How Major Cities around the World are Sustaining the Transit Services to the Growing Passengers

YOUSEF KIMIAGAR
Vice President
Rail Systems Canada
Gannett Fleming
Toronto, Ontario
• Population growth
• Transit in major cities
• Ridership demand growth
• Network capacity limitations
• Solutions
• Best practices
HONG KONG
BEIJING
PARIS
TORONTO
GLOBAL RIDERSHIP

- 160 million passengers/day
- 50 billion/year
- 7.9% increase 2012-2015
UN PROJECTIONS - 2030

- World population over 8 billion
- Rural population to decline
- Urban population 4.9 billion (~60%)
- Average growth 1.7% / year

URBAN POPULATION GROWTH

Table 2. Total, urban and rural population by major area, selected periods, 1950-2030

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<td>Urban population</td>
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<td>15</td>
<td>22</td>
<td>23</td>
<td>31</td>
<td>1.96</td>
<td>1.18</td>
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- Europe 0.16%
- North America 1.05%
- Asia 2.12%

• Is the ridership growth proportional?
RIDERSHIP GROWTH

Ridership Growth 2014 - 2012

TOP RIDERSHIP CITIES

Network Length - Km

Number of Stations

[Diagram showing TOP RIDERSHIP CITIES with cities like New York, Shanghai, Beijing, Moscow, Seoul, London, Tokyo, Guangzhou, Mexico City, Paris, Hong Kong, with color-coded bubbles indicating ridership categories: 3 B < Ridership, 2 B < Ridership < 3 B, 1.5 B < Ridership < 2 B, Ridership < 1.5 B]
AVERAGE NETWORK DENSITY

Density million/km

Tokyo, Guangzhou, Hong Kong, Moscow, Paris, Mexico City, Beijing, Seoul, Shanghai, New York, London
PERFORMANCE CRITERIA

• Safe
• Reliable
• Sustainable
• Clean
• Accessible
• Comfortable
Long term ($$$$$$)
  – New infrastructure
  – New lines

Short term ($$)
  – Using the existing infrastructure efficiently
  – Maximizing the capacity
**London 2050 (Part 5).**

Further progress on the development of the Communications Based Train Control (CBTC) system on the Queens Boulevard Line connecting Queens and Manhattan in New York this week with the announcement of who has been awarded a $223.3 million contract. The radio-based CBTC technology provides real-time data on vehicle position and speed conditions, increasing the reliability of the system. As a result, the modernisation plans will include new tracks, longer platforms, a new signalling system and rebuilt depots. The cost of modernising signalling on four Tube lines has more than doubled.
MTR SEVEN LINE MODERNIZATION

1. Tsuen Wan – red line
2. Island – blue line
3. Kwun Tong – green line
4. Tseung Kwan O – purple line
5. Disneyland Resort – pink line
6. Tung Chung – orange line
7. Airport Express – green line
2015: Single contract $350m
Largest resignalling award at the time
CBTC technology solution
Interoperable
TOKYO
TOKYO

- Over 3b ridership
- On time, clean
- 32 trains/hour
- 2 new lines
  - Tokyo Station to the Rinkai
  - Central Tokyo to Shinagawa

• Since 1900 - over 5 million/day
• UTO: Line 1, 14
• Headway 105 => 85 sec (over 40 trains)
• Capacity up by 10%
• Power saving 15%

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<th>Line Description</th>
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<td>Line 14 (Meteor) UTO / 30%</td>
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<td>RATP Metro Line 1 UTO / 30%</td>
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<td>RATP Metro Line 13</td>
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<td>RATP Metro Line 12</td>
<td>2020</td>
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<td>RATP Metro Line 4</td>
<td>2022</td>
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http://media.firaben.es/content/S088011/Presentaciones/1_salaB/Estivals_Nicolas.pdf
NEW YORK SUBWAY

- Built over 100 years ago – end of Life (W4th St)
- Interoperable CBTC (I2S)
  - Canarsie - done
  - Flushing - construction
  - QBL - construction
  - 8th Ave – procurement
  - Culver line - procurement
- Backlog > 50 years

https://www.nytimes.com/2017/05/01/nyregion/new-york-subway-signals.html?_r=0
MTA’s FUTURE

- 2016: Governor Cuomo - $27 billion
- Largest investment in the history
- Leading MTA into 21st century
• 1025 New Subway Cars
  – Wider doors
  – Open gangway
  – Open space / Flip seats

• CBTC Implementation
  – Headway 90 sec
  – Dwell time 30 sec

MODERNIZATION UNDERWAY

31 Station
- Modernization
- Safety
- Reliability
- Efficiency
- Consistency
- Wayfinding
- Wi-Fi & USB ports
LONDON MODERNIZATION

TIIL said it needs to replace old signalling equipment

• Demand increasing by 60%

• TfL’s solution:
  – Heavily automated tube and sub-surface system
  – New trains: up-to-11% capacity gain with continuous internal space
  – Unattended Train Operation (UTO)
• Peak Tubes
• May 22, 2017
• 36 Trains/hour
• Headway 100 sec
• Dwell 40 sec

THE NEW TUBE FOR LONDON

• Faster, more frequent, more reliable
  – Piccadilly line
  – Bakerloo
  – Central
  – Waterloo
  – City lines

• Wider doors

• Platform edge doors

• Open gangway
4 LINE MODERNIZATION

• 40% of the LU Network
• Oldest built in 1863 (314 km track)
• Largest resignalling contract to date
• CBTC solution: 32 train/hr
• By 2022: capacity up 33%
  – District
  – Circle
  – Metropolitan
  – Hammersmith & City
BEST PRACTICES
AUTOMATION

Year 2014

- Asia: 57 lines
- Europe: 26 lines
- North America: 10 Lines
- South America: 4 lines

By 2025: over 2000 km

CBTC BENEFITS

- Increased safety/reliability
- Increased capacity (40 train/hr)
- Operation flexibility
- More accurate train arrival time
- Reduced energy consumption
- Less crew (one or none)
- Reduced maintenance cost
OPEN GANGWAY

- Increased capacity >> 10%
- Redistribute passengers
- Enhanced security
WALK BETWEEN THE CARS
## ENTRY/EGRESS CAPACITY

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<th>Model</th>
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<th>Max cars</th>
<th>Max doors</th>
<th>Doors per 100'</th>
<th>Units</th>
<th>Door width</th>
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<th>Max train length</th>
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Performing feasibility studies
Developing ConOps/ConMaint
Implementing systems engineering
Learning from lessons
Eliminating/minimizing constraints
Automating (CBTC)
Designing configurable train consist
Increasing train capacity - gangway/design
Minimizing dwell time
Increasing entry/egress circulation
THANK YOU

YOUSEF KIMIAGAR
Vice President
Rail Systems Canada
Gannett Fleming
ykimiagar@gfnet.com
+1 (416) 565-2562