

2010 MULTIMODAL OPERATIONS PLANNING WORKSHOP NEW YORK CITY

From Southeast Asia to New York – Density, Profitability, and Reliability of Subway Systems

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Why Southeast Asia?

- ***“How is performance measurement used to achieve goals and enhance service quality?”***
- **Modern and “profitable” systems in Asia**



April 2010

TRANSIT COOPERATIVE RESEARCH PROGRAM
Sponsored by the Federal Transit Administration

Responsible Senior Program Officer: Gwen Chisholm-Smith

Research Results Digest 95

International Transit Studies Program
Report on the Spring 2009 Mission

PERFORMANCE MEASUREMENT AND OUTCOMES

This TCRP digest summarizes the mission performed March 20 to April 3, 2009, under TCRP Project J-03, “International Transit Studies Program.” This digest includes transportation information on the organizations and facilities visited. It was prepared by Harrington-Hughes & Associates, Inc., and is based on reports filed by the mission participants.



New York City Transit

<http://www.tcrpstudymissions.com/>

APTA 2010 New York City

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Railway Bento Boxes ('駅弁' or '便當')

Japan



China



Taiwan

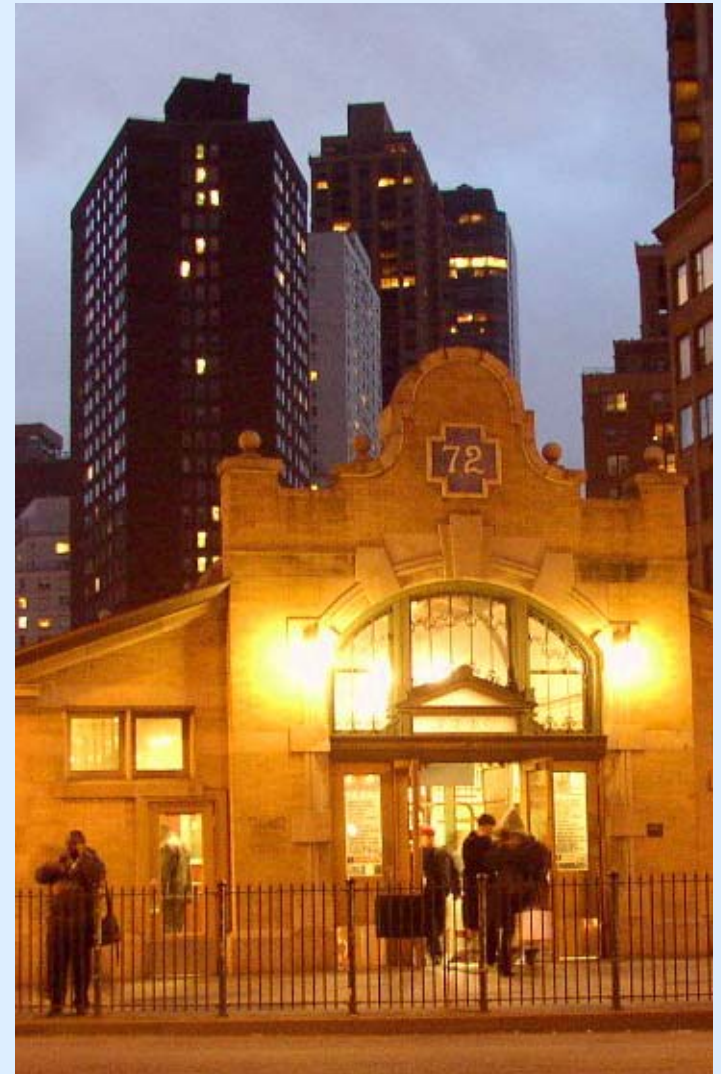


American Style



Comparative Analysis

- Transit system scope, density, design affect productivity, profitability, performance
- History, urban geography, governance, social context, regulations impact transit design and scope
- Comparisons should explain reasons for differences
 - Asian systems *really* profitable?
 - *What is* ‘profitable’?
 - If profitable, *why*?



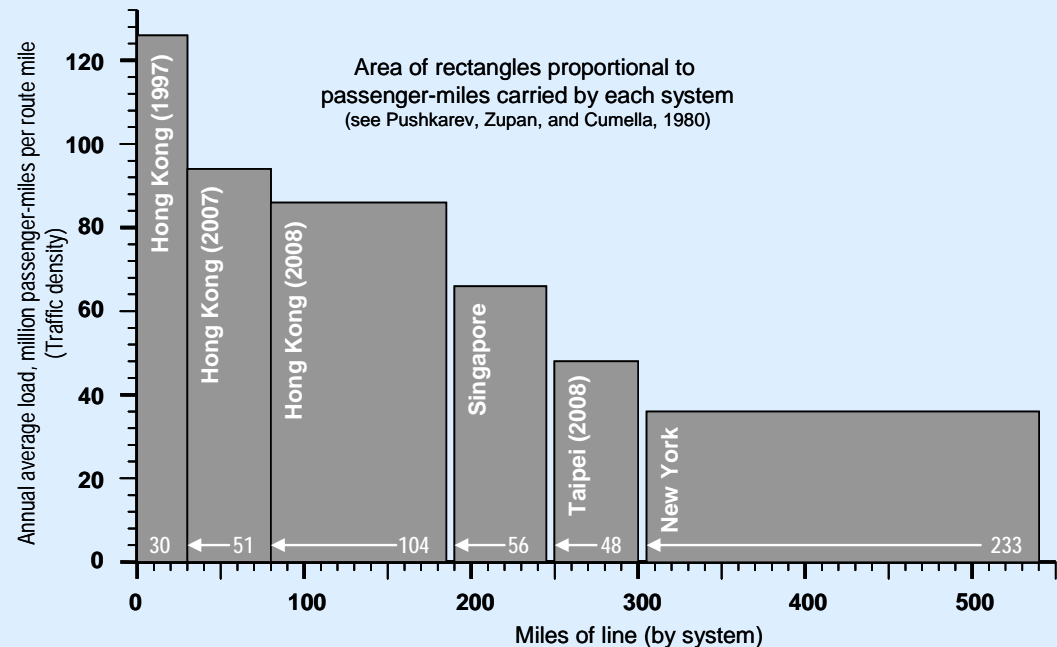
Lifecycles of Transit Systems

- **New York:** widespread, represented, equitable
 - **1900s~1920s:** real estate development, competition, service
 - **1930s~1940s:** public takeover, completion of combined system
 - **1950s~1970s:** consolidation, rationalization, modernization
 - **1980s onwards:** maintain, reconstruct, “serve all citizens”
- **Hong Kong:** “prudent commercial”
 - **1979-1985 (UK):** high density corridors only, strictly for-profit
 - **1998-2007 (SAR):** expansion, property & economic development
- **Taipei, Singapore:** quasi-private government enterprise
 - **1980s/1990s:** public works project like New York’s Independent subway, for commercial/housing development, national prestige
 - **Today:** expansion into lower density areas
- **Kuala Lumpur:** designed by concessionaires

Productivity: Density and Utilization

City	Hong Kong (1997)	Hong Kong (2007)	Hong Kong (2008)	Singapore (2008)	Taipei (2008)	New York
Stations	44	52	80	51	70	468
Passengers per Route Mile	27	18	14	8.4	9.4	7.0
Subway Non-Fare Revenue	\$248m	\$1.3 bn	\$1.2 bn	\$59m	\$39m	\$161m

- Hong Kong is densest, even after absorbing commuter rail; New York is a huge system, but not dense
- Hong Kong generates 8 times more non-fare revenue than NY from 80% fewer stations!



Profitability: Assets, Return-on-Investment

City	Hong Kong (2008)	Singapore (2008)	Taipei (2008)	New York
Carrier's assets "book value"	\$18 bn	\$960m	\$283m	\$52 bn
Annual carrier "profit" (US\$)	\$1 bn	\$119m	\$20m	None
Implied subway "ROI"	5.6%	12%	7.1%	Negative
Initial construction cost estimate at today's prices	~\$35 bn	~\$25 bn	~\$25 bn	~\$800 bn
ROI if initial capital were financed at low interest rates	Not known	Negative	Negative	Negative
Annual interest payment if construction bonded at 5%	~\$1.8 bn	~\$1.3 bn	~\$1.3 bn	~\$40 bn

- Systems have widely different profits and carrier assets
- Reported "ROI" basically depends on construction debt financing structure
- No one makes a true ROI except possibly Hong Kong



Performance: Design & Management

- **Asian subway systems have excellent operational performance compared to New York**
 - **By design:**
 - Long, wide, spacious articulated cars
 - Stations on straight and level track, platform screen doors, electronic ‘next train’ displays
 - “Platform Captains” help manage crowding and dwell times
 - **Thorough effective incident response:**
 - Wider troubleshooting and maintenance responsibilities for train operators, station agents, and other field staff
 - Strategic incident response teams, including press management
 - **Delay root cause analysis: weekly meetings**
 - **Strong regulatory regime: franchise revocation threat**
 - **International benchmarking: line-level competition**



Contracted Cleaning Operations



One-Person Departure Process



Platform Captains



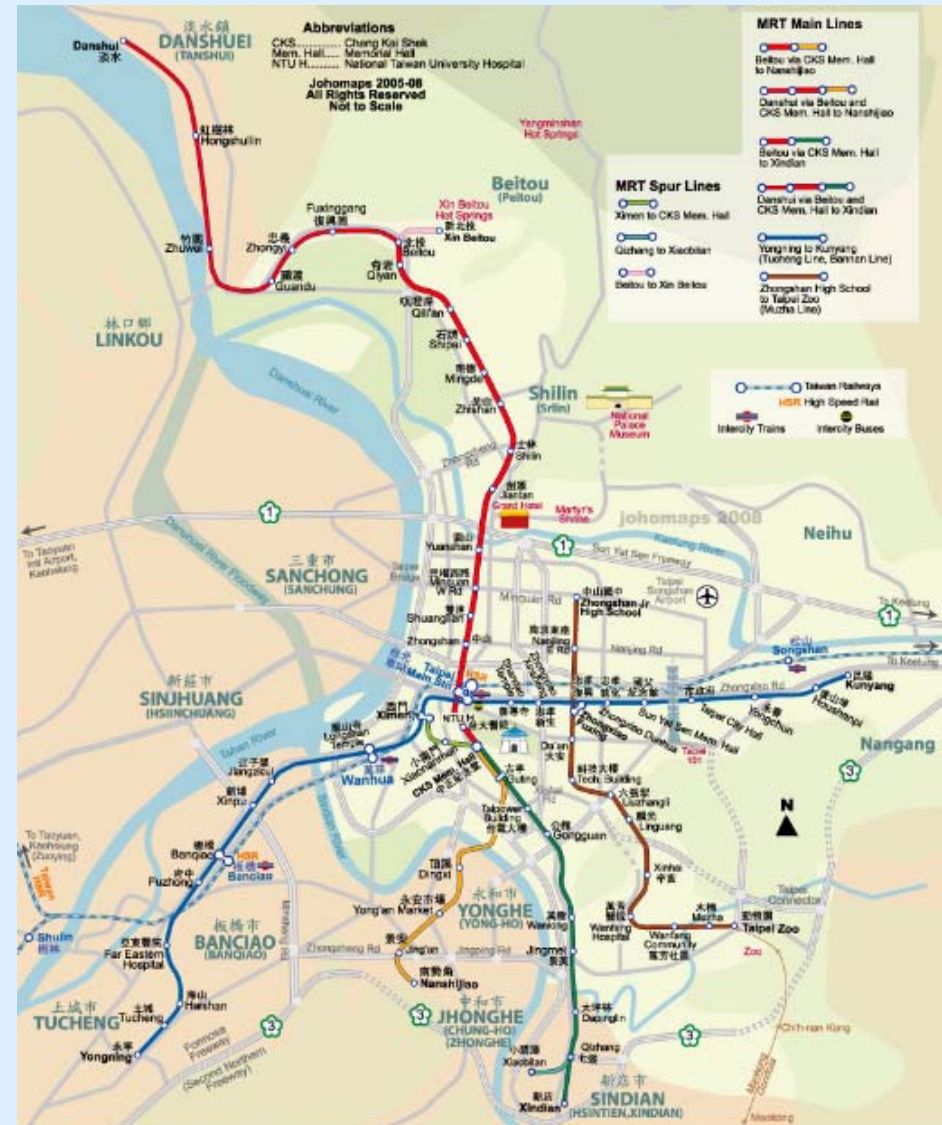
Multi-Tasking/Equipment Design





Taipei, Taiwan

- Capital of Taiwan (Formosa) = “Beautiful Island”
- 106 square miles
- 2.7 million population (10 million in metro area)
- 12 city districts
 - “Metro area” stretches 3 counties to the south
- Settled by Ketagalan tribes, Spanish and Dutch colony before 1700
- Fujian Chinese Immigration circa 1700-1895
- Japanese colony until 1945
- Mandarin, Taiwanese, Hakka, and English





Taipei Transport Scene

- **Mass Rapid Transit**
 - monopoly operator
 - government infrastructure investment \$20 bn
- **Commuter Rail**
 - Uses contactless AFC
- **Franchised Buses**
 - 14 major private operators
 - formerly private suburban buses
 - market sharing (“Lianying”) since 1977
 - Taipei Municipal Bus privatized in 2004
- **Bus:Rail Ridership = 4:3**
- **Yellow Cabs!**





Taipei Yellow Cabs



Scooter Mountain, Scooter Sea



Taipei Main Station (Rail/Bus Hub)



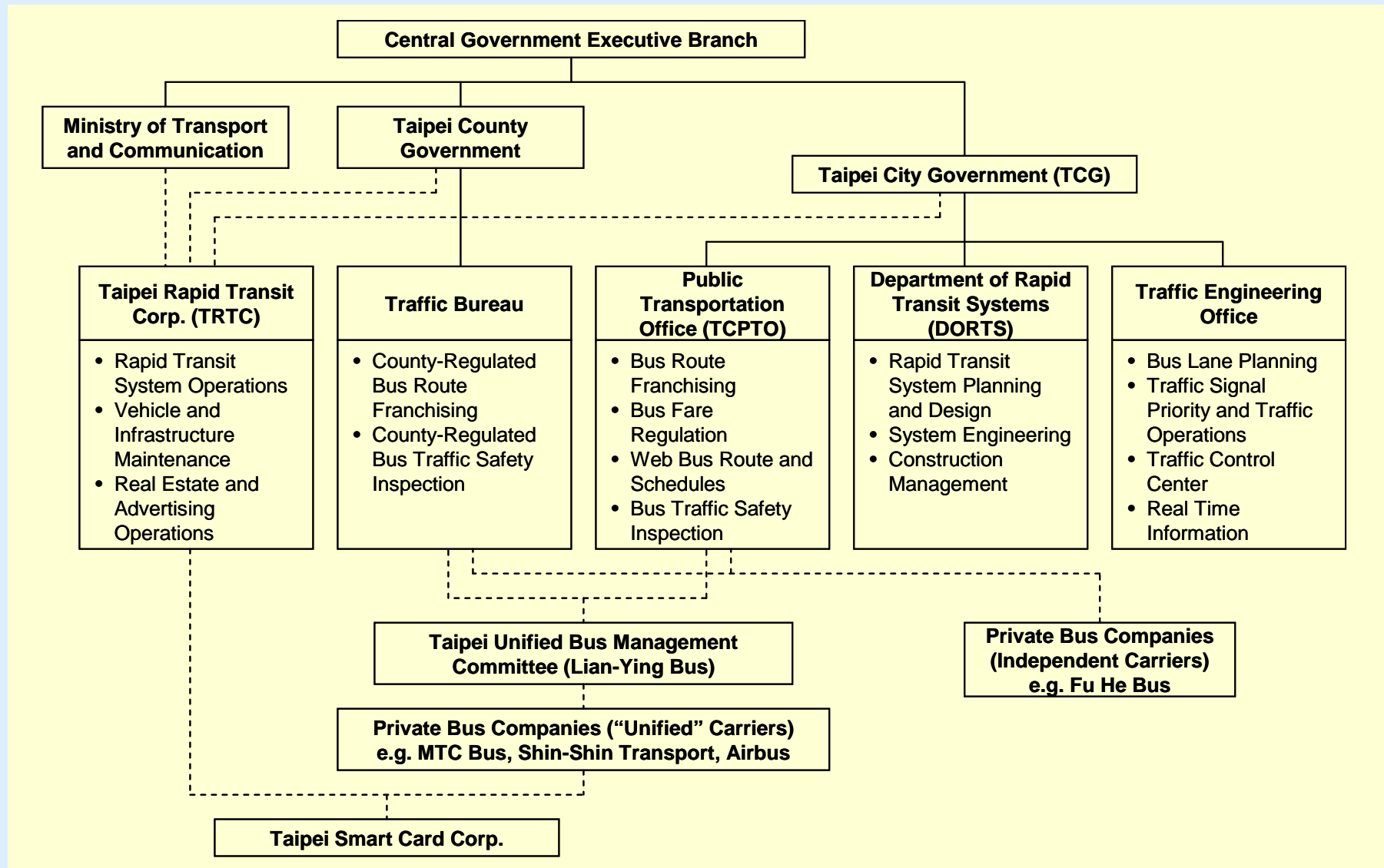
Taipei County

Photo: Linyu Guan





Institutional Organization





The Taipei Metro System

- 1986: MRT authorized
- 1996-97: First two lines opened
 - Muzha light rail
 - Damshui heavy rail
- 1997-2000: Substantial completion of Phase I routes
- 2004-06: Line extensions
- Additional phases totaling 50 route miles are under construction
 - Complete by 2015

48 route miles • 70 stations

6 lines • 3 depots • 3 yards

1.25 million daily passengers

102 light rail cars • 384 subway cars

3,800 employees • EasyCard AFC



Taipei Rapid Transit Corp. (TRTC)



- **74% owned by Taipei City Government**
 - 25% other public entities
 - < 1% institutional owners
- **US \$283m in asset base**
 - excludes fixed infrastructure
 - Lease-and-maintain agreement for fixed plant
- **US \$20m annual “profit”**
- **11% of revenues from “affiliated” activities**
 - advertisement, real estate rental, commuter parking





Profit Sharing Bonus System

- **Performance Measurement for:**
 - Total Quality Management
 - Reliability Improvement
 - International Benchmarking
 - Performance Bonus
- **Year End Bonus**
 - 1 to 16 weeks' pay awarded at year end
 - Applies to all staff (management and labor)
 - Dependent on:
 - Composite performance index
 - Company profits





Taiwan Railway Administration

- 1891: First rails laid by the Manchurians
- 1895~1940s: Rebuilt by the Japanese
- 1950s: World War II repairs
- 1970s: Electrification, modernization, double-tracking, resignalling
- 1980s: Soaring deficits, continued investment, line extensions
- 2000s: Renewed focus on commuter rail and economic development

682 route miles • 3'6" gauge
9 commuter rail metro areas
179 million annual ridership
40% farebox recovery • 95.3% ontime
13,500 employees • contactless AFC



Schedule & Plant: Designed Together



Strategic Incident Management

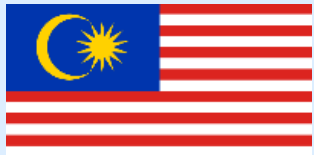


Capable Staff/Appropriate Automation



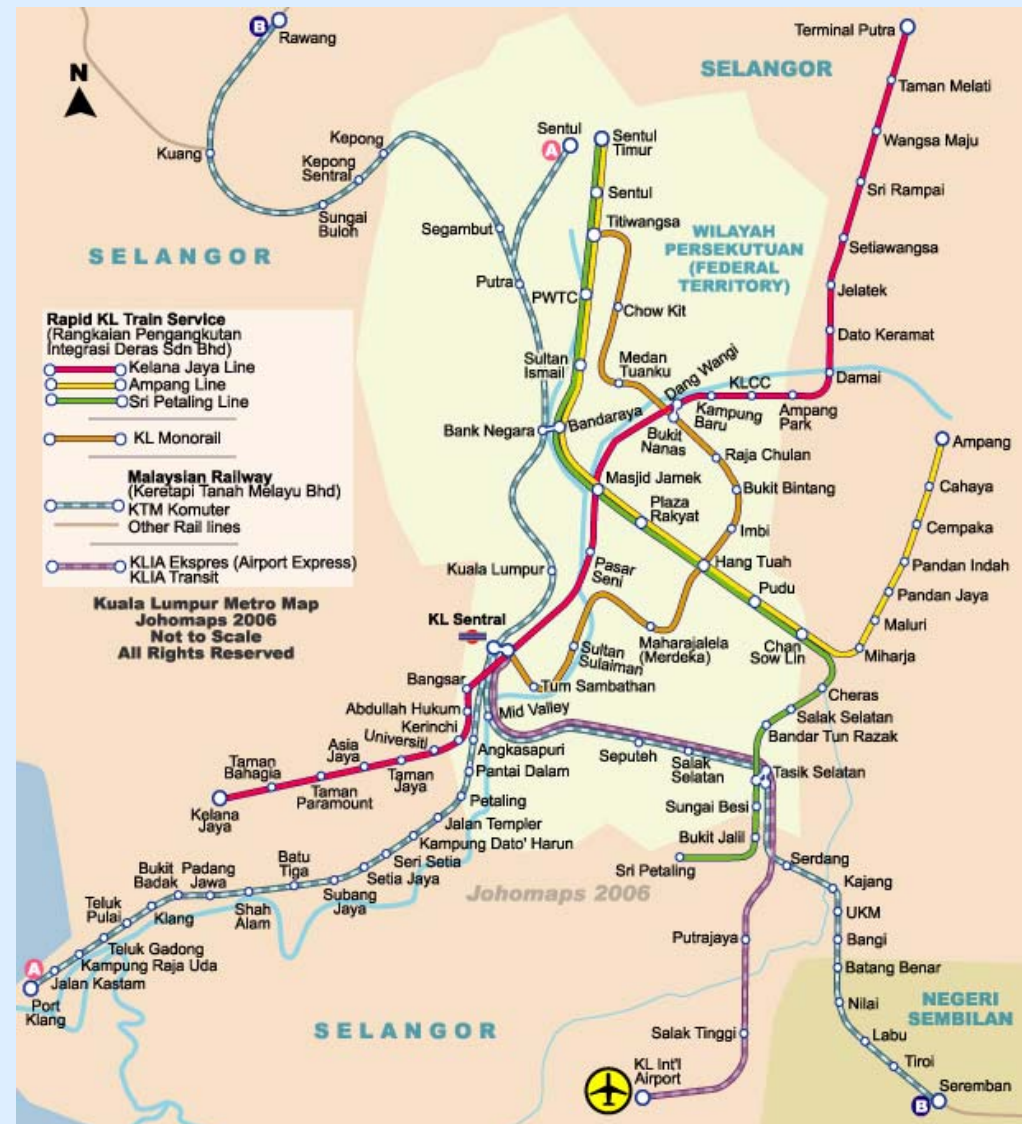
Efficient Construction Methods

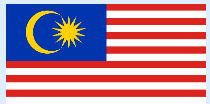




Kuala Lumpur, Malaysia

- Kuala Lumpur = “Muddy Confluence”
- 94 square miles, merge point of Klang and Gombak rivers
- 1.9 million population (7.2 million in metro area)
- RapidKL divides city into five main areas
- Settled in 1850s as “Pengkalan Lumpur”
- Chinese Kapitan “Yap Ah Loy” was early leader
- British colony until 1957
- Malay = official language
 - Chinese and Indian dialects also spoken



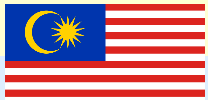
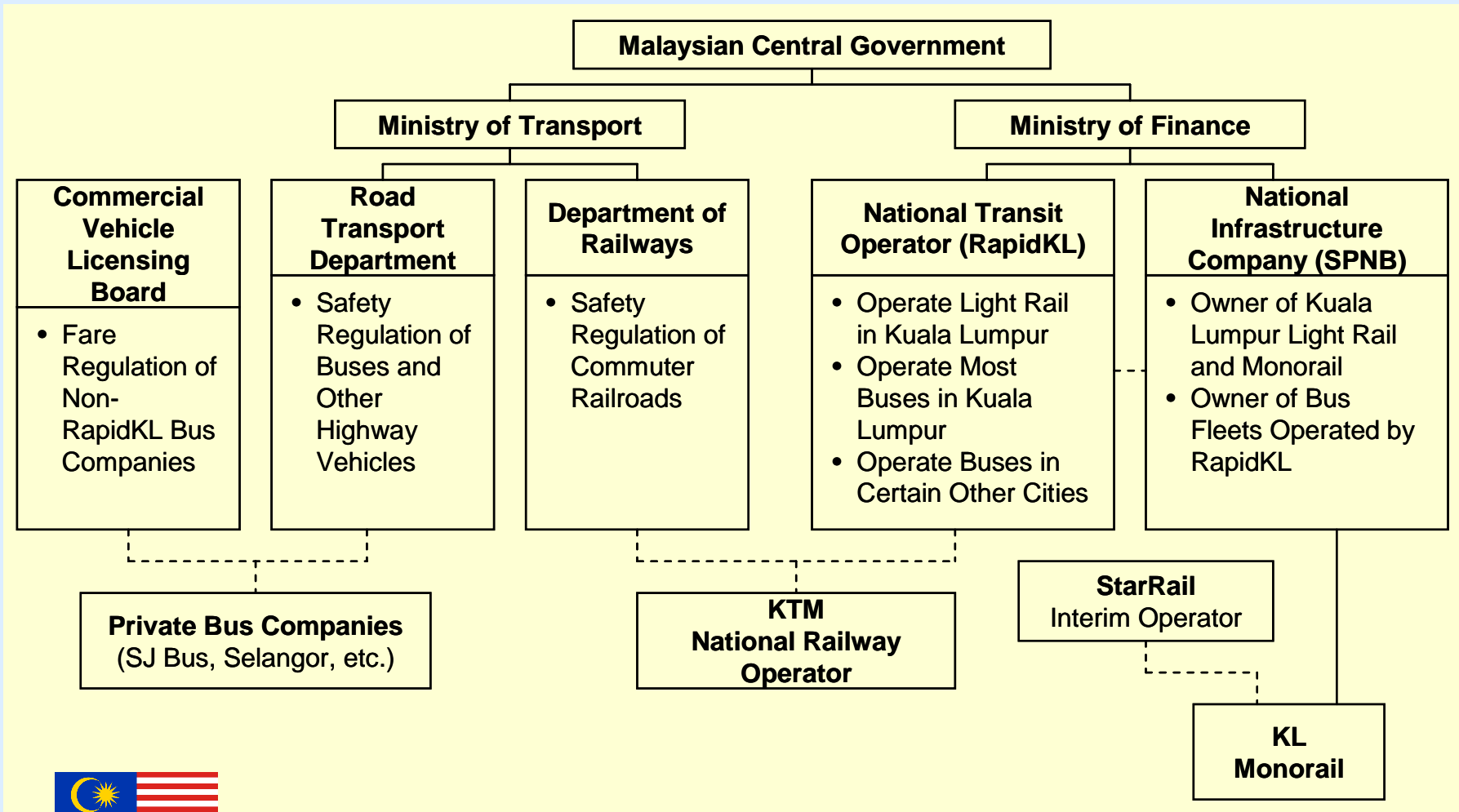


Kuala Lumpur Transport Scene

- **Light rail**
 - 2 independent line-haul light rail lines
 - JFK Airtrain technology
- **Monorail**
 - 1 peplemover line
 - Seattle Monorail technology
- **Commuter Rail**
- **Buses**
 - 80% operated by consolidated multimodal public operator
 - other private operators
- **Motorbikes**
 - many cannot afford car
- **Jitney Companies closed**
 - licences suspended mid-1990s during restructuring



Complex Institutional Relationships





Kuala Lumpur Rail Transit

- Multimodal operator
- 16% overall mode share
- Ridership Bus:Rail = 4:3
- Regulated near-monopoly
 - Infrastructure separated
- 100% publicly owned
 - Infrastructure controlled by Ministry of Transport
 - Operator controlled by Ministry of Finance
- Public takeover after earlier concession failures
 - negative return on investment
- Intermodal connectivity is a key present goal



Putra Line



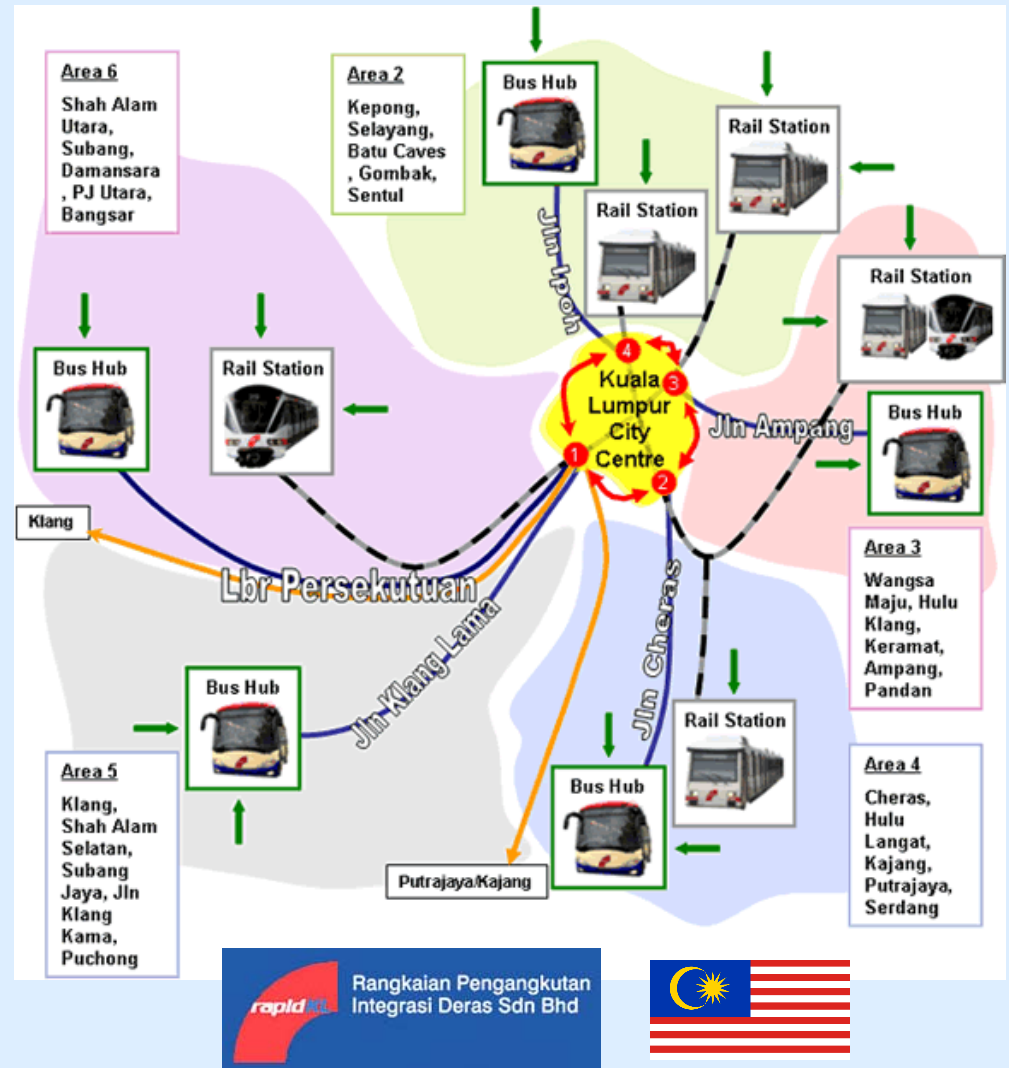
Star Line



The RapidKL System

- 2 radial light rail lines
 - opened 1996, 1999
 - cost US\$ 1.6 billion
 - practically bankrupt by 2001
- RapidKL is also bus operator
 - substantial service planning/restructuring power
- Buses have a four-tier hub and spoke structure
 - Downtown circulator, local feeder, trunk line-haul, and direct express bus

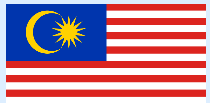
35 route miles • 48 stations
 310,000 daily passengers
 ~150 railcars • 900 buses
 11 depots • 167 routes





RapidKL Bus Interior





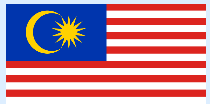
Private Suburban Selangor Bus





Private Suburban 'SJ Bus'





Traffic Congestion





KL Monorail

- **Single circumferential elevated line**
 - articulated one car “trains”
 - completed 2003
 - cost US\$ 340m
- **Insolvency by 2007**
 - StarRail is the interim operator
- **Intermodal connectivity is a problem**
 - Poor transfer station design

**5 route miles • 11 stations
44,500 daily passengers**



Photo: Alla Reddy



Photo: Steve Callas





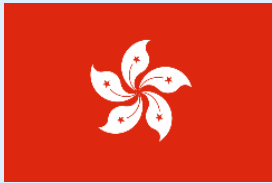
Airport Express & Commuter Rail

- **Airport Express built as first segment of Kuala Lumpur to Singapore high speed rail**
 - **German ICE Technology, cost US\$ 690m (1999)**
 - **Commuter Rail is narrow 'meter' gauge**
 - **Operated by Keretapi Tanah Melayu Bhd (KTM)**
 - national railway bureau
- 4 branches • 42 stations**
airport express line (5 stations)
86,000 daily passengers



Hong Kong

Special
Administrative
Region



- Hong Kong = “Fragrant Harbour”
- 427 square miles
- 7.0 million population
- Four regions:
 - Hong Kong Island
 - Kowloon Peninsula
 - Lantau Island
 - New Territories
- British colony until 1997
- Cantonese, Mandarin, and English
- “Pearl of the Orient”



Photo: Ted Wang





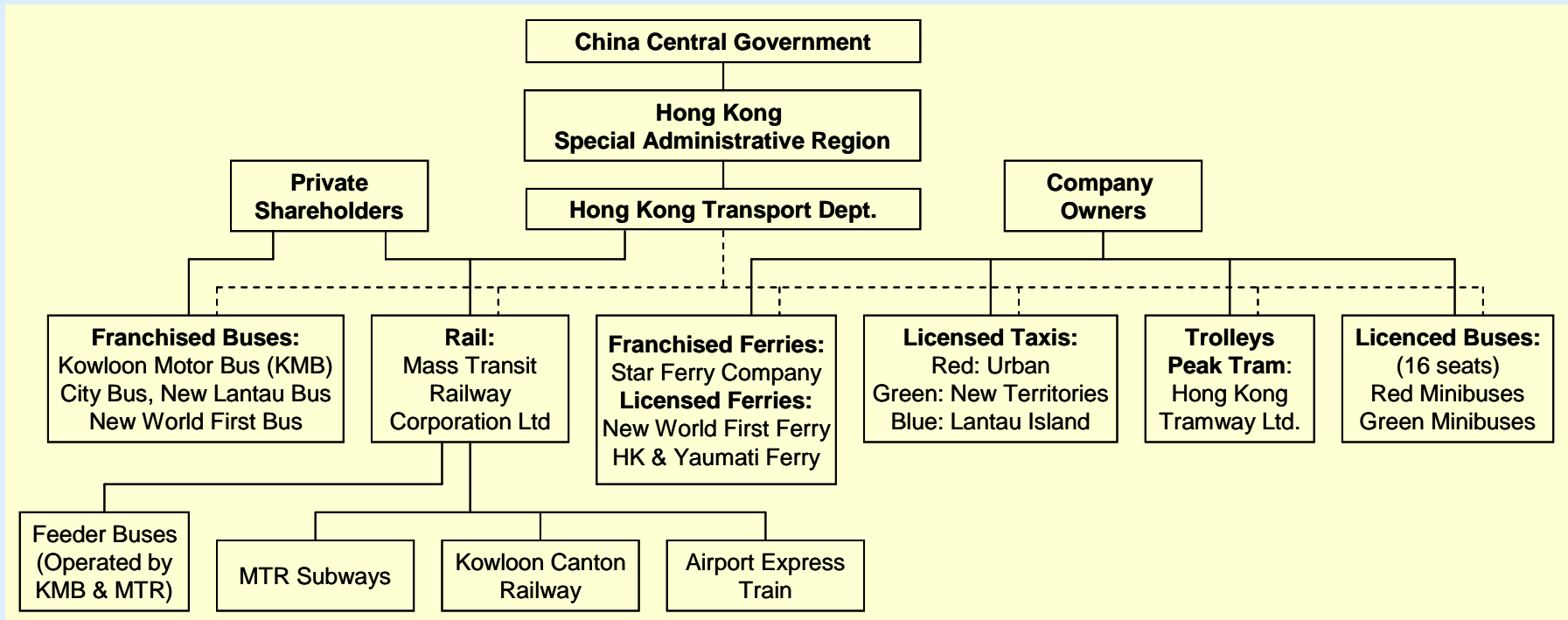
Hong Kong Transport Scene

- **Mass Transit Railway**
 - includes commuter rail and light rail
 - monopoly operator
- **Franchised Buses**
 - 4 major operators
- **Ridership Bus:Rail Ratio = 1:1**
- **Licensed, non-Franchised Buses**
 - like jitneys (16-seater)
 - red and green
- **Trolleys, Peak Tram**
- **Taxis**
 - color coded by geography
- **Ferries**
 - franchised (trunk routes)
 - licensed (smaller)





Institutional Organization



- **Most transit companies are privately owned or publicly listed**
- **All transit subject to regulation by the Transport Department**
- **Most transit operators are licenced at the geographic zone or route level**
- **Franchises have additional frequency and quality of service requirements**



Mass Transit Railway (MTR)

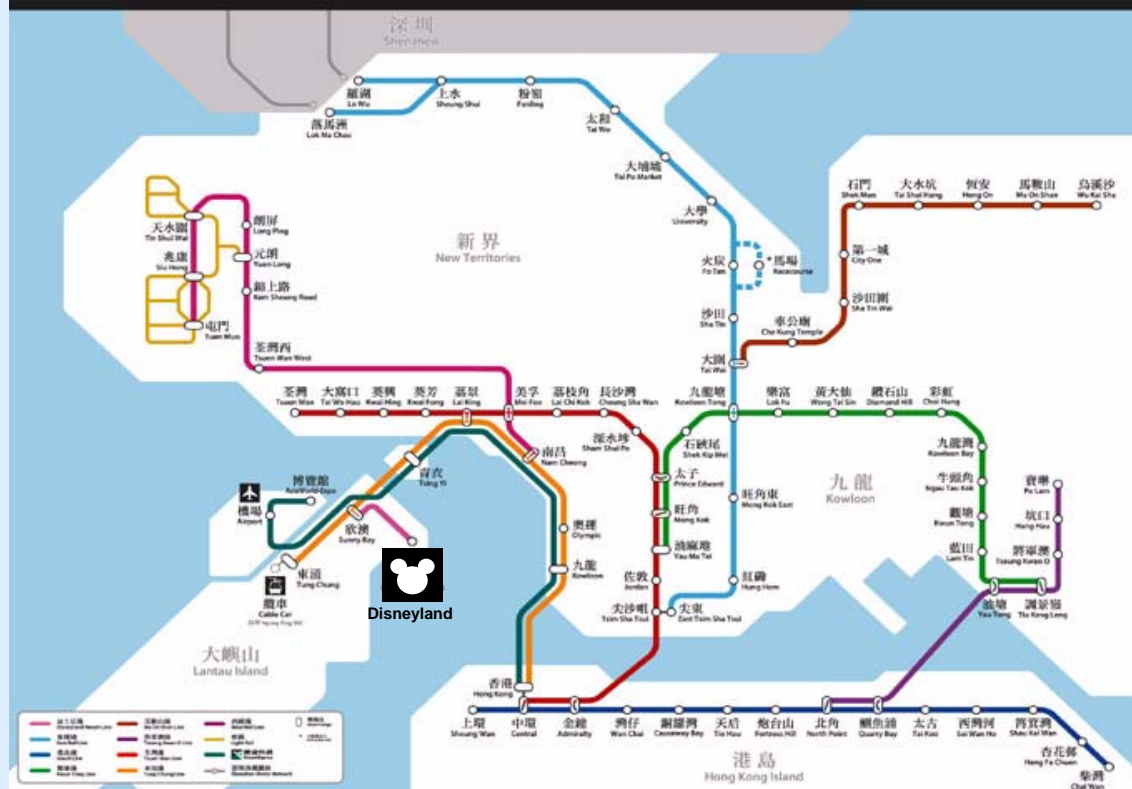
- 76% owned by Hong Kong Government
- Subway infrastructure owned by MTR outright
 - Railroads leased from KCR
- US \$11 bn in market capitalization
- US \$18 bn in asset base
- US \$1 bn annual surplus
- “Prudent commercial” high-density design
- 33% of revenues from non-transport activities
 - media, real estate, consulting, telecommunication



- 1972: MTR authorized
- 1979-80: First line in Kowloon, harbour crossing complete
- 1982: Tsuen Wan extension
- 1984-5: HK east-west main line, 2nd harbour crossing
- 1998: Airport, Lantau
- 2007: Kowloon Canton Railway acquisition

港鐵路綫圖 MTR system map

www.mtr.com.hk



104 route miles • 80 stations

3 commuter rail + 6 subway + NT light rail feeder lines

3.7 million daily psgrs • 1,698 railcars • 9,892 employees

9 depots • Octopus AFC • 99% on-time



Full Height Platform Screen Doors



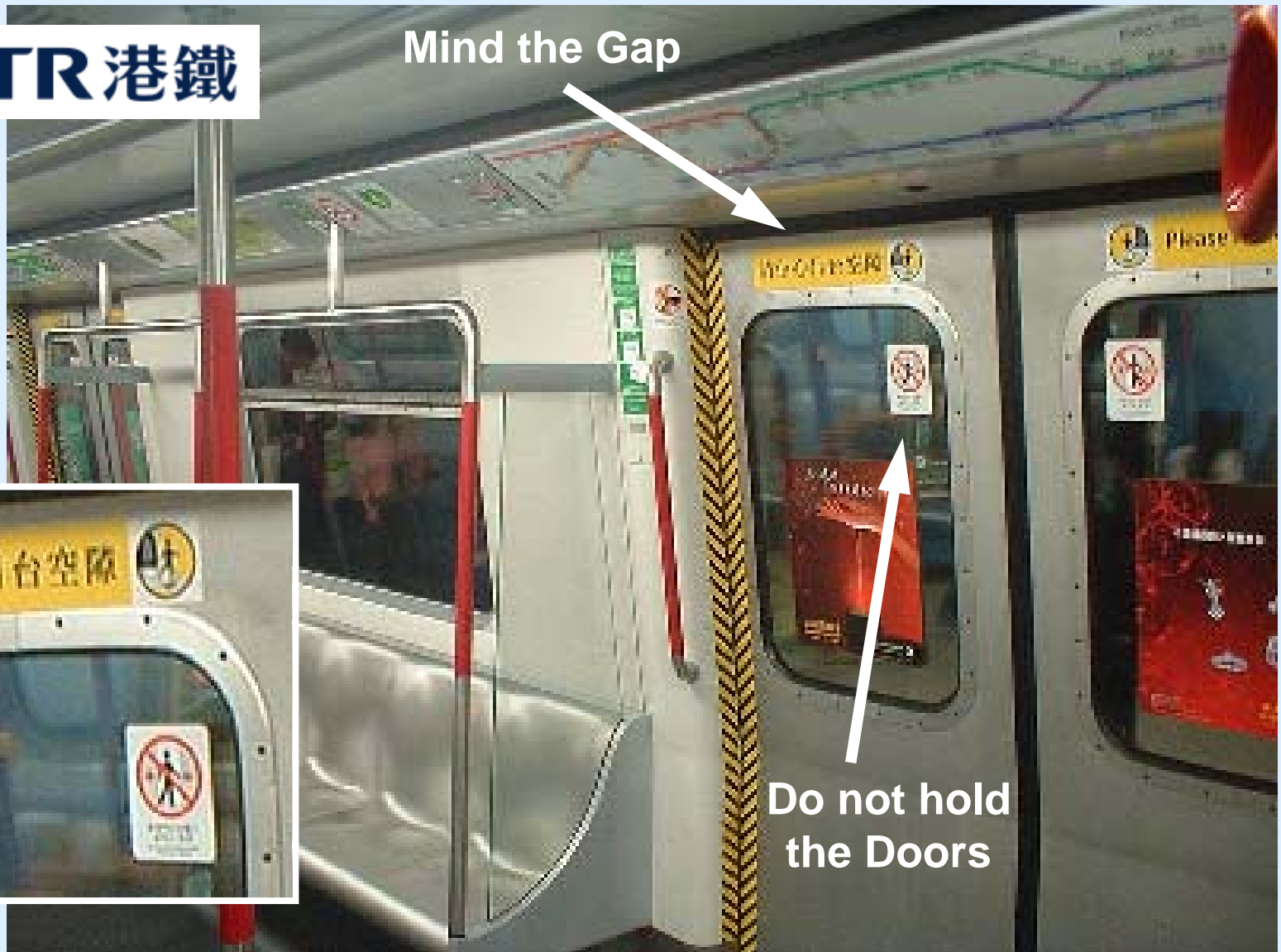
Half-Height Screen Doors



Some Issues are Universal



Mind the Gap



Do not hold
the Doors

Commuter Rail Acquisition



Singapore



Singapore

- Singa Pura = “Lion City”
- 244 square miles, Island nation
- 4.6 million population
- CBD in the south, and four “sectors”:
 - East, Northeast, West
 - Nature Reserve
- Temasek is the original settlement
- British colony until 1959
- Malay, Chinese, Tamil, English



Photo: Steve Callas

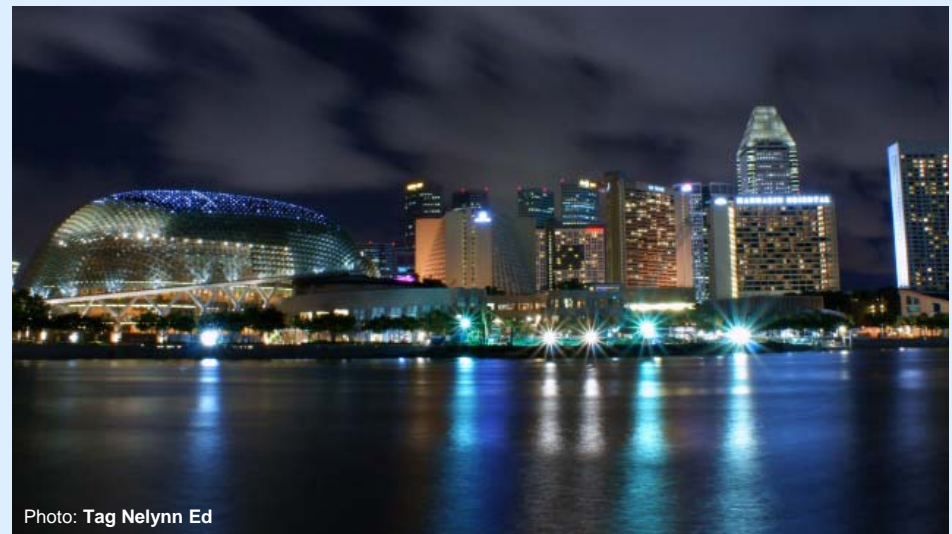


Photo: Tag Nelynn Ed





Singapore Transport Scene

- **Mass Rapid Transit**
 - 3 main MRT trunks
 - 4 light rail feeder systems
 - 2 franchised operators
 - government owned infrastructure
 - circle line planned
- **Buses**
 - 2 major operators with government route authorities
- **Ridership Bus:Rail = 4:3**
- **Taxis**
 - intermodal operators run rail, bus, and taxi services
 - other taxis also licenced
- **Electronic Road Pricing**
 - variable time-of-day toll set by congestion levels



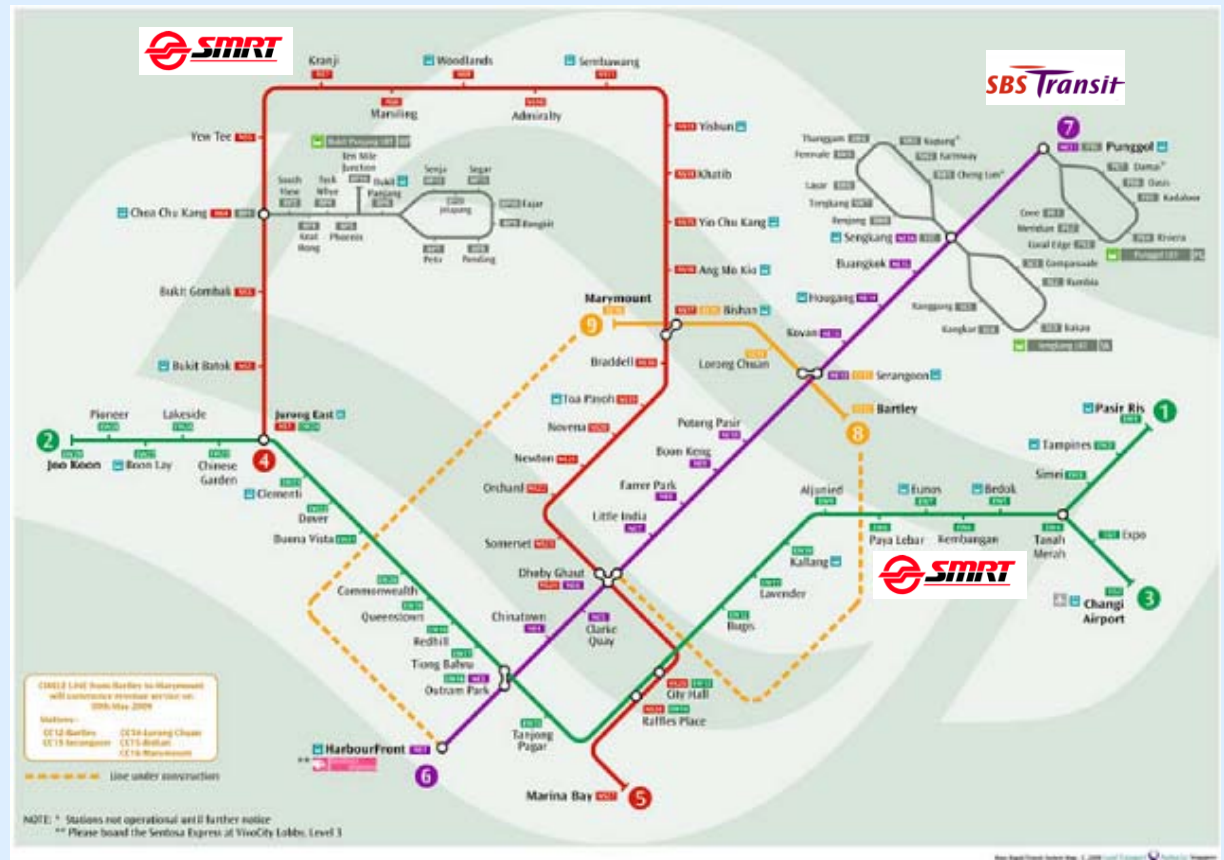
Photo: Steve Callas





The Rapid Transit System

- 2 original rapid transit lines
 - planned extensions and new circle line
- one light rail feeder
- bus routes in north and north-west



56 route miles • 51 stations (+14 light rail stations)
 1.4 million daily passengers • 636 railcars • 5,555 employees
 97%~98.5% on-time performance (within 2 minutes)

Singapore Mass Rapid Transit (SMRT)

- Multimodal operator
- Regulated duopoly
- 55% owned by Government of Singapore
 - 20% private investors
 - 25% institutional investors
- US \$1.4 bn in market capitalization
- US \$960 m in asset base
- US \$119 m annual “surplus”
 - 8%~12% “return on investment”
- 20% of revenues from non-transport activities
 - Engineering, advertising, real estate, taxi



Ticket Vending Machines



Outdoor Elevated Station



Wide Doors on Railcars



Ubiquitous Security Camera Systems



Observations

- **Infrastructure debt cannot be fully covered by the subway concession through the farebox**
 - even in successful, high density, “private” Asian systems, including Southeast Asia and Japan
 - recapturing real estate and economic development benefits is essential
- **Coverage, density, span of service has huge impacts on productivity and thus capital and operating costs**
 - service scope and historic designs not under agency control

Observations

- **Land grant model may produce transit oriented development more easily**
- **Many factors affect service reliability**
 - **Density, governance framework, regulation, cultural, weather, and historic design are beyond transit agency control**
- **“Profitability” is relative, depends on assets valuation, discount rates, etc.**
- **Avoid performance comparisons without understanding local contexts and analyzing reasons for differences**

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- **Singapore Mass Rapid Transit**
- **Rangkaian Pengangkutan Integrasi Deras Sdn Bhd (RapidKL)**
- **Taipei Rapid Transit Corp. (TRTC)**
- **Bureau of Taiwan High Speed Rail**
- **NSYSU, ITRI, K&L Gates**

Any Questions?



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