ANNEX D
Records on Study Tour to Japan

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1. Itinerary of Study Tour to Japan

Date		Beginning Time	Ending Time	Program	Accommodation
23-Aug	Sun	14:35	19:05	Manila to Haneda (Tokyo) (Flight No.: NH870)	Tokyo
		21:45	-	Check in at hotel	
24-Aug	Mon	10:30	11:30	Courtesy Call to JICA	Tokyo
		14:00	15:30	Courtesy Call to MLIT (Presentations about Overview of Japanese Urban Railway and Integrated Policy for Urban Development and Transportation in Japan)	
		16:20	18:00	Discussion with Prof. Morichi, National Graduate Institute for Policy Studies (Lecture on Urban Transport Policy in Asia) – Data 1	
25-Aug	Tue	9:45	17:30	Site Visit: Tokyo Metro Co. Ltd. (Counter Disaster Measures, Rail/Non-Rail Operation, Operation & Maintenance, Organization, Operation Center, Training Center, Depot) – Data 2	Tokyo
26-Aug	Wed	9:15	10:45	Site Visit: Tokyo Monorail – Data 3	Tokyo
		14:30	16:00	Site Visit: Shinjuku Station Multi Modal Transit Hub Construction Site	
27-Aug	Thu	9:10	11:40	Tokyo to Osaka (Travel by Shinkansen)	Osaka
		13:00	14:30	Site Visit: Mitsubishi Electric Factory	
		15:40	17:00	Site Visit: Kinki Sharyo Factory	
28-Aug	Fri	10:00	11:30	Site Visit: Osaka Station Non-Rail Business	Osaka
29-Aug	Sat	9:55	13:00	Kansai to Manila (Flight No.: PR407)	-

2. List of Participants

Name	Designation, Division and Organization
Mr. Rafael E. Peñafiel	Supervising Transport Development Officer, Rail Transport Planning Division, Department of Transportation and Communications, DOTC
Mr. Joseph Ishmael P. Ferrer	Engineer I, Office of the Director for Project Development Service, DOTC
Ms. Mikaela Eloisa D. Mendoza	Engineer I, Office of the Director for Project Development Service, DOTC
Mr. Alex G. Bote	Project Manager, UPMO-Bilateral Cluster, Department of Public Works and Highways (DPWH)
Mr. Elmo F. Atillano	Engineer IV, PPD-Planning Service, DPWH
Ms. Maripin Jacinto Faulan	OIC-Director, Office of the Assistant General Manager for Planning, Metro Manila Development Authority (MMDA)
Mr. Emilio M. Llavor	Chief, Planning and Design Division, Traffic Engineering Center, MMDA
Mr. Tomas Y. Macrohon	Project Manager IV, Project Management Department, Bases Conversion and Development Authority
Mr. Jayzon P. Mag-atas	Economic Development Specialist I, Infrastructure Staff, National Economic and Development Authority
Ms. Megan T. Barte	Planning Officer III, Bilateral Assistance Division of International Finance Group, Department of Finance
Ms. Leah Penarroyo	Senior Program Officer, JICA Philippines Office

Data 1

Presentation Material by Prof. Morichi (GRIPS)

Urban Transport Policy in Asia

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Prof. Dr. Shigeru MORICHI

Academic Fellow, Professor :

GRIPS National Graduate Institute for Policy Study

Director of Policy Research Center

Former Program Director of Development Policy

Former Program Director of Disaster Management Policy

Former President, Institute for Transport Policy Studies

Professor Emeritus : Tokyo Institute of Technology

Professor Emeritus : Tokyo University

- Birth Place & Date : Kyoto City September 29, 1943
- Education : Dept. of Civil Engineering, Tokyo University, 1966
- Academic Degree : Doctor of engineering, Tokyo University, 1974

Academic Societies

- Former President of Japan Society of Traffic Engineers
- Former President of Japan Society of Civil Engineers
- Former President of EASTS-Japan
- Former President of EAST : East Asian Society for Transportation Studies
- Former Board Member of Japan Society of Transportation Economics
- Former Board Member of Japan Society of Urban Planning

Government Council (-2010.2)

Council for National Development Plan: Vice Chairman

the Planning Committee : Chairman

Council for Infrastructure Policy: Vice Chairman

the Division for Research & Development : Chairman

the Division for Road Policy : Vice Chairman

the Committee for Basic Issues : Chairman

Council for Transport Policy

the Division for Research & Development : Chairman

the Division for Railway Policy : Chairman

the Division for Port Policy : Vice Chairman

Council for Transport System in Kanto Region : Chairman

-2015

- Council for National Resilience
- Committee on Airport Management against Earthquakes and Tsunamis
- Council for Urban Planning in Yokohama City : Chairman

Chairman of Planning Committees in foreign countries

- High speed railway projects
  in Malaysia(1980's), Viet-Nam(2011-4), India(2014-), and Indonesia(2014-),
- National-wide comprehensive transportation plan
  in Pakistan(1980's), and Vietnam(VITRANSS 1 : 1998-2000) (VITRANSS 2 : 2005-06)
- Urban transportation plan
  in Lahore, Pakistan(1980's), Manila (1994-5), and Ho Chi Minh(2002-3)
- Founding project of the Hanoi Metro(2013-)

Urban Transport Policy in Asia

Lecture for
the high government officials of the Philippines

Aug. 24, 2015

GRIPS

Prof. Dr. Shigeru MORICHI
Director, Policy Research Center
National Graduate Institute
for Policy Studies (GRIPS)

Contents

1. Introduction

Japanese Railway Policies that bought International Impacts

① High Speed Railway : Shinkansen
② Airport Access Railway : Monorail for Haneda Airport
③ Privatization of Japan National Railway
④ Urban Railway service in Tokyo
- Hierarchical Network of Urban Railway
- High density of Urban Railway Network
- High Frequency Operation of Trains
- Direct Operation of Trains between Different Lines
- Transit Oriented Development

Thai Transport Policies that bought International Impacts

① Meter Taxi :
Deregulation brought the service improvement
② BOT Railway in Bangkok
Successful Sky Rail Project and Failure of SRT Project
③ High Fare for Urban Railway :
Higher fare of urban railway than the existing public transport and getting the high income passengers

↓

Important information for other Asian Megacities

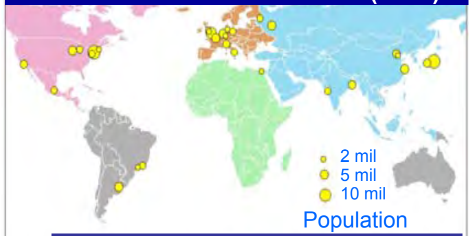
↕

Requirements for Asian Megacities

2. Urban Transport in Asia

Location of Mega-cities

World 30 Largest Metropolitan Areas (1950)



☞ In 1950, only 7 cities from Asia

Metropolitan Areas with Population >5 mil (2010)

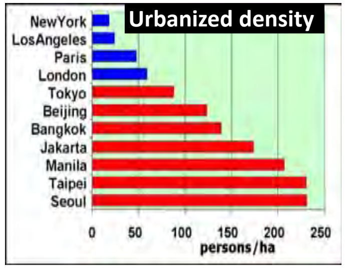
☞ Out of 52, 27 cities from Asia

2. 1 Typical Characteristics of Asian Megacities

Difference from metropolitan areas in US & Europe

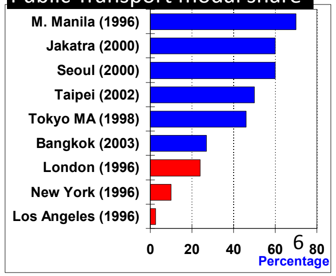
① ***Economic growth and urbanization :***

- Huge size of mega-cities
- Rapid growth of population and car ownership
- Mono-centric city structure
- Weak land-use control and Mixed land-use



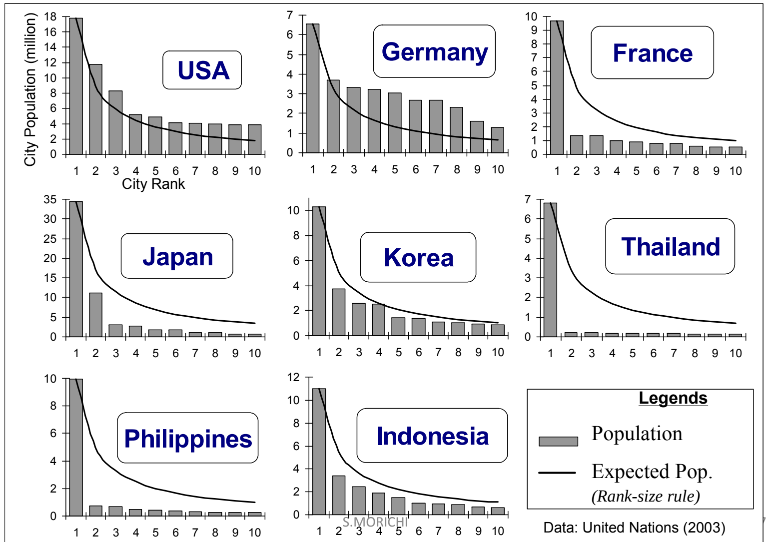
② ***Transport infrastructure and services***

- Hierarchically unbalanced road networks
- Higher share of public transport
- Rapid motorization
- Lack of inter-modal coordination
- Higher traffic accidents

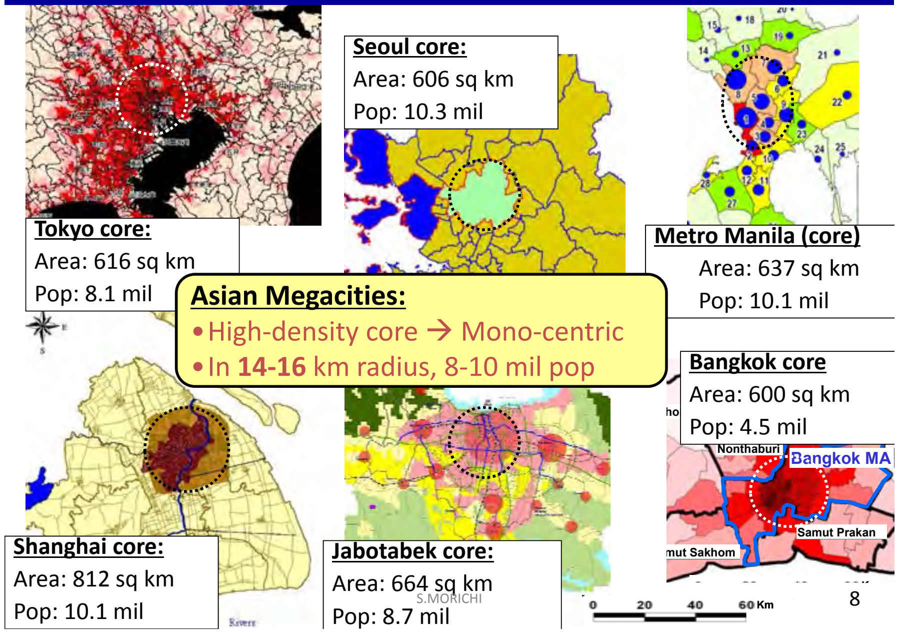


2.2 Urban Structure

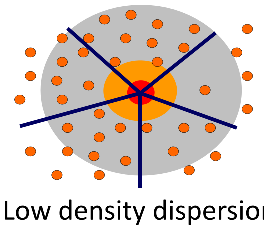
City-size distribution ☞ In Asia, over-concentration in capital city



Urban Structure and Transport: Mono-centric urban form

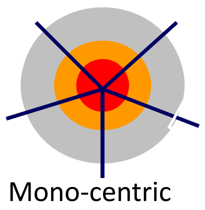


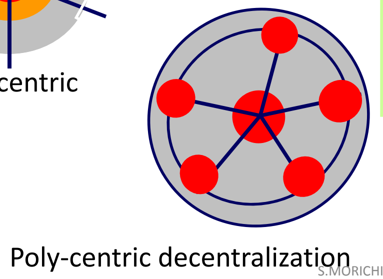
Population Decentralization: possible spatial patterns



- Car-oriented sprawl

→ Undesirable !



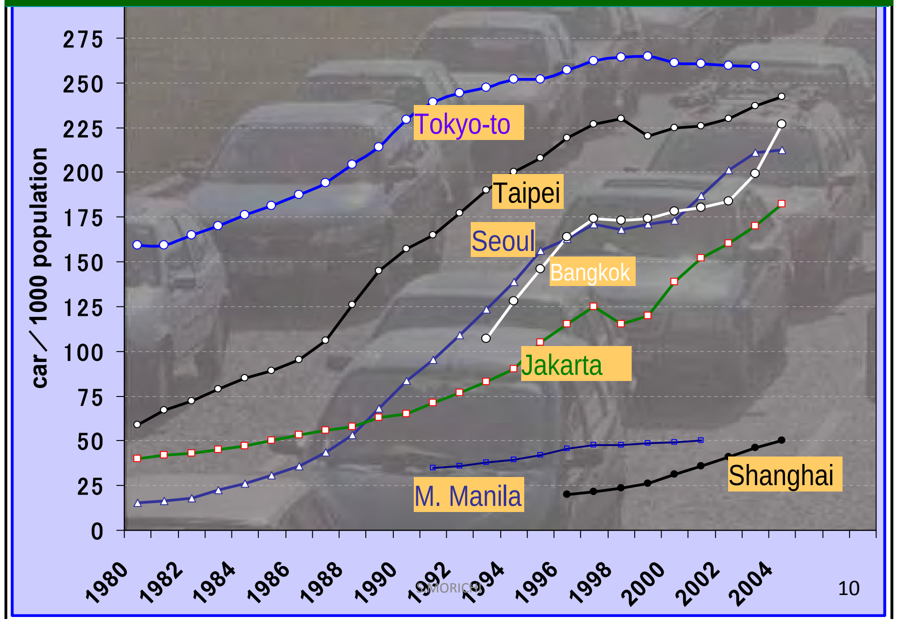


- Public-transport oriented poly-centric form

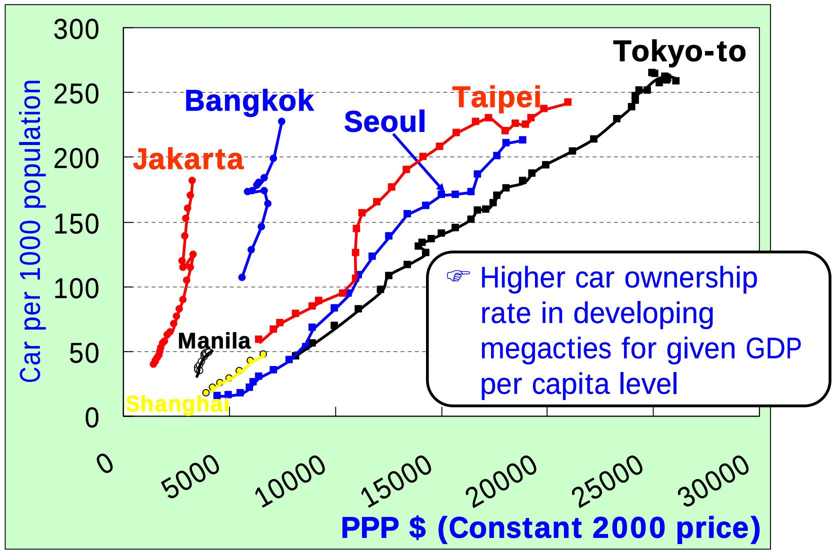
→ Desirable!

Or Transit corridor with weak centers

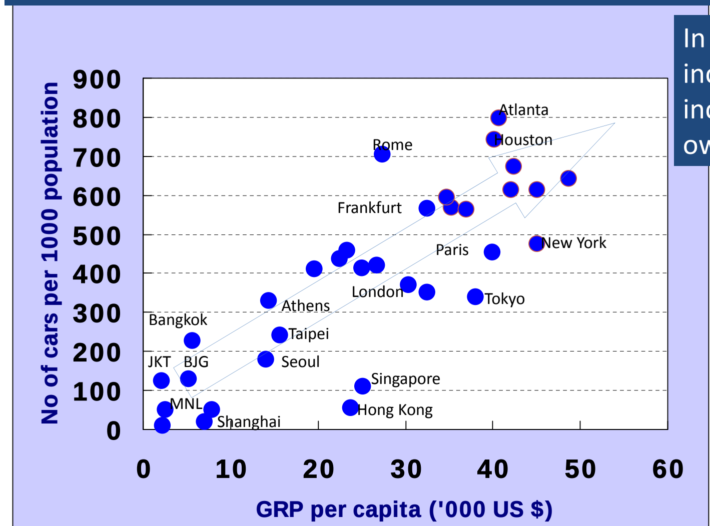
2.3 Car Ownership and Road Transport



GDP per capita and city-level car ownership rate



GRP per capita Vs car ownership rate: Selected metropolitan areas (2002~04)



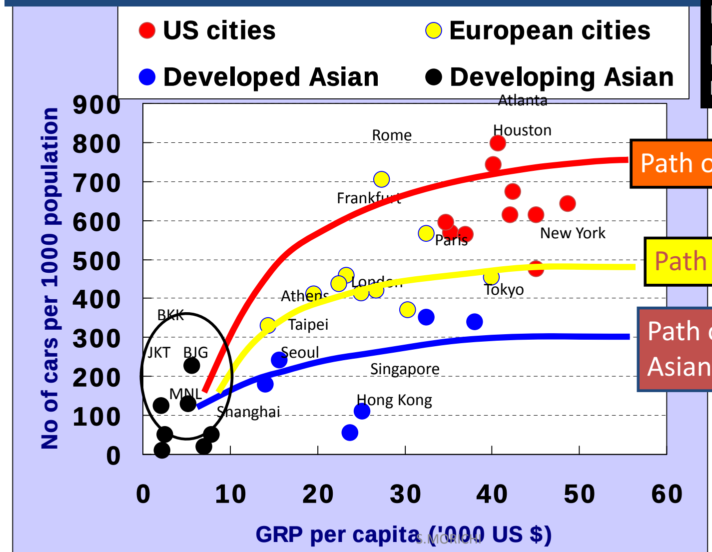
Data source: STREAM Study compilation from various sources

In general, income growth increases car ownership rate

GRP per capita Vs car ownership rate:

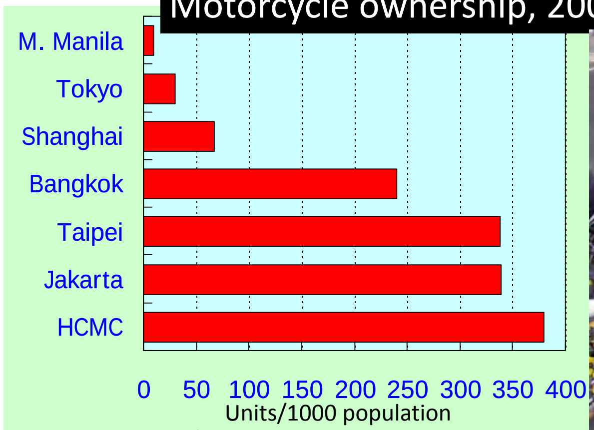
Selected metropolitan areas (2002~04)

Alternative paths for Asian Dev'ping cities?



Data source: STREAM Study compilation from various sources

Motorcycle ownership, 2004



Data source: STREAM study, 2006

Rapid growth in motorcycle ownership

Pressure of motorization at early stage

Impact on environment and safety

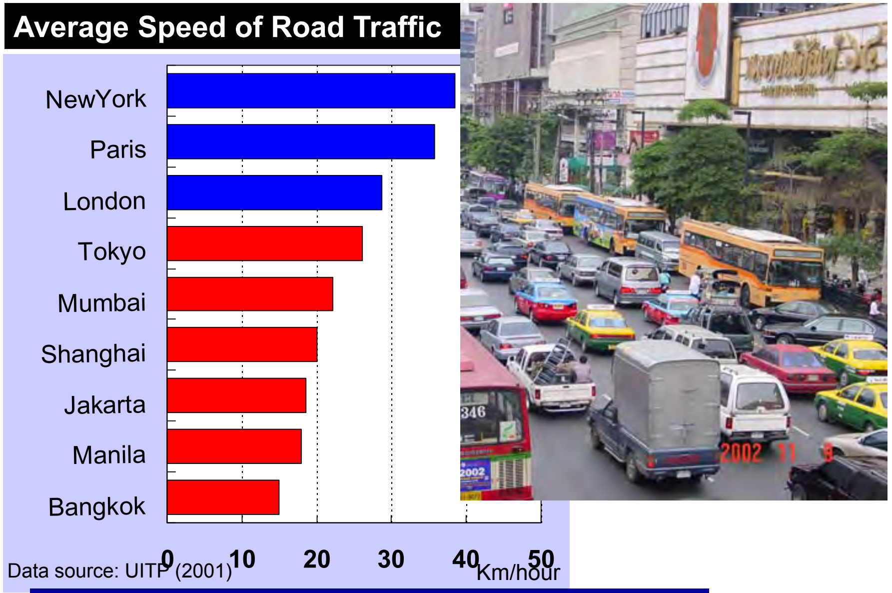
Road Space in Selected Cities 2004

	Area (Km2)	Pop. Density Per/ha	Road Area Km2	Road Area % (city area)
City of Paris	105	202	27	**25.8**
New York City	678	112	210	**25.2**
Inner London (12 boroughs)	589	72	96	**16.4**
Inner Tokyo (8 wards)	110	121	24	**21.7**
Tokyo 23-wards	621	131	114	**18.1**
Seoul City	605	168	80	**13.3**
Taipei City Inner Core	134	197	20	**14.9**
Shanghai City Inner Core	108	378	13	**12.0**
Bangkok City Core	225	96	16	**7.2**
Jakarta City	656	133	48	**7.3**

Data source: STREAM Study compilation

Asian Megacities

- In adequate road
- Inefficient road hierarchy



☞Result → severe traffic congestion !

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Policy Response to Congestion → Build Expressway

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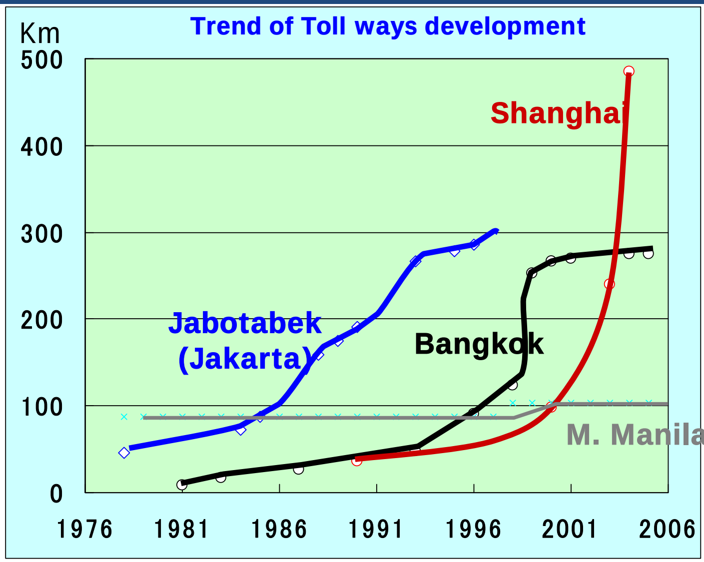
Some cities have developed Toll ways rapidly…



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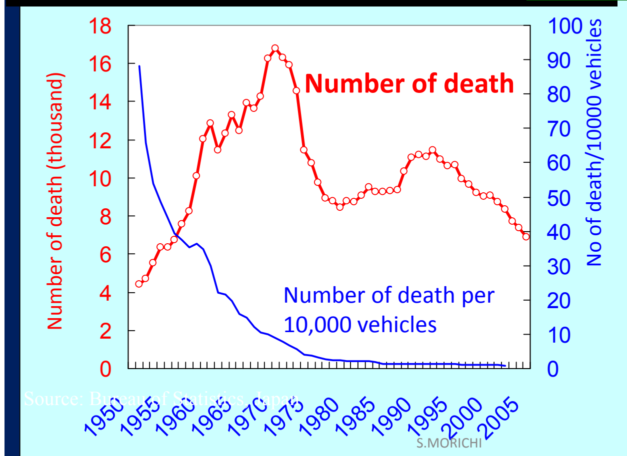
Under rapid motorization challenging accident dynamics

Japan: # of death : from 16765人(1970) to 4411人(2012)

# of cars : 79,620,000
# of death / 10,000 cars
= 0.556

road traffic accident death in Japan



2018 Target
2500人/year

- How to avoid the peaking of fatalities?
- Possibility of stabilizing total fatalities earlier?

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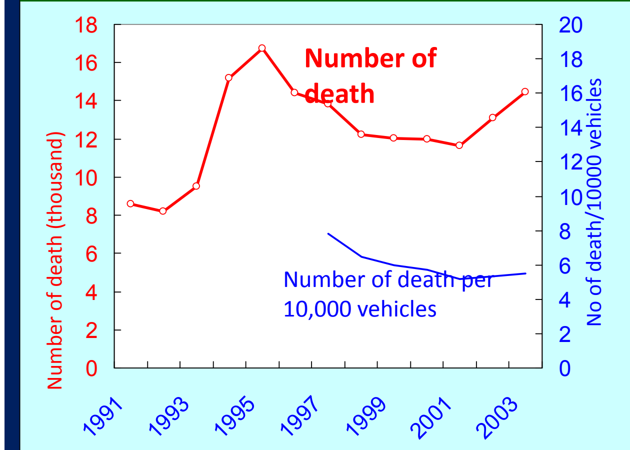
Thailand: following Japanese pattern?

Trend of road traffic accident in Thailand

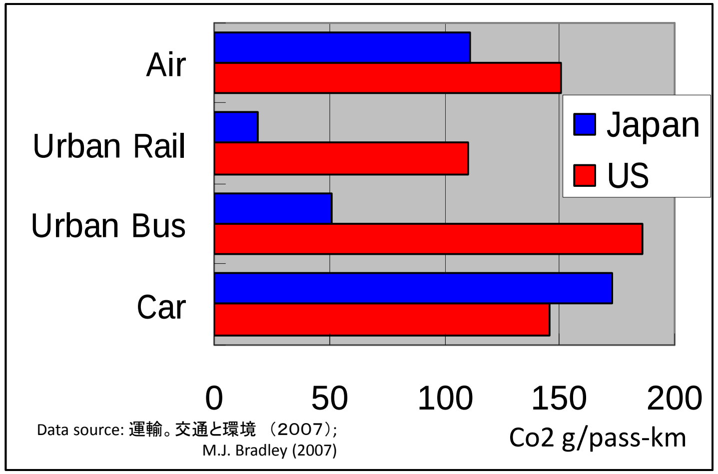


Notes:

- Motorcycles included in vehicles pop
- Vehicle population over-estimate
- Is it possible to achieve Japanese rate of 0.56 death per 10000 vehicles?

Japan # of cars : 79,620,000
# of death / 10,000 cars = 0.556

CO2 Emission by transport mode: Japan and US



Significant difference in urban public transport modes: why? Due to different urbanized density and public transport ridership?

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2.4 Public Transport

- Toward better transport service that is..
  - Accessible and Efficient (Economically efficient)
  - Clean and healthy (Environmentally sound)
  - Safe, Affordable, Inclusive (Socially acceptable)

Diverse modes in Asia

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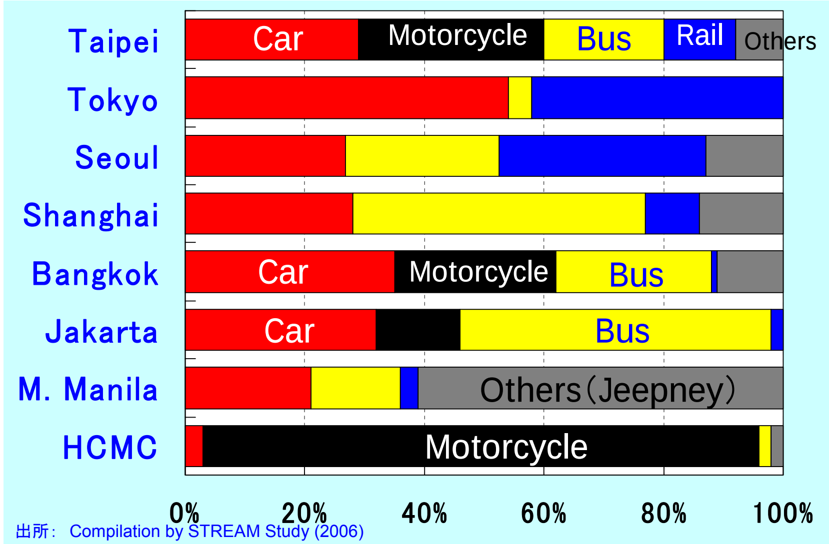
Modal split（1998～2004）



Developing cities：Bus & Para-transit main modes for Public Trans.

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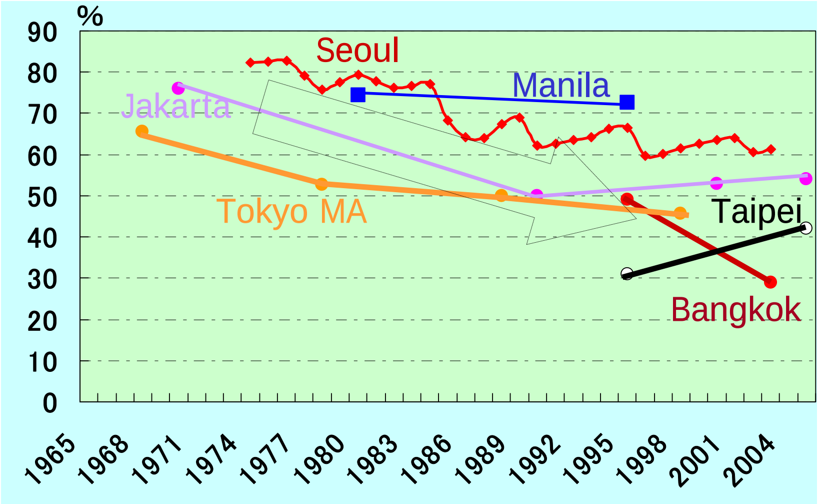
Trends of public transport mode share



☞In general, public Transport mode share on declining trend

Asian megacities: breeding ground for Public Transport reform

Examples:

- **Tokyo, Osaka, Seoul: Extensive MRT network**
- **Taipei, Shanghai, Beijing, Bangkok: Rapid expansion of MRT network**
- **Seoul, Taipei: Innovative bus reform**
- **Jakarta: introduction of BRT System**

BRT for Asian megacities

- **Low-cost alternative for MRT??**
- **Capacity and road space issue**
- **BRT Vs MRT → BRT + MRT**

Miss understandings for LRT and BRT in Asian Mega-cities

- LRT and BRT could not cover the huge demand
  - Not for trunk corridor, only for feeder lines
  - ex. Failure in Manila
    - three hours waiting time for LRT 3
- Required MRT in mega-cities
  - ex. Yamanote Line in Tokyo ;
    - ･ The capacity of one vehicles ; 250 persons
    - ･ 11 vehicles in one train
    - ･ Frequency ; every 2minutes operation

Policy experience: Bus reform

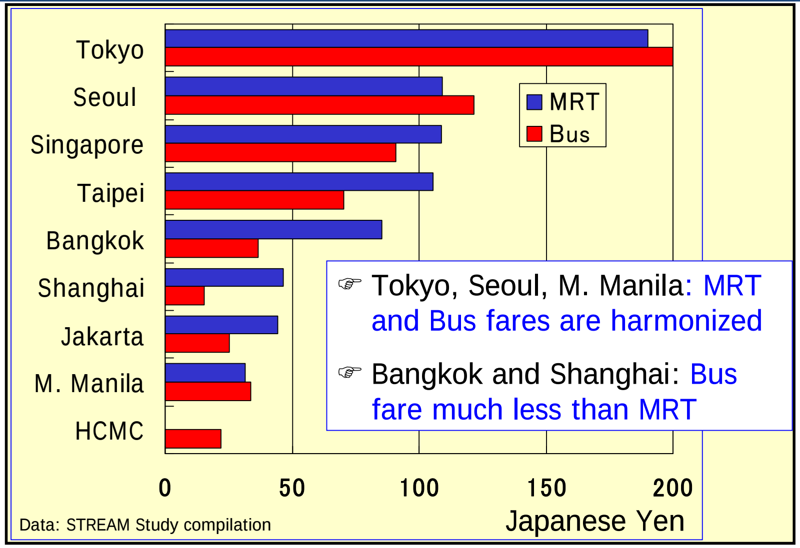
Bus reform in Seoul and Taipei:

Common features

- Comprehensive reform: modernization, Median bus-lane, IC-ticketing, fare and service integration with MRT, fare-discount for transfer (distance-based fare)
- Improvement in service and ridership, Differences:

Taipei	Seoul
Reform through gradual process	Reform through major intervention
Ownership and operation largely by private sector; regulation by public sector	Public-private partnership in management and operation, significant role of public sector
No direct subsidy (indirect cross-subsidy from MRT for fare discount)	Significant financial burden on public sector (direct subsidy)

Public Transport Fare for a 10 km one-way trip (2007)



Note: Bus fare is for Air-conditioned bus; LRT in M. Manila and BRT in Jakarta are considered as MRTs.

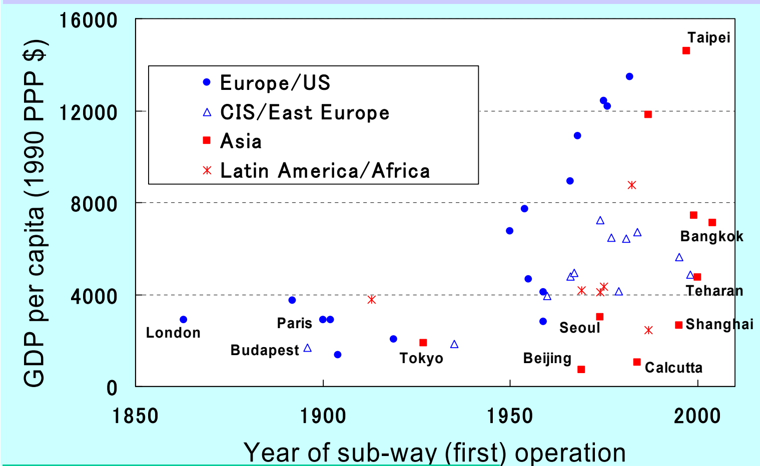
Comparison of Taxi and MRT Fares (US$) 2007

	Taxi	MRT	Fare Ratio	Number of passenger to make taxi ride cheaper
Jakarta*	0.42	0.37	1.14	2 persons
Manila	0.75	0.26	2.92	3 persons
Bangkok	1.10	0.44	2.50	3 persons
Shanghai	1.45	0.40	3.63	4 persons
Singapore	1.63	0.45	3.59	4 persons
Hongkong	1.92	0.51	3.74	4 persons
Seoul	2.00	0.95	2.11	3 persons
Taipei	2.12	0.61	3.50	4 persons
New York	2.50	2.00	1.25	2 persons
Frankfurt	2.70	2.25	1.20	2 persons
Rome	3.15	1.36	2.31	3 persons
London	4.37	3.03	1.44	2 persons
Tokyo	5.78	1.40	4.13	5 persons (not allowed !)
Paris	7.02	1.91	3.68	4 persons

*BRT

Timing of subway opening: Income stage

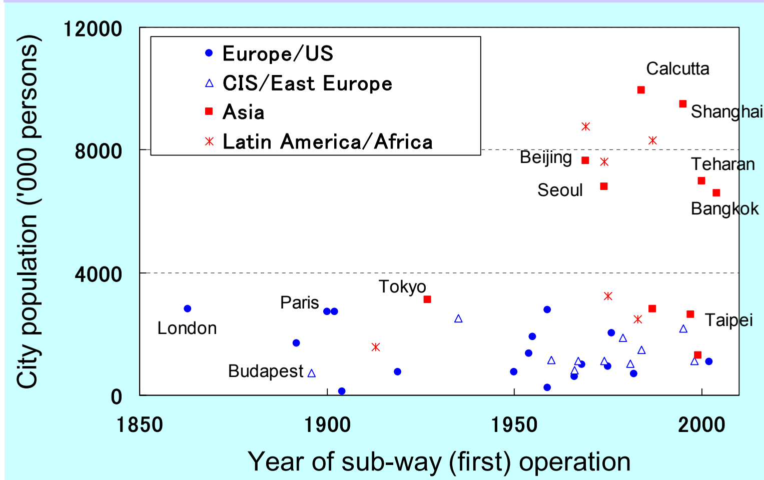
Opening year of the first subway and income per capita



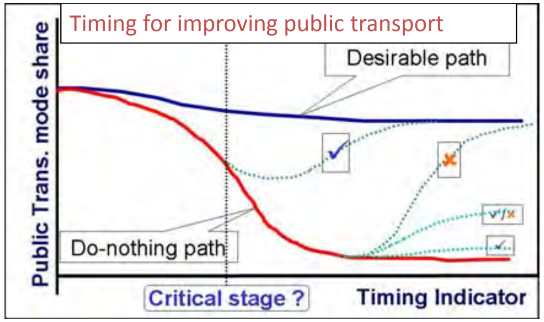
Data source: OECD (2003); http://osamuabe.ld.infoseek.co.jp

Timing of subway opening: City population

City population and opening year of the first subway



Timing of MRT development: to maintain the high share of public transport mode



Multiple timing indicators

Indicators	Right timing when….
Income	**high enough** for charging reasonable fare
Car ownership	**not too high** to ensure good patronage
Population	**high enough** for threshold demand volume
Urban density	**Not too low** for required passenger density

☞ Timing should be decided considering the state of all indicators !

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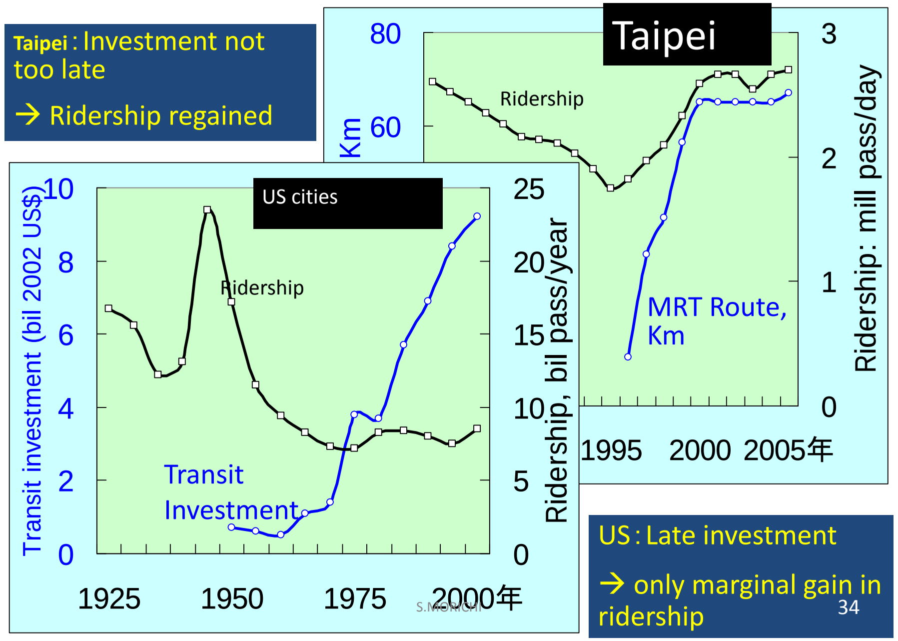
Timing of transit investment and ridership trend



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1.5 Conclusion

Modal share is still high in Asian Megacities, however it is going down. What are key issues ?

1. Without Railway, with BRT and with LRT, it is impossible to manage the transport in Asian Megacities.
2. Hierarchy railway network is required in future for megacities as same as road network.
3. Profitability of railway operators is required for the Innovation of service and technology.
4. The fare of Bus and para-transit have to be compatible to railway. Bangkok case is remarkable for successful higher fare.
5. The timing of investment for urban railway is important, however the master plan should be prepared at early stage. The master plan of urban railway network in Tokyo in early1960's.

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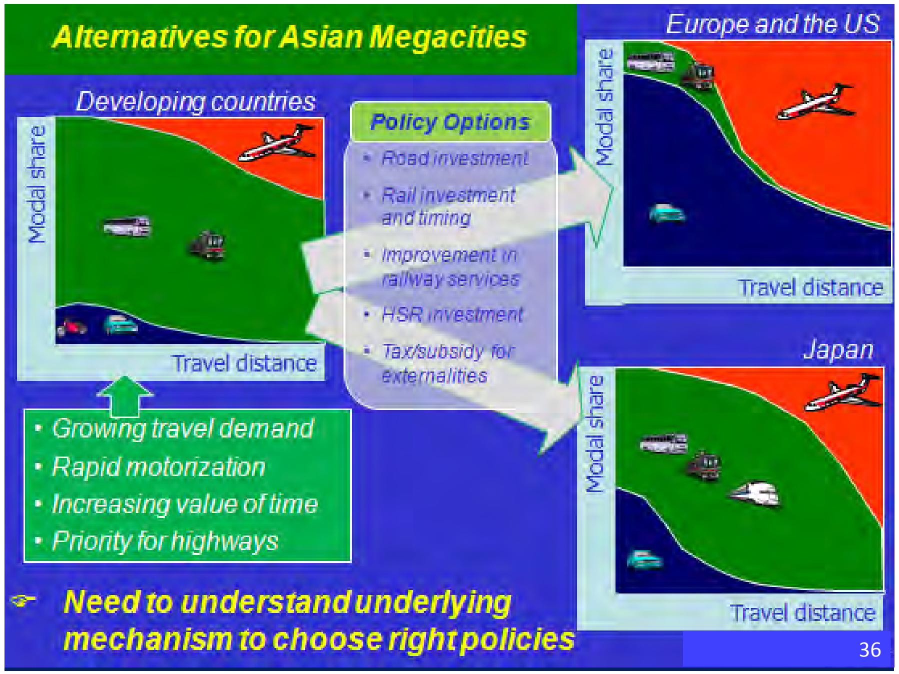
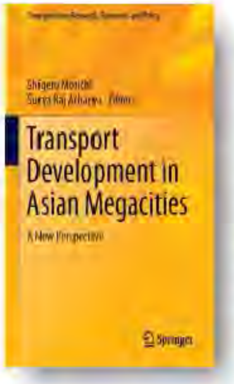


Published in July 2012.

Springer
springer.com



Shigeru Morichi, National Graduate Institute for Policy Studies (GRIPS), Tokyo, Japan; Surya Raj Acharya, Institute for Transport Policy Studies (ITPS), Tokyo, Japan (Eds.)

Transport Development in Asian Megacities

A New Perspective

The rapid growth of the Asian urban population concentrates on a few large cities, turning them into giant megacities. Despite new theoretical insights into the benefits of megacities, the emerging Asia is facing a daunting challenge concerning the management of infrastructure and services in their megacities. The deteriorating urban mobility is the most difficult challenge with respect to the sharp increase in vehicle numbers and to inadequate and poorly managed road infrastructure. Public transport, a sustainable mode of mobility, is subjected to a vicious cycle of poor service, decreasing ridership and lower investment. Despite various policy initiatives, the situation has not improved. The scale and growth pattern of Asian megacities have distinctive features which generate a unique set of challenges and opportunities. New perspectives are needed to effectively address the transportation problems making the best use of available opportunities. This book, which is a result of an international collaborative

Contents

3. Transport Policy in Japan

1950's
- Expansion of Capacity and Network (Railway, Road, Port, Airport)
- Financial Scheme / Transport rerated organizations
- Start of Expressway & Shinkansen projects

1960's
- Urban expressway
- Improvement of Terminal (Rail, Bus)
- Horizontal Division of Rail and Road
- Direct Operation between Subway and Suburban Rail etc.

1970's
- New Transportation Systems
- Transportation System Management
- Rail – Bus Transfer Terminal, etc.

1980's
- Transportation Demand Management
- Privatization of Japan National Railway

1990's
- Public – Private – Partnership
- Incentive Scheme for Private Railway

2000's
- Coordination Scheme for Transport Industries

New Policies for Better Connectivity, Service and Safety

2005: The Law for Urban Railway Improvement
: The Law of Passenger Information for Foreign Travelers
2006: The Law of Universal Design
① Accessible and Usable Building Law
② Barrier Free Transport Law
③ Transfer Service Improvement
2007 : The Law for improvement of Regional Public Transport
: The Law for Regional Infrastructure Improvement
2008: The Law for Regional Railway
2009: The Law for Safety of Taxi (Improvement of Deregulation Policy)
2010: The Law against Tsunami Disaster
2013 : The Law for Earthquake-proof buildings and infrastructures
2014 : The law for Compact City under declining population
: The Basic Law for Transportation
: the Law for support for Foreign Transport and Urban Development

3.1 Examples of Intercity Transport Policies

Railway:

Successful policy : High speed railway (Shinkansen)
Privatization of JNR
Airport access railway

Failure policy : Provincial railway investment
Cross subsidy between HSR and Local lines

Road :

Successful policy : Toll road network
Financial scheme
Special account and toll road
Transport safety
ITS

Failure policy : Two lane expressway

Port

Successful policy : Location of industries in each region
Investment for local ports

Failure policy : Decentralization of port authority
Efficiency of port management and labor union

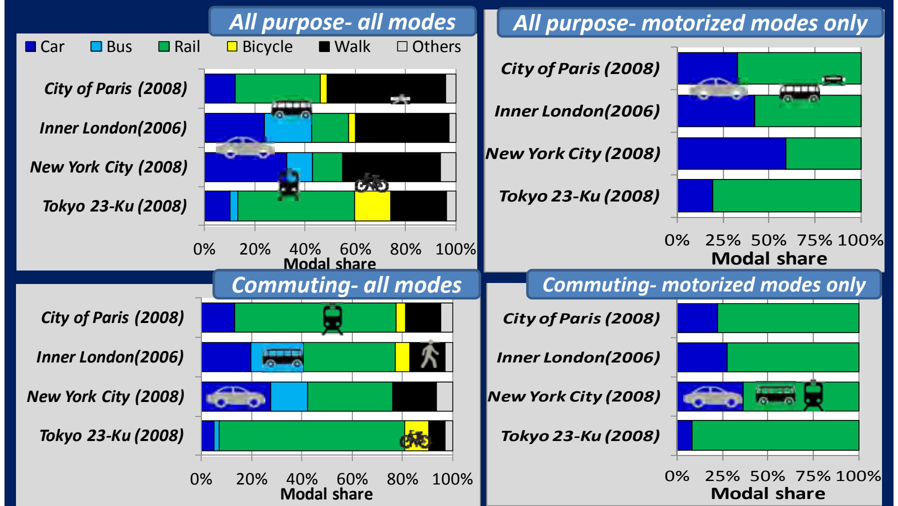
Airport

Successful policy : Investment scheme for airports
Relocation of airports for jet planes

Failure policy : Delay of Narita airport
Location of Kansai airport

3.2 Examples of Urban Public Transport Policy

Modal share in selected metropolitan cores (trip based)



Data source: person trip survey from respective public agencies; Data year is indicated in the parenthesis after the name of each city; For Paris, Rail also includes Bus

How does the TMA Achieve High Modal Split for Public Transport?

① High Railway Network is Constructed before Moralization

② Railway Oriented High Density Urban Development

③ Role of Private Railway Companies (Coordinating Transport and Land Use)

④ New Town Development (Rail Transit Oriented)

⑤ Direct Railway Operation between Suburban Railway and Subways

⑥ Circular Line Connecting Terminal Stations

⑦ Hierarchical Urban Railway Network

1) Profitability of Urban Railway

- Subsidy for Subway
  - Japan : 50% of Subway Construction Cost (25% Government, 25% Local Government)
  - No subsidy for operation cost
  - US & EU : 100% of Construction Cost, 20-80% of Operation Cost
- Profitability
  - Except Japan, Only Taipei : profitable for operation cost
  - Railway operators in Tokyo enjoy the profitability (At the first stage not profitable)
- Only the profitable railway companies innovate the system, technology and service.
  - Unprofitable company cannot take the risk to change the system.
- All railway operators in Tokyo enjoy the profitability.

Major policy issues in US and EU :

- Benchmark regulation to improve the efficiency of railway operators
- Expansion of network through public investment
- Better service and fare through government efforts

Major policy in Japan :

- Incentives for railway operators
- Private railway operators and operators by Local governments make efforts for better service under the competition
- Only profitable operators can innovate the railway system
  - R&D, Expansion of network, Improvement of System, etc

To keep the future profitability

Organization, Management, Efficient technology, Subsidy, Suitable fare level, Consistency between rail and urban development, etc

Operational characteristics of selected subway systems (2005)

	Tokyo		Seoul[1]		Taipei	London	New York[2]
	Tokyo Metro	Toei	Seoul Metro	SMRT			
Route (km)	183	109	135	152	67	408	371
Passengers (mil/year)	2,110	761	1,440	819	361	971	1449
Pass/km/day (1000 persons)	**32**	**19**	**29**	**15**	**15**	**7**	**11**
Revenue /cost	**1.29**	**1.07**	**0.74**	**0.55**	**1.07**	**0.59**	**0.51**
Fare (US$)	**1.3 ~ 2.5**	**1.4 ~ 3.5**	**0.8 ~ 1.1**		**0.6 ~ 1.9**	**3.0 ~ 8.0**	**2.0 ~**

1. data year 2003, 2. revenue/cost includes also of bus
2. Data source: Seoul (Sung 2007), rest from homepage of respective agencies

☞ Ridership & fare policy are key factors

Financial Resources for Public Transport and Related Key Issues

① Fare
② Cross Subsidy ┐ ･･･ ┌ Operators' Initiative
③ Value Capture ┘ └ Regulators' Role
④ Subsidy ･････････ Public Sector's Decision

⑤ PPP Scheme
- Limited Successful Projects
- Failure of Public and Private Sectors
- Competitiveness of Project in the World-wide market
- Difference the Optimizations between Public and Private

① Fare for Profitability

- Fare Regulation and Political Decision
- Balance between Bus and Railway
  Competition under the Different Costs
- Regional Disparity between Prior and Inferior Regions
- Transport Behavior by Income Segmentations
  and the Time Series Change

Philippines' Example :
LRT3 Fare and Deregulation for Air-conditioning Bus

Thailand' s Example:
High Fare for New Urban Railway :
High Income Passengers


SRT Station and inside of Vehicle

⇕

Sky Train Station and inside of Vehicle


② Cross Subsidy between Routes

- Profitable and Efficient Organization
- Profitability of Urban Railway Operator
  Tokyo Metro and Hanoi Metro
- Rationale for Cross-subsidy
- Independent PFI Projects

Rationale for Cross-subsidy
- Financial support at the first stage
- Risk taking for innovation / technology, service, etc.
- Regional Disparity between Prior and Inferior Regions
  because of different ⇔ service and fare
- Inefficient investment and operation

Cross Subsidy Scheme
- Private or public organization Political pressure
- In same organization or between ⇔ different organizations
- Direct cross subsidy or through government
- Independent PFI Projects lack of cross subsidy

③ Subsidy

- Disincentive for efficiency
- Incentive for Operators
- Neutral for Transport Modes
- Difference between EU, US and Japan
- Role of Government for PFI Projects

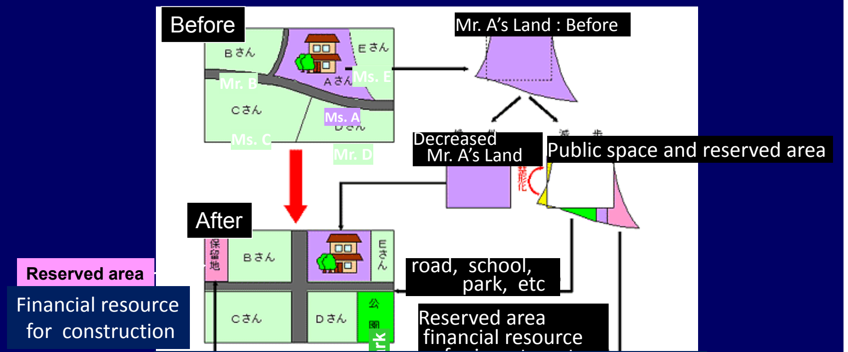
Subsidy for each mode

	Central Government	Local Government
Subsidy for Subway : Construction cost	35%	35%
for Monorail: Infrastructure	30%	30%
for LRT : Track, Station etc.	33%	33%
Subsidy for Newtown Railway : Construction cost	15%	15%
Interest free financing for JOBAN-SHINSEN : Construction cost	40%	40%
: Equity	0%	less than 20%
Subsidy for grade separation of rail and road crossing	28.7 - 63.3%	57.3 - 31.6%

④ Value Capture

- Transit Oriented Development
- Multi-core Urban Structure for Mega Cities

Land Readjustment



Land readjustment project
Public & Private Sector can organize the project
Government can support the project
Subsidy for the project
Change the zoning of land-use
Deregulation for urban development and building
Investment for infrastructure

Scheme of Value Capture

- Development business by Railway operator
  (JR, Taiwan HSR, etc.)
- Land readjustment business with railway operator
  (Private railway in Japan, Tokyu, etc.)
  Tsukuba express railway
  (Land Readjustment law for Railway)
- Subsidy by increment property tax and other tax revenue

- IF : Impact fee
- TIF : Tax Increment Financing
  (Special Assessment District)

From Japanese experience:

- Urban railway can be profitable.
- Main Revenue of railway company
  - 1st step (Population is limited) : housing, real estate
  - 2nd step (population increased) : high land price, all business increased railway passengers
  - 3rd step (almost land was sold out) : railway, urban renewal, etc
- Profitability is essential for innovation of system.
- Railway Company is key factor of attractiveness of area (Attractiveness decides the land price)

How can such projects become possible ?

- Profitability of Railway Company
- Agreement by land owners and citizens
  - Improvement of environment
  - Increase of property value (higher land price of smaller space)
- Difference of land prices before and after the project
  - (Land use regulation, reasonable reduction of space)
- Speedy Implementation of the projects (Role of government)
- Support of Central and Local Governments
  - Coordination
  - Subsidy for the project
  - Change the zoning of land-use
  - Deregulation for urban development and building
  - Investment for infrastructure

⑤ PPP Scheme

Limited successful projects for railway

- Failure of public and private sectors
- Competitiveness of project in the world-wide market

Change of PFI scheme : PF2 from PFI in UK

- too much profit of private sector
- too much cost after the withdraw of the private sector
- time consuming process of PFI

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Land Acquisition	Public	Public	Public	Public	Public	Public
Civil Work	Public	Private	Public	Public	Public	Public
E & M	Public	Private	Private	Public	Public	Public
Rolling Stock	Public	Private	Private	Private	Public	Private
Operation	Public	Private	Private	Private	Private	Public
Maintenance	Public	Private	Private	Private	Private	Public

Case1: JNR Shinkansen Case2: Taiwan Shinkansen
Case4: Present HSR in Japan

Examples of PPP urban railway projects in Asia

Data source : ITPS, Institute for Transport Policy Studies

Seoul Metro Line 9 :

- Change of MRG (Minimum revenue guarantee)
- Government rejected the SPC report for increase of fare
- Lawsuit against government
- Withdraw of MKIF (Macquarie Korea Infrastructure Fund) and Hyundai Rotem

Delhi Airport Express Line

- Delay of construction and broken parts
- Lack of demand and revenue
- Lack of revenue from rental business
- Transfer the project to the Delhi Metro(public sector)

Bangkok Metro

- Lack of demand and revenue
- Excess of assets
- Debt rescheduling, Loan condition changing
- Financing by public corporations
- Revision of fares

Taipei MRT Xinyi Line

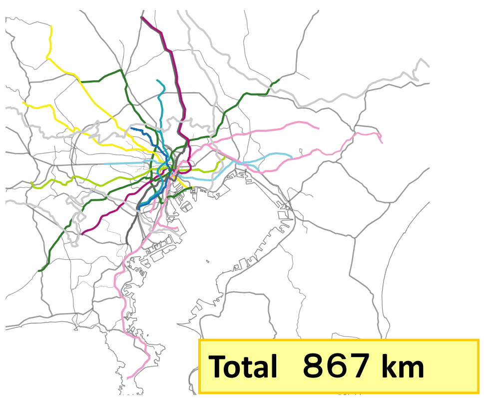
- DORTS (Dept. of Rapid Transit System, Taipei City)
  Construction, Vehicles, Control and signal syatem
  Subsidy of Central Gov. : 32%
- TRTC (Taipei Rapid Transit Company) : Operation
  Taipei City(74%), Central Go.(17%), New Taipei City(9%)
  Private Co. (0.3%)

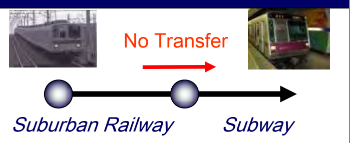
How can such projects become possible ?

- Profitability of Railway Company
- Agreement by land owners and citizens
  Improvement of environment
  Increase of property value (higher land price of smaller space)
- Difference of land prices before and after the project
  (reasonable reduction of space)
- Speedy Implementation of the projects (Role of government)
- Support of Central and Local Governments
  Coordination
  Subsidy for the project
  Change the zoning of land-use
  Deregulation for urban development and building
  Investment for infrastructure

2) Urban railway network

① Direct Railway Operation between Suburban Railway and Subway





Urban Railway Lines of Direct-Through Operation in Tokyo

Direct Railway Operation between Suburban Railway and Subway

For Suburban Railway Operators

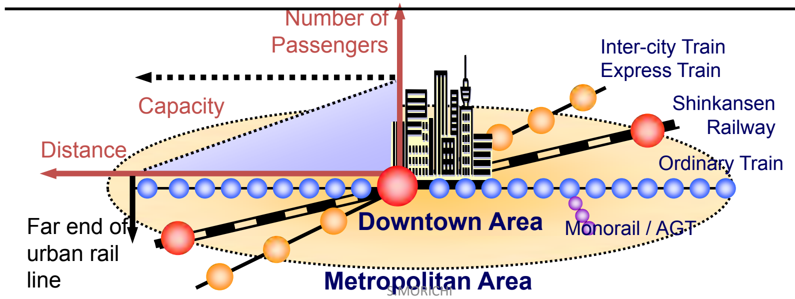
- Shorten Time Distance to Downtown
- Development of Area along Railway
- Reduction of Congestion in Downtown Terminals

For Subway Operators

- More Demand
- Availability of Railway Yard in Suburban Location

② Hierarchy of Urban Railway Network (Tokyo)

Railway Type	St. Spacing	Operating Speed *
Shinkansen Railway (Bullet Train)	30 – 50 km	120 -130 km / hr
Inter-city Train (Japan Railways) Express Train (Private Railways)	5 – 6 km	50 - 60 km / hr
Ordinary Train (Private Railways)	1 – 2 km	40 - 45 km / hr
Subway	0.5 – 1 km	30 - 35 km / hr
Monorail / AGT **(BRT?)**	0.5 – 1 km	20 - 30 km / hr



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③ Circular Line Connecting Terminal Stations

- Terminal stations were joined by a circular line
- Suburban lines have direct operation through subway lines
- High speed intercity train terminal at the city center

Evolved into a hierarchical urban railway network

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Capacity of circular line

Passenger/hr/direction

- High capacity heavy rail systems
- In most section, duel lines (circular +parallel)
- Heavy peak-hour loading
- Over 200 % crowding in train cars
- Circular line attracts largest demand volume

- Low capacity: LRT/MRT
- Capacity expanded on LRT-1; still under crush load condition
- Grossly inadequate capacity for future demand

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3） Multimodal Policy

Rail to Rail

-Improvement of Transfer Facilities in Terminals

-Direct Operation between Subway and Sub-urban Railway

Rail to Road

-Grade Separation between Rail and Road Crossings

-Station Plaza

-Rail – Bus Transfer Terminal

Station to Surrounding Area

-Under Ground Shopping Area

-Skyway

-Commercial Station Building

Software Improvement

-Information System

-Fare Discount for Transferring

-IC Based Common Ticket

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IC Cards Based Common Ticketing System

JR

JR East
Tokyo Monorail
Tokyo Rinkai

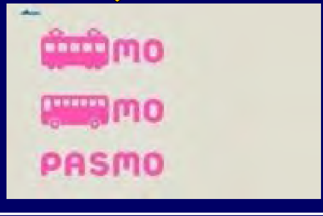
Private Rail, Subway, Bus

Passnet (magnetic card) + Bus Card (30 Co) (magnetic card)

Railway Co : 26

Standardization 2007

Common Ticketing 2007



Collaboration with other regions and fields

2009: Common ticketing with JR Hokkaido
2010: Common ticketing with JR Kyusyu and urban railway in Fukuoka
2011～: Common use with many shops and restaurants
2013: Common ticketing and use all over the Japan

4) Coordination between transport and urban planning

1) Legal level coordination
ex. ・Urban Planning law
Urban planning procedure for transport facility
・Environment assessment law
・Special law for the railway between Tokyo and Tsukuba
(Housing area and railway development law)

2) Institution level : Budget and system for coordination
ex.・Subsidy for new town railway
・Subsidy for continuous vertical division of railroad crossing

3) Planning level coordination
ex. ・Coordination by Local Government
・Planning Committee :
Professors, related agencies and stakeholders

4. Conclusion

Key words for better urban railway in Asian Mega-city

- Timing of policies implementation
- Identification of each mega-city
- Users' burden
- Long term strategies
- Incentives for operators
- Moral hazard

Thank you for your kind attention !

Appendix

Urban Railway Network Improvement and Terminal Renovation

1. Network Expansion and Better Accessibility

2. Terminal Renovation

1. Network Expansion and Better Accessibility

Opened in June 2008

① Tokyo: New Subway line (Fukutoshin Line)

- Connect major sub-centers
- Direct operation : 3 lines
- Design of stations
- Local and express trains in subway

② **Osaka:** Nakanoshima-line (along the river)

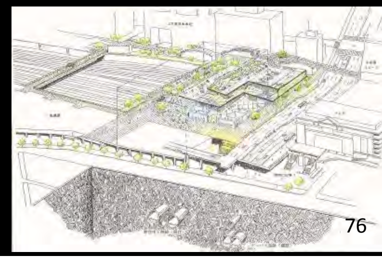
Opened in Oct. 2008

Stations along riverside

- ☞ Attracted new investment for development around river-side stations
- ☞ Contributed to urban renewal in the city core areas

2. Terminal Renovation

① Shinjuku Station

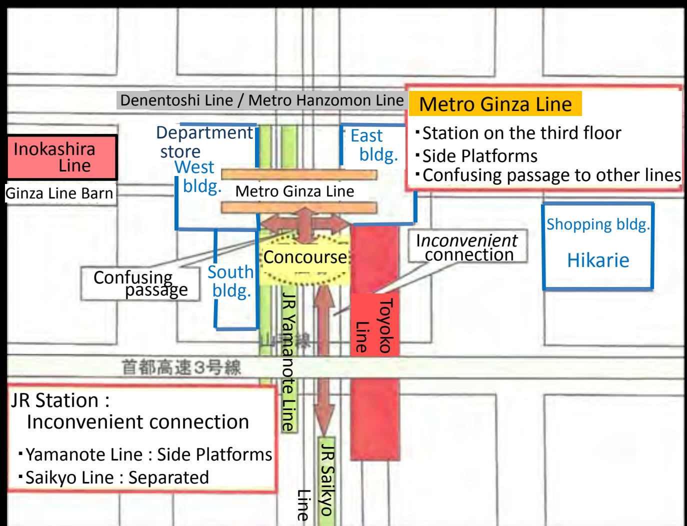


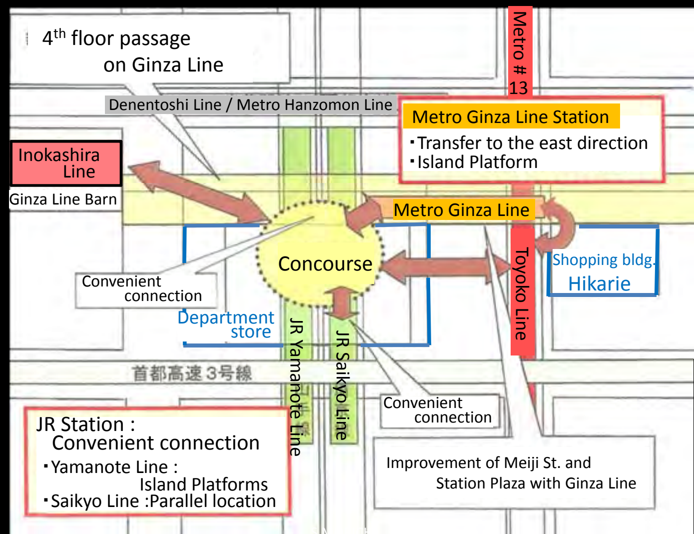
Space Utilization above Railway Tracks

② Shibuya

Station Plaza

Present Layout of Shibuya Station





Data 2

Presentation Material by Tokyo Metro Co., Ltd.

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Tokyo Metro Outline

Tokyo Metro Co., Ltd.

August 25, 2015

Jul. 16, 2014 Revised

Subways in Japan Overview

	City	Population / mil.)	No. of lines	Km
1	Sapporo	1.9	3	48.0
2	Sendai	1.1	1	14.8
3	Tokyo	9.1*	13	301.8
4	Yokohama	3.7	3	53.4
5	Nagoya	2.3	6	93.3
6	Kyoto	1.5	2	31.2
7	Osaka	2.7	8	129.9
8	Kobe	1.5	3	30.6
9	Fukuoka	1.5	3	29.8
	Total		**42**	**732.8**

* Tokyo 23 wards

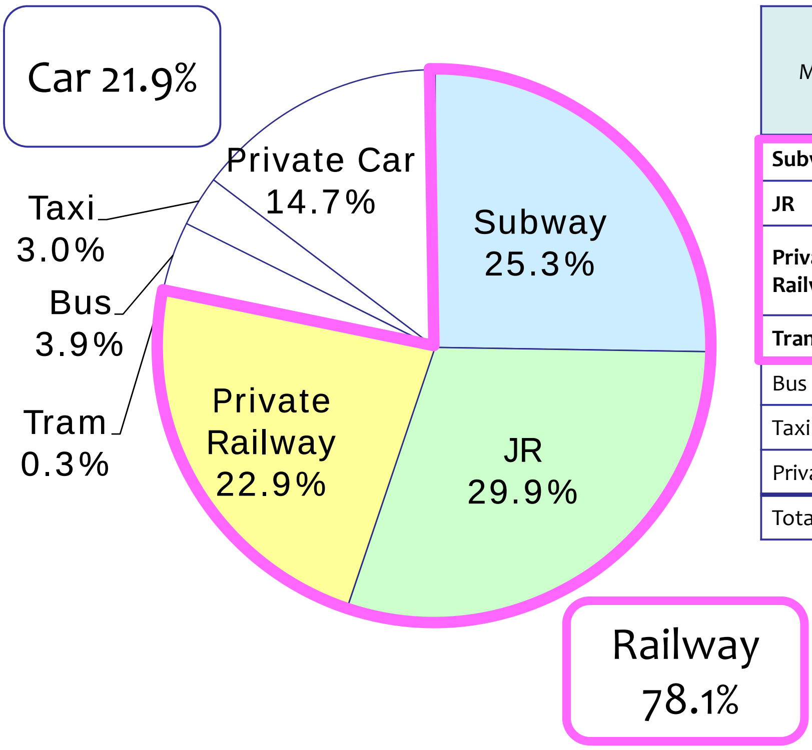
As of FY2103

Subway Operators in Tokyo

	Tokyo Metro (Tokyo Metro Co., Ltd.)	Toei Subway (Transportation Bureau of Tokyo Metropolitan Government)
First section opened (year)	1927	1960
Number of lines	9	4
Route length (km)	195.1	109.0
Number of stations	179	106
Number of cars	2,705	1,116
Number of passengers per day	6.73 million	2.46 million
Average ticket revenue per day (JPY)	856 million	350 million
Capital (JPY)	58.1 billion	-

As of FY2013

Transport Volume by Different Modes in Tokyo's 23 Wards



Mode	No. of passengers (thousand) Per year	No. of passengers (thousand) Per day	Ratio (%)
Subway	**3,117,926**	**8,542**	**25.3%**
JR	**3,694,686**	**10,122**	**29.9%**
Private Railways	**2,831,449**	**7,757**	**22.9%**
Tram	**38,930**	**107**	**0.3%**
Bus	485,291	1,330	3.9%
Taxi	364,465	999	3.0%
Private Car	1,813,557	4,969	14.7%
Total	12,346,304		

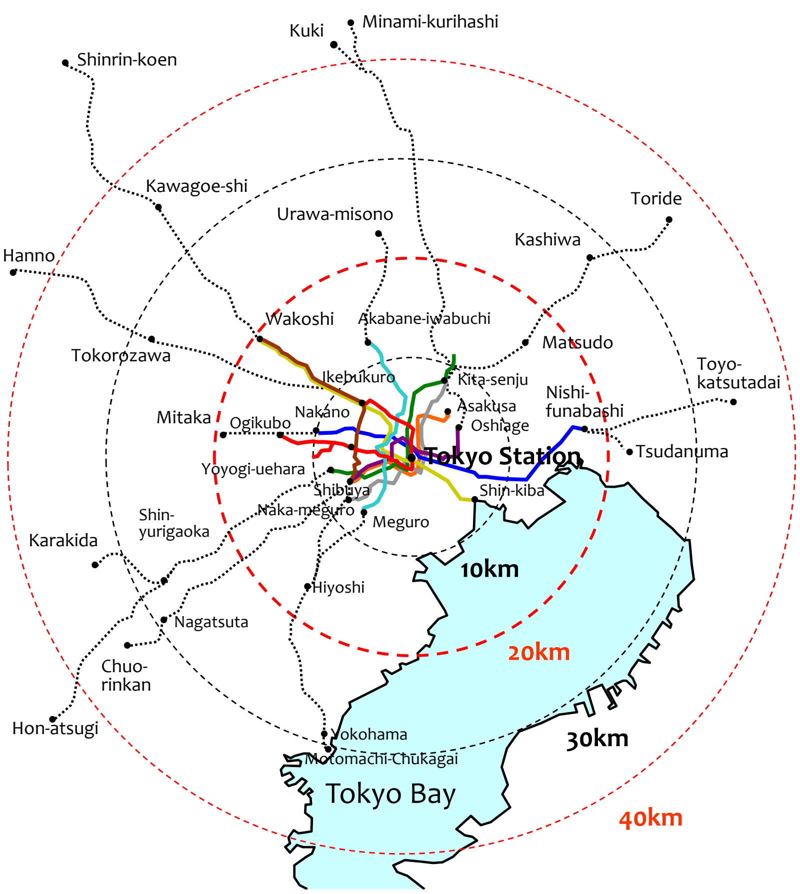
As of FY2009

History of Tokyo Metro

History		
1927	Dec.	Tokyo Underground Railway Company opened the first subway in Asia between Asakusa and Ueno
1934	Jun.	Tokyo Underground Railway Company extended the line to Shimbashi
1938	Nov.	Tokyo Rapid Railway Company opened the section between Shibuya and Shimbashi
1939	Sep.	Tokyo Underground Railway Company and Tokyo Rapid Railway Company started through-service operation between Asakusa and Shibuya
1941	July	Tokyo Underground Railway Company and Tokyo Rapid Railway Company were merged and Teito Rapid Transit Authority was established
2004	Apr.	Tokyo Metro Co., Ltd. was established

Tokyo Metro Network

Distance from Tokyo Station

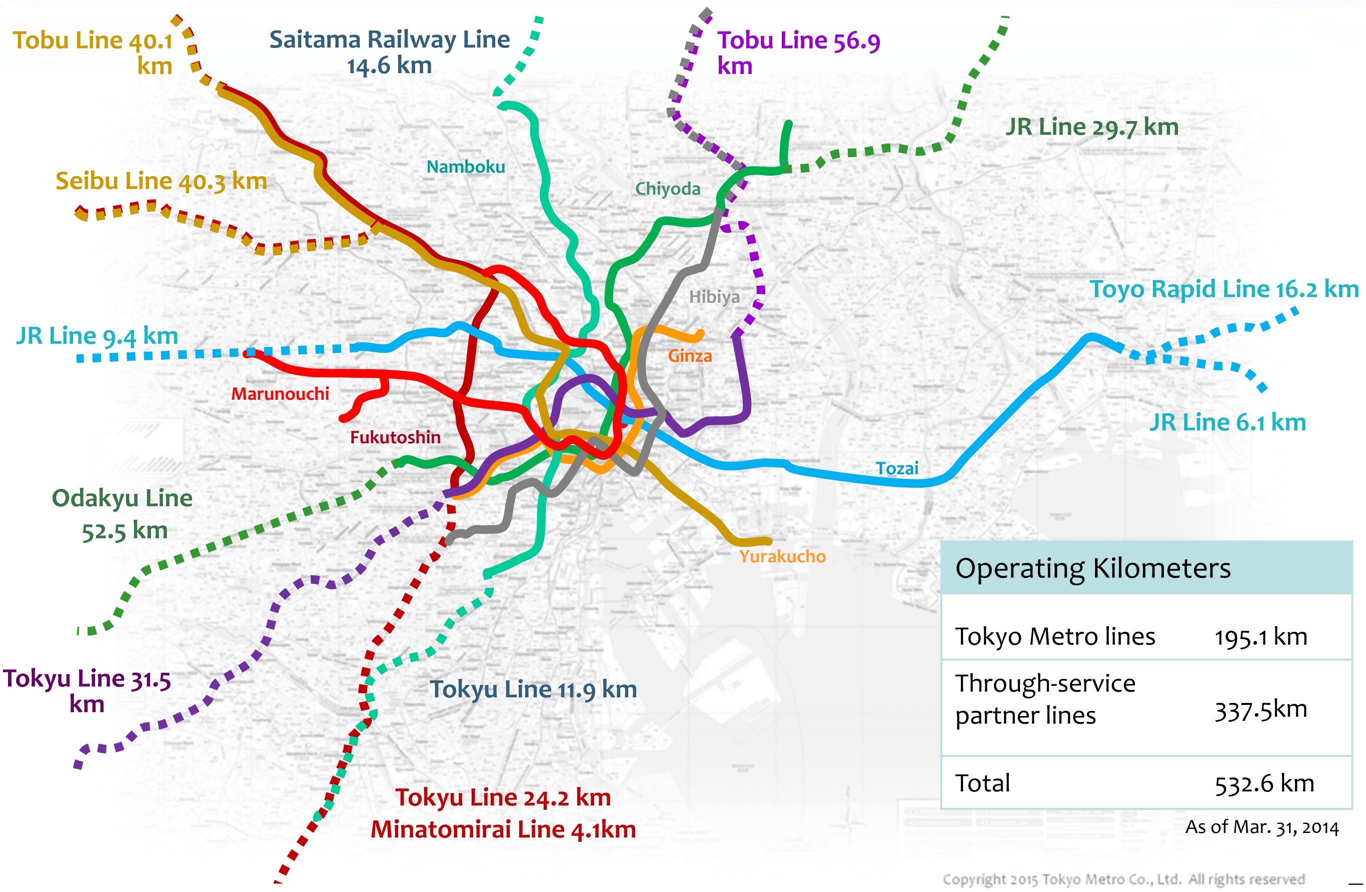


Example

- Ginza line
- Marunouchi line
- Hibiya line
- Tozai line
- Chiyoda line
- Yurakucho line
- Hanzomon line
- Namboku line
- Fukutoshin line
- ……. Through-service

As of Mar. 31, 2014

Tokyo Metro Nine Lines and Through-service



Operating Kilometers	
Tokyo Metro lines	195.1 km
Through-service partner lines	337.5km
Total	532.6 km

As of Mar. 31, 2014

Tokyo's Subway Network (including through-service sections)

As of Mar. 31, 2014 (in km)

	Line	Subway	Partner Line	Details of through-service sections
Tokyo Metro	Ginza	14.3	-	None
	Marunouchi	27.4	-	None
	Hibiya	20.3	44.4	Tobu 44.4
	Tozai	30.8	31.7	JR 15.5, Toyo-kosoku 16.2
	Chiyoda	24.0	82.2	Odakyu 52.5,JR 29.7
	Yurakucho	28.3	80.4	Seibu 40.3, Tobu 40.1
	Fukutoshin	11.9	108.7	Seibu 40.3, Tobu 40.1, Tokyu 24.2, Minatomirai 4.1
	Hanzomon	16.8	88.4	Tokyu 31.5, Tobu 56.9
	Namboku	21.3	26.5	Tokyu 11.9, Saitama Railway 14.6
Tokyo Metro total		195.1	337.5	
Toei Subway	Asakusa	18.3	190.1	Keisei 64.6, Keisei/Hokuso 49.9, Shibayama 2.2, Keikyu 73.4
	Mita	26.5	11.9	Tokyu 11.9
	Shinjuku	23.5	67.3	Keio 67.3
	Oedo	40.7	-	None
Toei Subway total		109.0	269.3	
		301.8*	594.9	
		896.7		

*A section 2.3km is shared by both operators and counted once.

Headway

As of Mar. 31, 2014

Line	Headway		
	Morning peak hour	Off-peak hour	Evening peak hour
GINZA	2' 00"	3' 00"	2' 15"
MARUNOUCHI	1' 50"	4' 00"	2' 25"
HIBIYA	2' 10"	5' 00"	2' 30"
TOZAI	2' 15"	5' 00"	3' 10"
CHIYODA	2' 05"	5' 00"	3' 20"
YURAKUCHO	2' 30"	6' 00"	4' 00"
HANZOMON	2' 10"	5' 00"	3' 10"
NAMBOKU	3' 45"	6' 00"	5' 00"
FUKUTOSHIN	3' 00"	4' 20"	3' 45"

Tokyo Metro Outline Line Profile

	Ginza	Marunouchi	Hibiya	Tozai	Chiyoda	Yurakucho	Hanzomon	Namboku	Fukutoshin
Route length (km)	14.3	27.4	20.3	30.8	24.0	28.3	16.8	21.3	11.9
No. of stations	19	28	21	23	20	24	14	19	11
Completed	1939	1962	1964	1969	1979	1988	2003	2000	2008
Minimum headway (Peak)	2'00"	1'50"/ 4'40"*	2'10"	2'15"	2'05"/ 7'30"*	2'30"	2'10"	3'45"	3' 00"
Average speed (Km/H)	34.2	37.2/ 34.9*	34.3	43.7 49.4 (RAPID)	42.2/ 30.2*	41.3	39.0	40.6	40.2 50.4 (EXPRESS)
Maximum speed (Km/H)	65.0	75.0/ 65.0*	80.0	100.0	80.0/ 60.0*	80.0	80.0	80.0	80.0
Gauge (mm)	1435	1435	1067	1067	1067	1067	1067	1067	1067
Power collection system	3rd rail system DC 600V		Rigid Catenary system and Catenary system DC 1500V						
Length of car (m)	16	18	18	20	20	20	20	20	20
Train make-up (number of cars)	6	6 / 3*	8	10	10 / 3*	10	10	6	8 or 10
Number of substations	6	12	5	8	7	9	6	6	3
Signaling system	CS-ATC	CS-ATC ATO Single-person Operation	CS-ATC	CS-ATC	CS-ATC ATO*	CS-ATC ATO	CS-ATC	CS-ATC ATO Single-person Operation	CS-ATC ATO Single-person Operation
Radio system	Inductive Radio							Space Radio	Inductive Radio

* Branch Line

As of Mar. 2014

Thank you for your attention !

Data 3

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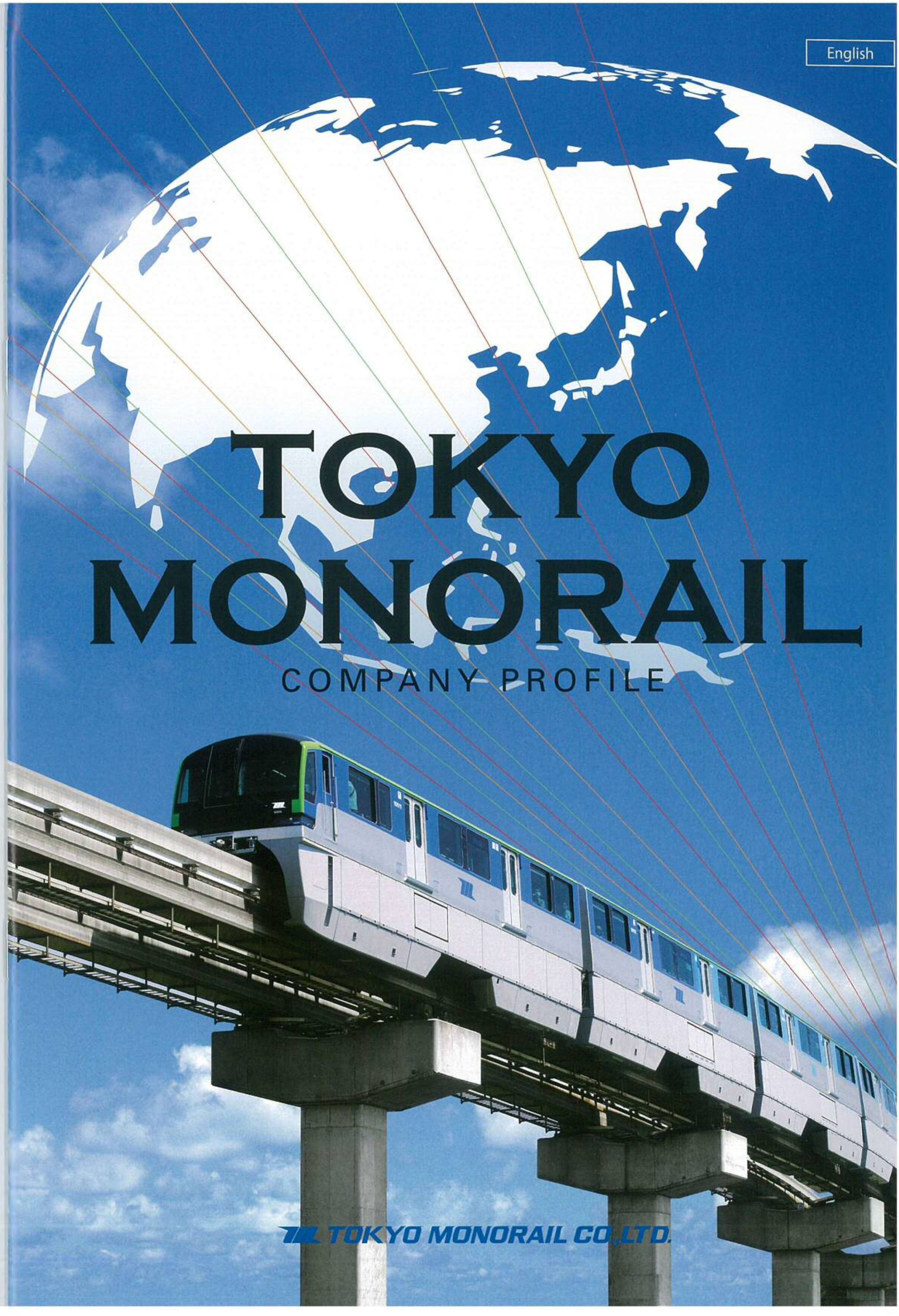
TOKYO MONORAIL

COMPANY PROFILE



TOKYO MONORAIL CO.,LTD.

Company Profile

Corporate Name	Tokyo Monorail Co.,Ltd.
Line Name	Tokyo Monorail Haneda Airport Line
Head Office	4-12 Hamamatsuchō 2-chome, Minato-ku, Tokyo
Established	August 7th, 1959
Start of Operations	September 17th, 1964
Capital	3,000,000,000 yen

Operation Overview

		Weekdays	Saturdays, Sundays and Holidays
Operating distance (km)		17.8 km (Monorail Hamamatsuchō - Haneda Airport Terminal 2)	
Maximum speed		80km/h	
Scheduled speed		Local: 43.4 km/h; Rapid: 49.1 km/h; Haneda Express: 54.3 km/h	
Running time		Local: 24 min; Rapid: 21 min; Haneda Express: 19 min	
Number of cars per configuration		6 cars	
Rolling stock		126 cars	
Time between trains	Morning commuting hours	3 min 20 sec	—
	Daytime	4 min	4 min
	Evening commuting hours	4 min	—
Number of train runs		534 (includes 217 Rapid)	506 (includes 273 Rapid)
Number of car runs	Morning commuting hours	6 cars x 17 runs	—
	Daytime	6 cars x 13 runs	
	Evening commuting hours	6 cars x 14 runs	—
Train kilometers		9,338.3km	8,885.4km
Car kilometers		56,029.8km	53,312.4km
Capacity	Peak (one hour for one way)	10,512 passengers	—
	All day	311,856 passengers	295,504 passengers

(As of March 31, 2015)

Corporate Philosophy

We will ensure that each and every one of our employees can shine while having a sense of pride and responsibility as pioneers in the monorail business, and we will fly into the future by delivering higher quality services to our customers that they can use with peace of mind.

Behavioral Guidelines

1 Pursuit of safety
We will continue to tirelessly make progress on safety so that our customers can use our services with peace of mind

2 Services
We will actively work on providing higher quality services from the perspective of our customers

3 Technologies
We will refine our technologies so that we continue to evolve as a pioneer in the monorail business

4 Regions
We will develop hand-in-hand with areas near the line and the regions that rely on the monorail

5 Human resources, corporate climate, and a robust management foundation
We will become a company in which the employees have job satisfaction and fly into the future

Corporate History

August, 1959	Daiwa Kanko Co. Ltd. established
June, 1960	Company name changed to Nihon Koka Dentetsu Co.,Ltd.
January, 1961	Application for straddle type monorail train line license
May, 1963	Monorail Haneda Line construction started
May, 1964	Company name changed to Tokyo Monorail Co.,Ltd.
September, 1964	Operation of Monorail Haneda Line started
May, 1965	Ōi Keibajō Mae Station opened
March, 1967	Haneda Seibijō Station opened (name changed to Seibijō Station in September, 1993)
December, 1969	Shin Heiwajima Station opened (name changed to Ryūtsū Center Station in January, 1972)
February, 1985	Shōwajima Station opened
September, 1987	Passenger reached 500 million
June, 1992	Tennōzu Isle Station opened
September, 1993	Tokyo Monorail extended due to the offshore expansion of Haneda Airport. Haneda (name changed to Tenkūbashi Station in November, 1998), Shin Seibijō, and Haneda Airport (name changed to Haneda Airport Terminal 1 in December, 2004) Stations.
June, 1997	Total number of passengers reached 1 billion
August, 2002	Use of platform movable fences started in all stations
September, 2002	One-man operation started
December, 2004	Haneda Airport Terminal 2 Station opened
January, 2007	Total number of passengers reached 1.5 billion
March, 2007	Shōwajima Station passing lines completed
October, 2010	Haneda Airport International Terminal Station opened
	Line name changed to Tokyo Monorail Haneda Airport Line
September 2014	50th anniversary of the opening of the monorail

Tokyo Monorail character The blue bird of good fortune Monorun

CONTENTS

Connecting the Tokyo shoreline, from the center of Tokyo to Haneda Airport

From	To	Train	Time
From Monorail Hamamatsuchō Station	Haneda Airport International Terminal Station	Haneda Express	13min
		Rapid	15min
		Local	18min
	Haneda Airport Terminal 1 Station	Haneda Express	17min
		Rapid	19min
		Local	22min
	Haneda Airport Terminal 2 Station	Haneda Express	19min
		Rapid	21min
		Local	24min

Monorail Hamamatsuchō Station

Connections with the JR Yamanote Line and the Keihin-Tōhoku Line are available through JR Hamamatsuchō Station and connections with the Toei Ōedo Line and the Toei Asakusa Line are available through Daimon Station. In addition, Takeshiba Pier provides landing for ships bound for Izu and Ogasawara Islands, and Hinode Pier, which serves as a port for water taxis that tour Tokyo Bay and the Sumida River are near the station. You can also see Tokyo Tower from the station platform.

Tennōzu Isle Station

Once a warehouse district, the area was transformed by waterfront planning that saw the area reborn as a modern city.
There are now high-rise offices, theaters, hotels, apartment complexes, sports facilities and more in the area. With the addition of a connection to the Rinkai Line from March, 2001, access to recreational spots such as Odaiba and Tokyo Disney Resort is smooth and trouble-free. This station was chosen as one of the top 100 stations in the Kanto area in 1999.

Ōi Keibajō Mae Station

Oi Racecourse, which is located in front of this station, opened in 1950, and is currently an exciting attraction for the "Twinkle Races", held on an evening. On the opposite shore, you can find the Oi Futo Chuo Kaihin Park sport complex that is complete with tennis courts and baseball fields. Additionally, Nagisa-no-mori Park is a great place to enjoy fishing and BBQ.

Ryūtsū Center Station

The area was originally developed as a distribution point for the Jonan area of the capital on the second piece of reclaimed land in Tokyo-Yokohama. Nearby are many truck terminals and warehouse complexes, as well as Tokyo Ryūtsū Center that holds many large and small events throughout the year. In addition, you can also find Ohta Market, which is Japan's largest fruit and vegetable market, and has an incredible variety of produce on sale.

Shōwajima Station

The heart of the Tokyo Monorail, Shōwajima Center houses much of the machinery and manpower that keeps our trains running safely: The operations control center, the power control center, repair and maintenance factories, and track inspection teams that inspect and repair the tracks themselves. After the completion of the passing lines in March, 2007, it is now possible for the trains to pass each other. Also nearby are the Morigasaki Water Reclamation Center, the Haneda Tekko apartments, and Keihinjima Tsubasa Park where you can enjoy a relaxing evening camping.

Seibijō Station

This area is home to many of the maintenance factories that ensure the safety of airplanes. Seibijō Sta. was established to provide convenient access for both commuters and visitors to these facilities. In addition, this area is also home to the Japan Coast Guard, as well as storage warehouses for newspaper companies.

Haneda Airport International Terminal Station

Directly connects to the 2nd and 3rd floors of the Haneda Airport International Passenger Terminal so you can proceed smoothly to the airport. Commercial facilities on the 4th and 5th floors of the International Terminal have restaurants and shops in reproduction Edo period-style streets. There is a planetarium on the 5th floor, which is the first ever planetarium to be built at an airport.

Tenkūbashi Station

The former Haneda Station was renamed to Tenkūbashi station in November 1998.
The station building was designed under the motif of jet engines. The nearby tranquil seaside area of Haneda includes the Anamori Inari Shrine, making it a wonderful place for a stroll. There is also a convenient connection to the Keikyu Line.

Shin Seibijō Station

This station was built underground for the convenience of employees working at the various maintenance and repair factories.
Near the entrance is a connecting taxiway for runways A and C, so you can see aircraft from up close. The perfect viewing spot for aircraft fans.

Haneda Airport Terminal 1 Station

Directly connects to the underground level 1 of Haneda Airport Terminal 1, where you can find JAL and other airline counters. Haneda Airport Terminal 1 has various restaurants and shops from B1 to 6th floor, and observation decks on the 6th floor and above. This station was chosen as one of the top 100 stations in the Kanto area in 2000.

Haneda Airport Terminal 2 Station

Directly connects to underground level 1 of Haneda Airport Terminal 2, where you can find ANA and other airline counters. Haneda Airport Terminal 2 has various restaurants and shops from B1 to 5th floor, and an observation deck on 5th floor.

	Monorail Hamamatsuchō	Tennōzu Isle	Ōi Keibajō Mae	Ryūtsū Center	Shōwajima	Seibijō	Tenkūbashi	Haneda Airport International Terminal (International Terminal)	Shin Seibijō	Haneda Airport Terminal 1 (Terminal 1)	Haneda Airport Terminal 2 (Terminal 2)
Haneda Express	●							●		●	●
Rapid	●	●	●	●				●		●	●
Local	●	●	●	●	●	●	●	●	●	●	●

In addition to "Local train", Tokyo Monorail has a "Rapid train" which leaves Hamamatsuchō Station to stop at every station until Ryūtsū Center Station, and which then stops at Haneda Airport International Terminal and Haneda Airport Terminal 1 Station before terminating at Haneda Airport Terminal 2 Station. There is also the "Haneda Express" which leaves Hamamatsuchō Station and stops at Haneda Airport International Terminal and Haneda Airport Terminal 1 Station, before terminating at Haneda Airport Terminal 2 Station.

Haneda Express passes the local train at Shōwajima Station.
(Shōwajima passing lines newly built in March 2007)

Hamamatsucho Area

Gateway connecting the center of Tokyo and Haneda Airport with one simple trip!

Start on your journey from Hamamatsucho

The Monorail is enormously popular as a means of transportation from Hamamatsucho to Haneda Airport. The arrival time to the airport was shortened in response to requests from many passengers when non-stop trains were introduced between Hamamatsucho and Haneda Airport on March 18, 2007. Together with the International Terminal opening in October, 2010, operating hours have been extended to facilitate international travelers.

Monorail Hamamatsuchō Station

More convenient connection to JR services

The passage from JR Hamamatsuchō Station to the monorail provides an easy and trouble-free connection. A new elevator was installed in the central ticket gate concourse to provide further convenience during your transfer. We will continue to search for more ways to make your trip easier.

Elevator connecting the ticket gate level directly with the platform

3F Central Ticket Gate

5F Boarding Platform

Haneda Airport Area

Direct connection to both International and Domestic Passenger Terminal Buildings

Haneda Airport International Terminal Station

Haneda Airport International Terminal Station was opened in October 2010 in conjunction with the commencement of operations by the Haneda Airport International Passenger Terminal which was built to fulfill the mission of being a gateway to overseas destinations again for the first time in 32 years since the transfer of international routes to Narita Airport in 1978. It is most notable for its glass design which gives a sense of integration with the terminal and the wonderful views. The third floor ticket gate and the terminal departure lobby are positioned on the same floor, enabling smooth and seamless access.

Airlines departing and arriving at the international terminal: all international routes

● Passengers coming to Haneda Airport International Terminal Station from the city center will find the international passenger terminal's departure lobby on the same floor as the platform they get off at, making the trip from the ticket gate to the check in counter in only one minute.

● Passengers arriving can go from the international passenger terminal's arrival lobby to the ticket gate of the Haneda Airport International Terminal Station on the same floor. Moving up only one floor to the platform, transfers are easy even if you have heavy luggage.

■ Inside Haneda Airport International Terminal Station *Images may vary from the actual structure.

■ JR East Travel Service Center is located next to the arrival lobby (2nd floor) ticket gate. Services including ticket sales and collection, and traffic information are provided here. You can find all the services you would expect from an international terminal.

Smooth domestic and international transfers are made possible thanks to the excellent access to the airport and with the trains operating at only 3~5 minute intervals!

Haneda Airport Terminal 1 Station

Haneda Airport Terminal 1 Station was opened in September 1993 as "Haneda Airport Station" in conjunction with the commencement of operations by the first passenger terminal which had been built in Phase II of the Haneda Airport Offshore Development Project, and subsequently in 2004 it was renamed with its current station name when Haneda Airport Terminal 2 Station opened. The ticket gate floor of the station is directly connected to the first basement floor of the airport terminal, there are enhanced guidance signs for the directions to aircraft departures and arrivals, and the design of the station takes into consideration the direction the customers will walk in after getting off the monorail as they head towards the terminal.

Airlines that serve Terminal 1 : JAL Group, SKYMARK AIRLINES, STARFLYER(Kitakyushu flight)

Haneda Airport Terminal 2 Station

Haneda Airport Terminal 2 Station opened in December 2004 in conjunction with the commencement of operations by the second passenger terminal which had been built in Phase III of the Haneda Airport Offshore Development Project. Subsequently, the South Exit was added in October 2010 as a result of the expansion of the terminal building. Information about the locations of the boarding gates and security checks for the flights used by our customers is displayed on flight information displays on the platforms and there is guidance to the shortest route to the departure lobbies of the terminals.

Airlines that serve Terminal 2 : ANA, AIR DO, Solaseed Air,STARFLYER(Fukuoka,Kansai, Yamaguchi-Ube flight)

The departing and arriving airline information for each terminal is as of April 2015

Monorail Suica

Even more convenience with IC cards

Touch & go with one card

From 2002, we introduced the "IC card system" and currently we are selling the "Monorail Suica Commuter Pass," the "Monorail My Suica" which has the passenger's name written on it, and the "Monorail Suica card" which does not have the passenger's name written on it.
These cards enable smoother use of the monorail by passengers.

Type of Monorail Suica

Monorail Suica Commuter Pass

Monorail My Suica

Monorail Suica card

There are three types of "Monorail Suica": "Monorail Suica Commuter Pass", "Monorail My Suica", and "Monorail Suica card".

IC Cards Usable on the Tokyo Monorail

In addition to the "Monorail Suica card," ten nationwide transportation-type IC cards including Suica, PASMO, etc. can be used.

* "Kitaca" is a registered trademark of JR HOKKAIDO. "PASMO" is a registered trademark of PASMO Co., ltd. "Suica" is a registered trademark of JR EAST. "manaca" is a registered trademark of Nagoya Transportation Development Organization Co. Ltd and M.I.C. Co., Ltd. "TOICA" is a registered trademark of JR CENTRAL.
"PiTaPa" is a registered trademark of Surutto KANSAI Co., Ltd. "ICOCA" is a registered trademark of JR WEST. "Hayakaken" is a registered trademark of Fukuoka City Transportation Bureau.
"nimoca" is a registered trademark of Nishi-Nippon Railroad Co., Ltd. "SUGOCA" is a registered trademark of JR KYUSHU.

Safety

Barrier-free facilities at station

Multifunctional toilet

Multifunctional toilets are available for wheelchair users, and are equipped with emergency buttons and ostomate facilities.

Wheelchair friendly slope way

We are eliminating floor height differences between platforms and train floors so that wheelchair users and passengers with baby buggies and roller bags can use our trains easily.

Platform movable fence and ramp

Platform movable fence

Platform fences were installed to provide a physical barrier between the platform and tracks after one-man train operation was started. The fences prevent accidents such as people falling from the platform, being struck by a train, and other such accidents.

Automatic boarding ramps

Automatic boarding ramps were installed for the Haneda Airport – bound platform in the Haneda Airport International Terminal Station to prevent passengers from falling or tripping on the platform when getting on or off trains.

Seismic Strengthening Works

In response to the Kobe Earthquake, we have been advancing seismic strengthening works as earthquake disaster countermeasures. In fiscal year 2006 we commenced strengthening works on a total of 225 sets, including 119 ground sets and 106 sea sets, and plan to complete the work in fiscal year 2016. At the end of fiscal year 2014 we had completed 119/119 land sets (100%) and 96/106 sea sets (91%), for a total of 215/225 sets (96%).

Furthermore, regarding the stations, in fiscal year 1998 we implemented seismic strengthening of the Hamamatsuchō Station building which is the point of transfer to the JR lines, and subsequently gave priority to the seismic strengthening of concrete struts, conducting a seismic diagnosis of the intermediate elevated stations in fiscal year 2006 and carrying out strengthening of Ōi Keibajō Mae Station in fiscal year 2012 and Ryūtsū Center Station in fiscal year 2014. We are aiming to complete the work on the intermediate elevated stations in fiscal year 2016.

Seismic strengthening of sea areas

Seismic strengthening of the Hamamatsuchō Station building

AED facilities

As part of our efforts to make safer stations for passengers, AEDs are installed at the stations that have a greater number of passengers.

[Installed stations]
Monorail Hamamatsuchō, Tennōzu Isle, Haneda Airport International Terminal, Haneda Airport Terminal 1, and Haneda Airport Terminal 2 Stations

Environmental efforts

Rooftop gardening

We are making building rooftops greener in the Shōwajima Center to lower the temperature in rooms within the building, reduce power consumption, and contribute to lower CO_2 emissions.

As of October, 2010, we have constructed approximately 2,000m^2 of rooftop gardens.

Solar power system

As a part of our efforts to prevent global warming and to reduce CO_2 emissions, Haneda Airport International Terminal Station introduced a solar power system. A total of 320 solar panels are installed on the rooftop of both platforms to supply sunlight-generated power to some of the facilities in the station. Approximately 60kW of electricity is generated, which is enough to cause a reasonable reduction in our CO_2 emissions.

History of Tokyo Monorail and its Trains

■ 10000 Series (2014~)
Next Generation monorail developed under the "Smart Monorail" concept

2014.9 / 50th Anniversary of Tokyo Monorail Opening

2010.10 / Opening of Haneda Airport International Terminal Station

2007.3 / Application of Overpass Facilities at Shōwajima Station

2007.1 / Achieved the accumulated 1,500,000,000 passengers since 1964

2004.12 / Opening of Haneda Airport Terminal 2 Station

1997.6 / Achieved the accumulated 1,000,000,000 passengers since 1964

■ 2000 Series (1997~)
First monorail to adopt VVVF inverter (24 energy-saving cars produced)

1993.9 / Opening of Haneda Station (now Tenkūbashi Station), Shin Seibijō Station and Haneda Airport Station (now Haneda Airport Terminal 1 Station)

1992.6 / Opening of Tennōzu Isle Station

■ 1000 Series (1989~)
Fixed 6-car and observation seats adopted in front-end cars (96 cars produced)

1987.9 / Achieved the accumulated 500,000,000 passengers since 1964

1985.2 / Opening of Shōwajima Station

■ 800 Series (1985~1998)
Produced as intermediate cars (8 cars produced)

■ 700 Series (1982~1998)
First monorail to adopt AC Units
(11 cars produced)

■ 600 Series (1977~1997)
Aluminum body adopted (18 cars produced)

1973.10 / Achieved the accumulated 100,000,000 passengers since 1964

■ 500 Series (1969~1991)
First monorail to adopt tandem design bogies
(26 cars produced)

1969.12 / Opening of Shin Heiwajima Station (now Ryūtsū Center Station)

1967.3 / Opening of Haneda Seibijō Station (now Seibijō Station)

1965.5 / Opening of Ōi Keibajō Mae Station

1964.9 / Opening of Tokyo Monorail

■ 100/200/300/350 Series (1964~1979)
Constituted by three cars/units. Streamlined front for the 300 Series (right image)
(14/11/4/4 cars produced each)

Providing our passengers with safe, comfortable car designs

From the series 100 cars at the start of operations to the series 10000 cars of today, we have continually improved our cars to provide passengers with a pleasant riding experience. In addition, the first ever use of variable-voltage variable frequency (VVVF) control systems in a monorail in the 2000 series cars allows the adoption of T (non-powered) cars, which are lighter and provide superior air conditioning for passenger comfort. The monorail always delivers a comfortable ride, no matter what the time of year. A wide range of new devices and equipment has been added to the trains since the start of one-man operation in September 2002.

Driver's instrument board

Emergency contact system

Onboard information display (10000 Series)

Equipment for one-man operation

Display unit on the driver's instrument board

Additional instruments were added to the driver's instrument board to alert the driver of any abnormalities. The new instruments indicate the closing and opening status of passenger car doors and fences.

Master controller door switch

Master controller door switches were aligned in front of the driver's instrument board so that the driver can open and close the doors of passenger cars while seated. In addition, the TP reception indicator that indicates which side of doors should be opened when the train has stopped at a position where doors can be fully opened or closed, and the reopen/reclose switch that releases objects caught in doors were placed together.

Platform surveillance monitor

A triple LCD monitor system was placed in the upper part of the driver's instrument board so that the driver can check the safety of the platform while seated when passenger car doors are opened or closed. The monitor automatically switches on and off according to the timing that the train stops at or leaves a station. In addition, the screens split into six individual displays when the train is stopped at curved platforms with limited views.

Wireless microphone

The driver can make announcements to the platform using the wireless microphone placed on the driver's instrument board. The battery charger for the wireless microphone is also installed on the driver's instrument board. Furthermore, in the 10000 Series cars, a speaker for external announcements is installed on the side of the car body, and the driver can make announcements to the platform using the wireless microphone placed on the driver's instrument board by flicking the switch inside the crew's room. Note that the driver can also sound the train departure bell on the platform.

Emergency contact system

In the event that abnormality occurs in a passenger car, passengers can communicate with the driver through the emergency contact system located in the passenger car. If there is no answer from the driver within 30 seconds, the contact system automatically connects to the operation control room. The driver can also use this system to make announcements to the passenger car. In the unlikely event that the driver becomes unwell and cannot operate the train, the train automatically stops, and a radio signal immediately informs the control room of the situation.

Missed stop prevention function

Trains are equipped with many functions to support the driver, including a missed stop prevention function that ensures the driver stops at the necessary stations.

TP control unit/pick up

Various information required for passenger car door operation, automatic announcements, and onboard information signs is transmitted and received by ground antennas (beacons) and on-board antennas (pick ups).

Platform image optical transmission system

Images captured by platform cameras are transmitted from light transmitters incorporated in the movable fences to light receptors placed at the motorman's instrument board, and are displayed on the platform surveillance monitor.

Onboard automatic announcement system/onboard information signs

The onboard automatic announcement system/ onboard information signs are installed to provide important information in passenger cars. The automatic announcement system can provide a wide range of event broadcasts in addition to the standard broadcasts as necessary. The onboard information signs are in map form and indicate the current station, next station, and travelling direction.

Car Overview

Model	1000 Series	2000 Series	10000 Series
Number of cars	84	24	18
Configuration	Fixed 6-car		
Manufactured from	1989	1997	2014
Body structure	Aluminum alloy		
Maximum dimensions	93.2m × 3.03m × 4.36m (L x W x H)	92.9m × 3.03m × 4.36m (L x W x H)	
Linear acceleration	0.97m/s2 (3.5km/h/s)		
Linear deceleration	Normal: 1.11m/s2(4.0km/h/s); emergency: 1.25m/s2 (4.5km/h/s)		
Normal maximum speed	80km/h (maximum design speed: 90km/h)		
Running wheels	(4 wheels/bogie): (Mi) 330/85R16 tubeless (steel cord, nitrogen-filled) (BS) 13.50/80R16 tubeless (steel cord, nitrogen-filled)		
Guide wheels	(4 wheels/bogie) 200-15-18PR (nitrogen-filled)		
Safety wheels	(2 wheels/bogie) 200-15-18PR (nitrogen-filled)		
Traction motor	DC electric motor Output: 70kW (24 sets/configuration)	AC electric motor (3-phase cage-type induction) Output:100kW (16 sets/configuration)	

As of March 31, 2015

10000 Series

For the latest model of 10000 Series cars, we have made "Smart Monorail" the basic concept and have carried out the development with the goals of improving "Safety," "Passenger service," "Energy Saving and Environmentally Friendly," "Maintainability," "Recyclability" and "Design."

Features

Safety

These are the first monorail cars to adopt a car information control system (ATI system) with Ethernet as the core communications system, and there are two screens installed on the driver's instrument board, one for instruments display and one to support the crew. Due to this, the creation of data for car drive control and control of onboard devices and centralized control has become possible. In addition, sophisticated management of breakdown information has also become possible.
Furthermore, we have adopted a width indicator using a blue LED on the front of the cars, so it has become possible to make the car gauge in the air above the track easy to understand, increasing the safety of work near the railway lines.
Moreover, we have equipped both front-end cars with one escape chute each as equipment for rescuing the passengers if there is an emergency.

Passenger service

In the intermediate cars, we installed cross seats on the sea side and long seats on the mountain side so that the passengers can enjoy the view along the line. The seat moquette is separated into blue for general seats and green for priority seats, and in the priority seat part we have installed Stanchion poles to ensure it is barrier-free.
We have installed onboard information signs using the latest 17-inch LCDs above the entrance doors inside all of the passenger cars to display the train category, the destination guide, the route guide, and the transfers guide. They are designed to display the train category and destination guide in four languages, Japanese, English, Chinese, and Korean. Taking into consideration increased convenience for passengers using the airport, we have installed one luggage compartment with the capacity to store large suitcases in each car.

Energy Saving and Environmentally Friendly

We have taken energy-saving performance into consideration, for example we have adopted LEDs which use little power for the interior lights and headlights and we have continued to adopt a VVVF inverter control system in the 2000 Series. Furthermore, we have endeavored to lighten the car body by adopting aluminum leaving the surface unpainted, and have reduced the painting work and the amount of organic solvents we use.

Maintainability

A large reduction in the number of components compared to conventional methods has become possible and we have improved our low-maintenance operation, by developing bolster-less bogies with a simple structure designed for narrow underfloor spaces, and the first ever wireless-type running wheel internal pressure detection device for monorail cars.

Recyclability

We have taken recyclability into consideration by adopting polyester materials for the seat padding and rubber mats for the floors inside the passenger cars, and using a lot of aluminum materials with a low lead content in the car bodies.

Design

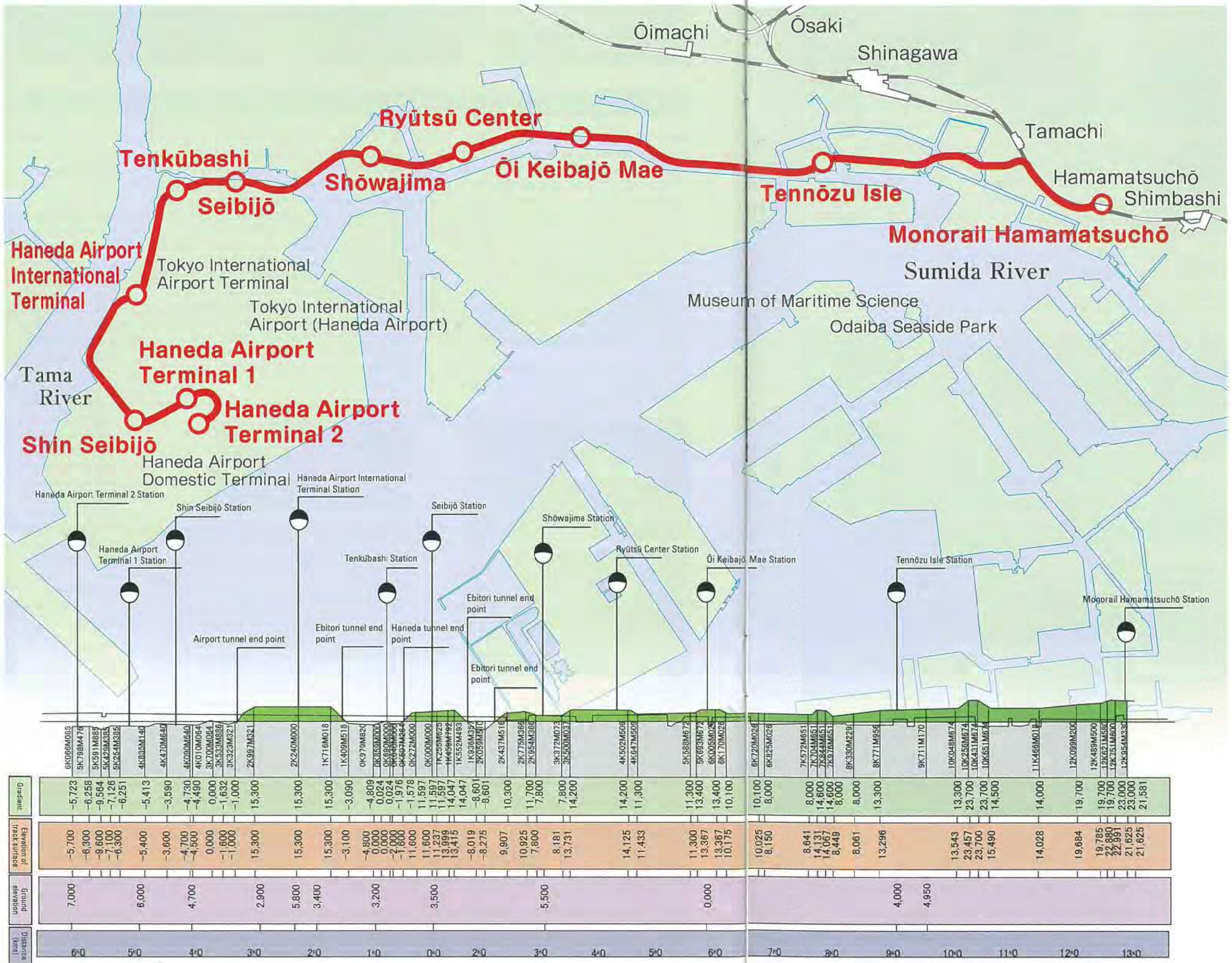
On the exterior, instead of using paint for the coloring of the car body, we used film and expressed the abundant greenery along the line using the color green and the sky and water using gradations of blue and sky blue.
In the interior, we have used a pattern like Japanese paper on the glass covers of the LED interior lights and the ancient Japanese *Seigaiha* pattern that expresses waves in the seat moquette, and we incorporated illustrations of Mount Fuji, five-story pagodas, fans, etc. on the sliding doors between cars, to create a design which expresses "Japanese-style" hospitality.

Model		1000 Series			2000 Series			10000 Series		
Control system		Multiple unit control, multi-step automatic acceleration/deceleration			VVVF inverter control system					
		Electric cam shaft (3 sets/configuration)			Equipped with fixed-speed operation function (2 sets/configuration)					
		One-handle master controller								
Air brake system		Electric command brake (HRD) (3 sets/configuration)			Electric command brake (HRDA) (2 sets/configuration)			Electric command brake (HRDA) (6 sets/configuration)		
		Electro-pneumatic operation			Air supplement control used together with regenerative brake					
		Equipped with load compensation system and security brake								
Auxiliary power supply		Static inverter (SIV) (3 sets/configuration)			Static inverter (SIV) (2 sets/configuration)					
		40–48kVA			100kVA			124kVA		
Signal safety device		ATC system								
Air conditioning		Roof-mounted central AC unit								
		12,000–16,000kcal/h×2units/car			17,500kcal/h×2units/car			20.3kW (17,500kcal/h)×2units/car Equipped with rapid heating function		
Capacity		Lead car	Mid car	Configuration	Lead car	Mid car	Configuration	Lead car	Mid car	Configuration
	Seating capacity	42	36	228	34	43	240	33	40	226
	Standing capacity	52	63	356	62	59	360	43	36	230
	Total	94	99	584	96	102	600	76	76	456

Advanced technology to overcome natural obstacles and difficult conditions

It is 17.8km from Hamamatsuchō in the center of Tokyo to Haneda Airport Terminal 2. The Tokyo Monorail was world's first true monorail, and it took various innovative technologies to make it happen. A great many challenges were overcome in order to build the monorail. First, a new rail system had to be developed, and portions of the line had to be built on the water, and on sludge sediment layers. And since the monorail was built, we have continued to research and implement such improvements as measures to combat noise, vibration, snowfall, and other environmental hazards. Furthermore, in the route extension project that was implemented in response to the Haneda Offshore Development Project, we have introduced various innovative technologies based our unique experience and track record accumulated over the years to enable access to the new airport.

Route Map



Track Overview

Total length	17.8km (Haneda Airport Terminal 2 Sta. – Monorail Hamamatsuchō)
Distance between track centers	3.7m standard
Maximum grade	60 / 1,000
Smallest curve radius	120m
Track girders	Pre-stressed concrete girders: 0.8m x 1.4m x 20m (W x H x standard girder length) Steel girders: 0.8 x 2 – 4 x 25 – 66m (W x H x L) Composite girders: 0.8 x 2.3 – 3.3 x 35 – 53m (W x H x L)
Struts	Steel-reinforced concrete & steel
Bearings	Pin & roller type
Tunnels	Immersed tube and cut & cover type
Switches	Monorail Hamamatsuchō Sta.: Steel articulated switch (1 set) Haneda Airport Terminal 1 Sta.: (Scissor switches) Steel articulated & flexible (4 sets), Rotary girder (1 set) Haneda Airport Terminal 2 Sta.: (Scissor switches) Steel articulated & flexible (4 sets) Rotary girder (1 set) (Bifurcation switches) Steel articulated & flexible (1 set) Shōwajima car barn entrance: Steel articulated (5 sets) Shōwajima Passing Lines: Steel indirect & bending type (4 sets) Shōwajima car barn interior: Steel articulated (6 sets)

Station Overview

Station	Structure	Platform type	Platform height	Platform specification Height x Width
Monorail Hamamatsuchō Sta.	5-story station building above ground (steel-framed reinforced concrete construction)	Opposite type (entrance & exit separated)	18.1m above ground level	104.5m × (2.5m ~ 10m)
Tennōzu Isle Sta.	Elevated structure above ground (Column construction: steel; Shed construction: steel) (Over road)	Opposite type	9.6m above ground level	130m × 5m
Ōi Keibajō Mae Sta.	Elevated structure above ground (Column construction: steel; Shed construction: steel) (Above-sea section on seawall)	Opposite type	11.0m above sea level	105m × 3m
Ryūtsū Center Sta.	Elevated structure above ground (Column construction: steel-framed reinforced concrete construction; Shed construction: steel) (Over road)	Opposite type	9.7m over road	105m × 2.5m
Shōwajima Sta.	Station built above ground (steel construction)	Island type (Two 4 lines)	2.5m above ground	100m × (1m ~ 3m)
Seibijō Sta.	Elevated structure above ground (Column construction: steel; Shed construction: steel) (Over road)	Opposite type	8.8m above ground	100m × 2m
Tenkūbashi Sta.	Single-level underground box type (Steel-framed reinforced concrete construction)	Opposite type	3.4m below ground	100m × 5m
Haneda Airport International Terminal Sta.	Elevated structure above ground (Column construction: steel; Shed construction: steel) (Over road)	Opposite type	12m above ground	Hamamatsuchō-bound platform: 100.5m × 5m Haneda Airport – bound platform: 102.7m × 5m
Shin Seibijō Sta.	Two-level underground box type (Steel-framed reinforced concrete construction)	Opposite type	11.5m below ground	Hamamatsuchō-bound platform: 131m × 2.7m Haneda Airport – bound platform: 128m × 2.7m
Haneda Airport Terminal 1 Sta.	Two-level underground box type (Steel-framed reinforced concrete construction)	Island type	11.9m below ground	130m × 12m
Haneda Airport Terminal 2 Sta.	Two-level underground box type (Steel-framed reinforced concrete construction)	Island type	13.4m below ground	130m × 12m

Showajima Center

Traffic management system

Tokyo Monorail has installed an advanced traffic management system that ensures course control during peak times, and improves passenger service in individual stations throughout the whole line. This system consists of a central processing unit that stores diagrams of trains and tracks/controls the actual train service. The operation control board and the traffic indication board are used to configure and change the diagram. The centralized train control unit, automatic passenger information signs, and the automatic announcement system are used to remotely control the courses of all train services from the operation control room. The operation control room is also equipped with various meteorological monitoring equipment including an aerovane, and an emergency earthquake alert receiving terminal.

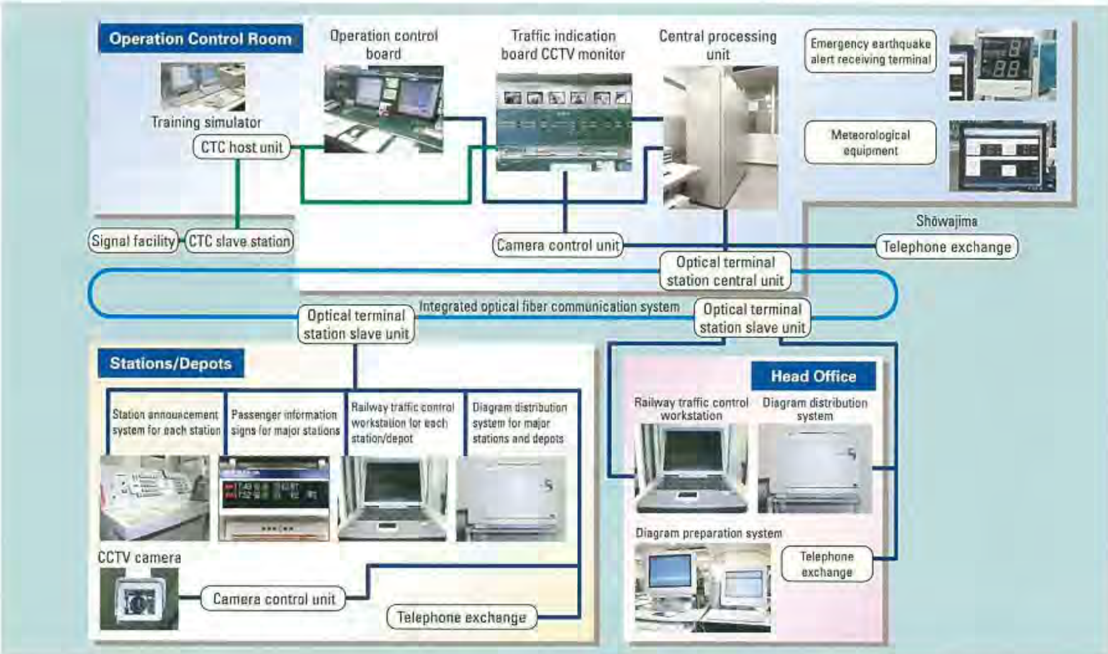
System functions

The system has a wide range of features, including train tracking, traffic displays, diagram control, route control, automated announcements, human-machine communication interface, error recovery, history log, closed circuit TV control, train/configuration number control, a monitor screen, diagram distribution, and more.

Integrated optical fiber communication system (LAN)

An optical terminal station slave unit (IOS) is installed at each station, and a central optical terminal station unit (LSC) is installed at the Shōwajima base station traffic control room. Each of these stations is connected via a 2-core optical fiber loop, and stations communicate via telephones and workstations (connected via an RS-232C interface) connected to each station.

System features



Architecture

The system achieves central control through a combination of a centralized train control (CTC) unit that registers the position of the train and a duplex central processing unit. A wide range of diagram data that forms the basis of the train service is prepared by the Diagram Preparation System and stored in the central processing unit.

Adoption of an integrated optical fiber communication system (LAN)

The optical LAN communication network is installed to transmit diagram-based data from the central processing unit to equipment such as information signs, announcement systems, and railway traffic control workstations in each station. Workstations installed in each station and depot constantly indicate the railway traffic conditions, car allocation status, and course configuration status. In addition, the transmission line is also used for monitoring facilities, relaying private branch exchange information, and switching CCTV cameras.

Integration and speedy distribution of railway traffic conditions

The central processing unit enables collective processing and necessary output of important data including the number of kilometers trains have traveled, actual diagrams, and car allocation. In addition, daily diagram data can be distributed in real time to major stations and depots that includes updated diagrams from the diagram distribution system.

Instruction support during malfunctions

The operation display of the operation control board is equipped with a system that continuously displays the train diagrams and allows traffic control by directly inputting updated data should a traffic abnormality occur. Various functions are arranged into patterns to make input operations quicker and easier. In addition, a training simulator has been installed in the system so that controllers can further polish their skills at any time.

The Showajima Center provides strict monitoring on the safety of train operations 24 hours a day

The Shōwajima Center is the heart of the Tokyo Monorail system. This center plays a vital role in monorail operations, and houses the operation control room that controls train movements, power control room that controls the power supply and reception, rolling stock inspection & maintenance depot, track & trolley inspection & maintenance depot, and the crew depot.

Car maintenance

Cars are inspected and maintained at the Shōwajima Center maintenance shop. All cars are inspected regularly.

Electric power management system

Controlled substations: 7
Location of the control center: Shōwajima Power Control Center
Control system: Central monitoring system controlled by computers, CSMA/CD system

Substation and distribution facilities

The proper power capacity must be ensured in order to reduce operating intervals, and improve transportation capacity. To this end, Tokyo Monorail has systematically upgraded its power facilities and improved their capacity, has currently installed seven substations on all of the lines, and is aiming to achieve a stable supply of electricity using the mutual reserve method.

Substations (7): 1,000kW~3,000kW each (16,000kW total)
Rectification: Silicon rectifiers
Receiving voltage: 20kV AC or 6kV AC, 50Hz
Feeder voltage: 750V DC
Control system: Remote monitor control system
CSMA/CD system

Signal safety system

The signal safety system incorporates TD devices, which detect train position; relay interlocking devices, which control switches and signal (routes); and ATC devices. The ATC devices transmit signals corresponding to the limiting speed determined by the train conditions, forward route clear, and track conditions (e.g. curves) to onboard devices to control train braking. These devices are remotely operated and controlled from operation control room. These advanced safety features ensure safe operation.

Block system: Cab signal block system
Train detection system: Continuous transmission/reception check-in/check-out system
Signal indication system: Speed indication system
Automatic train control system: High frequency induction continuous control system
Interlocking: Class 1 electrical relay interlocking (with automatic interlocking function)
Centralized traffic control system: I: N code transmission system and real line system
Operation control system: Computerized central program control system
Signal rooms: Shōwajima, Hamamatsuchō and Haneda Airport Terminal 1

Safety communication system

The safety communications system includes train radios for communication between the trains and the operation control room, operation command telephones for transmitting instructions from the operation control room to each station or depot – either in a group or individually – and a number of railway telephones for business communications. These communications devices are also vital for safe operation.

Train radio device: 150MHz band semi-duplex wireless telephone
Train telephone: Concatenated polling
Operation command telephone
selective calling railway telephone

Power storage systems (large capacity storage batteries)

Tokyo Monorail has installed power storage systems (large capacity storage batteries) at two locations on every line, as backup power-supply systems to enable trains stopped between stations when there are large-scale power failures, etc. to drive to the nearest station. In the case that a power failure has occurred, it is possible to drive all of the trains on the main lines to the nearest station, usually within one hour, using the electricity in these storage batteries, so we can rescue our passengers quickly and safely.
Furthermore, this system also functions to store the regenerated electric power that is produced when the energy-saving cars (the 2000 Series and the 10000 Series) apply the brakes, and going forward, when increasing the number of energy-saving cars, it is expected that the electricity can be effectively utilized and energy savings can be made by using this electricity as the electricity for driving other trains.

Advanced technologies including scissor switches and composite girders are used throughout the monorail

Scissor switch – a compilation of points

There are two types of switch used in monorail systems: flexible switches and articulated switches. Switches are also classified by the number of switching directions: from 2-point switches to 5-point switches. A number of improvements have been implemented to improve switch efficiency and increase reliability. The "scissor switch" is the product of many years of research, and embodies the latest development in switching technology. The scissor switch features a flexible articulated system, high-speed switching (to reduce operation intervals), and a 24 × 7 switch status monitoring system. These switches are a vital part of the Tokyo Monorail safety features.

Aligned in straight line

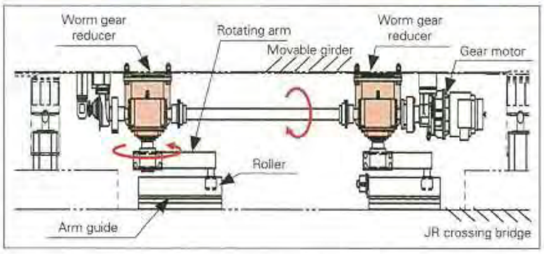
Aligned with crossover (R-shift, #1 line)

Aligned with crossover (L-shift, #2 line)

Work to upgrade the No. 41 switch

The No. 41 switch in the station yard of Hamamatsuchō Station is the only switch that has remained in service on the main line since Tokyo Monorail was opened in 1964. It had been changed approximately 6,500,000 times, and structures such as the movable girders, bogies, etc. had become dilapidated.

For this reason Tokyo Monorail implemented replacement work for the No. 41 switch upgrade from 8pm on July 5, 2014 to 12 noon the following day, July 6. When carrying out the upgrade, we changed the drive system of the switch from the rack and pinion method to adopt an under-girder arm drive system, to further improve the switch change speed (from 15 seconds → within 8 seconds), and achieve higher levels of reliability and low-maintenance operations, and regarding the 24 × 7 switch status monitoring system, we introduced a system with a higher level of intelligence (strengthened rationality checks, etc.).



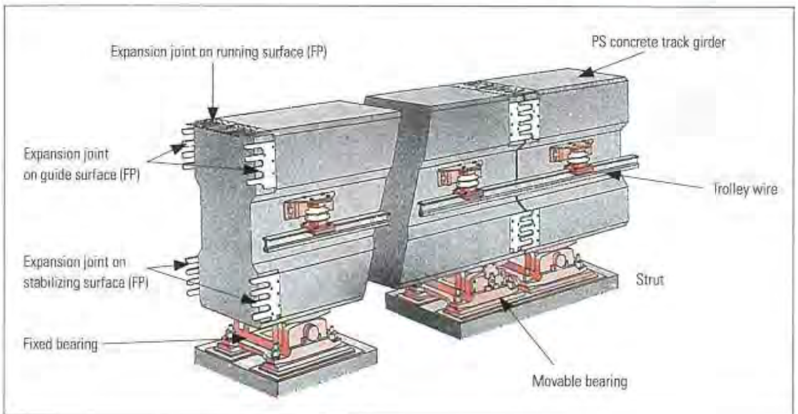
Concept Diagram of the Under-Girder Arm Drive System

Pre-Stressed concrete tracks

The pre-stressed concrete tracks use the standard construction for a straddle type monorail system. A standard track length of 20 meters is used throughout the system. The original lines utilize the Freyssinet, Dywidag, and Leoba methods, but the new extension only uses the Freyssinet method.

Composite track girder design minimizes noise and vibration

The composite track girder developed by Tokyo Monorail was applied to the extension line constructed under the Haneda Offshore Development Project. This new design eliminates slipping and skidding on the running surface, and almost entirely eliminates track girder fatigue. Additionally, the relatively high rigidity minimizes track girder sag, improving riding comfort by improving traveling performance and reducing vibration and noise.



Track maintenance

Track inspection cars (see photos) carry out a multitude of maintenance tasks, from inspection and repair of the expansion/construction seamless plates, to adjustments of track position with millimeter accuracy. In addition, the track inspection car is able to download track status data from the central computer in order to ensure fast and accurate track maintenance.

Pre-stressed concrete girder overview
(R: curve radius, W: girder width, H: girder height)

Shape	
Standard girder length	L=20m
Cross section	W=0.8m H=1.40m
Plane linearity	Min. curve radius:120m
Longitudinal linearity	Min. curve radius: 1,000m
Cant (one-way grade)	Max. 12%
Weight	
Approx. 42 tons when length =20m	
Construction	
Type	Post-tension simple girder (hollow), Freyssinet method
Material	Concrete σck=45N/mm² Pre-stressed steel wire 12 φ 7 Reinforced steel: SD345
Bearings	
Type	Pin fixed bearings, movable rollers
Material (major parts)	SCW480
Expansion joint	
Type	Finger plate (FP)
Material (major parts)	SS400
Suspended material	
Trolley wire	Al/sus steel allow trolley wire
Signal cable	Signal loop line for ATC/TD
Cable rack	For signal/communication cable

Aluminum-stainless steel trolley wire

Battery utility truck

Diesel engine utility truck

Maintenance and repair of extendable-joint striker plates

Tokyo Monorail was opened on September 17th, 1964 as a safe and secure means of transportation to Haneda Airport to coincide with the 1964 Tokyo Summer Olympics.
There are 11 stations including the Haneda Airport International Terminal Station, which was opened on October 21st, 2010, serving our loyal passengers every day.
As we celebrate our 50th anniversary in 2014, Tokyo Monorail carries our passengers towards a brighter future.

TOKYO MONORAIL CO.,LTD.

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JR-EAST GROUP

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Data 4

Photos

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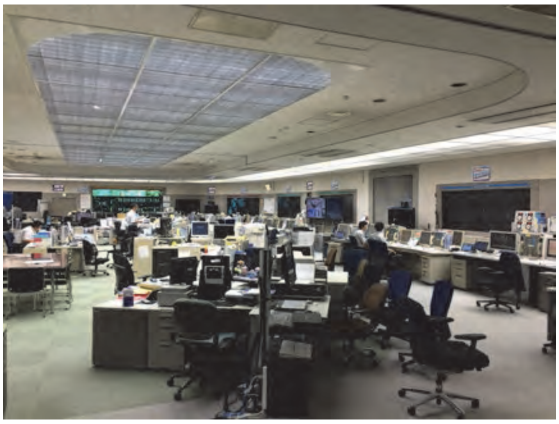
Tokyo Metro


Operation Control Center 1


Operation Control Center 1


Flood Protection Gate


Rolling Stock Depot 1


Rolling Stock Depot 2


Driving Simulator

Tokyo Monorail


Briefing about Tokyo Monorail Co., Ltd.

Rolling Stock Depot


Operation Control Center 1


Operation Control Center 2

JR East – Shinjuku Station South Exit Commercial and Multi-modal Transfer Facilities Development Construction Site


Model of Commercial Bldg. and MMF


Inside Commercial Bldg. under Construction

Mitsubishi Electric Itami Factory


Briefing about Itami Factory 1

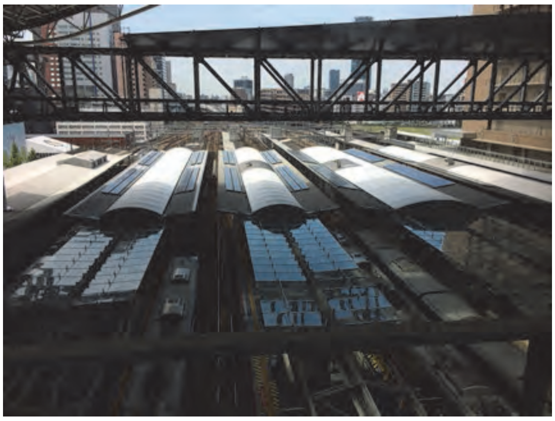

Briefing about Itami Factory 2

Kinki Sharyo Tokuan RST Manufacturing Factory


Inside RST Manufacturing Factory


In front of Main Building

JR West – Osaka Station Renovation


At-grade Tracks and Platforms


Exhibition Space above Platforms


Station Plaza


Roof Garden at South Terminal Building