” said Mr Ng.

Some lessons can be particularly harsh. Nicoll Highway was one – but it is one lesson LTA never wants to have to take again. LTA has done much – immediately after 2004 and in the years since – to continuously improve its processes, safety protocols and training, and move forward stronger than ever.

“We’ve learnt. We’ve moved on,” said Mr Ng. “But we must never forget.”
Construction is a massive undertaking that is noisy and disruptive – and the public’s patience and understanding are of paramount importance.

YOUR UNDERSTANDING, YOUR PATIENCE
“Ultimately, what LTA does is for people,” said Mr Chew Hock Yong, LTA’s Chief Executive. “Commuting is a part of modern city life and infrastructure like roads and MRT tracks and tunnels must be built. The challenge of course, is that not everyone benefits to the same extent from each project. Build an expressway and the people who do not drive may not benefit. Build an MRT line and the people who do not use the train may not benefit. The challenge lies in how to get them to see the bigger picture and support the project.”

TAKING CARE OF YOU

Mr Tay Chin Guan, Deputy Director of Project Communications said, “Finding ways to mitigate inconveniences like noise, dust and detours is just one part of the job. The other bigger – and I think tougher – part is getting people to see that everything is ultimately for them and even if the benefits may not seem obvious now, they will be there for their children. With infrastructure, you do need that long-term view of things. And you also do need long-term tolerance of the inconveniences. Our teams help prepare people for this.

“LTA works very hard to keep people who live or work near the affected areas informed. When people know what’s going on, they are reassured that things are safe and being taken care of. Gaining public confidence is important.”

SEEK TO UNDERSTAND

Although LTA’s engineers design solutions that minimise some of the inconveniences, people still have to take alternate routes. Hoardings will be up for a long time. Drivers will have to negotiate odd bends in the road while tunnelling goes on beneath the surface.

While building a people-centred land transport system, LTA needs to also be as people-centred as possible. Thus, LTA takes the views of the public very seriously and has a dedicated Project Communications team all set to talk to the people affected by the work. From these discussions, the team then works to find ways to either solve or minimise the problems.

“The community engagement teams’ job is also to help people understand — the need for the project, the reason why certain problems cannot be avoided completely – for example, noise – or the reason why things need to take so long,” said Ms Suzanna Goh, Director of Project Communications & Feedback.

“Understanding is a little harder to come by. Sometimes there are technical practicalities to consider, like the pouring of concrete – it cannot be stopped midway. But I think people understood and put up with things because I think they could see that we were trying very hard to take note of their feedback and then taking action where possible.”

“ULTIMATELY, WHAT LTA DOES IS FOR PEOPLE.”

Chew Hock Yong
Mr. Teo Chee Hean, Minister in charge of the Civil Service, highlighted LTA when commenting on the state of Singapore’s public service in the May–June 2008 issue of the public service magazine, Challenge.

“We need to look at process change and mindset change at the same time,” he said. “Take, for example, the Land Transport Authority (LTA). In the past, if a community leader or member of the public had a suggestion to improve traffic flow in his town, he would write in to LTA and the roads people would consider it from a road engineering point of view.

“LTA restructured the process. Rather than just examine the issue along functional lines, LTA assigned officers who would be responsible for each town or area. This process change followed a mindset change which came from saying, ‘Let me put an officer there to work with the community to understand what the problem is, and how we can solve it.’ The LTA officer can bring his professional knowledge and match that with the more intimate understanding of the actual ground situation to address the issue in a more holistic way, working with the community to find the best solution.”
The Circle Line Discovery was a time of fun and games for commuters of all ages.
The community, Advisors to Grassroots Organisations (GROs) and LTA management enjoying a sneak preview of the Circle Line.
A PART OF OUR LIFE

“A big project like an MRT tunnel dig outside your home is really quite an eyesore,” said Ms Jenn Tan, a junior college student. “I live at Farrer Road and for I think about half my life, there was this work going on under the main road outside my flat. There was noise, lights, heavy traffic. Almost all the time.

“But sometimes, I saw these LTA officers coming by to talk to residents. Sure, there were days when I felt like asking my parents to send me to boarding school. But to be fair, things were always within reasonable limits.

“I thought when the dig was done, it was over. But guess what? Now there’s a dig going on in my school! But again – I’ve seen those LTA officers come over. They’ve had an exhibition in my school. And my teachers tell me LTA does go to great lengths to make up for our loss of use of the school field and things like that. Like they don’t do noisy work when there’s exams on.”

Jenn’s father, Mr Henry Tan, laughed when he heard Jenn say the dig had been on for half her life.

“I think that’s quite true actually. And when they finally moved everything away while I was away on business, the emptiness was quite startling really. I think on the whole, my family and neighbours just learnt to deal with it and eventually, that dig just became a part of our lives. It became part of the landscape, the soundscape.

IN TOUCH AND IN TUNE

During the construction of the Circle Line, residents were kept up-to-date with regular circulars and brochures. But sometimes, having an LTA officer listen to your problem was even better. The Project Communications team organised dialogue sessions and put up exhibits at block parties and community days.

“You need to explain the project, its potential problems and potential benefits,” said Mr Tay Chin Guan, Deputy Director, Project Communications.

NOISY NEIGHBOURS

Noise was one of the problems raised. At the Ramakrishna Mission in Bartley Road, for example, residents complained about the noise from the machinery.

“We installed double-glazed windows and noise barriers to reduce the noise from the nearby construction work,” says Mr Tan Kian Thong, Director, Downtown Line Stage 2, Civil Construction Team 2 (former Director, Circle Line Stage 3).

Exhibitions and discussions are key sources of information and feedback for LTA.
How long did the construction for each stage of the Circle Line take?

- CCL1: 8.5 years
- CCL2: 7.5 years
- CCL3: 5.7 years
- CCL4 & 5: 7 years
IT’S HOME AFTER ALL

But what if the solution were far more expensive? One example of LTA going the extra mile to treat people fairly was at Jalan Rindu. There, five terrace houses had to be torn down because their piles were in the way of the tunnel that was being bored below them. For the safety of the affected families, temporary homes elsewhere were found for them.

The five houses were torn down – and rebuilt. But this time, with new foundations that were out of the way of the tunnels. When the families returned, they went home to brand new buildings. They were delighted – as was Mr Seah Kian Peng, the Advisor to Braddell Heights GROs.

The Corporate Communications team threw a homecoming party for the residents – Mr Seah, grassroots representatives and nearby neighbours were invited.

WELCOME TO OUR WORLD

Given the enormity of the project and its long time frame, residents sometimes got curious about what exactly was happening behind the hoarding – or beneath their feet.

To give them an insight to the work that was surrounding their world, LTA also conducted site visits for residents. The visits were popular and many, like Mr Zainudin Nordin, Advisor to Bishan-Toa Payoh North GROs, came away impressed. He said: “I think it was very useful in the sense that we discovered the kind of work that was being done in the tunnel, the importance that's been placed on security and safety, and the cleanliness of the work site.”

Civil Engineering lecturer Mr Tan Poh Seng said his students benefited from the exposure. “It will definitely help them in their studies as well as their future career.”

Deputy Prime Minister Teo Chee Hean, during a visit to the Botanic Gardens Station in 2008, said: “It’s important for all of us to see the work so we don’t think the lines just appear!”

Mr Ng Cher Pheng, Pasir Ris West Citizens' Consultative Committee (CCC) Chairman, said he and his grassroots leaders appreciated the visit very much. “I’m totally impressed,” he said. “There’s nothing like being underneath the work site to see how hard the people are working. It helps us to explain to people in the community what’s happening.”

Deputy Prime Minister Teo Chee Hean during a visit to the Botanic Gardens Station in 2008. (Photo: LTA)

For others, like Madam Chua Ah Ber, a resident from Shunfu estate, a site visit was an opportunity she could not pass up. She was one of those who had the chance to visit Marymount Station in July 2008. After the visit, she said: “Although I am 77 years old and my legs are wobbly, I still signed up for this tour. This is the only chance for me, at my age, to visit the station first hand. It has been a rare opportunity and experience for me. I would also like to thank LTA for the efforts in constructing the station. The station is very near to my house and the house value has gone up by a large bit because of the proximity to the station. This has made the inconveniences which we experienced during the construction period insignificant.”

“We are also thankful to LTA for listening and addressing the residents’ concerns during the construction period. With the completion of the station, we are all very happy. Once the station opens, it will bring a lot of convenience to the residents,” said Chairman for Shunfu Residents’ Committee, Mr Tan Kia Tan.
KEEP LISTENING TO FEEDBACK

Shortly after the Circle Line opened the Bartley to Marymount stretch in 2010, LTA began to receive feedback about it from commuters.

“We’re having problems finding our way around in the new stations,” one commuter complained, echoing the sentiments of quite a number.

In response, LTA met grassroots leaders to get a better idea of the problem before deciding on what needed to be done. So on 13 March 2010, they came together to discuss what could be improved before the next part of the line came into service on 17 April 2010. In all, 21 grassroots leaders representing areas around the 11 stations from Dhoby Ghaut to Bartley attended the tour.

Said Mr Kenneth Lee from the Tanglin-Cairnhill Constituency: “LTA has really gone the extra mile to gather feedback from the grassroots leaders who are also commuters.”

Ms Lily Teo from Mountbatten agreed. “I think it is great to have such visits prior to the opening so that LTA can identify the needs of commuters. It is such attention to details which will improve a commuter’s travelling experience.”

The feedback was important when the next stage opened on 17 April 2010. This time, the MRT operator, SMRT, put up more signs to make sure commuters did not get on the wrong trains. There were also 16 “service ambassadors” at the interchanges for the whole week to help give commuters directions.

“The first and second day were a bit confusing,” said service ambassador Ms Pamela Chin. “People were curious too. But today, it’s a bit more under control.”

Despite the initial confusion about directions, commuters still said having the Circle Line saved them time.

For security supervisor Mr Zai Ramli, the commute to work used to take him an hour – and three buses. With the Circle Line, it is now one feeder bus and one train – all in 25 minutes.

“The stations also look modern and nice – and the trip to work is now more pleasant,” he said.

For some, the time savings are not great. Mr Lim Hui De saves just 5 minutes by using the Circle Line. But he gets to sit down for his ride.

“The morning crowd is crazy if you are taking the red line (North-South Line) but if you take this Circle Line, it is really a lot better,” another commuter agreed.

“I am surprised that it is not too crowded even during peak hours,” said another. “It is comfortable, and I don’t really feel the congestion.”

Site visit to Circle Line Stage 4 – an unforgettable first-hand experience!

How many enquiry and feedback calls does LTA receive in a year?

1 year =
12 months
365 days
8,760 hours
≈ 114 calls per hour
On 7 June 2008, Thomson residents had the rare opportunity to visit Marymount Station. They were shown non-public areas such as the ventilation room and monitoring systems room. LTA officers explained how the systems worked as well as how their features ensured the safety of commuters. Participants also got a chance to walk along the cross tunnel.

With the residents were Advisor to Bishan-Toa Payoh North GROs Mr Hri Kumar Nair, members of the Thomson CCC and various grassroots leaders. The tour included a visit to the LTA Transport Gallery, which showcases the changes in Singapore’s public transport systems.

Said Advisor to Bishan-Toa Payoh GROs, Mr Zainudin Nordin, of a visit he made: “It was very useful in the sense that we discovered the kind of work that was being done in the tunnel, the importance that’s been placed on security and safety, and the cleanliness of the worksite is amazing. I thought work like tunnelling would involve a lot of mess and all that, but what we saw was very clean, and the technology that was being used was also the latest.

“And the explanation about the progress, the importance about preserving the environment, and how the work is being done is also something which is very useful for us to know. I think the grassroots leaders will be able to share the knowledge and the information with the residents, so that residents can understand and they will be more aware. It will be very helpful for them to understand because the tunnel will go through their estate, and will go under their houses. So this will help them and will also reassure them about the safety and security of the tunnelling works in the Bishan area.”

(Facing page) Project engineers briefing residents on safety procedures before the tour.
(Top left) The tour begins!
(Top right) Engineers explaining how various machinery work to make LTA’s job easier.
(Left) Walking through the tunnel.
(Top left) Students from Singapore Polytechnic taking a tour of the work site.
(Top right) Advisor to Bishan-Toa Payoh GROs, Mr Hri Kumar Nair, with residents at Marymount station work site.
(Bottom left and right) Residents visiting the Lorong Chuan station work site.
From 26 March to 9 May 2004, LTA invited people to give suggestions for station names. Can you figure out which names were suggested for which stations?

| Yellow | Chola   |
| Red | Tulip   |
| Blue | Neptune |
| Green | LongSands |
| Pink | Fair Wool |
| Purple | Saturn |
| Pink | Zheng He |
| Pink | Takshila |
| Pink | Sunflower |

ANSWER:

- Yellow - Kent Ridge
- Red - Holland Village
- Blue - Farrer Road
- Green - Labrador
- Purple - Pasir Panjang
- Pink - Botanic Gardens

**Thank You for your patience and understanding**

While the engineers worked to mitigate the practical problems of traffic diversion, the Community Engagement teams worked to win the hearts and minds of a nation. And from the smiles and cheers, it appears they won.

As Ms Veronica Er, a Dakota resident says: “In the beginning, we felt the inconvenience. But I accepted it. If I want the MRT, I have to accept that inconvenience, right? After all, at the end of it, I enjoy the fruits.”

“I think community engagement really reaches its high point when people also give you their support,” said Mrs Tammie Loke, Group Director, Corporate Communications. “Over the decade, the Community Engagement teams have had great moments when thousands of people have showed up for events, signed up to take their tours, gone on familiarisation visits. We’ve had letters from people thanking us for the experience, for the explanations, for the road, the tunnel or the track that’s finally open. For us at LTA, it’s a great feeling because it was all for the people anyway.”
CIRCLE LINE PHOTO COMPETITION 2010

The Circle Line is more than just a way to get from one place to another. Stations are in themselves architectural works of art and their surfaces are the backdrop to the life that flows around them.

The Circle Line Photo Competition of 2010 gave people a reason to pause, to look – and then to see. Not just the beauty of the station, or the trains or little features that individualise the stations, but the fact that it was ultimately, their station.

1st Prize: Suhaimi Abdullah
2nd Prize: Ng Yean Fong
3rd Prize: Bernard Pan
Merit Prizes: Chua Teaw Eng, Lee Kia Jiam, Tan Ai Bee
The rails are in. From the outside, the stations look very nice. So why aren’t the trains running yet?
Mass Rapid Transit systems are extremely complex in nature, consisting of many sub-systems. Each one needs to be checked and re-checked to make sure everything is working well – and working well together. Failures in any part of the system have the potential to disrupt the entire line, making it extremely inconvenient for commuters.

**MAKING SURE IT WORKS FOR YOU**

“The testing and commissioning process takes between 12 and 18 months,” said Mr Sim Wee Meng, Group Director, Rail (Circle & Downtown Lines).

In this period, LTA has to test and commission many systems to ensure everything works perfectly together before the trains can begin service. Systems include the driverless train system and its control centre, and the power systems that move the trains and power the lights and ventilation systems on the trains.

“After turning on the power supply to the equipment, we have to carry out thorough checks and rigorous testing to pre-empt all kinds of foreseeable failure scenarios. This ensures that the electrical and mechanical (E&M) systems can function to support the railway operation with emergency systems and back-up supply,” said Mr Goh Eng Joo, Deputy Director (Services), Circle & Downtown Lines.

“Rigorous tests have been carried out to confirm that all station lighting, station signages, air-conditioning systems, ventilation systems, fire protection systems, lifts and escalators, amongst other systems, will work as planned and under emergency situations to provide commuters with a good travel experience. It goes without saying that the other systems like faregates and platform screen doors have been similarly ‘stress tested’ too, to see that they work impeccably and safely,” added Mr Goh.

“But testing takes time,” said Mr Sim Wee Meng, Group Director, Rail (Circle & Downtown Lines).

“Based on lessons learnt from the implementation of the North-East Line, it has been envisaged that a lot of engineering and testing effort and time will be required to integrate the core systems (trains, signalling, communications and integrated supervisory control systems) to establish a safe, reliable and fully integrated system. As such, extensive pre-delivery systems integration testing outside Singapore was carried out to eliminate major system interfacing problems even before site testing commenced in Singapore.”
How many passengers can each Circle Line train carry?

ANSWER:

931 passengers in the three carriages.
SOMEONE’S WATCHING OVER YOU

The Circle Line is fully automated. It has no drivers – at least not on board the train itself. Trains are controlled directly from the Operation Control Centre (OCC).

Said Mr Yee Boon Cheow, Deputy Director (Systems), of the OCC: “The Operation Control Centre or OCC is manned 24/7 to monitor the status of each individual train (e.g. position and movement) and other equipment on the line. Any incident would be immediately picked up by the OCC operators and managed accordingly as they are able to view the situation using the closed circuit television and if required, communicate with the commuters.”

THE PHYSICS OF SAFETY

Testing clearly cannot be static. Trains are not tested only while stationary at Kim Chuan Depot. They need to be tested on the move too. For example, is there a difference between trains with passengers and trains without? Given that each train on the Circle Line can carry just over 900 passengers in its three cars, variations in weight are an important consideration.

“I suppose someone can say we could have just extrapolated from a few data points,” said Mr Chia Choon Poh, Senior Project Manager, Rolling Stock. “If this were simply a train simulation, like those video games so popular in Japan, well, I suppose we could have. But in the real world, where real mechanical and electrical devices are concerned, there are far more variables, some of which might be difficult to anticipate. For example, how much more heat might braking generate as the weight goes up? Beyond a certain temperature, brakes lose some effectiveness. How much more braking effort to apply as the weight goes up? Too much effort might affect the comfort of the ride. How can we account for these? So we test, test and test, collect as much data as we can, and over the long period of testing, also subject all the systems to wear and tear and maintenance cycles. This way, we can be sure.”

GETTING THE TRAIN TO YOU

The Circle Line was not opened all at once. In an effort to make its benefits available as soon as possible to the communities it passed through, the Circle Line was opened in stages. This, however, presented the testing team with some challenges.

With the Bartley to Marymount line being the first to open, they had to work out a way to carry out testing for the other stages of the line without affecting the Bartley to Marymount service.

“We wanted to put part of the line into service as soon as possible,” said Mr Ong Boon Ann, Director, E&M (Circle & Downtown Lines). “We wanted commuters who had waited so long and given us their support despite all the inconveniences, to have the convenience of the line as soon as it was possible. So here, we had the Circle Line Stage 3 ready to go – why wait another year or year and a half before making it available?”

“So yes, testing the other stages while Circle Line Stage 3 was in revenue service has required more work, but we got Stage 3 to the commuters. There was also the benefit of running only a small segment of the line first. The operator would then be able to fine-tune procedures and give us feedback for the rest of the stages.”
TRAIN TRIVIA

- Top speed: 90km/h, but operational speed is 80km/h. The older trains move at 70km/h.
- The French-made Alstom Metropolis train is made up of only three cars. Total length – 70m.
- Each train weighs 120 tons.
- There are 146 seats and 2 wheelchair spaces. The first car has green seats, the middle car has blue seats, and the final car has maroon seats. (Useful if you are trying to meet a friend on the train!)
- Each car has eight doors, each with its own emergency handle switch.
- The emergency ventilation system is good for 45 minutes and the train has a fully redundant train management system.
- There are also “detrainment” doors. These are on the face and rear of the train and open like jaws in an emergency. A ramp is released and passengers can get out that way.
- The train is also equipped with smoke and heat detectors. And yes, it can be controlled by a driver if necessary and has a special low emergency speed of 18km/h.

The trains were part of C830, the contract for the provision of various systems such as trains, signalling, communications, control and power that make the trains run reliably and safely. Alstom Transport Asia-Pacific Region was the contractor responsible for this.

Said the company’s Senior Vice-President Mr Dominique Pouliquen: “With the strong partnership between LTA and Alstom, our teams, together with ST Electronics, were able to complete and hand over all stages of the Circle Line system on time and ahead of schedule for Stages 4 and 5 – this demonstrates our commitment to contribute to LTA’s plan and its successes.”
Kim Chuan Depot is the station that the commuter will never see. But the Kim Chuan Depot is 17m underground. What’s more, it is also the largest underground rapid transit depot in the world and can stable up to 77 trains of three cars each.

It is from here that they slip out almost silently every morning to run their routes and it is to this place that they come home to rest. Here, crews will work overnight to clean them, carry out checks and maintenance and prepare them for the next day’s work.

The depot was deliberately situated underground to maximise the use of space. The land above the depot is now vacant, but a building up to 9-stories high can be erected safely over it.

“Kim Chuan Depot is a minor engineering marvel,” said LTA Chairman Michael Lim. “The depot is a showcase for the wide-ranging expertise of the LTA from engineering and construction, to IT. You can imagine that it is not easy to design and build a complex underground system that can stable up to 77 trains, but that is exactly what we have done.”

The depot itself had to be thoroughly tested too. Being underground, fresh air intake, exhaust and smoke extraction are vital to the safety of the crew who work there. Fire systems incorporated into the entire structure also had to be tested fully.

**READY FOR EMERGENCIES TOO**

Testing and checking does not apply only to hardware. Systems and procedures must be tested too – especially those needed in an emergency.

As the last train completes its final run and heads back to Kim Chuan Depot, the other trains have already come in. Crews perform meticulous checks on the trains. If there are repairs to be made, the crew can get a part in just about 4 minutes, thanks to the fully-automated storage and retrieval system.

This gigantic rack is 23m high and has a floor area of 720 sq m. It can hold up to 24,000 individual spare parts. Once checked and maintained, the trains are cleaned. Even washing is automated, thanks to a machine that looks like a giant carwash. Interestingly, this is a “car” wash that is self-propelled and even provides a choice between a wash with or without detergent.
The Automatic Storage and Retrieval System, located at Kim Chuan Depot is the tallest underground automated warehouse storage system in Singapore. The 23m-high system is the central warehouse for the Circle Line and can hold up to 24,000 train spare parts.
A train going through the automated trainwash.
About 2.16 million cubic metres of earth was excavated in the construction of Kim Chuan Depot. The size of the Depot is equivalent to about 17 football fields! Much of the earth excavated was transported to Pulau Tekong for projects by the Ministry of Defence.
The Operation Control Centre in Kim Chuan Depot is the “brain” controlling the entire Circle Line system.
During such tests, LTA is assisted by the Singapore Civil Defence Force, the Singapore Police Force and many volunteers who role-play as passengers or victims.

Said Mr Teo Ser Luck, Minister of State for the Ministry of Trade and Industry and Mayor of North-East District (former Senior Parliamentary Secretary of the Ministry of Transport and Ministry of Community Development, Youth and Sports) of a 2009 exercise before the opening of the first stages of the Circle Line: “Today’s emergency exercise was an excellent opportunity for residents in the area to learn about safety procedures in a realistic setting.”

“In all, I think we’ve built a really first class system for the Circle Line,” said Ms Kock Yen Hui, Senior Project Manager, Signalling.

“The testing and commissioning work that we have conducted is not just to satisfy ourselves that the system delivered is safe, reliable and meets the expectations of the authority and operator as well as the commuters of Singapore. The Circle Line team put in effort in delivering the best product possible for our commuters. It is a moment of real pride when the testing and commissioning is over and we sign-off and hand over the system to the Operator.”

Testing and commissioning are absolutely necessary before service is opened to the public. And every night, while Singapore sleeps, a daily test and maintenance cycle is carried out to ensure that the system will work flawlessly the next day too.

You can expect no less.
Officers from the Singapore Civil Defence Force (SCDF) evacuate “casualties” of a train explosion during an emergency exercise on 23 March 2009.
All Circle Line trains can be remotely driven from the Operation Control Centre. However, if necessary, they can also be driven from inside – there’s just no seat for the driver. This is why Kim Chuan Depot and the entire Circle Line is equipped with such lights, just in case – an on-board driver would need signal lights!

**ATTENTION**

In the depot, the amber signal light means “GO” and the red signal light means “STOP”. There is no green signal light!
The full Circle Line is now ready for passengers, such as the breathtakingly beautiful Bras Basah station and inspirational Stadium station.
You will be riding on the French-made Alstom Metropolis train, the latest rolling stock running on the MRT network. Completely automated – or driverless – these three-car trains will zip you from station to station in smooth and almost silent comfort.

**DHOBY GHAUT: AN OLD FRIEND RENEWED**

Dhoby Ghaut is an interchange station with three lines passing through it – it’s quite a conversion from its original status as a single station on the North-South Line. But thanks to efficient layout and clear signage, navigating this station is not a problem at all.

Passengers coming from the North-East Line have a long underpass to walk through, but they could also take a glide on some very long travelators. The Circle Line from the North-South Line is just a short escalator ride away.

Ms Chan Mei Chen, a teacher, finds the new-look Dhoby Ghaut impressive.

“The station is so huge now and it’s been beautifully redesigned,” she said.

**BARRIER-FREE ACCESS**

Common to all stations is LTA’s commitment to providing Barrier-Free Access to all MRT stations. Since the Circle Line is new, commuters can expect all of these features to be already in place.

- Ramps at taxi stands and drop-off points help wheelchair-bound commuters move easily from the road to the path to the station.
- Wide faregates make moving a wheelchair or big bags through a cinch.
- Those with problems getting from the entrance to the concourse can use the lift. Every station has at least one.
- The visually-challenged have tactile tiles on the floor to guide them.
- Disabled-friendly toilets are available at all stations too.
- Designated areas in train cars for wheelchair users.

Interchange stations at Dhoby Ghaut, Paya Lebar, Serangoon, Bishan, HarbourFront and Buona Vista have routes that lead to other rail lines designed with wheelchair users in mind. There are lifts, of course – and clear signs to lead people to them.
Which station is the busiest on the Circle Line?

ANSWER: Bishan
In the heart of Singapore’s civic district is Bras Basah station. At 35m deep, it is built into the level of rock called the Kallang Formation, which overlies the Fort Canning Boulder Bed. It’s that deep because it has to go under and across the East-West Line beneath Victoria Street.

Mr Desmond Ong, a postgraduate student at SMU, thought the pool was a water feature that was part of the garden – until he went for his interviews at SMU. “I was awestruck. It was really beautiful and I did not know that there was this MRT station right under that pool!”

A fellow SMU student, Mr Ng Jin Han, said: “It’s easier for me to get to SMU now that the Bras Basah station is open. Right next to school!”

WOHA Designs, the architectural firm responsible for Bras Basah, also designed Stadium station – and both designs won prestigious international awards. Bras Basah was named “World’s Best Transport Building of the Year” under the transport category at the World Architecture Festival in 2009. Stadium won an award for International Architecture given out by the Australian Institute of Architects in 2008, as well as a design award from the Singapore Institute of Architects.

Both stations were the result of a design competition in 2000 organised by LTA and the Singapore Institute of Architects. It attracted entries from all over the world. Called the Marine Line Architectural International Design Competition, it was the first time LTA had organised a design competition for its MRT stations.

“The purpose of the competition was to attract new talent. This was the first time LTA had organised a design competition for its stations,” said Mr Andrew Mead, LTA Senior Design Manager, Architecture.

“The contest called for designs for these two stations in particular as they offered different challenges,” says Mr Mead, who has worked on the Circle Line since 1997.

“Bras Basah station is at the heart of the civic district and it was a strategically important station,” he says. “Stadium station had to respond to surge crowds from the surrounding stadiums.

“One of WOHA’s founding directors, Mr Richard Hassell said, “The stations were inspired by European train stations of the 19th century – where train stations were grand, inspiring spaces that gave commuters a really exciting architectural experience as part of their travel or commute.”
“You no longer need a car to go shopping now,” said Ms Grace Fu, Admin/Project Executive. “Especially if you’re not going to buy too many things but just want to window-shop and meet friends for tea. All you need to do is take a train to Orchard Station. From that station, you can walk under shelter to quite a number of places around that junction. It’s the same one stop further with Somerset. And then there’s Dhoby Ghaut and Esplanade… traffic, parking fees and the ridiculously short drive between malls just don’t make driving worth it. Too many malls, too little time! What’s a girl to do? The train helps.”

Ms Victoria Ang, another business executive agrees. “I’ll go one further and say I don’t think a car is necessary for anyone anymore, given the extensive network we already have and the upcoming lines.”

Like many other interchanges now, Esplanade features the “Xchange”, a small shopping mall within the station itself, just past the faregates and extending towards the other buildings in the area. Esplanade station is linked to Raffles City, One Raffles Link, Suntec City and Marina Square.

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“YOU NO LONGER NEED A CAR TO GO SHOPPING NOW.”
Grace Fu

Not every station looks as dramatic as Stadium, but all stations are designed with safety, comfort and convenience in mind. The other stations do need to look quietly high-tech too, in a way that will not go out of style anytime soon.

Besides cost, there is also another reason why it is good for stations to have a standardised look and layout – it makes it easier for commuters to find their way around.

While it is simpler to build a standard station for lines that are above ground, putting a station underground presents different challenges. As a result, no two underground stations can look exactly the same.

“The main thing is to have a station that works, that integrates well with the other lines in the interchange, for example,” said Mdm Neo Bian Hong, Director, Design.

“But once that is settled, there is some room for creative expression in terms of colours, textures, finishes. We consider the integrated artwork – what are the predominant colours, for example? Sometimes, there is a need for the features, like the Y-shaped columns that support some of the stations such as Paya Lebar. What sort of panels do we have for ceilings? That can vary too – sometimes flat metal panels, other times, the ‘airfoil’ design. We can put in sweeping curves in some places, other places require straight edges. But sometimes, you want something quiet and understated too.”

IS EVERY STATION DIFFERENT?

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At the opening of the first three stages of the Circle Line, various activities – from catwalks to story-telling sessions – were organised to entertain the throngs of curious Singaporeans who flocked to see the new line.
STADIUM STATION: HEAR US ROAR

The award-winning Stadium station is built in an area surrounded by the Indoor Stadium, Kallang Theatre, Leisure Park and the new National Stadium. It is built on a tiny sliver of space, but still pays a grand tribute to the spirit of sport.

You can actually see from one end of the station to the other – and high above the faregates, are giant images of athletes in action. As you come out of either end, the passage widens – a great idea for handling large crowds when either important matches or concerts are on. The only thing missing now is a great soundtrack like the Kallang Roar.

Mr Desmond Ong, postgraduate student, is too young to remember the Kallang Roar, but he has been to enough concerts at the Singapore Indoor Stadium to know how difficult it was to get to – and get away from after a show.

“Stadium really works out for people like me. I don’t drive and after paying for concert tickets, there’s not much left for cab fare. So having the MRT at Stadium is really perfect for me.”

Desmond Ong

I DON’T DRIVE AND AFTER PAYING FOR CONCERT TICKETS, THERE’S NOT MUCH LEFT FOR CAB FARE ... THE MRT AT STADIUM IS REALLY PERFECT FOR ME.”
The Circle Line, in some ways, the “arts and heritage” line of the MRT network, because of its passage through some of Singapore’s most important art and heritage venues and beauty spots. LTA has taken it a step further and made some stations and trains art venues in themselves.

The Circle Line’s Art in Transit features Art Seats and Integrated Art. Art Seats are installed at all interchange station platforms on the Circle Line – Dhoby Ghaut, Paya Lebar, Serangoon, Bishan, Buona Vista and HarbourFront. These whimsical pieces of furniture serve two purposes: to arouse curiosity and spur inspiration. But they are also great for sitting on!

The Art Seats came from an international design competition launched at the Venice Biennale in 2006. Integrated Art is, as the name suggests, built into the stations themselves as far as possible. Thus, instead of aluminium or glass panels, commuters will see works of art installed in their place.

Each of the 28 stations on the Circle Line is home to a unique work. Twenty-two were commissioned while the other six were competition-winning artworks.

To help create this collection, an eight-member Art Review Panel judged the competitions and provided guidance and support to artists, advising on how to develop artwork that could be displayed in the environment of an MRT station.

Mr Kwok Kian Choo, Chairman of the Art Review Panel and Director of the Singapore Art Museum said the Circle Line Art in Transit programme had yielded a fine collection of work by local artists.

“The quality is achieved through the strength of the artistic proposals as well as collaboration by multiple parties in the course of realising the works. Beyond the aesthetics of ‘beauty’, public art is also about social renewal, civic pride, public enjoyment, environmental improvement, and a clear relationship between the art and the local geography, features and communities.”
For Stadium station, the whole station is a piece of art; other stations have a more understated approach, with the artwork confined to the lift shaft – such as for Holland Village station.

The artwork at Esplanade station features stylised nostalgic scenes of the Esplanade area in the old days – a gentle reminder of the history of the place.

Splat! The large black splash on the floor leads the eye up to the mirrored drops hanging from the roof of Promenade station.
How much electricity would you need to move one train (all lights and air-conditioning on) down the full loop of the Circle Line?

ANSWER:
The electricity needed to move one train is about 462 kwh - which could power 4,620 lightbulbs for an hour!
Many MRT stations have been hardened to serve as Civil Defence shelters in wartime. In 1983, nine underground MRT stations on the North-South and East-West Lines were first hardened as public shelters. Today, there are 33 such shelters on the North-South, East-West, North-East and Circle Lines.

The Circle Line shelters are at:
- Mountbatten
- Dakota
- MacPherson
- Bartley
- Lorong Chuan
- Bishan
- Caldecott
- Botanic Gardens
- Buona Vista
- Haw Par Villa
- Labrador Park

Stations that are designated as shelters have special design considerations, apart from the necessary hardening. (CD shelter structures and fittings must be able to handle a force of 12g in all directions. 1g is earth gravity. 12g refers to 12 times the force of earth’s gravity.) Botanic Gardens, for example, must be able to accommodate up to about 7,000 people below ground and still have sufficient ventilation. Wall tiles also need to be specially secured with metal bindings as well as epoxy so that they do not fall on people. CD shelters must also have extra generators that will provide the operational power requirements during emergencies as the station will stop taking power from the main grid.
A special gate has been built for direct entry from the station to the Gardens. But before you leave the station, take a few minutes to look around. The moment you get off the train, look for the water feature – it covers an entire wall at one end of the platform. Above the platform doors are the panels of the thematic artwork. Let the peaceful green and earth hues of the station get you in the mood for a leisurely walk in the park.

“It can be difficult getting a parking lot at the Botanic Gardens,” said Ms Diana Phee, a business owner. “Especially early in the morning or evening. So having the train is nice. And I guess walking to the station and all that is just part of the overall green and healthy idea, right? The station is quite pretty too.”
The HarbourFront station is – depending on the end you start from – the start or end of the Circle Line. There have been suggestions that a line be built to connect HarbourFront to Promenade. Should that come to pass, the Circle Line will be a truly full circle. But as it stands now, the Circle Line is complete.

“The land transport system is not just about building more rail lines or adding more trains and buses to the network,” said Minister for Transport and Second Minister for Foreign Affairs Lui Tuck Yew in a June 2011 speech. “It is also about how it serves the needs of our people. Every day, millions of trips are taken on our trains and buses. Making our system one that is centred on people is an ongoing journey.”

When a project the size of the Circle Line is carried out over such a long span of time, it is not only the men and women of a single agency that are involved. Besides the contractors, there are many other government agencies that bring their specialist knowledge and skills to the project.

But above all, the understanding, cooperation and support of the public are also vital.

For all that, thank you. The line is open. The line is yours. It has always been.
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Branson anDrew gerarD • BUSTaMaM Bin Koshni •

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chong cheong heng • chong chong siang • chong Jeow Koon • chong Jia chYi • chong Kah leUng, soloMon • chong Kheng JoKe • chong
nath • DhanDaPani PrithiViraJan • Dheera chatterJi • Dinesh s/o achratlal • Ding woon Keong • DoBBala raMesh • Dong weihao DerricK •
chUa Kee tecK • chUa KhiM hong freDa carMen • chUa Kian tiong • chUa Kien tiong • chUa laY Peng • chUa lee ching • chUa lee hong • chUa
hUat • foo teK shYong • foo toon Yong • foo YUng thYe henrY • foong KoK wai • foziah Binte MUsa • francis sUMaDhi • freDDY ng wei siang •
KaY lian, Karen • goh Keng swee saMUel • goh Kheng leong • goh Kian hUat • goh Kian hUat • goh KiM hUaY, alethea • goh KiM hwa • goh
goVinDaraJoo YUVaraJ • gUaM JU hao, JoshUa • gUan Peishan sharon • gUan saU Kwin • gUo DongBin • gUo zeQin • gUo zhao zhe • gUrMeit
song • goh YocK Kin • goh YocK wen • goh zi Xin • goh-chin soo Keow • goPala Krishnan s/o KUPPUsaMY • goPalsaMY raViKUMar •
KiM Pin • goh KoK eng • goh KoK hin • goh KoK hUn • goh KoK hwa • goh KUng gYee • goh Kwee hUi • goh lee Ming • goh lian wee • goh lin
seng •

H
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