

A CONNECTED & INCLUSIVE CITY



To make Singapore a great city to live, work and play

A CONNECTED & INCLUSIVE CITY

SINGAPORE URBAN DESIGN GUIDEBOOK

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FOREWORD THE PUBLIC REALM - THE SECRET SAUCE OF SUCCESSFUL CITIES

Dear urban designers, planners, do-ers, and dreamers,

It is with great enthusiasm and honor that I present this insightful volume of Singapore's Urban Design Guidebook, focusing on the theme of "A Connected and Inclusive City," drawing on the remarkable experiences of Singapore – a city whose dedication to innovative and thoughtful urban planning resonates strongly with our endeavors in New York City.

In June of 2024, I had the incredible opportunity to visit Singapore for the World Cities Summit* to meet with city planners and managers from around the world. The experience opened my eyes to the ways in which our cities, while thousands of miles apart with different cultural histories and governance structures, have much in common. We are connected by a singular conviction that the secret sauce to the success of cities is its public spaces. We are connected by the pursuit of creating vibrant public spaces for all.

As the first Chief Public Realm Officer for the City of New York, I am tasked with coordinating the constellation of public and private entities that oversee our public spaces. Three key areas define our public space work:

Hardware: Expanding the public space footprint across five boroughs especially in underserved communities with least access to open space.

Software: Cutting red tape for partners so they can help city government clean, maintain, and activate public spaces.

Org-ware: Coordinating, planning, and managing public space projects and policies across whole of government agencies and offices to ensure we deliver improvements on time and on budget.

As you explore the pages of this book, you will discover how Singapore, a city renowned for its forward-thinking urban design, has embraced these principles to create spaces that are both connected and inclusive. The parallels between our cities are striking, and the lessons shared here offer valuable insights into how thoughtful design can transform public spaces into vibrant, thriving parts of urban life.

Singapore's approach to the public realm serves as an inspiring example of how cities can innovate while remaining deeply rooted in the principles of connectivity and inclusivity. The detailed case studies and design philosophies presented in this book are a testament to the city's commitment to creating environments where people feel a true sense of place. By prioritizing good design and paying meticulous attention to detail, Singapore continues to set a high standard for urban design that not only meets the needs of its residents but also enhances their quality of life.

This book is more than just a collection of ideas and strategies; it is a reflection of a

shared vision for the future of urban living. It underscores the importance of designing cities that are not only functional but also meaningful places where every detail contributes to a greater sense of connection and belonging. As we move forward in our own urban design efforts in New York City, we draw inspiration from the innovative approaches documented here, and we remain committed to our shared goal of creating cities that truly serve their inhabitants.

I invite you to immerse yourself in the insights and inspirations that this book offers. The insights and experiences shared here are not only a testament to Singapore's success but also a valuable guide for anyone passionate about creating public spaces that truly reflect the spirit of a connected and inclusive city. May it serve as a valuable resource and a catalyst for continued innovation in the pursuit of a connected and inclusive urban future.

Ya-Ting Liu
Chief Public Realm Officer
City of New York
September 2024

*The biennial World Cities Summit is a platform for government leaders and industry experts to address liveable and sustainable city challenges, share integrated urban solutions and forge new partnerships, jointly organised by the Centre for Liveable Cities (CLC) and the Urban Redevelopment Authority (URA). One of the highlights of the summit is the Lee Kuan Yew World City Prize, of which New York City was the Prize Laureate in 2012.



PREFACE

THE IMPORTANCE OF CONNECTIVITY FOR THE CITY

Connectivity is a key priority of urban design work in Singapore, contributing to efficiency and productivity in the city by making it easy to move around to accomplish one's daily tasks. Out of the nine urban design elements that guide urban design work in URA, three directly relate to connectivity – streetscapes, pedestrian networks and vehicular access. These are carefully considered and shaped by urban designers to enhance the movement of people within and between developments, streets and districts.

Connectivity strategies in Singapore are largely centred on connecting people to public transit, from their homes, work places and to other destinations. Urban planners take a transit-oriented approach, putting jobs, homes and services within walking distance of the Mass Rapid Transit (MRT) system and public buses. Urban designers ensure that the connectivity is seamless, integrating developments with transit infrastructure, deconflicting pedestrian and vehicular circulation and ensuring good last-mile connectivity.

This takes long term planning and coordination, from drawing up the connectivity plans to guide developments over years and decades, to making structural provisions for underground rail infrastructure years in advance so that buildings can be built on top of them in future.

URA works closely with the other agencies to plan and shape connectivity in the city. Land use planning in URA is integrated with transport planning to ensure that developments are well-served by and well-integrated with public transit infrastructure. URA also works with the Building and Construction Authority (BCA) to ensure that pedestrian networks in developments are designed to be barrier-free and accessible to all, in line with universal design standards.

This book looks at the gamut of issues planners and urban designers face in shaping better connectivity outcomes for Singapore. From the macro scale – in planning for good integration of developments, public transit and active mobility in the urban fabric, to the meso scale – in shaping districts to have good walking networks and car-lite outcomes, and down to the micro scale – where urban designers pay particular attention to the design of walkways and scrutinise level treatments to ensure barrier free accessibility.

Making our city walkable is not just a science but also requires the art of making walking, strolling and promenading pleasurable, fun and exciting. Can each component defining the public realm be made with love and care to create visual delight, wonder and perhaps humour? The details of the facade, canopy, ceiling, lighting, choice of plants, pavement, public seating and public sculpture that contribute to making the city a place to enjoy will definitely encourage walking.

Good connectivity requires the contribution of all involved in the planning and development process. In land scarce Singapore, we cannot afford to dedicate more land for roads, so we must focus on designing our public realm to make walking, cycling and taking public transport convenient and comfortable. Only then can we make green mobility our choice mode of transport. In addition to providing the necessary guidelines and standards to guide developers and architects, it is important the considerations behind the guidelines are well-understood, so that thoughtful connectivity is considered upfront in the design process.

I hope that this guidebook on connectivity helps to achieve this purpose, by sharing the vision with design professionals, project commissioners and developers to craft a delightful, well-connected, transit-oriented, car-lite and inclusive Singapore.

Fun Siew Leng
Chief Urban Designer
Urban Redevelopment Authority

How to read this publication

Each chapter covers a different Urban Design topic

Each chapter explains 3-4 key considerations around each topic / policy

Illustrated diagrams offer behind-the-scenes insights into built examples

Online links to key policies and guidelines

Case Study Features on successful built examples

Interviews with planners, urban designers and industry practitioners

Online links to full versions of interviews

About this series

Behind the many places that are loved and cherished across Singapore are careful and concerted efforts and strategies to shape them, sometimes hidden from plain sight. This series on urban design aims to demystify the work of Urban Designers and illuminate the impact of their work in shaping Singapore.

It will provide insights into URA's planning and urban design policies, explaining the rationale and interpretation of various guidelines through 3D visualisation. It also provides best practice guides on the application of these guidelines, highlighting successful examples by architects, developers and government agencies in shaping positive urban outcomes.

Through a curated selection of projects and initiatives, this series will unpack the insights, innovations, learning points and outcomes of urban design efforts that have shaped the physical environment of Singapore.

Different books are planned within the Urban Design Guidebook series to cover the range of issues urban design efforts address in the city.

DISTINCTIVE & DELIGHTFUL

This book looks at the urban design strategies used to enhance the legibility and imageability of the city's districts and urban form to make Singapore distinctive and delightful. It also looks at placemaking strategies that enhance the "sense of place" and result in endearing places that people are emotionally connected to.

CONNECTED & INCLUSIVE

Urban design plays a key role in shaping effective walking networks that are functional and enjoyable in the city. This book looks at the various scales of connectivity in the city and how comprehensive walking and cycling networks are realised through different mechanisms.

GREEN & LIVEABLE

This book looks at the ways greenery is integrated into the urban fabric at various scales to enhance the liveability of the city, covering planning and urban design efforts to help Singapore transition from being a "Garden City" to a "City in Nature".

FROM PLANS TO REALITY

Realising urban design outcomes requires careful navigation of complex development frameworks and processes. This book examines how good urban design is realised through guidelines, incentives, promotion and education efforts, with close collaboration between public and private sector entities.

How is urban design realised in Singapore?

Urban design entails the complex act of bringing together many elements of the built environment to create a coherent and cohesive whole, such that the city is made more functional, attractive and liveable.

URA uses three main levers to realise urban design outcomes across Singapore:

Development Control

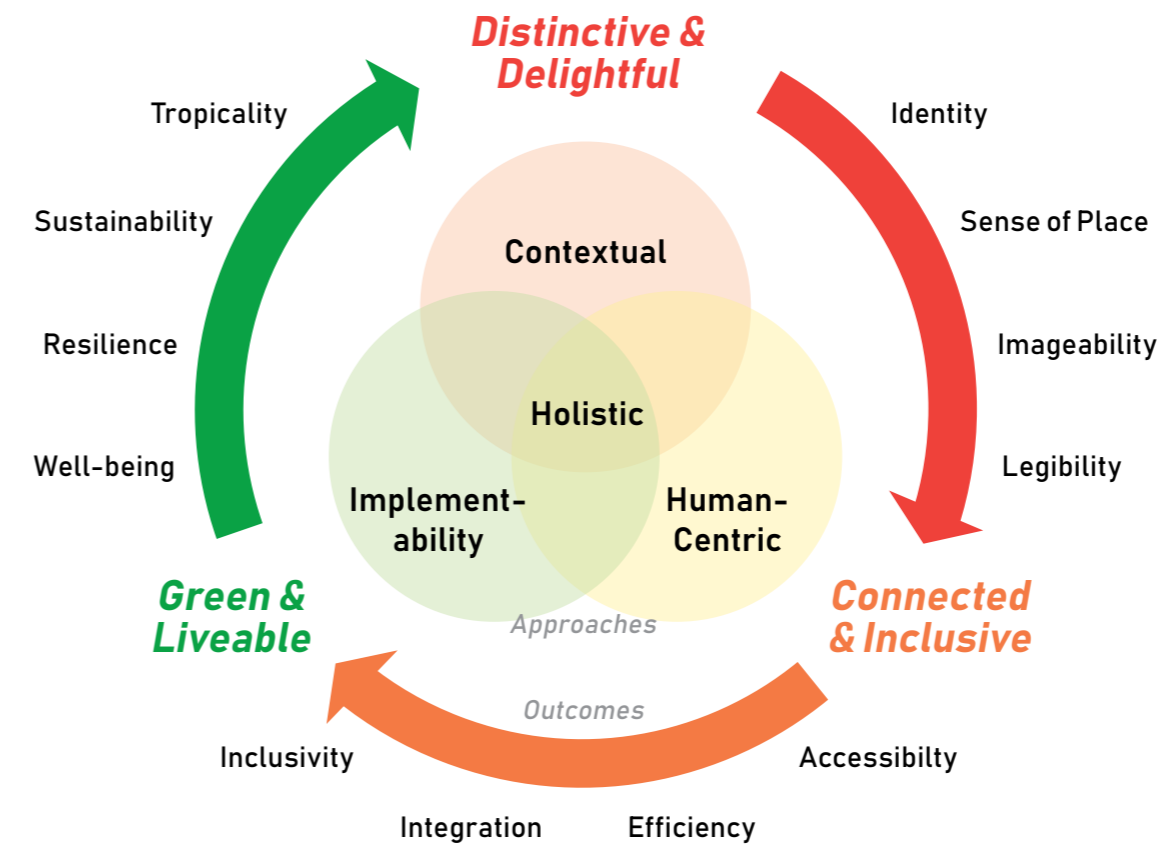
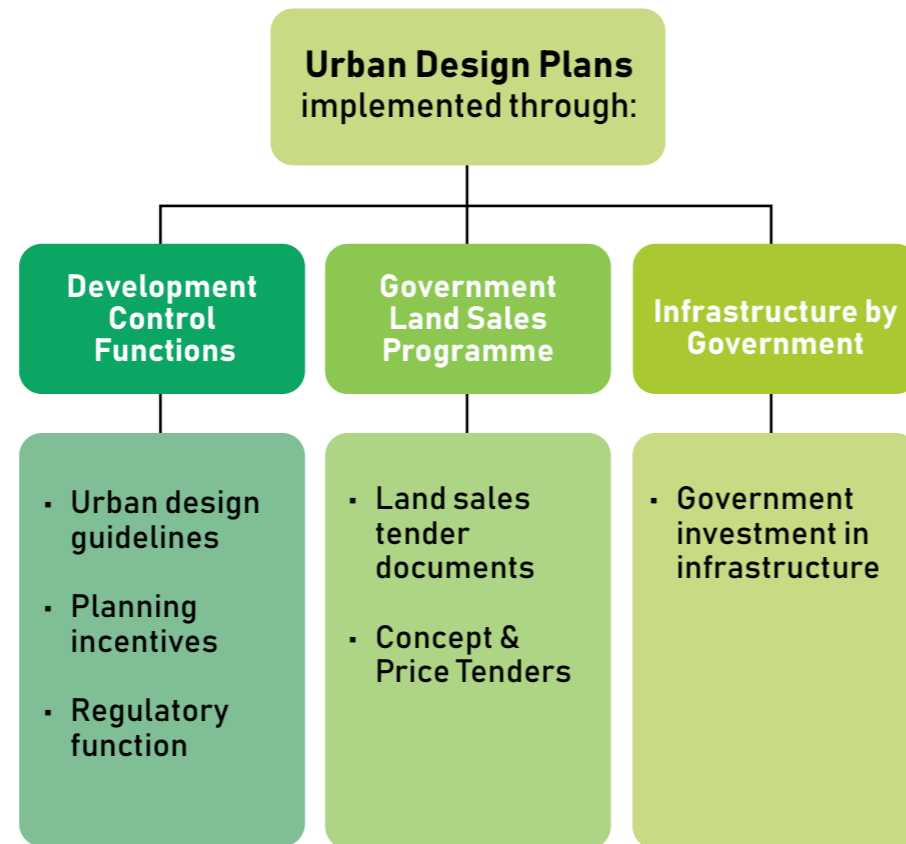
Development and building works are regulated through the Development Control arm of the URA. As the planning authority in charge of planning and development approvals, URA is able to ensure that urban design guidelines and conditions are adhered to before planning permission is granted for development and building works. This means that every time new buildings are built or buildings undergo redevelopment and major alterations works, they are guided by a set of urban design guidelines relevant to their site context.

Sale of Sites

Secondly, URA is also the land sales agent for the government and is therefore able to include urban design guidelines as part of the tender conditions issued for the sale of sites, and ensure that they are complied with as part of the development approval process. In addition, URA may convene a Design Advisory Panel to guide the design of strategic developments in the city.

Infrastructure

Thirdly, where necessary, URA also implements works to enhance the city, such as environmental improvement works at key streets and public spaces. These works help to improve the image of the city or create conditions for developments to achieve better design outcomes.



URA's urban design framework

URA's approach to urban design can be summed up in the diagram below:

Contextual: urban design always starts by having a thorough understanding of the unique demands of each site, resulting in proposals and interventions that respect and enhance the existing physical, social and economic context.

Human-centric: urban design focuses on people – shaping environments that are safe and comfortable to be in and to move around to conduct daily work and social life.

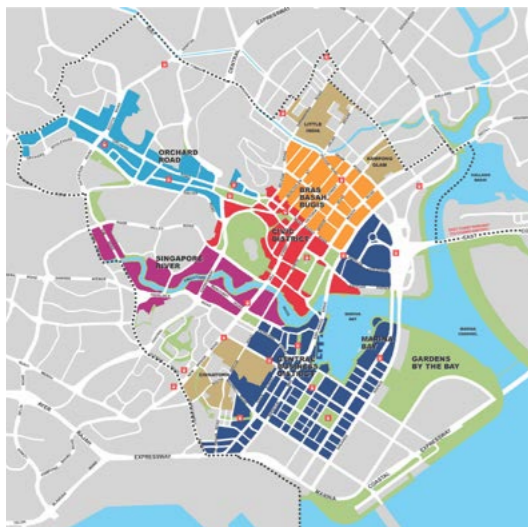
Implement-ability: This is what separates plans from reality. Urban design guidelines are grounded in realities like development costs, timing and market conditions, often requiring private sector participation.

It is also part and parcel of urban design work to develop procurement mechanisms and incentives to encourage good design outcomes.



The guiding plans for urban design in Singapore

Over the years, URA has developed several key plans which serve as the guiding framework for its urban design work.



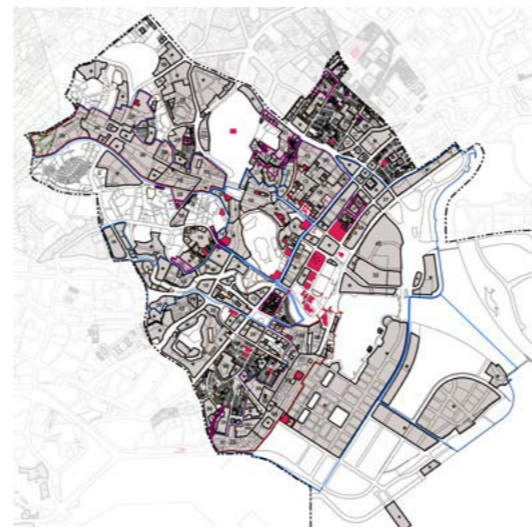
District Character Plan

This plan outlines the various districts in the Central Area which are distinctive due to their unique positioning, land use, built form and history. Detailed urban design guidelines have been developed for each district to enhance their character and identity.



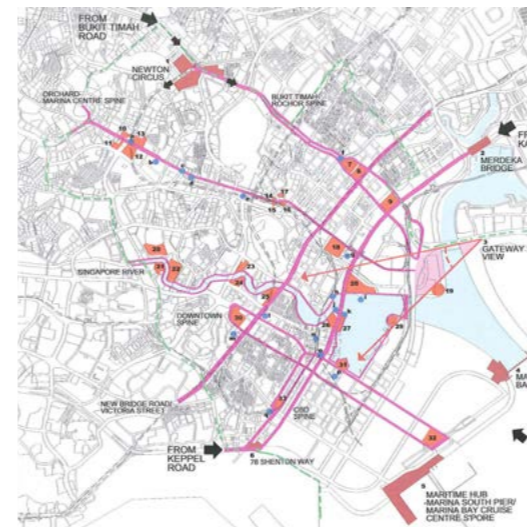
Parks and Waterbodies Plan

This plan maps out where existing and future green spaces and open spaces are envisioned, and how they will be connected by comprehensive walking and cycling networks. Developments are required to contribute to the network of parks and open spaces as part of redevelopment or major additions and alterations work.



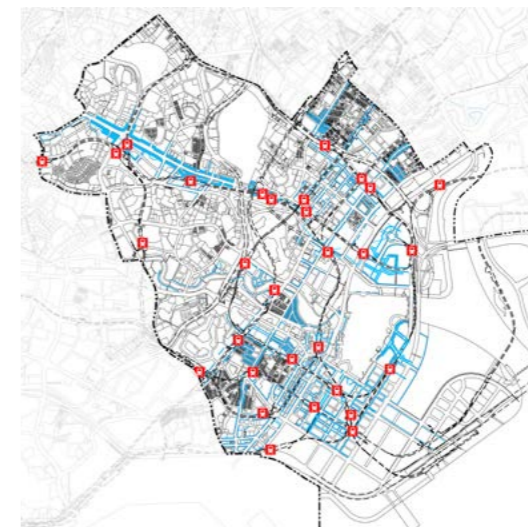
Building Height Plan

Certain sites or districts are subject to building height controls to shape legibility in the urban form. For example, building heights may be guided to relate to natural features like hills and waterways to avoid overshadowing them. Higher heights may be stipulated around transport nodes to optimize development density around transit.



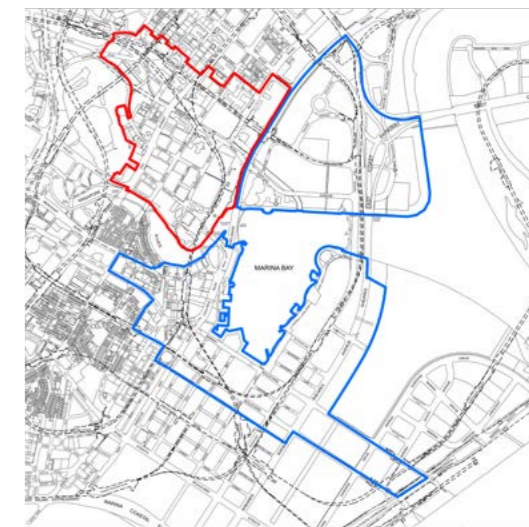
Landmark and Gateway Plan

This plan identifies strategic sites that mark key locations and approaches in the city where landmarks and gateway developments are desired, to strengthen a sense of orientation and structure for the urban fabric. These sites are subject to special urban design guidelines and design evaluation through different mechanisms such as Design Advisory Panels or Concept Price Tenders.



Activity Generating Uses Plan

This plan identifies where activity generating uses (AGU) such as shops and restaurants are required along the 1st storey of developments to enliven key activity corridors in the city, such as along pedestrian malls and waterfront promenades.



Nightlighting Master Plan

This plan identifies areas where there are requirements and guidelines for external building lighting, to contribute to the character of each district.



Explaining the urban design elements

The nine urban design elements were developed as a toolkit for URA's urban designers to better identify and organise the components of the built environment for intervention and guidance.

The initial list started with seven elements but expanded to include Nightlighting and Greenery to reflect the importance of these aspects as URA developed plans and policies around them in later years.

The elements form the basis of urban design guidelines which have been developed for various areas around Singapore.

Urban Design Guidelines

Urban Design guidelines have been published for different areas in Singapore such as Central Area districts and the Regional Centres. They can be found at this [link](#).





Why is connectivity and inclusivity important for the city?

What is **connectivity** and why is it important?

Connectivity affects our quality of life, influencing the options we have in where we can go and how we can get there, as well as how fast and comfortable the journey is. It is critical to the functioning of the city – getting people from home to work, leisure and services, as well as other destinations in their everyday routines.

Enhancing connectivity means investing in the right transport infrastructure. The experience of some cities shows that over-reliance on private cars can result in traffic gridlock and massive highways that blight the cityscape. Singapore’s planners decided in the 1980s that public transit was the more sustainable way forward, leading to the creation of the MRT system as well as trunk and feeder bus networks that support it. At the same time, decentralisation was adopted in order to optimise usage of the transit system, providing better accessibility to areas outside the city centre.

Since then, planning and urban design have worked hand in hand to shape better connectivity outcomes in the city. There are several overarching strategies that guide this work.

Transit-oriented development

This means planning and designing developments to maximise accessibility and reliance on public transit, e.g. areas within close proximity to MRT stations would typically be densified. Homes, jobs and services are concentrated around transit hubs, making it more convenient for people to take the train and bus rather than drive. Extensive design and coordination work goes into integrating developments with transit to ensure seamless outcomes.

Car-lite

In the past decade, the car-lite movement has grown from experimental car-free zones in the city centre to the gazetting of car-lite areas that are planned and designed with reduced car-related infrastructure upfront. This approach reduces car-use and road space in districts and frees up valuable land for other uses, like greenery and public space. This also allows the land to be intensified further without needing to set aside more land for roads to support the intensification.

Walkability (and active mobility)

Urban design work has always prioritised walkability outcomes in Singapore, creating comprehensive pedestrian networks and

enhancing streetscapes so that people find it pleasant and enjoyable moving around the city on foot. In the past decade, this focus has expanded to include active mobility outcomes, leading to the creation of an islandwide network of cycling paths and active mobility corridors that are integrated into streetscapes and developments so that cycling can serve as a viable form of commute.

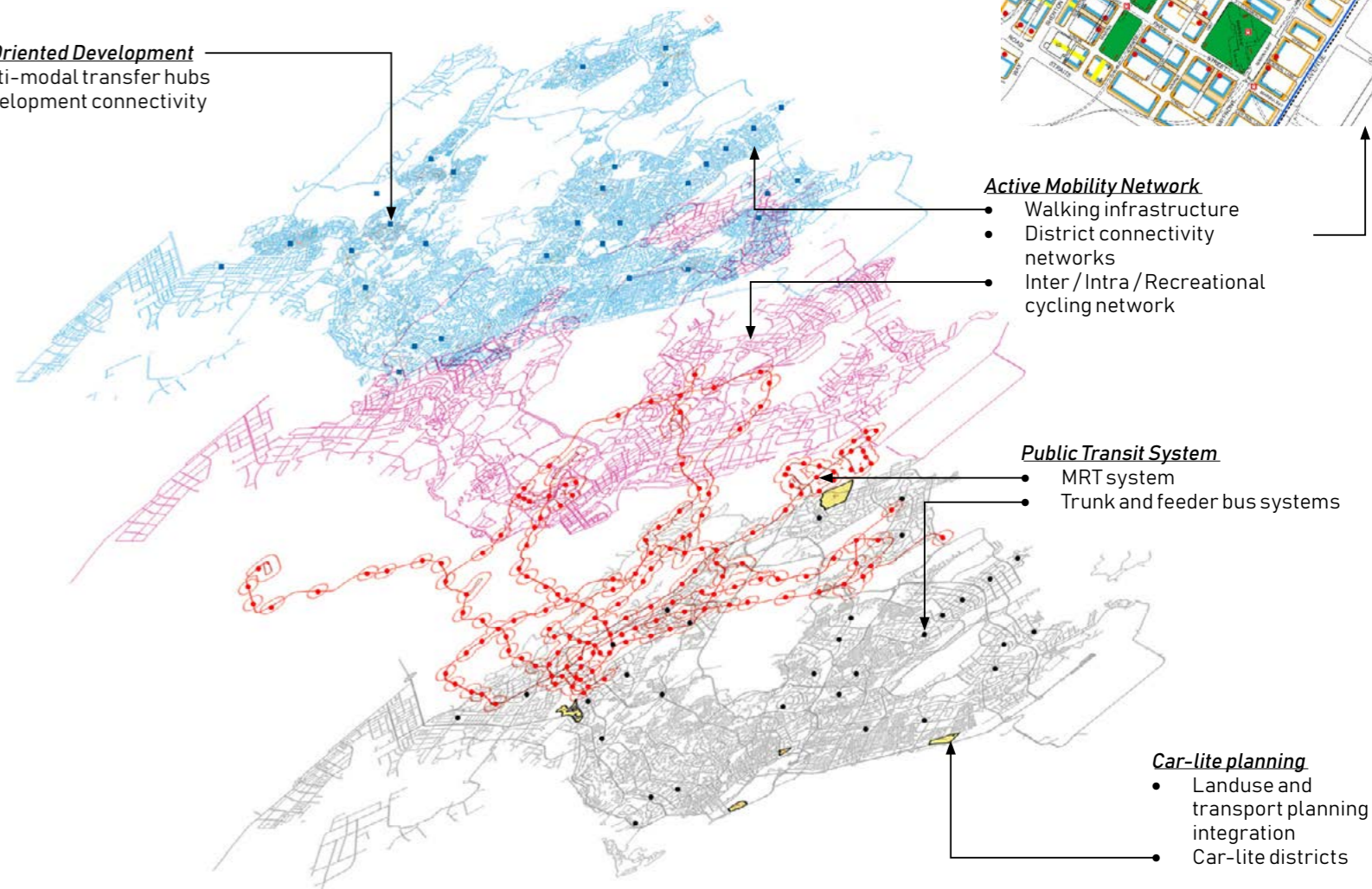
Barrier-free accessibility

The underlying principle behind barrier-free design is that all people get to enjoy the same level of connectivity and experience moving around the city, regardless of their abilities, as opposed to the notion of simply retrofitting pedestrian networks with ramps. Designing for universal access is how URA guides the design of covered walkways, through-block links and other pedestrian network infrastructure in developments.

These strategies underscore the importance of connectivity as a matter of inclusiveness and equity. Making travel and movement fast, easy and affordable to all Singaporeans means that everyone can access the same opportunities in the city.

Transit Oriented Development

- Multi-modal transfer hubs
- Development connectivity





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CONTENTS

<i>Introduction</i>	
Singapore's Urban Design Framework	9
How do we make the city connected and inclusive?	14
<i>The Connected City</i>	
1.1 Polycentric City	18
1.2 Active Mobility	28
<i>Walkable Districts and Neighbourhoods</i>	
2.1 Walkability	46
2.2 Mixed-use Vibrancy	54
2.3 Car-lite Design	60
2.4 Vehicular Access	72
<i>Integrated Developments</i>	
3.1 Transit-Oriented Developments	84
3.2 Pedestrian Networks	104
<i>Epilogue</i>	
The continual journey to build a connected and inclusive city	128



1.1

POLYCENTRIC CITY

Connectivity planning starts with the urban structure of the city. URA has been pursuing decentralisation to rebalance transportation flows away from the core to regional centres, towns and estates islandwide.

This is so that overall travel distances can be kept short and the transport system better optimised in multiple directions of travel, resulting in faster and more comfortable trips for all.



1983 map of Singapore - jobs were previously concentrated in the city centre leading to higher traffic going into and within the city.

Why is decentralisation needed?

1.1.1: Bring jobs closer to homes

Bringing jobs closer to homes and vice versa is critical to shortening the overall length of trips taken each day on the public transit system, reducing congestion on the network.

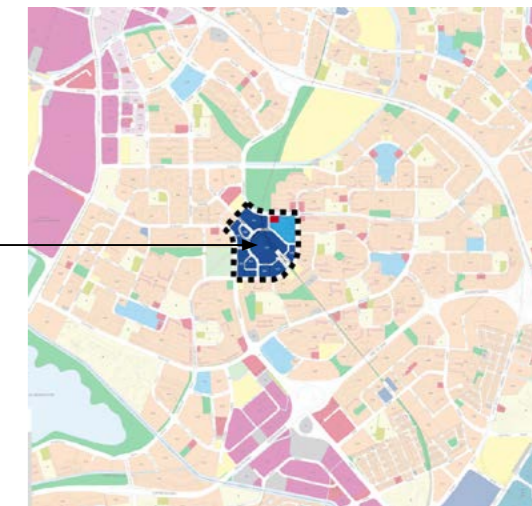
The decentralisation of growth to regional and sub-regional centres has resulted in the creation of vibrant mixed-use regional centres around the island, which sustain local ecosystems of jobs, amenities and housing.



- Industrial Estates/ Business Parks
- Business Nodes
- Polycentres

Decentralised, polycentric structure of Singapore today with more balanced commuting flows on a comprehensive public transit system

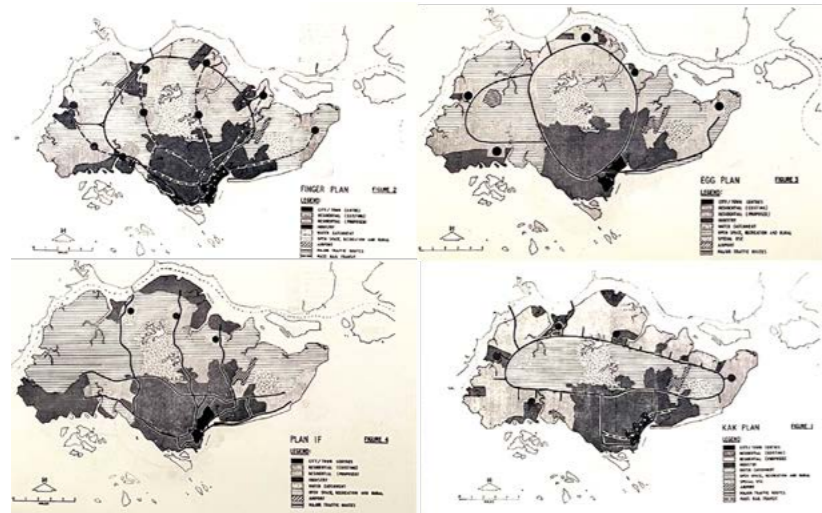
For example, the 410ha Jurong Lake District, positioned as the largest business district outside of the Central Area, will have 1.4mil sqm of office space, compared to 5.2mil in the downtown core presently. When fully developed over the next 20 to 30 years, it can provide 100,000 new jobs and 20,000 new homes. This is 100,000 less workers travelling in the direction of the city centre every morning.



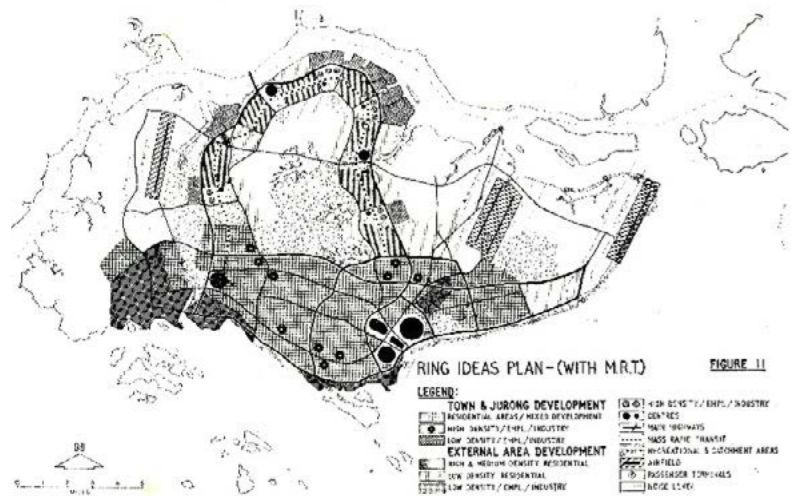
Key polycentre in the East: Tampines Regional Centre



Key polycentre in the West: Jurong Lake District



Clockwise from top left: Finger Plan, Egg Plan, Kak Plan and Plan If (grid)



The "Ring" structure plan adopted for Singapore in 1971

How did decentralisation take place over the years?

Up to 13 draft concepts were explored in the 1971 Concept Plan to cater for a rapidly growing population of four million people, such as the Finger, Egg and Grid plans, as well as a plan for a large east-west green area in the centre of the island (known as the Kak Plan).

Eventually, a ring structure was adopted for the city – it was seen as the most flexible structure to support growth, and also most economical for the laying of utilities and transport. This paved the way for decentralisation in the city, spreading out high density satellite towns and smaller employment centres along corridors circling the Central Catchment area, served by an MRT system.

The 1991 Concept Plan built on this idea to outline the development of regional centres at Jurong, Woodlands and Tampines.

Smaller sub-regional centres and other nodes were later identified at locations such as Paya Lebar, Novena and Bishan, resulting in the polycentric urban structure for Singapore today.

How do we reduce reliance on private cars to get around?

1.1.2: Develop strong car-lite urban mobility

In line with the decentralisation of jobs and amenities around the island, URA and LTA emphasised the development of strong public transit infrastructure to meet urban mobility needs. This resulted in the MRT train system forming the main backbone of mobility in the city, complemented by bus services and active mobility to facilitate last-mile connectivity.

Rail as the backbone of urban mobility

In line with the Ring structure plan adopted for Singapore, the currently 260km long MRT network was initially laid out to frame the Central Catchment area in the middle, serving various public housing towns and employment nodes along its length.

Planners in URA and LTA work together to ensure that development is directed along the transit network, and new lines are planned to serve future development areas. Transit-oriented development is adopted islandwide, with districts and developments planned to integrate seamlessly with MRT stations.

Based on a 2014 study by Arup, Singapore is at the forefront for underground rail development, with rail density slightly ahead of London and behind Tokyo. Continued expansion to 360km by 2030 will allow 80% of all households to be within a 10min walk of MRT or LRT station, up from current 70%.¹



A Public Transport Accessibility Level (PTAL) mapping of Singapore today, which guides planners to focus development around areas with good public transit access, or improve transit access to underserved areas.

Trunk and feeder bus services

An extensive bus system has been developed to provide various functions that complement the reach of the MRT network. Trunk services ply longer direct routes that connect different towns together, which may otherwise take a more circuitous route on the MRT, while feeder services connect MRT stations and bus interchanges to surrounding areas. City-direct services also operate between major residential estates and the CBD during peak hours, providing an express service that can be more attractive than taking the train. They account for over 3.7 million rides a day on average (in 2023), with over 5800 buses in operation.

In areas where bus speeds are low or affected by traffic congestion, transit priority corridors may be created to ensure dedicated road space for greater bus efficiency.

The rise of active mobility

In the past decade or so, active mobility has also taken on greater priority in planning, with the aim of making cycling serve as first and last-mile connectivity with public transit, as well as a viable form of daily commute.

Currently, only about 1–2% of commutes are done by bicycle. However there are opportunities to grow this form of mobility through the acceleration of cycling path implementation.

In 2020, LTA announced that 1300km of cycling paths would be built by 2030, up from 440km then, comprising inter-town and intra-town networks. The development of main cycling corridors in key directions of the city will help make cycling a viable form of daily commute. The completion of comprehensive intra-town networks also serve to connect all residents seamlessly to major public transport nodes such as MRT stations and bus interchanges.

Reducing reliance on private cars

Private car use is not sustainable in Singapore, with roads already occupying 12% of total land area and the land transport sector being the third largest carbon emitter following the energy and industry sectors.

Strong measures to curtail private car use, such as COE* and the electronic road pricing system, has helped manage overall vehicle population numbers on the road. Today, only one-third of Singaporean and Permanent Resident households own cars in Singapore, down from 40% in 2013.

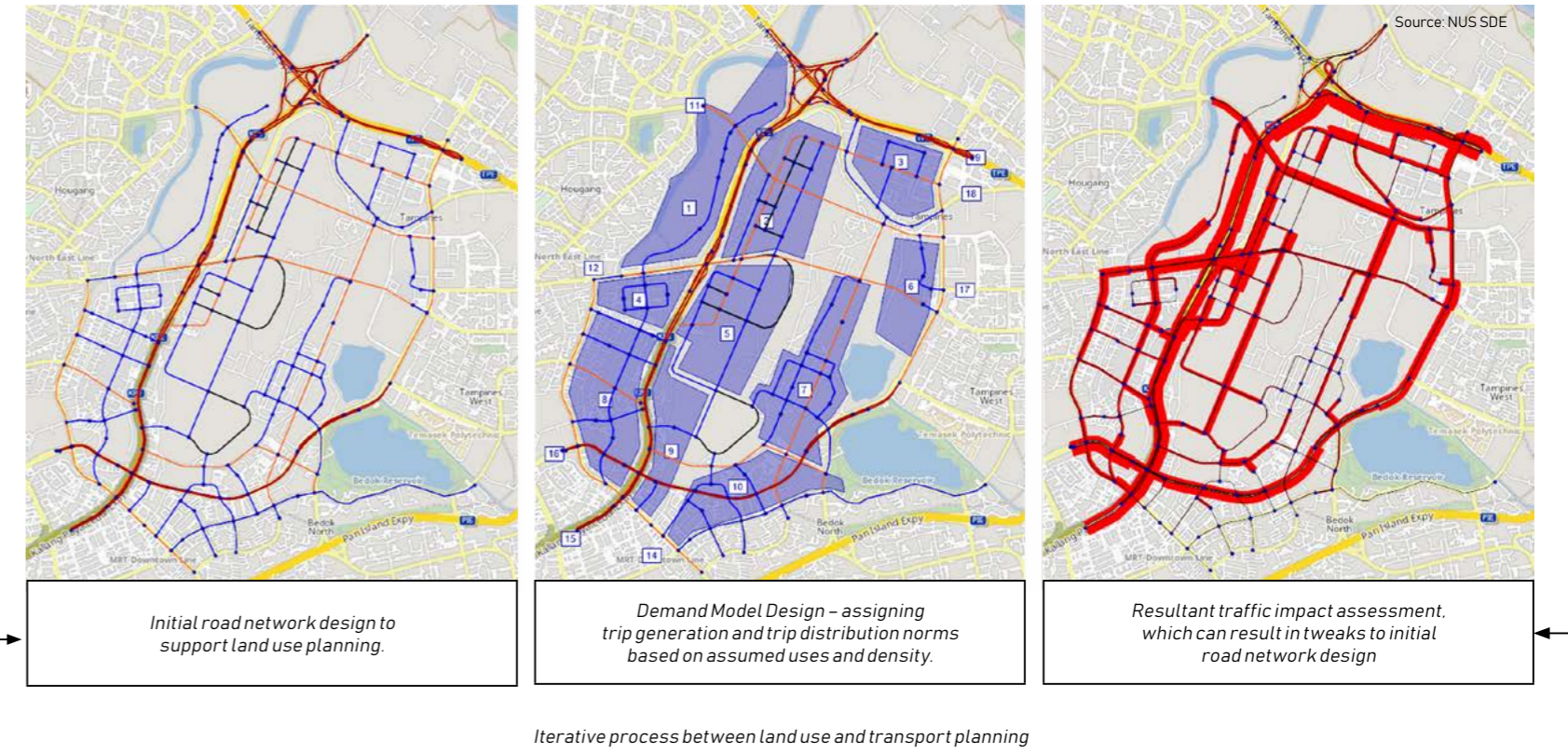
In addition, new districts around Singapore are being planned to be car-lite, with reduced parking provisions and strong public transit connectivity, to minimise the need for private car use.

Taken together, these measures have enabled Singapore to achieve a high degree of public transit use. Today 7 in 10 peak hour journeys are undertaken via walk-cycle-ride (WCR) modes. Moving forward, as charted out in the Land Transport Master Plan 2040 (LTMP2040), LTA aims to achieve 9 in 10 peak hour journeys undertaken via WCR modes by 2040.

New greenfield districts that are being developed are planned based on the concept of a 45-minute city and 20-minute towns. This means that 9 in 10 peak period journeys using WCR modes can be completed in less than 45 minutes, while all journeys to the nearest neighbourhood centre using WCR modes can be completed within 20 minutes.

*COE or Certificate of Entitlement is the quota license for owning a vehicle in Singapore, it was implemented in 1990 to regulate the number of vehicles on the road and control traffic congestion, and priced according to demand levels.

Preliminary testing of possible road networks for Paya Lebar Airbase redevelopment conducted by NUS research team led by Professors Heng Chye Kiang and Raymond Ong from the College of Design and Engineering, National University of Singapore



1.1.3: Integrate land use and transport planning

It is essential to integrate transport system planning with land use planning – so that the transportation network is designed in response to the travel demand created by land use decisions, and planned land uses optimise the use of our transport infrastructure.

URA and LTA have integrated land use and transport planning workflows over the years. In essence, this is an iterative process where URA first generates the land use plans based on future development needs. The resultant traffic is then predicted by LTA using modelling tools with the results shared back with URA. Both agencies will then fine tune the development plans and transport infrastructure design to achieve optimal outcomes.

1.1.4: Support with good indicators and analytics

Integrated land use and transport planning is supported with advanced modelling and simulation tools, as well as indicator and analytics apps to provide more accurate insights into travel patterns and demand.

Public Transport Accessibility Level (PTAL)

This is a tool that measures accessibility to public transport services across Singapore, based on walking distance to bus stops and train stations, the number of public transport services at each bus stop / train station, and the frequency of each service.

PTAL is further refined for accuracy by incorporating detailed maps of walking and cycling networks islandwide.



Accessibility to Opportunities and Services (ATOS)

This is another indicator that measures residents' accessibility to different types of key amenities, such as food, groceries, healthcare and parks & recreation, based on the walking and cycling network.

Home-work flows

This is another important indicator that tracks overall commuter movement in the city using farecard data, which is recorded when commuters tap in and out of transit stations (MRT or bus).

It establishes the directions and scale of travel demand in the city, and this information is used to identify where and how employment or housing uses can be better redistributed around the island, to avoid the need for long travel in the city.

Achieving a more balanced distribution of land uses around the island allows for usage of available transport capacity in a more optimal manner.

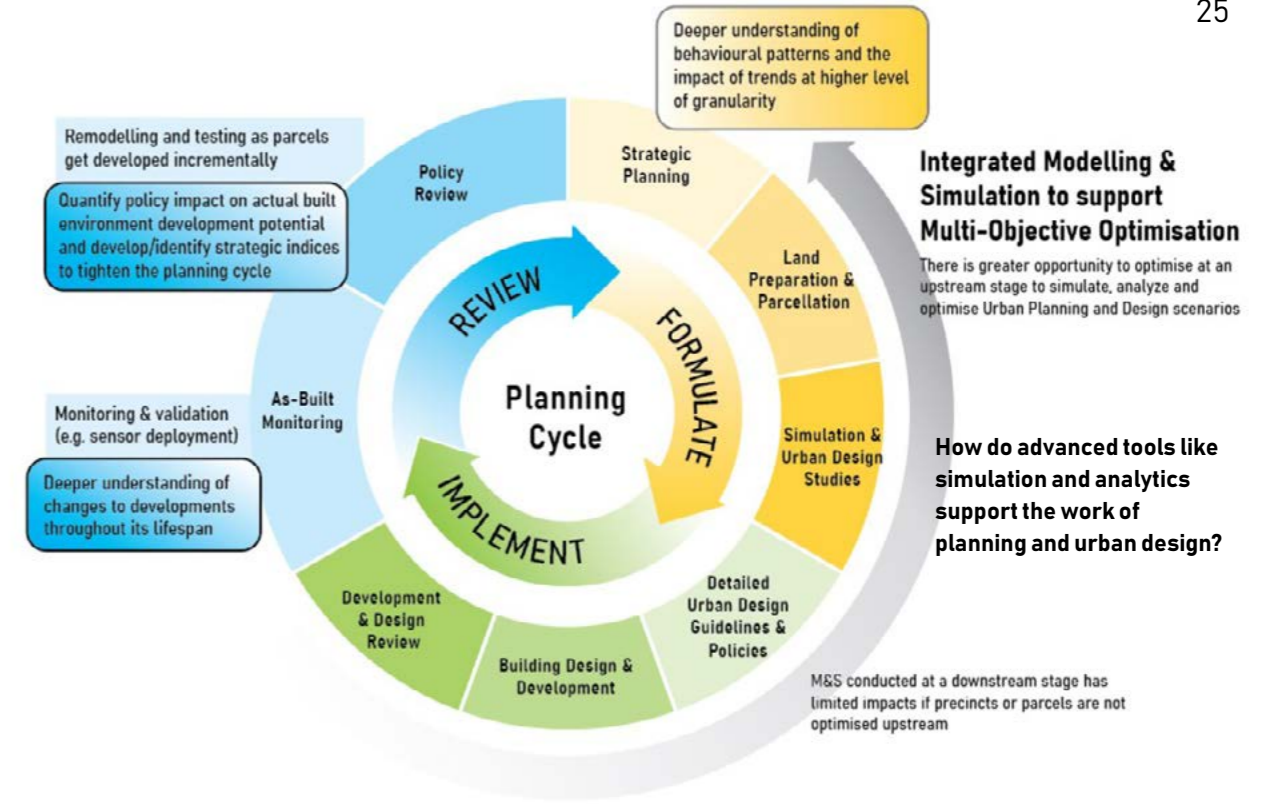


Job-reach and job-worker ratio

This indicator shows the percentage of island-wide jobs reachable from any part in the city during morning peak hour commute.

Darker areas indicate areas with better reach to jobs, as well as areas that have more jobs than workers (job-worker ratio). These are areas for suitable for housing injection so that workers can potentially live closer to work.

On the other hand, lighter colours indicate areas with poorer job reach and hence injection of employment uses in these areas will help to balance job-worker ratios.



About URBEX

Many of these new apps and tools were developed under URBEX, which is URA's Urban Planning & Design Technology Centre of Excellence, that drives the use of data and analytics to enhance urban planning and design capabilities of the government.

Comprising urban planners, designers and data scientists, they develop new tools and apps that support the work of evidence-based planning and design. More importantly they establish workflows and processes of data collection, standardisation and sharing between the agencies to support data analytics work.



BEHIND THE SCENES

Data Science and the planning / urban design process

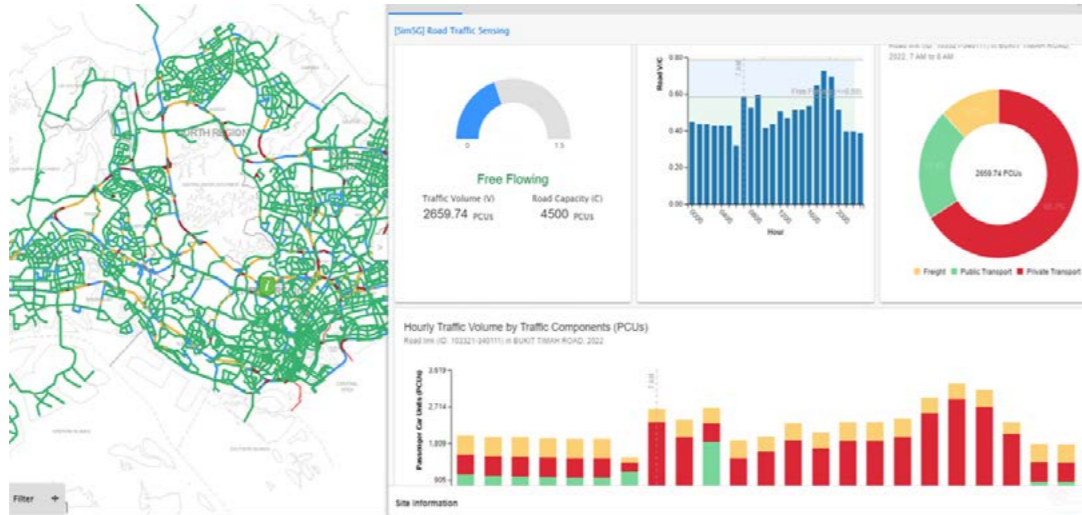
Ching Tuan Yee and Xie Litian

Data Science and the use of analytics has had transformational impact on planning and urban design. We speak to Ching Tuan Yee – Director of Design & Planning Lab – and Senior Data Scientist Dr Xie Litian to find out more.

How has the nature of planning and design evolved over the years with the rise of big data and the tools to provide detailed insights into the impact of various planning scenarios?

Tuan Yee: Traditionally, urban planning & design relied heavily on practitioners' knowledge and experience, intuition and historical precedence. Decision-support systems were developed, but remained largely specialised tools. The rise of widely-available data analytics and modelling and simulation tools has unlocked new opportunities.

In Singapore, data and modelling tools have thus been applied to multiple scales at various stages of the planning process. For example, our strategic land use and transport models are developed to support the review of the Long-Term Plan and Master Plan. For precinct and parcel-level planning scenarios, wind models are used to simulate flow patterns around buildings. Such tools enable data-driven decision-making, improving planning efficiency and effectiveness.



URA has developed a 2D-3D GIS web platform ePlanner used by more than 1,600 users across 40 government agencies, providing quick access and visualisation of more than 200 planning data sets.

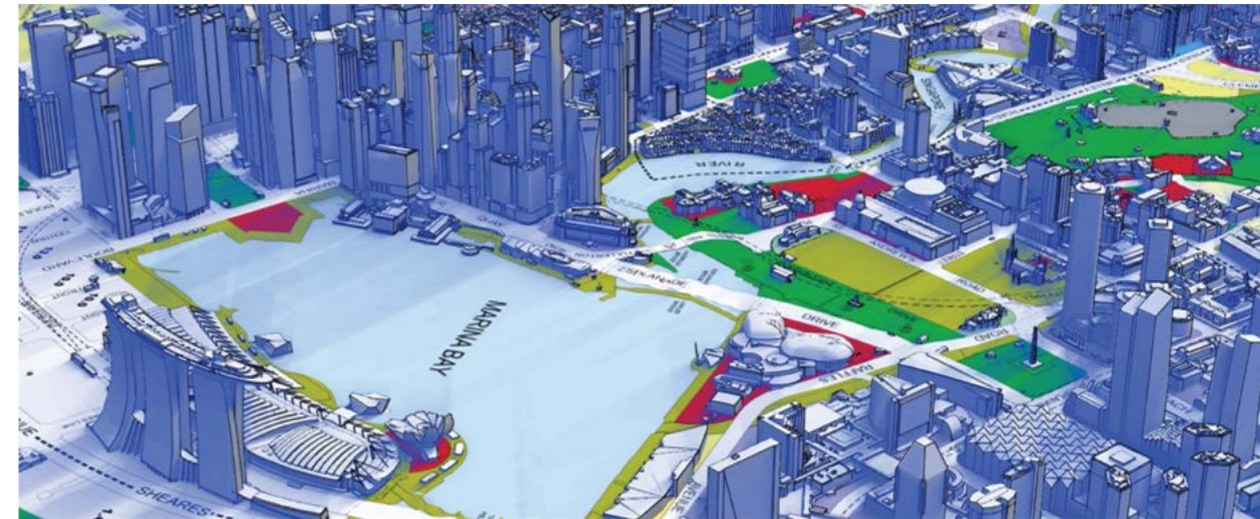
How do data scientists at URA work with the planners and urban designers to enhance and even transform traditional planning and urban design work?

Litian: Data scientists at URA play a vital role in enhancing and transforming traditional urban planning & design practices by working closely with planners and architects. We focus on three key areas to achieve this:

1) Project Integration: Our data scientists actively participate in planning and urban design projects. We apply data and modelling tools, for example, traffic modelling, mobility analytics, and environmental simulations, to inform decision-making.

2) Cross-Agency Collaboration: Data scientists collaborate with various agencies to tackle planning challenges. Our data scientists identify pain points and user needs and codesign and develop solutions that effectively address challenges.

3) Capability Building: To equip planners and architects with the necessary skills to leverage data and tools, URBEX prioritises user capacity-building through various training programmes, such as our bi-annual AIM201 programme and Urban Design studios. By training planners and architects, URBEX data scientists can focus on developing more advanced solutions and promoting a data-driven culture.



Use of a digital twin for the city to undertake detailed analytics like shadow studies before actual development

What is URA's role as the Urban Planning & Design Technology Centre of Excellence (URBEX)?

Tuan Yee: In 2022, the Centre of Government (COG) designated URA as URBEX. URBEX drives the development of science and technology capabilities for the planning sector, focusing on advancing urban planning & design for Singapore by creating solutions alongside our partners.

Our efforts are guided by four thrusts: (A) improving the quality and access to planning data, (B) developing models and tools, (C) shaping the knowledge frontier and (D) building capabilities across the sector. These solutions are integrated into various stages of the planning lifecycle, fostering a transformative approach to how we Think, Plan, and Design our city.

What is the role of the architect / planner / urban designer with the rise of technology and integration of AI in the planning / design process?

Tuan Yee: Throughout history, the emergence of new technologies has impacted societies. Similar to other professions, architects / planners / urban designers can choose to harness and adapt to new technologies, or risk being disrupted or rendered irrelevant over time (e.g. outdated skillsets, job displacement).

We have opportunity to continually shape our practices and processes to take advantage of productivity gains that new tools bring, as well as helping us achieve better planning and design outcomes.

While technology is a powerful and disruptive enabler, it still cannot replace human judgement and aspects of creativity. As professionals, we can work together with our education partners to continually shape and bring out the best in our technology-augmented practices.

The longer version of the interview can be found at this [link](#).

1.2

ACTIVE MOBILITY

Active mobility is an essential part of connectivity in a transit-oriented city like Singapore, bridging the gap between public transport nodes, homes and work places.

Urban designers plan for walking and cycling networks to connect developments together and to transit nodes, and to achieve well-connected networks at the island, town and neighbourhood levels.

How do we encourage active mobility as a way of life?

1.2.1: Develop cycling networks at the island, town and neighbourhood levels

The government has been investing heavily in developing comprehensive walking and cycling networks around the island to encourage active mobility as a way of life.

Walking networks

In the 1970s, when URA embarked on urban renewal programmes, the planners and urban designers were cognisant of the need to ensure the city remained walkable, making covered walkways mandatory in developments. The formulation of district connectivity plans under the Development Guide Plans (DGPs) in the 1990s also provided a framework for realising comprehensive networks in the city.

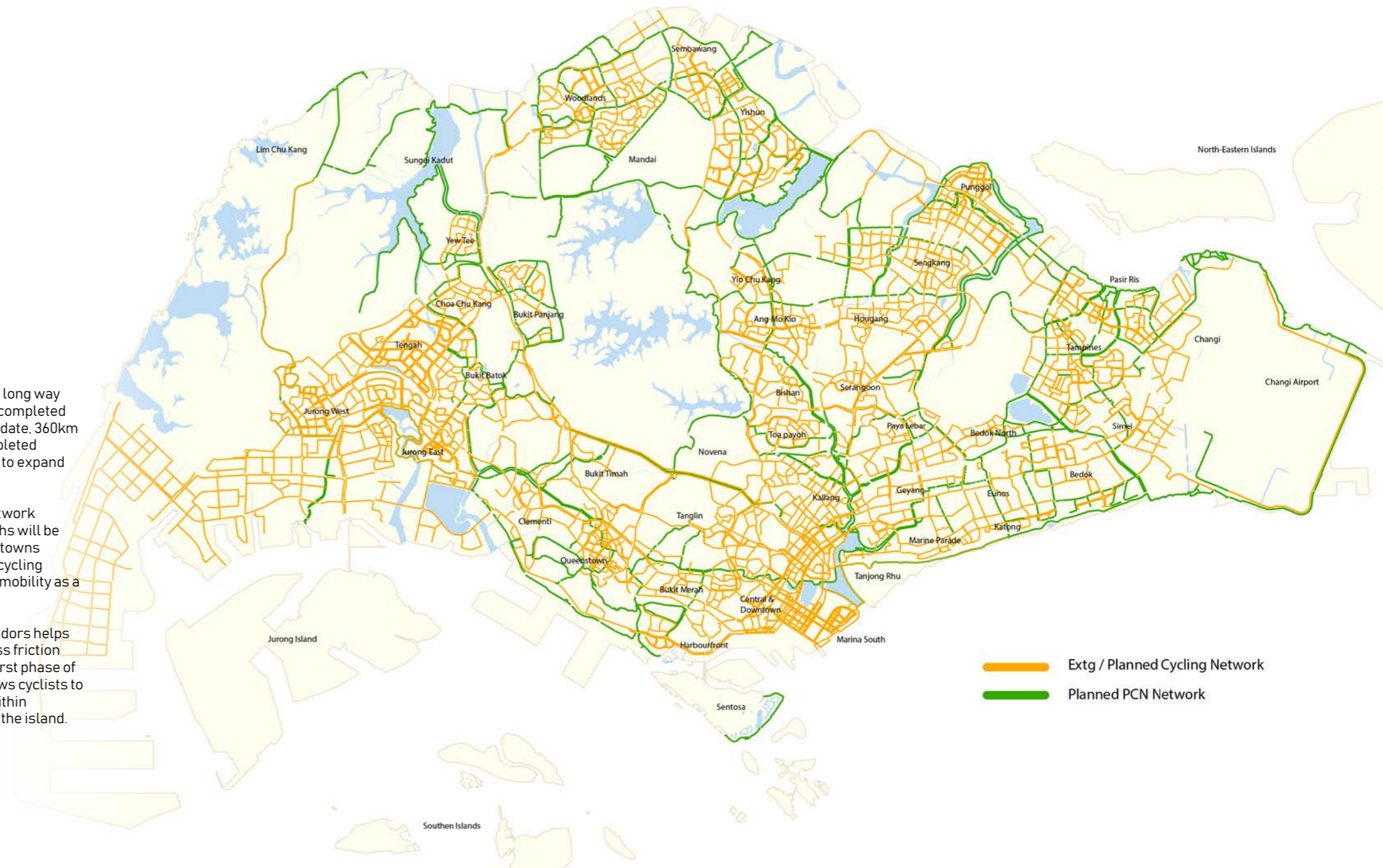
Around the rest of the island, LTA began to build covered linkways to connect all developments within 400m radii to their nearest transit node, under the Walk2Ride programme in 2013. As of 2018, 200km of covered linkways have been completed with another 150km planned by 2040.

Cycling networks

Cycling networks have also come a long way since the first park connector was completed along Kallang River in the 1990s. To date, 360km of park connectors have been completed islandwide by NParks, with the aim to expand them to 500km by 2030.

Under LTA's Islandwide Cycling Network Programme, 1,300km of cycling paths will be completed by 2030. With this, all 27 towns and estates in Singapore will have cycling infrastructure to encourage active mobility as a way of life.

The creation of active mobility corridors helps to facilitate smoother rides with less friction points. In 2023, URA launched the first phase of the Bishan-to-city links which allows cyclists to reach the city centre in the south within 30 minutes from the central part of the island.



— Extg / Planned Cycling Network
— Planned PCN Network



1.2.2: Bridge connectivity gaps

Gaps in connectivity can greatly affect the walking and cycling experience. Planners and urban designers look for opportunities to improve connections along key routes, such as introducing bridges, underpasses or street level crossings.

Overcoming space constraints

Such connections often require space to bridge level differences. For example, long circuitous ramps are typically needed to bring cyclists across roadways and waterways while maintaining a gentle 1:25 gradient. A borrowed-land approach is taken to allow these ramps and bridges to be sited in adjacent state-owned areas, such as within public housing developments.

Another issue is having insufficient space to build walking or cycling paths based on code requirements, especially in older parts of the city that are already built up. This usually requires a deviation from standard design typologies that has to be carefully negotiated between the agencies. In some instances, road repurposing is undertaken to widen road side tables for cycling paths.

Navigating ownership and maintenance issues

URA also plays a coordinating role to sort out the ownership and maintenance arrangements for infrastructure that crosses various parts of the public realm managed by different agencies. This is to ensure that all stretches of connectors like cycling paths and covered linkways remain well-maintained.



A 700m long elevated cycling bridge will be completed as part of the Bishan-to-city links, to bridge connectivity across the Pan-Island Expressway.

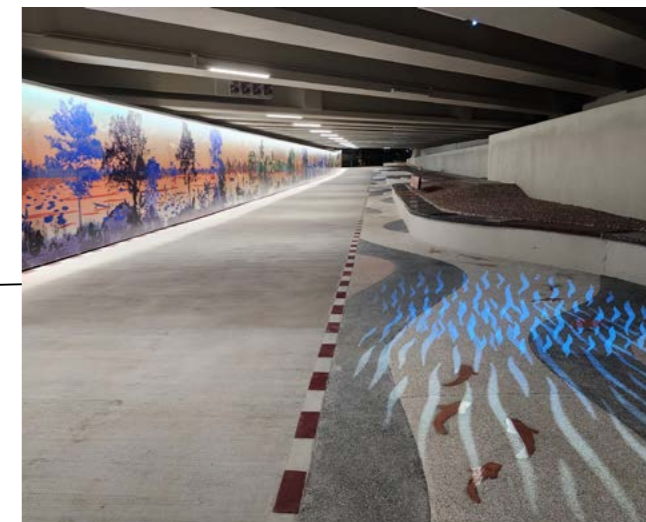
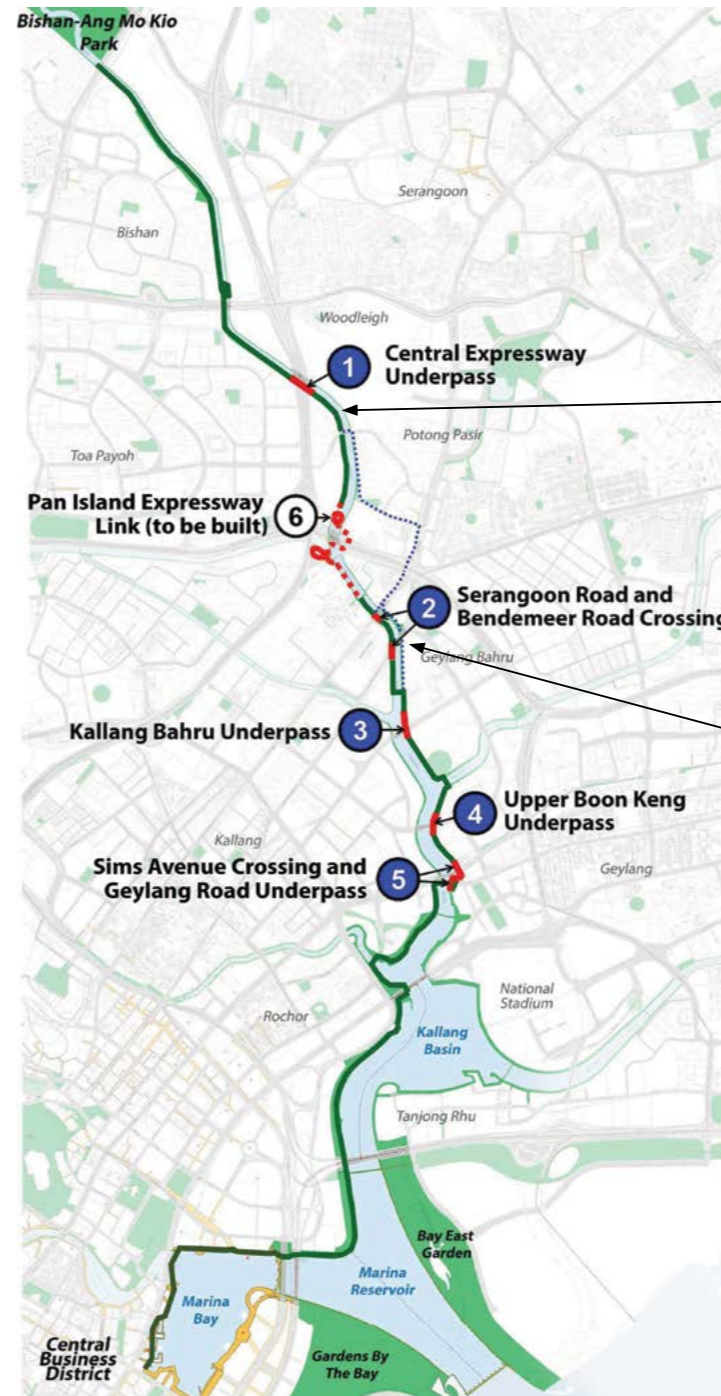
Bishan-to-city links

The Bishan to city links project illustrates some of these challenges faced in trying to achieve a seamless experience for the 10km cycling route. To bridge existing gaps in connectivity, four underpasses, two street level crossings and two cycling bridges will be built along the 10km long cycling route.

To bring cyclists across the dual-four lane wide Braddell Road, two cycling ramps have to be constructed within the approximately 50m wide Drainage Reserve due to lack of space within the Road Reserve to accommodate the ramps. The

future drainage widening plans had to be studied in advance to ensure that the ramps and their columns would not pose constraints to widening works in future that may be needed, to cope with increased rainfall due to climate change.

Holistic studies such as these are needed to take into account different infrastructure improvement plans to ensure coordinated and non-abortive works in the public realm.



The old CTE underpass was deepened and widened for cyclists, with murals and artwork recalling the history of the river.



Street crossings were also introduced as part of the connectivity enhancements for Bishan-to-City links.

1.2.3: Establish clear typologies and guidelines

In built-up areas of the city, many challenges are faced in the retrofiting of existing roadways and drains to accommodate widened walking and cycling paths to meet active mobility standards.

The Walking and Cycling Design Guide was jointly developed by LTA and URA in 2018 to provide guidelines on how to prioritise conflicting demands for space in the public realm.

Principles

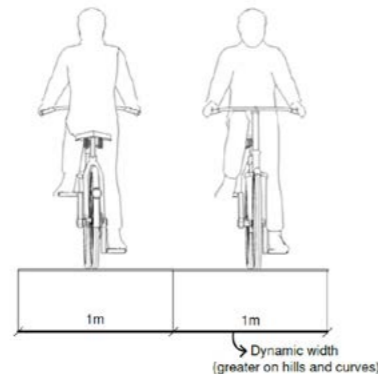
The guide firstly establishes minimum spatial requirements required for enhanced walking and cycling performance. For instance, the basic roadside footpath typology of 1.5m has been upgraded to 1.8m to align with BCA's standards on Universal design, which is the minimum width needed for two wheelchairs to pass each other.

Cycling paths tend to require more space to cater for lateral movements in cycling, as well as to meet the recommended safety and comfort distance of 0.5m between cyclists. Hence, the minimum width of inter-town cycling paths, where average speeds and volumes of cyclists are expected to be higher, is 2.5m, while that for intra-town networks is 2m.

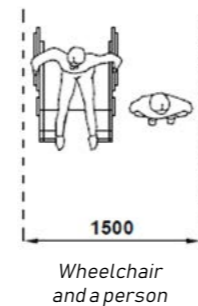
Other principles include the placement of cycling paths on the road side table, instead of sharing the vehicular carriageway, for the safety of cyclists. The placement of cycling and walking paths within the side table is governed by the gradation of speeds between cyclists and pedestrians, with the cycling path nearer the roadway.



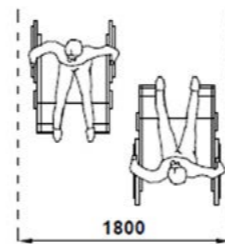
Source: Walking and Cycling Guide, LTA & URA
Minimum 2.0m wide cycling path and 1.5m footpath



2.0m wide cycling path to allow two cyclists to pass each other.



Wheelchair and a person

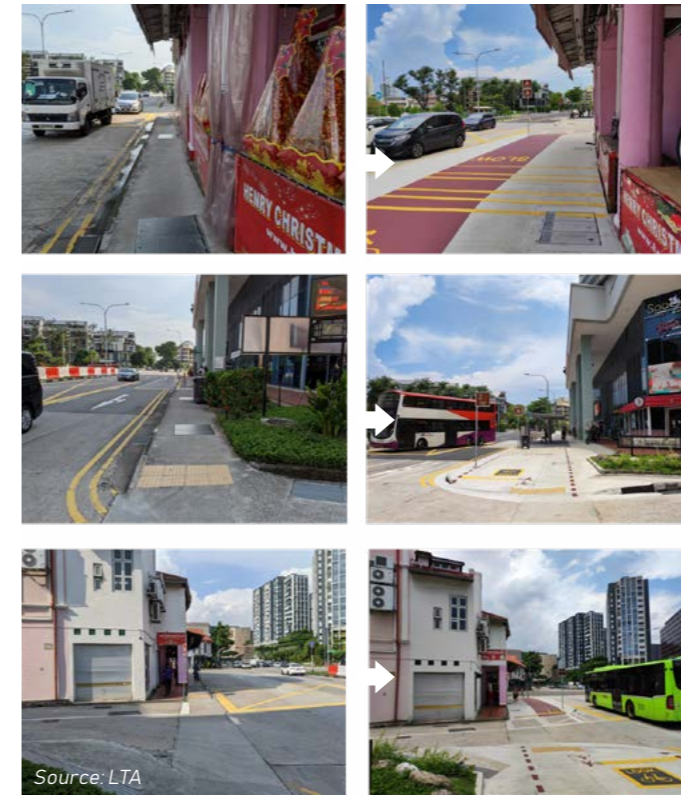


Two wheelchairs

1.8m wide footpath to allow wheelchairs to pass each other.

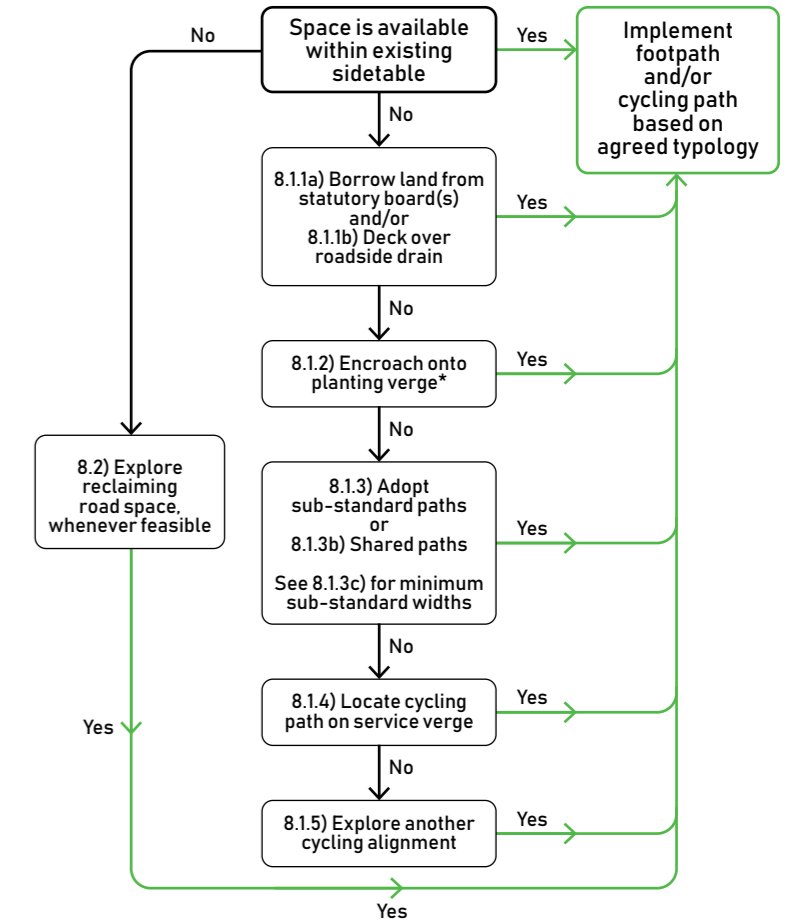
Working within the planned and built infrastructure, existing footpaths are widened to create more space for walking and cycling. Due to space constraints in these mature, built-up towns, adjustments to elements such as greenery, green buffers, drains, bus stops, staircases and repurposing of road space may be needed. Agencies work together to assess the technical feasibility of these options and engage other relevant stakeholders ahead of any changes.

At locations where a dedicated cycling path cannot be provided due to space constraints, localised narrowing of the paths would have to be considered.



Source: LTA

Creation of walking and cycling paths along constrained sidetables in the city.

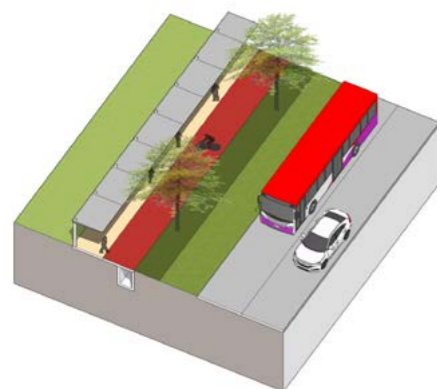


Considerations on securing space for walking and cycling infrastructure when there is limited space.

Walking and Cycling Guide
This guide sets out best practices and standards to guide industry practitioners in planning and designing active mobility-related infrastructure and can be found [here](#)

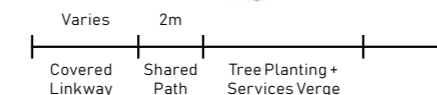
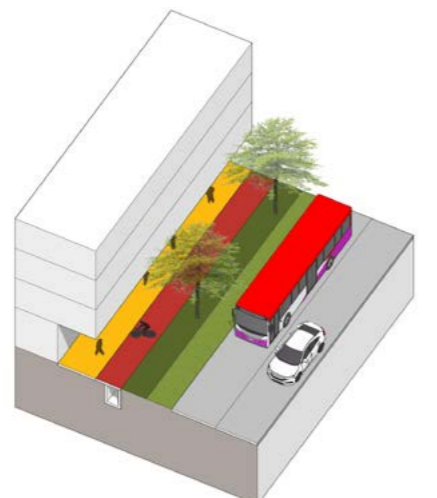


The range of typologies for roadside and off-road walking and cycling paths are illustrated here, as extracted from the walking and cycling guide.



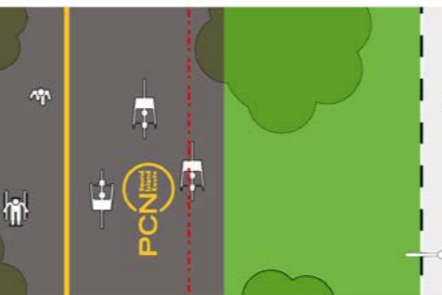
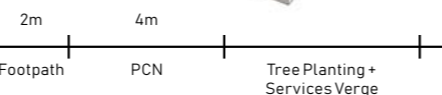
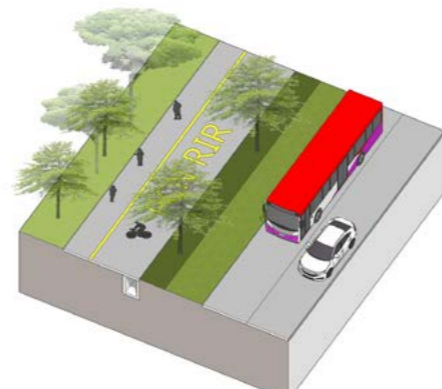
Along roads in a non-urban setting

This refers to situations where, in general, developments are set back from the road reserve. The existing 1.5m wide footpaths can be upgraded to a 1.8m wide footpath or 2.4m wide covered linkway. The cycling path is then created closer to the road carriageway.



Along roads in an urban setting

This refers to situations where developments are built up to the road reserve line, the covered walkway within the development can double up for the footpath if there are space constraints in the road side table. This is typically done in commercial and mixed-use areas.



Park Connector and RIR networks

Standard Park Connector Network (PCN) paths are 4m in width, with 1.5m space for walking and 2.5m space for cycling.

PCN within the Round Island Route will be 6m wide, with 2m space for walking and 4m space for cycling. Typically, up to 4m of space for landscaping is also added to the PCN for a total width of 10m for RIR paths.

1.2.4: Complete first-and-last mile connections and provide end-of-trip facilities

Last-mile connections and end-of-trip facilities are key elements of the whole urban mobility system, bridging the critical gaps between home or the workplace with the train station, bus stop or active mobility corridor.

Walking and Cycling Plans

To ensure good last-mile connectivity outcomes, URA and LTA require all developments within 400m radii of transport nodes to submit a Walking and Cycling Plan (WCP) as part of the design submission process. The Applicants have to propose the relevant walking and cycling connections to integrate the development to the surrounding active mobility network, as well as consider measures to minimise conflicts between pedestrians, cyclists and vehicles within the periphery of the proposed development. End-of-trip facilities are also encouraged under URA and LTA's Walking and Cycling Plan circular.

To accompany the WCP, LTA developed the Active Mobility Design Guide which outlines the design considerations and guidelines for active mobility-related elements to promote a conducive and safe environment for walking and cycling.

Walking and Cycling Plans must be submitted to LTA and URA as part of Development Applications for commercial, retail, business park and school developments which are expected to have high pedestrian and cyclist traffic. The requirements [can be found here](#)



27km of cycling paths are planned to make Ang Mo Kio a cycling town.

Illustration of Ang Mo Kio interchange station, with new cycling infrastructure integrated with the transit node



**Active Commute Grant**

This is a grant administered by LTA to support and encourage developers and building owners who wish to provide end-of-trip facilities in their developments. LTA will reimburse up to 80% of the construction costs of EOT facilities in certain developments within 400m of MRT stations, up to a maximum of \$80,000 per development. More details [can be found here](#)

End of trip facilities in developments

URA and LTA require developers to provide bicycle parking, with higher provision standards for developments within 400m of an MRT station or in the Central Area, in anticipation of higher volumes of people relying on active mobility in these areas.

Other end-of-trip facilities that serve cyclists, such as shower and locker rooms, are also encouraged by exempting these facilities from GFA computation.

With time, it is envisaged that these facilities will support and encourage people to embrace active mobility part of their daily lives.

Bicycle parking at transport nodes and public spaces

LTA, NParks, HDB and other agencies have also worked together to build extensive bicycle parking spaces at public transport nodes, public housing estates and public parks so that cyclists can easily find a convenient place to park. Today, most residential areas and transport nodes are within 5-minute walk to a parking facility.



Source: Funan



Source: Funan



Source: Funan

Examples of end-of-trip facilities at Funan Mall

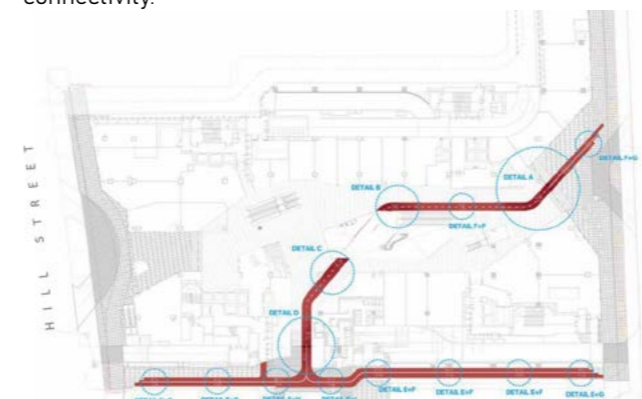
CASE STUDY**Supporting active mobility at Funan**

In the development of the former Funan IT Mall in 2016, the developer (CapitaLand) and architect (RSP Architects, Engineers & Planners) adopted a unique concept to support the government's car-lite vision for new developments.

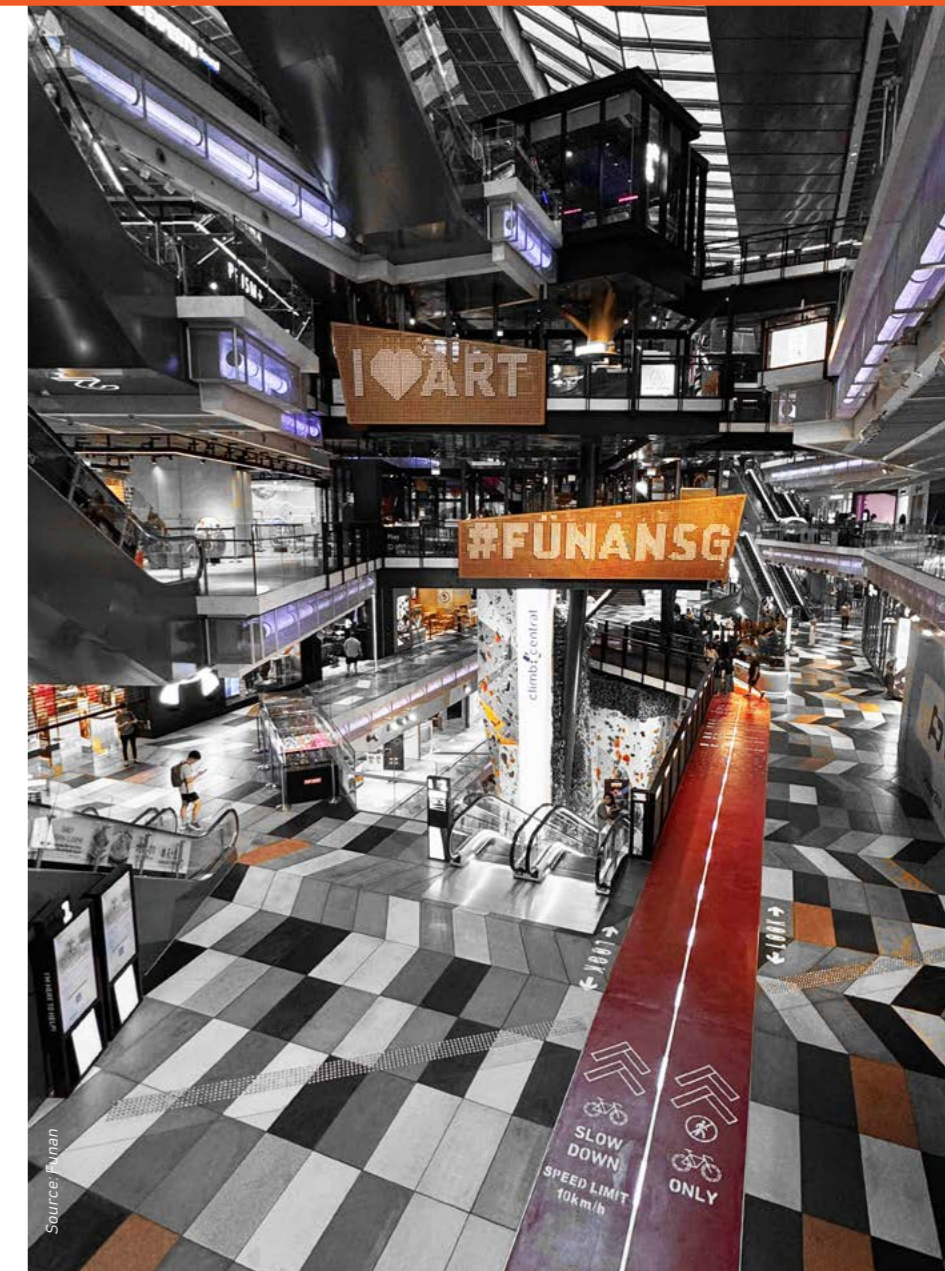
A bicycle hub was created at the first floor of the new mall with 166 bicycle bays, end-of-trip shower facilities, lockers and a bicycle repair station, encouraging visitors to consider cycling as the preferred travel option to reach the mall. One striking addition was a cycling path that ran through the first storey of the retail podium, connecting the outdoor cycling network into the mall, intended to serve nearby workers and residents who cycle to the office to make a quick pit stop in the mall.

Riders are encouraged to dismount and push their bikes within the mall during operation hours from 10am to 10pm.

In addition, Funan completed an underground pedestrian link under North Bridge Road to link commuters seamlessly from City Hall MRT station to the development, encouraging walking for last mile connectivity.



Plan showing cycling paths leading into Funan development



Source: Funan



Source: LTA

Cross section of the North-South Corridor showing car-lite outcomes at street level.

Transforming mobility with the NSC

The 21.5km North-South Corridor (NSC) is a multi-modal transportation corridor that will enhance connectivity from the northern region to the city, serving towns such as Sembawang, Yishun, Ang Mo Kio, Toa Payoh, Novena and Rochor.

Originally conceived as the North-South Expressway (NSE), the project was reimagined to become the NSC in 2016 to enhance the Walk-Cycle-Ride (WCR) experience, and now comprises the NSC Expressway (viaduct and tunnel) and the NSC's surface streets.

With the majority of motorists channelled to the 8.8km viaduct and 12.3km tunnel, surface streets along the Corridor will be repurposed to give more priority to walking, cycling, public transport, and community spaces to enhance commuter experience.

Redefining journeys for tomorrow



Source: LTA

Cycling trunk route that enables cycling between different towns along the NSC, connecting to the intra-town and PCN networks.



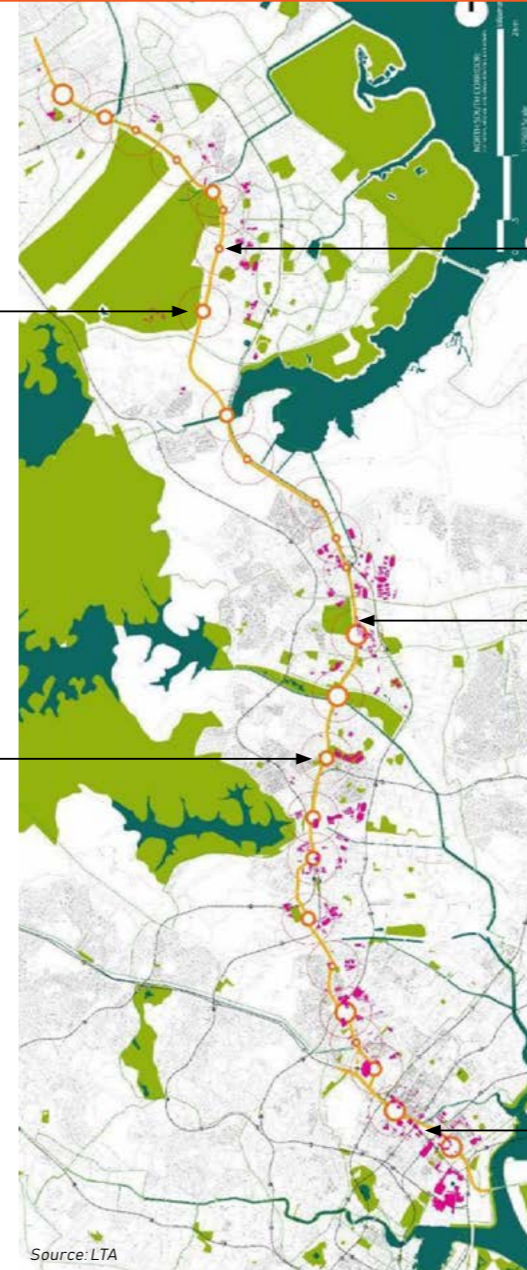
Source: LTA

An "urban green" corridor with ample shade and tree planting, improving heat resilience and giving more opportunities to be outdoors.



Source: LTA

Comprehensive path network to facilitate walking, cycling and recreational activities, enabling healthier and more sustainable lifestyles.



Source: LTA



Source: LTA

Nodes along the NSC will become gateways to neighbourhoods and amenities, with spaces to rest, play and socialise.



Source: LTA

Continuous bus lanes and bus priority measures for more seamless and pleasant bus journeys.

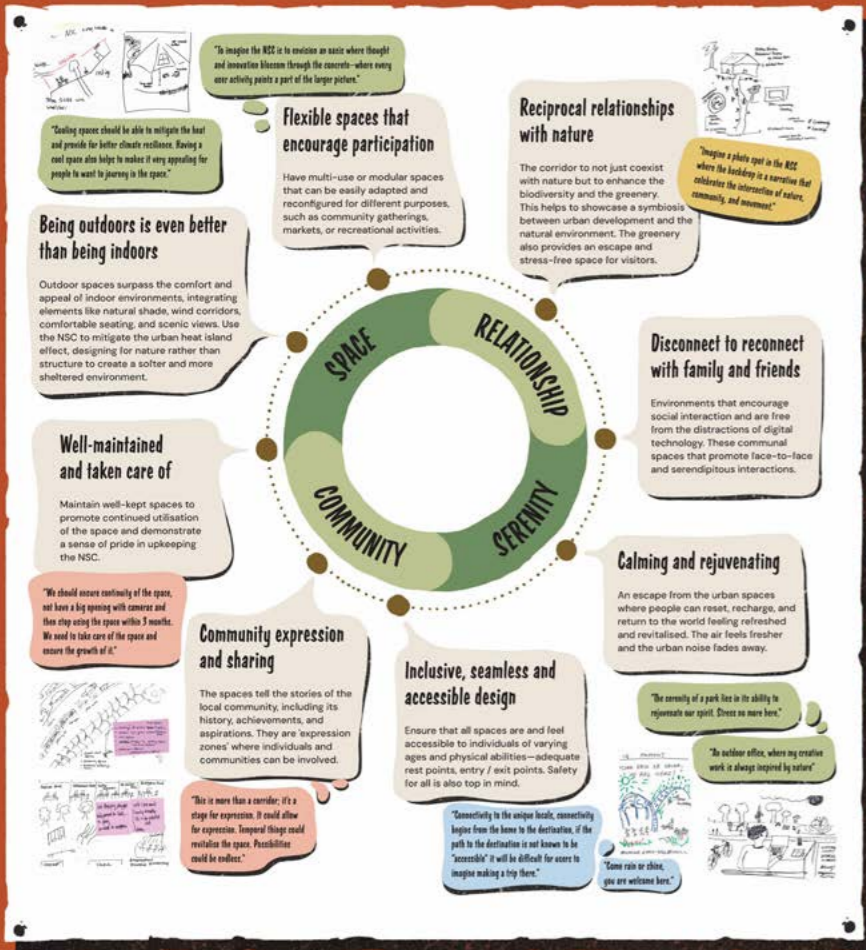


Source: LTA

Pedestrianised spaces to bring communities together. An avenue to slow down and a canvas for community activities.

DESIGN PRINCIPLES OF THE NSC

Design principles help to inform and guide the eventual building of NSC. They are based on what participants have shared around their needs and desires throughout the engagement workshops.



Design principles for the NSC developed through extensive public engagement efforts.

From the NSE to the NSC

In 2016, LTA undertook a consultancy to repurpose the surface streets to be more walk-cycle-ride friendly and allocate more space for the community. From this, over 30 football fields of space is freed up for active mobility and community spaces, and new typologies such as bus-only roads and centre median cycling paths were proposed.

A canvas to co-create Public Spaces

LTA, together with NParks, organised a series of visioning workshops to gather ideas on the potential uses of the NSC. LTA also launched online surveys and worked with URA and schools on design projects to co-create NSC's surface streets. In 2023, over 600 residents, stakeholders, students and members of public have been engaged through the various platforms.



Source: LTA

A Master Plan for the NSC's Surface Streets

LTA launched a two-stage Request for Proposal (RFP) on 30 October 2023 to invite professionals to form multi-disciplinary design teams and submit proposals to develop a Master Plan for NSC's surface streets.

The awarded consultant will develop the Master Plan taking into consideration the ideas from public engagement and develop a design guide to guide the implementation of streets and developments around the NSC.

On 27 August 2024, LTA announced the award of the contract to the Henning Larsen Design Team who submitted the best overall proposal in the RFP exercise to develop the Master Plan for the NSC's surface streets. The Master Plan is expected to be completed in 2026.



Source: Henning Larsen

Developing the Master Plan with the Community

The proposal adopted a people-centred approach that is inclusive to all users and prioritises walking, cycling and public transport users. To realise this vision, the multi-disciplinary team will build on the previous engagements and continue to co-create the surface streets with the community. Some of the feedback gathered from the earlier engagement includes making NSC:

- 1 A connector to places people value, such as places with good food and relaxation, by creating more possibilities for people to walk, cycle and ride;
- 2 An inclusive and safe mobility corridor for all, including the elderly, children, and people with special needs; and
- 3 A shared community experience which brings people closer to nature and encourages them to be more active.



Source: Henning Larsen

**Henning Larsen's concept:
Singapore's life reserve**

In their preliminary concept, the Henning Larsen design team had envisioned the NSC as a linear corridor with a distinctive identity featuring four distinct character segments - from the North to the South - a 6km Community-Industrial segment, a 7km Ecological Loop, a 5km People's Wellness Corridor, and a 3.5km Cultural-Heritage Segment.

In the city, an iconic public space at the intersection between Rochor Canal Road, Sungei Road and Jalan Besar could serve as a focal point connecting the three cultural districts in the area - Little India, Kampong Gelam and Waterloo Street, as well educational institutions such as LASALLE College of the Arts, Nanyang Academy of Fine Arts and Singapore Management University in the vicinity.

The proposed Ecological Loop at Ang Mo Kio would feature nature-based public spaces, cycling paths, footpaths and play spaces lined with lush greenery to connect neighbourhoods and destinations such as Bishan-Ang Mo Kio Park.

For the viaduct stretch at Gambas Avenue, at the northern stretch of the NSC, Henning Larsen had proposed public spaces beneath the viaduct as areas for activities and installations such as cycling, public seating, art, and playgrounds.

LTA and Henning Larsen will develop these concepts further together with the public agencies and the community.



BEHIND THE SCENES

The intersection of urban mobility and community

The 21.5km North-South Corridor (NSC) is a multi-modal transportation corridor that will enhance connectivity from the northern region to the city. We talk to Mak Keng Seng, Director of Strategic Planning Division in LTA and Leonard Ng, Country Market Director (APAC), Henning Larsen to find out more about the genesis of the plans and their vision for the NSC.



Source: Henning Larsen

What led to the reconception of the North-South Expressway into the North-South Corridor – transit and active mobility focused infrastructure project?

Keng Seng : In land scarce Singapore, we are constantly seeking ways to optimise land use by integrating various transportation modes. We aim to cater to the diverse needs of commuters, while providing them with a seamless and efficient travel experience.

The reconceptualisation of the North-South Expressway to the North-South Corridor allows us to move the majority of motorists to the viaduct and tunnel, freeing up surface streets. These reclaimed spaces can then be used for more greener travel options such as walking, cycling and buses. This will also free up space for community areas and enhanced accessibility to existing and future transport nodes and destinations along the NSC.

What is the vision for the corridor? What do we hope that it can achieve in terms of advancing the vision for a car-lite city? How do we anticipate commuting patterns to shift as a result of greater bus and cycling connectivity to the north?

Keng Seng : When completed in 2029, NSC will be a gamechanger for connectivity between the northern and southern regions of Singapore. The road spaces along the NSC will be repurposed to provide more space for walking, cycling, public transport and community activities. Pedestrians will enjoy wider footpaths and enhanced greenery which also connects to parks and the park connector network across Singapore. Cyclists will be able cycle between towns, such as from Sembawang to Ang Mo Kio or Yishun to Novena. Motorists and bus commuters will also enjoy smoother commutes.

This project presents many opportunities for creation of public spaces and community nodes. How will the agencies achieve and deliver meaningful places that resonate and are successful with the community?

Keng Seng: LTA, in partnership with NParks has conducted a series of visioning workshops between July 2023 and January 2024 to gather ideas on the potential uses of the NSC. As part of the development of the NSC Master Plan, we will continue engaging the community and stakeholders to co-create the master plan concepts. We hope the Master Plan will address the needs of the community, while accommodating the evolving demographics along the NSC over time.



Source: LTA

What were your priorities and main strategies in approaching a masterplan of this scale and size?

Leonard: We approached the North-South Corridor (NSC) Master Plan with a strong focus on connectivity, sustainability, and community engagement. The scale of the project required a comprehensive vision that integrates public transport, active mobility, and public spaces, while still maintaining a strong connection to the local community.

One of our main strategies was to ensure that the design reflects Singapore's "City in Nature" vision, by integrating extensive greenery and ecological features. Another priority was creating a design that grows and adapts over time, making the corridor resilient, vibrant, and inclusive for the future.

Tell us more about the vision for NSC.

Leonard: Our vision for the NSC is to create a dynamic, adaptable corridor that prioritises people and the environment. We're not just building a transportation route; we're designing a corridor that seamlessly integrates public spaces, greenery, and multiple modes of transport.

The idea is to transform surface streets into vibrant, socially connected spaces that serve the community and enhance urban living. From the Community-Industrial Segment to the People's Wellness Corridor and Cultural-Heritage Segment, every part of the NSC will reflect Singapore's diversity and forward-thinking urban strategies.

Are there examples of projects overseas that are similar with NSC that the team was inspired by?

Leonard: While the NSC is unique to Singapore, we drew inspiration from various urban transformation projects around the world that emphasise multimodal transport, public space activation, and green infrastructure. Projects like Copenhagen's "Superkilen" and New York's "High Line" have demonstrated how integrating community spaces, active transport, and urban greenery can create lasting positive impacts on cities. These projects helped shape our vision for the NSC, but we also ensured that our approach is tailored to Singapore's specific needs and aspirations.

Tell us more about how stakeholders along the corridor can be involved to contribute to the final outcome, why is it important that they are involved?

Leonard: Involving local stakeholders is essential to ensure that the design of the NSC reflects the needs and aspirations of the community. We've planned a series of public engagement sessions to co-design the surface streets with residents, businesses, and local organisations. This collaborative process ensures our public spaces along the NSC are inclusive, functional, and culturally relevant. By involving them from the start, we can build stronger ownership and instill pride, ensuring the NSC truly benefits the people who live and work along it.

The longer version of the interview can be found at this [link](#).

2.1

WALKABILITY

At the district scale, walkability is the underlying foundation of a well-connected and inclusive city, serving people of all backgrounds and levels of mobility.

This chapter explores how URA formulates extensive walking networks around different districts and promotes walkability in the urban fabric.

How do we create a walkable city?

2.1.1: Create comprehensive walking networks

The benefits of walkability

Walkability has always been a key priority of urban design in Singapore. It was realised early on that making the city walkable contributes to its functional performance, enabling people to move around efficiently to carry out various activities with ease. Making walking convenient and safe is critical to encouraging more use of public transport, which is the backbone of Singapore's transport strategy.

It is also the most sustainable form of mobility, requiring only the power of one's own legs – a consideration made more critical by the need to decarbonise our transportation system. A city designed for walking minimises the need for pollutive vehicles, contributing to fewer roads and cleaner air. It also frees up valuable land for greenery and other uses.

Walkability also brings about social and public health benefits. Walking can be a source of exercise for all Singaporeans, improving cardiovascular health and mental well-being. Walkable districts tend to have higher levels of social interaction, leading to stronger sense of community. Walkability has also been linked to reduced crime and safety in neighbourhoods.

Walking networks

URA plans walking networks according to the principles of providing choice, convenience and comfort to people of all abilities.

Networks typically start at transit nodes and connect to surrounding developments within a five to ten-minute walking radius. The widths of covered walkways or underground and elevated pedestrian links may be sized according to the distance from the transit node, to cater for anticipated pedestrian volume.

Networks are also created at various levels of the city depending on whether the MRT stations are underground or elevated. This has led to extensive underground walking networks in areas like the CBD and Orchard Road, and elevated networks in areas like Jurong Lake District. However, street level connectivity is always prioritised as this is the level most used by people, that all developments are connected to.

For this reason, covered walkways are required in all commercial and mixed-use developments fronting major roads and pedestrian routes, to allow people walking on the street to seek shelter and continue their journey at any moment. In addition, urban designers introduce various elements where appropriate like through-block links, courtyards and pedestrian malls to add to the richness of the street-level walking network in many districts.



At-grade pedestrian connectivity network at Bras Basah, Bugis

Shaping a comprehensive pedestrian network at Bras Basah, Bugis (BBB)

URA set out to achieve a comprehensive pedestrian system for BBB to support vibrancy around the time the Bugis and Dhoby Ghaut MRT stations were completed in the 1980s.

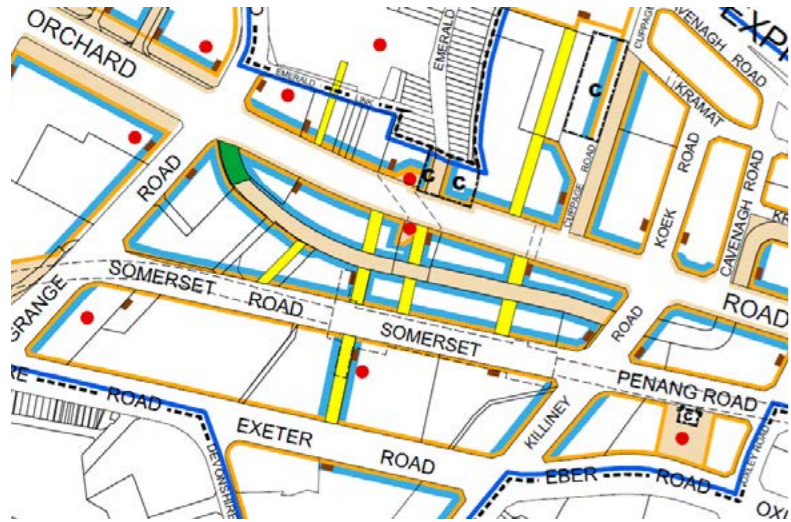
Covered walkways were required for all developments to line the various streets within BBB, complemented by through-block links through larger developments like the La Salle College of the Arts campus.

Two of the main streets in the district – Waterloo and Albert Street, were pedestrianised to form a walking spine in the 1990s, which has become a vibrant public space hosting festival celebrations.

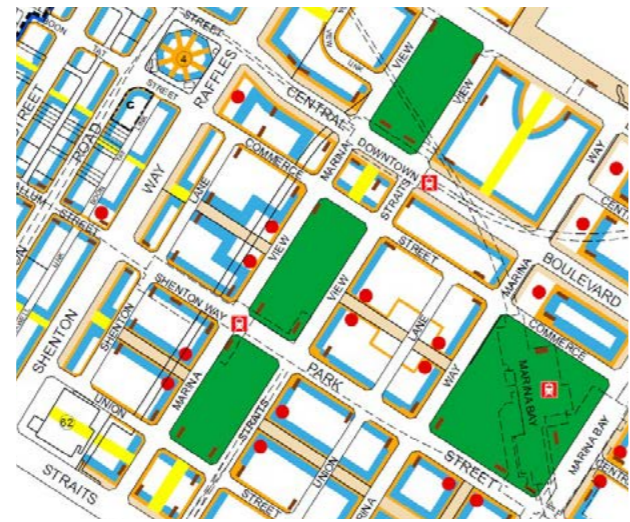
In 2013, URA embarked on environment improvement works to widen the sidewalk space and enhance walkability along Queen Street, while LTA turned Bencoolen Street into a car-lite active mobility and transit priority street in 2017.

Various laneways and courtyards also improve porosity in the urban fabric, creating interesting circulation experiences that add to the charm of the district.

Together with the host of arts, cultural, collegiate and retail activities, BBB has become one of the most vibrant and walkable areas to explore in the city.



Cross block porosity within Somerset subzone



Through-block links through large development sites at Marina Bay

- Public Space
- Covered walkway
- Activity-generating use
- Vertical circulation point
- Through-block link
- Pedestrian mall/promenade/plaza
- Park/open space

2.1.2: Ensure good porosity at street level

Porosity in the urban fabric is essential to promote walkability and social interaction in the urban setting. In formulating the connectivity plans for any given area, URA considers the frequency and intervals of connections through street blocks and developments to ensure good porosity at street level.

As street blocks and development sizes tend to be larger in today's context, porosity is usually achieved through the introduction of through-block links or courtyards that provide shortcuts through the developments.

Examples of this can be seen around the Somerset precinct of Orchard Road. To create access from Orchard Road to the MRT station entrance, URA introduced a number of through-block links within 313@Somerset, Orchard Gateway and Orchard Central. This was to account for the high pedestrian volumes in the area.

Likewise, a number of through-block links have been safeguarded in the developments at Jurong Regional Centre to promote walkability. In Marina South, a residential mixed-use neighbourhood, the street blocks are sized to ensure that the urban fabric has sufficient porosity to enable residents to walk to transport nodes and amenities all within 10 minutes.

There is no fixed formula for urban porosity and intervals of connections. In built-up areas, the creation of through-block links is opportunistic, i.e. URA will require a redevelopment proposal to provide such a link if it will provide a more direct connection to a transport node or amenities.

In recent years, URA has used analytical tools to determine the need for through-block links to enhance overall connectivity to transport nodes and amenities.

URA will frequently carry out benchmarking studies to determine if connectivity provisions should be enhanced to improve the walking experience in a district.

CONCEPTS EXPLAINED

Pedestrian comfort in walking networks

To better understand what factors and design elements could provide a comfortable and seamless walking experience, URA worked with Singapore University of Technology and Design (SUTD) to carry out a multidisciplinary study on "Pedestrian Comfort in High Pedestrian Activity Areas" from 2017-2020.²

Pedestrian networks around transit hubs were mapped based on various attributes such as width, height, adjacencies and distance from traffic. The SUTD team carried out psychophysiological measurements in both physical and virtual environments to better understand the perceptual, cognitive and experiential aspects of pedestrian behaviour in these walkways.

High-crowd vs low-crowd areas

From the behavioural, eye-tracking and verbal data collected from the survey participants, it was found that the level of crowd could influence people's choices. In low-crowd walkways, it was suggested that people preferred having functional physical elements, such as seatings, planters, etc. However, in high-crowd areas which were already cognitively demanding, minimal physical obstructions were preferred.

Digital preference survey

The research team generated various design ideas for indoor walkways which were subsequently validated through digital preference surveys. Survey findings revealed that pedestrians preferred variations of open spaces, followed by walkways with active uses (e.g. commercial, F&B), greenery and public art as compared to an empty walkway.

Using findings from the study, SUTD recommended the following strategies to enhance pedestrian comfort in walkway design, which are summarised on the right.



Brighter colours, mirrors and transparent edges enhance perceptions of spaciousness and comfort.



Barriers in crowded areas help to facilitate smoother pedestrian flow.



Smother floor surfaces give the impression of cleanliness and are preferred for areas with higher pedestrian volume.



Rougher surfaces like carpeting help with absorbing noise levels for calmer experiences.



Small flowering bushes and greenery can increase perceived comfort levels of walkways.



Pathways should be free from obstructions like dustbins, bicycles, etc to minimise circulation conflict.

2.1.3: Remove barriers in the city

Removing barriers in the city facilitates unimpeded movement and shaping of a more inclusive society. This can take the form of barrier-free design in the public realm or requiring developments to be fenceless.

Shaping the open city

At the macro scale, Singapore is largely open and accessible due to the prevalence of public housing in the landscape. Housing Development Board (HDB) towns are designed to be open and fenceless, with shared communal facilities and amenities that serve all residents. Open “void decks” on the ground floor of older slab blocks serve all manner of communal uses and activities, such as weddings and funeral wakes. In newer estates where tower block typologies are more prevalent, the communal spaces take the form of pavilions, and rooftop gardens.

Mixing of public and private housing

URA also adopts planning strategies to mix public and private housing developments to avoid the creation of exclusive enclaves, which can also inadvertently end up being areas with weaker walkability and accessibility to basic amenities.

Fenceless design and porous developments

At the meso-level, URA may adopt guidelines to make private housing developments more porous or open, e.g. with through-block links, 1st storey shops or fenceless design, so that they do not resemble gated communities. This is typically pursued in mixed-use districts where there is scope to require the ground floor to be lined with shops and other communal spaces to keep it open and accessible to all.

Barrier-free accessibility

At the micro-level, removing barriers to movement takes the form of ensuring developments and the public realm cater to barrier-free accessibility (BFA). The key principle of BFA is not about making special provisions for the less mobile, but about designing the public realm such that people of all abilities can navigate it freely and comfortably.

This is exemplified in URA’s design guidelines for covered walkways in developments. URA requires covered walkways to be level with adjoining open walkways along the street so that all regardless of mobility level can freely and easily use them.

Community amenities within easy reach in a neighbourhood

Image courtesy of the Housing & Development Board



CONCEPTS EXPLAINED

Age-friendly design

To better understand existing gaps in walkability from seniors’ perspectives, as well as propose design interventions that promote active ageing in Singapore, URA launched a research grant call in 2019 with HDB, LTA, MOHT and AIC under the Cities of Tomorrow R&D framework.³

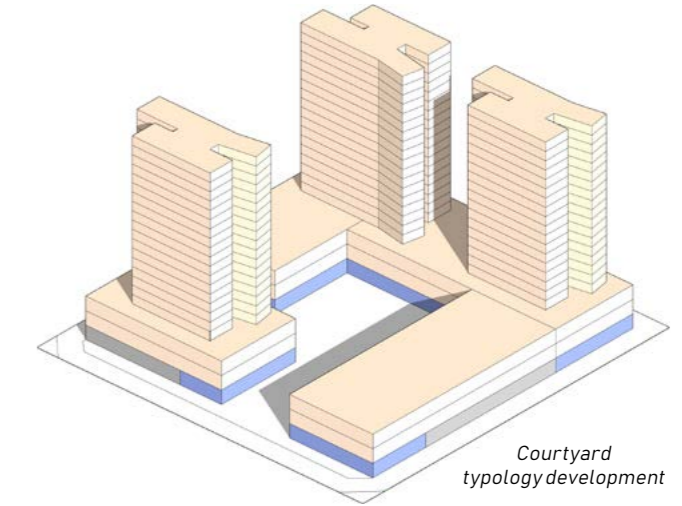
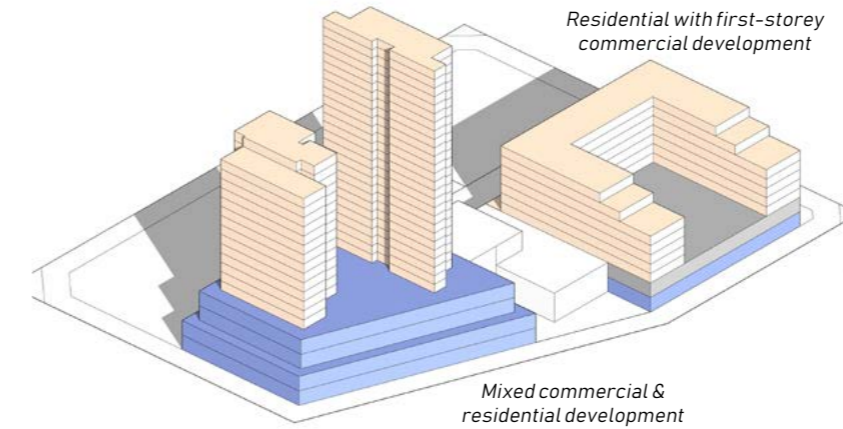
A research project led by SingHealth and collaborators Duke-NUS and SUTD was completed in Feb 2024, called the Elderly Life Activity-Space (EASE) project. It proposed a framework for shaping walkable neighbourhoods to support active ageing, with seven defining features as indicated below.

Strategies gleaned from such research projects can be incorporated into existing planning and design strategies, where appropriate such as in the rejuvenation of ageing towns. One example is Queenstown with the provision of barrier-free ramps, road centre dividers to help older adults cross streets easily, as well as including dementia-friendly features in new housing developments such as Queensway Canopy.





Fenceless residential developments with first-storey shops at Robertson Quay



2.1.4: Shape fenceless developments

Fenceless developments are the antithesis of gated communities, designed sans boundary fences so that the development is made more inviting and inclusive to the public.

Such developments often contribute through-block links, courtyards and other urban spaces, expanding and enriching the local walking network.

The security and privacy of residents can be ensured at the block level as well as other methods of segregation.

Vertical segregation

This refers to methods of organising different uses within the development vertically so that residential uses are located above the ground level for privacy and separated from public circulation at street level.

Podium-tower typologies are common in mixed-use areas, where shops or carparks fill the publicly-accessible podium while residential units have their own secured access cores leading to the tower.

In other areas with less concentration of commercial activity, residential buildings with first storey shops may be introduced as a form of fenceless development, with shops that contribute to vibrancy at street level while preserving privacy for residents.

Horizontal segregation

This refers to methods of organizing uses on the ground plane to separate private and public areas of the development.

Courtyard developments usually have building blocks arranged around a publicly accessible public space, with controlled keycard access to the residential lift cores and circulation areas.

Active frontage developments usually have one side of the development lined with shops or restaurants and is publicly accessible, while private communal and service areas are kept to the back and away from public access. One example is Robertson Blue along Singapore River.



2.2

MIXED-USE VIBRANCY

Vibrancy and walkability go hand in hand – areas devoid of activity can be unattractive places to walk even if the infrastructure is well-designed.

URA therefore adopts a mixed-use planning approach to ensure the vibrancy and walkability of districts around Singapore, bringing homes, jobs, amenities and leisure options within walking distance to each other.



Mixed-use districts tend to have more round-the-clock activity and vibrancy

How do we ensure vibrancy in the city?

2.2.1: Zone for mixed-uses in the city

A mixed-use planning approach ensures that districts are self-contained and vibrant, where daily necessities can be found within walking distance.



Rich mix of land uses that evolved over time at Bras Basah, Bugis



"White" zoning that allows for flexible mixing of land uses within Marina Bay

Zoning is used as a key tool to achieve this, facilitating the development of mixed-use areas.

Mixed-use areas and districts

In some areas of the city, the Master Plan reveals colourful mosaic-like patterns as a reflection of a high mix of different uses in the area.

This occurs organically to a certain extent, especially in older parts of the city where such diversity reflects traditional ways of live, work and play, but it can also be the result of policies that encourage mixed-use redevelopment.

The Central Business District Incentive (CBDI) is such a policy that offers GFA incentives to encourage single-use office buildings to

redevelop into mixed commercial, residential and hotel developments. The policy intention is to introduce a live-in population which is key to sustaining day and night activity in the area.

Mixed-use zoning types

Another strategy is allowing other complementary uses to be accommodated within a predominant land use, e.g. allowing a small quantum of retail and F&B uses in condominiums to provide convenience to residents.

The zoning code also has a number of "hybrid" zone types which allow fixed proportions of land uses to mix, e.g. "commercial and residential use" which allows up to 40% of commercial uses in the predominantly residential development.

Flexible white zoning

In 1997, URA introduced "white site" zoning in selected areas to facilitate even more flexibility in use mixing, which can be led by market demand.

A white site is one where a range of uses are allowed without the need to adhere to specific proportions. As the mix can be changed subsequently during the lease tenure of the land, this flexibility allows developers to respond to changing market forces and trends.

2.2.2: Ensure good provision of key amenities and services

In addition to taking a mixed-use planning approach to facilitate more vibrant and active neighbourhoods and districts, URA also tracks the provision level of key amenity types in each community to ensure that basic services can be found within walking distance from homes.

Basic amenity types

The four basic amenity categories commonly tracked are food, groceries, healthcare and parks & recreation. Access to these are deemed essential in daily routines, hence their provision levels are carefully tracked around the island using ATOS (access to opportunities and services), which measures actual walking distance to a basket of services.

For areas with gaps in provision (i.e. not all 4 amenity categories are within 400m walking distance), namely the yellow / orange / red areas on the map, planners may consider whether coverage can be improved through injection of the needed amenity or improving connectivity conditions.

Oftentimes, accessibility can be achieved by addressing barriers to connectivity, such as the lack of a street crossing or bridge.



Illustration of ATOS mapping showing areas with better walking accessibility to key amenities

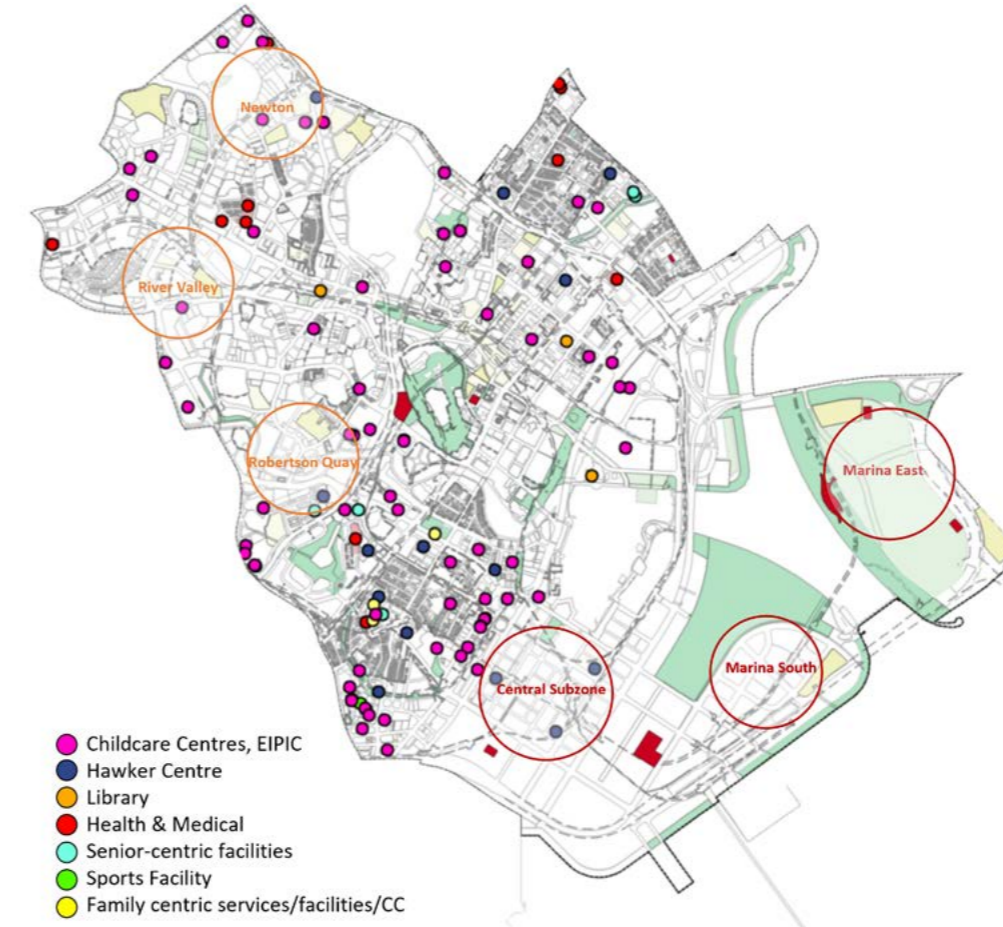
Granular mapping of service types

Granular tracking of the nature of the amenity within each category type can also be carried out, to ensure better fit with the surrounding demographic context and planning intention for the area.

For example, the map on the left looks at the distribution of family-centric amenities within the Central Area, such as schools, sports & recreation and libraries, as the intention is to increase their provision levels to attract more families to live in the Central Area.

The demographic profile of each sub-district is also analysed to see if there is a need for injection of more child-care or senior-care facilities based on the population demographic. URA then works with the relevant agencies to ensure community amenities are right-sized and right-sited within the neighbourhood.

ATOS is a highly versatile tool that visualises the accessibility of residents to different types of amenities, using a tiered symbology to help planners identify areas with lesser accessible amenity provisions.



Mapping of family centric amenities within the Central Area

2.2.3: Plan for 10-minute neighbourhoods

10-minute neighbourhoods

To ensure that the key amenities are sited within walking distance of homes and work places. URA uses a 5 to 10 minute walking threshold to assess the spread of amenities. When translated to average walking speeds of 5 to 6km / hour, this means maximum distances of within 400m and 800m respectively.

This is seen as the threshold of walkability in Singapore, catering for various demographic segments such as the elderly and families with young children, ensuring that everyone is able to reach key essentials comfortably.

Concepts such as the 15-minute city commonly found around the world are also based on this idea of ensuring smaller liveable and walkable units within the urban fabric.

Longer distances of 10-15 minutes are sometimes deemed acceptable for recreational journeys made by jogging and cycling, such as NParks' targets to ensure that every home will be within 10-minutes walk to a park.



URA plans using 5-10 minute walking distances to ensure that key amenities can be reached easily

Refining network analysis

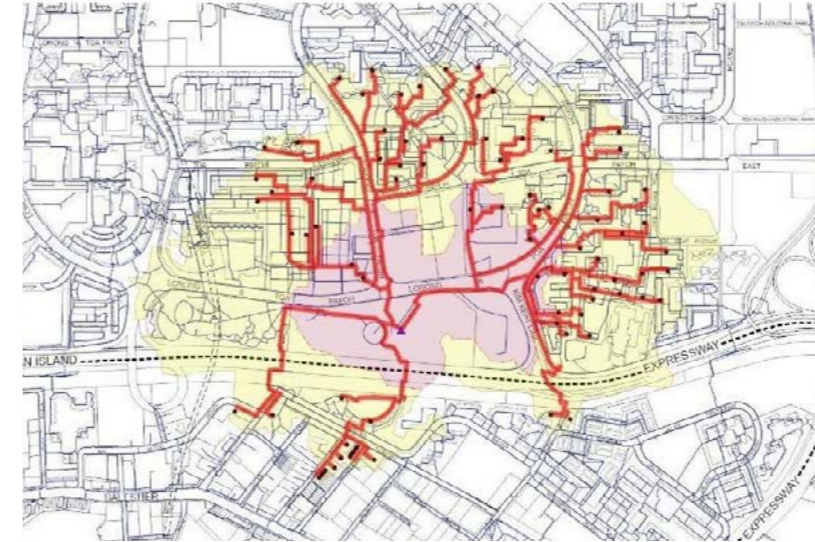
Initial analysis on accessibility using ATOS utilised geographical distances of 400m and 800m, or distances "as the crows fly", to determine accessibility to key amenities. With the building up of walking and cycling network data by various government agencies, such analysis has become more accurate and reflective of actual walking conditions, using actual footpaths, linkways and bridges in the city.

Further refinements to the datasets have allowed URA to map routes with barrier-free accessibility, shelter, proximity to landscaping, as well as other factors, to aid in more granular analysis.

The diagrams in the next page depict an analysis of the walking network around Toa Payoh MRT station, showing how the lack of barrier-free provision in parts of the network affects accessibility of certain neighbourhoods to the MRT station.

The ability to map out routes that overlap with covered linkways and greenery also allow for predictions of preferred routes based on weather protection or scenery.

The potential application of such data is wide-ranging, and can help inform planning decisions such as the upgrading and introduction of new linkways. Data on barrier-free routes may even soon be available on publicly accessible apps.

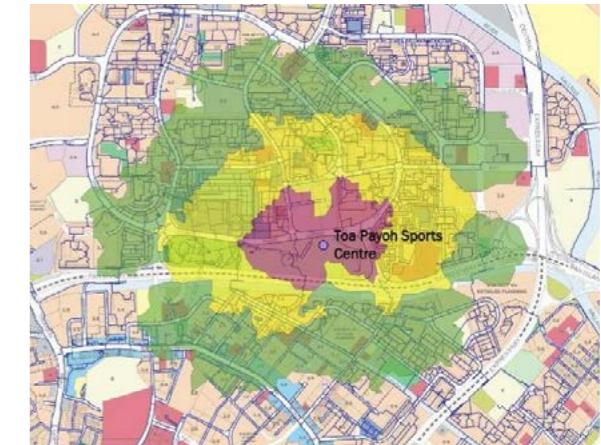


Mapping of "shortest routes" from every block within 800m of the sports centre



Mapping of sheltered linkways and routes with tree planting that may influence residents' choice of route

Beyond efficiency and productivity considerations, planning the city on a 5 to 10-minute walking basis is also a matter of equity and inclusivity, ensuring that most if not all residents have access to the same services and opportunities without the need to drive.



Walking Network Service Analysis of 400m, 800m and 1.2km walking distance around Toa Payoh Sports Centre

Walking
 Within 400m
 Within 800m
Jogging / Cycling
 Within 1.2km



2.3

CAR-LITE DESIGN

Singapore has embraced a car-lite approach in shaping connectivity for the city, emphasising public transit and active mobility instead of building more roads to support car population growth. This is a matter of necessity in land scarce Singapore, allowing land to be freed up for other more pressing priorities such as housing.

Going car-lite takes a concerted approach to plan the city structure, district layouts and building typologies to reinforce car-lite behaviour.

How can the city turn more car-lite over time?

2.3.1: Plan for car-lite areas in existing and future areas of the city

Many cities are moving towards planning for more car-lite areas, with the understanding that this will create more quality living environments and is better for our overall mental well being.

Planning districts to be car-lite through active policy is key to achieving this. Some existing parts of the city are already naturally car-lite, being districts that are highly accessible, mixed-use, self-contained and walkable.

Historic areas with conserved buildings also tend to be car-lite as parking requirements are exempted for such buildings. Many such areas also have pedestrianised streets and temporary road closures to discourage driving behaviour.

Since 2019, new development areas like Jurong Lake District, Woodlands Regional Centre and Bayshore have been designated as "car-lite areas" to ensure that they are developed upfront to require less parking, have good public transport connectivity and alternative travel options. As of 2023, there are 16 such areas in the city.

In some of these districts like Marina South, the reduction of parking provision numbers is as much as 50% of the original requirement. Theoretically the naturally occurring traffic in the area is reduced by 50%.

Such measures can help foster car-lite behaviour, as homeowners moving into the district would be consciously buying into a new car-lite lifestyle.

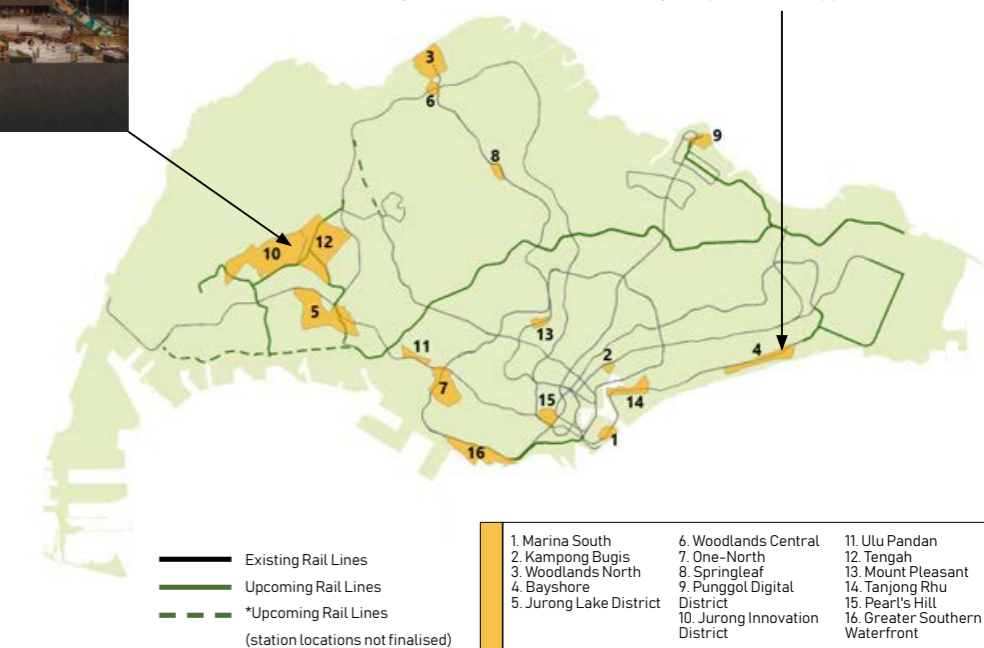
The policy for car-lite areas is governed under LTA's Range-based Parking Provision Standards (RPPS), which can be found [here](#). These areas are classified as Zone 4 in the policy, comprising areas such as Mount Pleasant, Tanjong Rhu, Tengah, Bayshore and more.



Artist impression of the "car-free" Tengah Town Centre where vehicular traffic is completely segregated from pedestrians and cyclists



Artist impression of Bayshore which has been gazetted as a car-lite estate, and will feature a Transit Priority Corridor and a network of cycling and walking paths



Existing and future car-lite neighbourhoods planned in Singapore

Reducing the parking provisions for a car-lite area also means that other car-related infrastructure can be scaled down, such as the width of roads and size of multi-storey car parks.

The future Tengah Town Centre is planned as the first "car-free" Town Centre in Singapore, where vehicular traffic is planned to be completely segregated to develop a fully pedestrianised plane, freeing up contiguous space for a safe and friendly pedestrian cycling experience.

The upcoming Marina South district will also have a car-lite focus. It will enjoy wider sidewalks, a pedestrianised shopping street and direct connections to the MRT network.

How can car-lite behaviour be reinforced on a local scale?

2.3.2: Create car-lite streets and pedestrian malls

Car-lite areas tend to have significant infrastructure catering to walking and public transit to encourage car-lite behaviour, such as car-lite streets and pedestrian malls.

Origins of pedestrian malls

In the city centre, such projects were initially pursued as rejuvenation projects in historic areas, but they also had the effect of reinforcing car-lite behaviour. One example is the conversion of the very vibrant Albert and Waterloo Streets in Bras Basah, Bugis into a pedestrian mall in the 1990s, which linked multiple street blocks directly to three MRT stations. With the pedestrianisation, space was created to allow the long time street vendors to stay as well as cater to staging of community events and festive celebrations.

Car-lite movement

Car-lite streets began to emerge alongside the "car-lite" movement around the early 2010s, incorporating wider sidetables to accommodate cycling lanes, wider open walkways as well as dedicated bus lanes. This is similar to a "complete streets" approach driving many road repurposing projects in other cities.

The first "car-lite street" was realised at Bencoolen Street by LTA in 2017. The road was repurposed into a transit priority corridor with dedicated space for buses, walking and cycling, with generous bike parking and public seating.

Urban designers at URA also specified that covered walkways are to be flushed with the open walkways within the sidewalks. MRT entrances are also integrated into the building envelope such that the entire appearance and transition between walking and cycling pathways is seamless.

Such integrated outcomes are also commonly seen elsewhere with urban design guidance, such as Orchard Road, the CBD and Transit Priority Corridors in other parts of the city.

Perspective courtesy of the Housing & Development Board - artist's impression only. Actual developments may differ.



Illustrated perspective for car-lite street along Bayshore. The bus-only Transit Priority Corridor along Bayshore Drive can be transformed for community use.



Club Street / Ann Siang Road closures



Road closures at Lorong Mambong, Holland Village



Car-Free Sunday SG around the Civic District and CBD

What is a low-cost and low-risk way to test out car-lite initiatives?

2.3.3: Create temporary car-free zones

Low-risk, small-scale tactical urbanism

Temporary car-free zones are a short term, low-cost method to test the potential for longer term car-lite initiatives in the city. Such efforts are sometimes referred to as "tactical urbanism".

URA began to deploy experimental car-free zone pilots in the city in 2013, launching them at three locations: Club Street / Ann Siang Road, Haji Lane and Circular Road Road. This was followed by the Car-Free Sunday SG project in 2014, where URA closed 5km of major roads in the Civic District and CBD on Sunday mornings, for cycling and public enjoyment, attracting thousands of participants each time.

These projects had the effect of socialising stakeholders and residents to car-lite behaviour. The temporary closures at Haji Lane for example eventually expanded to Bussorah and Arab Streets. Following the suspension of Car-Free Sunday SG during the COVID-19 pandemic, Connaught Drive within the Civic District became permanently pedestrianised, having seen the success of the earlier experiment.

Empowering stakeholders to push for car-lite

Not all pilots have been successfully scaled up or sustained into longer term arrangements. For them to have longevity or for the government to consider making them permanent, they require the support of local stakeholders as stewards of their own communities.

Therefore in 2015, URA introduced a grant called "Lively Places Fund" to provide funding and administrative support to empower local communities to initiate such programs from the ground up.

To qualify for the grant, stakeholders must band together to put up a joint submission with strong majority support from all parties. They must also make alternative arrangements for stakeholders affected by the event. To date URA has supported 68 street closures on 31 streets through this programme, in places as diverse as Serangoon Gardens, Keong Saik Road and Liang Seah Street.



Car-Free Sunday SG route

Pedestrianisation areas indicated in brown and orange.



Permanent road closures along Connaught Drive and Armenian Street in the Civic District after multiple runs of Car-Free Sunday SG, allowing the green spaces of the Civic District to be more seamlessly integrated

CASE STUDY

An integrated car-lite active mobility street – Bencoolen Street

A “complete streets” approach

“Complete streets” is commonly used to describe streets that prioritise transit and active mobility modes over private vehicles, making it safer and more efficient to walk, cycle and ride than to drive a private car.

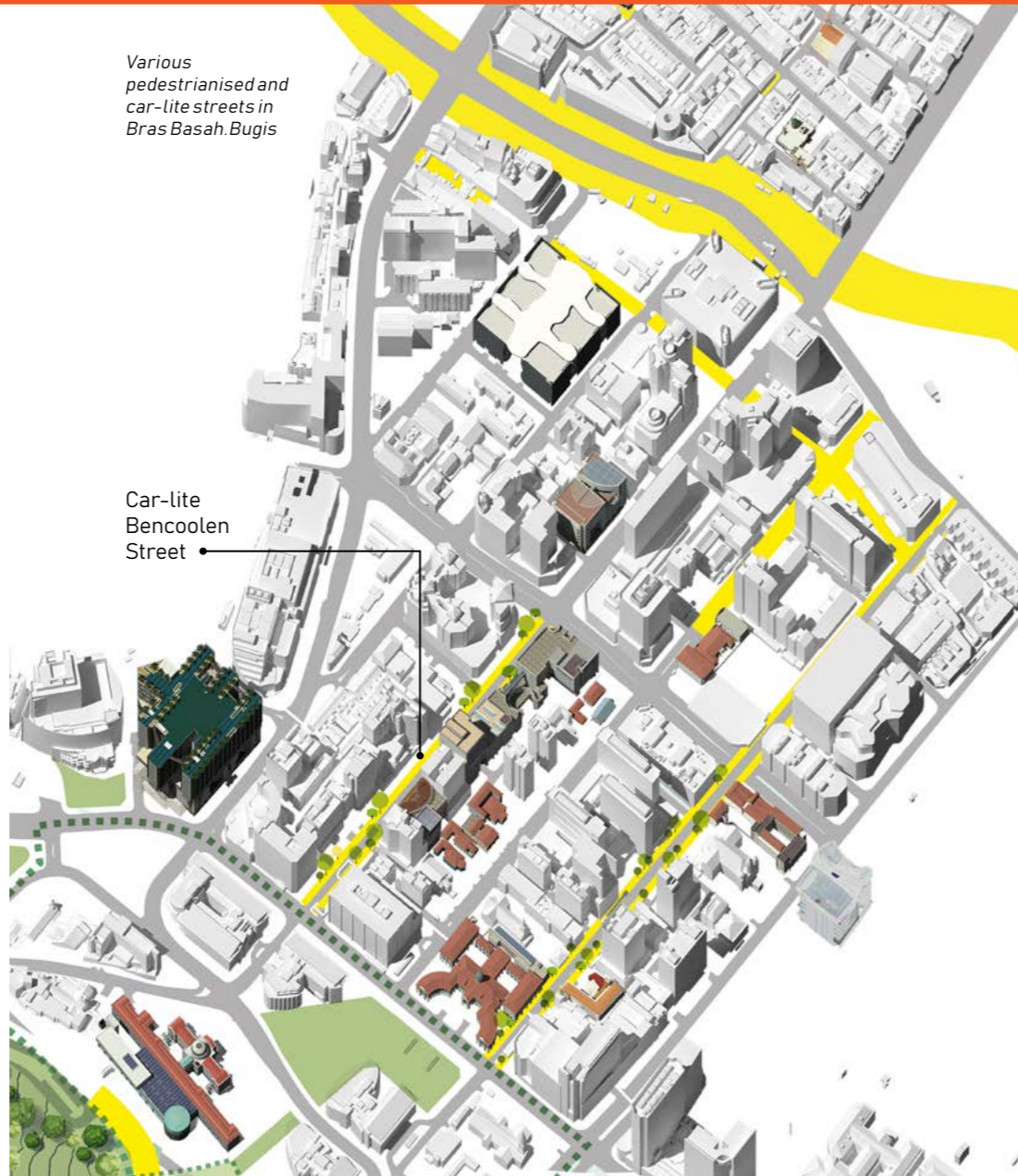
Such streets can have a higher capacity to move more people, as space-efficient buses are able to ply through faster on dedicated lanes, instead of competing with private car traffic.

The transformation of Bencoolen Street within the Bras Basah, Bugis area was carried out based on the “complete streets” approach, with the road carriageway narrowed down to create generous side table spaces. This provided space for footpaths and dedicated cycling paths sheltered by trees. The reduced road carriageway has one lane set aside for buses only, leaving the remaining lane for cars. The narrowing of the carriageway makes crossing the street easier on foot.

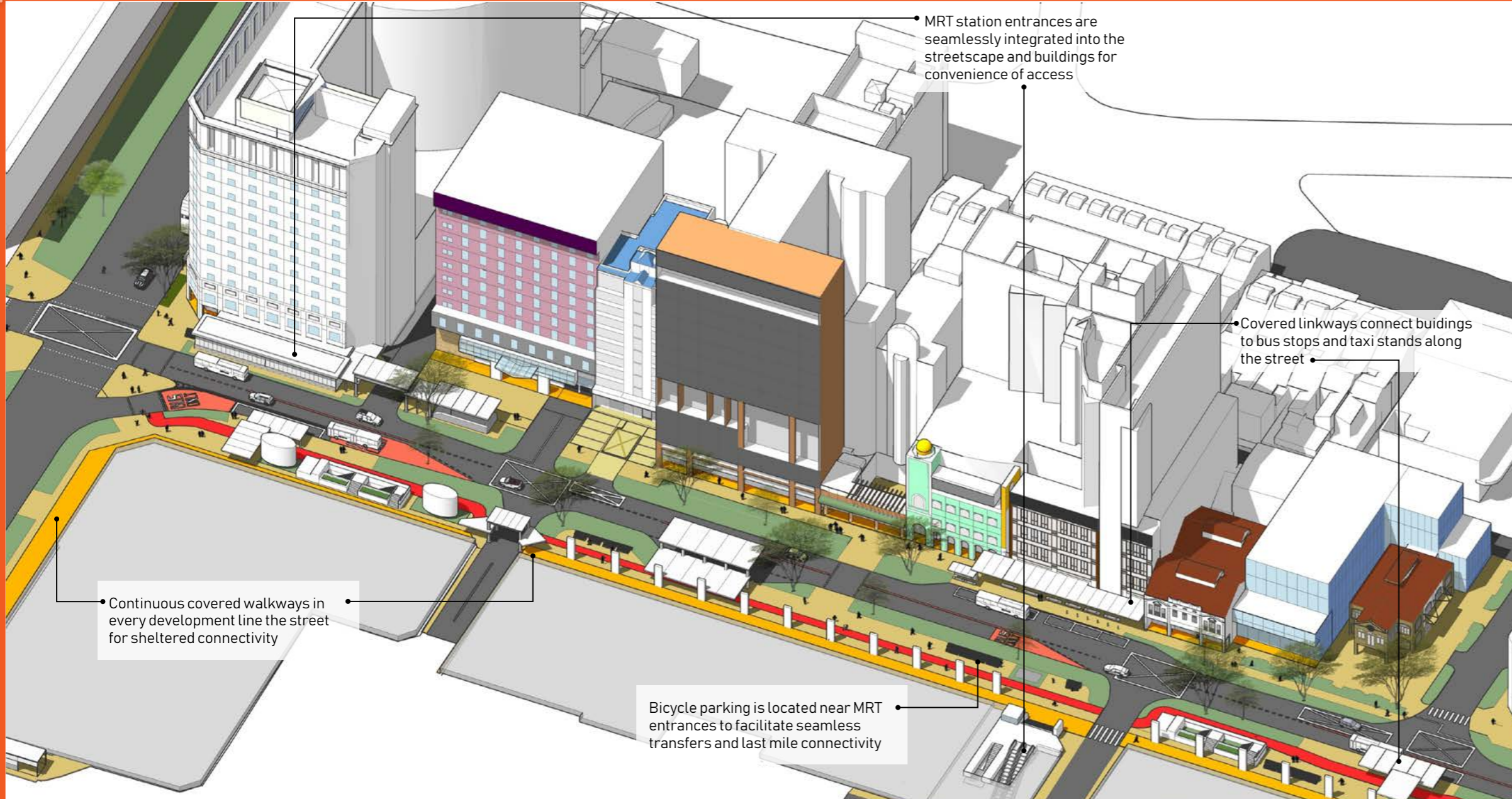
Adjacent buildings are also built up directly to the street – with no setbacks – allowing covered walkways to be seamlessly located right next to the open walkways at the same level. The MRT station entrances are integrated into the buildings lining the street (Nanyang Academy of Fine Arts), or designed to be part of the streetblock as a party-wall building.

Completing the set up of Bencoolen Street are the 125 bicycle parking spaces located right in front of MRT entrances, to allow for easy transfers between taking the train, walking and cycling. Designing for seamless connectivity between different modes of movement is part of a “complete streets” approach.

Various pedestrianised and car-lite streets in Bras Basah, Bugis



Dedicated bus lanes, walking and cycling space at Bencoolen Street



Overall positioning and connectivity strategy

The transformation of Bencoolen Street is in line with the overall vision for Bras Basah Bugis to be a pedestrian friendly and vibrant walking district, first outlined in the Development Guide Plan for the area released in 1994 by URA.

The vision for good walkability was intended to complement the diverse mix of uses that were planned for the district, including arts, culture, learning and entertainment.

Early efforts focused on the pedestrianisation of Albert and Waterloo Streets, forming a cross-shaped car-free core for the district. In 2013, URA also undertook environmental improvement works at Queen Street. This involved narrowing down the road carriageway and removing kerb side parking, to create more space for footpaths, benches and landscaping and curate a more attractive environment around the conserved buildings and monuments.

Conceptualisation of Bencoolen Car-lite Street

In 2011, construction started on the Downtown Line MRT with the MRT station located underneath Bencoolen Street. That part of the street was closed off to traffic to facilitate the construction works for several years.

Prior to the road closure, Bencoolen Street had been a major four-lane road carrying citybound traffic from Jalan Besar into the city centre. With the lane closures, traffic filtered to the adjoining streets, primarily using Middle Road as a diversion towards the city centre. Traffic monitoring analysis showed that there was enough carrying capacity in the nearby streets to absorb the diverted traffic.

When construction works concluded around 2017 and the time came to reopen the street to traffic, LTA took the opportunity to redesign Bencoolen Street for a reduced private vehicle throughput to become a transit and active-mobility-oriented street instead. Two of the original four lanes were reclaimed for expanded sidetable space.

Public realm and placemaking

The widened sidetables presented the opportunity to use the reinstatement works for generous landscaping space to enhance the lushness of the street. URA also invited NAFA students, who studied on the same street, to design benches for public use along the street.

Six students and members of the alumni came up with creative interpretations for the benches, which were funded under URA's Our Favourite Place programme.

The benches allowed the voices and perspectives of local stakeholders to be given expression through art and design.⁴

BEHIND THE SCENES**Achieving seamless integration between mobility and the urban environment**

William Chee was the project lead for the construction of Bencoolen MRT station, which required shutting down the busy roadway for nearly four years before its reinstatement as a car-lite street. Representing Arup Singapore Pte Ltd and Aedas Pte Ltd, he shares insights on how the complex works were coordinated and why having car-lite streets is important for Singapore.

The construction of Bencoolen MRT was highly complex, being Singapore's deepest MRT station and sited within a very tight urban context. What were some of the technical challenges of planning and building this station?

William: To facilitate the station construction, the entire carriageway of Bencoolen Street from Middle Road to Bras Basah Road was closed for nearly four years.

A key challenge was undertaking deep excavations and carrying out works in such a built-up area while ensuring minimal impact to the immediate neighbourhood. The mix of historic buildings and modern high-rise buildings also meant that there was a difference in construction standards and records. The project team also worked with Nanyang Academy of Fine Arts (NAFA) to integrate the façade with the NAFA building.



Source: William Chee

Bencoolen MRT station under construction

What were the challenges faced in designing the MRT station exit for integration with NAFA building?

William: The main challenge in locating a station within a congested urban environment is finding suitably sized lots for the station's entrances and at-grade facilities. Entrance A together with ventilation shafts and cooling towers was to fit within a small lot which was separated from the main NAFA building by an access road, while the smaller Entrance B was designed as a narrow structure located in front of the Rendezvous Hotel.

Early in the design stage for the station, URA informed LTA of NAFA's extension plan for their campus building. The building extension will span over the access road with seven floors to be built above Entrance A, which is designed to be integrated with the NAFA building above.



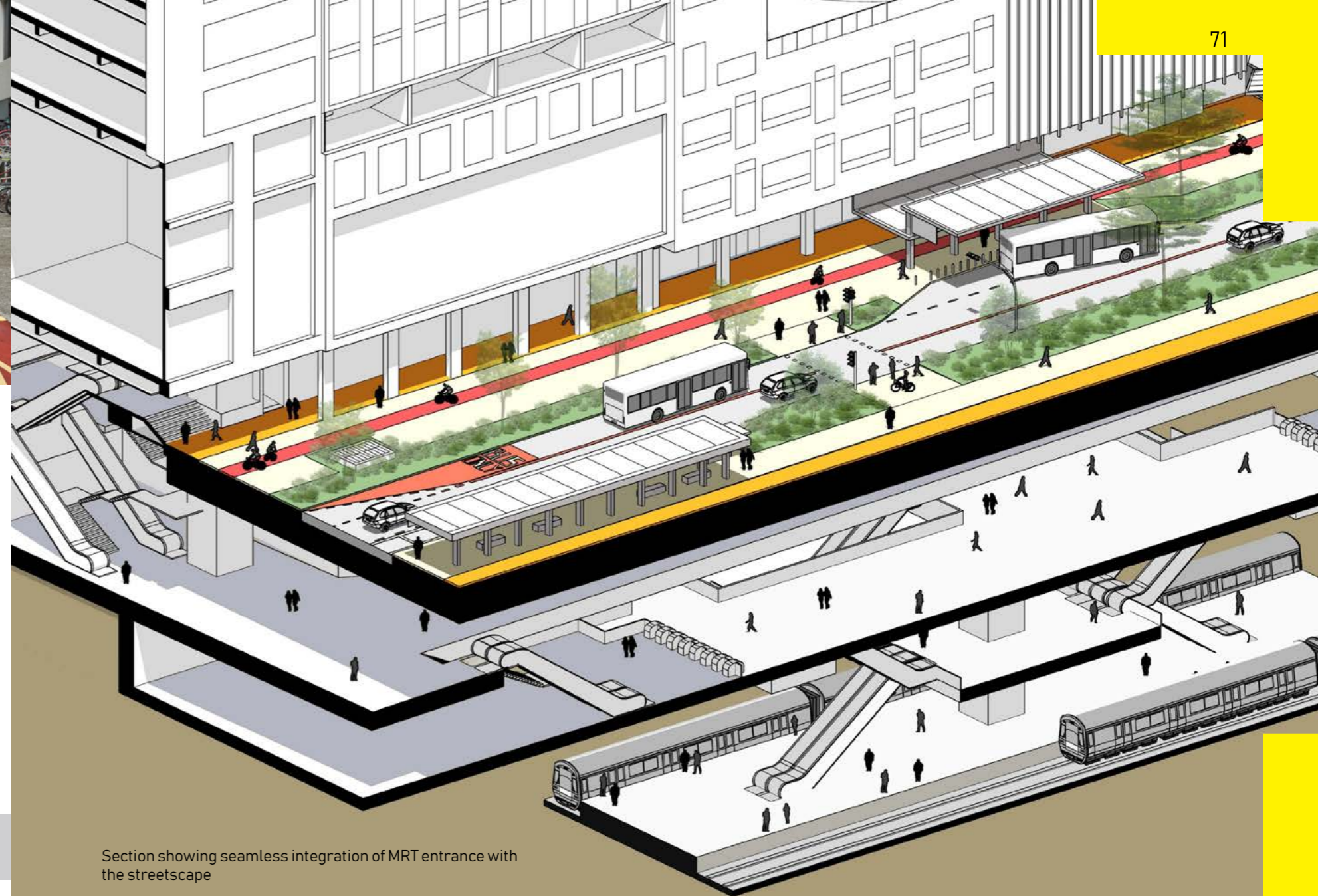
Source: LTA

Active mobility enhancements along Bencoolen Street

Bencoolen MRT contributes significantly to the reconceptualisation of Bencoolen Street into a "complete street" that prioritises pedestrians, cyclists and public transport riders. Why is this vision important for Singapore?

William: The car-lite vision is crucial for Singapore for several reasons, especially in a dense and land-scarce city-state where sustainability and quality of life are top priorities. Bencoolen Street's transformation into a "complete street," with Bencoolen MRT playing a key role, embodies this vision by prioritising pedestrians, cyclists, and public transport users over cars.

A longer version of the interview can be found at this [link](#).



Section showing seamless integration of MRT entrance with the streetscape



2.4

VEHICULAR ACCESS

Shaping well-connected, car-lite districts requires careful planning and management of vehicular circulation and access arrangements, at both the district and development level.

Urban designers are involved in upstream planning and downstream development control stages to ensure that pedestrian circulation is safeguarded and deconflicted from vehicular traffic as far as possible.

How can pedestrian connectivity be enhanced in a district?

2.4.1: Deconflict vehicular and pedestrian circulation at district level

Roads and streets form the basic structure of the city, allowing vehicles to deliver passengers, goods and emergency services to all developments. As such, some form of vehicular access is still required for every development in Singapore.

Without careful planning, these vehicular access points can disrupt the overall pedestrian network and circulation experience in the district.

Urban designers work with transport planners to optimise the locations of vehicular access points to avoid vehicular and pedestrian conflict. This is particularly important for mixed-use, walkable districts where major pedestrian malls or car-lite streets are planned, to avoid having roads and vehicles disrupt the walking experience.

The pedestrian connectivity plan is therefore usually developed in parallel with vehicular circulation and road network plan, to deconflict vehicular and pedestrian traffic especially around areas with high pedestrian traffic, such as at Orchard Road – Singapore's premier shopping street.

In addition, service access areas are planned to be discreet and out-of-view from the main pedestrian thoroughfares where possible. Service roads are sometimes introduced to consolidate such activities away from the major roads. For example, a rear service road was introduced parallel to Shenton Way and Cecil Street for service and carpark access for developments in the CBD.

How is vehicular access planned at the district level?

There is a hierarchy of road types serving different functions in the city. Vehicles with different purposes are channeled to different road types based on traffic impact and connectivity considerations.

Major roads or major arterials

carry faster-moving through-traffic, including bus services. Hence development access points are usually not located along them to avoid increasing traffic friction

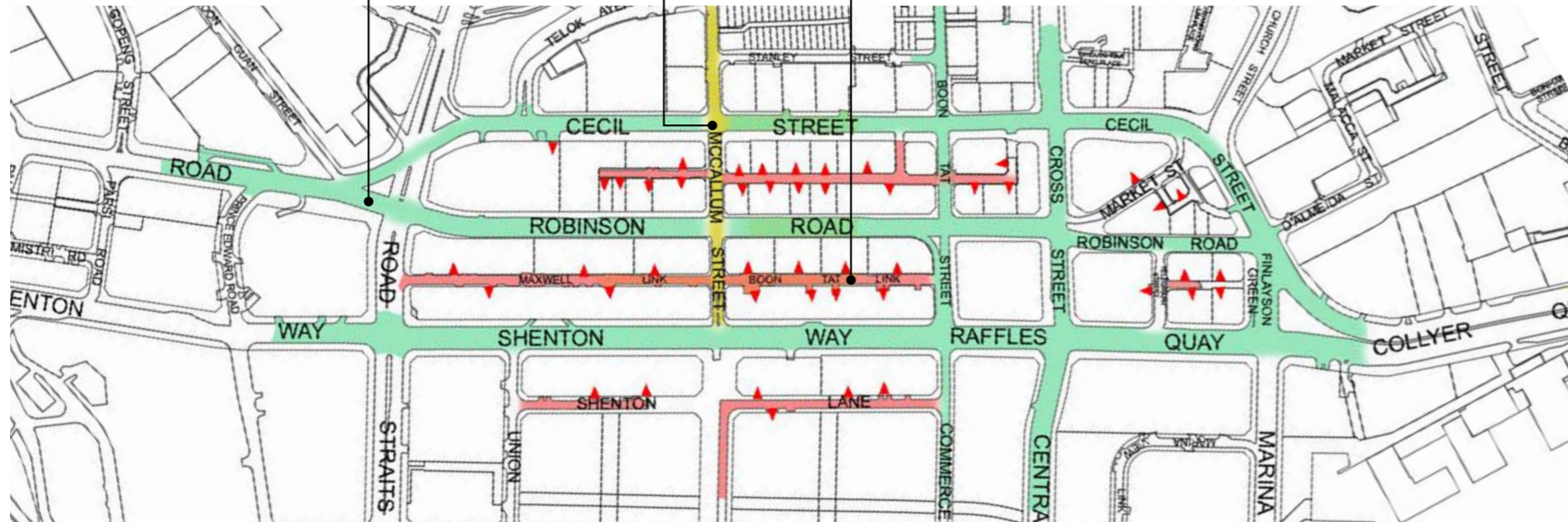
Minor roads filter traffic from the main roads and channel them to the developments, where pick-up and drop-off (PUDO) points are located.

Service roads are dedicated roadways for carpark and servicing access.

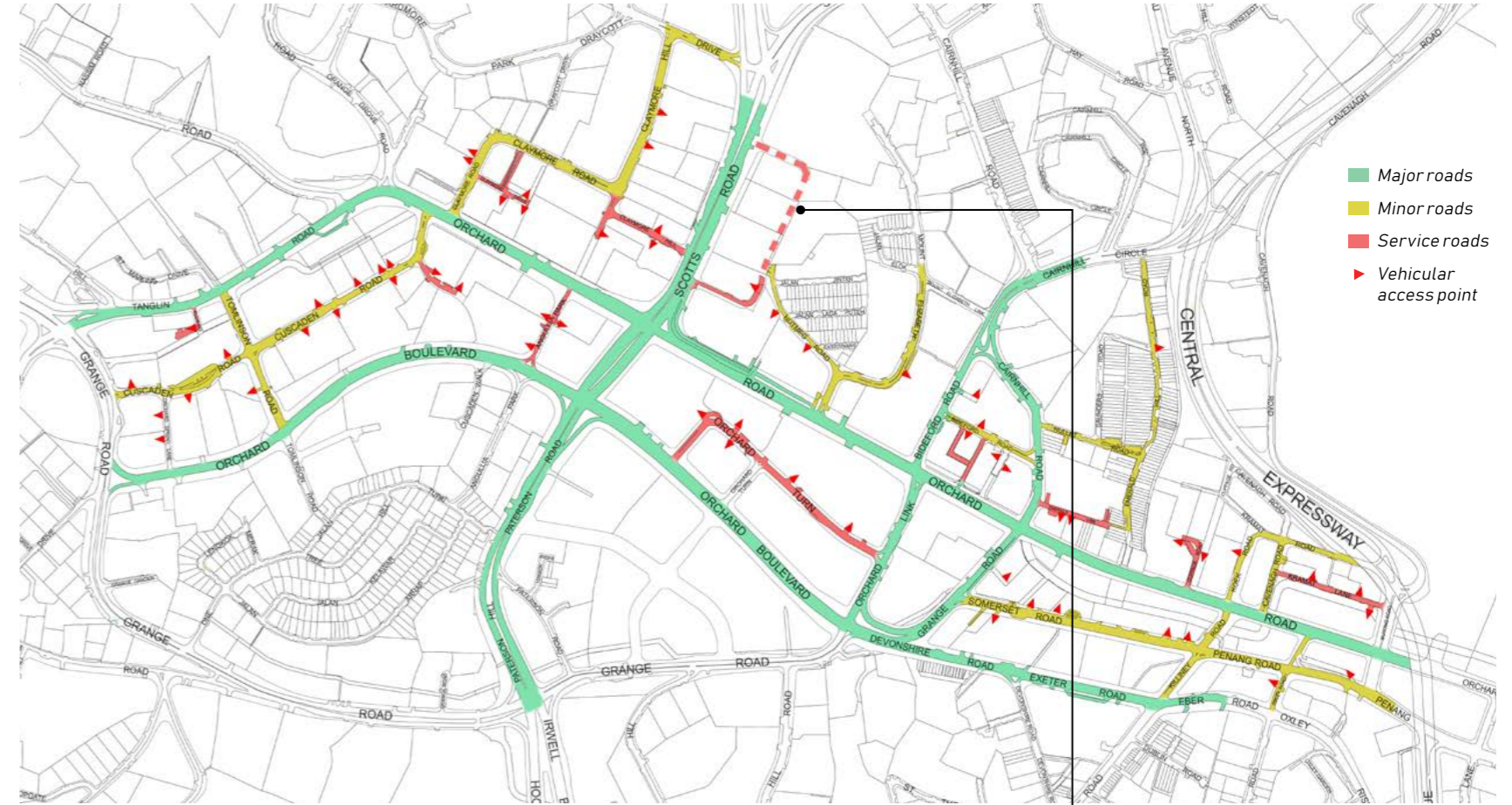
Golden Shoe area

The introduction of rear service roads in the Golden Shoe CBD area challenged the norm of having PUDO at the front entrance of developments taken directly off the main road, which is popular in many car-centric cities.

PUDOs or lay-bys are best avoided along main streets to maintain contiguous and pedestrian-centric street frontages. Hence, by inserting 10m-wide service roads parallel to the main street, to accommodate vehicular access points, building frontages can be freed up for a more seamless public realm.



Street hierarchy in the CBD



Street hierarchy in Orchard Road

Orchard and Scotts Roads

The same principle has been adopted at Orchard and Scotts Roads - to divert the vehicular access points to the rear of developments to form the Orchard Road pedestrian mall.

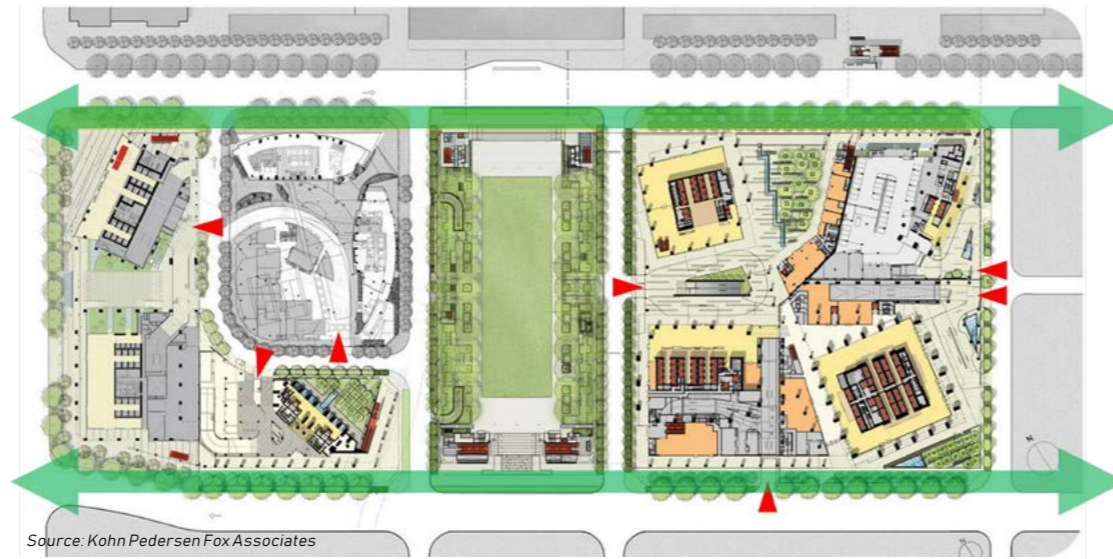
This process took many years to realise incrementally as many developments originally had grand PUDOs and front porch parking. Some of the ones that still exist are at Tang Plaza and Hyatt Hotel, which will be phased out upon redevelopment.

Along Scotts Road, there was no rear road to divert the access points to. Hence URA introduced a safeguarding for a rear service road to be created as and when the building owners undertake redevelopment or major A&A works.

How is vehicular access planned at the development level?

At the development level, urban designers pay closer attention to how vehicular access is integrated with the development and public realm.

- **Pick-up and Drop-off (PUDO) points** are locations where passengers alight and board from cars, taxis and coaches. They bring people into contact with cars and must be carefully designed with proper treatment of the public realm.
- **Lay-bys** are queuing areas for vehicles within the development to keep them from spilling out into the main roads. Where possible, these are integrated into the building envelope to avoid sterilising the streetscape.
- **Service access / areas** should be tucked away from pedestrian routes and screened from view.
- **Emergency and fire fighting routes** are not utilised on a frequent basis hence it is a good principle to try to design them to blend into the landscape.
- **Parking access** – the ramp of multi-storey car parks should only begin after the covered and open walkways.



Source: Kohn Pedersen Fox Associates

Vehicular access planning around Marina and Central Boulevards to minimise kerb cuts.

2.4.2: Locate entrances to minimise sterilisation of the public realm

Developments, especially mixed-use ones, tend to have complex servicing and access requirements.

Separate accesses are usually required for different uses to avoid conflicts due to different usage patterns over the day and the volume of vehicles attributed to different user groups. Access points must also be spaced out to spread out the traffic impact to surrounding roads. They need to be located away from bus-stops, taxi-stands and traffic junctions.

However it is also important to consolidate access points where possible to minimise kerb cuts, and locate them away from major pedestrian thoroughfares to minimise vehicular-pedestrian conflicts.

Designing the vehicular accesses around a development therefore has to take all the above factors into consideration, but when done well can achieve better circulation and experiences for both vehicular and pedestrian traffic.



Vehicular access point at China Square Central

2.4.3: Design vehicular access to interface with pedestrian circulation seamlessly

Vehicular access points may sometimes cross paths with covered walkways fronting the building. It is essential that ramps to multi-storey or basement car parks only start after the covered walkway, so that the latter is kept level and barrier-free.

In addition, the part of the driveway crossing the covered walkway should be paved in the same finish as that of the covered walkway, as a form of traffic calming, sending visual and tactile cues that pedestrians have priority over cars.

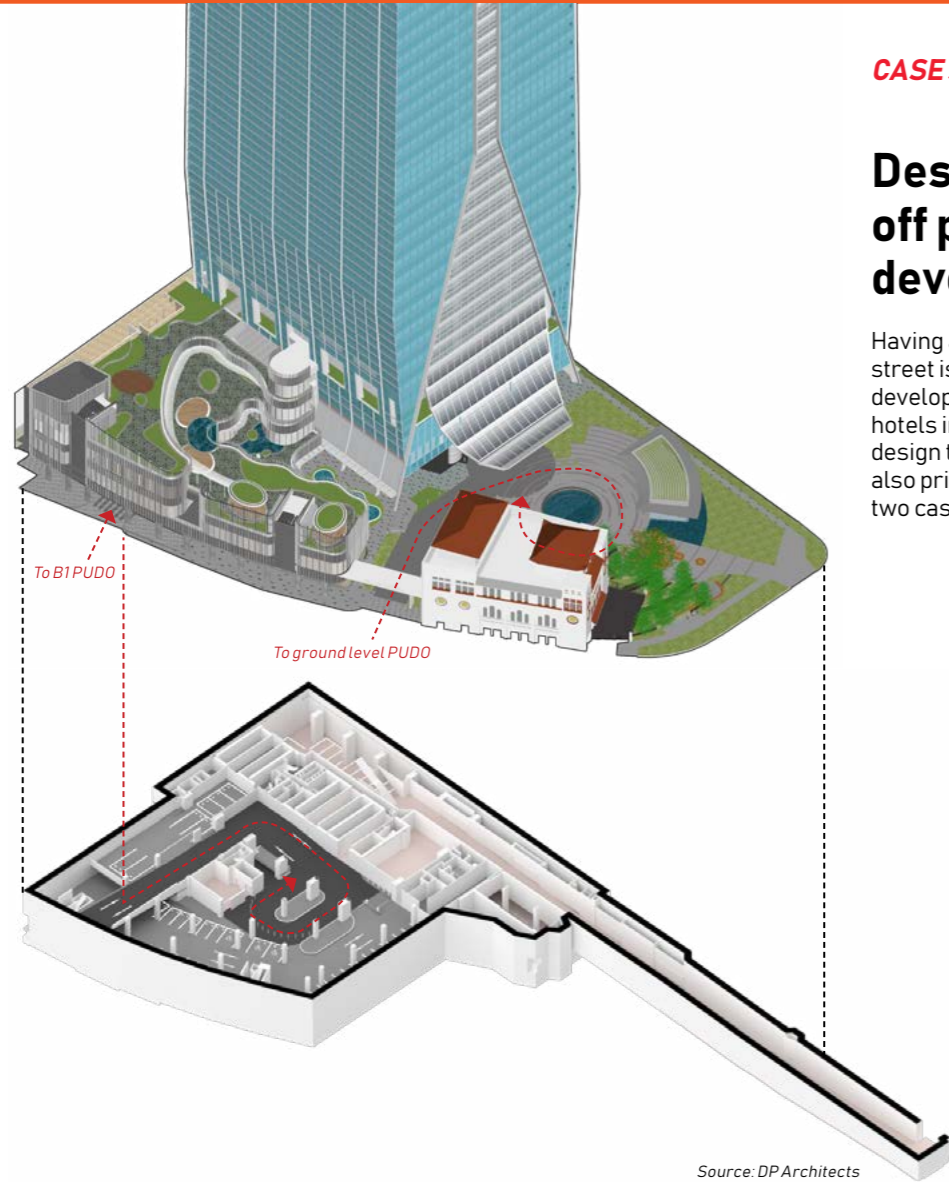


Main vehicular drop off at Park Royal Collection Pickering

2.4.4: Integrate sensitively with the public realm

All vehicular circulation spaces like lay-bys and PUDOs should be designed as part of the public realm, with proper paving and landscaping, so that they do not end up sterilising the main frontages or circulation areas of the development.

This is about creating a good sense of arrival at the development and signalling that it is a shared space between vehicles and pedestrians.



Diversion of vehicular drop off to basement level at Frasers Tower

Source: DP Architects

CASE STUDY

Designing vehicular drop-off points sensitively within developments

Having a grand vehicular drop-off along the main street is often seen as an important feature for many developments, such as grade-A offices and high-end hotels in the city centre. However, there are ways to design them so that the pedestrian arrival experience is also prioritised and kept uninterrupted by vehicles. The two case studies demonstrate how this can be achieved.

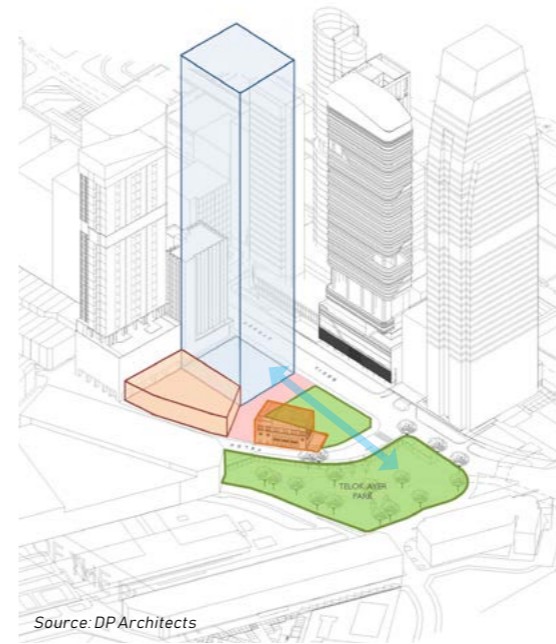
Frasers Tower, Tanjong Pagar

Maintaining the public realm connection to the park network

This was a URA Sale Site in 2012 for an office development with a prime location at the heart of the CBD along Cecil Street. The site was also opposite Telok Ayer Park which forms part of a green network in the city.

URA included the condition for part of the land parcel to be developed as a public open space to ensure the Telok Ayer Methodist Church next to the site, which is a monument, would continue to be visible from Cecil Street. The open space would also form part of the green network in the city.

DP Architects designed the space with a fountain to relate to the history of Telok Ayer (which means bay and water in Malay). They landscaped it with *bucida molineti* trees (also known as Spiny Black Olive) and *alstonia angustiloba* trees (also known as Pulai), creating an inviting civic space with water and greenery.



Source: DP Architects

Providing an alternative PUDO at the basement level

URA required the PUDO to be located at the basement to ensure that the landscaped civic space would be well connected to the front of the building. Extra effort was put in by the architects to design it as an attractive PUDO with skylights and well-appointed detailing. An additional PUDO at the street level was allowed for occasional use. Active management measures were introduced to limit vehicular drop off activity there.

This ensured that the civic space remained well-integrated with the ground level public realm, allowing pedestrians to walk freely with little conflict with cars.



Street level drop-off point integrated with Telok Ayer Park



Main vehicular drop-off at basement level



Level 1 Plan

Source: DP Architects



Basement 1 Plan

Source: DP Architects



Source: IOI Properties Singapore

Diversion of vehicular drop off to second storey at IOI Central Boulevard Towers to free up the ground level for public spaces.

IOI Central Boulevard Towers, Marina Bay

Keeping the ground level for public space rather than for vehicles

This was a URA sale site in 2017 for a mixed-use office development in Marina Bay, prominently sited next to Lau Pa Sat and directly across the green spaces such as the Lawn and Central Linear Park.

To contribute to the planned park and open space network in Marina Bay, the sale site was required to contribute public spaces equivalent in size to at least 25% of the building footprint.

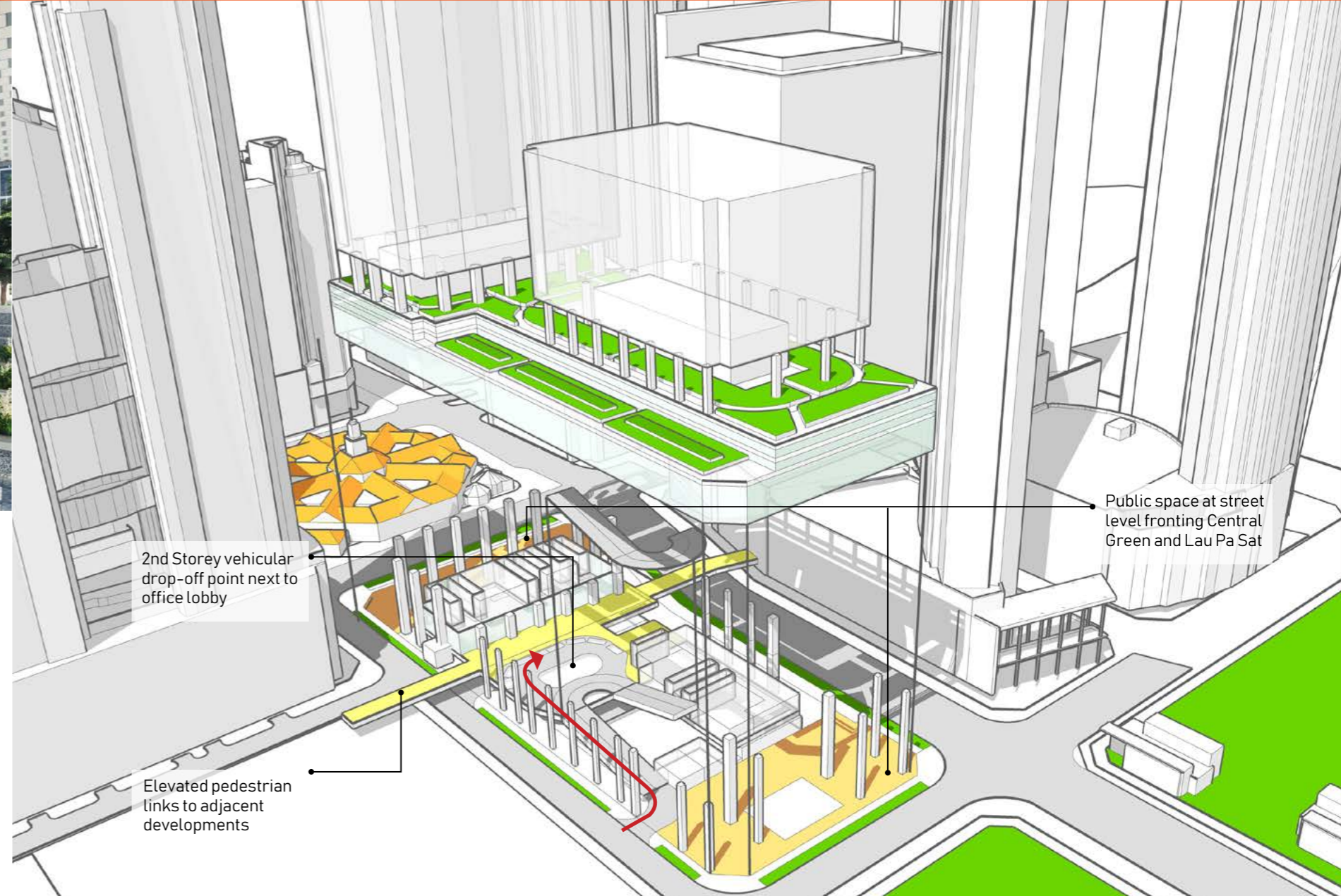
The developer chose to provide two public spaces on both ends of the development, one fronting Lau Pa Sat and the other addressing the green open space across from it.

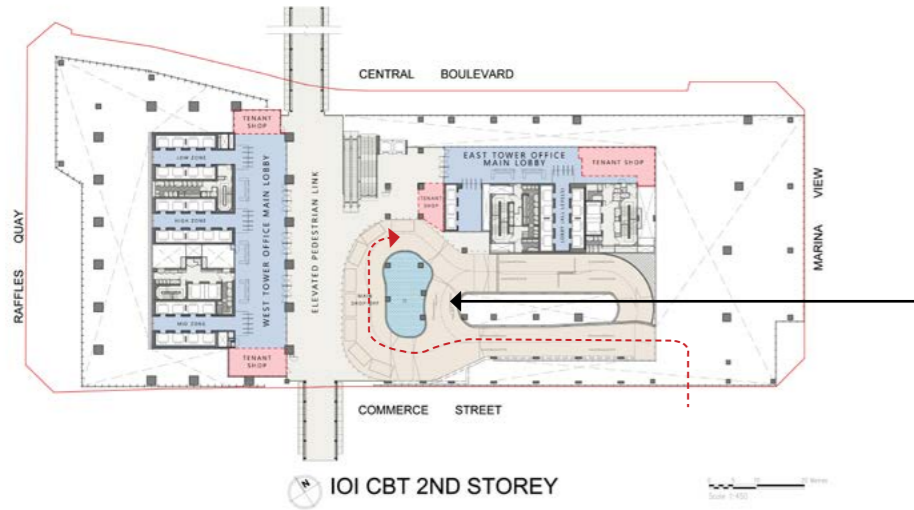
Diverting vehicular activity away from the ground plane

As part of the sale site conditions, URA required all vehicular drop off points to be sited either underground or above the first storey, so as to keep the ground plane car-lite and pleasant for pedestrians.

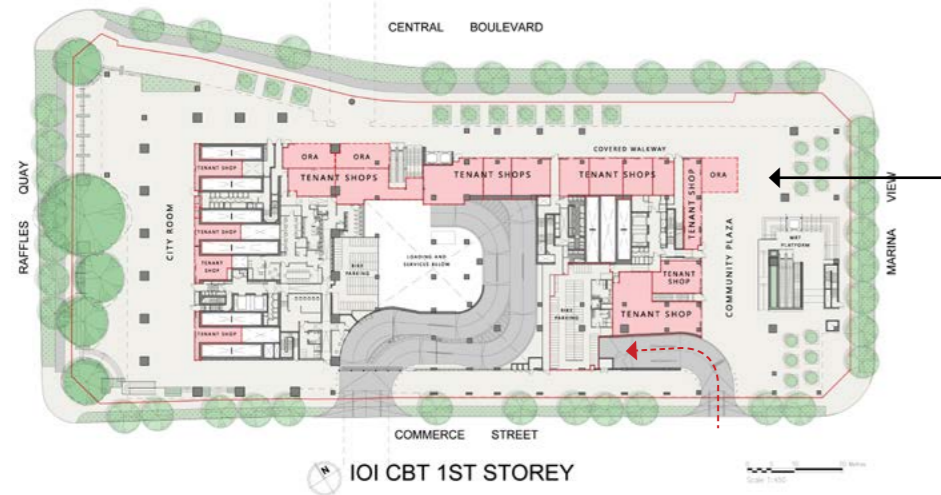
Hence, the main vehicular drop-off was designed to enter the site and immediately ramp up to the second storey where the main office

tower lobbies are sited. This arrival space is also directly connected to the elevated pedestrian network, allowing people to easily walk to the developments across the road directly.





Vehicular drop-off diverted to level two to keep ground plane car-lite

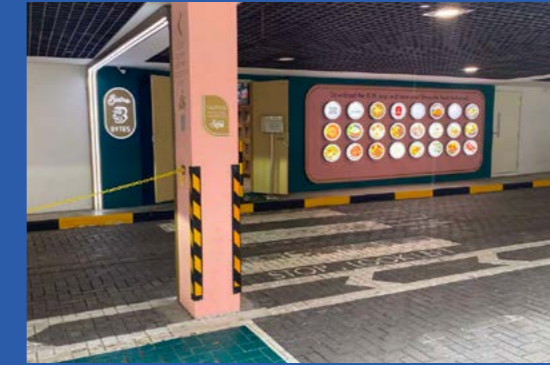


Discreet vehicular entrance at street level and expanded public space

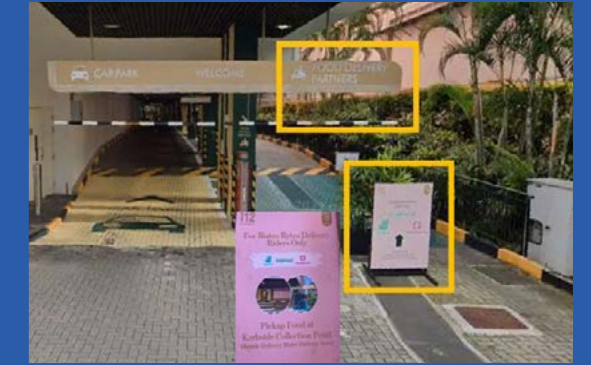
CONCEPTS EXPLAINED

Urban logistics and its impact on vehicular access arrangements

Every day, a complex system of urban logistics runs in the background, supporting business operations. Goods travel from ports, airports and land checkpoints to warehouses, stores and more. Developments need to consider designing for urban logistics to facilitate smooth traffic flows and efficient deliveries.



Good practices are exemplified at i12 Katong such as segregated/dedicated lane for delivery riders (right) and dedicated sheltered waiting bays next to centralised pick-up point for food orders (left)



Good loading / unloading bay design

The design and operation of loading bays are essential to support safe and efficient deliveries and business operations of a building.⁵

Segregated ingress and egress lanes should be created for passenger and goods vehicles to minimise conflicts. If the ingress and egress of loading bays must intersect pedestrian movement, building owners should use traffic calming strategies to alert motorists of potential pedestrian movement.

Efficient loading bays allow quick turnaround time for vehicles and minimise traffic queuing outside buildings. Measures such as locating goods lifts next to the loading bay, dedicated and unobstructed delivery corridors, and locating the loading bay closer to units with high delivery volumes (e.g. supermarkets), allow for smoother flow of goods and less dwell time for delivery vehicles in the development.

Rethinking infrastructure for new trends

The accelerated shift towards e-commerce has increased the demand for quick and convenient deliveries, at increased volumes.

Developers and mall operators should provide sufficient well-designed parking spaces for the vehicles of food and parcel delivery personnel.⁶

Providing waiting bays for delivery motorcycles and active mobility devices, with clear signages and wayfinding, is a good practice. Where possible, waiting bays should be in a sheltered location, away from pedestrian routes, and near F&B outlets, parcel lockers or mall entrances (preferably a short walking distance). Separate waiting bays for motorcycles and active mobility devices should be provided to avoid conflict.

A Best Practice Guide for Last Mile Delivery for Condominiums has been developed to share ways to improve service experience for delivery stakeholders. It can be found [here](#).

3.1

TRANSIT-ORIENTED DEVELOPMENTS

At the district and development level, URA adopts a transit-oriented approach to maximise catchment and utilisation of public transit to meet the mobility needs of the city. Urban designers focus on achieving strong connectivity outcomes to make transit hubs the starting point of journeys in the city.

TOD often takes many years or decades to plan and complete, involving the integration of transit facilities and surrounding developments. Its importance in helping the city achieve a high utilisation of public transport cannot be overstated, especially in high density cities like Singapore.

What are TODs?

Transit-oriented development, or TOD, is a form of urban development that concentrates the provision of jobs, housing, services and amenities around transit hubs to maximise convenience and accessibility, allowing people to combine various activities on the same journey to and from work, such as dropping off their children at the childcare in the morning or picking up groceries on the way home.

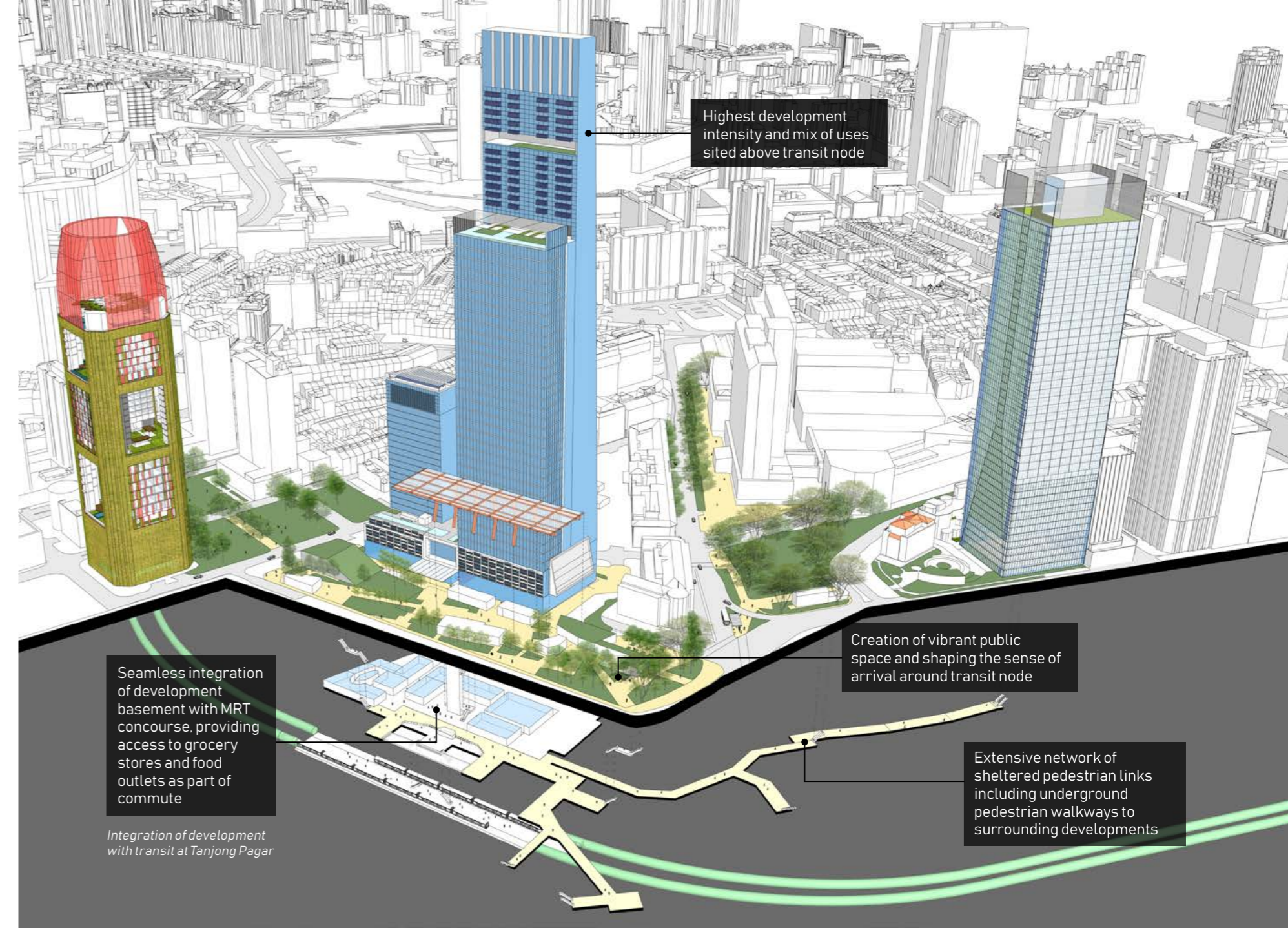
3.1.1: Optimise density and amenities above transit hubs

TOD is applied at both the district and development levels. Strategies at the district level were covered extensively in the preceding chapters, such as elevating development density, pursuing mixed-use developments, as well as building up extensive walking networks, around transit.

An example of this is how regional and sub-regional centres have been built around the MRT stations and bus interchanges, with the highest development intensities found directly above the station.

Similarly, at smaller polycentres, mixed-use developments are planned around the MRT station, making them convenient hubs with shops, services and entertainment to serve the catchment of people passing through daily.

At the development level, TOD are technically highly complex forms of development, requiring the stacking of high-rise buildings above transit infrastructure, and integration of pre-existing station structures with new buildings. This chapter will dive into the multifarious and complex challenges of planning for TOD.



Highest development intensity and mix of uses sited above transit node

Seamless integration of development basement with MRT concourse, providing access to grocery stores and food outlets as part of commute

Creation of vibrant public space and shaping the sense of arrival around transit node

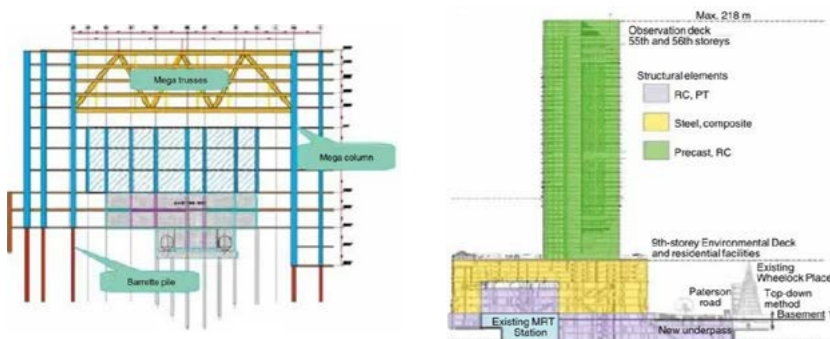
Extensive network of sheltered pedestrian links including underground pedestrian walkways to surrounding developments

Integration of development with transit at Tanjong Pagar



Source: Benoy

Integration of mixed-use development with MRT Station at Orchard



Truss system of construction over underground MRT station box

Source: Steel Construction Today & Tomorrow, Nov 2011

What are some examples of Transit-Oriented Developments?

Ion Orchard

Ion Orchard sits directly above Orchard MRT station, serving as a key gateway into the Orchard Road shopping belt. Owing to its strategic location, the development enjoys a higher GPR and height compared to other developments along the corridor.

The underground MRT station was completed in 1987 while the site above was sold for development in 2005.

The TOD relies on a truss system to span over the underground MRT station box to carry the weight of the 218m tall development. It uses 14 mega trusses, with the longest and heaviest one being 500 tonnes and 75m long, to span over the underground MRT, to form the main structure for the building. The trusses are 4 storeys deep (from levels 5 to 8).⁷

The multiple vehicular access points to the mixed-use development are also located along Orchard Boulevard to avoid impacting the main Orchard Road pedestrian mall, allowing commuters to discharge directly from the basement MRT concourse to a 3000sqm public plaza at street level.

Clementi Mall

Clementi Mall is an example of a typical TOD in the suburbs, comprising a mixed-use residential – commercial development over a bus interchange, with direct connection to the MRT station that has been built above the adjacent road.

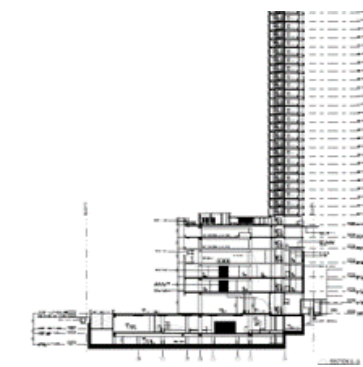
The development was completed by HDB in 2011, comprising a 5-storey retail podium called Clementi Mall (integrated with the bus interchange), and two residential blocks with 388 public housing units above called Clementi Towers. Communal facilities were sited on the podium deck while elevated links connected the podium directly to the Clementi MRT station concourse.

There were limited frontages for vehicular access points as it has one frontage to the main road, and thus required careful consolidation of various access points along Clementi Avenue 3.

Integration of mixed-use development with MRT Station and Bus Interchange at Clementi

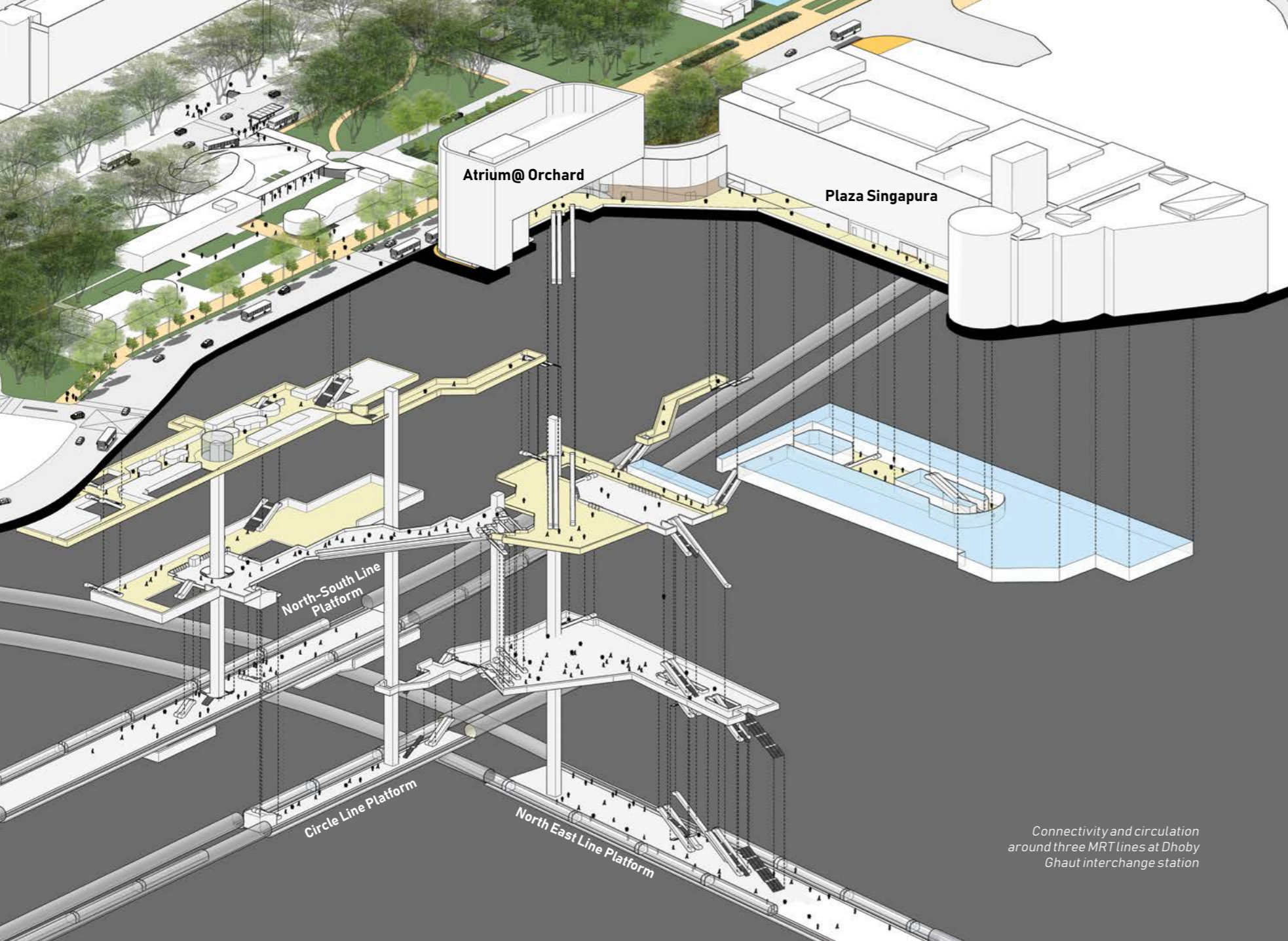


Connectivity of the TOD to the Town Centre



Stacking of retail and residential uses above the Integrated Transport Hub (ITH)





3.1.2: Resolve circulation issues for traffic, pedestrians and commuters

Seamless passenger transfers between modes

To work effectively as a hub, modal transfers must be designed to be as seamless as possible, so that connections can be easily made by walking between the MRT station, bus stop and PUDOs.

Where possible, the concourses of these systems should be integrated or be sited as closely as possible. Often, the bus interchange will be located directly above the MRT station, or in the adjacent plot, where elevated and underground pedestrian links can then be provided to directly connect them.

Agent-based modelling is often carried out to understand the potential scale of passenger transfers and movement within the interchange, so that the width and length of connections can be sized accordingly. The sizing of concourses, processing spaces, waiting and arrival halls are also carefully sized to meet demand.

Wayfinding is a critical element in guiding smooth transfers between different modes of transport. LTA and URA develop wayfinding guidelines to guide signage and directory design, locations of signs and walkway design standards.



Concept of integration of MRT station, bus interchange and adjacent developments

Vehicular access and circulation planning

TOD emphasises the integration of different modes of transport, e.g. trains, buses, taxis, etc – to enable seamless transfers for passengers within the same development. As they are typically also mixed-use, TODs therefore have many points of access and circulation requirements which require careful planning to resolve, to ensure that the overall circulation experience of commuters is pleasant and seamless.

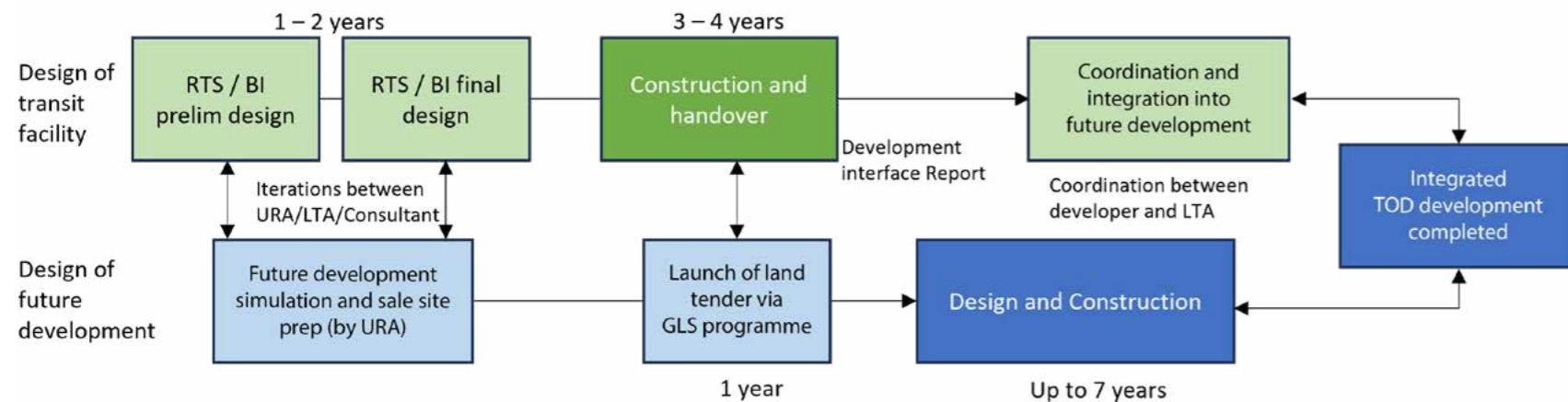
These are the key considerations when planning for different transport modes within TOD:

- **Public bus interchanges (BIs)** require back-up access points in case the main one is affected. BIs are also usually located on the ground floor of the development where they tend to occupy a large part of the building floor plate.
- **Private buses and coaches** require their own boarding facility and tend to not share space with the public bus interchange due to different operational schedules and level of service required for public buses.
- **Taxi pick-up and drop-off points** tend to require long lay-bys to hold queuing vehicles, to prevent traffic tailback into surrounding roads.

- **Private car pick-up and drop-off points** (also for private car hires) require holding areas but the traffic flow is unlike that for taxis, where longer waiting times are usually expected
- Different **development parking access points** are typically required for different uses within the development, to deconflict different traffic patterns, adding to the number of access points needed for a TOD.

These complex issues underscore the importance of long term planning for TOD to safeguard optionalities in design and ensure integrated outcomes. The work starts prior to construction of the transit facility and carries on until completion of the final development, often taking many years, as shown in the flow chart below.

Typical development timeframe of TODs



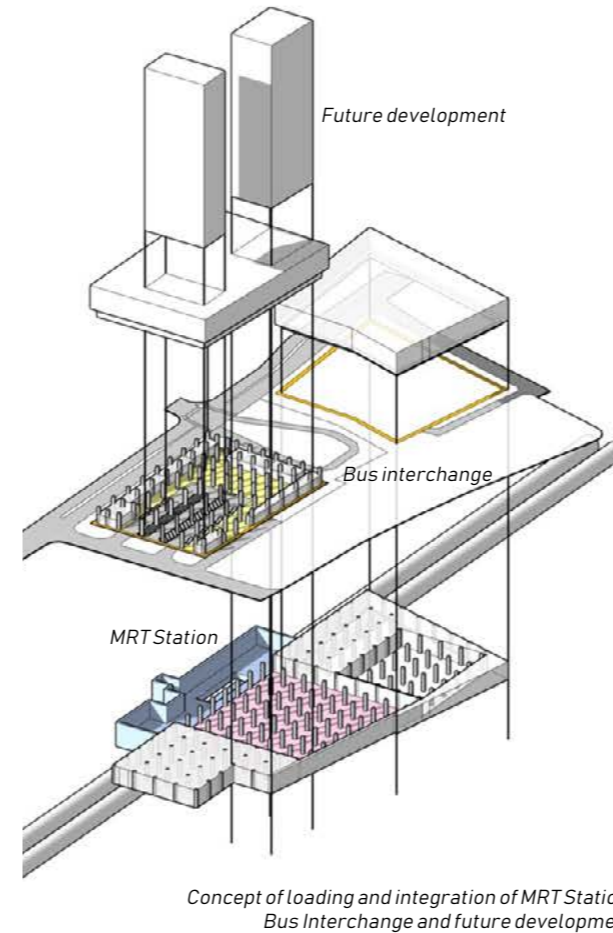
3.1.3: Cater for loading and integration

To facilitate the stacking of multi-storey future developments above transit infrastructure, loading provision is incorporated in the transit structure upfront. This would entail detailed studies for the final development to be completed years, if not decades, in advance.

Safeguarding future piling locations

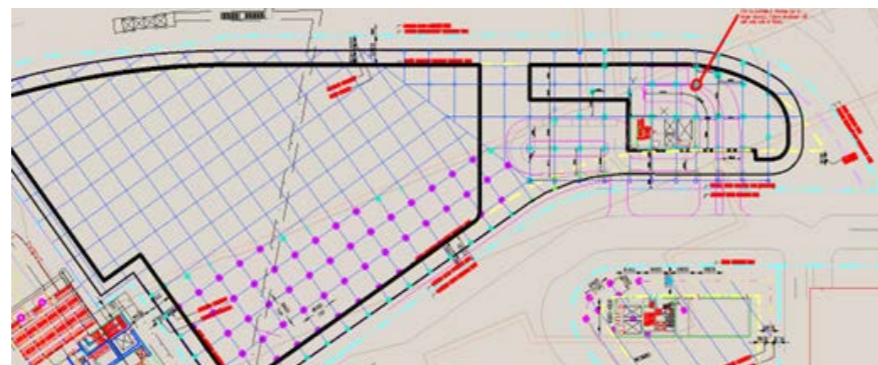
It is possible to think of the transit infrastructure and future development as two different buildings that need to sit on top of each other, when planning for the structural design and integration of both.

Where possible, it is better to keep both structures separate, to minimise liability issues and to allow independent redevelopment of each other. When planning the transit infrastructure below the future development, the locations for the columns of the future development must be predetermined upfront and safeguarded during construction of the MRT tunnels and station box.



This requires detailed simulation of the future development to determine its likely footprint and column grid. The typical column grid for most commercial developments is 8.4m x 8.4m. Longer spans of up to 15m or more are possible if deeper beams are used to connect them and transfer heavier loads. The part of the station box where the future development will be built over will therefore adopt the appropriate structural grid and structural provision according to the number of storeys of the future development. If not considered beforehand, the future columns may end up being spaced too far apart and will require costly transfer structures to span between column locations.

When piling within 6m of underground station structures (an area also known as LTA's first reserve), the future piles will have to be debonded. This refers to a method of piling where a sheath is installed first to reduce the transfer of vibrations to the surrounding soil during piling, which could affect MRT operations.



Example of column grid planning during MRT station construction

Loading

When there is insufficient clarity on future market demand, or a need to safeguard flexibility on future development outcomes, the loading provision will have to be designed to cater for a range of scenarios. Extensive studies and cost benefit analysis is typically done to help narrow down the options, to reduce the cost of providing structural loading upfront.

URA's urban designers will indicate the location and structural grid within the transit structure where the future development will sit as well as the use and number of storeys of the future development. This plan is then handed over to LTA's engineers for them to incorporate the requirements into the structural design of the transit infrastructure.

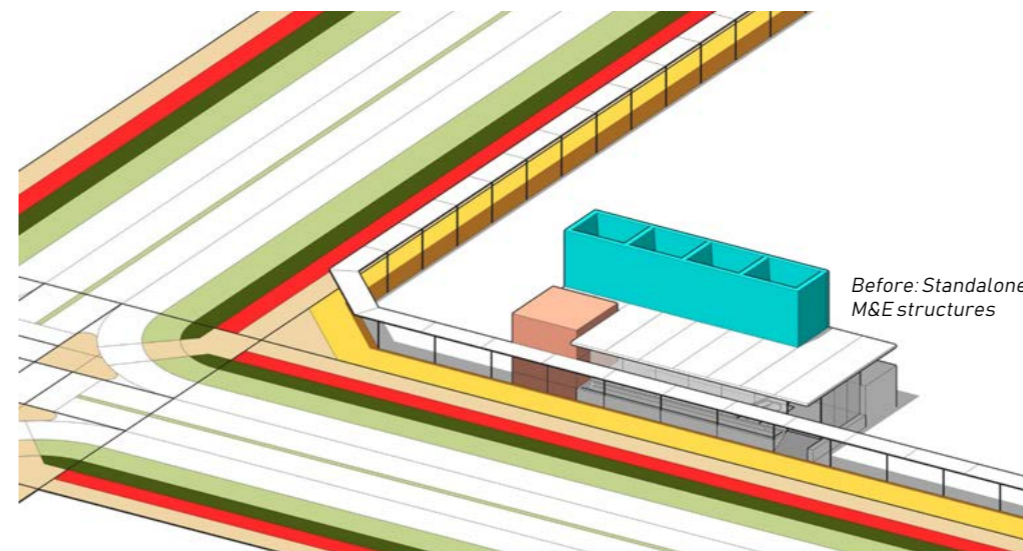
After the structures are built, a development interface report is generated to provide the future developer with the information on the structural provisions and possible methods of constructing the future development above.

Integration of at-grade structures

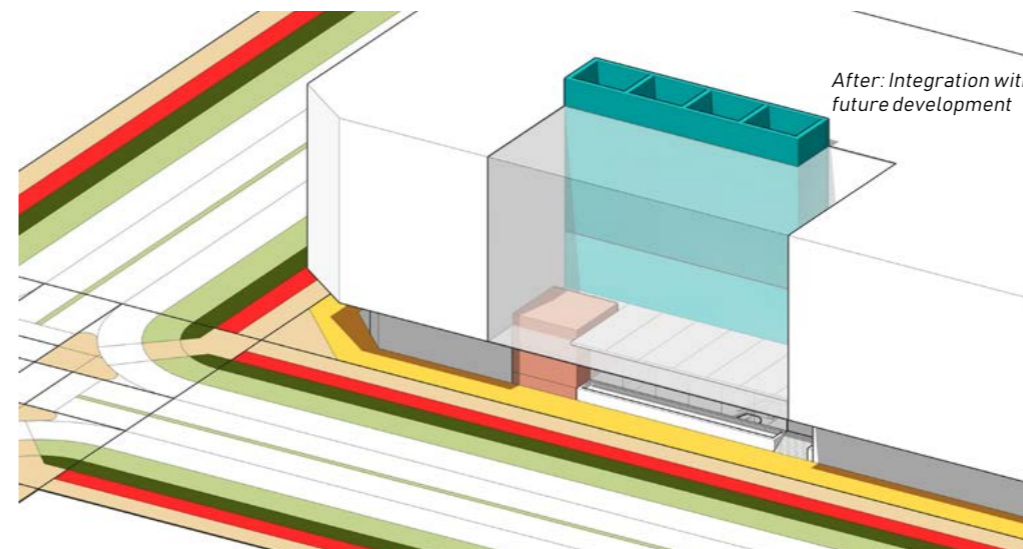
Transit infrastructure, including underground stations, usually have extensive at-grade structures that must be carefully designed for physical integration with the future development. These include station entrances, fire escape stairs and M&E buildings amongst other structures.

URA's urban designers will work with the station designers to ensure that the structures are properly "set out", or arranged around the site, such that they will fit in neatly with the future development. The structures are guided to set back to observe requirements for fire-fighting, green buffer and covered walkways / linkways for the future development.

Another consideration is how the at-grade structures will be physically integrated with the future development. The simplest method is for the future building to just abut the sides of the structures, or wrap around them so that they are physically integrated into the building envelope.



Before: Standalone M&E structures



After: Integration with future development

Pop-up entrances, M&E and fire escape structures must be "set out" properly to fit in neatly with future development setbacks and covered walkways

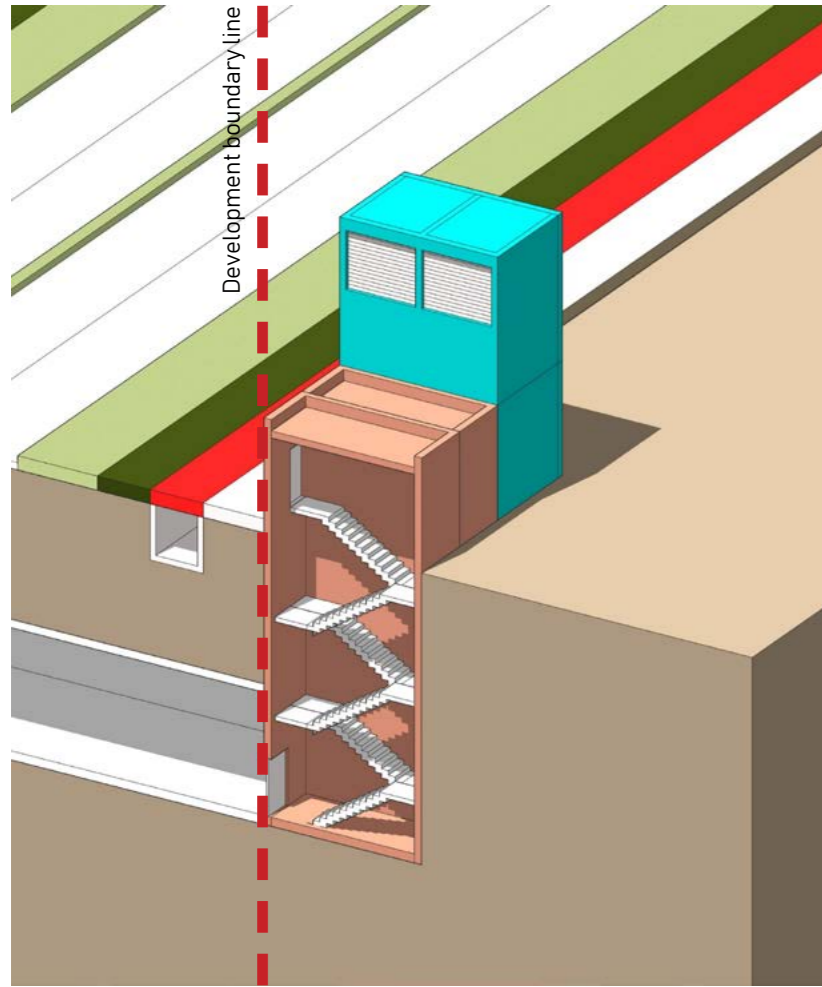
For seamless integration, the height of the at-grade structures are then planned to match the future building features, e.g. the height of the podium. URA may also guide the façade design, materiality or colour of the at-grade structures to more easily match the future development.

When there is no near-term plan for the TOD, and where there is sufficient space (such as within the building setback of the future development), interim above-grade transit structures could be built within that space. No structural provision is required for these interim structures as they would be eventually relocated and integrated into the future development when the time comes.

To facilitate this, knock-out panels are provided in the underground station box to allow for the diversion of pedestrian routes and M&E services from the at-grade entrance structures or M&E buildings into the future development.

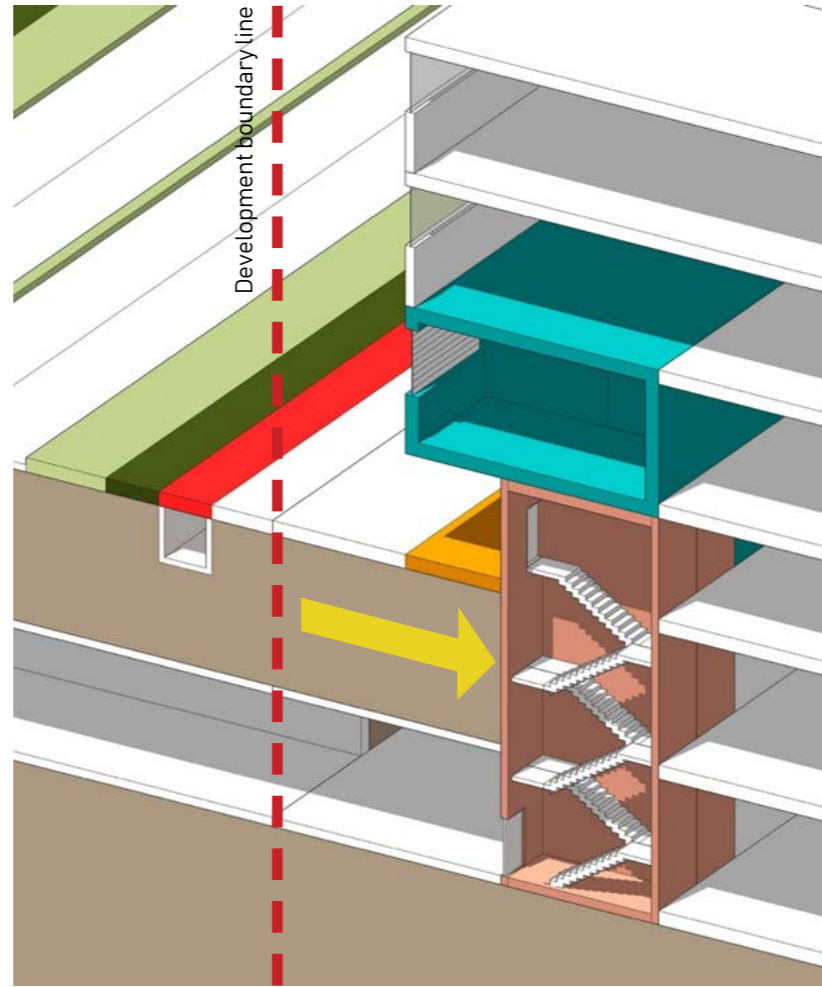
There is usually a maximum **displacement extent** for fire escape stairs or M&E ventilation pipes, beyond which they would not meet code requirements or functional effectiveness. These also have to be studied upfront when planning the station structures for integration into the future development.

Before: Standalone M&E structures



Alternatively, the fire escape and M&E structures must be planned with enough "displacement extent" to allow shifting and integration into the future development

After: Integration with future development



Knock-out panels

Knock-out panels (KOPs) are a key element used in the integration of transit infrastructure with future developments. They represent sections of basement walls that can be 'opened up' to allow for the connection of pedestrian routes or services between underground transit infrastructure and future developments.

The locations of connections from the MRT station to surrounding developments are based on the planned underground pedestrian network for the area. KOPs are provided at these locations within the basement walls of the MRT station.

There are several scenarios where KOPs are required:

- Between underground MRT stations and future developments above – KOPs are required to allow for direct connections between the MRT station box and the future development's basement;
- Between MRT stations sited in the Road Reserve (underground or elevated) and developments across the road – KOPs are required to allow the nearby developments to connect directly to the MRT. The KOPs are sited at the external walls of the concourse level (either underground or elevated); or
- Between the TOD development and adjacent developments – KOPs are required to allow nearby developments to connect to the MRT via the TOD development.



Knock-out panels (orange) are safeguarded as part of underground pedestrian networks to allow future connections to take place incrementally

KOPs must be provided at the development boundary lines, so that future developments do not have to build part of the connection beyond their boundaries to avoid liability issues related to ownership, maintenance and safety.

Where possible, **generous provision** of KOPs would provide more flexibility for future connections to be made, or for more extensive integration of the station box with the future development basement. One good example is the integration of Tanjong Pagar MRT station and the Guoco Tower basement, which feels like one seamless integrated space.

Vertical circulation points (VCPs)

These are key points of access between underground stations and the street level, which must minimally comprise a pair of two-way escalators, staircases and two passenger lifts (for contingency in case one set breaks down). They have to be planned upfront as part of the transit infrastructure, so that they align with the future development layout.

For example, VCPs are usually planned to emerge along the building perimeter, opening out into the covered walkways, so that people can discharge directly into sheltered access that is linked to the surrounding developments. Where appropriate, additional VCP will be planned to emerge into planned public spaces where they can be more easily found.

3.1.4: Pay attention to the streetscape

Compacting at-grade structures

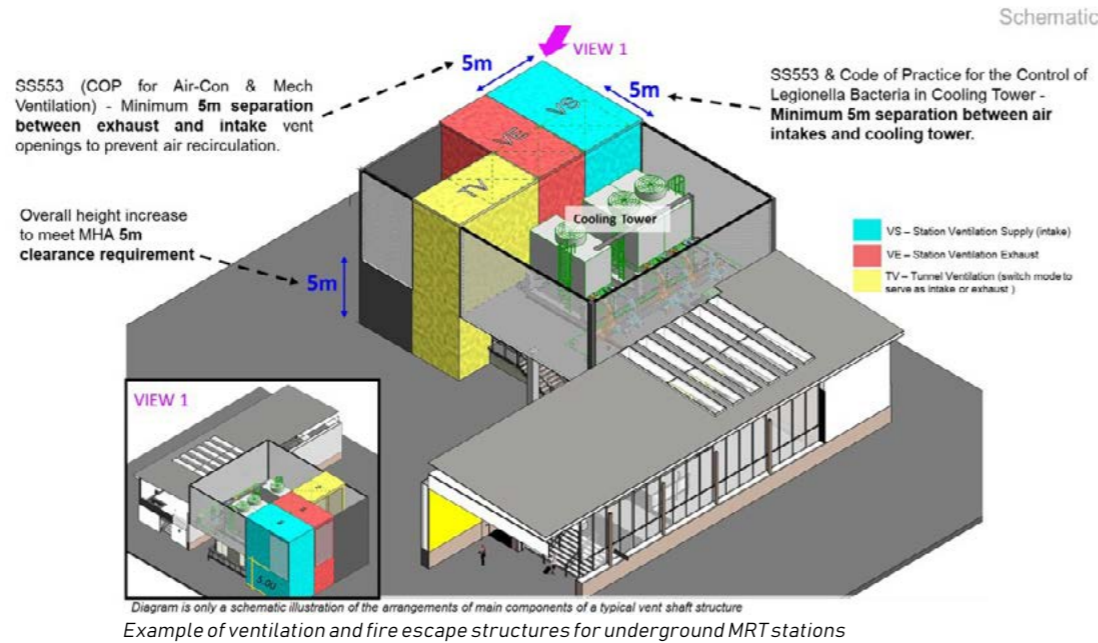
Underground MRT stations have a variety of structures that emerge at-grade to support transit operations, such as entrance and exit structures, fire-escape staircases, ventilation buildings, M&E spaces (battery rooms and A/C equipment), etc.

Their size and number are related to the capacity of the rail line, e.g. a station for an 8-car line can require double the M&E capacity of a station serving a 3-car line, but in general they tend to be large standalone structures that can be imposing along the streetscape. Due to various safety, air-flow and even health considerations, these structures may have to be further spaced out or elevated to meet prevailing codes.

Simple, elegant design

Hence, the preference is for these structures to be kept to a minimum size, and designed with unobtrusive, simple and elegant forms and architectural treatment, unless the location calls for a contextual design response.

Neutral colours, such as grey, are usually preferred. This is especially so for interim structures before they are integrated into future developments.



Ventilation buildings

Ventilation buildings tend to be the largest and most visible components of at-grade MRT ancillary structures. They comprise air intake openings at least 5m above ground (for security requirements to prevent the likelihood of someone throwing dangerous objects in), and exhaust openings for air and smoke discharge.

Air intake and exhaust openings must be sited away from each other to avoid recirculation / short circuiting the system (where dispelled air gets sucked in again).

Cooling towers for air conditioning systems need to be at least 5m away from human circulation to comply with NEA's requirements on control of spread of Legionella bacteria.

Together these requirements contribute to the bulk of overall ventilation structure.



Splitting or compacting of structures

Sometimes the approach to split up the pop-up structures is preferred if that can result in smaller structures that are visually less obtrusive in the streetscape. Otherwise, the consolidation of these structures to reduce the overall land take is preferred, resulting in a single structure that may be easier to integrate into future developments above the RTS station.



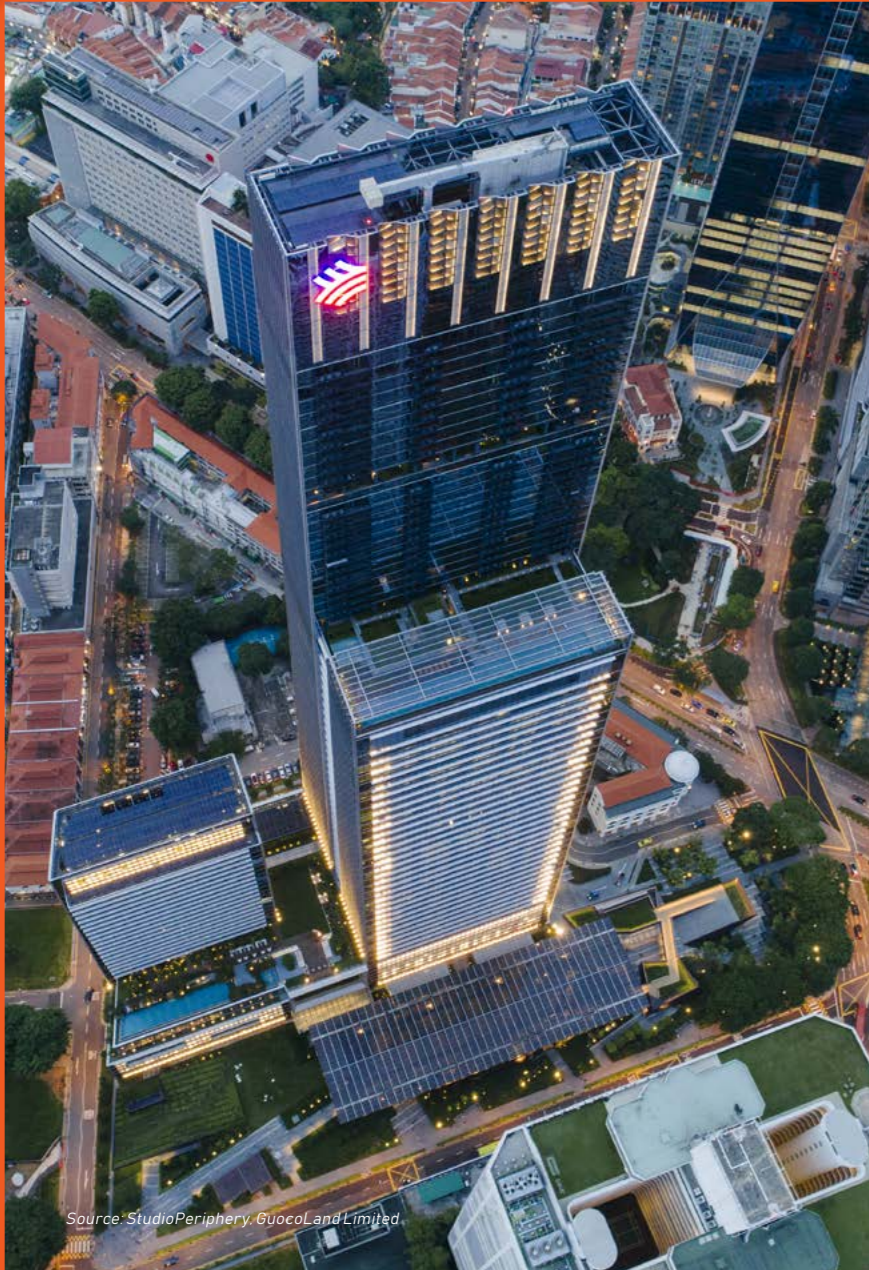
Integration with adjacent buildings

Future developments are guided through urban design guidelines to integrate these structures into the building envelope, rendering them effectively invisible. One example of this is the integration of the Lentor MRT exit with the Lentor Central mixed-use development. The height and setback of the station entrance structure was planned carefully to align with the podium of the future development.



Absorption into future buildings

Another approach is to allow the future development to demolish and rebuild these structures within their building envelope. For this, the replacement M&E equipment, ventilation structures and fire escape facilities must be completed before the existing ones can be removed. Careful studies are done beforehand to ensure that the required knock out panels are safeguarded to allow for the reconnection of these services with the future building, and for the running distances to work in the new layout.



Source: StudioPeriphery, GuocoLand Limited

CASE STUDY

Creating a welcoming transit-oriented development at Tanjong Pagar

An important transit gateway into the city

At 290m, Guoco Tower currently stands as Singapore's tallest development and is a highly visible gateway into the Tanjong Pagar area. Similar to the skyscrapers found above Raffles Place and City Hall MRT stations, the development marks an important transit gateway into the city through the Tanjong Pagar MRT station.

The 1.5ha site was put up for sale in 2010 with a mix of uses allowed - at least 60% for office, at least 10% for hotel, as well as retail and residential uses. URA highlighted that special consideration should be given to the architectural design to contribute positively to the skyline of the city - with emphasis on the creation of a distinctive, garden-like environment with 100% landscape replacement.

The developer Guocoland and architects Skidmore, Owings and Merrill (SOM) conceived the development as a dynamic vertical city with over 82,000 sqm of grade A office space, 92,000 sqm of retail and dining space, 181 residences and a 5-star hotel. There would also be an urban park to complement the premier business and lifestyle positioning for Tanjong Pagar.

SOM designed the 64-storey tower with a tapering form to resemble the Chinese words for "entry" and "people". The 20-storey hotel located west of the main tower is a design response to shophouses across it at Peck Seah Street.



Source: SOM

Guoco Tower and surrounding green network

Requirement for a focal point

As part of the sale site conditions, URA stipulated requirements for a major public space as well as a 1000sqm large "city room" to mark the entrance into the district as well as the part of the Duxton Linear park extending all the way to Pearl's Hill.

SOM designed the "city room" to be three times larger than the base requirement, integrating it with a generous 8000sqm park above the MRT station.

The public realm was divided into three activity zones: a park-like space to the west, a multi-



First storey plan of Guoco Tower

function city room in the centre and an urban retail village to the east. Multiple retail and F&B spaces were provided on the ground level to activate the urban park and city room. SOM also designed the MRT entrance structure along Peck Seah as a cascading landscape deck, bringing visitors up a series of rooftop gardens.

Porosity and permeability to encourage walking

URA also envisioned a high level of visual and physical porosity through the development at ground level, including a 7m-wide through-block link between Wallich Street and the park.

SOM designed the through-block link to be much wider than required, integrating it with the residential drop off point to create a lofty and inviting arrival space. The driveway was also paved in the same material as the rest of the through-block link, to signal the priority of pedestrians in the space.

Covered walkways line all sides of the development to provide convenient sheltered connectivity along the surrounding streets.

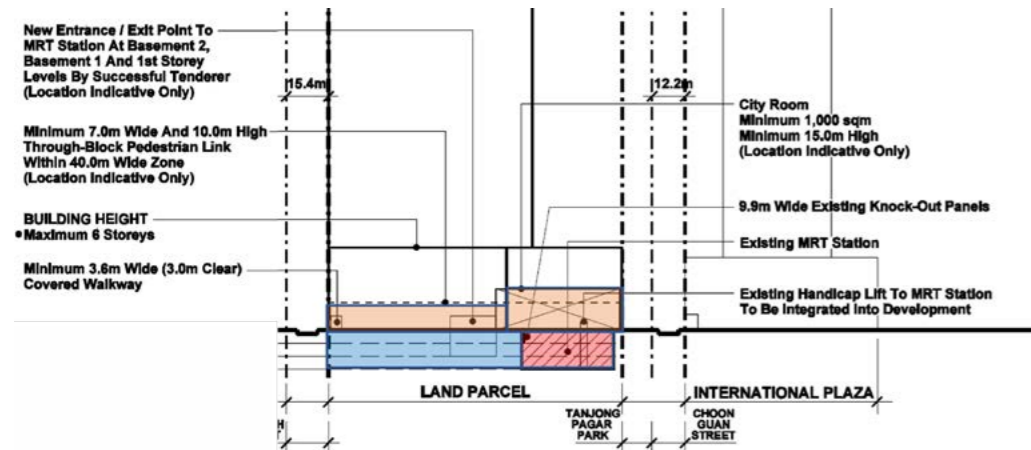
Integrating seamlessly with transit

When Tanjong Pagar MRT station was completed in 1987, some 23 years before the future development, the underground station was designed with structural provision to cater for a low-rise building above it - to provide scope for the developer to add a building at that location should that be desirable.

Instead of siting a new building above the MRT station, the developer shifted the quantum elsewhere within the development to make space for the park and city room directly above the MRT station, and have a consolidated office and residential tower beside it. A 16m-high glass canopy was provided over the city room for thermal comfort, creating a vibrant welcoming activity space for the community and starting point to journey into the surrounding areas.

In addition, knock-out panels had been provided in the MRT station walls to allow for seamless integration of the station concourse with the future development basement levels. These were catered for across basement 1 and basement 2 levels to facilitate extensive integration.

The result was a transformation of the MRT station - allowing the faregates to open directly into the development basement. The developer also located shops, eateries and a mini-mart at the basement, providing convenience for commuters who could easily pick up meals and groceries as part of their commutes to and from work.



Technical control section for the development as part of sale site conditions



Source: SOM

BEHIND THE SCENES

What does it take to create a well-designed and curated public space?

Architect Nicolas Medrano, Principal, Skidmore, Owings & Merrill and Valerie Wong, Managing Director, Asset Management, GuocoLand share lessons and insights on designing and curating the expansive, vibrant and lively Guoco Tower Urban Park in Tanjong Pagar, one of the largest public spaces on the site of an office building.

Why was the decision taken to create a distinctive public space for the Guoco Tower office building?

Nicolas: The structure or canopy where the urban park is currently located was originally intended for a building when the Tanjong Pagar MRT Station was developed in the 1980s.

As part of the land sales requirement, a city room space and public plaza were to be provided near the Tanjong Pagar Park. But after we studied the site carefully, we decided not to build over the MRT station but instead create a more generous and continuous urban park space throughout the ground floor of the building, and we moved the car parking space into the building. We used the existing structure to create a canopy to provide shade for the public space.

In designing the public space, we wanted to create a space that can be easily accessed and used by different groups of people. Aside from allocating space for the cafes and restaurants, we



Source: GuocoLand Limited

A lush and inviting public space greets visitors arriving by MRT at Tanjong Pagar

intentionally left a large part of the public space open and flexible. This offers a greater variety of experiences and excitement for people as it allows them to decide how they want to use the space in their own ways.

Being in this urban park, it feels much cooler and enjoyable with a lot of greenery. How did you design for such a comfortable space?

Nicolas: Singapore has a tropical climate, and during the design process, we wanted to create a space that would be comfortable for visitors and people in the neighbourhood. We made sure that the space was very well shaded and protected from the intense sun and created natural comfort through wind flow.

The many studies we did helped us to design for natural wind to flow through the site. The canopy over the space is open on the west and the east. There is a building facade on the north and there is a screen on the south. This not only captures the primary wind direction, funnelling it through the site, but it also accelerates the prevailing wind such that you feel a cooler temperature when you are in the space.

The design also allows air to move in and out from the north and south whenever the wind changes. This means even if there is a storm and the wind changes, you can still feel the wind throughout the site. Porosity of the site is key in ensuring that wind can flow through the site throughout the year.



Source: GuocoLand Limited

The generously-sized City Room is actively programmed for the surrounding community

Beyond design, what makes this space more engaging is a year-round calendar of events and activities. It is both a space for activity and for people to relax in.

Valerie: Most of the people who access and use the space tend to be office workers. But we also have residents dropping by from nearby residential areas. In curating activities for this space throughout the year, we try to plan for events that appeal to a wide range of people: from yoga sessions to pets and plant events, artisan markets, women's run and even mid-autumn festivals.

In curating the space, we have to be mindful of managing the needs of the restaurants and cafes, people using the space and the ongoing events to ensure that noise from events do not affect the cafes and people sitting around too much.

On the weekends, while it is quieter, families like to come by where I see toddlers playing with the water jets. We now even have new inhabitants – chickens!

One thing that has been well received is our introduction of public seats. It encourages people to linger longer and feel like they are part of a larger community. Beyond having activities in the space, it also offers a quiet space for people to just relax in.

What has been the impact of such a public space on people and the neighbourhood?

Nicolas: I see a public space such as this contributing to our overall health and wellness. Such a space is an extension of our natural environment and enables us to interact with our colleagues, friends, and families. This helps people thrive in terms of their mental and physical health.

Having a comfortable space like this, with fresh air, daylight, and breezes helps you feel more at peace. It helps you feel like it is your space. This benefits us on an individual level and as a community.

Valerie: Besides serving the office crowd and residential community, I observe that there is also an impact on the immediate neighbourhood in that more people are motivated to come to this place and linger longer. And this benefits the shops and businesses in the area too.

A longer version of the interview can be found at this [link](#).



3.2

PEDESTRIAN NETWORKS

At the micro-scale of the city, urban designers pay attention to the design of connectivity elements like walkways and linkages within and between developments and transit nodes, to ensure that they are well-designed, barrier-free and effective in connecting people to places.

Urban designers also have to be well-versed in implementation and coordination matters, and take a long term view in realising parts of the larger network.

How do we shape a more walkable city?

3.2.1: Shape comprehensive connectivity networks at various levels

Good pedestrian networks contribute to the walkability and liveability of the city. They enable efficient movement in the urban fabric, allowing people to reach places quickly and safely without the need for cars.

In key areas in the city with high concentration of people and good transit infrastructure, URA pays particular attention to creating and enhancing the pedestrian networks in these areas to make it convenient for people to walk, cycle and ride the MRT and public buses, to get to their destinations in a convenient and pleasant manner.

At-grade network

URA prioritises the at-grade pedestrian network. Compared to elevated and underground networks, it is always easier to orientate oneself in the city when standing at the street level, as streets, buildings, public spaces, landscape features all contribute to providing visual cues of place, space and time.

Underground networks

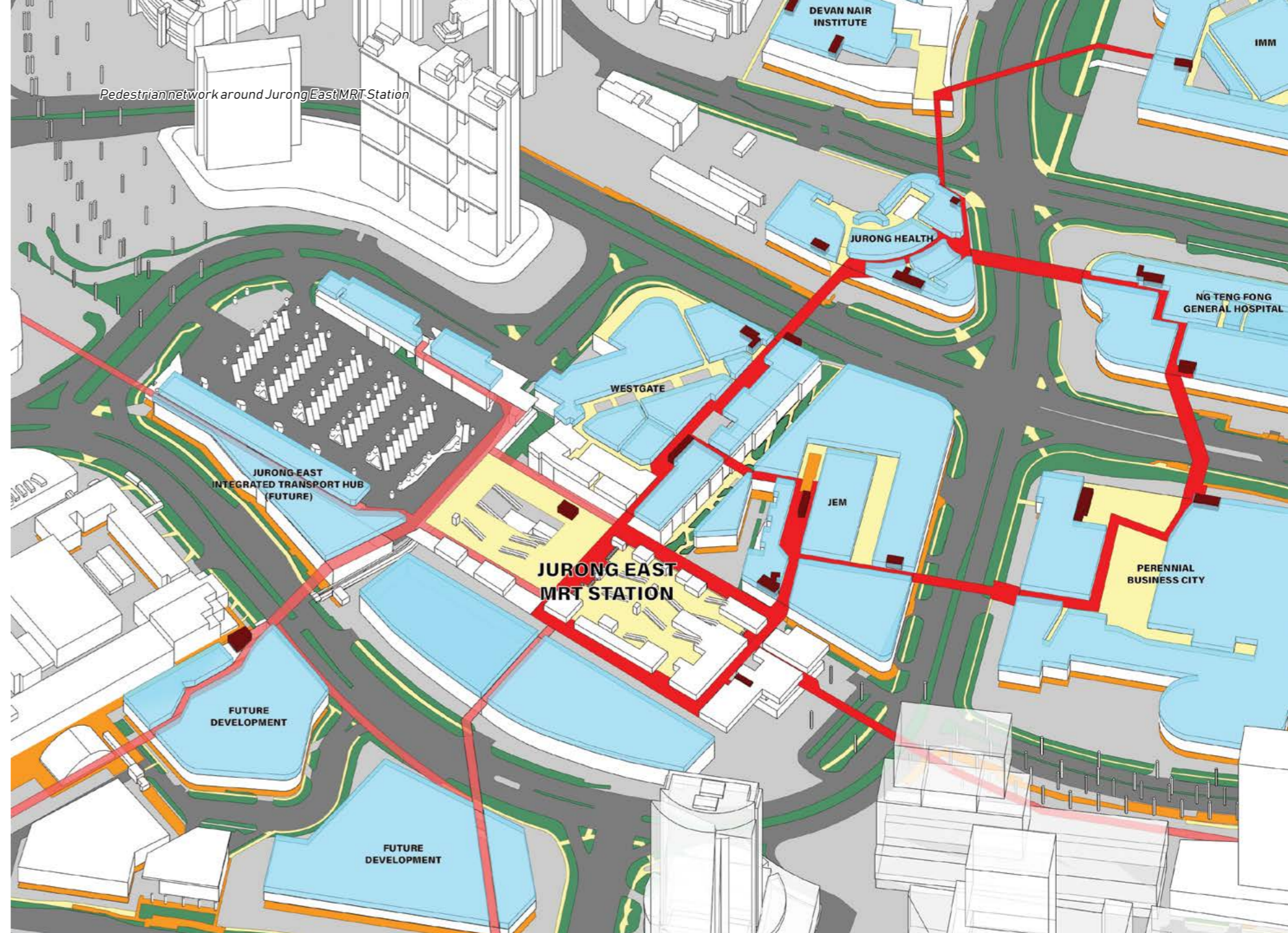
Underground networks are implemented in dense and built-up areas where the MRT system is underground, and there are developments that have basements to receive the underground links. This allows for direct connections from MRT stations to the surrounding developments.

Elevated networks

Elevated networks make sense in areas where the MRT system is elevated and there are multi-storey developments with publicly accessible second or third storey spaces, allowing for direct connections between the MRT concourse to these developments.

Elevated networks are technically easier to realise than underground links as they pose less structural impact to existing buildings. However, they can still be very complex to coordinate, with ownership and liability issues to navigate when such links cross development boundary lines.

The illustration in the overpage depicts the multi-level connections around Jurong Gateway connecting heavy volumes of commuters between the MRT station to their work places everyday.





Colonnaded covered walkway in the Central Business District

3.2.2: Elements of the at-grade pedestrian network

This section will go into the design standards and requirements for elements in the at-grade pedestrian network, such as covered walkways and through-block links in developments, free-standing covered linkways, and other related infrastructure like courtyards and pedestrian malls.

Covered Walkways

Covered walkways are one of the most ubiquitous and fundamental elements of at-grade pedestrian networks in Singapore, contributed by almost every development fronting a road or pedestrian route. They allow people to walk along the street under shade or seek shelter easily from the rain.

A uniquely local response to the tropical climate, covered walkways originate from the five-foot ways found in traditional shophouses. They are integrated into the frontage of the building envelope that front the street. As a public good, they are exempted from GFA computation.

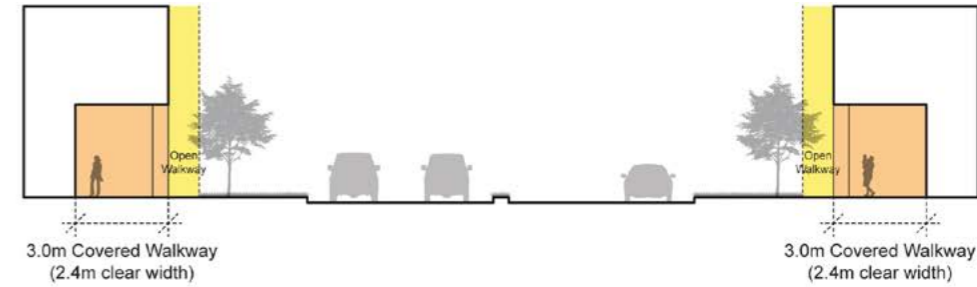
Minimum dimensions

The width of the covered walkway depends on the context of the development. In busy parts of the city like the CBD, URA may require covered walkways to be as wide as 5m overall and 4.4m clear (at localised areas where there are columns along the outer edge of the walkway). This is to cater for larger volumes of pedestrians. Otherwise, the more typical requirement is 3.6m-wide, and along smaller side streets, it can go down to 2.4m-wide overall and 2m clear.

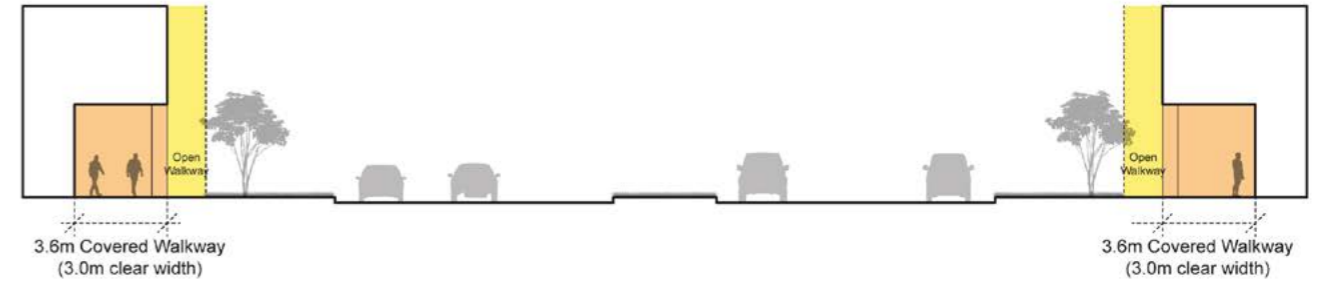


Traditional five-foot ways in shophouses – precursors to the modern covered walkway

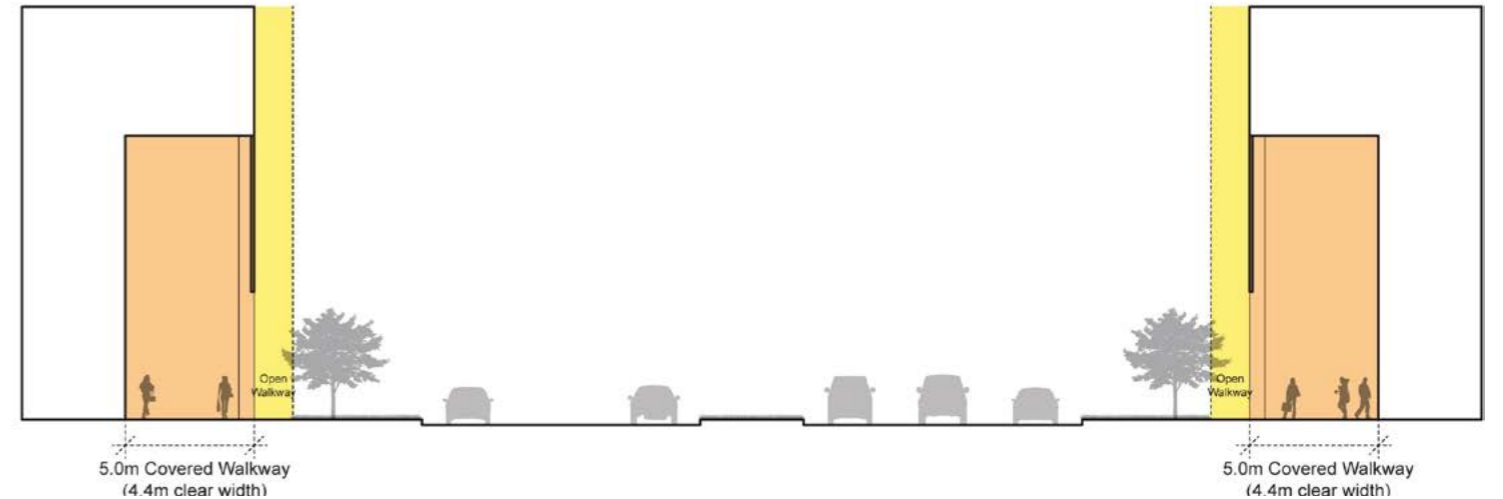
MINOR ROAD



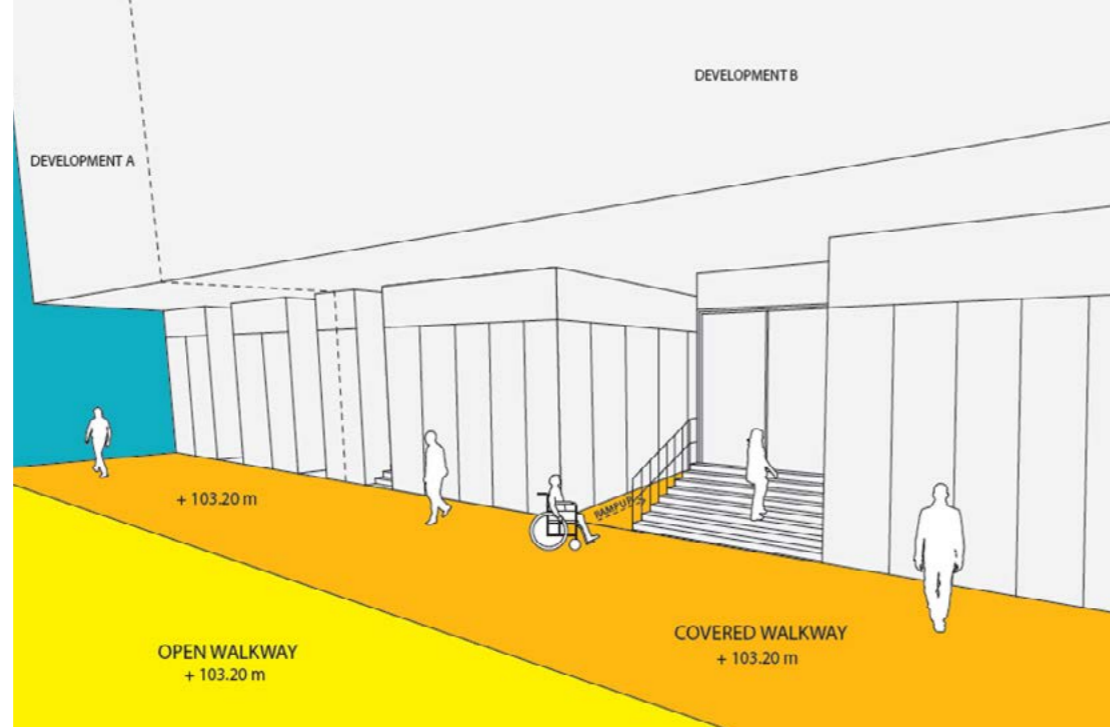
MAJOR ROAD



MAJOR ROAD



Width requirements for covered walkways depend on the urban context and anticipated footfall levels of the area



The covered walkway should be level with the open walkway. Any level differences for the development to comply with the Public Utilities' Board's (PUB) Minimum Platform Level (MPL) shall be taken within the development.



Covered walkways should be flush with the levels of the open walkway as far as possible. examples shown are along Bencoolen Street and Orchard Road

Level mitigation

One key aspect that URA's urban designers look at when guiding covered walkway design is to ensure that the levels of the covered walkway match that of the open walkway within the Road Reserve or pedestrian malls within the building setback. This is to ensure that pedestrians can move seamlessly from the street into the development. This is also part of Universal Design considerations to ensure that covered walkways are fully accessible to people on mobility devices.

As most developments have minimum platform levels that are higher than the street for flood protection, as mandated by the Public Utilities Board (PUB), there is a need to mitigate the level differences between the covered walkway

with the rest of the development, e.g. shops and entrance lobby.

For shops to be directly accessible from the covered walkway, they can be designed to have an entrance with steps fronting the covered walkway and another entrance from inside the building.

Sloping each component of the public realm between the road to the covered walkway can help reduce the amount of level mitigation required within the development. However there is a need to ensure that the gradients are kept gentle, i.e. optimally at 1:40 to be comfortable or maximum 1:20 to be accessible to people of all abilities.

Using slopes or ramps also minimises the need for any unsightly retaining walls along the streetscape.

Another important consideration is how the corners of the building and covered walkways relate to the street. Where possible, a portion of the open walkway should slope to function as a ramp down to the street.

The minimum clear width must be maintained at all times, with no doors allowed to open into this zone as that reduces the effective width of circulation, posing danger to pedestrians. If there are fire escape or general access doors opening into the covered walkway, these should be set back from the covered walkway.

Weather protection

In general the height of the covered walkway is not allowed to exceed the width, maintaining a 1:1 ratio. This ensures that there are parts of the covered walkway that are always beyond the reach of wind-driven rain.

If the height exceeds the width of the covered walkway, which may be the case as many developments have first-storey heights higher than 3.6m, then drop panels must be provided at the edge of the covered walkway so that the height of the opening is reduced to match the covered walkway width for better weather protection.

Accessibility

All covered walkways must be built up to align with the building setback line and cannot be internalised, covered up or deviate from this alignment. This is to ensure that they are always visible from the street, easily accessible and safe to use. For this reason, unnecessarily wide columns which block sightlines are to be avoided.



Covered Linkways help connect developments to nearby transit infrastructure and other developments

Covered Linkways

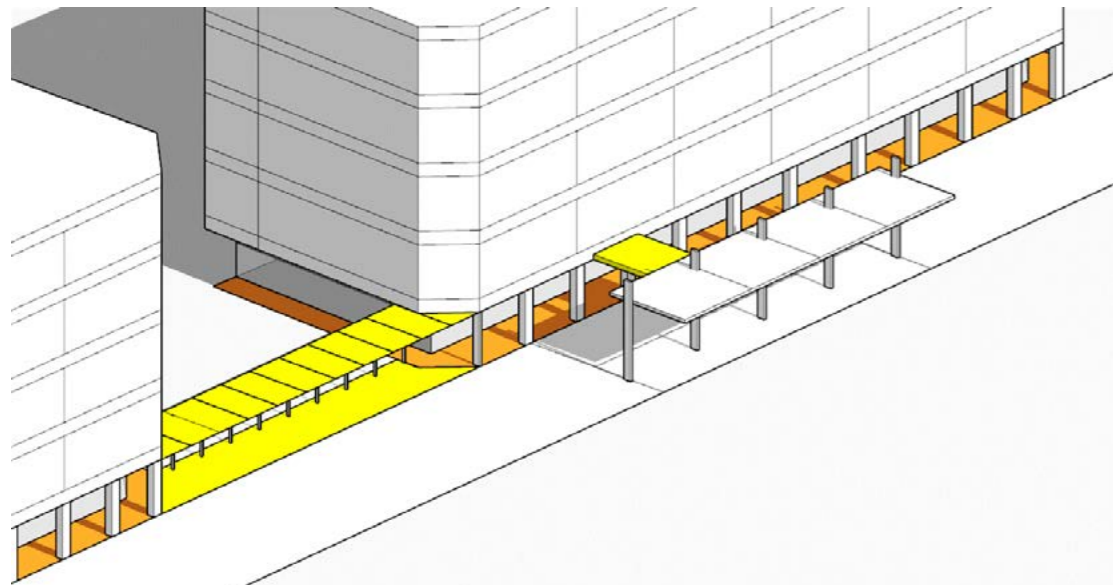
Covered linkways are standalone structures that are detached from the building envelope and typically used to connect standalone buildings together or connect them to bus stops and taxi stands along the street. Covered linkways are usually required within the road reserve where there are no covered walkways, such as in residential areas.

Minimum dimensions

If the covered linkways are provided to connect the covered walkways of buildings together, the width of the linkways should match that of the covered walkways they are connected to.

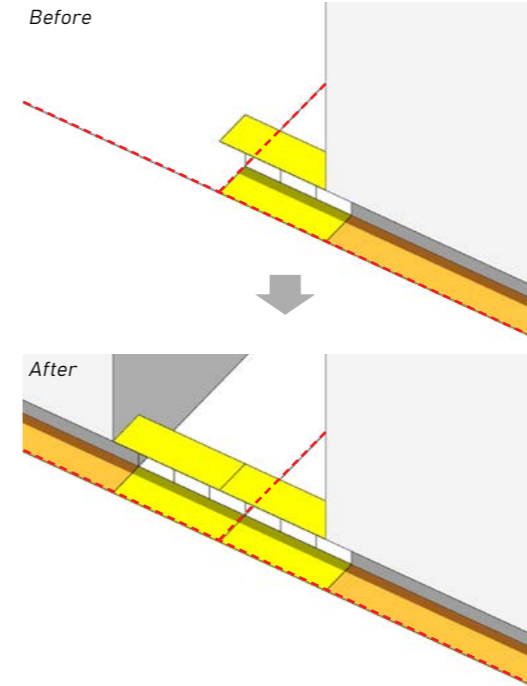
If the covered linkways are provided along the street within the Road Reserve, the minimum widths shall be as set out in the Walking and Cycling Guide, i.e. at least 2.4m wide and 2.4m high, with the columns sited away from the road.

Where covered linkways cross roads or vehicular access points, they are to be minimally 5.7m in height, with sufficient headroom for large vehicles to pass under.



Requirements to receive linkway

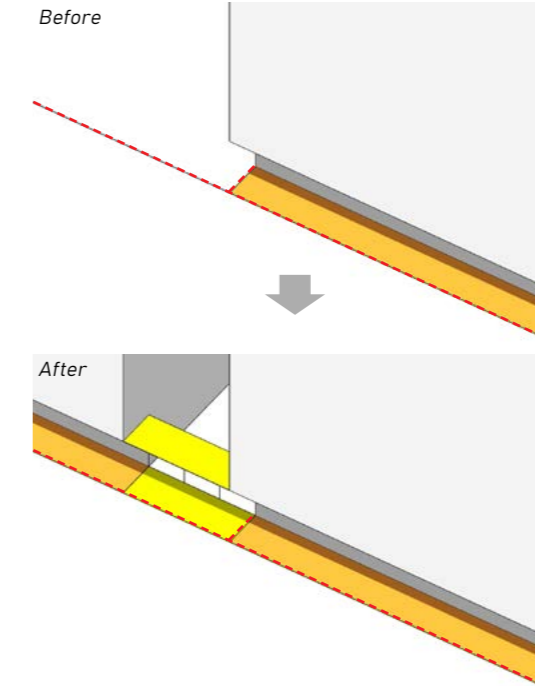
Linkway networks are realised as and when developments are built. When guiding two adjacent developments to link up, URA will guide the first development to build the covered linkway up to the boundary line, with no gaps, and include relevant clauses for it to be ready to receive the neighbouring covered linkway in future - typically with six months to a years' notification. These clauses include giving the neighbour the necessary access and rights-of-way to enter the land and complete the connection.



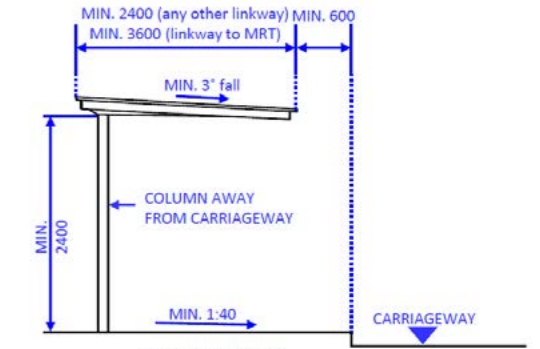
If the development is set back from the boundary, a covered linkway shall be provided up to the boundary line in anticipation of the future connection

If the neighbouring linkway has to connect directly to the first building structure, URA will stipulate that the first development has to be built with structural provision to receive the linkway. This is to avoid complications later on when the first development is not ready to allow the second party to link up.

It is critical that all covered linkways are built up to the common boundary to avoid the need for the neighbouring development to have to enter the neighbouring land to complete the link, which results in liability issues in terms of ownership, maintenance and safety.



If the development is built up to the boundary line, loading shall be provided to receive the future covered linkway canopy from the neighbouring development



Typical section of a covered linkway.

Weather protection

Generally the roofs of covered linkways require a minimum 3 degree fall towards the road carriageway for rain to flow towards the street side drainage.

Flashings shall be provided at the interface between low and high covered linkways to prevent rainwater from splashing onto pedestrians.



Example of a through-block link at Marina Bay Sands

Through-block links

Through-block links serve as shortcuts through developments and contribute to the overall porosity of the urban fabric. They are typically required in developments with long frontages.

They can be exempted from GFA computation if they form part of the overall connectivity network.

Alignment and access

To qualify as through-block links, they must connect key pedestrian routes or circulation areas together, such as significant streets on two sides of a development, or between the main road and an MRT station entrance within the development.

The alignment should be such that it provides a direct line of sight from one end to another, to function effectively as a through-block link.

Through-block links should also be accessible to the public during the normal operating hours of the building, or in some cases, 24 hours a day.

Minimum dimensions

The minimum width of through-block links ranges from 4m to 7m, depending on the anticipated footfall. Through-block links lined with shops usually need to be wider to cater for spillover activity.

They are also minimally required to be at least double-volume in height. Along Orchard Road they are required to be at least 10.0m high. This is to ensure that through-block links have good line-of-sight and stand out from the standard circulation spaces of the development.

Signage

Prominent signages must be provided for the through-block links, highlighting where they connect to and the hours of operation. To be easily read by pedestrians, the recommended minimum size of such signages is 4m x 1m.

CASE STUDY

A historic through-block link at Change Alley

A historic connector in the city centre

Change Alley was a lane that used to stretch from Collyer Quay to Raffles Place, thought to be named in 1890 after a trading hub called Exchange Alley in London. It was the site of a bazaar where a good variety of goods at bargain prices and numerous money changers could be found, servicing tourists and sailors arriving and departing Singapore through Collyer Quay.⁸

In 1973, the formerly open air street was transformed into an air-conditioned shopping arcade as part of the Change Alley Aerial Plaza development, which also featured Singapore's third revolving restaurant and a pedestrian overhead bridge with 56 shops. Change Alley underwent further modifications over the years but always retained its function as a convenient through-block link connecting Marina Bay waterfront to Raffles Place park – the heart of the Central Business District.

Shaping the design of the through-block link

In 2019, enhancement works were carried out to the through-block link again as part of CIMB Plaza. As part of the scope of works, URA worked with the building owners to ensure that a minimally 6m wide and 9.5m wide thoroughfare was provided to cater to the large volume of pedestrians that typically use the link.

URA also guided the building owner to align the through-block link such that it connects two public spaces to ensure visibility and accessibility. URA also guided the design to ensure a sense of loftiness in the through-block link.

In 2023, a storyboard was also installed at one end of the through-block link to commemorate the historical significance of the through-block link, showcasing the history and origin of the name "Change Alley".





Pedestrian Mall in Bras Basah, Bugis

Other elements in the at-grade connectivity network

Pedestrian malls

As outlined in the earlier chapter, pedestrian malls serve as major elements of car-lite infrastructure in the city, connecting street blocks and developments together and to nearby transit nodes.

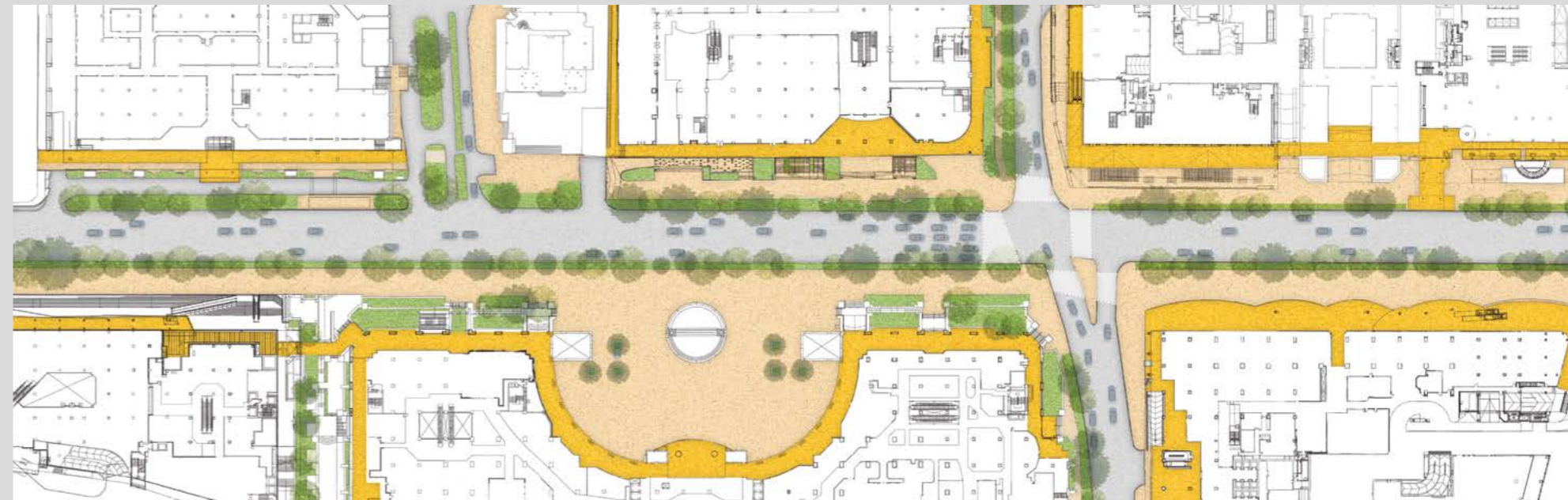
Typical dimensions of pedestrian malls usually resemble that of a street, ranging from 10m to 20m in width. Further subdivision of the space is done to create space for circulation, seating, tree planting (which is important for shade), and even outdoor dining areas, so that the space is convivial and inviting for public use.

These elements also help to make the space feel more human-scale, relating better to the activities that take place in the public realm.

Orchard Road

The pedestrian mall along Orchard Road is one of its key defining features. It was created in the 1970s by the then-Public Works Department by decking over Stamford Canal. This was carried out in response to the growing popularity of the street. In 2008, one road lane was reclaimed to further widen the pedestrian mall on the south side of the road.⁹

On both sides of the street, a minimum 5m wide clear walkway is safeguarded within the side table space for circulation. Additional spaces are set aside along it for public seating, landscaping and "urban green rooms", which are pockets of spaces for buskers and other pop-up events which contribute to vibrancy along the pedestrian mall.



Orchard Road pedestrian mall.

Albert Mall, Bras Basah, Bugis.



Albert Mall

This is a cross-shaped pedestrian mall stretching 700m from east to west, created by pedestrianising Albert and Waterloo Streets in the heart of the Bras Basah, Bugis district in the 1990s.

The section of the pedestrian mall is approximately 18m wide, with a 6m wide circulation zone in the middle, flanked by two rows of trees and lined with designated spaces for bazaar stores and retail outdoor display and /or alfresco dining. Buildings are guided to line both sides of the pedestrian mall to define and frame the public space.



Courtyard at Raffles Hotel

Courtyards

Courtyards likewise contribute to porosity in the urban fabric, being publicly-accessible spaces within the development that people can use to move through the site. Courtyard typologies can be considered as a type of fenceless development.

URA encourages courtyard typologies in areas of the city where a high degree of walkability is desired, such as Marina South and Jurong Lake District. In areas like Robertson Quay, development courtyards have become vibrant public spaces with F&B outlets and outdoor dining.



Back lane in Chinatown

Backlanes

These refer to backlanes found in older parts of the city, historically created behind shophouses to provide access for waste disposal and fire-fighting. These backlanes contribute to the connectivity network of the area as colourful routes for exploration.

In certain areas like Joo Chiat, these backlanes have been turned into interesting spaces, with murals and public art, and even 'hole-in-the-wall' pop up cafes and shops.

CONCEPTS EXPLAINED

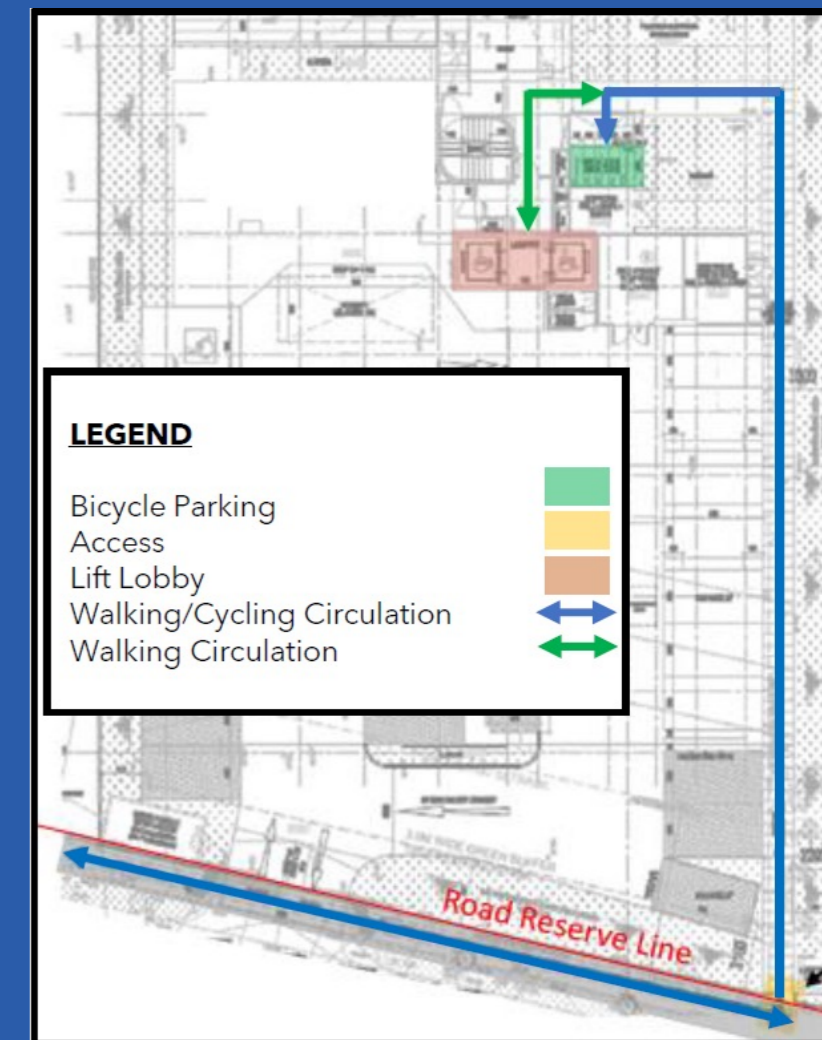
Why is a Walking and Cycling Plan (WCP) required as part of submissions?

Walking and Cycling Plan (WCP) submission requirements were first launched in 2016 to help building owners and architects develop better strategies for active mobility in the design of their developments, early in the design process. It was recognised that every development in Singapore has to contribute the necessary infrastructure to make the city more walking and cycling friendly.

WCP submission is required for commercial, retail, business park and school developments that reach a certain GFA level, being developments that would generate higher pedestrian and cyclist traffic.

WCPs need to consider the safety, convenience and accessibility for active mobility users by incorporating the following elements:

- Convenient and direct access routes from nearby public transport facilities and adjacent properties to the development, with covered walkways, linkways and crossings;
- Conflict mitigating strategies such as signages and traffic calming features at intersection points between pedestrians, cyclists and vehicles in the development, for example at ingress / egress points, carpark entrances, drop off points and taxi stands;
- Sufficient and conveniently located bicycle parking spaces and supporting amenities such as shower rooms and lockers;
- Easy-to-understand wayfinding signages to key transit nodes, active mobility facilities and nearby amenities; and
- Barrier-free accesses and routes to serve children, the elderly and mobility-challenged individuals.



Example of a walking and cycling plan submission



Source: CapitaMall

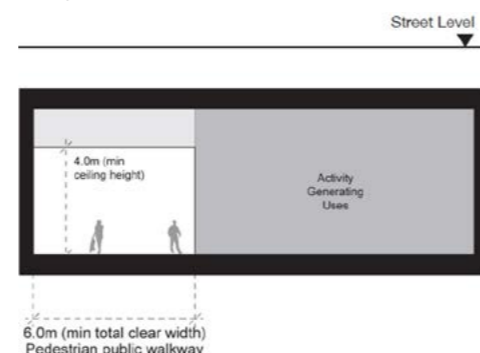
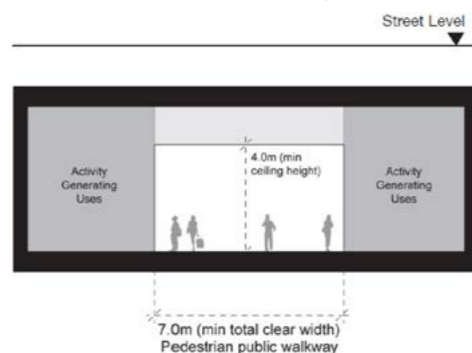
Underground pedestrian link at ION Orchard



Source: CapitaMall

Underground Pedestrian Link at City Link Mall

UPLs should be 6m if there are shops on one side or 7m if there are shops on both sides



3.2.2: Elements of the underground pedestrian network

Underground pedestrian links

Underground networks offer all-weather connectivity and are primarily found in areas with underground MRT stations and basement retail spaces. These networks mainly comprise underground pedestrian links (UPLs), which connect buildings together through their basement spaces as well as beneath roads.

Minimum dimensions

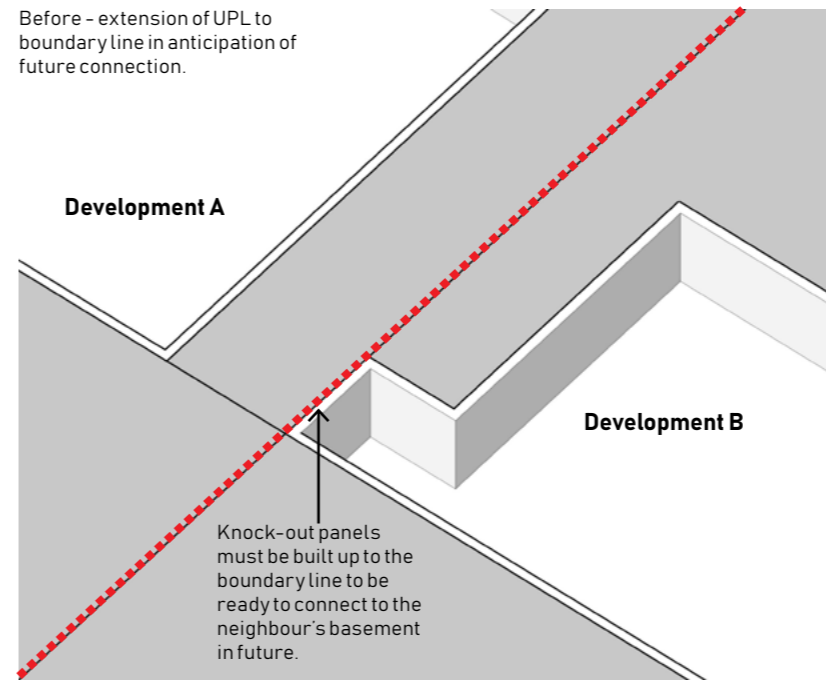
To ensure they do not end up as long claustrophobic spaces, UPLs should have a minimum width of 6m for walkways with shops on one side, and 7m if there are shops on both sides. In addition, they are required to have a clear minimum ceiling height of 4m.

UPLs that see higher volumes of users will require wider widths, e.g. the requirement is 10m in Marina Bay, to cater for large volumes of users.

Integration with shops

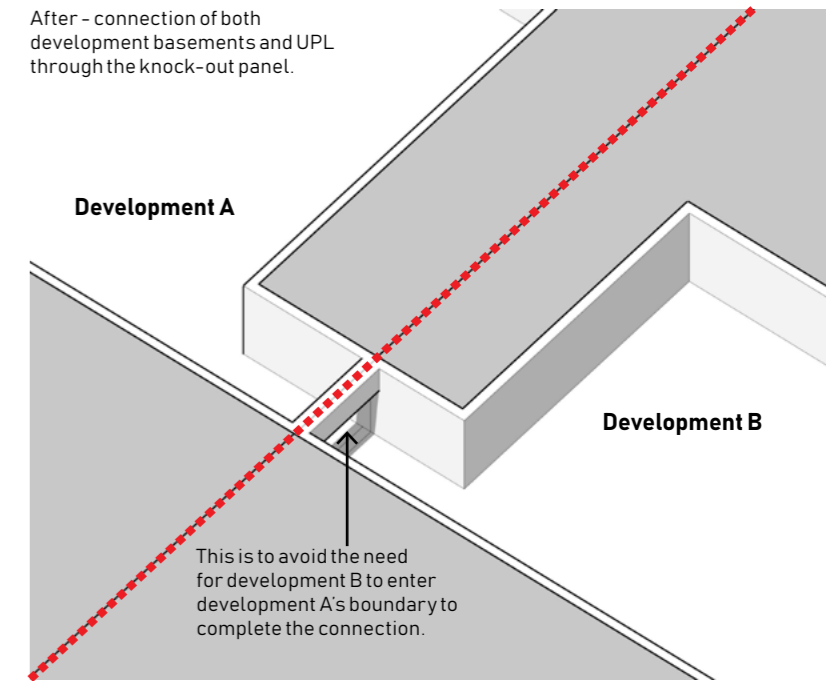
Generally URA guides UPLs to be integrated with the basement spaces of developments so that they can be lined with shops and eateries, and are lively and well-used spaces.

Before - extension of UPL to boundary line in anticipation of future connection.



Building up of knock-out panels at the boundary line to facilitate ease of connection in future

After - connection of both development basements and UPL through the knock-out panel.



Vertical circulation points

These are needed to provide direct access from the UPL to street level. They must minimally comprise a pair of two-way escalators, staircases and two passenger lifts (for contingency in case one set breaks down).

Vertical circulation points will usually be provided along the building perimeter at the first storey, that open out directly to the covered walkways so that people can discharge directly into sheltered links to surrounding areas. Sometimes additional VCP will be planned to emerge into planned public spaces or along main routes to the MRT.

Requirements to receive

Similar to covered linkways and walkways, the linking up of UPLs usually happens one development at a time, with the first one required to build the UPL up to the common boundary with a knock out panel, in anticipation of the second development to connect through.

URA will then include the relevant clauses for the first development to be ready to receive the future adjacent UPL when it is constructed, through the KOP, upon 6 months to a years' notification. These clauses include giving the neighbour the necessary access and rights-of-way to enter his land to complete the connection.

Knock out panels

A knock out panel is a part of the basement wall that can be opened up to allow the movement of people and services across developments. They are created at the ends of UPLs at the development boundary line in anticipation of connection from the adjacent development in future.

URA usually requires the KOP to be the same width and height as the UPL, so that the final connected passageway is continuous and seamless.



Elevated Pedestrian Link at Collyer Quay



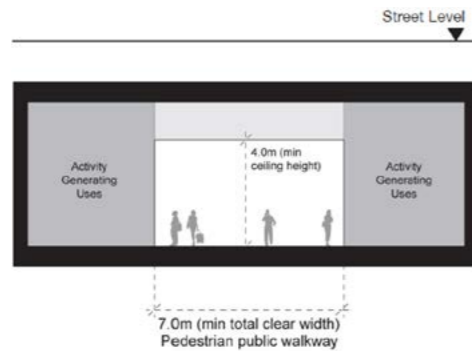
Elevated Pedestrian Link at Bugis

3.2.3: Elements of the elevated pedestrian network

Elevated pedestrian links

Elevated pedestrian links (EPLs) are high-level pedestrian links that connect buildings together, often overcrossing roads, allowing people to walk easily from one building to another.

They make more sense in areas where there are buildings with publicly-accessible second and third storey spaces that can be linked up together, and also in areas served by elevated MRT stations where the EPLs can connect directly to the elevated concourse levels.

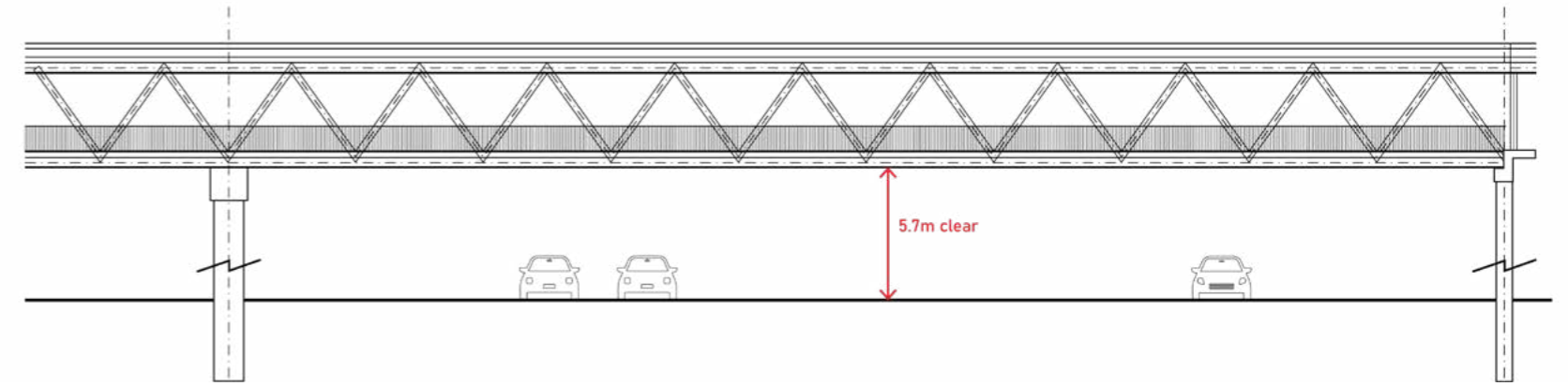


Minimum dimensions

EPLs range in width depending on the levels of footfall anticipated in the area. Around Jurong East MRT, the EPLs in the elevated J-walk network start at 6m in width closest to the MRT and scale down to 5m further beyond.

Agent-based modelling is sometimes used to determine if the proposed width for the EPL is sufficient to cope with potential pedestrian demand.

For example, EPLs connecting to the National Stadium at Sports Hub are sized up to 9m in width to cater for crowd surges during event days.



Levels

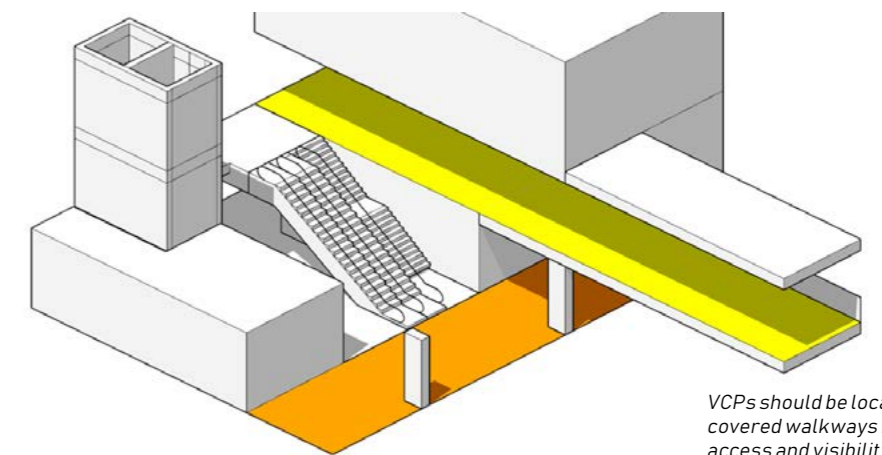
As EPLs cross public roads, they have to be designed with at least 5.7m of headroom from the street level, to cater for the largest vehicle on the roads.

The levels of the EPLs also have to tie back to the levels of the developments they connect to. For new developments, the floor level shall take reference from that of the EPL to ensure that there are minimal level differences across the entire EPL network. All levels within the EPL network must be mitigated with barrier-free code compliant ramps.

Vertical circulation points

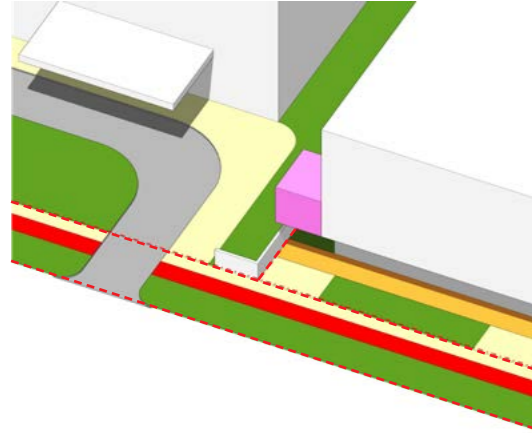
Similar to UPLs in the earlier section, vertical circulation points are needed to provide direct access from the EPL to the street level. They usually comprise as least two sets of lifts and escalators in case one breaks down, to ensure barrier free accessibility is always maintained.

Vertical circulation points are usually provided around the building perimeter at the first storey, opening directly onto the covered walkways so that people can discharge directly into sheltered links to the surrounding streets.

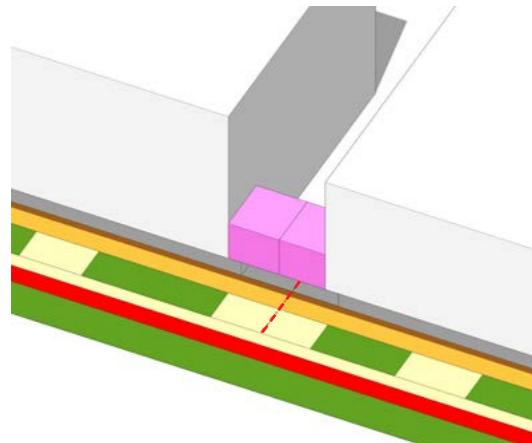


VCPs should be located along covered walkways for ease of access and visibility

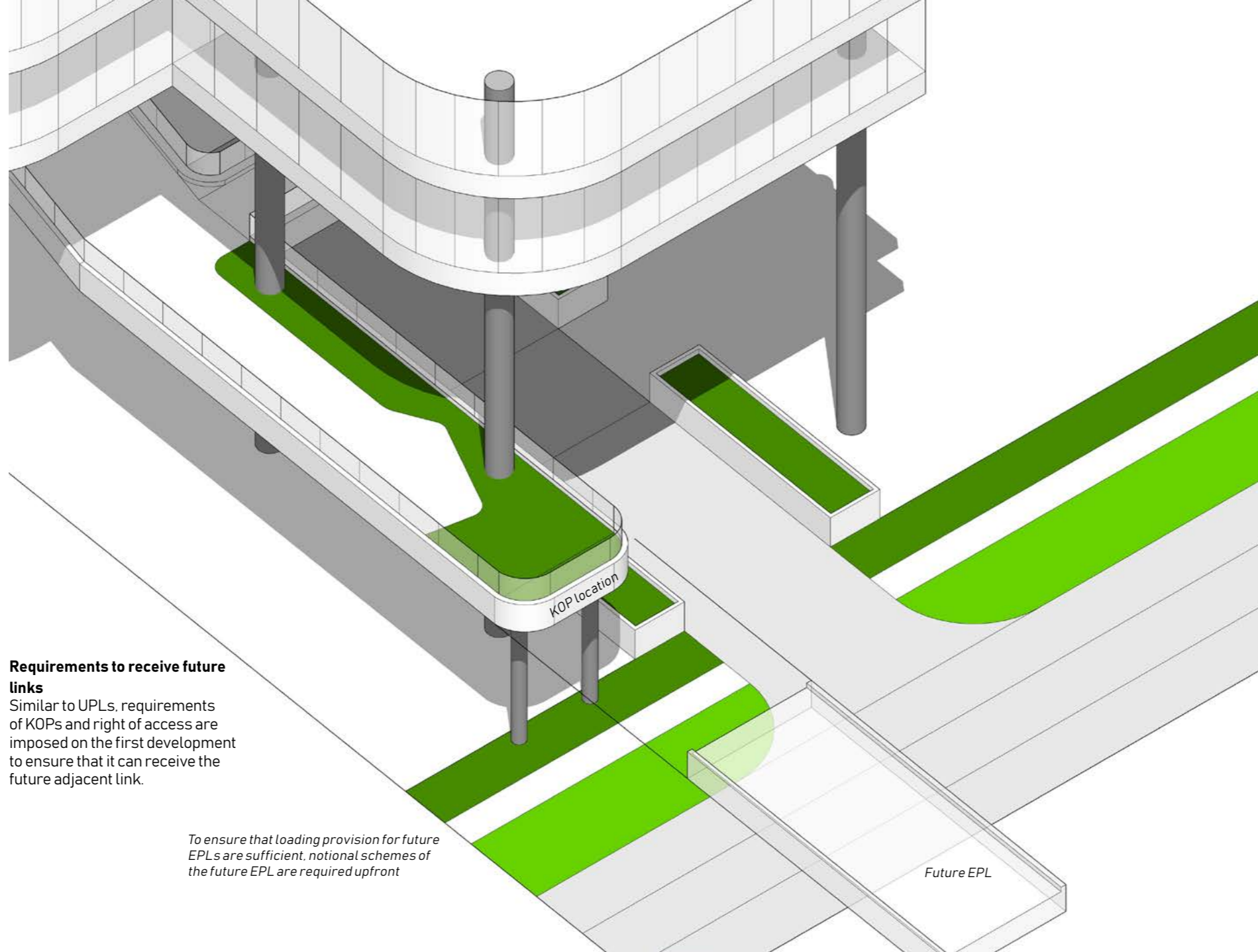
Before – extension of EPL to boundary line in anticipation of future connection.



After – connection of both developments through the EPL.



Linking up of EPLs via knock-out panels along the development boundary



Requirements to receive future links

Similar to UPLs, requirements of KOPs and right of access are imposed on the first development to ensure that it can receive the future adjacent link.

To ensure that loading provision for future EPLs are sufficient, notional schemes of the future EPL are required upfront

Permanent Action	
Structural self-weight of bridge	
Structural self-weight of roof	
Weight of hand-rail	
Weight of floor finishes	
Weight of cladding	
Weight of any other elements	
total weight / 2	
Permanent Force catered for at 'knock-out' panel	xxkN

Variable Action	
Live load at roof level	
Live load at deck level	
Total loading (multiply against total area) / 2	
Variable Force catered for a 'knock-out' panel	xxkN

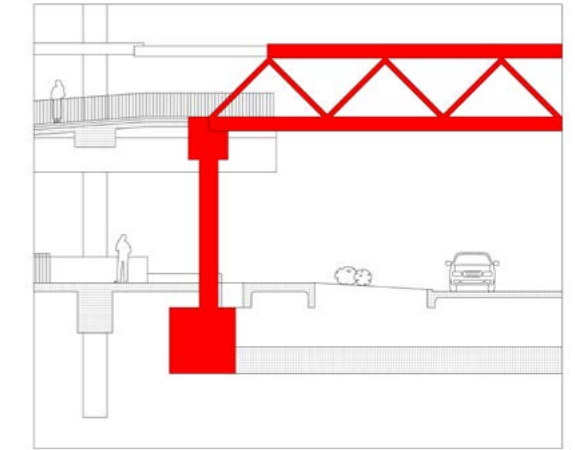
Example of notional scheme loading calculations and interface design

Structural loading requirements

KOPs for EPLs usually have to be built with sufficient structural provision to support the weight of the neighbour's future EPL connecting to it, especially if there is no room for columns below the EPL to support it.

Information on the structural provision must be submitted to URA to ensure that it is sufficient to receive the weight of the future EPL.

The loading provision shall take into account the prevailing guidelines for the future elevated pedestrian link such as LTA's Civil Design Criteria and BCA's building codes.



Notional scheme

To allow the architect and URA to be able to determine and verify the amount of structural loading required, a notional scheme of the future neighbour's EPL shall be developed by the architect of the development providing the KOP.

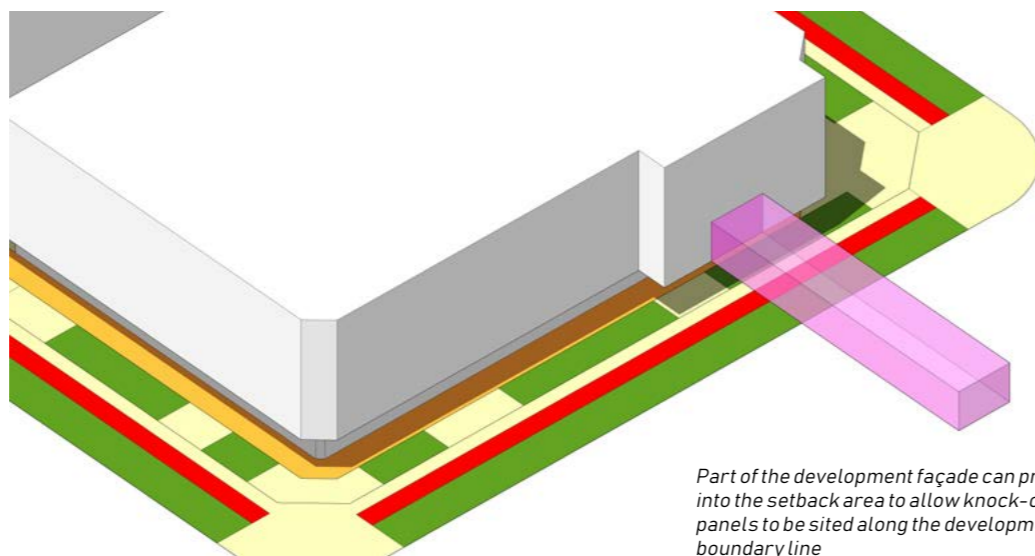
The notional scheme ensures that the structural loading, levels and method of integration, as well as methods to safeguard the integrity of the link during redevelopment of the building, are all worked out before construction of the KOP.

After clearance with URA, the notional scheme is then handed over to the neighbouring owners when they are ready to build their side of the link.

**Interim design condition**

As EPLs and KOPs have to be built up to the boundary line while the building is typically set back to comply with road buffer and green buffer requirements, this can sometimes result in a strange appearance of EPLs extending to the development boundary like a bridge to nowhere, sometimes for many years until the neighbour is ready to connect to it.

To minimise the awkward appearance of the EPL during this interim period, URA may guide the development to extend part of its overall façade to the boundary line so that the EPL and KOP do not appear out of place in relation to the design of the development.



Part of the development façade can project into the setback area to allow knock-out panels to be sited along the development boundary line

EPL design integration

The designs of different stretches of EPLs also have to be carefully considered so that they appear seamless and whole when connected. In this depicted example of connected EPLs between JEM and West Gate, the architects were able to effectively coordinate and match the design of both EPLs as both developments were under construction at the same time.

As this is not always the case, URA prefers timeless and elegant designs for EPLs so that they will be easier to match between developments, especially when work on the second EPL takes place many years after the first one is completed.



Example of coordinated EPL design from two adjacent developments

CASE STUDY**Taking to the sky at J-Walk****Solving connectivity contextually**

Today, Jurong Lake District is the gateway to major business centres and education hubs in the west, like Jurong Innovation District, NUS and NTU, with close to 3000 multi-national companies located nearby, within a catchment of 1 million residents in the western part of Singapore.

A regional centre was conceptualised here in the 1990s to bring jobs closer to the western region of Singapore, at the intersection of the East-West and North-South MRT Lines.

As the rail network here is elevated, it was logical to develop connectivity to surrounding developments using a network of elevated pedestrian links, extending directly from the 2nd storey MRT concourse level. This allows pedestrians to overcross the surface level roads and walk conveniently to all nearby developments unhindered by vehicular traffic.

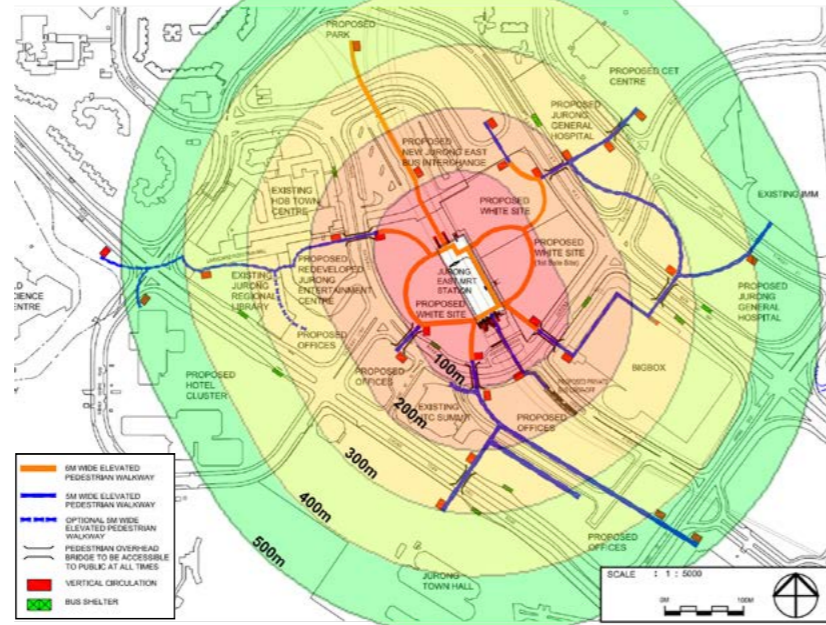


A comfortable skywalk

URA drew up an elevated pedestrian network (EPN) plan to connect Jurong East MRT station to the surrounding developments, as well as the future Jurong Lake District MRT station on the upcoming Cross Region Line about 700m away.

Anticipating high passenger volumes arriving by train, URA carried out agent-based modelling to determine the required widths for the elevated pedestrian links (EPLs) – this was set at minimum 6m near the station and narrower as it gets further away. Numerous vertical circulation points are also planned along the streets to provide convenient access to the network from the street level.

The network is realised incrementally, included as land sale site conditions when each site is sold, or imposed upon redevelopment, such as for existing developments. The relevant knock-out panels (KOPs) are safeguarded in each development for the next development to link up to.



Varying of linkway widths for J-Walk depending on distance from the MRT station

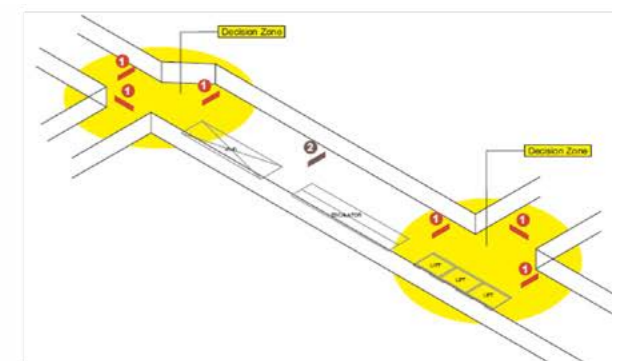
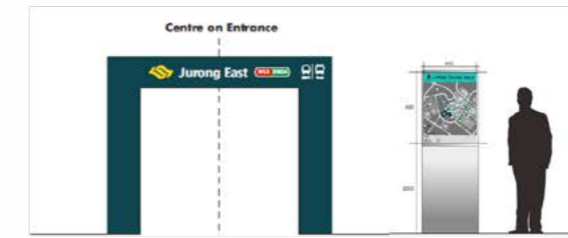
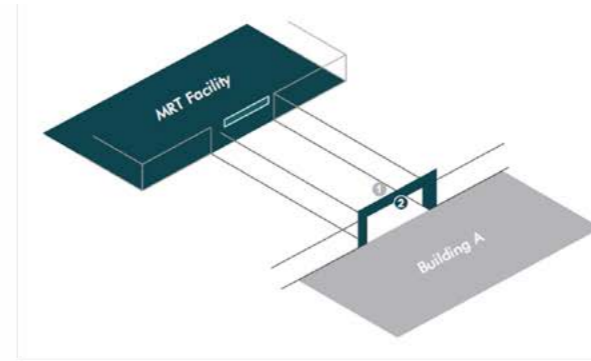
A new hub for mobility at Jurong

A new integrated development is planned for Jurong East, which is integrated with a bus interchange and the existing MRT station, billed as the Jurong East Integrated Transport Hub (JEITH). The development also features 27 and 8-storey office tower blocks connected by sky bridge over the MRT viaducts.

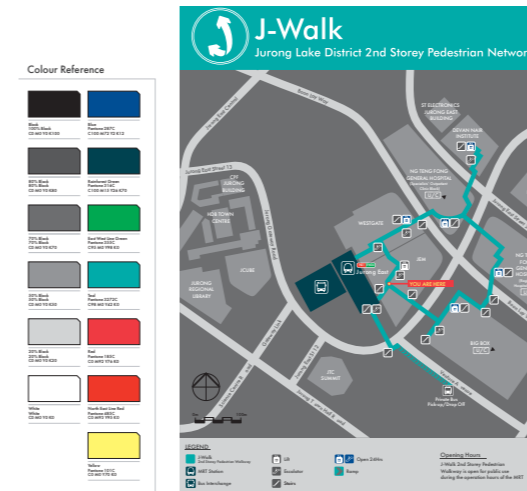


Future JE-ITH

Source: LTA



Wayfinding design standards for J-Walk



Ensuring good wayfinding

As parts of the elevated pedestrian network pass through the internal spaces of developments, it is easy to lose sense of where one is in the network. URA developed a wayfinding guide to ensure that developments provide relevant signage and directories for orientation along the network.

Wayfinding signs and directories are required at the entrances and exits to developments, highlighting the direction to the nearest public transport facility.

Within the internal corridors of the development, directional signs are also required, especially at decision making junctions. These signs may be ceiling, wall or floor-mounted, to highlight the next 2 building names ahead as well as the nearest vertical circulation points (lifts, escalators, staircases).

Specifications on the signage size, typefont, logos, illumination, etc are also provided to ensure coherent branding identity for the signages, allowing people to identify them easily.

THE WAY FORWARD

THE CONTINUAL JOURNEY TO BUILD A CONNECTED AND INCLUSIVE CITY

Chiu Wen Tung
Group Director
(Research and Development), URA

and Teo Pei Yun
Planner
Strategic Research Group, URA



Step 1: Identify routes that have the greatest number of residents passing through and filter out sheltered routes



Step 2: Identify unshaded key pedestrian routes by comparing total shadow cast from buildings and trees throughout the day



Step 3: Consider appropriate interventions such as additional planting for shade provision (subject to detailed studies)

Developing Singapore as a connected city has been the effort of many stakeholders over decades from our first Concept Plan which laid the foundation for a polycentric city. Our journey towards a more comprehensive, people-centric and sustainable mobility network, which can also support increasing volume of goods deliveries, continues. New trends and technologies offer further possibilities to improve.

What would the future of mobility in Singapore be like?

Walk-Cycle-Ride will continue to be the main mode of our commutes. Active mobility is a healthy and environmentally friendly way to get around.

How can the walking and cycling experience be made more accessible, attractive and comfortable? With the expansion of our cycling network to more than 1300km by 2030, more places would be easily accessible through cycling.

We also make journeys more pleasant and interesting by linking routes to key recreational, identity and green corridors such as Singapore River, Rail Corridor and Kallang River.

Exploring new methods to enhance pedestrian comfort level

By using network analysis of Walking and Cycling Network data, together with sunshade analysis of 3D datasets of buildings and trees, we can potentially study how to make the journey even more comfortable by identifying areas where more shade could be provided.



New modes of transport powered by technology

New business models such as bicycle sharing, and alternative mobility devices such as Personal Mobility Devices (PMDs) may boost active mobility.

Shared bicycles offer a convenient and economical option for short trips. Shared bicycles can be easily located anywhere in the city and can even be reserved at bus stops ahead of time.

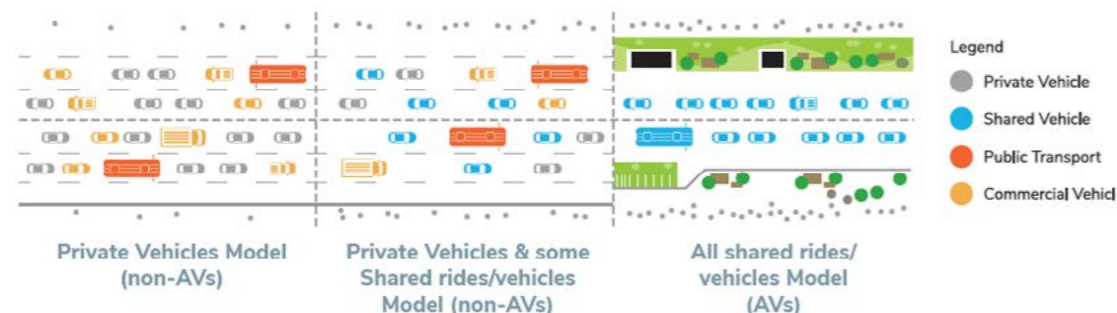
Active mobility devices such as PMDs can offer a convenient mode of first and last-mile commuting



Autonomous vehicle, previously on display at the URA Centre during the public exhibition on 'Reimagining Urban Mobility with Autonomous Vehicles' (2022)

but need adequate safety provisions. Enhanced regulation, better infrastructure and continued technology advances to manage speed and risk could help to enhance the safe use of such devices. Users are encouraged to refer to the online E-scooter Handbook or Power-Assisted Bicycle Handbook published by LTA, for information on the rules, code of conduct and safe riding practices.

Another technology is autonomous vehicles (AVs), which are self-driving vehicles that can sense their environment and hence can move with little or no human intervention.



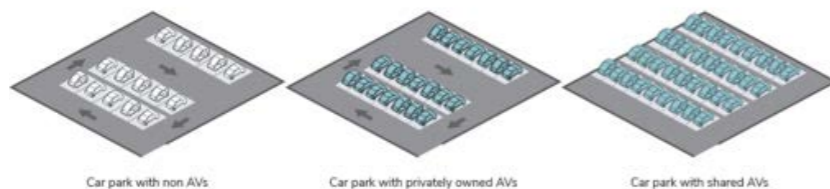
Adapted from: San Francisco Municipal Transportation Agency

By combining ride sharing and use of autonomous vehicles, we will be able to reclaim streets to provide more streetside greenery and space for walking and cycling

AVs may transform our commutes by offering convenient point-to-point transport. If unmanaged, it could lead to greater traffic congestion with more trips and even 'zero passenger trips'. However, coupled with trip sharing and new models such as mobility as a service, the number of trips and vehicles needed could be reduced significantly. There are also opportunities to redesign towns by reclaiming road and parking spaces.

Redesigning streets to prioritise people

AVs have the potential to create more liveable and walkable environments as the precision awareness of an AV of its surroundings can reduce the space needed for roads. With less vehicles and more dedicated space for non-motorists, our streets will be safer for active mobility users.



Shared AVs will reduce the need for car parks in developments.

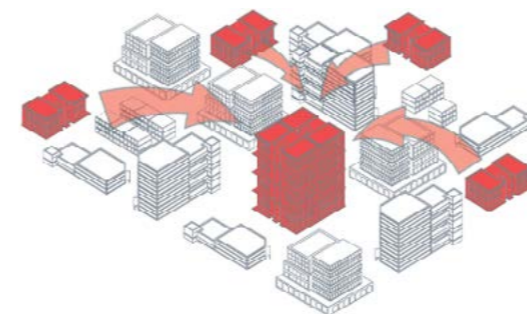
Freeing up car parking space for other uses

AVs can park closer to one another due to automated and highly precise access and parking manoeuvres. There is also no need to allocate space for walkways and safety buffers needed with traditional human parking. This can increase the layout efficiency of car parks. If AVs are fleet-owned and shared, the parking can be even more space efficient with no need to move specific vehicles 'out of turn'.

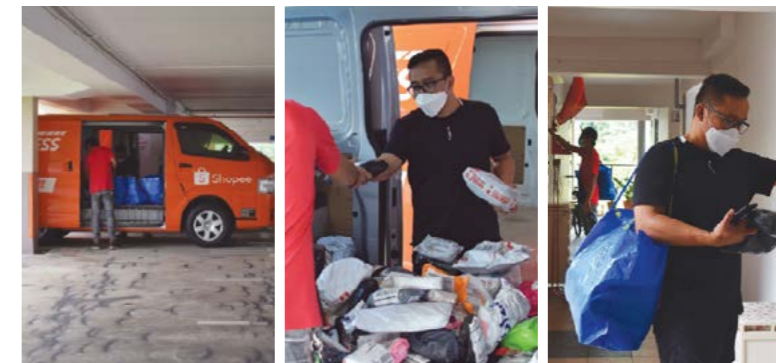
Redesigning Pick Up Drop Offs for more seamless travel

As people do not need to park AVs, origin and destination points can be located where most convenient. We may need to incorporate more Pick Up Drop Off points in our city to facilitate new mobility patterns.

Shared AVs can also be stored in a shared 'hub' located away from prime districts, instead of being parked in many buildings and dedicated car parks across the island. The freed-up space could then be converted to community and recreational spaces, such as playgrounds or parks.



The freed up car parking space could then be converted for community uses and events.



Improving the way we plan urban logistics

Other than people movement, we also observe changing patterns in goods movement due to the rise of e-commerce activities.

In the past, we travel to our destinations to consume goods and services. With the rise in e-commerce trends, more goods and services are being delivered to consumers instead.

Such trends will require us to adapt our spaces. Courier hubs are an example and came about as a result of close engagements with the industry to understand the changing needs of urban logistics. In 2021, we worked with logistics companies and the Housing & Development Board (HDB), with support from Enterprise Singapore, to pilot courier hubs in two HDB multi-storey car parks. The pilot showed promise in reducing the number of delivery vehicles needed, smoothing the delivery process and improving productivity. At one courier hub, driver productivity improved fourfold.

The initiative was formalised in September 2024 to allow more companies to participate. Agencies will work closely with industry partners to study new initiatives that can facilitate safe and efficient deliveries.



Besides exploring ways to redesign our spaces, new technology can also improve the ways deliveries are carried out. In the future, such deliveries may be completed by autonomous mobile robots (AMRs).

AMRs could deliver goods from a collection point to consumers directly and help to reduce manpower cost for last-mile delivery.



Alternatively, more deliveries can be made to lockers.

This is a secure option that reduces the risk of failed deliveries. This can improve delivery productivity by tenfold for delivery companies. If lockers were as commonplace as post boxes, it would also be highly convenient to residents.

The future of mobility is ever changing and presents opportunities to enhance how we travel and experience our city.

Besides enhancing convenience and improving efficiency, we aim to also design the city for enjoyable and memorable journeys. It is hoped that this guidebook contributes to understanding of the various urban design guidelines and requirements which go towards improving liveability in Singapore, to make the city more connected and inclusive.





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Government Agencies

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Infocomm Media Development Authority

Land Transport Authority (LTA)

Ministry of Transport (MOT)

National Parks Board (NParks)

Ministry of Health Office for Healthcare Transformation

Singapore Tourism Board (STB)

Private / Non-profit organisations and institutions

Capitaland Group

NUS School of Design and Environment

National University of Singapore

Arup Singapore Pte Ltd

Henning Larsen Architects

Ramboll Group

Singapore University of Technology and Design (SUTD)

Duke-NUS Medical School

IOI Properties Singapore

Orchard Turn Developments

Penta-Ocean Construction Co Ltd

GuocoLand Singapore

Skidmore, Owings & Merrill

Funan

ADDP Architects LLP

RSP Architects Planners & Engineers Pte Ltd

DP Architects Pte Ltd

Frasers Property Ltd

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RELEVANT LINKS

Introduction

Urban design guidelines
<https://www.ura.gov.sg/Corporate/Guidelines/Urban-Design>

Chapter 1

Interview on data science
<https://go.gov.sg/sgurbandesignguidebook-connected-datascience>

Walking and Cycling Guide
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Active Commute Grant
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Interview on North-South Corridor
<https://go.gov.sg/sgurbandesignguidebook-connected-nsc>

Chapter 2

Range-based parking provision standards
<https://www.lta.gov.sg/content/ltagov/en/newsroom/2018/11/2/new-parking-standards-for-private-developments-from-february-2019.html>

Interview on Bencoolen MRT station
<https://go.gov.sg/sgurbandesignguidebook-connected-bencoolen>

Best practice guide for last mile delivery for condominiums
<https://slaprodapi.flyingcapetech.com/api/Common/GetPDF?type=artical&&fileName=2b4509e6-dead-489a-9caf-5e9f9f892086.pdf>

Chapter 3

Interview on Guoco Tower
<https://go.gov.sg/sgurbandesignguidebook-connected-tanjongpagar>



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