

Subway Productivity, Performance, and Profitability: Tale of Five Cities

Hong Kong, Singapore,
Kuala Lumpur, Taipei,
New York City

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**System Data & Research
Operations Planning
New York City Transit Authority**

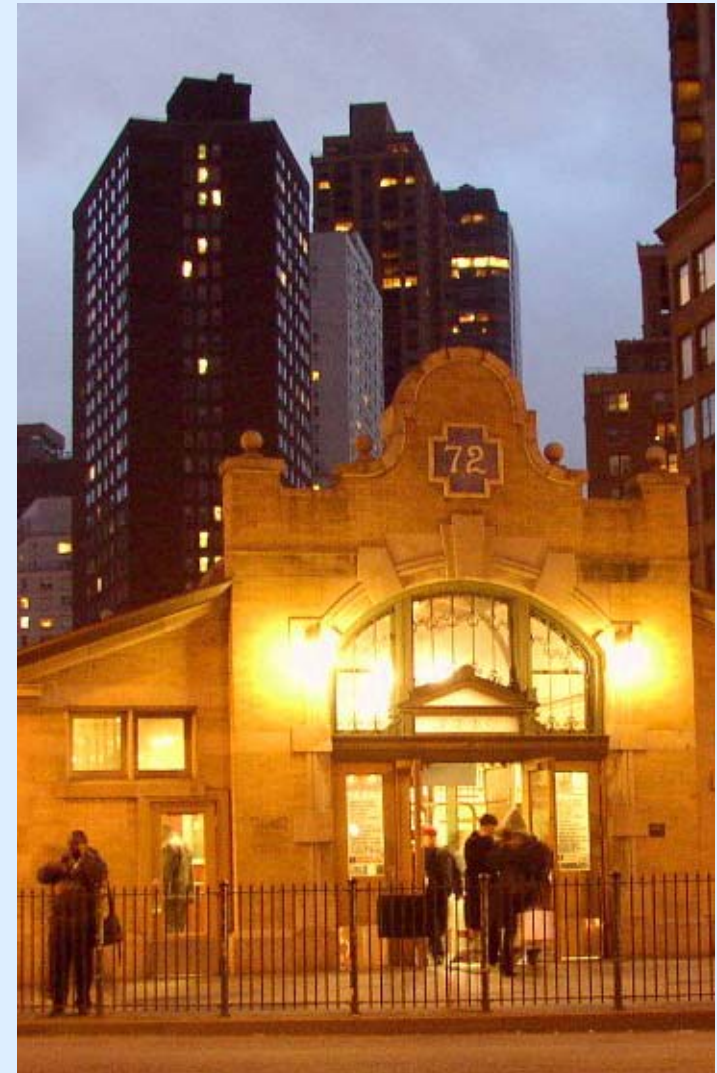
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Photo: Trevor Logan, Jr.



Comparative Analysis

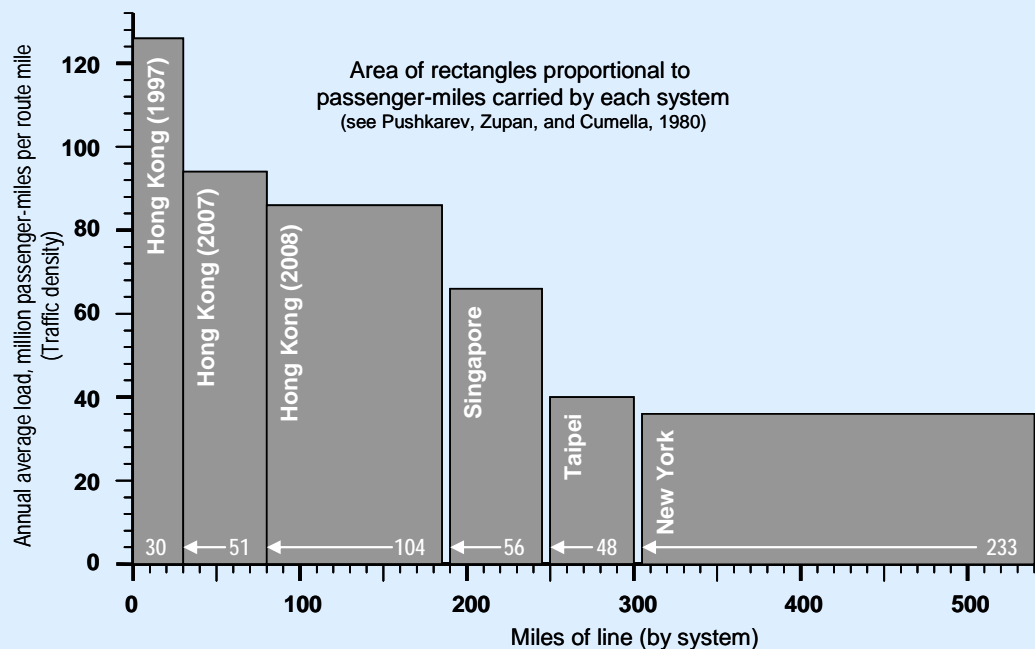
- **Transit system scope, density, design affect productivity, profitability, performance**
- **History, urban geography, governance, social context, regulations impact transit design and scope**
- **Comparisons should explain reasons for differences**
- **Transit design philosophies**
 - **New York:** high-service, widespread, represented, and equitable
 - **Hong Kong:** “prudent commercial”
 - **Taipei, Singapore:** focus on real estate development



Productivity: Density and Utilization

| City | Hong Kong (1997) | Hong Kong (2007) | Hong Kong (2008) | Singapore | Taipei | New York |
|---------------------------|------------------|------------------|------------------|-----------|--------|----------|
| Stations | 44 | 52 | 80 | 51 | 69 | 468 |
| Passengers per Route Mile | 27 | 18 | 14 | 8 | 8 | 7 |
| Subway Non-Fare Revenue | \$248m | \$1.3 bn | \$1.2 bn | \$59m | \$36m | \$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 | Taipei | 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 |

- 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
 - Loads generally within design capacity
 - **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**

Performance Measures

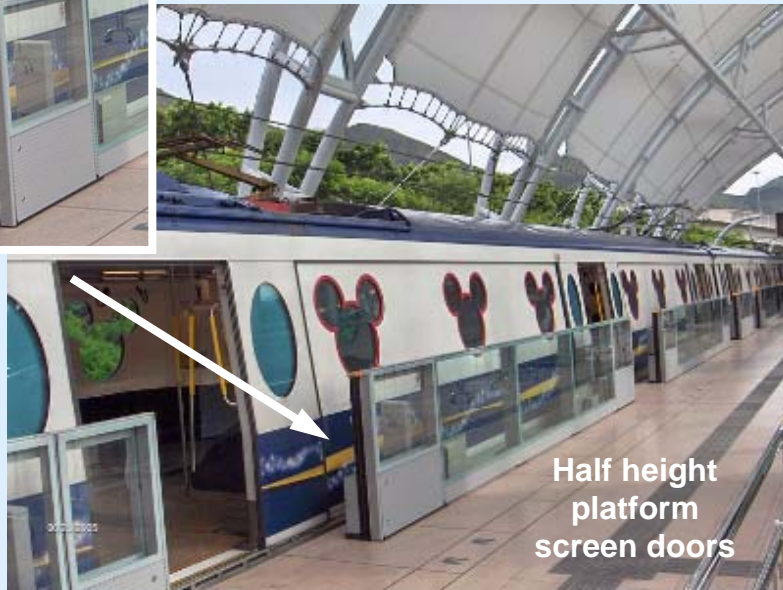
| City | Hong Kong | Singapore | Taipei | Kuala Lumpur | New York |
|--------------------------------|--------------------|------------------------------|--------------------------|----------------------------|---------------------|
| Service Reliability Measure | Psg On-Time | Train Arr. & Dep. | Train Punctuality | Service Reliability | Wait Assment |
| Measure Type | Origin-Dest | En-Route | En-Route | | En-Route |
| Allowable Deviation (Peak/O-P) | +5 +5 | +2 +2 | +5 +5 | | +2 +4 |
| Typical Performance | > 99.5% | 97%~99% | 99% | 96%~98% | 80%~85% |
| Equipment MDBF (millions) | 1.4 | 1.2 | 1.0 | | 0.2 |



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

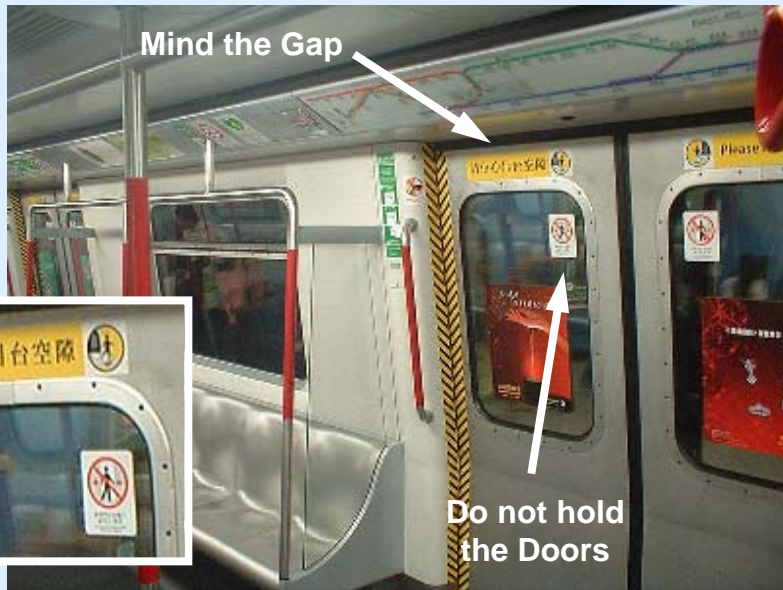




Half height platform screen doors



Full height platform screen doors



Mind the Gap

Do not hold the Doors



MTR's Kowloon Canton Railway

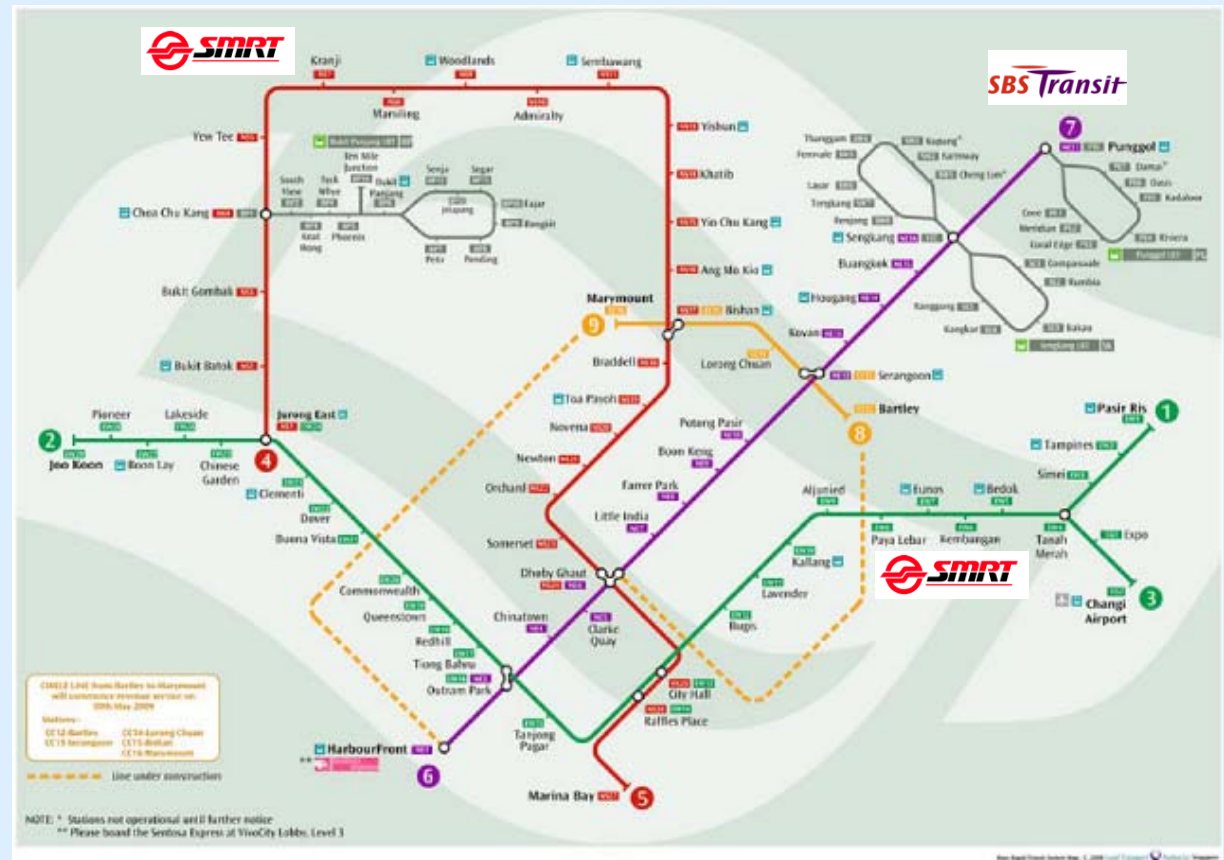
Singapore Mass Rapid Transit (SMRT)

- 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



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)



Ticket Vending Machines



Outdoor Station



Security

Kuala Lumpur Rail Transit



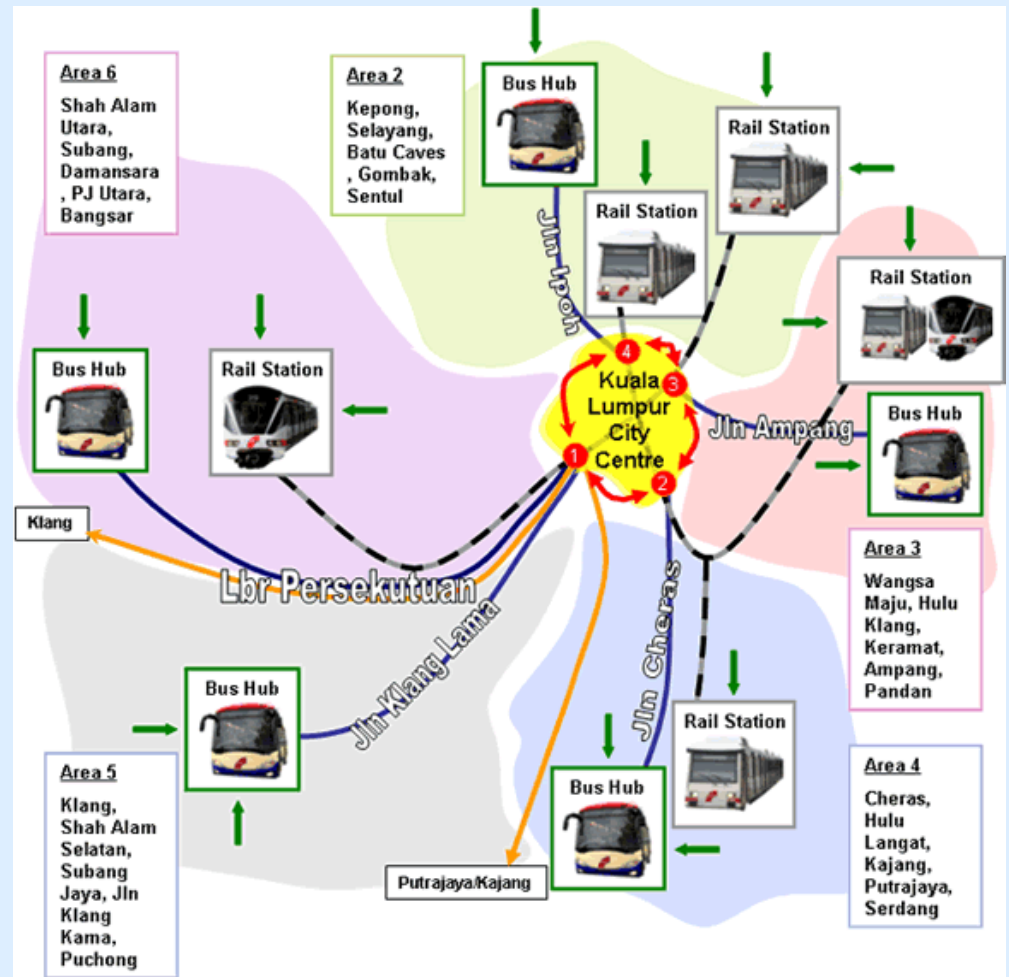
- **Multimodal operator**
- **16% overall mode share**
- **Ridership Bus:Rail = 4:3**
- **Regulated near-monopoly**
 - Infrastructure separated
- **100% publicly owned**
 - Infrastructure controlled by Ministry of Transport
 - Operator controlled by Ministry of Finance
- **Public takeover after earlier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



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



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



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 • 69 stations
 6 lines • 3 depots • 3 yards
 1.25 million daily passengers
 102 light rail cars • 384 subway cars
 3,800 employees • EasyCard AFC



TRTC 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



Observations

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

Acknowledgements



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- **Taipei Rapid Transit Corp. (TRTC)**