

# O&M Business in Japan

## Comparison of subway businesses

This section highlights the differences in profit margins (as a result of the scale of O&M operating costs), personnel count of routes where new railway development is carried out, and transport density of subway businesses in Japan.

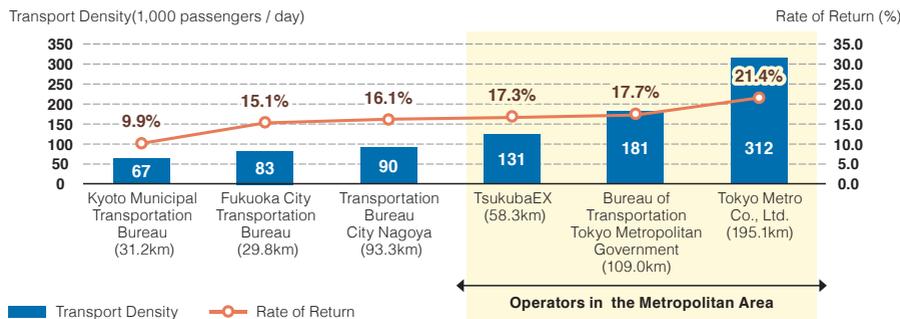
### ▼ Comparison of Japanese Subway Businesses (MLIT, 2018)

Item / Operator	Fukuoka City Transportation Bureau	Kyoto Municipal Transportation Bureau	Tsukuba EX	Transportation Bureau City of Nagoya	Bureau of Transportation, Tokyo Metropolitan Government	Tokyo Metro
Management type	Public management	Public management	Third sector	Public management	Public management	Co., Ltd.
Operation type	Vertically integrated	Vertically integrated	Vertically integrated	Vertically integrated	Vertically integrated	Vertically integrated
Line length (km)	29.8	31.2	58.3	93.3	109.0	195.1
Passengers carried/day (1,000 people/day)	470	397	386	1,336	2,821	7,579
Passenger kilometer <sup>20</sup> (1,000km/day)	2,464	2,077	7,662	8,433	20,319	60,787
Number of personnel	576	638	698	2,745	3,486	9,666
Fare range (JPY)	210-380	220-360	170-1,210	210-340	180-330	170-310
Railway operating revenue (million JPY)	30,945	28,256	46,340	83,725	152,996	383,372
Railway operating expenditures <sup>21</sup> (million JPY)	26,269	25,446	38,307	70,237	125,980	301,314
Operating expenditures <sup>22</sup> (million JPY)	13,336	12,212	14,454	43,713	79,824	193,853
Ordinary income <sup>23</sup> (million JPY)	4,676	2,810	8,033	13,488	27,016	82,058

### ■ Transport Density and Rate of Return

Transport density is defined as the average number of passengers per kilometer per day, calculated by dividing passenger kilometer by line length; and it is used as an index to demonstrate the transportation efficiency of railway lines. It is high in areas where a large number of passengers are transported (e.g., Tokyo Metropolitan Area), which advantageously translates to high-profit margins. Based on profitability and transportation efficiency, 4,000 passengers/day<sup>24</sup> is considered the standard for choosing between railway and bus. The figure below compares the transport density and rate of return of the aforementioned organizations.

### ▼ Relationship between Transport Density and Rate of Return

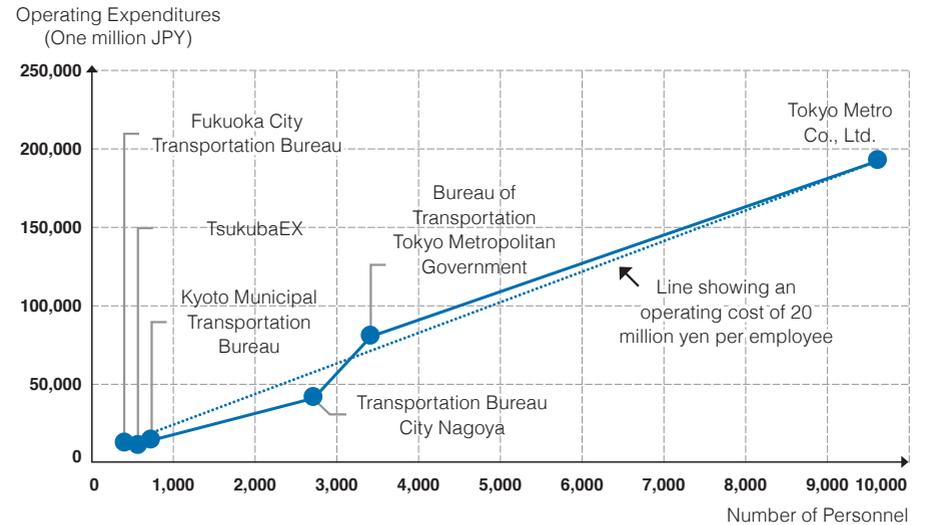


<sup>20</sup> Product of the number of passengers carried multiplied and the average distance traveled  
<sup>21</sup> Sum of the annual expenditures incurred by the operating entity  
<sup>22</sup> Sum of the different costs of direct work and labor costs of train operations required for O&M (e.g., stations, tracks, electricity, and rolling stock), excluding costs of general administration and other non-O&M items (e.g., depreciation, taxes, welfare benefits)  
<sup>23</sup> Difference between the railway operating revenue and railway operating expenditures  
<sup>24</sup> Japanese National Railway Management Reconstruction Promotion Special Measures Law Enforcement Ordinance

### ■ Number of Personnel and Operating Expenditures

The figure below shows a strong positive correlation between the number of personnel of an organization and its operating expenditures, which is influenced by the volume of work required for O&M activities. Based on the slope of the graph, the average operating cost per employee is about 20 million yen.

### ▼ Relationship between the Number of Personnel and Operating Expenditures



### ■ Key Points for JICA Project Utilization

#### Graph of Transport Density and Rate of Return

An index can be obtained to verify the potential of a business using transport density, which is derived from demand forecasts of railway lines. The calculated profit margins are based on the assumed fare level when developing urban railways in emerging economies; if it is significantly lower compared to the transport density of Japanese operating entities, various factors (e.g., high O&M cost, fare setting problems) should be reconsidered.

#### Graph of the Number of Personnel and Operating Expenditures

The graph can be used when formulating an O&M plan, as it serves as a guide in determining the appropriate level of direct work costs and labor costs required for railway O&M. However, these figures will change depending on the conditions (e.g., O&M organizational management structure, work outsourcing situation, and equipment installation scale), which have to be considered when estimating O&M costs.

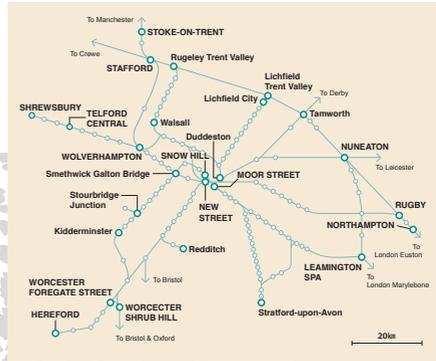
# Overseas O&M Projects: Japanese Company Involvement<sup>25</sup>

## 1 West Midlands Trains, United Kingdom

A Japanese company was jointly involved in a European railway business with an overseas operating entity.

- JR East invested in a train operating company that operates the business.
- JR East dispatched a director to participate in management.
- JR East dispatched employees to the operating entity to support the analysis and improvement in the transportation field, among other items, while sharing knowledge on safety and operations

Operating rights acquired in December 2017



## 2 Mumbai Metro Line 1, India

It is an example of a BOT scheme with a private sector investor.

- With private investment and asset ownership, the private operating entity faced significant financial deficits after opening.
- This case highlights the challenges of private sector investment in spite of the route having good potential for retaining ridership.

Opened in June 2014

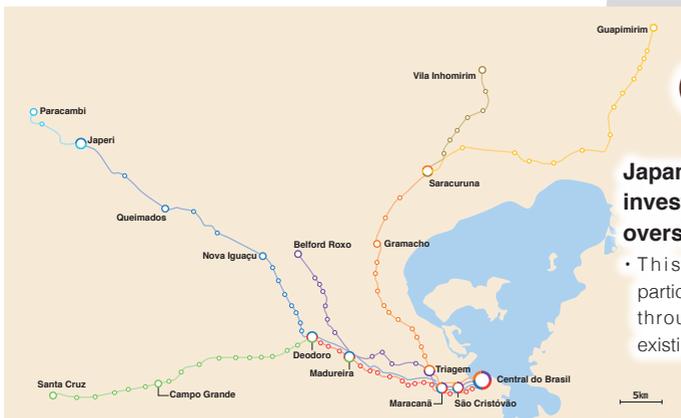


## 3 Rio de Janeiro State Suburban Railways, Brazil

Japanese companies invested in an existing overseas operating entity.

- This is a case of business participation and technical support through indirect investment in existing railway lines.

Investment in 2016



## 6 Manila LRT Line 1, Philippines

This is a case of a Japan ODA loan leading to investments made by Japanese companies.

- Overseas O&M business by a Japanese trading company
- Acquired a 20% stake in a local operating entity in 2020

Opened in 1984 and transitioned to private sector O&M in 2012

## 7 Manila MRT Line 3, Philippines

This is a case of Japanese company undertaking maintenance through a Japan ODA Loan.

- 25-year BLT contract
- Operational risk borne by government

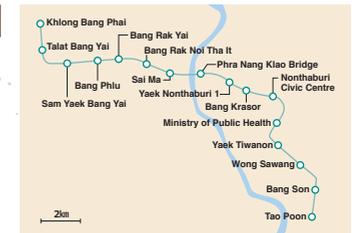
Opened in 1999

## 4 Bangkok Purple Line, Thailand

Japanese companies led maintenance activities in a developing country. Construction was through a combination of PPP and Japan ODA loan.

- A corporate alliance that includes a Japanese railway operator participated in the maintenance of a local urban railway

Opened in 2016

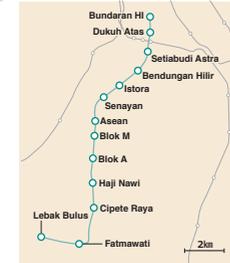


## 5 MRT Jakarta North-South Line, Indonesia

Pre- and post-opening consulting support was provided through a Japan ODA loan.

- It was the first "all-Japan" subway project in Southeast Asia that utilizes Japanese railway technologies and know-how in all aspects.

Opened in March 2019



Other examples (mainly involving trading companies) as of December 2021 are the following:

- Sydney Metro PPP Project (2014, Marubeni)
- Rail fleet maintenance business in North America (2015, Sojitz and Cad Railway Industries, Ltd.)
- Canberra LRT System PPP Project (2016, Mitsubishi Corporation)
- Dubai Metro O&M Project. (2021, Mitsubishi Heavy Industries Engineering, Mitsubishi Corporation)

<sup>25</sup> Excluding Mumbai Metro Line 1, India

# Overseas O&M Projects



Overview	West Midlands Trains, UK	Mumbai Metro Line 1, India	Rio de Janeiro State Suburban Railways, Brazil	Bangkok Purple Line, Thailand	MRT Jakarta North-South Line, Indonesia	Manila LRT Line 1, Philippines	Manila MRT Line 3, Philippines
<b>Implementing Agency</b>	Department for Transport	State government	State of Rio de Janeiro	MRTA	MRTJ	DOTr	DOTr
<b>Operating Entity</b>	WMT	Mumbai Metro One Pvt Ltd (MMOPL)	Supervia	BEM	MRTJ	LRMC	DOTr
<b>Funding</b>	Government	Government/private sector (BOT)	State of Rio de Janeiro	Government/private sector (BTO)	Government of Special Capital Region of Jakarta	Government (existing) Public and private (extension)	Government/private sector (BLT)
<b>Total Project Cost (Planned)</b>	Unknown	64.7billion JPY 43.2 billion rupees	Unknown	212.4 billion JPY	180 billion JPY (22.2 trillion IDR <sup>26</sup> )	64.7 billion JPY	7.19 billion JPY
<b>Japan ODA Loan</b>	No	No	No	Yes (for infrastructure, track and other components)	Yes	Yes (transport capacity enhancement)	Yes (rehabilitation)
<b>Route Length</b>	899 km	11.4 km	270 km	23km	15.7 km (Elevated 10.1km/ Underground 5.6km)	19.6km	16.8 km
<b>Terminal Station</b>	See route map (P63)	Versova ▼ Ghatkopar	See route map (P63)	Khlong Bang Phai ▼ Tao Poon	Bundaran H.I. ▼ Lebak Bulus	Baclaran ▼ Roosevelt	North Avenue ▼ Taft Avenue
<b>No. of stations</b>	Approx. 170	12	104 (8 lines)	16	13	19	13
<b>Type of Railway Structure</b>	MRT Above ground	MRT Elevated	MRT Above ground	MRT Elevated	MRT Elevated / underground	LRT Elevated	MRT Elevated, Above ground, underground
<b>E&amp;M system suppliers</b>	—	Siemens, etc.	—	Marubeni and TISS	Mitsui & Co., and Toyo Engineering	Mitsubishi Heavy Industries, Alstom, etc.	Mitsubishi Heavy Industries, Bombardier, etc.
<b>Rolling stock manufacturer</b>	CAF, etc.	CRRC Nanjing Puzhen Rolling Stock Co., Ltd	Alstom, etc.	J-TREC	Nippon Sharyo	Kinki Sharyo, Nippon Sharyo, CAF, etc.	ČKD Tatra, CRRC Dalian
<b>Opened</b>	December 2017 (Operating rights)	June 2014	November 1998 (Privatized)	August, 2016	March 2019	December 1984	December 1999
<b>Passengers</b>	Approx. 73.6 million per year(2017)	Approx. 400,000 per day (2018)	Approx. 592,000 per day(2019)	Approx. 53,000 per day(2019)	Approx. 93,000 per day (2019)	Approx. 460,000 per day(2020)	Approx. 200,000 per day (December 2021)
<b>Consist of</b>	—	4 cars (6 cars)	8 cars	3 cars	6cars (8 cars)	3 cars (4 cars)	3 cars
<b>Headway</b>	—	4 minutes/8 minutes	4 minutes – 30 minutes	6 minutes / 9 minutes	5 minutes / 10 minutes	3 minutes	4 minutes
<b>Payment</b>	E-ticket Mobile ticket Ticket	Smart card Smartphone	Ticket Prepaid ticket IC card (RioCard)	Token (Resin medal with built-in IC) Smart card	Prepaid ticket Bank-based e-commerce Smartphone app	Smart card (Common use for LRT1, LRT2, and MRT3)	Smart card (Common use for LRT1, LRT2, and MRT3)

<sup>26</sup> Estimated at the 16 February 2022 rate

# West Midlands Trains, United Kingdom

## Commercial Information

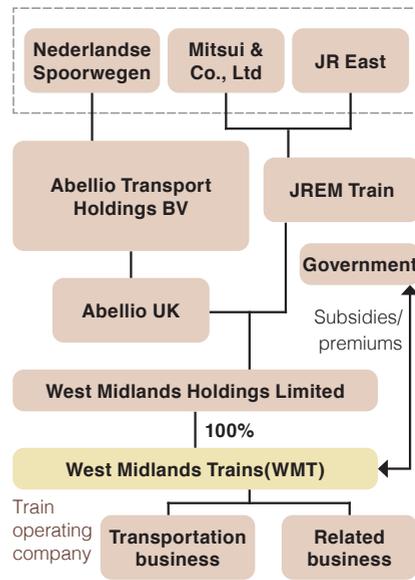
### ■ Key Points

- This is a case where a Japanese company participated in a European railway business together with an overseas operator.
- JR East invested in a train operating company that operates the business, and it participates in management through a director it appointed.
- Punctuality is a specialty of Japanese railway operators and serves as a sales tool in obtaining operating rights.

### ■ Business Scheme

The separation of railway infrastructure and operations is adopted in railway businesses. The operating rights of each train operating company are determined through bidding. In November 2016, JR East and Mitsui jointly bid with Abellio UK, a wholly owned subsidiary of Nederlandse Spoorwegen, and won the franchise for the West Midlands Trains (WMT). Railway operations started in December 2017. The operating rights were taken over from Govia, a major British and French transportation company that was in charge of operations for 10 years. The operating entity is responsible for metropolitan transportation near London and Birmingham, as well as long-distance routes connecting London and Liverpool. The franchise also includes the management of the Birmingham Snowhill Station, among others. The WMT, in which the three (3) said companies invested, is responsible for the actual operation work, with Abellio UK investing 70.1% while JR East and Mitsui have 14.95% investment stakes, respectively.

▼ WMT Business Scheme Diagram



in establishing a safe, high-quality, and stable transportation system.

### ■ Business Environment

The British Department for Transport implements a program that provides subsidies to franchises that encounter difficulties attaining profitability while instituting premium payments from franchises that are expected to be profitable. This system is seen to help maintain balance across the railway network.

### ■ Background to Operating Rights Acquisition

Abellio UK, along with Mitsui & Co., Ltd., and JR East also operate railways in Scotland and Germany and have considerable railway experience, including that of its parent company, Nederlandse Spoorwegen. In this case, JR East obtained opportunities to accumulate operational experience in the UK, a country considered the birthplace of railways. The company banked on its corporate strengths

# (Involvement of Japanese Company in European Railway Operations)

## Technical Information

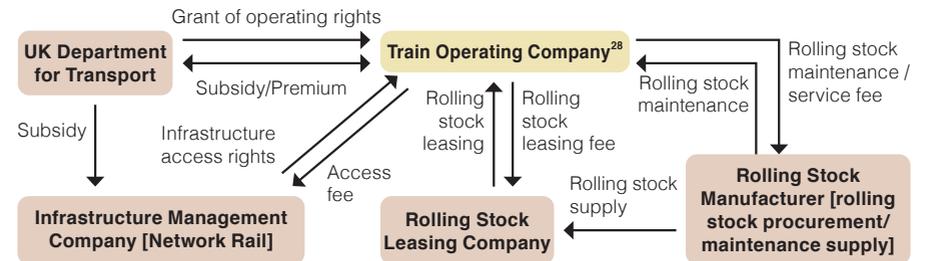
### ■ Key Points

- Personnel are deployed in the train operating company to provide knowledge on safety and operations while supporting the analysis and improvement in the transportation field.
- Personnel can continue their tasks even with a change of the operating entity. While the existing personnel can be utilized, they cannot be reconstituted in a short period.

### ■ UK Railway Industry (as of 2020<sup>27</sup>)

An infrastructure company, Network Rail, and rolling stock leasing companies invest and own assets, while train operating companies pay rental and lease fees.

▼ UK Railway Industry Relationship Diagram



### ■ Value Enhancement

- Personnel from three (3) departments (i.e., transportation, rolling stock, and station operation) were deployed by JR East. Their knowledge was applied in formulating measures to ensure safe and stable transportation and improvement of service quality.
- Under a contract with the British Department for Transport, the train operating company introduced rolling stocks and improved infrastructure.

applying Japanese railway management practices, as such this system is different from that of Japan. While attempts were made to implement punctuality—one of the strengths of Japanese railways—it does not apply to all local contexts<sup>29</sup>.

### ■ Project Challenges

- The separation of railway infrastructure and operations proved difficult to implement when

### ■ Business Risks

- In this scheme, the train operating company profits and earns dividends. Risks are shown on Page 12.
- These risks are absorbed by the operating company to a certain extent with the government sharing responsibility depending on the situation.

<sup>27</sup> A re-evaluation is planned according to the "Great British Railway Plans" announced by the British Ministry of Transport in May 2021.

<sup>28</sup> May also perform rolling stock maintenance

<sup>29</sup> In dealing with train operation disruptions, split operation can be carried out. When they reach a certain station, trains turn back as an effective method of limiting adverse impacts on operations. However, suspended train services or changed destinations could significantly affect operational performance

# Mumbai Metro Line 1, India

## (BOT Scheme with Initial Investments)

### Commercial Information

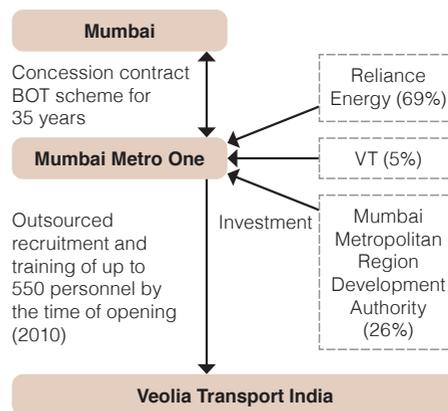
#### ■ Lessons for JICA Projects

- BOT scheme with private investment often exposes the private sector to significant risks.
- Delays in the rail opening pushed back revenue opportunities for the private sector operator.
- If the fares are set too low due to government interventions, compensation for the private sector operator is essential.

#### ■ Business Scheme

- The concession period is 35 years, including a construction period of five (5) years.
- Mumbai Metro One Private, Ltd (MMPOL) owns assets (e.g., viaducts, stations, bridges, depots, rolling stock, signaling systems, power supply, SCADA, communication, tracks, AFCS) on Metro Line 1.
- MMOPL is responsible for operations for 10 years, while the hiring and training of up to 550 personnel were outsourced to Veolia Transport India.

#### ▼ Mumbai Metro Line 1 Business Scheme



#### ■ Business Conditions

- MMOPL fell into financial deficits with an annual loss of 3 billion rupees (5 billion yen) in 2016.
- Although fare revenue can cover the operating expenses, financial costs (e.g., interest expenditures) exert pressure on business viability.
- The provincial government introduced lower fares against the proposal made by MMOPL before revenue service.
- Although the Metro Rail O&M Act stipulates a fare setting committee, extra-judicial measures were implemented with the involvement of the state government.
- As a result, in 2014, MMOPL demanded the appointment of an arbitrator from the Mumbai High Court, resulting in disagreements.

#### ▼ MMPOL Income and Expenditure Structure (2019)

<b>Fare Range</b>	INR 10-40 (approx. 15-60 JPY)
<b>Revenue</b>	INR 34,639 Lakhs (approx. 5.1 billion JPY)
<b>Railway Revenue</b>	INR 30,042 Lakhs (approx. 4.4 billion JPY)
<b>Non-railway Revenue</b>	INR 4,597 Lakhs (approx. 700 million JPY)
<b>Operating Expenses</b>	INR 15,518 Lakhs (approx. 2.3 billion JPY)
<b>Financial Cost (e.g., Interest Expense)</b>	INR 28,071 Lakhs (approx. 4.1 billion JPY)
<b>Other (e.g., Salaries, Insurance)</b>	INR 2,833 Lakhs (approx. 400 million JPY)

### Technical Information

#### ■ Lessons for JICA Projects

- Recruitment and training for operational readiness were outsourced to the Indian subsidiary of an international operator.
- Widely adopted KPIs in line with European standards (including RAMS-based indicators) were utilized.
- The operating entity arranged training and technology transfer exercises through third countries, thereby strengthening their O&M capacity.

#### ■ KPIs

- MMOPL sets KPIs for risk management and corporate value improvement.
- Service availability and punctuality records were at 100% and 99.9%, respectively.
- Transportation performance indices are used as part of KPI, including the number of trips, train kilometers, and the annual number of passengers.
- The cleanliness of trains and the number of complaints are used as indicators of customer service.
- RAMS-based indicators (e.g., Mean Time Between Failures) have also been introduced, implying European standards are widely adopted.

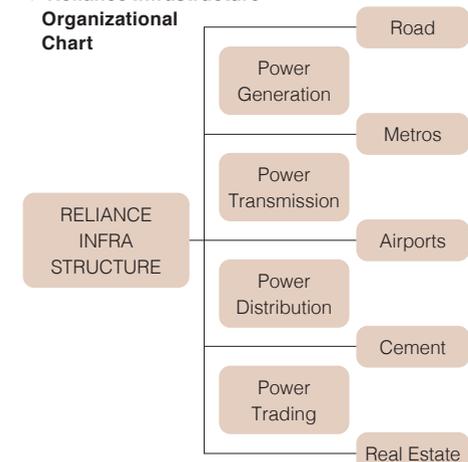
#### ▼ Mumbai Metro Line 1 KPIs and Status (2021)

<b>Availability</b>	100 (%)
<b>Punctuality</b>	99.9 (%)
<b>Max. trips per day</b>	806,000 (Trips)
<b>Train kilometers per day</b>	8,912,000 (km)
<b>Annual passengers</b>	676 million
<b>Cleanliness</b>	97 (%)
<b>Complaints</b>	27 per million passengers
<b>MTBF (elevators)</b>	800 hours
<b>MTBF (escalators)</b>	1,200 hours

#### ■ Organizational Chart and Number of Personnel

- MMOPL outsourced the hiring and training of up to 550 personnel to Veolia Transport India for operational readiness and was responsible for 10 years of operations after opening.
- Subsequently, the operating entity was changed to Transdev + Paris Subway (RATP), which acquired Veolia.
- Personnel training was commissioned for a five (5)-year contract. As of 2017, a total of 825 personnel completed the trainings.
- The total training hours by that year registered 29,060 hours.
- The training includes more than 50 training modules, instructor training, arrangements for technology turnover from third countries (e.g., Seoul Line 9, China CSR), and user training conducted by suppliers.

#### ▼ Reliance Infrastructure Organizational Chart



# Rio de Janeiro State Suburban Railways, Brazil

# (Investment by Japanese Companies in Existing Operating Entity)

## Commercial Information

### Key Points

- Business participation and technical support was provided through indirect investments in the existing urban railway lines in a developing country.

### Business Scheme

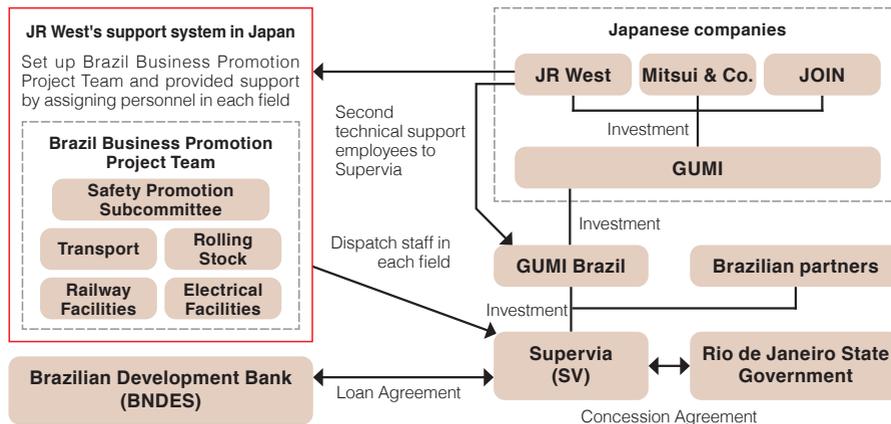
- The joint venture company, Guarana Urban Mobility (GUMI), consists of JR West, Mitsui & Co., Ltd., and Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (JOIN) participates in Brazilian passenger railway business by indirectly holding shares in Supervia, Rio de Janeiro State Suburban Railways.
- Supervia has been granted the railway operating rights since 1998 through a concession contract from the State of Rio de Janeiro. It has 8 lines<sup>30</sup> and 104 stations with a total route length of 270 kms.
- With more than 2,000 employees, the average daily number of passengers in 2019 was

590,000, which is comparable to a major Japanese railway.

### Background on JR West Participation

In addition to contributing to the safety and stability of transport operations of Supervia, JR West also contributes to the improvement of Supervia's corporate value through technical support and training based on railway O&M experiences in Japan. It also aims to contribute to the development of Japan's domestic railway business by obtaining overseas railway business knowledge, human resource development, and technical support.

### Rio de Janeiro State Suburban Railways Business Scheme Diagram



### JR West's Business Participation

This engagement involved participation in the form of indirect investments and technical support for O&M leveraging on their strengths as a railway operator.

### Supervia's Business Conditions

The number of passengers has decreased due to the COVID-19 pandemic. The financial positions for operations in 2020 showed the business incurring deficits.

<sup>30</sup> 5 routes and 3 extension routes as per the SV official website

## Technical Information

### Key Points

- Technical support was provided through advisories while respecting local ideas, customs, and speed.
- Local support was provided by setting up the project team and sending Japanese resident officers.

### Technical Support System for Railway Business

- The Brazilian Business Promotion Project Team was set up in JR West. Furthermore, Japanese personnel were stationed locally to build a support system.
- Utilizing knowledge and experiences on railway O&M in Japan, JR West provided support that contributes to safety improvements and the

corporate value of Supervia.

- In addition to JR West employees sent to Brazil, personnel from Japan involved in various fields were dispatched to the site as needed for additional local support.
- JR West provided support based on local contexts. It has achieved results in various efforts, such as derailment prevention and train collision measures.

### JR West Support Activities (2015-2019)

2015	2016	2017	2018	2019
Support provided in Japan	Dec. Supervia Rolling stock employees went to Japan for training.			Dec. SV president visited Japan.
		Oct. SV Electrical employees went to Japan for training.		
Support provided in Brazil by Japanese personnel in various fields	Jan. On-site investigation	Sept. Electrical facilities mission		Mar. Track maintenance and Rolling stock mission
	Apr. On-site investigation	Oct. Track maintenance mission		Apr. Track maintenance and Rolling stock mission
	Oct. On-site investigation	Jul. Rolling stock mission		Jul. Track maintenance mission
		Oct. Track maintenance mission		Aug. Transport mission
			Sept. Electrical facilities mission	Sept. Rolling stock mission
			Mar. Track maintenance mission	

### Project Challenges

Initially, the Brazilian company was not satisfied with JR West's explanation of the details of the technical support proposal that involved experience-based approaches. However, through the careful explanation of the significance, theory, and the technical

basis of these new initiatives, understanding was gradually obtained.

### Business risks

There are risks in relation to lower actual demand than forecasts, as well as non-implementation of fare increases due to policies.

# Bangkok Purple Line, Thailand

## (Maintenance by Japanese Companies in Emerging Economies; Construction Route through PPP and Japan ODA Loan)

### Commercial Information

#### Overseas railway O&M business reference points

- A case where a corporate alliance involves the participation of a Japanese railway operator for the maintenance of a local urban railway.
- Approximately a year after opening, the Blue Line was extended and connected, resulting in passenger ridership increases.

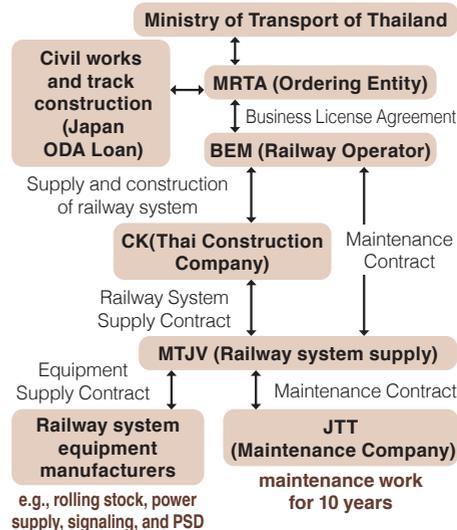
#### Business Scheme

- The Mass Rapid Transit Authority (MRTA), which is under the Ministry of Transport of Thailand, is the main ordering entity in the construction and operations of the Purple Line.
- The Bangkok Expressway and Metro (BEM) is given the railway operating rights and entrusted with the construction of the railway system under a business license agreement with the MRTA.
- The BEM subcontracts supply and construction of the railway system to CH. Karnchang Public Co., Ltd. (CK).
- The Marubeni-Toshiba Joint Venture (Thailand) Co., Ltd. (MTJV) is subcontracted to supply the railway system by CK.
- The Japan Transportation Technology (Thailand) Co., Ltd. (JTT), a consortium of Marubeni, TISS, and JR East, is entrusted with maintenance works for 10 years by BEM through MTJV. KPIs are also set for operational delays.
- Civil works and track construction were financed through a Japan ODA Loan.

#### Background on JTT Participation

- The delivery and construction of the railway system were under a design-and-build arrangement for rolling stock, power supply, signaling, and PSD.
- Since European standards are considered the de facto standard in the locality, Japanese companies found difficulty in negotiating and competing. When a proposal for an additional 10-year maintenance services contract including track was requested, the JTT considered it an opportunity to differentiate itself from the competition. This also solidified JTT's partnership with Marubeni, Toshiba, and JR East.
  - The JTT provided a detailed explanation of the Japanese high-quality system and low life cycle cost, among others.

#### Bangkok Purple Line Business Scheme Diagram



#### Matters of Reference for Overseas Railways

- The construction of the 23-km railway was completed in 33 months — a difficult schedule that did not allow any reworks in the process (e.g., design, manufacturing, construction, and testing).
- A significant amount of document preparation was required, which was unusual in Japanese railway construction (dealing with western engineers or European standards).
- Each design document requires approval not only from the CK but also from the BEM and MRTA. This greatly affected schedule management.

### Technical Information

#### JTT Maintenance Work Implementation System

- The system comprises an implementation team for rolling stock/depot equipment, power supply, and track, as well as support teams for failure management and health and safety.
- It is a fusion of European style maintenance<sup>31</sup> and Japanese style maintenance<sup>32</sup>.

#### JTT Technical Departments



#### Main Suppliers

Rolling stock	Japan Transport Engineering Company TISS (main circuits and other electrical parts)
Power supply/distribution	Meidensha
Signaling	Alstom
Communication/PSD/AFC/SCADA	Singapore Technologies Electronics
Depot equipment	Design and Projects (UK)

#### Human Resources Training

- Until about two (2) years after the business opening, Japanese team managers were seconded to train Thai managers. As of June 2018, all managers in the technical departments are Thai nationals.
- Unlike Japan, Thailand has an employment environment where people change jobs frequently for career advancement, thus applying the Japanese style of human resource development proved difficult.

#### Characteristics of Maintenance

Maintenance information is centrally managed among related organizations through a computerized maintenance management system (CMMS), which enables efficient implementation of tasks. For example, maintenance work instructions

are automatically issued based on registered information, such as maintenance cycles, manuals, checklists, and required number of personnel.

- The technical basis of failure risk is clarified and evaluated by applying the concept of risk-based maintenance. Maintenance works are consequently planned. This initiative has extended the maintenance cycles of the onboard power collection cable.

#### Business Risks

Below are the primary risks that companies work on to mitigate:

- Increased costs resulting from serious accidents caused by maintenance issues;
- Decrease in income due to the non-achievement of KPIs as specified in the contract; and
- Human resources (e.g., recruiting suitable Thai personnel).

<sup>31</sup> The intention was to create a common platform called CMMS so that even inexperienced operators could achieve a certain level of maintenance knowledge in a short period.

<sup>32</sup> The intention emphasizes "on-site solution ability" by improving each staff member's ability and accumulating know-how.

# MRT Jakarta North-South Line, Indonesia

## (Pre- and Post-Opening Technical Assistance through Japan ODA Loan)

### Commercial Information

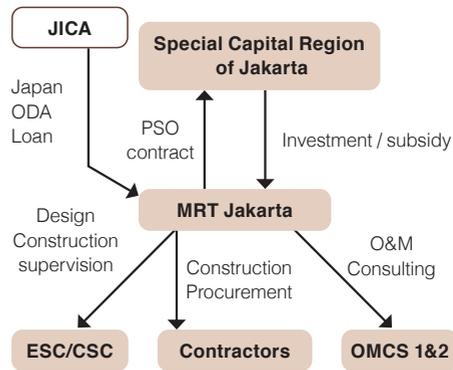
#### ■ Key Points of JICA Projects

- This involved government investment and direct management of MRT Jakarta (MRTJ) as the railway operating entity conducting O&M of the North-South Line, which is considered a future “cash cow line.”
- Immediately after opening, the majority of income relies on state subsidies, which requires the government’s financial capacity.
- The initial opening of the railway is considered a crucial time for railway operators. Balancing the revenue and expenditure by establishing demand at an early stage is urgently needed.

#### ■ Business Scheme

- The implementing entity, MRTJ, operates and maintains the railway as the operator.
- Government funding is drawn from a JICA ODA loan.
- Japanese companies, such as the Shimizu Corporation and Sumitomo Mitsui Construction, undertook the construction of infrastructure installations. Nippon Sharyo provided the rolling stock, while Mitsui & Co., and Toyo Engineering were responsible for the E&M systems.
- MRTJ owns the facilities. While the agreement type between MRTJ and the Special Capital Region of Jakarta is unknown, there has been a history of discussions, such as setting compensation based on transportation costs per passenger.

#### ▼ Business Scheme Diagram



#### ■ Business Conditions

The revenue and expenditure structure for 2019 (year of opening) was as follows:

- The farebox recovery ratio remained at around 25%.
- Even if the farebox and non-farebox revenues were added up, the figure remained at about 52% of cost of revenues.
- Subsidy revenue constituted 58% of income, as the business relies on state government support.
- In this case, the non-farebox revenue exceeded farebox revenue.
- The non-farebox revenue is mainly composed of advertising (85%) and prepaid card sales (14%), among others. Retail earnings make up only 1% of non-farebox revenues.
- The daily number of passengers was about 80,000. It is expected that the number of passengers will increase significantly in the future as demand becomes more established and with the line extended to the north.

#### ▼ MRTJ Income and Expenditure Structure (MRTJ, 2019)<sup>33</sup>

<b>Fare Range</b>	IDR 4,000-14,000 (approx. 32-113 JPY)
<b>Total Revenues</b>	IDR 933.230 mil. (approx. 7.54 billion JPY)
<b>Farebox Revenue</b>	IDR 191.552 mil. (approx. 1.54 billion JPY) 20% of total revenues
<b>Non-Farebox Revenue</b>	IDR 207.608 mil. (approx. 1.67 billion JPY) 22% of total revenues
<b>Subsidy Revenue</b>	IDR 534.070 mil. (approx. 4.30 billion JPY) 58% of total revenues
<b>Cost of Revenues</b>	IDR 760.415 mil. (approx. 6.12 billion JPY)
<b>Total Comprehensive Income (Loss) for the Year</b>	IDR 146.704 mil. (approx. 1.18 billion JPY)
<b>Net Profit Margin (%)</b>	15.74%

<sup>33</sup> Estimated at the 12 January 2022 rate.

### Technical Information

#### ■ Key Points for JICA Projects

- Japanese railway technology and expertise are utilized for O&M and organizational structuring.
- Assistance continued even after the opening. This greatly contributed to the establishment and improvement of daily personnel duties.
- The organization along with the number of personnel are planned and implemented based on Japanese practice, making the system operate smoothly.

#### ■ KPIs

- MRTJ itself sets KPIs for risk management and corporate value improvement.
- The percentage of the accuracy of train travel and percentage of the actual number of train trips as planned are levels close to 100%.
- Targets for Public Readiness Index, Customers Satisfaction Index, and (Good) Corporate Governance Score have also been met.
- Non-farebox revenues have reached 220%.

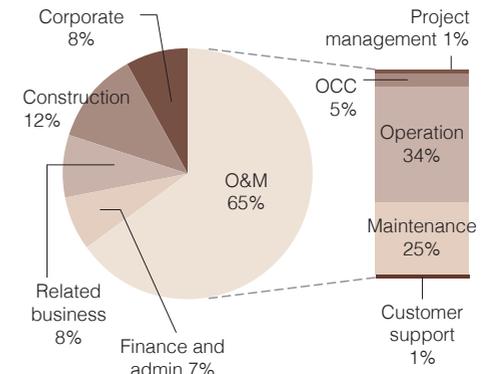
#### ▼ KPI and Achievement Status (MRTJ, 2019)

Percentage of accuracy of train travel	75 : 99.96 [%]
Percentage of actual number of train trips as planned	75 : 99.98 [%]
Public Readiness Index	70 : 72.9 [%]
Customers Satisfaction Index	75 : 82.78 [%]
Non-Farebox Revenues (Related business)	100 : 220.22 [%]
Good Corporate Governance Score	87 : 87.33 [%]

#### ■ Organization

- The O&M Consulting Services (OMCS) supported the formulation of organizational structures and personnel planning.
- The O&M headquarters is set up, with several departments (e.g., Operations and Maintenance) placed there.
- Excluding the 68 personnel in the construction department, the total number of personnel involved in O&M was under 500.
- After the opening, personnel had difficulty taking days off due to workforce shortage. This led to the gradual expansion of the number of personnel.
- As a result, the number has increased to 689 as of September 2021.

#### ▼ Number of Personnel during Railway Opening



#### ▼ MRTJ O&M headquarters (MRTJ, 2019)

##### Operation and Maintenance Director

<b>Operation and Maintenance Facility Services Division</b>	e.g., Security Department, Contract Administration and Vendor Management
<b>Railway Operation Division</b>	e.g., Train Operation Department, Station Operation Department, Information Technology Infrastructure and AFC Department
<b>Railway Maintenance Division</b>	Rolling Stock Depot Maintenance Department, Power Maintenance Department, Signal and Telecommunication Maintenance Department, Track and Infrastructure Maintenance department
<b>Customer Engagement Division</b>	Customer Intelligence and Management Department and Customer Care Department

# Manila LRT Line 1, Philippines

## (Investment by Japanese Companies Resulting from Japan ODA Loan)

### ■ Effects of JICA Assistance

- An increase in demand due to JICA assistance, such as the capacity expansion project, led to the participation of Japanese companies in the O&M of this line.
- Régie Autonome des Transports Parisiens (RATP) was assigned a 20-year advisory contract by the Light Rail Manila Corporation (LRMC) to assist in solving technical problems.
- Internal rules and manuals have been enhanced as a result of the support provided by RATP. Even with the Japan ODA, it is ideal to improve the ability to prepare such documents.

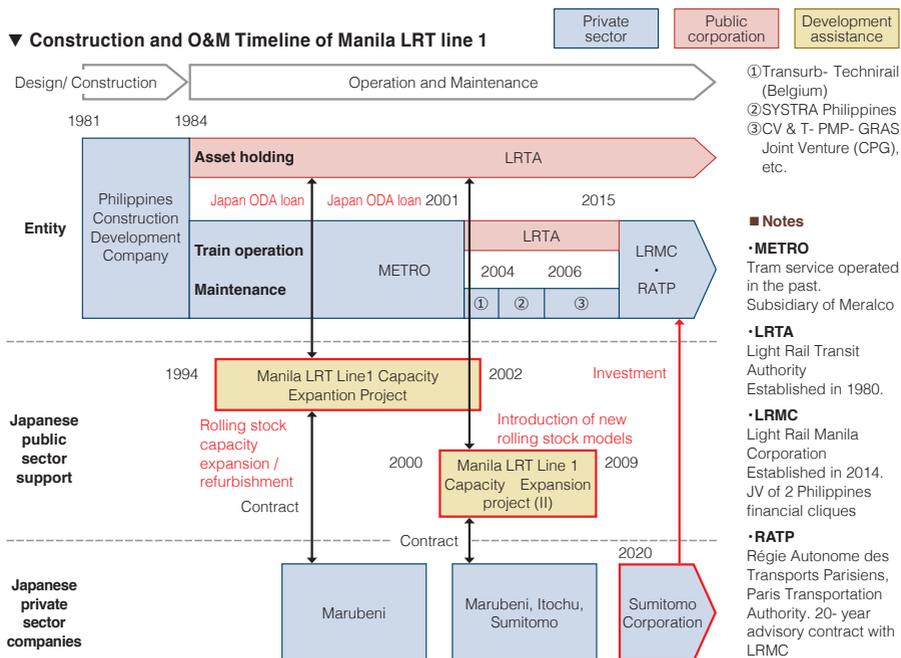
### ■ O&M Background

- The line was constructed in 1985 through a Belgian ODA loan.
- Infrastructure is owned by the Light Rail Transit Authority (LRTA), which was established in 1980; while O&M and system refurbishment is carried out by LRMC, a Philippine private sector consortium established in 2014.
- Two (2) capacity expansion projects were implemented through Japan ODA loans to address facility overuse due to lack of overall transportation capacity. Japanese-made rolling stock were delivered for the second capacity expansion project.
- The LRTA initially managed the rail line directly and eventually transferred to a private concession in 2015.

- The contract is a Rehabilitate-Operate-Transfer (ROT) scheme that includes both the rehabilitation of the existing section and investments in the line extension.
- Sumitomo Corporation invested and participated in the operations of the O&M company since 2020.
- Improvements to the reliability of rolling stock and systems, operational efficiency, safety, and other rehabilitation works are ongoing.
- The 6.6-kilometer south extension (Baclaran to Dr. Santos) will open in 2023.

### ■ Basic Route Information

- Fare range: PHP 11- 30 (approx. 22- 60 JPY)
- Average number of passengers per day: 460,000 (2020)
- Fare revenue : 22,937 mil PHP (2020)



# Manila MRT Line 3, Philippines

## (Maintenance by Japanese Companies through Japan ODA Loan)

### ■ Background and Effect of JICA Assistance

- System availability was declining due to system aging and delays in the procurement of maintenance parts.
- Through JICA assistance, Japanese companies re-entered the market, consequently providing an opportunity to carry out high-quality maintenance.
- TES Philippines, Inc., a subsidiary of the Mitsubishi Heavy Industries Group, is currently performing maintenance to address technical problems.

### ■ O&M Background

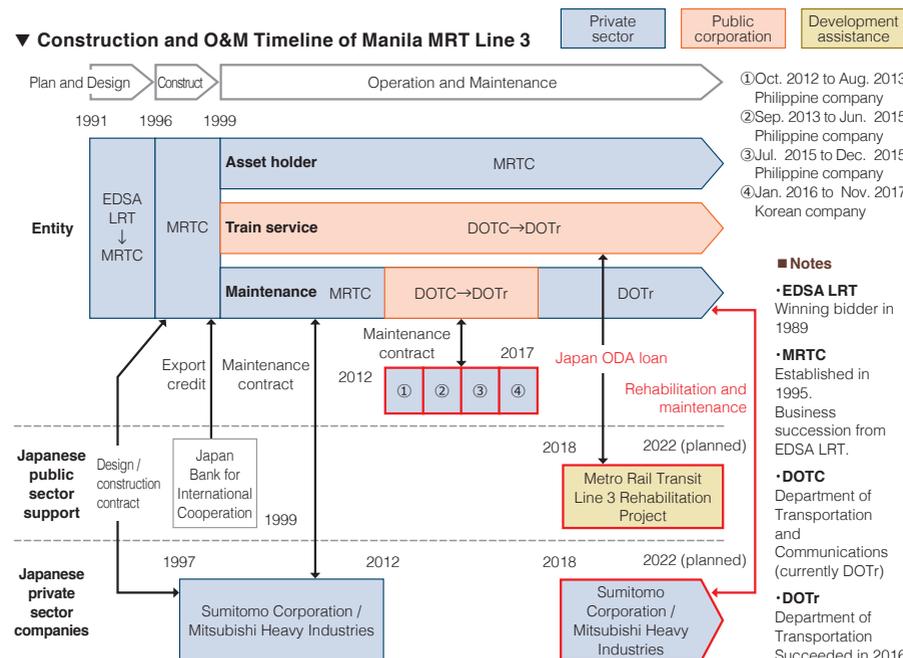
- The transaction is structured as a 25-year BLT scheme that leases the facilities to the government. Operational risk is borne by the government as it directly operates the railway.
- From 1999 to 2012, a Japanese company was in charge of maintenance, but after contract termination by the Philippine side, breakdowns and accidents occurred frequently due to a variety of factors.
- A Japan ODA loan was signed in 2018, with Japanese companies rehabilitating and maintaining the facilities.

### ■ Basic Route Information

- Fare range: PHP 13-28 (approx. 28- 61 JPY)
- Average number of passengers per day: 200,000 (Dec 2021)
- Fare revenue: 650 mil PHP (2020)

### ■ KPI

- Under the MRT3 rehabilitation maintenance contract, the number of trains operated in the morning and afternoon is controlled.



# O&M Projects in Other Sectors: Maritime

## ■ Lach Huyen Port, Vietnam

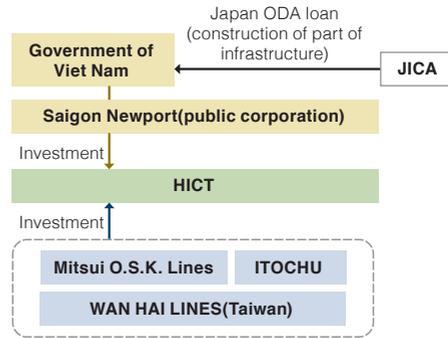
### Construction: Vertical separation method utilizing Japan ODA loan

- Water depth: 14 m, Total berth length: 750m x 2
- Landfill/ground improvement work (Japan ODA Loan)
- Construction of the container yard, procurement of cargo handling equipment, among other facilities (Private sector)

### Operation: SPC funded by Japanese companies

- Operator: Haiphong International Container Terminal Co., Ltd. (HICT)
- Start of operations: 2018
- Main source of revenue: cargo handling services, storage services, barge service

### ▼ Lach Huyen Port Business Scheme Diagram



## ■ Myanmar International Terminal Thilawa, Myanmar

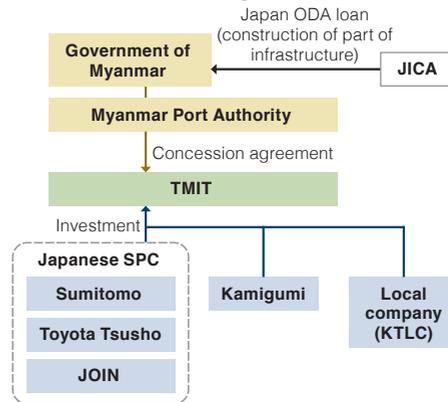
### Construction: Vertical separation method utilizing Japan ODA loan

- Water depth: 10 m; total berth length: 200 m x 2
- Construction of the multipurpose terminal with Japanese technology (Japan ODA Loan)

### Operation: SPC funded by Japanese companies

- Operator: Thilawa Multipurpose International Terminal Co., Ltd (TMIT)
- Kamigumi acquired operating rights from the Myanmar Port Authority (MPA) in March 2018.
- Operation period: 38 years
- Japanese port transportation companies, trading companies, and JOIN invested in TMIT.
- Main source of revenue: cargo handling services, storage services

### ▼ Myanmar International Terminal Thilawa Business Scheme Diagram



## ■ Sihanoukville Autonomous Port, Cambodia

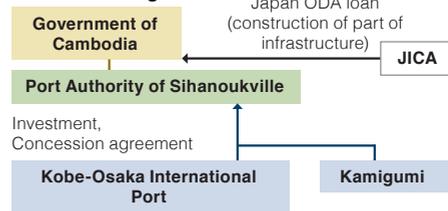
### Construction: Continue assistance utilizing Japan ODA loan

- Assisted in rehabilitating and expanding existing port
- Construction of new container terminal
- Procurement of cargo handling equipment

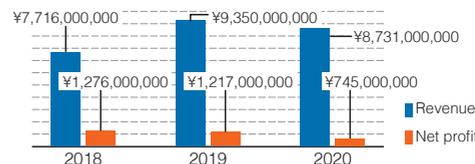
### Operation: Public operator with investments from Japanese companies

- Operator : Port Authority of Sihanoukville
- The JICA assisted capability building through technical cooperation.
- The JICA acquired equities (2017)
- The JICA transferred the controlling shares of Sihanoukville Autonomous Port (PAS) to Kobe-Osaka International Port and Kamigumi. (2018/2019)
- Main source of revenue: cargo handling services, storage services, port charges

### ▼ Sihanoukville Autonomous Port Business Scheme Diagram



### ▼ PAS Revenue and Net Profit



## ■ Demand risks

- Freight demand is highly correlated with the GDP growth rate, making demand forecasting relatively straightforward.
- Operators take on the demand risk if profitability is high enough.
- Demand is growing globally but is expected to drop significantly due to factors such as the Lehman Shock and the spread of COVID-19 infections.
- The existence of competing ports influences demand.

## ■ Handling charge restrictions

- Restrictions may or may not be applied.
- There are price caps (e.g., demand exceeds supply in Indonesia) and price floors (e.g., many competing ports in Vietnam).
- The necessity of regulation is determined by the market principles and the balance of supply and demand.
- Seaports tend to be more purely based on market principles than railway, in which government often set fares.

## ■ Capacity building<sup>34</sup>

- Most cargo handling is mechanized. However, bulk cargo is handled manually.
- High profitability enables the payment of high salaries, which makes securing highly qualified human resources possible.
- Sufficient operational work levels can be acquired through training.
- There are cases of port operation training in other countries for about half a year. The training period can be extended in case the start of services is delayed.
- Easier to secure human resources than in railways, in terms of the number of staff and employment conditions.
- The work is highly manualized and simple, and a training environment is easy to provide.

## ■ Trends of Japanese companies

- Shipping companies look upon container terminals as cost centers (paying for the sense of security that their vessels can be accommodated).
- Companies have their own strategies, such

as specializing in terminal operations or operating both shipping and terminals.

- Japanese terminal operators are expanding overseas with the support of the Japanese government.
- It is necessary to decide how Japanese terminal operators and shipping companies enter the operation of overseas ports for each project. There are restrictions on "all Japan" (trading company + shipping company + terminal operator) operations. Shipping companies look upon container terminals as cost centers (paying for the sense of security that their own vessels can be accommodated).

## ■ Barriers to market entry

- Construction financed through Yen loans, or loans to business entities by the Japan Bank for International Cooperation (JBIC) are effective methods.
- It is effective for a Japanese company to package the construction and operation.
- The key entry of Japanese companies is to be able to partner with influential local partners (for instance, state-owned enterprises and conglomerates).
- It is important to ascertain whether government-affiliated financial institutions will take on market risks and support the entry of Japanese companies.
- The entry of Chinese companies may hinder the transfer of Japanese knowledge.

## ■ How to utilize for JICA projects, and points of attention

### ○ Common lessons with the railway sector

- There are cases where Japanese companies expand overseas with the support of the Japanese government.
- Packaging of construction and operation by Japanese loans encourage the entry of Japanese companies.

### ○ Differences with the railway sector

- High profitability allows operators to take on demand risks.
- Regulations are governed by market principles and the balance between supply and demand.
- Manualized and simple tasks provide a conducive training environment.

<sup>34</sup> JICA is providing capacity-building assistance to Sihanoukville Autonomous Port

# O&M Projects in Other Sectors: Aviation

## Wattay International Airport, Laos

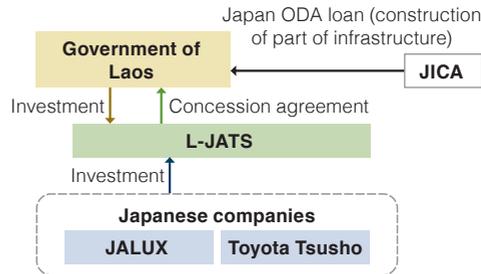
### Construction: Vertical separation method utilizing Japan ODA loan

- Expansion of the international terminal building, construction of the new domestic terminal building, and improvement of the surrounding facilities such as parking lots, roads within the premises, and taxiways.

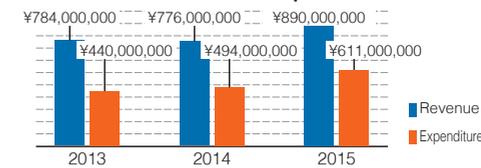
### Operation: SPC funded by Japanese companies

- Operator: Lao Japan Airport Terminal Service (L-JATS)
- A joint investment between Japanese companies (JALUX and Toyota Tsusho) and the Lao Airport Authority
- Scope of service: Ground handling business and terminal operations
- Start of operations: April 1999
- Business period: Basic agreement is to extend the contract for 10 years from March 2019
- Main source of revenue: ground handling service, passenger handling service, and commercial space rentals

### Wattay International Airport Business Scheme Diagram



### L-JATS Revenues and Expenditures



## New Ulaanbaatar International Airport, Mongolia

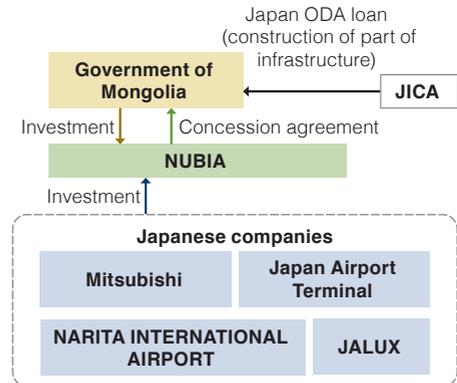
### Construction: Vertical separation method utilizing Japan ODA loan

- Construction of the passenger terminal building, runways, and control tower

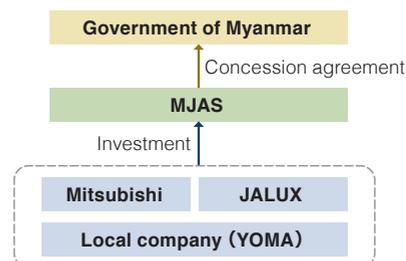
### Operation: SPC funded by Japanese companies

- Operator: New Ulaanbaatar International Airport (NUBIA)
- A joint investment between Japanese companies (Mitsubishi Corporation, Narita International Airport, Japan Airport Terminal, and JALUX) and the Mongolian Government
- Start of operation: July 2021
- Business period: 15 years
- Main source of revenue: ground handling service and passenger handling service

### New Ulaanbaatar International Airport Business Scheme Diagram



### Mandalay International Airport Business Diagram



## Mandalay International Airport, Myanmar

### Operation: SPC funded by Japanese companies

- Operator: MC-Jalux Airport Services Co., Ltd. (MJAS)
- A joint investment between Japanese companies (e.g., Mitsubishi Corporation and JALUX) and local private companies
- Scope of service: Rehabilitation and improvement of existing airport facilities and O&M
- 100% private sector capital
- Business period: 30 years
- Start of operations: April 2015
- Main source of revenue: ground handling service and passenger handling service

## Ridership risks

- Demand is highly correlated with the GDP growth rate, making demand forecasting relatively straightforward<sup>35</sup>.
- Operators take up ridership risks
- In the event of force majeure, such as the Lehman Shock or the spread of the COVID-19 infections, penalties are waived, but there are no compensations for foregone revenues.
- In Singapore as in other countries, airlines are being enticed by low landing fees. In Japan, the recent privatization of airports gave operators the authority to set landing fees for each airport.

## Capacity building

- A minimal number of personnel is required for managerial duties. On the other hand, a significant number of personnel is required for maintenance work.
- Many employees are originally engaged with airport maintenance work and have basic knowledge.
- Since airport maintenance work is simple and requires basic expertise, operational problems are unlikely to occur after opening. This is regardless of whether the operating entity is from the public or private sector.
- When introducing new equipment, personnel training is required, but since the manufacturer usually conducts training at the time of delivery, operational difficulty is not a concern.

## Investment

- In the case of brownfield investments, if the cost of O&M is minimal, implementation of the project using only private funds is possible. In such a case, the support required from the Japanese government is considered only a buffer against county risks.

- Since SPCs' operating costs for greenfield projects may be fairly significant despite Japanese government loans covering infrastructure investment, it is ideal to improve how overseas investments and loans are used.

## Barriers to market entry

- While it is said that Japan's strength is in its strong capital base due to investments from multiple companies, ODA remains the main consideration.
- As airport operations have only recently been privatized in Japan, airport operators in the country have less operational knowledge when compared to their overseas counterparts. For this reason, taking advantage of their expertise is difficult.
- Airport operation is generally expected to be profitable and is thus carried out domestically. Japanese companies have limited room to enter the market. Opportunities for Japanese companies exist mainly in making contracts and schemes that secure the interests of the recipient country.
- An effective measure is to encourage the preferential entry of Japanese companies is through bilateral assistance.
- Long-term contracts are difficult considering contingent risks, so schemes that share risks with the lender are advisable.

## Key Points for JICA Project Utilization

- Common lessons with the railway sector**
  - Infrastructure development should be covered by Japan ODA loans.
  - To ease the market entry of Japanese companies, the proactive support of the Japanese government through bilateral assistance schemes is effective.

### Differences with the railway sector

- Local knowledge exists for airport O&M.
- Airport O&M works are not as complex.

<sup>35</sup> Opinions suggest a decrease in correlation due to the spread of COVID-19

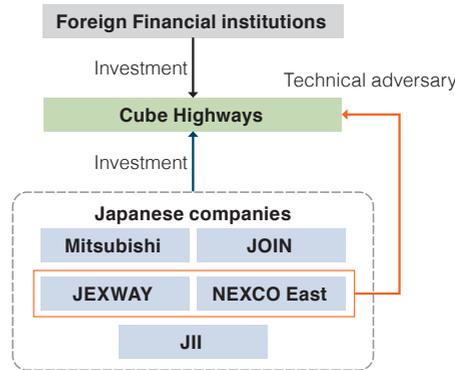
# O&M Projects in Other Sectors: Road

## India Highway, India

### Operation: SPC funded by Japanese companies

- Operator: Cube Highways
- Japanese companies (i.e., Mitsubishi Corporation, East Nippon Expressway Co., Ltd. (NEXCO East), JOIN, and Japan Expressway International Co., Ltd. (JEXWAY)) hold a 20% stake in Cube Highways.
- NEXCO East and JEXWAY concluded a technical advisory contract to provide technical support services.
- The Japan Infrastructure Initiative (JII) eventually joined the consortium of Japanese companies. Aside from additional investment infusion from JOIN, Japanese companies also placed investments. The total additional investments infused by Japanese companies amount to approximately 3 billion yen.
- New sections were added as an existing toll road operated following this scheme.
- Main Source of Revenue: Toll fee

▼ India Highway Business Scheme Diagram

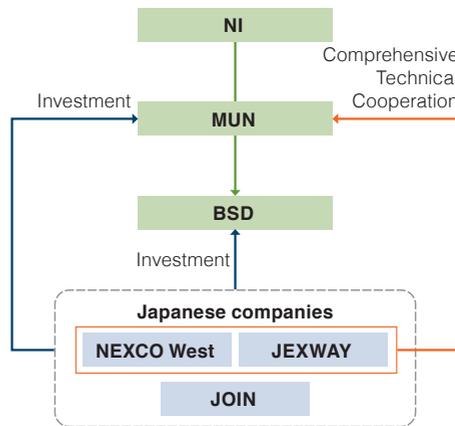


## Bintaro-Serpong Toll Road, Indonesia

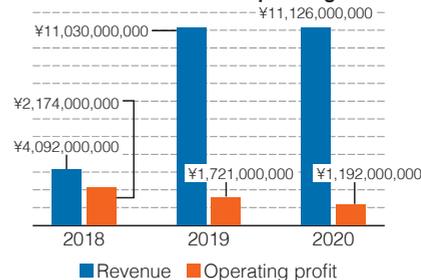
### Operation: SPC funded by Japanese companies

- Operator: PT Bintaro Serpong Damai (BSD)
- PT Margautama Nusantara (MUN), a subsidiary of PT Nusantara Infrastructure Tbk (NI), owns a majority of BSD shares.
- Japanese companies (i.e., NEXCO West and JEXWAY) entered into a Non-Disclosure Agreement with NI regarding the survey of the business entry in 2013.
- NEXCO West and JAXWAY acquired a 4% stake of BSD in 2014.
- A comprehensive technical cooperation agreement with MUN was concluded in 2015 that involved providing technical advice to meet local needs. The maintenance know-how and technology developed from experience in the expressway business were used for this undertaking.
- The SPC acquired a 10% stake in MUN, which holds the majority stake in BSD in 2020. The acquisition includes investment by JOIN.
- Main source of revenue: Toll fees

▼ Bintaro-Serpong Toll Road Business Scheme Diagram



▼ MUN Revenues and Operating Profits



## Demand risks

- For road projects, the concession period can be as long as 10 to 20 years. Toll operators usually do not have discretion over raising toll fees.
- Various schemes are implemented globally to cope with demand risks (e.g., Government burden, private-sector burden, and minimum income guarantee).

## Capacity building

- Skill levels often cannot be maintained locally even if the training activities are conducted through technical cooperation projects.
- In recent years, there have been cases of instructors' training.
- Investing in post-training follow-up activities is an effective initiative to firmly establish local skills.

## Trends of other donors

- The World Bank provides financial support to improve infrastructure rehabilitation and operational development. In countries where most of the infrastructure has deteriorated, asset management can be difficult to conduct. In such cases, initially performing full-scale infrastructure rehabilitation may be more effective.

## Trends of Japanese companies

- The Japanese government has ventured into promoting the market entry of Japanese companies through bilateral assistance schemes (e.g., Bangladesh).

- Some Japanese operators work on technical cooperation projects that are expected to lead to future maintenance works for highways in other countries.
- In some cases, the scope of O&M is included in the Japan ODA loan. Operators, contractors, and trading companies carry out monitoring activities as a joint venture even after construction (e.g., Bangladesh, Philippines).

## Barriers to market entry

- While the known strength of Japan is in its strong capital base due to investments from multiple companies, ODA remains the main expectation from it.
- The entry of Chinese companies may hinder Japanese knowledge transfer.
- Technologies that were once Japanese strengths (e.g., cable-stayed bridges) are becoming less competitive with foreign companies. Although Japan still has advantages in disaster countermeasures, it is difficult to determine defect liabilities in the event of disasters. This makes Japanese companies reluctant to expand overseas in the disaster countermeasures field.

## Key Points for JICA Project Utilization

- **Common lessons with the railway sector**
  - The setting of fares and toll fees tend to depend on political prerogatives rather than market principles.
  - Issues in capacity building exist.
  - The proactive support of the Japanese government within the bilateral assistance framework to ease the market entry of Japanese companies is effective.

## 6 Greater Cairo Metro Line No.4, Egypt

### Overview of the Greater Cairo Metro Line No. 4 (Phase 1) Project

- Construction works (development of a 17-km subway passing through the area of the Great Pyramids of Giza towards the west of the center of Cairo)
- Rolling stock procurement: 184 cars (8 cars x 23 sets)
- Consulting services include tender assistance, construction supervision, and O&M support.
- Project implementation schedule is from March 2012 to April 2027 (183 months in total) from the FS to the start of commercial operations.



Scheduled to open in 2027

## 5 Metro Manila Subway, Philippines

### Overview of the Metro Manila Subway (Phase 1) Project

- Civil and E&M works for underground sections (26 kms) and elevated sections (1 km) with 15 stations
- Rolling stock procurement: 240 cars (8 cars x 30 sets)
- Consulting services include tender assistance, construction supervision, O&M capacity enhancement, transit-oriented development assistance, and capacity building of implementing entities
- Project implementation schedule is from February 2018 to September 2027 (116 months in total) from tender assistance to the commissioning of the railway system.



Schedule to partially open in 2026

## 4 Ho Chi Minh Line 1, Vietnam

### Overview of the Ho Chi Minh City Urban Railway (Line 1 Section) Project

- Civil works for underground and elevated sections (19.7 kms with 14 stations)
- Rolling stock procurement: 51 cars
- Equipment procurement includes signaling and communication system, PSD, and AFC system.
- Consulting services include basic design, tender assistance, construction supervision, and O&M support.
- Project implementation schedule is from March 2007 to February 2024 (204 months in total) from the start of Japan ODA loan until the end of the designated maintenance period after the beginning of commercial operations.



Opening schedule under discussion

## 1 Mumbai Metro Line 3, India

### Overview of the Mumbai Metro Line 3 Project

- Civil and E&M works for underground sections (approximately 34 kms with 27 stations)
- Rolling stock procurement: 248 cars (8 cars x 31 sets)
- Consulting services include design review, tender assistance, construction supervision, and managerial capacity building.
- Original project implementation schedule is from June 2013 to December 2021 (103 months in total) from tender assistance to the start of commercial operations.



Originally schedules to open in 2021

## 2 Dhaka MRT Line 6, Bangladesh

### Overview of the Dhaka Mass Rapid Transit Development Project

- Civil and E&M works for elevated sections (20 kms with 16 stations)
- Rolling stock procurement: 144 cars (6 cars x 24 sets)
- Consulting services include FS review, detailed design, tender assistance, construction supervision, and O&M assistance.
- Project implementation schedule is from February 2013 to December 2024 (143 months in total) from detailed design to commissioning.

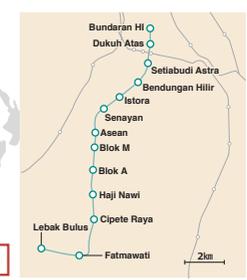


Scheduled to open in 2022

## 3 MRT Jakarta North-South Line, Indonesia

### Overview of the Jakarta Mass Rapid Transit (Phase 1) Project

- Civil and E&M works for underground and elevated sections (15.7 kms with 13 stations)
- Rolling stock procurement: 96 cars (6 cars x 16 sets)
- Consulting services include the FS, detailed design, tender assistance, construction supervision, and O&M support.
- Project implementation schedule was from January 2009 to April 2019, completed with the start of commercial operations.



Opened in 2019

# Summary of Overseas Maintenance Support



Overview	Mumbai Metro Line 3	Dhaka MRT Line 6	MRT Jakarta North-South Line
<b>Implementing Entity</b>	MMRC	DMTC	MRTJ
<b>Operating Entity</b>	MMRC (planned)	DMTC	MRTJ
<b>Funding</b>	Government	Government	Government of Special Capital Region of Jakarta
<b>Total Planned Project Cost<sup>35</sup></b>	Approx. 520 billion JPY (Approx. 340 billion INR)	Approx. 370 billion JPY (Approx. 280 billion BDT)	180 billion JPY (22.2 trillion IDR <sup>36</sup> )
<b>Cost per Kilometer</b>	15.3 billion JPY	18.5 billion JPY	11.5 billion JPY
<b>Demand Forecast</b>	1.39 million passengers per day (9 years after opening)	590,000 passengers per day (10 years after opening)	93,000 passengers per day (FY2019 actual)
<b>Japan ODA Loan</b>	Yes	Yes	Yes
<b>Total Line Length</b>	34 kms	20 kms	15.7 kms (Elevated: 10.1 kms; Underground: 5.6 kms)
<b>No. of Stations</b>	27	16	13
<b>Average Distance between Stations</b>	1.2kms	1.2kms	1.2kms
<b>Type of Railway</b>	MRT	MRT	MRT
<b>Structure</b>	Underground	Elevated	Elevated / underground
<b>E&amp;M System Suppliers</b>	Alstom	Marubeni, L&T	Mitsui & Co., and Toyo Engineering
<b>Rolling stock manufacturers</b>	Alstom	Mitsubishi Shoji, Kawasaki Heavy Engineering	Nippon Sharyo
<b>Opening Schedule</b>	Scheduled for 2023	Scheduled for 2022	2019

<sup>36</sup> Estimated at 16 February 2022 rate



Overview	Ho Chi Minh Line 1	Metro Manila Subway	Greater Cairo Metro Line No.4
<b>Implementing agency</b>	Management Authority for Urban Railways (MAUR)	DOTr	National Authority for Tunnels (NAT)
<b>Operating entity</b>	Ho Chi Minh City Urban Railways No. 1 Co., Ltd. (HURC1)	TBD	Egyptian Company for Metro (ECM)
<b>Funding</b>	Government	Government	Government
<b>Total Planned Project Cost<sup>35</sup></b>	Approx. 240 billion JPY (48.2 trillion VND)	Approx. 800 billion JPY (Approx. 360 billion PHP)	Approx. 400 billion JPY (Approx. 54 billion EGP)
<b>Cost per Kilometer</b>	12.1 billion JPY	29.6 billion JPY	23.3 billion JPY (Phase 1 section 17.2km)
<b>Demand forecast</b>	526,000 per year (Forecasted figures under the former partial section scheduled to open)	970,000 passengers per day (10 years after opening)	954,000 passengers per day
<b>Japan ODA Loan</b>	Yes	Yes	Yes
<b>Total route length</b>	19.7 kms	27 kms	Subway: 40.7 kms
<b>No. of stations</b>	14	15	35
<b>Average distance between stations</b>	1.4kms	1.9kms	1.2kms
<b>Type of Railway</b>	MRT	MRT	MRT
<b>Structure</b>	Elevated/ elevated	Underground	Underground
<b>E&amp;M System Suppliers</b>	Hitachi	TBD	TBD
<b>Rolling stock manufacturers</b>	Hitachi	Mitsubishi Shoji, J- TREC	Mitsubishi Corporation, Kinki Sharyo
<b>Opening Schedule</b>	Under discussion	Scheduled for 2026	Scheduled for 2027

Summary

Operating entity

Regulatory system

Railway systems (overall)

Railway systems (each department)

O&M Projects

O&M Projects in Other Sectors

Past examples of development assistance

Provision of assistance in the future

Overseas Expansion of O&M



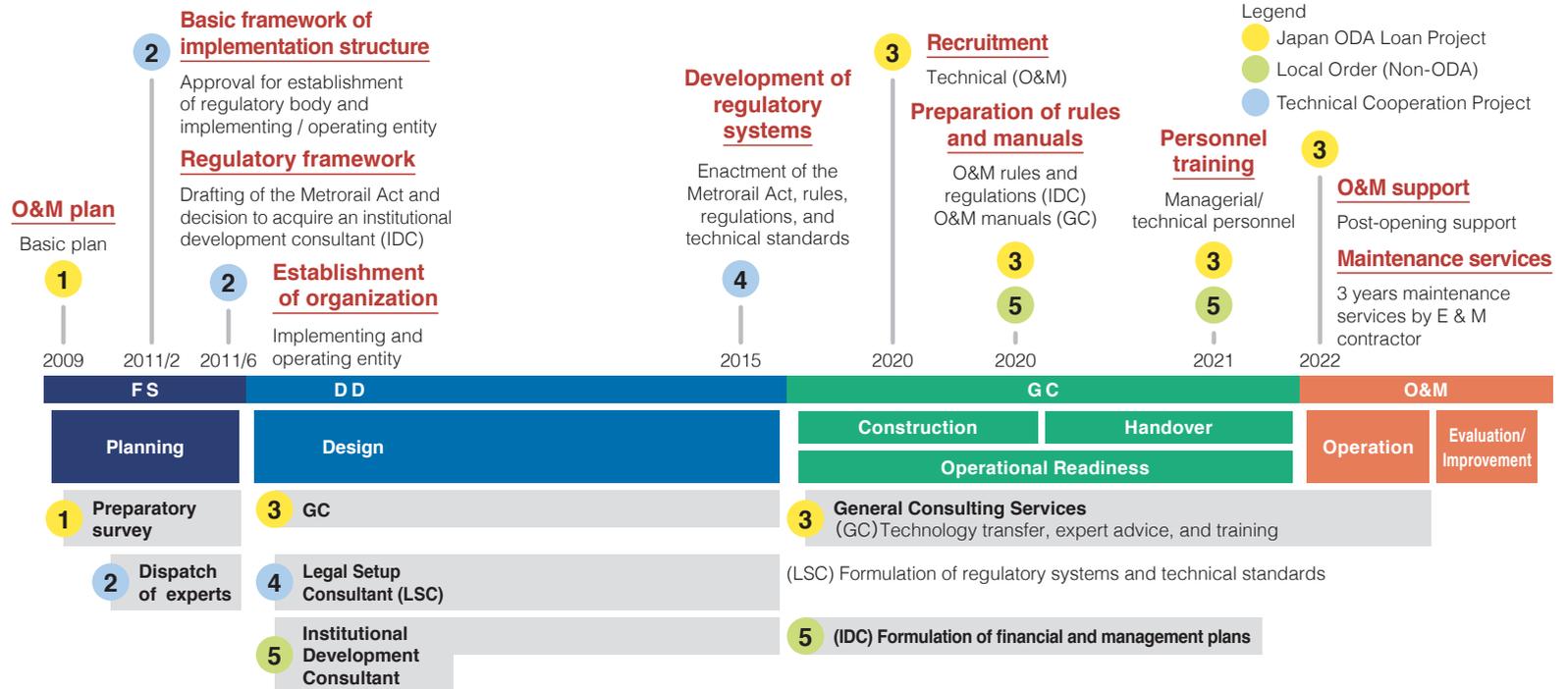
# Dhaka MRT Line 6, Bangladesh

## Project Characteristics

- With the JICA's institutional development assistance, the regulatory systems of urban railway O&M were developed from the beginning.
- The Government of Bangladesh enacted technical standards and established a regulatory framework that does not impede the business environment of Japanese companies.
- Similar initiatives are expected to be carried out in other countries to strengthen administrative capacities in the urban railway sector.

## Project Achievements and Challenges

- Projects will be implemented more efficiently if the recipient country consistently receives support from the same donor country.
- By deploying Japanese experts, the assistance framework developed for project implementation was robustly designed.
- The tasks of the general consultant, institutional development consultant, and legal setup consultant are well-delineated to avoid duplication of assistance programs.
- When the focus was still on detailed design and construction work, limited attention was given to the consulting service on institutional development. This hindered the effectiveness of the assistance provided.



	O&M Plan	Personnel and Organizational Plan	Business Plan	Economic and Financial Analysis	Regulatory System	Contracts
1	●					
2	●	●				
2		●		●	●	●
3	●		●		●	
4					●	
5		●	●	●	●	

	Organizational Development and Recruitment	Operational Readiness	Post-Opening Support	Training Center
1				
2	●			
2				
3	●	●	●	●
4				
5	●	●		



# Ho Chi Minh Line 1, Vietnam

## Project Characteristics

- The use of the General Specification for Standard Urban Railway System for Asia (STRASYA), which are the technical specifications designed for export to Asia based on Japanese railway technology and expertise, has been approved.
- Japanese companies have been involved in route construction and equipment installation. Aside from this, with Japanese enterprises involved in consulting services and technical cooperation, this project can be depicted as a comprehensive, hardware-software export undertaking.
- GC contracts include personnel training and post-opening maintenance.

## Project Achievements and Challenges

- The business plan and the articles of incorporation of the operating company were approved, establishing the operating company, Ho Chi Minh City Urban Railways No. 1 Company Limited (HURC1).
- The Conditions of Carriage and basic internal rules for the Safety, Personnel, and Finance departments have been created.
- Along with the training for counterparts (C/P) in Japan, training for drivers (conducted by GC) was started.
- Rising construction costs led to financial pressures on the project. This has also resulted in procedural delays in contract revisions between MAUR and GC. The technical cooperation project is likewise experiencing delays in implementation.

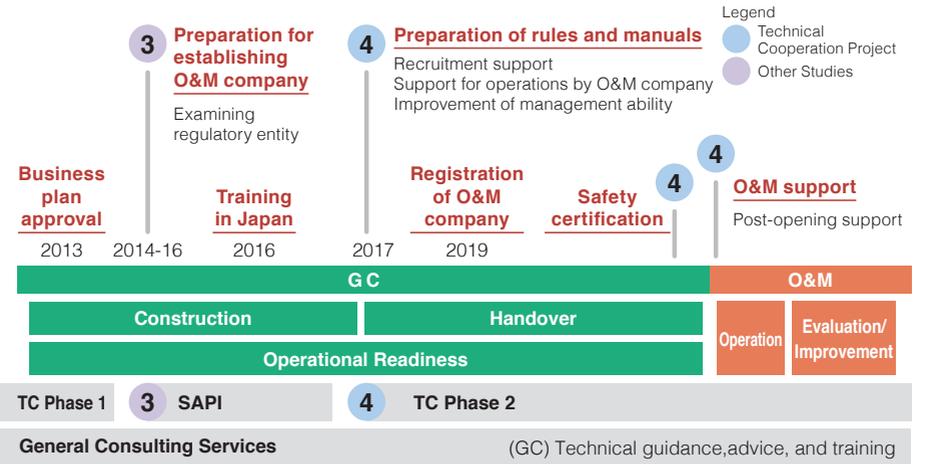
- Concerns have emerged regarding Line 1 not being open by the time the technical cooperation project is concluded in December 2022.



- The division of roles between GC and the technical cooperation project in the O&M field (e.g., preparation of manuals and training) is complicated.
- The C/P in the operating entity has limited knowledge of railways and has limited abilities to negotiate with regulatory entities (e.g., MAUR). As such, efforts to resolve problems have been challenging.

## General Comment

- If the same type of support is provided in the future in a context similar to Vietnam where there are essentially no existing urban railways, it is ideal for human resources with deep knowledge and expertise in railways to be deeply involved in the FS stages.
- In this project, although some on-the-job training was provided in Japan to local C/P who had limited knowledge or experience in railways, continuous support in terms of applied knowledge and skills is still needed.



<sup>37</sup> The Study on the Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area  
<sup>38</sup> Special Assistance for Project Implementation <sup>39</sup> Special Assistance for Project Formulation

O&M Plan	Personnel and Organizational Plan	Business Plan				Economic and Financial Analysis		Regulatory System				Contracts
		Service level	Business strategy	PR plan	Non-rail business	Replacement and reinvestment costs	Subsidy	Economic and financial analysis	Cash flow analysis	Regulatory framework	Regulatory capacity building	
Demand forecast												
Route plan												
Transport plan												
Railway system plan												
Station operation plan												
Maintenance plan												
Organizational designs												
Personnel plan												
Definition/delineation of duties/functions												
Asset ownership and management												
Project scheme												
O&M revenue and expenditure												
Selection of operating entity												
Fare policy												
Non-rail business												
Business strategy												
PR plan												
Service level												

\* Content of TOR on FS and GC are confidential, then those TOR are not described in the below chart.

Organizational Development and Recruitment	Operational Readiness						Post-Opening Support		Training Center	
	Organizational development	Hiring of admin. and management personnel	Hiring of O&M personnel	Training and readiness (Admin/Management)	Facility handover	Facility documentation(as-built drawings)	Organizational management	Operational license	Organizational and institutional development	Training center management
Organizational development										
Recruitment plan										
Hiring of admin. and management personnel										
Hiring of O&M personnel										
Training and readiness (Admin/Management)										
Facility handover										
Facility documentation(as-built drawings)										
Visits and technology transfer										
Training of train drivers										
Internal rules and regulations										
Training and readiness (Maintenance)										
Training and readiness (Operations)										
Quality management plan										
Maintenance plan and budgeting										
Equipment procurement										
Asset and resource management system										
Integrated testing and trial run										
Practical training										
Operational license										
Organizational management										
Maintenance improvement										
Organizational improvement										
Operations activities										
Maintenance activities										



