Urban Rail Development in Tokyo: Integrated Public Transportation Planning

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Introduction
Motorization has been linked with increasing demands for mobility.

This mobility is mainly supported by the internal combustion engine that consumes vast quantities of energy, mainly petroleum.

Environmental impacts is a cost mostly assumed by the society.
CO2 Emissions by Transportation Mode

Business car incl. taxi and truck
Passenger car
Air transport
Bus
Railway

Source: MLIT, Japan (2005)
Typical Problems in Urban Transportation

Motorization Spiral

Car-dependent lifestyle
(car-oriented way-of-thinking)

More car-use/
Public transport
declining

Car-oriented urban
structure
Urban Density vs. Transportation-related Energy Consumption

Concept of Compact City

Compact city is a design concept that promotes relatively high residential density with mixed land uses.

Source: MLIT, Japan
Transit-oriented Development (TOD)

A mixed-use residential and commercial area designed to maximize access to public transport, and often incorporates features to encourage transit ridership.
Urban Rail Network in Tokyo
Modal share of commuters to CBD in Tokyo in 2000

Timeline of distributions of rail-use travelers (1970-2010)


Source: Tokyo Metropolitan Transport Census (2010)
Map of Tokyo
Example of land-use pattern around rail station

Map of Tokyo
Example of TOD (1): Development of Den-en-chofu

• Den-en-chofu was built based on the "Garden City" idea.
• In the early 1900s Mr. Eiichi Shibusawa bought, named and developed the area with the suburban rail development.

Map of Den-en-chofu and photos
Photos of recent developments in Tokyo
Towards Better Service Quality in Urban Rail Service
The Latest Urban Rail Master Plan in Tokyo

Background
• Rapid aging in population
• Globalization
• Decline of urban rail demand

Plan (Five Targets)
• Reduction of in-vehicle congestion
  – Average congestion rate at major 31 links: 150%
• Speed-up of rail service
  – Travel time saving from suburban to CBD
  – High-speed connections between major business cities.
• Contribution to urban development
• Improvement of accessibility to airports/high-speed rail stations
• Development of the seamless rail network
  – Up-grading of station facilities for transfer.
Recent Development of Rail Network in Tokyo After the Latest Master Plan

- Rail network has been gradually developed since 2000.
- In 2006, Tsukuba Express started its service connecting Akihabara with Tsukuba.

Network of Tsukuba Express

Length of developed rail network in the Tokyo Metropolitan Area after 2000

- Monorail, LRT etc.
- Improvement
- Double tracking
- New construction

Year

- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011

km

- 0
- 50
- 100
- 150
- 200
- 250

Lengths of network development:

- 2000: 59.9 km
- 2001: 61.9 km
- 2002: 75.1 km
- 2003: 79.2 km
- 2004: 86.5 km
- 2005: 129.3 km
- 2006: 147.6 km
- 2007: 147.6 km
- 2008: 177.6 km
- 2009: 200.1 km
- 2010: 202.1 km
- 2011: 221.2 km
Current Discussion on Planning

- MLIT will commission a committee for the next urban rail master-plan in Tokyo from November 2012.
- The preparatory committee has discussed the current /expected problems and future directions in urban rail service of Tokyo.

- Major issues discussed
  - Rapid aging in suburban areas
  - Expected changes in travel behavior
  - In-vehicle congestion
  - Service delay
  - Improvement of accessibility to airport
  - Improvement of accessibility to rail stations at CBD
  - Rail service under the emergency
Rapid Aging in Suburban Areas

Percentage of senior population over 65 years old

- 0~20 (%)
- 20~25
- 25~30
- 30~35
- 35~40
- 40~45
- 45~
Development of Seamless Rail Network

• A number of barrier-free facilities have been introduced into rail stations.

Share of stations with over 5,000 passengers/day that have introduced the non-step route in Tokyo
In-vehicle Congestion

- In-vehicle congestion has been reduced during the past ten years.
  - This is not because of the increase of traffic capacity but because of the decrease of traffic volume.
- However, the target of the national government has not been achieved yet.
Service Delay of Urban Rail in Tokyo

The wide-spread impact of service delay due to direct-through operation

Direct-through operation of urban rail service

Average service delay time during the observed days in 2010

Before Direct-through Operation

After Direct-through Operation

Total operation length of direct-through operated rail lines

Graphs
One of the possible solutions for service delay is the reduction of the in-station congestion at subway stations in CBD. Examples at Kachidoki Station:
- Installation of new platform and new exit (A2b)
- Separation of platform by direction
- Integration of concourse floors

One of critical issues is the allocation of construction cost among stakeholders including rail operator and developers.

Kachidoki Station

Map of station

Map of station
Smart Traffic Information

- Traffic information contributes to better departure time choices of rail users.
  - Mobile phones enable individuals to access traffic information even during travel.
  - The possibilities of providing dynamic traffic information through mobile phones and/or personal digital assistants should be explored.

**Type of behavior to avoid delays (Kato et al, 2012)**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count (n)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection of traffic information before departure</td>
<td>195</td>
<td>49.4%</td>
</tr>
<tr>
<td>From TV programs</td>
<td>89</td>
<td>(45.6%)</td>
</tr>
<tr>
<td>From the internet using mobile phones</td>
<td>49</td>
<td>(25.1%)</td>
</tr>
<tr>
<td>From radio programs</td>
<td>16</td>
<td>(8.2%)</td>
</tr>
<tr>
<td>From the internet using personal computer</td>
<td>6</td>
<td>(3.1%)</td>
</tr>
<tr>
<td>Earlier departure from home everyday</td>
<td>262</td>
<td>66.3%</td>
</tr>
<tr>
<td>Earlier departure from home particularly when an important meeting is planned</td>
<td>212</td>
<td>53.7%</td>
</tr>
<tr>
<td>Others</td>
<td>21</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

Example of in-vehicle integrated information system for smart-phone users

Source: JR East
Conclusion
History of Rail Network Development in Tokyo

- Basic rail network in Tokyo was completed around in 1930s.
- Private rail companies led the construction of suburban rail network with suburban development.
History of Rail Master-plans in Tokyo (Morichi, 2000)

Initial Stage
1900  First Railway Master-plan of Tokyo by Haraguchi, K.
1925  Official Master-plan by Ministry of Domestic Affairs  Central Tokyo Sta.

Growing Stage
1946  A Plan proposed by Postwar Rehabilitation Agency
1956  Urban Transport Committee’s Plan No.1
1962  Urban Transport Committee’s Plan No.6  Congested Station in 70s

Quantitative-Investment Stage
1968  Urban Transport Committee’s Plan No.10
1972  Urban Transport Committee’s Plan No.15  Photo

Qualitative-Investment Stage
2000  Council for Transport Policy Deliberation Report No.18

Timeline of Population in Tokyo

![Population in the Tokyo Metropolitan Area (x million)](chart.png)
Graph
Concluding Remarks

• Quantitative investment is, of course, required for dealing with growing traffic demand.
• However, at some point, an improvement of quality of service will become essential for more attractive public transport.
  – Less congestion/better comfort
  – Higher speed/less travel time
  – Easy connection at station
  – Useful traffic information
• Additionally the integrated planning of land-use and public transport could be one of key issues for achieving low-carbon urban society.