The Role of Public Transport and TOD in China's Urban Transformation

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China Director, People-Oriented Cities
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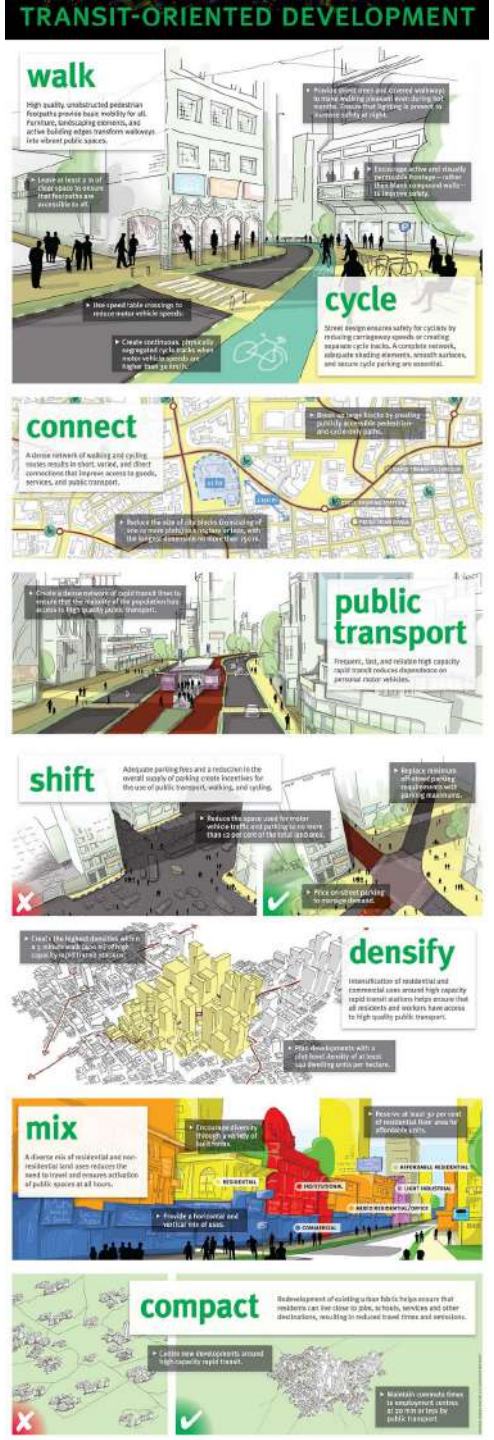
What is TOD?

8 Transit-Oriented Development (TOD) Principles:

1. Walk
2. Cycle
3. Connect
4. Public Transport
5. Shift
6. Densify
7. Mix
8. Compact

The ‘Public Transport’ aspect is considered in case studies of BRT in Guangzhou and Yichang, and the other TOD principles through case studies in Guangzhou. ‘Shift’ is considered in the context of parking policy, with examples from Kuala Lumpur and Johor Bahru.



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BRT Trends in China


Guangzhou BRT


Yichang BRT


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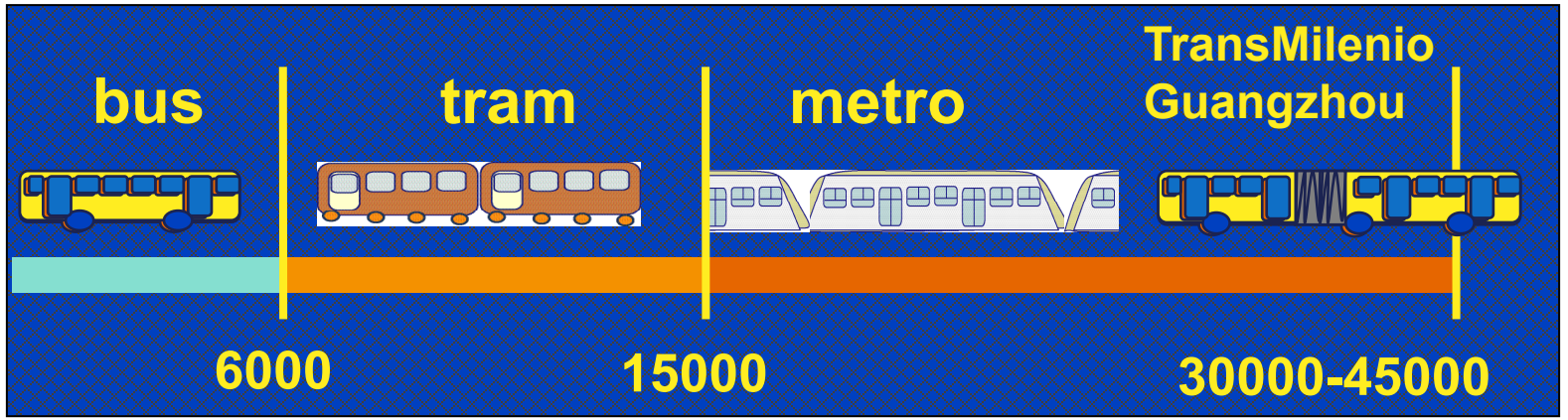
BRT as a Mass Transit Option

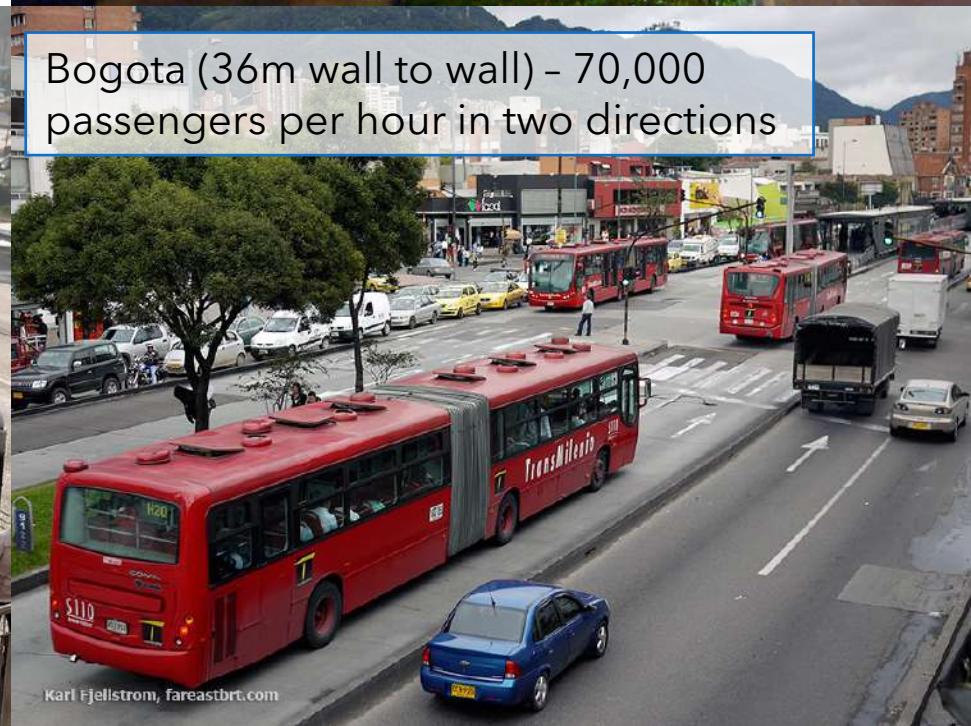


Passengers per hour per direction

Guangzhou BRT ~ 24,000 pphpd

Istanbul BRT ~ 20,000 pphpd

Bogota (36m wall to wall) – 70,000 passengers per hour in two directions



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CHINA
BRT


Embarque 5
SALIDA


CUIDA TU VIDA
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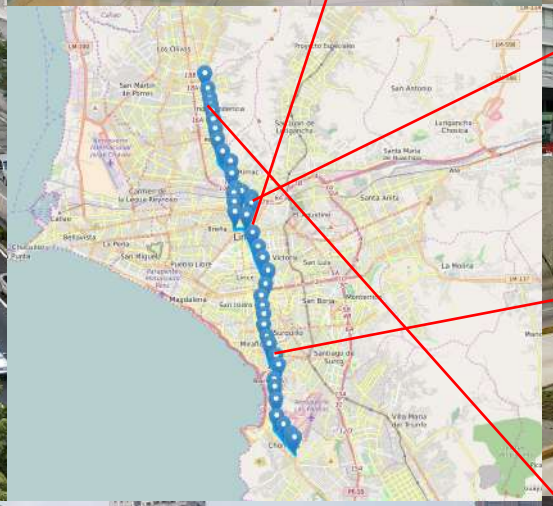


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BRT
BRT


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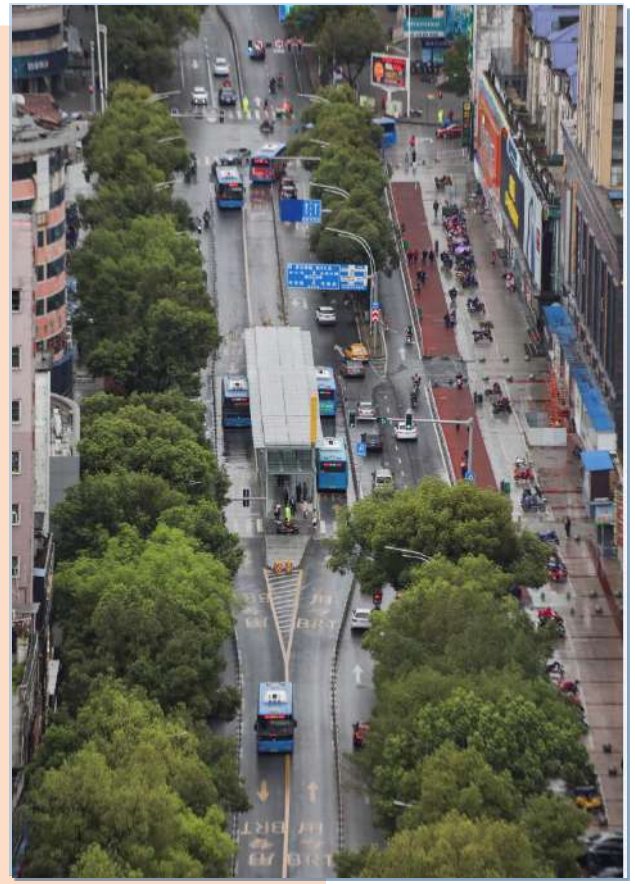
Guangzhou



Fuzhou

China: More than 35 cities implemented some form of Bus Rapid Transit (BRT) in the last 12 years. BRT provides great opportunities for urban development and multi modal integration, TOD, public space and NMT facilities development.

Six systems implemented with Far East Mobility involvement with GMEDRI

Lanzhou

Yichang

Nanning
Line1

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Chengdu
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Xiamen
SAMSUNG Anycall
Karl Fjellstrom, fareastbrt.com


Wuhan


Shanghai


Chengdu
FAR EAST MOBILITY


Guiyang
BRT
FAR EAST BRT


Xiamen
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Capacity and speed

Full corridor peak hour speed

Istanbul	35 km/hr	Multiple surveys, 6 July 2012
Xiamen	34.6 km/hr	Multiple surveys, 20 Jul 2020 AM peak
Amsterdam	34 km/hr	surveys 2011.6.27
Los Angeles	32 km/hr	27-Jun-13, PM peak, E-W
Guiyang	31.4 km/hr	Multiple AM peak surveys 13 Jul 2020
Chengdu	29.4 km/hr	Multiple surveys, 17 Jul 2020 AM peak
Bangkok	26 km/hr	speed surveys 18-Oct-11 PM peak, only in Sathorn-Rama IX section
Lianyungang	26 km/hr	Multiple surveys, 7-Jul-2020 PM peak
Kuala Lumpur	25.5 km/hr	8 PM peak trips, 2018.12.31
Brisbane	25 km/hr	Speed surveys PM peak 3-Aug-15 between city & Greenslopes
Lima	25 km/hr	Surveys on 24-25-Jun-11. Speeds ranged from 15-35km/hr
Nagoya	25 km/hr	Surveys 7-Oct-2013; elevated guideway section only
Dar es Salaam	24 km/hr	surveys 27 Mar 2017, AM peak
Bogota	16-30 km/hr	Speed varies by corridor & express / skipped stations
Nanning	22.6 km/hr	B1 16.8 km/hr (16 Jul 2020 PM peak); B2 26.6 km/hr (13 Jul 2020 AM peak)
Zhongshan	22 km/hr	7 trips on 12-Nov-2019 and 14 Nov-2019
Jakarta	20-23 km/hr	Average of 13 corridors, Apr 2020 [Transjakarta]
Wenzhou	20 km/hr	Multiple surveys, 15 Jul 2020 AM peak
Beijing	19.7 km/hr	Multiple surveys, 21 Jul 2020 AM peak, B1 21.8km/hr, B2 17.6 km/hr
Nantes	19 km/hr	AM peak surveys 24-Jun-10, south-north. Off-peak speed around 22km/hr
Fuzhou	18.7 km/hr	Multiple surveys, 15 Jul 2020 AM peak
Yichang	18.4 km/hr	Multiple surveys, PM peak, 20 Jul 2020
Yinchuan	18.2 km/hr	Multiple surveys, 14 Jul 2020 PM peak
Mexico City	18 km/hr	Jan-2013 avg of full corridor 3. (Center often < 15, outer areas >25, line 4: 12km/hr)
Shanghai	18 km/hr	Multiple surveys, 13 Jul 2020 PM peak
Lanzhou	17.8 km/hr	Multiple surveys, 13 Jul 2020 PM peak
Hangzhou	17.7 km/hr	10 AM peak trips Nov 2019 (6 22-11, 2 26-11, 2 28-11)
Zhengzhou	17.4 km/hr	Average of multiple AM & PM peak surveys, 2-Sep-2019
Leon	15-19 km/hr	Surveys 14-15 Jun 2013. Slower in mixed traffic corridors
Wuhan	16.3 km/hr	Multiple PM peak surveys, 6-Jul-2020
Changzhou	16.2 km/hr	multiple surveys of B1 and B2, 7 Jul 2020, AM and PM peak
Jinan	16.2 km/hr	Multiple surveys of B1, B4, B2, B6, B7, 9-10 Jul 2020, AM and PM peak
Guangzhou	16 km/hr	surveys in AM peak east-west, 15-Jul-2020
Cali	14.5 km/hr	Multiple surveys, 24-Jun-2013, AM peak
Urumqi	17.97 km/hr	2020.8.31, source:World Bank, B6 20.5km/hr, B6b 17.1km/hr, B4 16.3km/hr https://projects.

Peak throughput (passengers / hr / direction)

Bogota	37,700	Nth of Calle 76, S-N, PM peak 21-Jan-13. AM N-S 35,160
Guangzhou	23,500	17-Mar-17, east of Shidajida station, AM peak east-west
Istanbul	18,900	East of Cevizlibağ station, W-E, AM peak, 6-Jul-12
Lima	13,950	South of Uni, N-S, AM peak, 2011.6.24. PM peak 9,700 Uni Stn S-N
Chengdu	13,320	South of Hongpailou Dong, AM peak, N-S, 2019.07.22
Xiamen	11,807	North of Wolong Xiaocheng, N-S, AM peak, 2019.7.25
Cali	11,100	24-Jun-2013, east of San Pascual, PM peak, W-E
Urumqi	9,520	South of Hongshan Stn, N-S, AM peak, 2019.4.1
Dar es Salaam	8,800	West of Jangwani station, W-E, AM peak, 27 Mar 2017
Brisbane	8,750	South of Buranda, north-south, 10-Aug-2017, PM peak
Mexico City	7,550	18-Jan-13 south of Insurgentes Stn, AM peak, N-S
Zhengzhou	6,250	Zhongzhou Ave, Hongzhuanlu, N-S, AM peak, 2 Sep 2019
Lanzhou	6,130	West of Xingfuxiang, E-W, PM peak, 5-Sep-2019
Quito	6,000	In corridor 3. Corridors 1 and 2: 3,500 (October 2008)
Johannesburg	4,510	West of Mavumbi Station 4-Jul-2012 AM Peak [ITDP-Indonesia survey]
Yichang	4,450	South of Gezhouba Stn N-S, AM peak, 2019.6.12
Jakarta	4,080	South of Kuningan Timur Station, AM peak, S-N, 23-Jan-2019
Hangzhou	3,450	13-Oct-2017 AM peak, west of Wulin Guangchang Bei, E-W
Wuhan	3,050	13-Apr-2018, PM peak, E of Sheng Rongjun Yiyuan, E-W
Changzhou	2,980	South of Huaidelu Yanlinglu stn, PM peak S-N, 2015.11.27 [ITDP survey]
Guiyang	2,960	South of Wulichong Stn, S-N, AM peak, 2019.8.30
Yinchuan	2,950	East of Fuzhoujie stn, PM peak, E-W, 2019.9.4
Paris	2,900	East of Choisy Le Roi station, AM peak, 28-Jan-2016
Beijing	2,850	South of Tiantan, N-S, PM peak, 11-Jun-2015. Corr. 2-4 1,100-1,350 Jan 2013 surveys
Pune	2,680	Sangvi-Kiwale corridor Aundh Hospital, Dec-2015, N-S, AM peak [ITDP India data]
Wenzhou	2,600	12-Apr-2018, PM peak, east of Dongminglukou, E-W
Jinan	2,270	East of Lishan Lu station, 21-Nov-2018, west-east, AM peak
Lianyungang	2,260	North of Longhe Guangchang, N-S, PM peak, 2017.10.11
Nanchang	2,250	South of Sandian Xilu Dongkou station, N-S, PM peak, 2018.12.7
Shanghai	2,180	East of Changde Rd station, AM peak, west-east, 8-Nov-2018
Islamabad	2,100	AM peak eastbound, west of Stock Exchange Station, 2015.12.2 [ITDP-Indonesia survey]
Leon	1,950	East of Industrial Station, PM peak, east-west, 2013.6.14
Fuzhou	1,750	North of Zengjiayuan Station, S-N, 2019.4.30, AM peak
Nanning	1,260	W of Minzhu Xinminlukou station, E-W, AM peak, 2019.7.24
Amsterdam	1,250	West of Hoofddorp Station, west-east, AM peak, 1-Aug-2018
Nantes	1,200	South of Cite International des Congress, S-N, AM peak 24-Jun-10
Zhongshan	1,100	West of Nongshangyinhang Dongquzhihang station, E-W, PM peak, 23-Nov-2015
Los Angeles	1,000	27-Jun-13, east of Van Nuys Stn, PM peak, E-W
Bangkok	910	AM peak, south-north south of Arkan Songkroh, 19-Nov-2018
Cape Town	750	Surveys 5-Jul-2012, PM peak [ITDP-Indonesia survey]
Hanoi	520	South of Nhà chờ Nguyễn Tuân, S-N, AM peak, 2017.7.10
Nagoya	500	South of Moriyama Stn, 7-Oct-2013, S-N, PM peak
Kuala Lumpur	400	South of Sunway Lagoon Station, S-N, PM peak, 2018.12.31

BRT vehicles innovations

- 双侧四开门设计，满足BRT站台上客、下客分流进出，上下客速度快，不拥挤。
- 左侧车门宽度、门间距按照抚州BRT站台尺寸无缝对接设计。

8

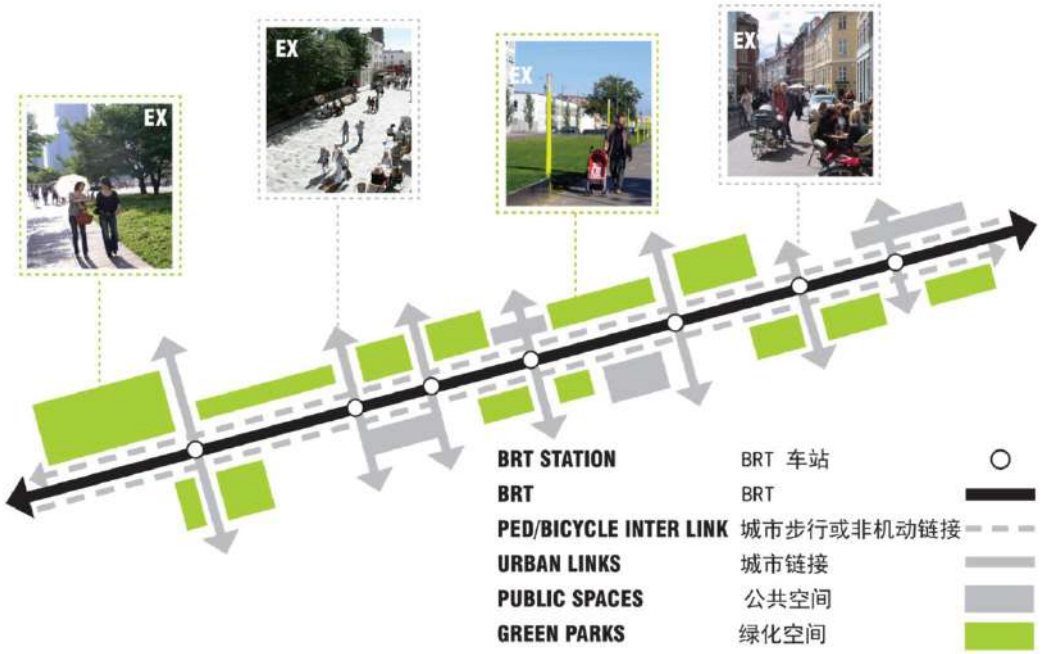
“量身定制”“抚州市双侧四开门BRT

YUTONG

- 宇通客车为抚州公交定制开发的10.5米双侧四开门纯电动BRT，由“原奔驰造型总监-现任宇通造型总监Mathias Lenz”基于国外设计平台，参照“上海滨江路新造型（中运量二期进博会车型）”设计，线条灵动，体现出智能化、科技感、未来感。

2

Mass Transit Station Area Zones



Mass transit station area zoning approaches in Chinese cities.

City	Increase FAR	Encourage mixed-use	Parking reduction	Pedestrian access requirements	Bike facility requirements
National policy					
Hong Kong					
Shanghai					
Shenzhen					
Nanjing					
Wuhan					
Guangzhou					
Beijing					

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BRT as Mass Transit: Guangzhou BRT

Guangzhou BRT

updated: 20 August 2019 Full page map Guangzhou BRT photos

Peak throughput (passengers / hr / direction): **23,500** 17-Mar-17, east of Shidajida station, AM peak east-west

BRT Standard score: SILVER 73. 12 point deductions

Year system commenced: **2010** Opened 10 February

System name: **GBRT**

City centre peak hour speed: **13.1 km/hr** AM peak east-west surveys in August 2019 and July 2020

Number of BRT stations: **26**

Segregated busways or bus-only roadways: Traffic police allow mixed traffic during peak hour

Pre-board fare collection and fare verification:

Performance

Peak throughput (passengers / hr / direction): **23,500** 17-Mar-17, east of Shidajida station, AM peak east-west

Peak buses / hr / direction: **254** Shidajida station, surveys March 2017

Infrastructure

Number of BRT stations: **26**

Stations with functioning passing lanes: **100%** All stations have passing lanes

Most station substops: **4** Tiyu Zhongxin & Shidajida Stations

Lasting, impactful innovations include:

- BRT as mass transit, with 'direct service' operations. (Start with existing routes and make adjustments
- Station configuration to distribute passengers
- Major traffic improvements despite BRT lanes
- Old and new BRT buses; various sizes
- No transfer terminals
- Integration with greenways, parks, and urban renewal projects
- Two-phase intersection benefits

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Kuala Lumpur	400	South of Sunway Lagoon Station, S-N, PM peak, 2018.12.31

Conditions in the BRT corridor before the BRT implementation were poor for all road users.

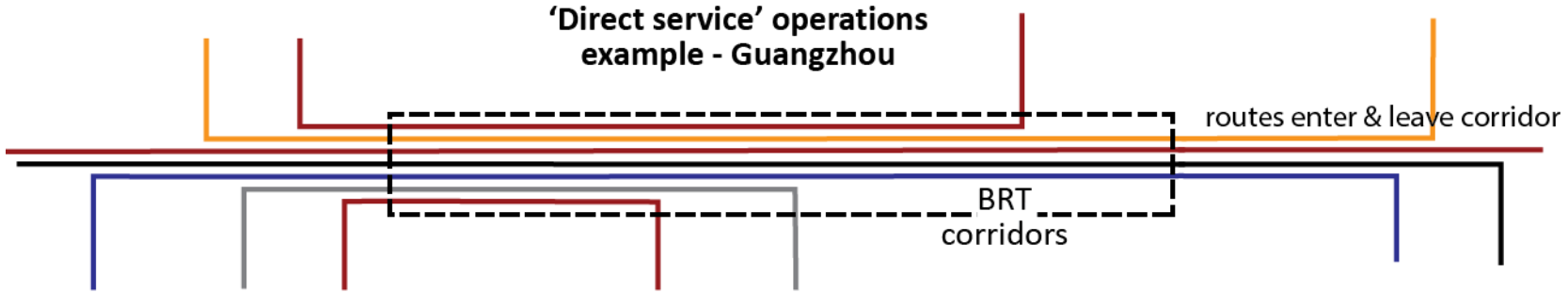
Variety of station configurations, based on:

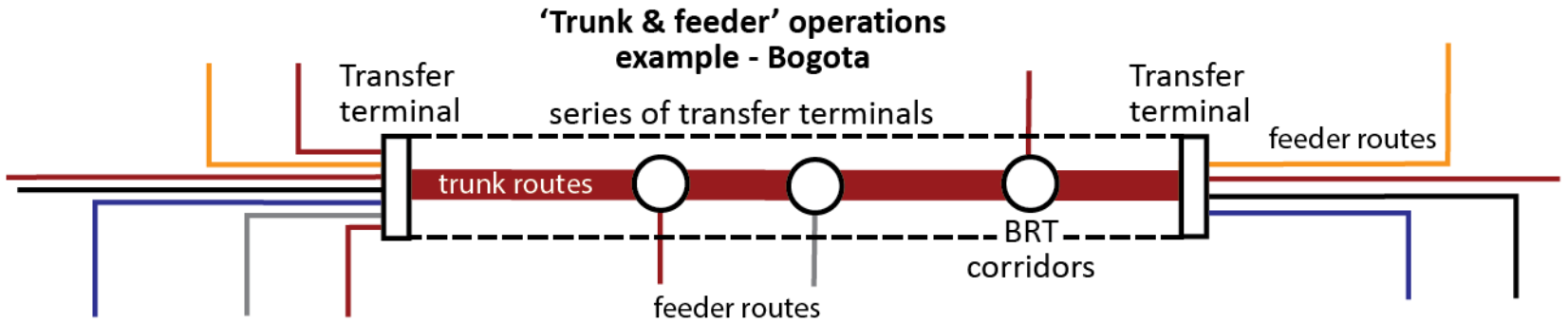
- Road width
- Traffic volumes
- Boarding and alighting demand
- BRT bus frequency

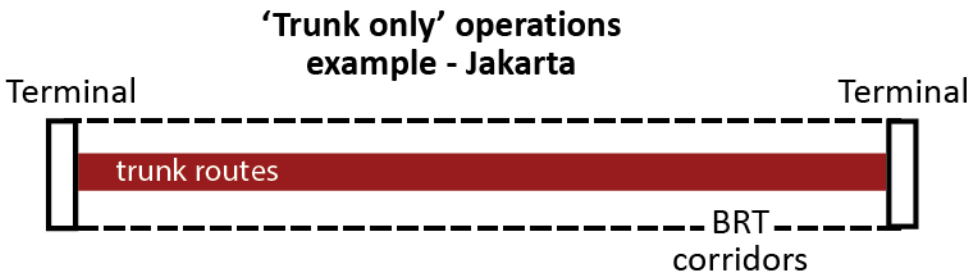
Waiting passengers blocking doorways in Bogota (top) and Lima (below) BRT stations.

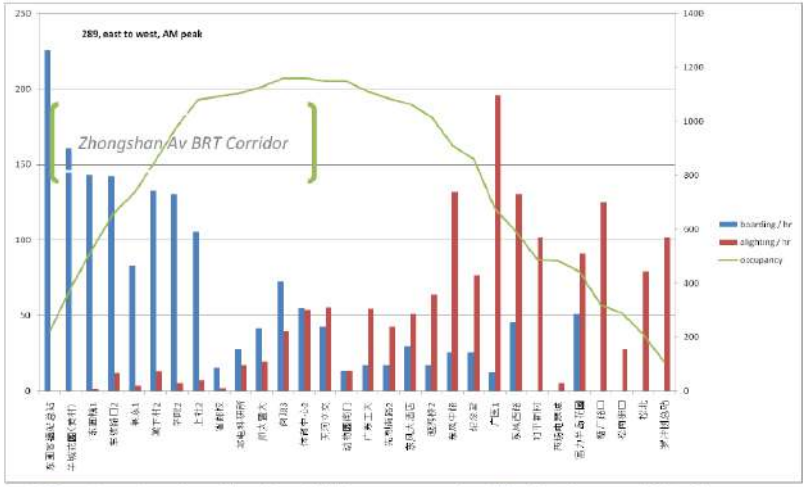
Distribution of waiting passengers in GZ BRT stations

Guangzhou BRT showed that even very high-capacity BRT systems could use a ‘direct service’ operational mode, greatly reducing passenger transfers.



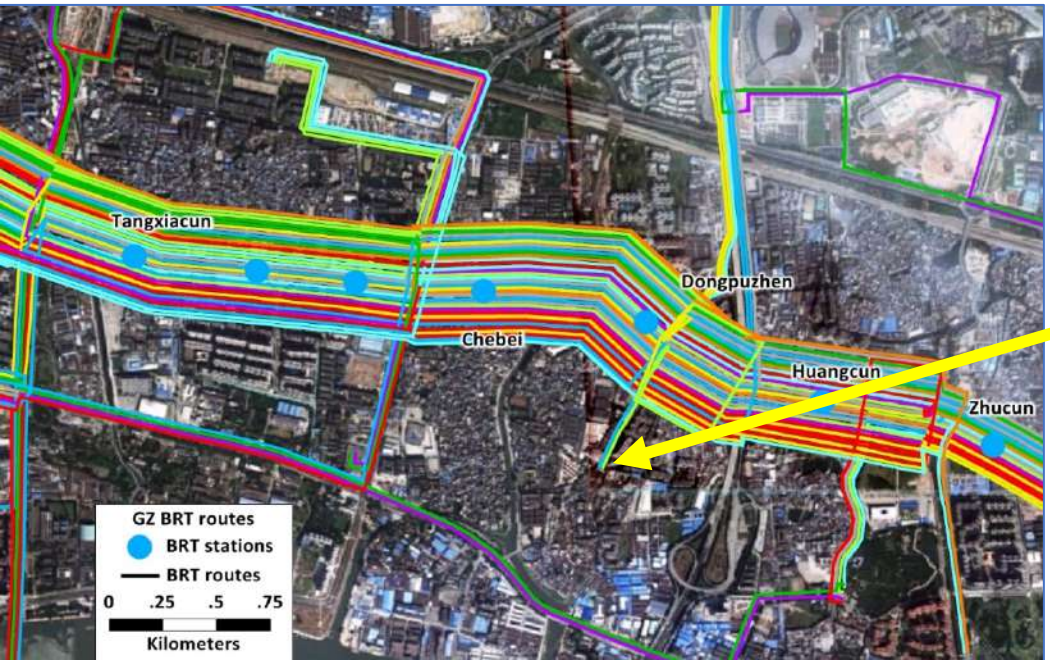


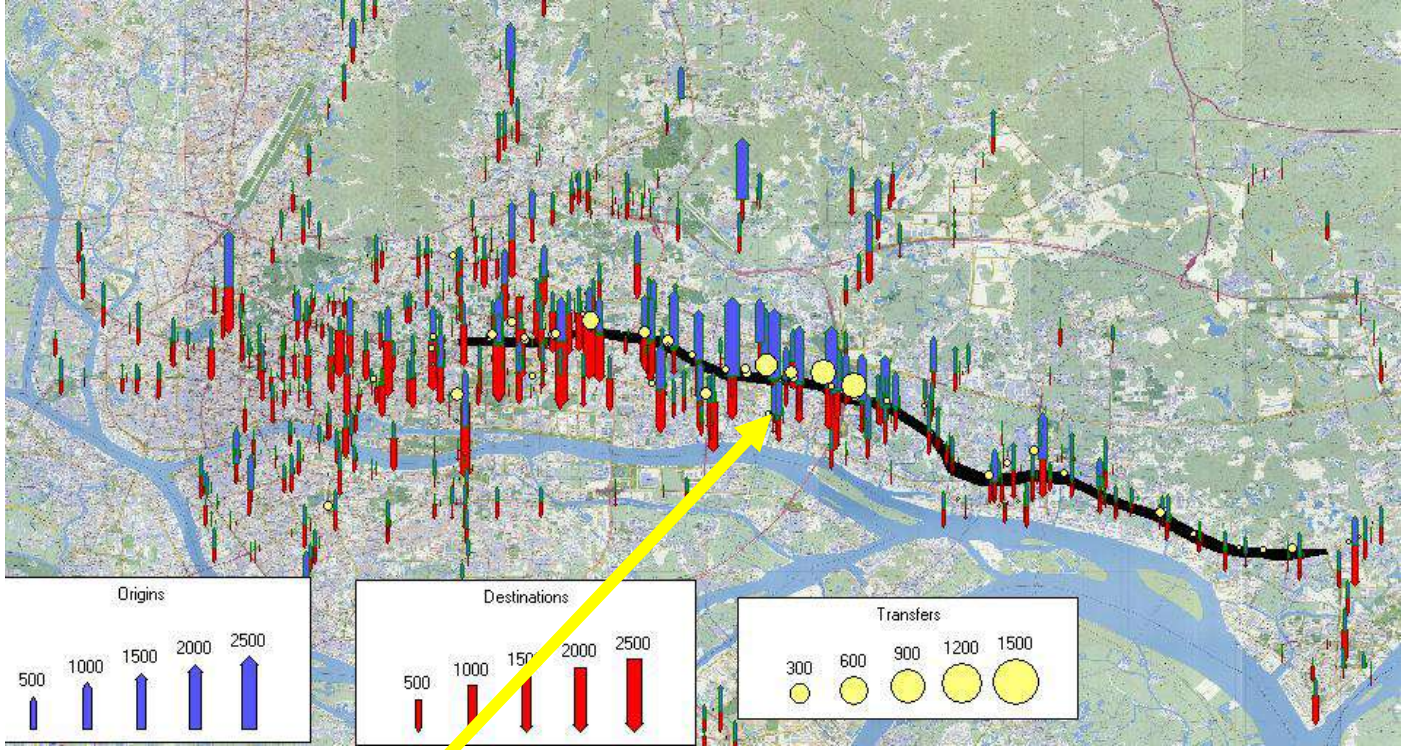


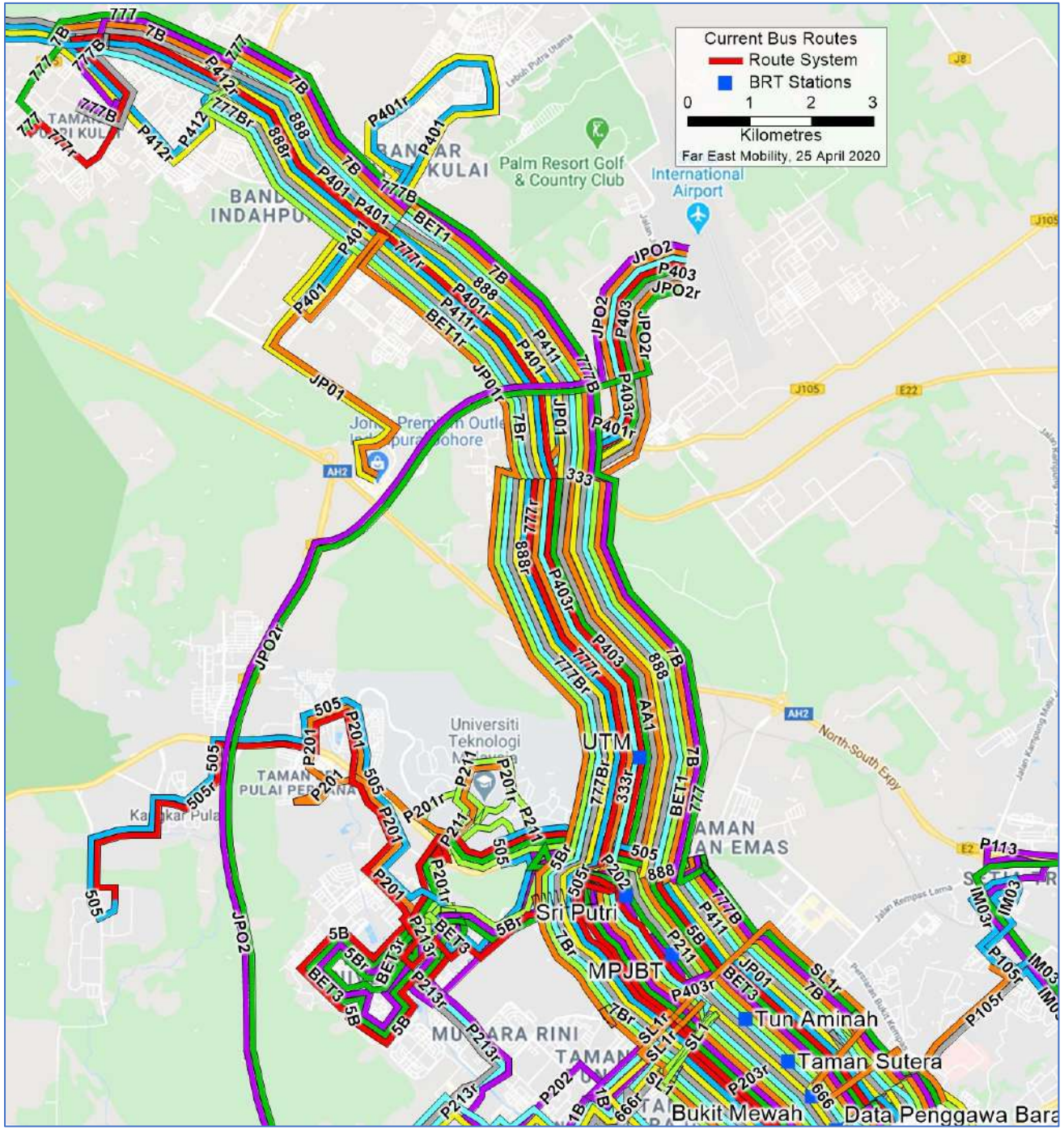


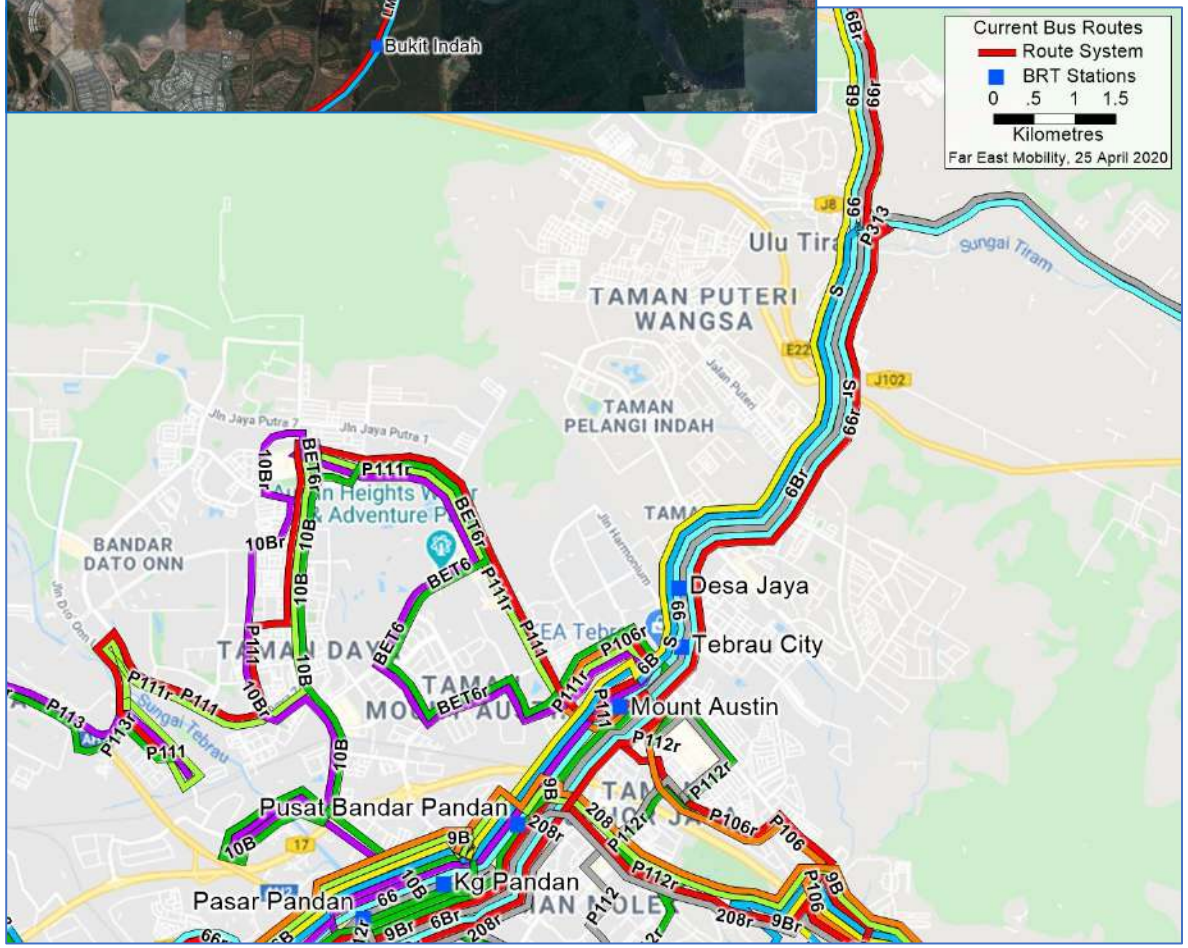
Route 289, east to west, morning peak boarding and alighting passengers per hour (left axis) and occupancy (right axis).

Many routes operate off-corridor only for short segments (1km or less)

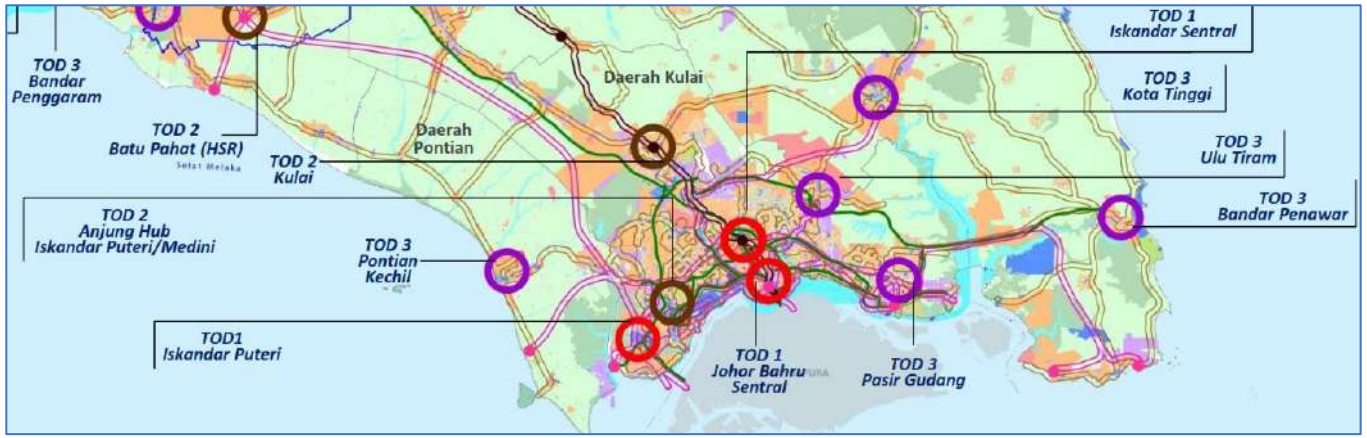


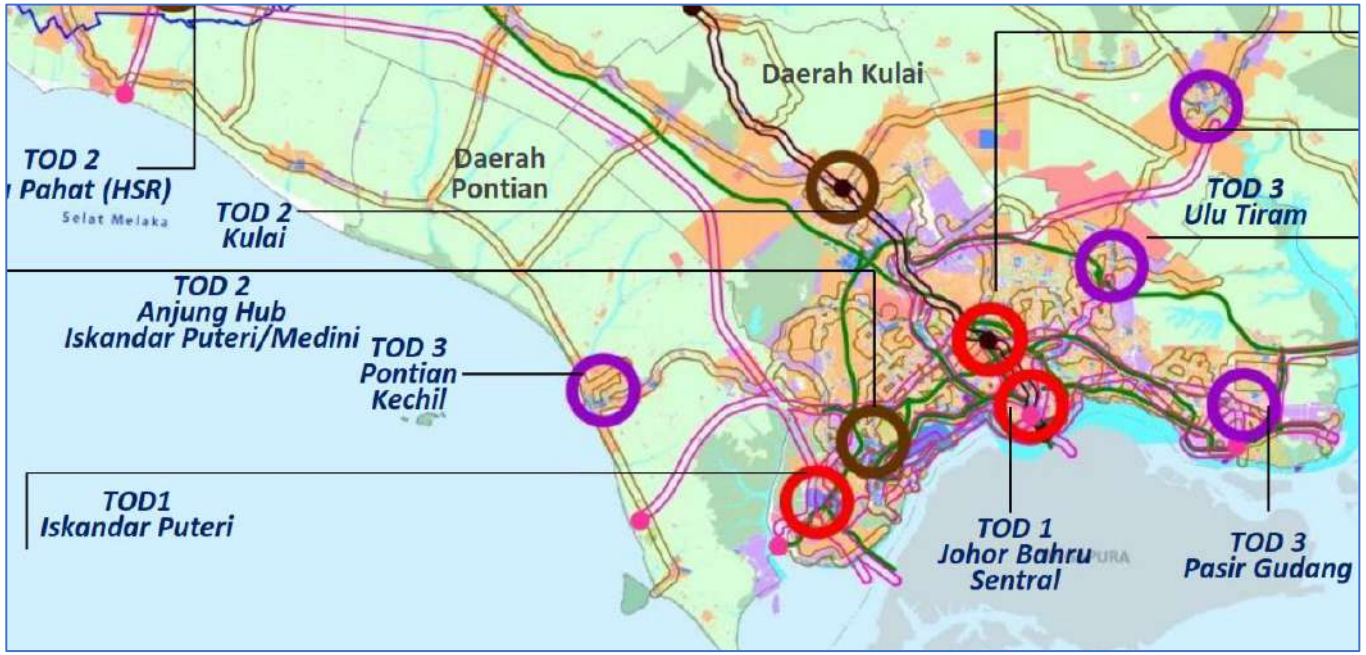




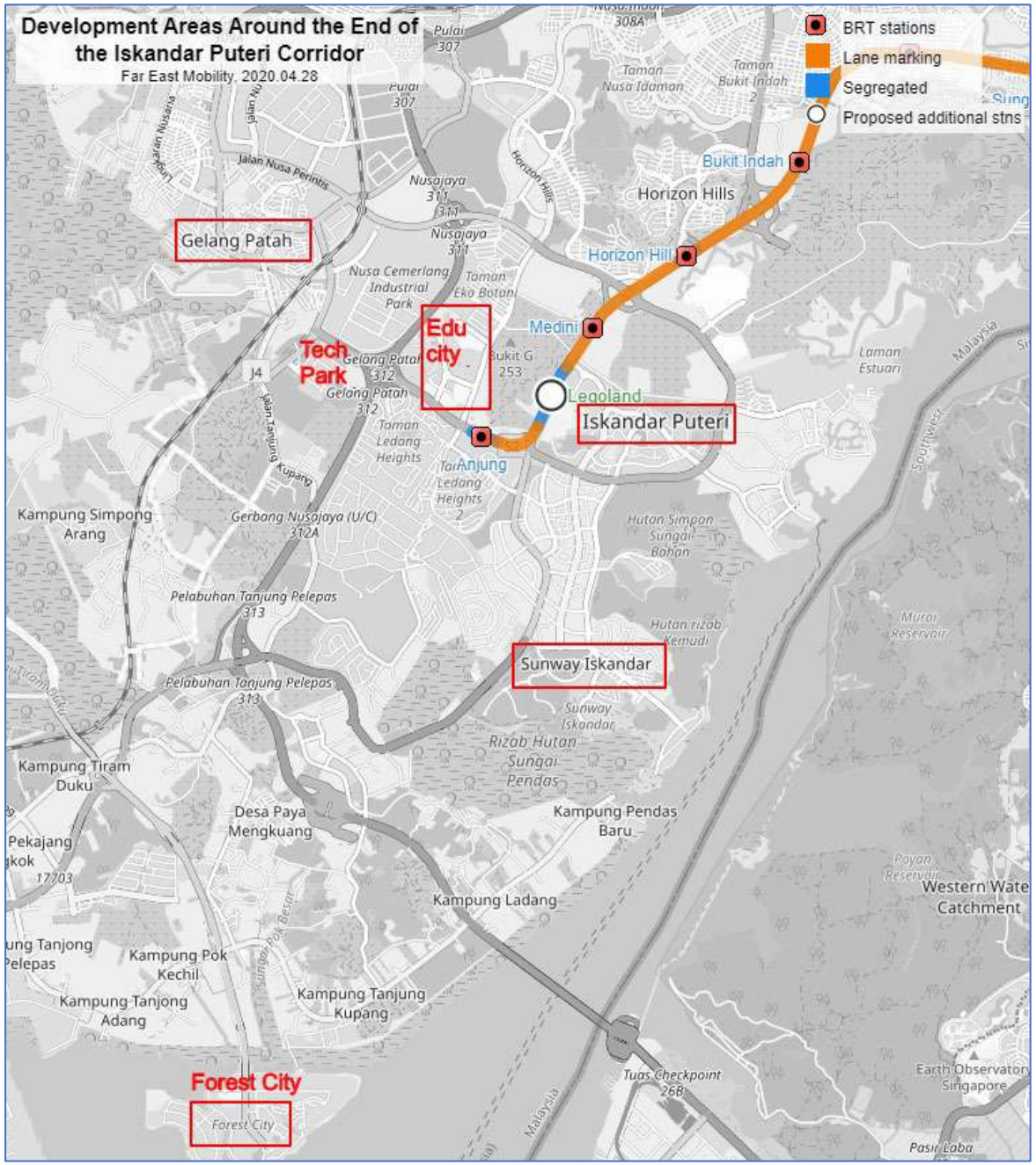


The IMBRT should use a similar operational approach

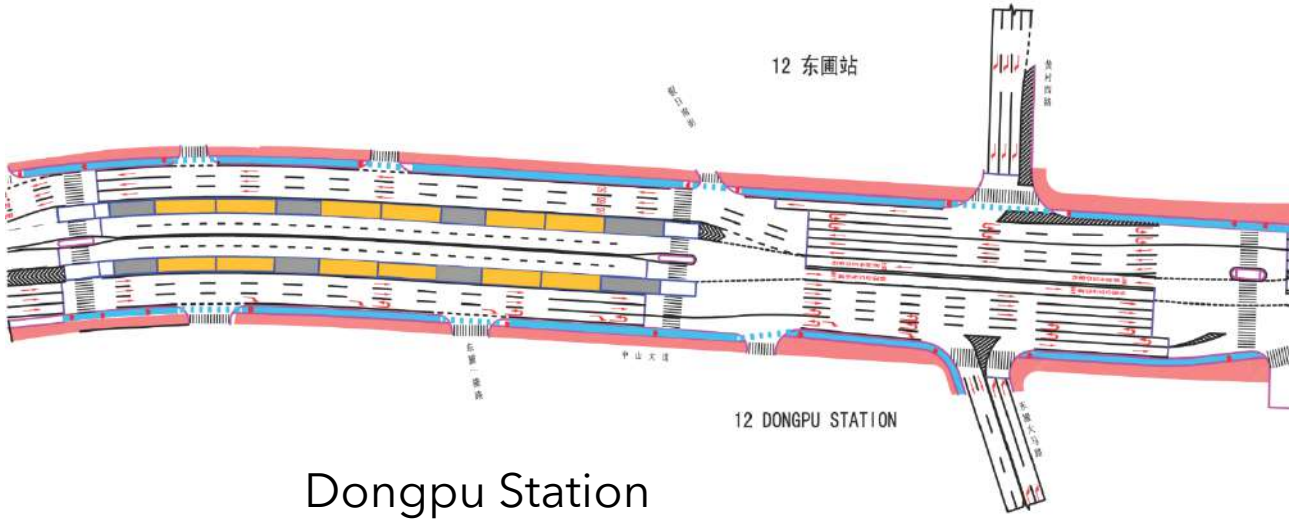




TOD locations, from the Johor Public Transport Master Plan 2015-2045. Note the need to extend beyond the three BRT corridor ending points of Ajung, UTM and Desa Jaya.



Signal phase reduction, and street-level access combined with related u-turns.



Dongpu Station

Chebei intersection &
Tianlang Mingju Station

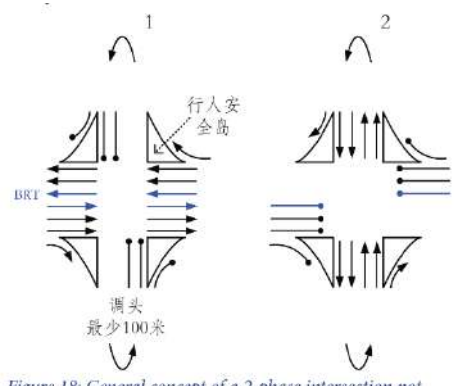


Figure 18: General concept of a 2-phase intersection not allowing left turns at the intersection

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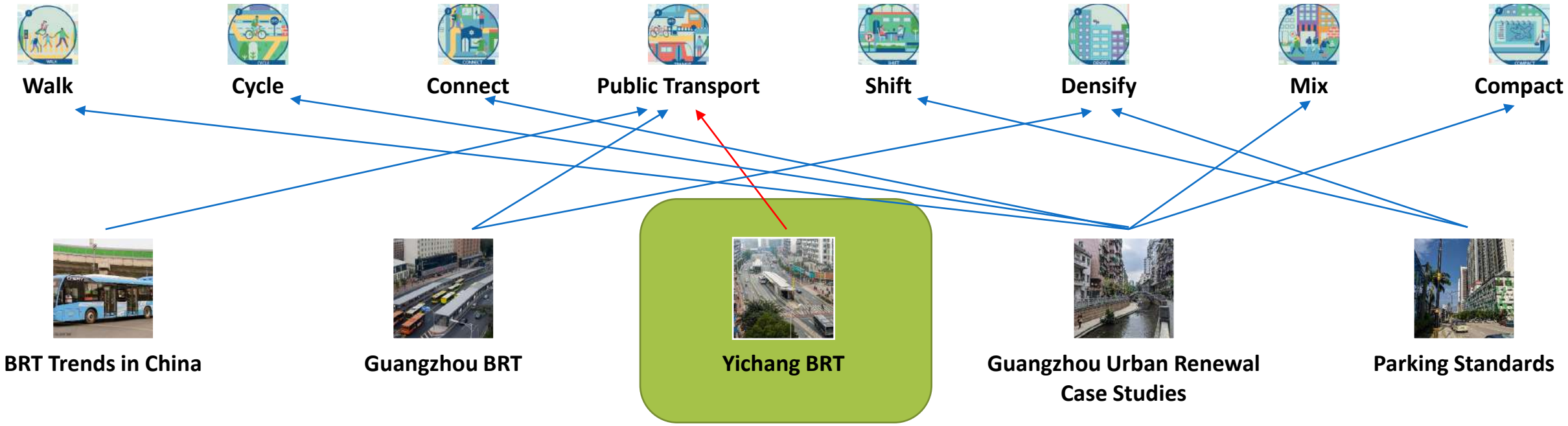

Far East Mobility

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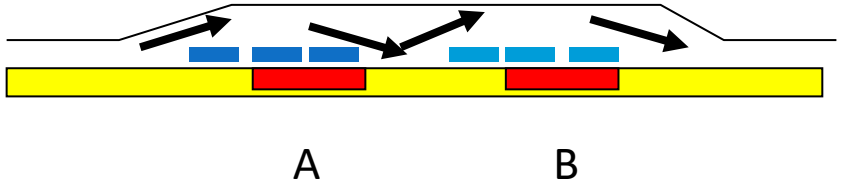
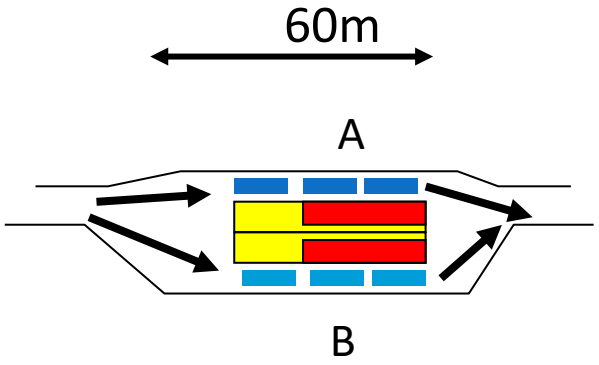
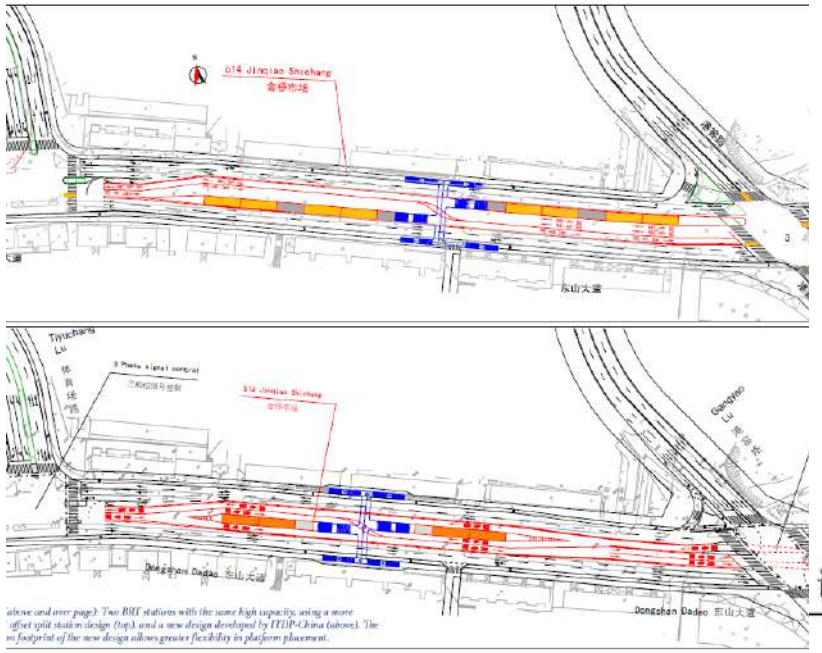
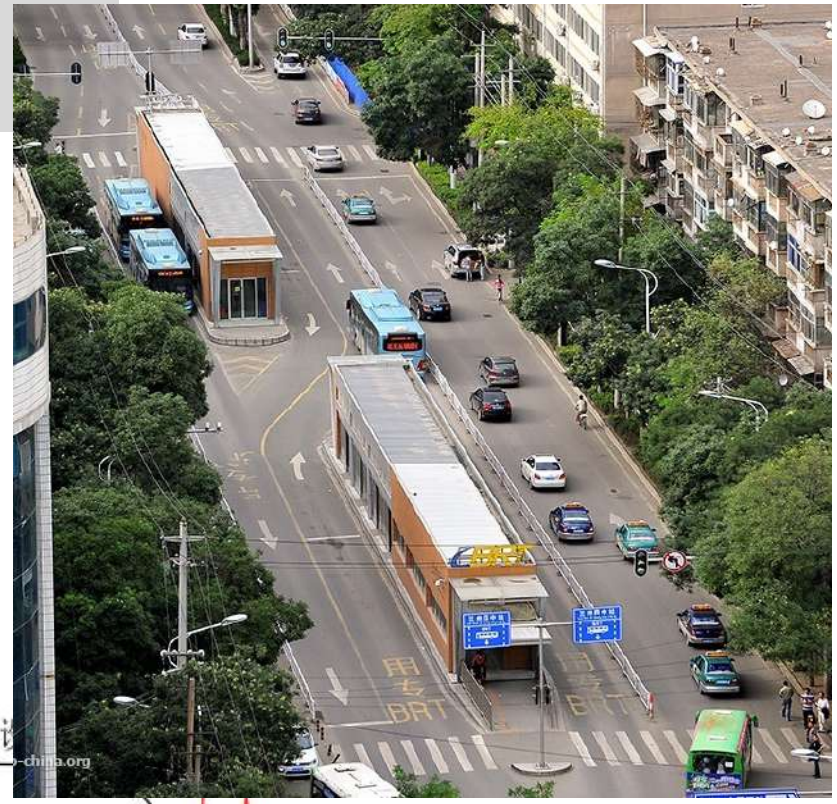
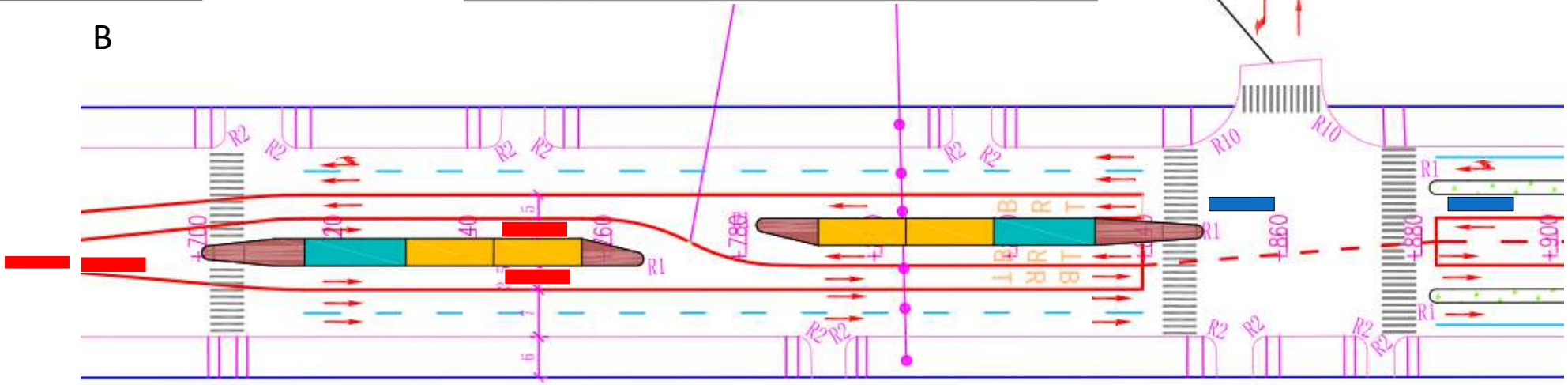
‘Directional’ BRT Stations











Far East Mobility

PEOPLE ORIENTED CITIES

Range of BRT Vehicles & Doors

Far East Mobility

PEOPLE ORIENTED CITIES

High-Capacity BRT Configuration

- Fit within streetscape
- Visibility of arriving services
- Passenger environment
- Space needs at stations

Contents – TOD Principles


Walk


Cycle


Connect


Public Transport


Shift


Densify


Mix


Compact


BRT Trends in China


Guangzhou BRT


Yichang BRT


Guangzhou Urban Renewal Case Studies


Parking Standards

Far East Mobility

PEOPLE ORIENTED CITIES

Guangzhou Good Practice Case Studies: BRT and TOD

Urban renewal

Greenways & waterways

BRT

Vehicle vs Pedestrian Networks

Figure 47: Pedestrian & bicycle (left) and motor vehicle (right) networks in Junjing Huayuan.

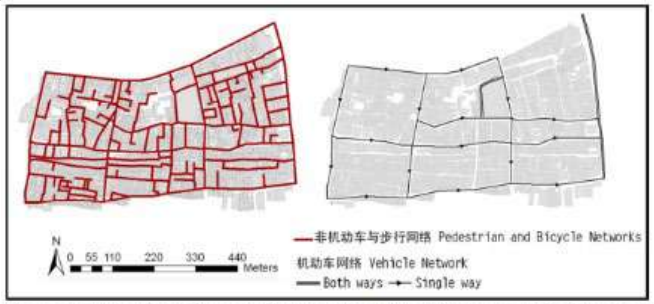


Figure 34: Pedestrian & bicycle (left) and motor vehicle (right) networks in Shangxiajiu

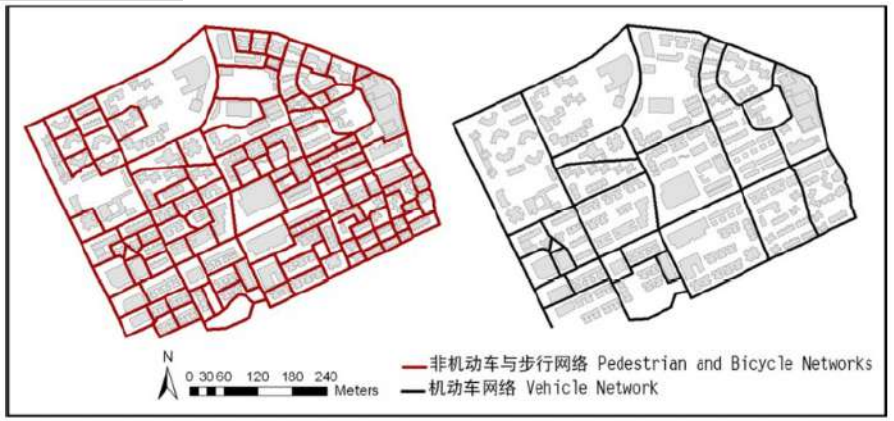
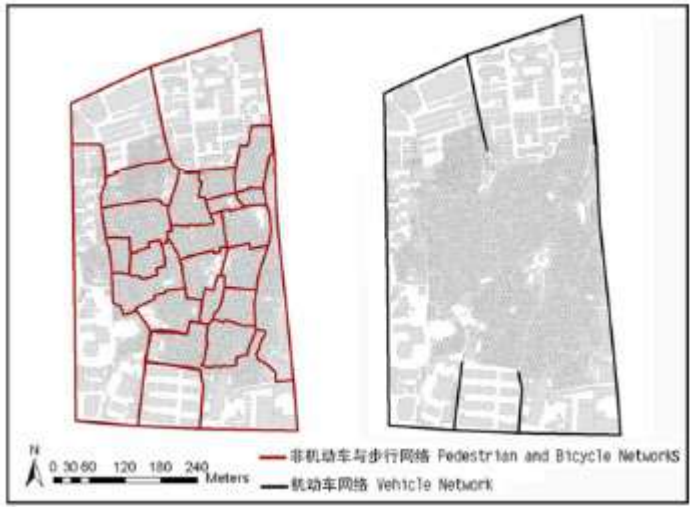
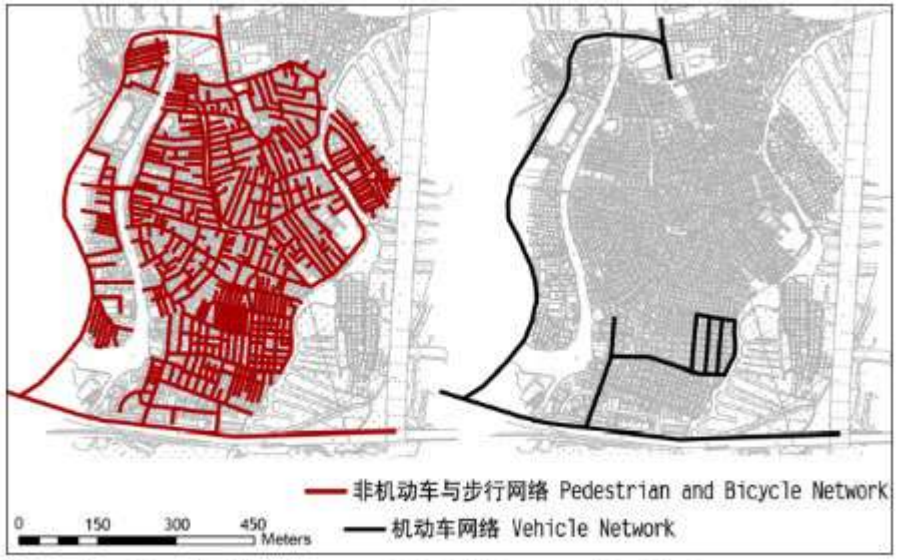


Figure 5: Pedestrian & bicycle (left) and vehicle (right) networks in the Jiangnanxi area





Pedestrian & bicycle (left) and motor vehicle (right) networks in Xiaozhou.

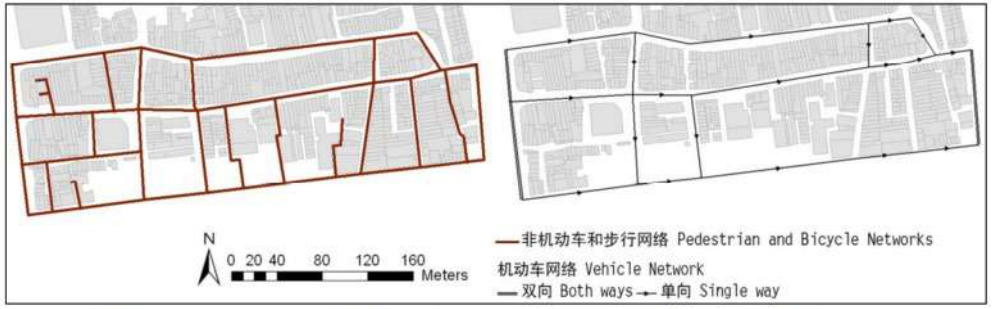


Figure 31: Pedestrian & bicycle (left) and motor vehicle (right) networks in Shisanhang.

Far East Mobility

PEOPLE ORIENTED CITIES

BRT Enabling Car-Free Development: Tangxia Village

BRT corridor at Tangxia & Junjing Huayuan in 2006, before BRT implementation

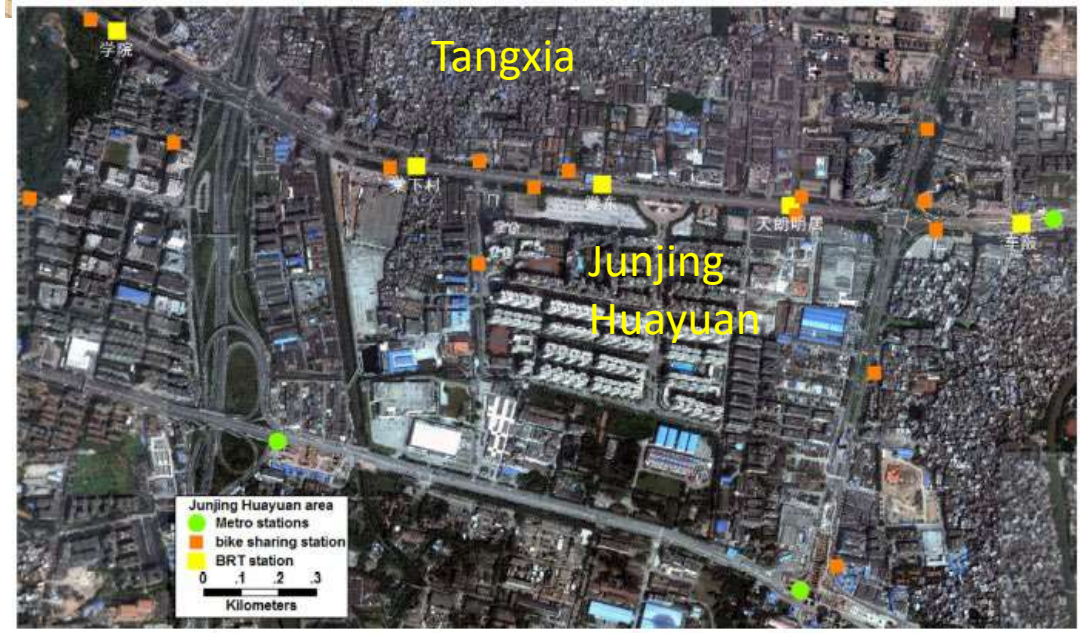


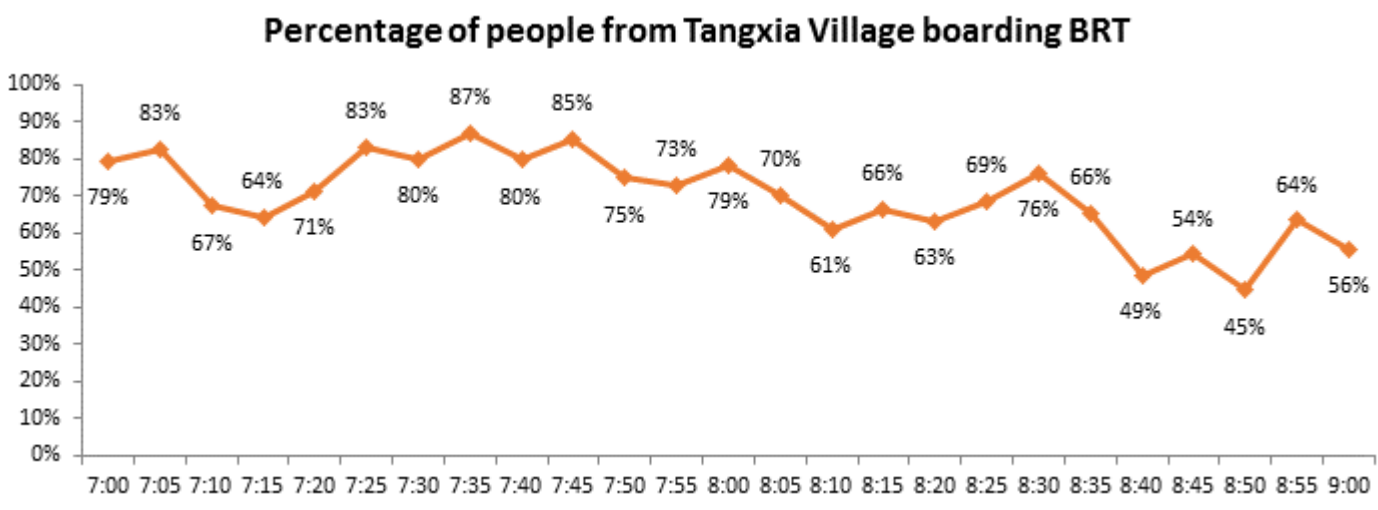
Figure 45: Public transportation infrastructure around Junjing Gardens: BRT stations, metro stations, and bike sharing stations.

Far East Mobility

PEOPLE ORIENTED CITIES

Far East Mobility

PEOPLE ORIENTED CITIES



Revitalizing Guangzhou's Historic Quarters and Waterways: Lizhiwan and Donghao Canals

Historical quarters built long before the automobile age frequently have narrow walkways and roadways and varied buildings that make for lively streets ideal for walking and cycling. Over time, however, if such areas are unable to attract investment to restore the buildings, and if the city does not modernize the infrastructure, the area can deteriorate. In Guangzhou, many of these historical quarters were built along canals that were later paved over and turned into roads.

Lizhiwan Canal

The Lizhiwan Canal was once a classic canal connecting the Pearl River to the imperial Liyuan gardens. Over time, however, as it became a sewage and drainage canal, the Lizhiwan was covered and turned into Xiguanguwan Road.

In the 1990s, Guangzhou began to restore the entire hydrological system in the Liwan District. With construction taking place mainly during 2009-2010, 121 segments of the river and canal system began restoration, including the Lizhiwan canal. Sewers were connected to new sewer pipes, the canal was dredged and decontaminated, the walls of the canal rebuilt, the land along the canal cleared, adding new walkways and period landscaping. The waterway was then connected to the Liwan Lake to allow the water to circulate. In 2009, the Liwan District created a 58-hectare Lizhiwan cultural and recreational district in the surrounding area, preserving and restoring many of the historical buildings.

Many derelict properties were redeveloped as shops and offices. Restaurants in the area saw their revenues triple, rents along the canal doubled in the first year, and rent on the surrounding streets increased by about 50% after the project was completed.

Lizhiwan Canal, before & after












Far East Mobility

PEOPLE ORIENTED CITIES

Donghaochong Canal

As part of the city's greenways project, the Donghaochong canal was also restored. Of the 3 ancient canals that brought water from the Baiyun Mountains to Guangzhou since the Song Dynasty, only the Donghaochong was never buried.

Until recently, it was a polluted ditch running mostly under an elevated expressway and uncontrolled urban development had encroached on the banks of the canal, spilling sewage sometimes into adjacent residential and commercial properties. Periodically, the buildings were flooded when waters overflowed the banks of the canal. Starting in 2009, over 7 hectares of land along the Donghaochong were cleared and turned into a greenway, with excellent walking and cycling facilities. Over 1000 families had to be resettled and over 48,000 m2 of commercial real estate cleared for this restoration.

The sewers had to be connected to sewer pipes and the entire canal dredged and cleaned. Ten new bridges across the canal were built, 5.4 km of new pedestrian walkways, 1.3 km of new bike paths, and 3.2 km of new road works make up the first phase of development. In the surrounding area over 329,000 m2 of new commercial real estate were developed. The Donghaochong canal museum, housed in two historic villas, opened to provide more information on the place and its history.

Far East Mobility

PEOPLE ORIENTED CITIES

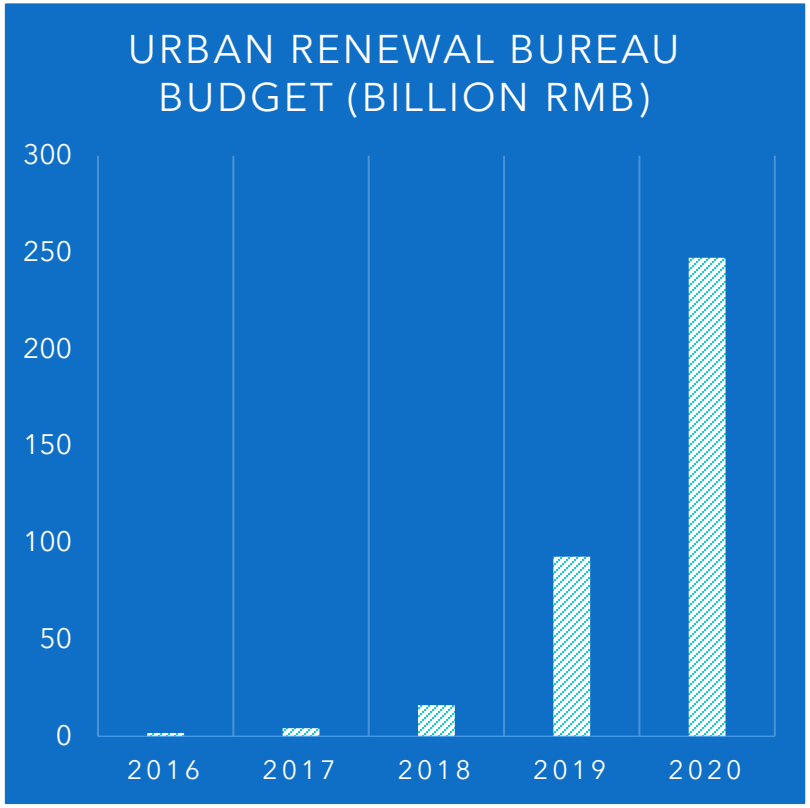
Guangzhou Urban Renewal Bureau

- Established Feb. 2015
- 7 divisions/offices:
  - Administration & Coordination
  - Organization and Personnel
  - Planning and Funding
  - Land Preparation
  - Preliminary Work
  - Project Review
  - Construction Supervision

"In 2020, the nine key annual tasks of urban renewal were successfully completed. A total of 34 square kilometers of land for the nine tasks in the city was activated, 1.7 million square meters of supporting public service facilities were added, and 2.77 million square meters of green area was added." (From 2020 work report)

http://www.gz.gov.cn/xw/jrgz/content/post_7016197.html

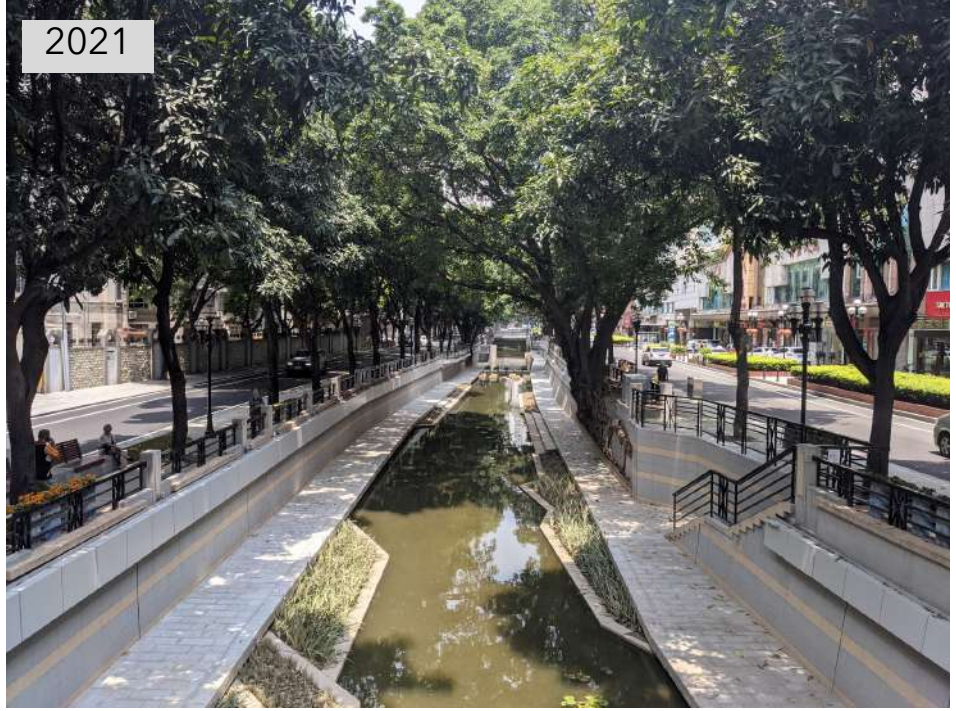
"It is understood that at the beginning of 2019, on the basis of summarizing ten years of practical experience in urban renewal, the municipal party committee and government proposed to take urban renewal as the core starting point, coordinate the nine key tasks of old cities, old villages, and old factories, and explore urban renewal. Integration with urban ecological restoration and urban function repair is transformed into quantifiable, operable, and implementable action goals, and systematically solves the problem of unbalanced and inadequate urban development."

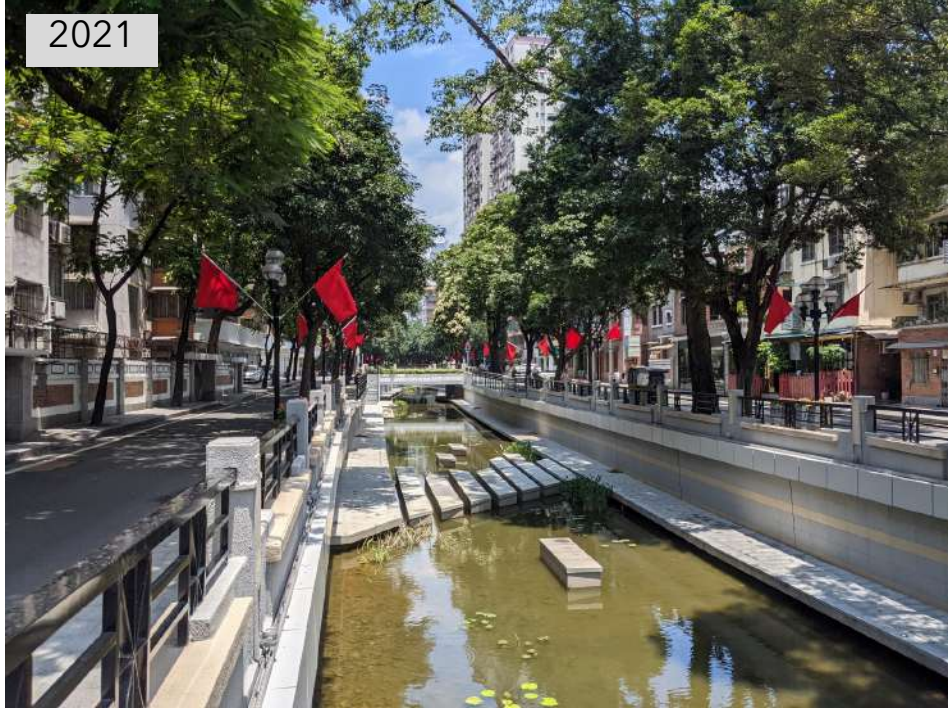


Far East Mobility

PEOPLE ORIENTED CITIES


2010


2021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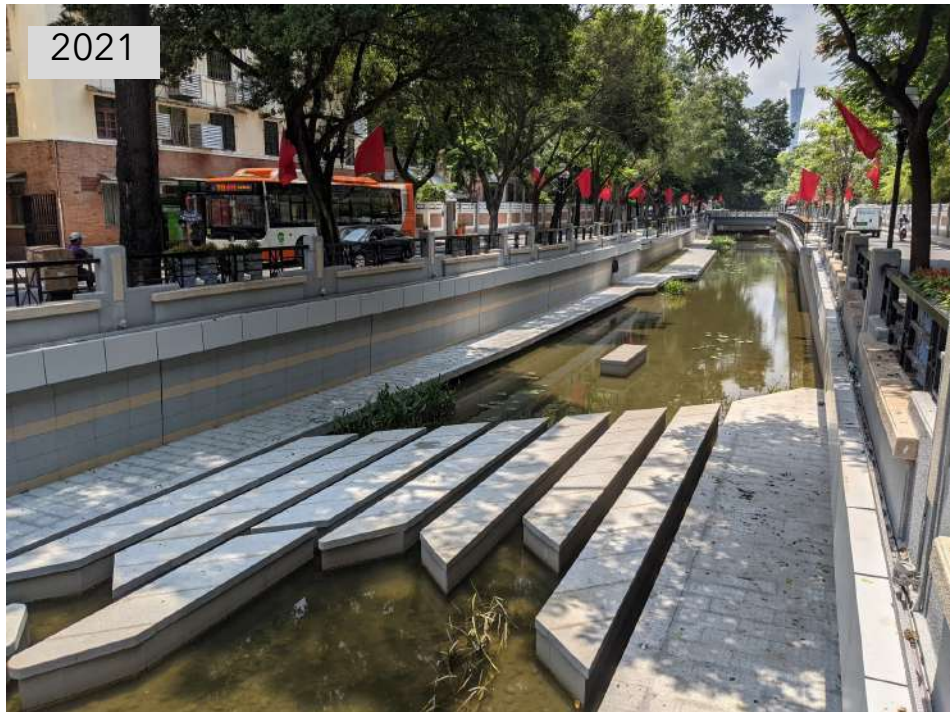
2010


2019


2021


2021


2020


2016


2021

Yongqingfang Phase 1

Main transformation concepts

- Construction and operation mode

Government leading, enterprise undertaking (bid won by developer Vanke in 2015), and paying attention to public participation

- image promotion

1. Keep the original texture of the community, and repair blocks partially
2. Update and repair the facade of the building to reproduce the architectural features of Lingnan
3. Reuse of site waste, including transforming into landscape elements

- Community function improvement

1. Increase the public activity space
2. Update the business format, attracting crowds and enhancing the vitality of the community

The scope includes Yongqing St, Yongqing Lane 1, Yongqing Lane 2, Zhibao St. and Zhibao Lane 1, covering an area of about 8000 m2 and renovating buildings of about 7000 m2.

Yongqingfang phase 1 opened in October 2016

Far East Mobility

PEOPLE ORIENTED CITIES

Source: website of Shiliangshe architectural design company

https://www.163.com/dy/article/GDJKN2L405464MDD.html

https://www.163.com/dy/article/GDJKN2L405464MDD.html

The total investment of Yongqingfang is 59.6 million yuan. Yongqingfang phase 2, which his 8 times larger, has a reconstruction cost of around 1.07 billion yuan.

Yongqingfang Phase 2

Protection and utilization planning of historical and cultural block in Enning Road approved by the government in 2018 (http://ghzyj.gz.gov.cn/hdjl/rdhy/content/post_2685709.html)

Construction started in 2018 and was largely completed in December 2020.

The phase 2 is about 10 times larger than the phase 1, which is divided into eight areas.

Main implementation contents

1. Protect the existing traditional streets, respect the traditional space texture and style, and strictly control the building height

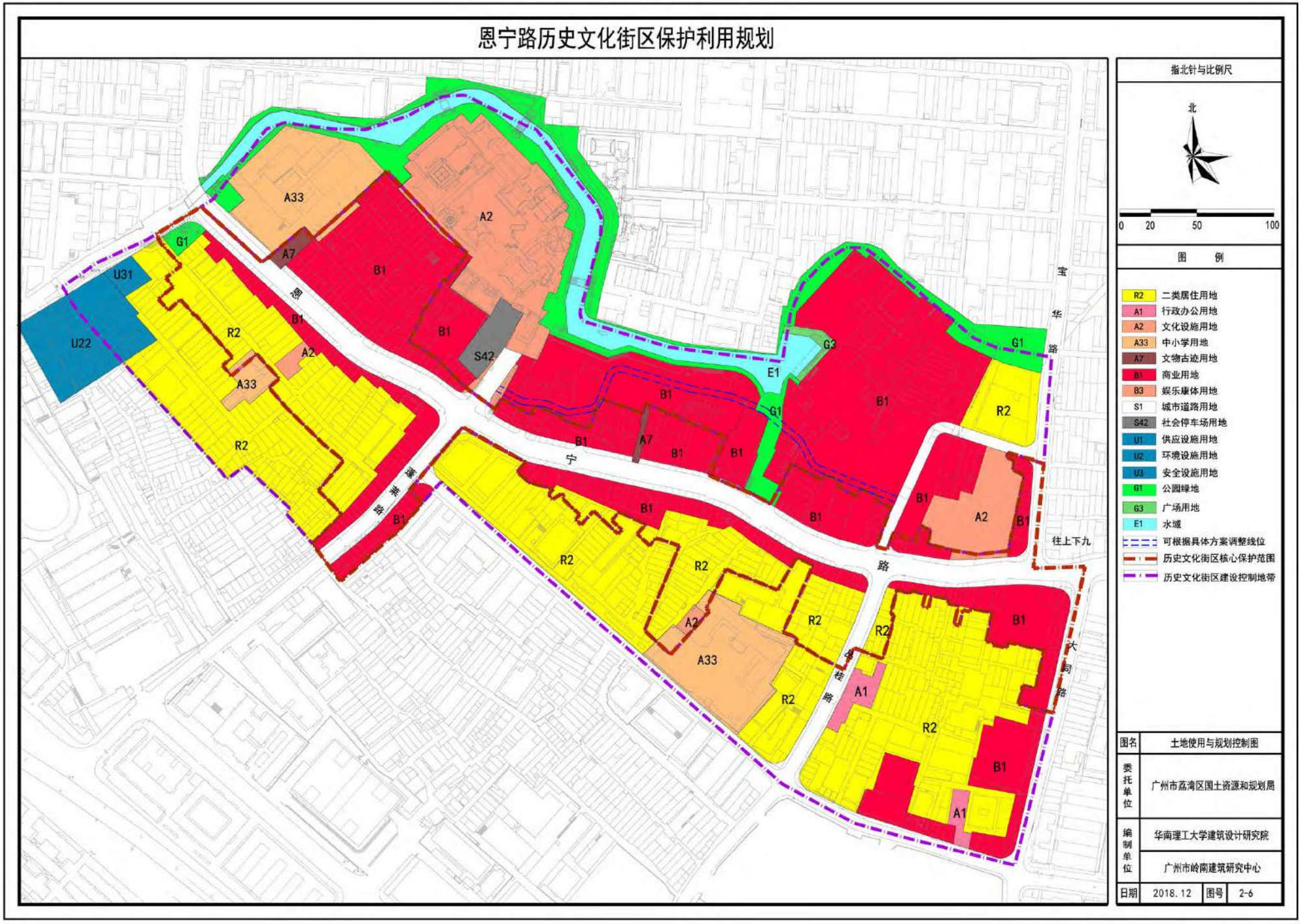
2. The architectural design and treatment methods are divided into protection, renovation and reconstruction, and the external facade, internal space and the fifth facade are proposed to be repaired

3. Improve the quality of public space, including optimizing the public waterfront, improving the quality of street space, and creating a complete street arcade space; Improve the NMT corridor network to form a livable environment.

4. Optimize the service function and vitality, retain and inherit the traditional characteristic business form, encourage the mixed use of multi-function, improve the vitality of the block, and increase the neighborhood center and other community facilities in combination with the building transformation and plot construction, so as to promote the integration of community life and culture, business and tourism.

Far East Mobility

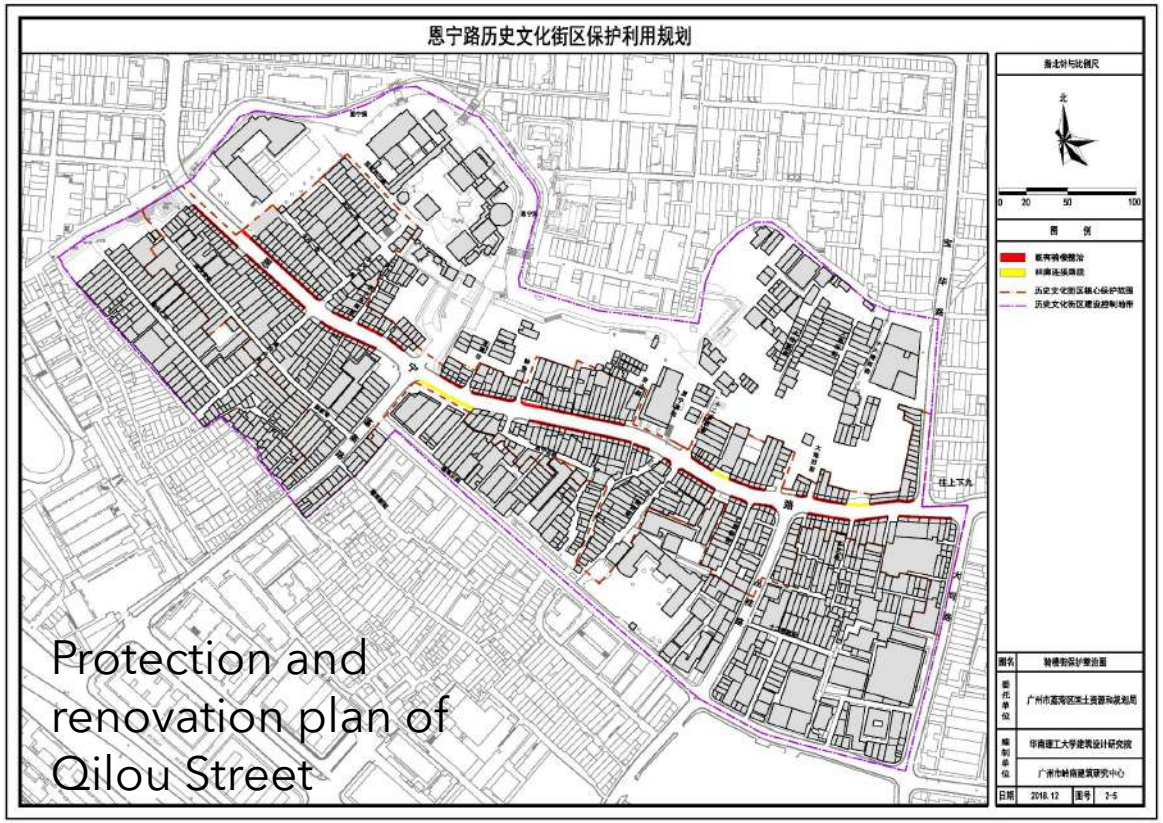
PEOPLE ORIENTED CITIES



Land use map, before and after the Yongqingfang Phase 1 and 2 renewal projects.

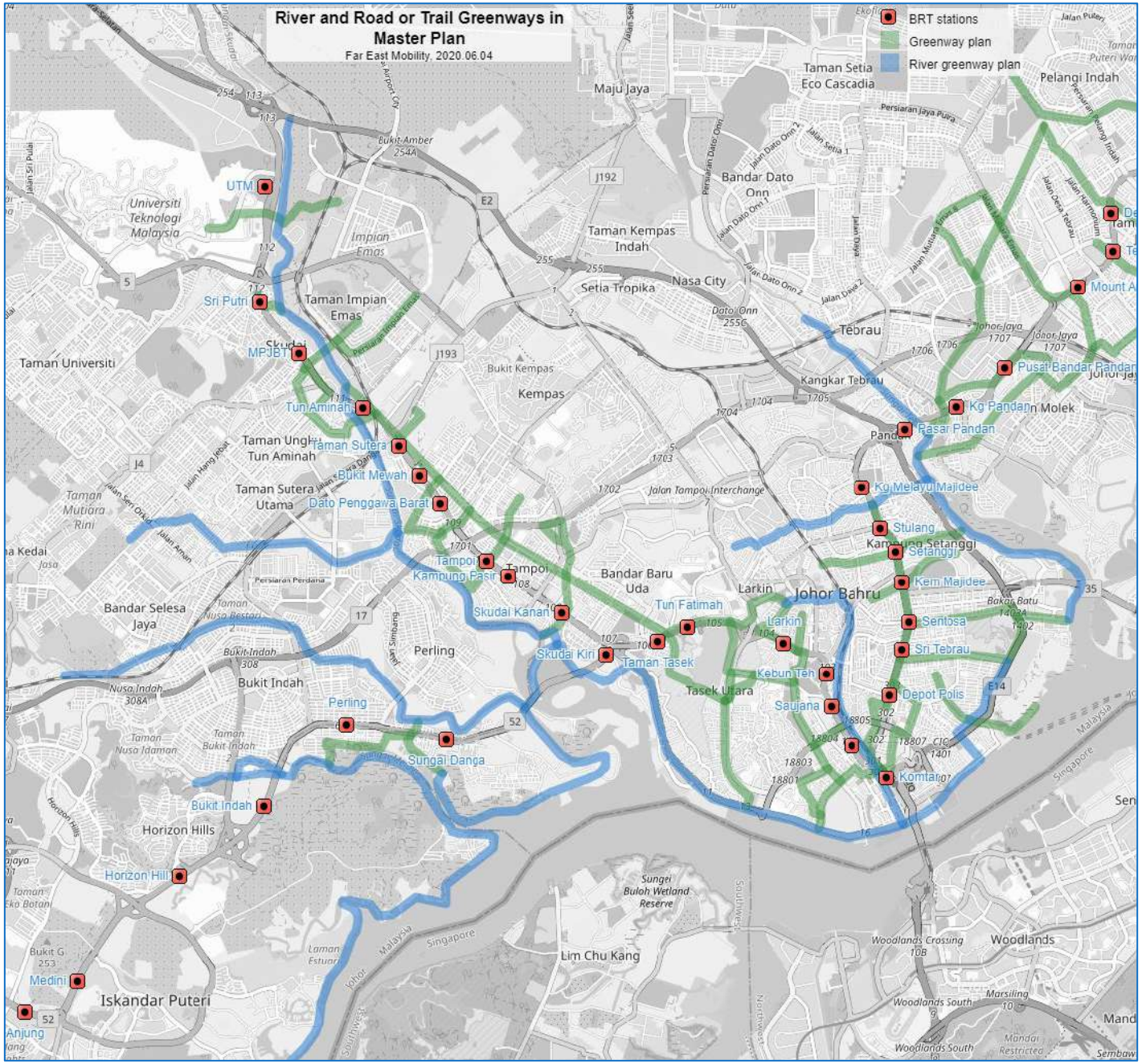
Significant increase in commercial areas (red), including along and around the upgraded waterway.

Plazas and cultural areas are designed in similar dimensions and locations as before.


愚宁路历史文化街区保护利用规划
Protection and
renovation plan of
Qilou Street


广州荔湾发布

Integrating transit with ongoing urban development projects



Liuyun Xiaoqu: from housing estate to mixed use

Especially before the 1990s, workers from the same work unit, or danwei, frequently lived in estates provided by their employer. Today, there remains a large stock of housing in the 'danwei' estates. Liuyun Xiaoqu is an example of how one such housing estate was improved.

When the nearby Tianhe Stadium was built for the National Games in 1987, the Tianhe District Government built Liuyun Xiaoqu to develop the area and provide housing for people that were relocated. The area was gated, severing connections to nearby communities, and the single use zoning meant that residents had to walk considerable distances to reach the nearest shops. As it was built before motorization took off, it had little parking.

Starting in about 2000, the tenants in the buildings gained the title to their apartments. The owners of the ground floor apartments in 2003 realized they could make a living by converting their premises to commercial uses, at first for cafes and later for designer clothes and restaurants, and they succeeded in allowing public pedestrian access to the area; a key measure to support shops. The ground floor conversions occurred in waves, starting nearest Tianhe Plaza and eventually converting nearly all the ground floors to commercial use, turning the area into an open, mixed use neighbourhood.

Parking that had come to occupy some of the small alleys was removed. In the lead up to the 2010 Asia Games, due to proximity to key sporting venues, the municipality improved the utilities and infrastructure, the pedestrian areas and landscaping, and added some pastiche architectural ornamentation. The area has expanded and thrived since the initial improvements in 2003.

Liuyun Xiaoqu (right background), behind Tiyu Zhongxin BRT station

Before & after


Karl Hellstrom, Tareastbrt.com


www.itdp.org.cn

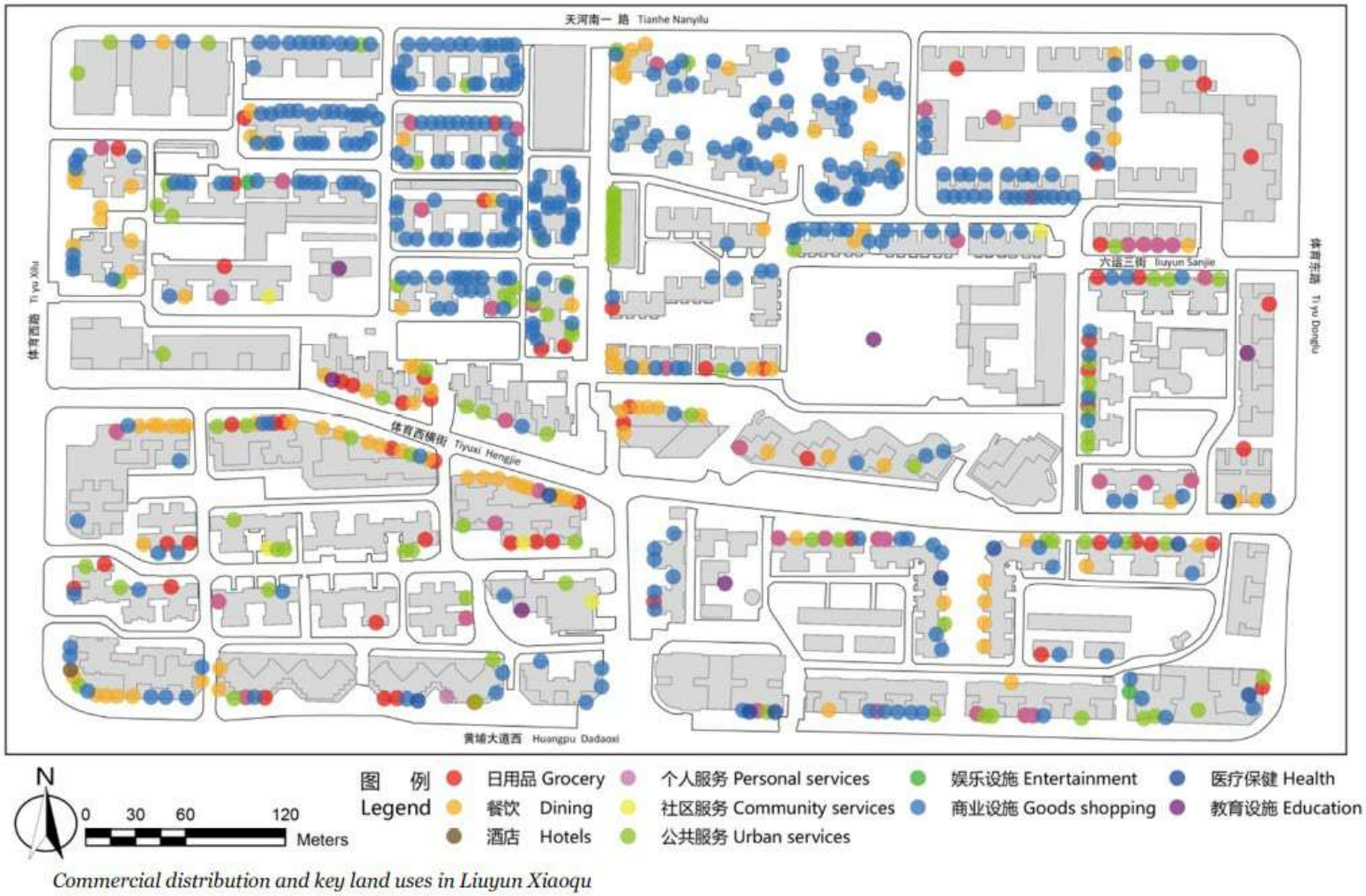

Karl Hellstrom, Tareastbrt.com


COFFEE
COCKTAIL

Key elements to Liuyun Xiaoqu success:

- **Parking removed from central area**, with parking removal gradually increasing
- **Pedestrianization** of the interior
- Landscaping elements focusing on **robust public space** including seating, lighting, paving, plantings, exercise areas
- **Public pedestrian & bicycle access**
- **Mixed use**, with shops and services at the ground level
- **Progressively expanded**, and close to nearby **BRT, bus, and metro**

This model is now being duplicated in many other areas of Guangzhou.



Commercial distribution and key land uses in Liuyun Xiaoqu

Shipaiqiao: Where Guangzhou BRT meets the Guangzhou Metro: TOD

Guangzhou's BRT is one of the first metro integrated BRT systems, and a new wave of BRT systems that combine full BRT station features but also do not require passengers to change buses to reach destinations not directly on the BRT corridor.

The new developments at Shipaiqiao BRT station are commercial, but also surrounded by new high density residential developments. The area is surrounded by a dense network of small walking-oriented streets, and offers a seamless connection between the Metro, BRT, and surrounding properties.

The massive new Taikoo development, which combines retail, hotel, and offices, has only 4% of the built floor area dedicated to parking.

Shipaiqiao before BRT, in 2008

Far East Mobility

PEOPLE ORIENTED CITIES

Major transit hub: Mall – metro – BRT connection

Contents – TOD Principles


Walk


Cycle


Connect


Public Transport


Shift


Densify


Mix


Compact


BRT Trends in China


Guangzhou BRT


Yichang BRT


Guangzhou Urban Renewal Case Studies


Parking Standards

Far East Mobility

PEOPLE ORIENTED CITIES

Push & Pull Measures

Western Europe

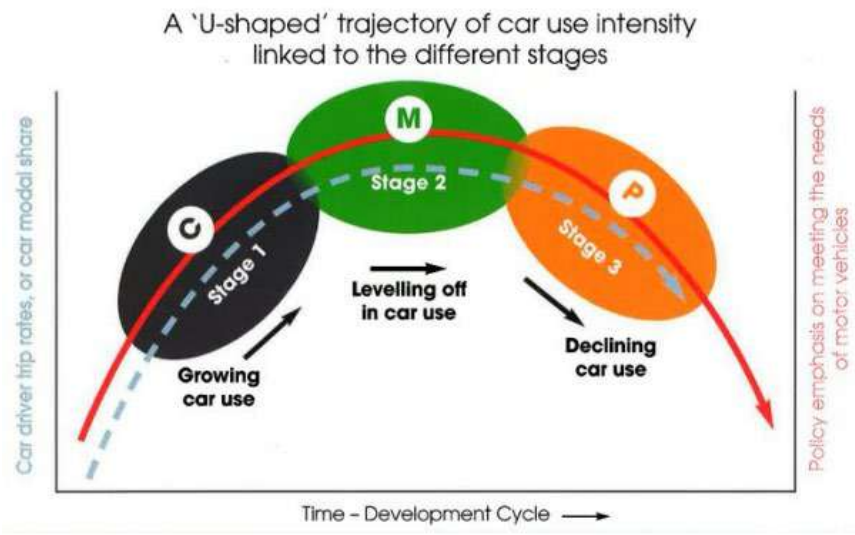


Figure 1: Evolution of city planning policies and impact on car use [1]

Copenhagen

Year	Pull measures	Year	Push measures
1974	First bus lane	1970s	Low Speed policy for cars, car traffic diverted to main streets
1974	Combined PT tickets		
1976-80	Bus prioritisation at signalled intersections		
1983	Bikes permitted on trains	1989	Council agrees to remove parking from Kongens Nytorv square
1998	New S-trains cycling dedicated carriages	1990	Paid parking
1999	Taxis obliged to accept bikes on board		
2000	Harbour ferry buses		
2002	Metro opens	2005	Car free streets network increases
2008	Bike Sharing Scheme	2008	Low Emission Zone
2012	Let's Go car share scheme		
2012	First Cycle Superhighway opened		

Table 2: Key measures implemented in Copenhagen over time

Source: www.globalpetrolprices.com

Source: Congestion Reduction in Europe: Advancing Transport Efficiency, May 2018

London

Between 2000 and 2011, there was an 11% shift in modal share from car to other modes in London, namely public transport, walking and cycling. This is recognised as a very significant achievement. In 2000, 43% of trips were made by car, compared to 32% in 2011. Bus mode share alone during this period increased from 15% to 21% indicating the early investment by the Mayor was very successful in pulling citizens onto this alternative.

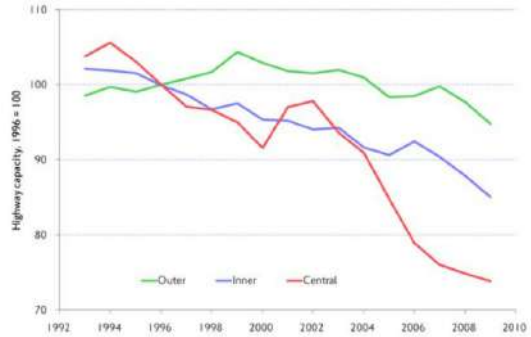
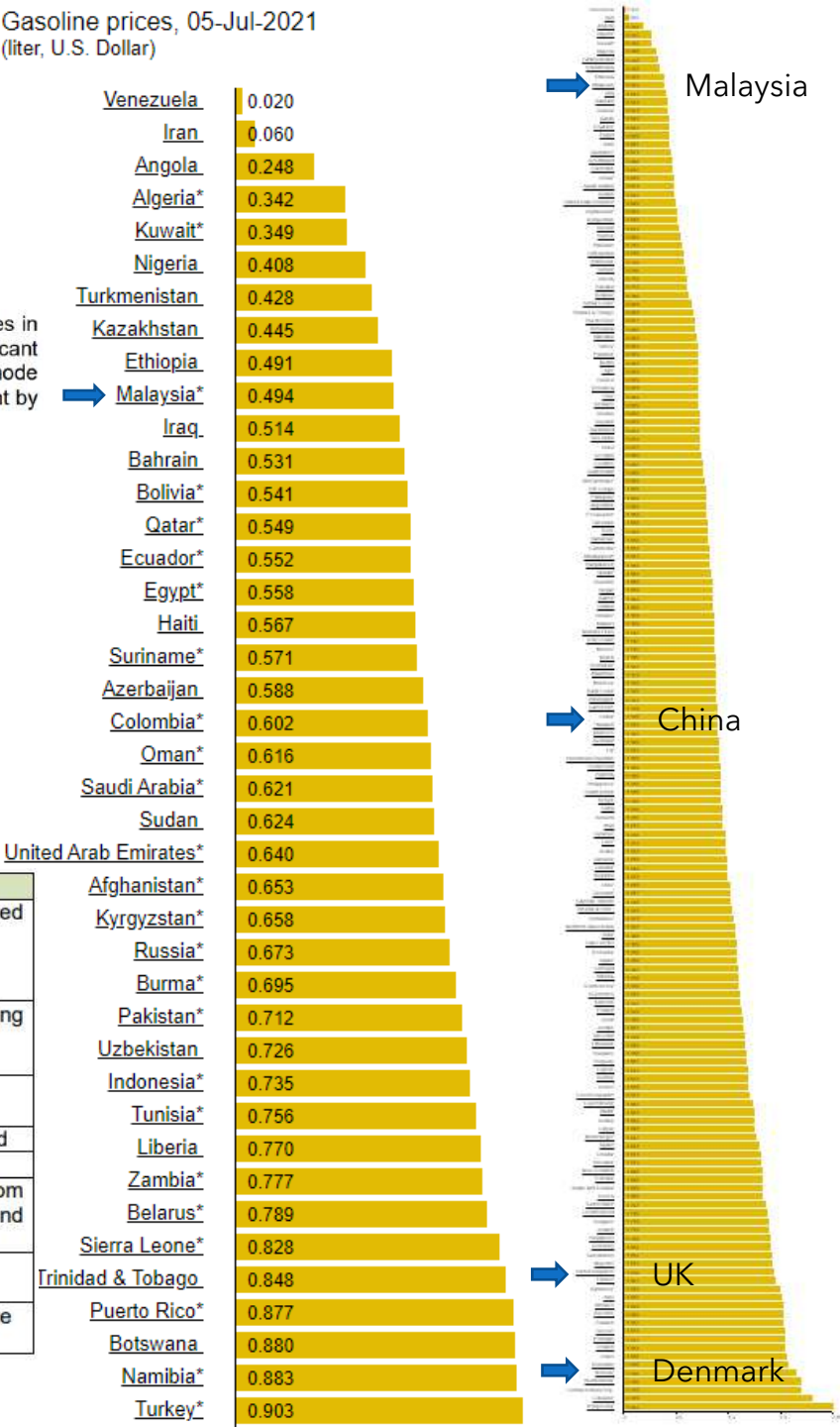


Figure 12: Inferred change in available road network capacity in Greater London

Year	Pull measures	Year	Push measures
1983	Zonal based travel cards for PT	1969	Inner London Parking Area extended and meter charges raised
1998	Trafalgar Square part-pedestrianised		
2000	Croydon Tram Link		
2001	Significant investment in bus network commences, including prioritisation	2001	20 mph zones started being introduced
2003	Oyster Card introduced – smart contactless PT card	2003	Congestion Charge introduced
2006	Legible London programme to improve pedestrian wayfinding	2007	Congestion Charge Zone extended
		2008	Low Emission Zone
2010	First two Cycle Superhighways opened	2010s	Reallocation of road space from private car to PT, walking and cycling.
2011	London Underground upgrade programme commences	2019	Ultra-Low Emission Zone due
2018	Crossrail due to open delivering 10% extra PT capacity for London	2020	Oxford Street pedestrianisation due

Table 3: Key measures implemented in London over time



Singapore minimum parking requirements

https://www.corenet.gov.sg/media/2268535/cop-on-vehicle-parking-provision-in-development-proposals-2019-edition.pdf (2019 edition)

http://www.redas.com/assets/files/information/codes_and_standards/VPCOP2011.pdf (2011 edition)

Use Categories	Minimum Parking Provision Standards (based on unit or gross floor area)
1.0 Residential Flats, non-flats, Service Apartments and home-office	1 car space per 1 residential unit.
2.0 Commercial (a) Offices	Zone 1: 1 car space per 450 sq.m. Zone 2: 1 car space per 250 sq.m. Zone 3: 1 car space per 200 sq.m. All Zones: 1 loading/unloading space per 10,000 sq.m (Up to 50,000 sq.m.)
(b) Shops and departmental store (retail use)	Zone 1: 1 car space per 400 sq.m. Zone 2: 1 car space per 200 sq.m. Zone 3: 1 car space per 150 sq.m. All Zones: 1 loading/unloading space per 4,000 sq.m
(c) Restaurants, nightclub, coffeehouse, bar, cafeteria, eating house and canteen.	For 1st 150 sq.m:- All Zones: 1 car space per 150 sq.m After 1st 150 sq.m:- Zone 1 & 2: 1 car space per 60 sq.m Zone 3: 1 car space per 50 sq.m

Code of Practice on Vehicle Parking Provision in Development Proposals -2011 Edition

APPENDIX A

Table 1: Range-Based Parking Provision Standards

			Lower Bound			Upper Bound		
S/n	Uses	Lot Types	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
1	Residential	Car	1 lot per 2 dwelling units	1 lot per 1.25 dwelling units		1 lot per 1.25 dwelling units	1 lot per dwelling unit	
		M/cycle						
		Bicycle	1 lot per 4 dwelling units		1 lot per 6 dwelling units	No Upper Bound		
		HV						
2	Serviced apartments	Car	1 lot per 4.2 dwelling units		1 lot per 2.6 dwelling units	1 lot per 2.1 dwelling units		
		M/cycle	1 lot per 80 dwelling units		1 lot per 50 dwelling units	1 lot per 40 dwelling units		
		Bicycle	1 lot per 4 dwelling units		1 lot per 6 dwelling units	No Upper Bound		
		HV						
3	Offices	Car	1 lot per 950m²	1 lot per 530m²	1 lot per 260m²	1 lot per 590m²	1 lot per 330m²	1 lot per 210m²
		M/cycle	1 lot per 18,000m²	1 lot per 10,000m²	1 lot per 5,000m²	1 lot for the first 590m² & 1 lot per subsequent 11,250m²	1 lot per 6,250m²	1 lot per 4,000m²
		Bicycle	Refer to Table 2, Category 1		Refer to Table 2, Category 2	No Upper Bound		
		HV	1 loading and unloading bay per 10,000m² up to 50,000m²			No Upper Bound		

Far East Mobility

PEOPLE ORIENTED CITIES

Parking & Mass Transit

1.2 Zonal Standards

Singapore Island is divided into four (4) zones.

Zone 1 comprises of the city (Restricted Zone) and the Marina Bay.

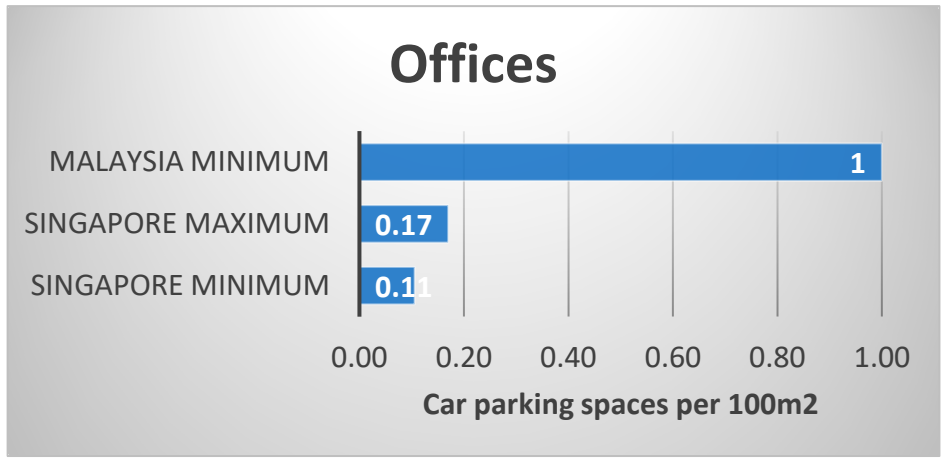
Zone 2 refers to the areas within 400m radius from Rapid Transit System (RTS) stations outside Zone 1.

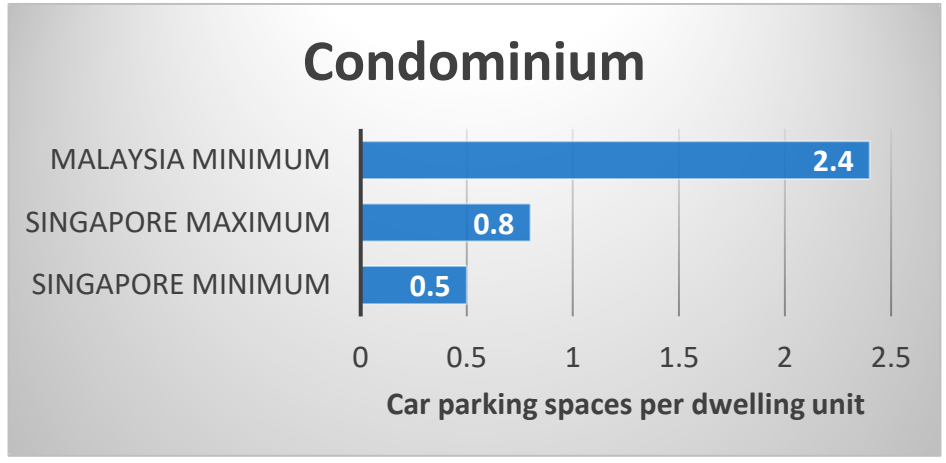
Zone 3 is the rest of the island, excluding Zones 1, 2 & 4.

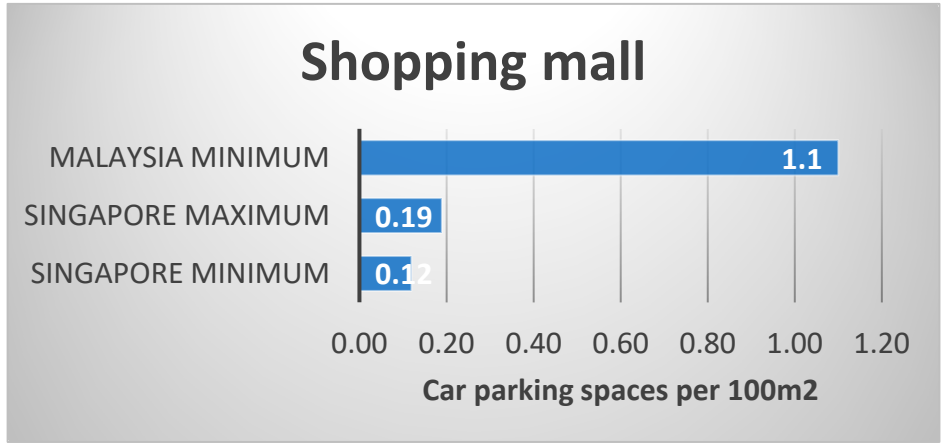
Zone 4 refers to car-lite precincts.

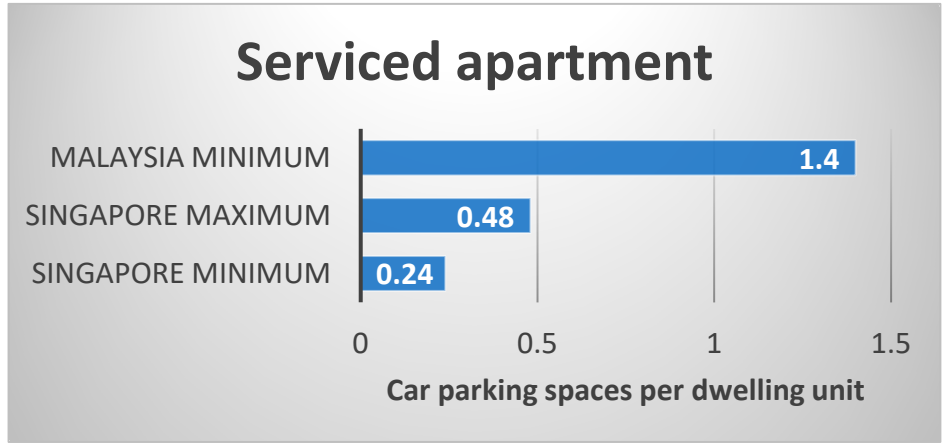
SUMMARY OF CHANGES TO THE CAR PARKING STANDARDS

Parking Zone	Upper Bound	Lower Bound
1 (CBD and Marina Bay, except car-lite precincts)	➢ 20% reduction from CPS: Office, Retail, F&B, Hotel, Non-residential white sites, Private condominiums and apartments ➢ Same as CPS: All other uses	➢ 50% reduction from CPS: Office, Retail, F&B, Hotel, Non-residential white sites, Private condominiums and apartments ➢ 20% reduction from CPS: All other uses
2 (Within 400m of a Rapid Transit System station, except car-lite precincts)	➢ 20% reduction from CPS: Office ➢ Same as CPS: All other uses	➢ 50% reduction from CPS: Office, Retail, F&B, Hotel ➢ 20% reduction from CPS: All other uses
3 (All other areas outside of Zones 1 and 2, except car-lite precincts)	➢ Same as CPS: All uses	➢ 20% reduction from CPS: All uses
4 (Car-lite precincts)	➢ Parking provision to be advised by LTA on a case-by-case basis.	









Far East Mobility

PEOPLE ORIENTED CITIES

Parking standard minimum spaces - residential, centre

Johor Bahru	**2.4.0/unit** 2.4 for condominiums (J
Jiuquan	**1.5/unit** (Jun-21)
Harbin	**1.3-1.5/unit** <60: 0.8-1.0 /unit; 60-90: 1.0-1.3 /unit; >90: 1.3-
Guiyang	**0.5-2.0/unit** economic apartment: 0.5/unit, high-floor apartment
Jinan	**0.5-2.0/unit** Low-grade apartment:0.5-0.8/unit,high-grade apartı
Hangzhou	**1.2/unit** <60m2: 0.6 /unit; 60-90: 1.0 /unit; 90-140: 1.2 /unit; >140
Tianjin	**1.2/100m2** (Jun-21)
Yichang	**0.8/100m2 and minimum 1.2/unit** for multi floors apartme
Xiamen	**0.8-1.5/unit** <70m2: 0.8/unit; 70-144m2: 1.0 /unit;144-180m2:1.5/u
Guangzhou	**1.0-1.2/100 m2** (Jun-21)
Shenzhen	**1.0-1.2/unit** <60m2: 0.4-0.6 /unit; 60-90m2: 0.6-1 /unit; 90-144m2: 1
Beijing	**1.1/unit** (Jun-21)
Chengdu	**1/100m2** 1/100m2 is the minimum (Jun-21)
Copenhagen	**1.0/100m2** (Apr-11)
Lanzhou	**1.0/unit** (Jun-21)
Shanghai	**1/unit** <90m2: 0.8 /unit; 90-140m2: 1.0 /unit; >140m2: 1.2 /unit (Jun-21
Taipei	**1.0/100m2** (Mar-12)
Xian	**0.9/unit** (Jun-21)
Zhuhai	**0.8-1.0/100 m2** (Jun-21)
Kunming	**0.7-1.0/100m2** economic apartment: 0.7 /100m2, marketable apartment: 1
Antwerp	**1.1/unit** plus 2 bike parking spaces per unit [assumed: 75m2/unit] (Jun-11)
Utrecht	**1.1/unit (min.); 1.2/unit (max.) + 0.25 for guests** assumed: 75m
Zurich	**0.83/100m2** 1 space/120m2 (Jul-12)
Foshan	**0.8/100m2** (Jun-21)
Budapest	**1.0/unit** This is the national standard. Cities are allowed to decrease or increase
Nanchang	**0.7/100m2** (Jul-21)
Wuhan	**0.25-1/unit** economic apartment: 0.25/unit, marketable apartment: 1/unit (Jun-2
Hong Kong	**0.057-1.275/unit** high variety, depending on public transport availability and apart
Seoul	**0.5/100m2** 1 in 3 units for < 80m, 1 in 2 for 80-120m, 1 to 1 for 120m+ (Jul-21)
Singapore	**1 per 2 units** 0.8 per unit is a max (Jul-21)
Urumqi	**0.5/100m2** (Jun-12)
Stockholm	**0.14/room** assumed: 3 rooms (Jun-11)
Chongqing	**0.34/100m2** (Jul-21)
Tokyo	**0.28/100m2** average (Jun-13)
Barcelona	**1.0/2-6 apartments (depending on area)** assumed: 100m2/unit, 4 apartments (Ap
Amsterdam	**1.0/unit + 0.2 for guests (MAXIMUM)** this is a maximum (Apr-11)
London	**0/unit** <1 for units with 1 or 2 beds; 1-1.5 for units with 3 beds; 1.5-2 per unit with 4 or more beds.
New York	**0.2/unit** this is a maximum, Manhattan below 60th street (May-12)
Paris	**0/unit** parking supply minimums are eliminated, maximums are 1 parking space/unit (Jul-12)
San Francisco	**0.25/unit** this is a maximum (Jul-11)

Parking standard minimum spaces - large mall, central area

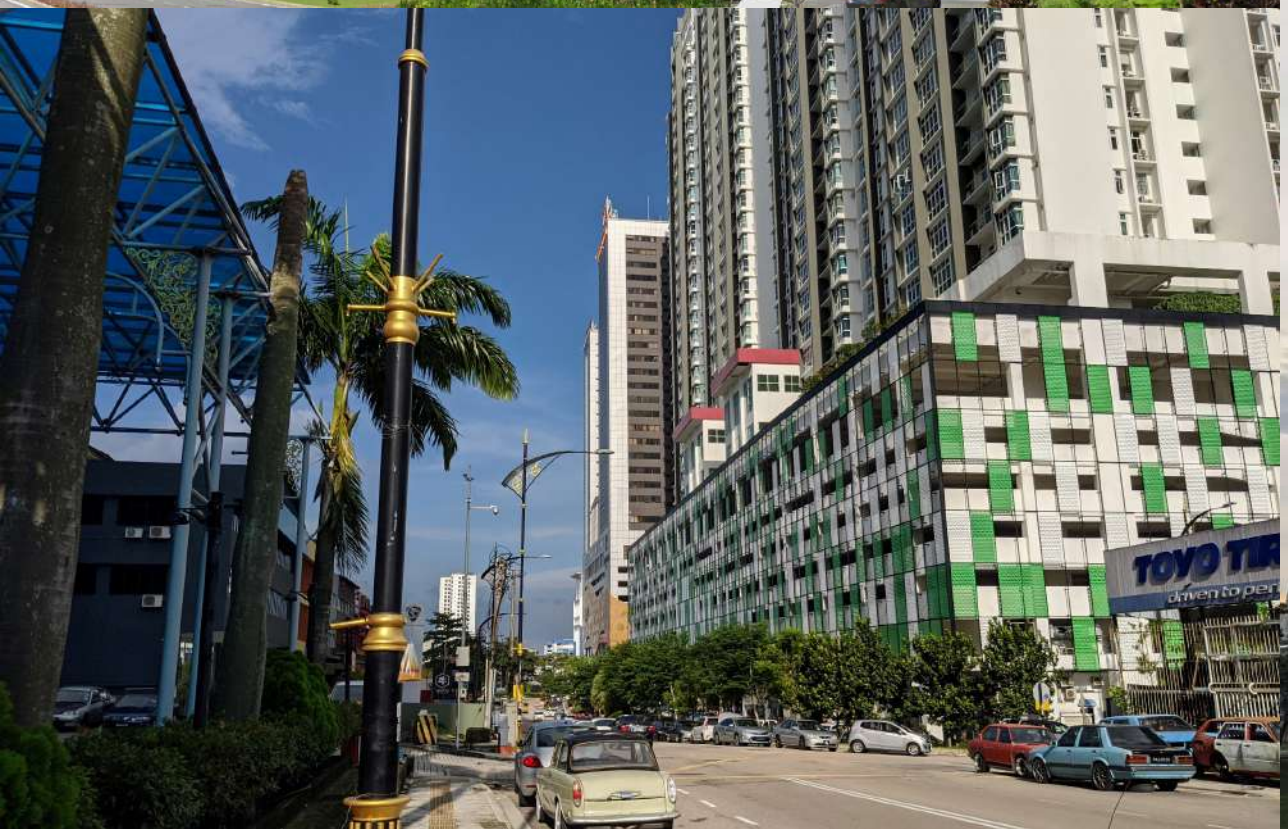
Johor Bahru	**1.1 per 100m2** (Jul-21)
Hangzhou	**1/100m2** (Jul-21)
Shenzhen	**0.8-1.2/100m2** (Jul-21)
Xian	**0.9-1.0/100m2** <10000m2,0.9/100m2;>=10000m2,1.0/1
Nanchang	**0.8/100m2** (Jul-21)
Shanghai	**0.8/100m2** 0.8/100m2 is the minimum (Jul-21)
Beijing	**0.5-0.6/100m2** <10000m2,0.6/100m2;>=10000m2,0.5/100m2 (Jul-21)
Singapore	**1 car parking lot per 840m2** 1 car parking lot per 530m2 is max (Jul-21)

Parking standard minimum spaces - serviced apartment

Johor Bahru	**1.4 parking spaces per unit** (Jul-21)
Wuhan	**1/100m2** (Jul-21)
Harbin	**0.6-0.8/100m2** (Jul-21)
Nanchang	**0.7/100m2** (Jul-21)
Shenzhen	**0.3-0.5/100m2** (Jul-21)
Singapore	**1 lot per 4.2 units** 1 lot per 2.1 units is the max (Jul-21)

Parking standard minimum spaces - office, centre

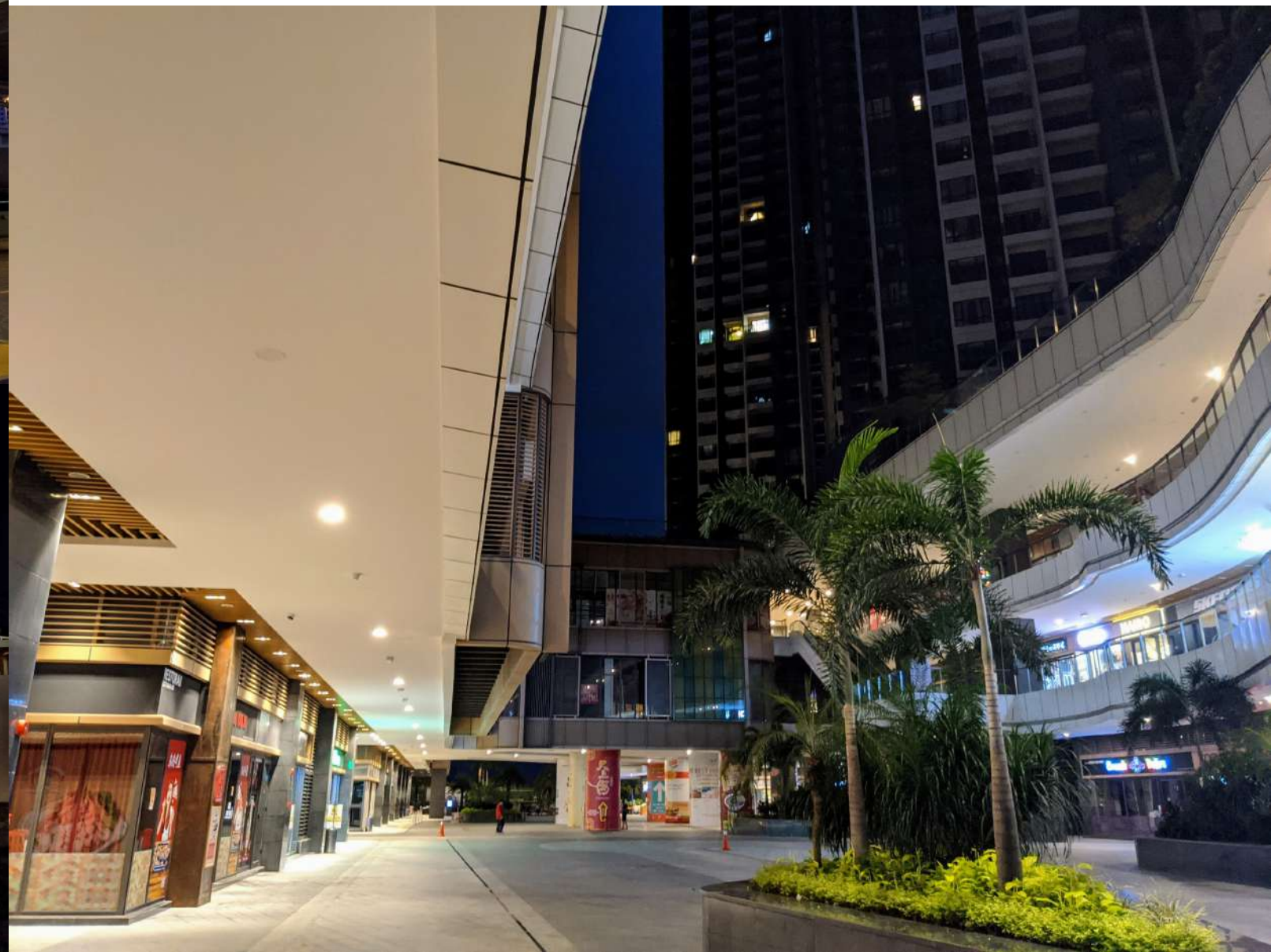
Foshan	**1/100m2** (Jun-21)
Hangzhou	**1.0/100m2** (Jul-21)
Harbin	**0.9-1.1/100m2** (Jul-21)
Johor Bahru	**1/100m2** (Jul-21)
Xiamen	**1.0/100m2** (Jun-21)
Xian	**1/100m2** (Jun-21)
Yichang	**1.0/100m2** (Jul-21)
Kunming	**0.8/100m2** (Jul-21)
Jinan	**0.5-1.2/100m2** (Jun-21)
Zurich	**0.83/100m2** 1 space/120 m2 for th
Nanchang	**0.6-1.0/100m2** (Jun-21)
Tianjin	**0.8/100m2** (Jun-21)
Utrecht	**0.8/100 m2** (Apr-12)
Guiyang	**0.7/100m2** (Jun-21)
Lanzhou	**0.7/100m2** (Jun-21)
Taipei	**0.7/100 m2** (Mar-12)
Shanghai	**0.6-0.7/100m2** (Jun-21)
Guangzhou	**0.5-0.7/100m2** (Jun-21)
Wuhan	**0.6/100m2** (Jul-21)
Budapest	**1.0/200m2** for the first 100m2 1 space; for larger surfac
Chengdu	**0.5/100m2** 0.5/100m2 is the minimum (Jun-21)
Chongqing	**0.5/100m2** (Jul-21)
Stockholm	**0.4-0.6/100m2** 4-6 spaces per 1000m2 (Jul-12)
Zhuhai	**0.4-0.6/100m2** (Jun-21)
Jiuquan	**0.45/100m2** (Jun-21)
Shenzhen	**0.3-0.5/100m2** (Jul-21)
Beijing	**0.35/100m2** (Jun-21)
Tokyo	**0.3/100m2** (Apr-11)
San Francisco	**<7% of total floor space for parking** assumed: 25m2/parking
Singapore	**0.11/100m2** 0.17 is the max allowed (Jul-21)
Seoul	**0.1/100m2** (Apr-11)
Amsterdam	**1.0/250 m2** this is a maximum (Apr-11)
Hong Kong	**0/100m2** CBD office buildings can decide not to provide any parking at all (Mar-12)
London	**1.0/1000-1500m2** this is a maximum (Jul-12)


TOYO TIR


AEON
COUNTRY GARDEN

The new Toppen Mall in Johor Bahru. No transit or pedestrian access.

R&F Mall in Johor Bahru. Street level public access, 650m connection to JB Sentral, even a bus stop in front.




JALAN SEHALA
RESIDENCE ENTRANCE
NO ENTRY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Thank you!