Japan's "Quality Infrastructure" Around the world

--Compendium of Good Practices--

March, 2021

Ministry of Land, Infrastructure, Transport and Tourism

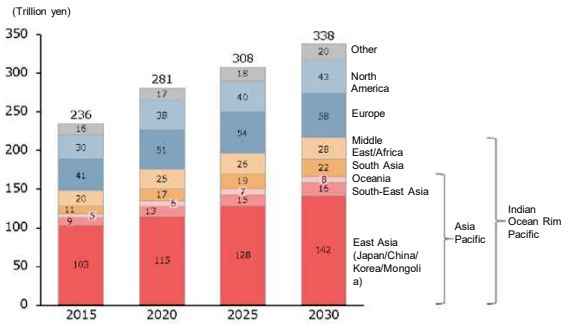
Introduction

Infrastructure is critical as a driver of economic prosperity and a solid basis for economic growth and sustainable development. Nonetheless, the world, especially developing countries, still faces a gap in financing for investment in infrastructure development and maintenance, which could generate a serious bottleneck to economic growth and development or provision of secure and reliable public services. In this vein, there is the need to scale up infrastructure investment.

Additionally, quality of infrastructure investment is increasingly important.

It is indispensable not only to meet the quantitative demand but also to consider quality such as transparency, openness, economic efficiency in view of life-cycle cost and debt sustainability in infrastructure development in order to realize "quality growth" in developing countries.

Major infrastructure markets per region Scale estimate (*)



Source) Nomura Research Institute
(*)Based on the prediction of total fixed capital formation in the electricity, information communication, aviation, harbors, roads, and water categories by Global Infrastructure Outlook

We also need to consider the impact of infrastructure investment on our economy and society not only from a short-term perspective but also from a long-term perspective.

From this viewpoint, Japan has been leading international discussions and actively promoting “quality infrastructure investment” at international conferences and bilateral leaders' meetings. As a result, the “G20 Principles for Quality Infrastructure Investment” was endorsed by G20 Leaders at the G20 Osaka Summit (June 28-29, 2019).

June 2019 G20 Osaka Summit
The “G20 Principles for Quality Infrastructure Investment” was endorsed by G20 Leaders

June 2019 G20 Minister of Finance/Central Bank Governors Meeting
The “G20 Principles for Quality Infrastructure Investment” was endorsed

November 2018 APEC Committee on Trade and Investment

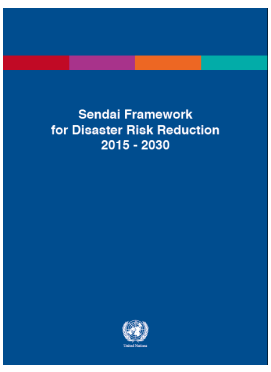
June 2016 G20 Hangzhou Summit

June 2015 G7 Ise-Shima Summit
Agreement on the “G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment”

May 2015 Prime Minister Abe proclaimed the
“Partnership for Quality Infrastructure”

G20 2019 JAPAN

Promoting quality infrastructure investment contributes to achieving international goals such as the “2030 Agenda for Sustainable Development”, “Sendai Framework for Disaster Risk Reduction 2015-2030”, “Paris Agreement” and the “The United Nations New Urban Agenda”.



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About the “G20 Principles for Quality Infrastructure Investment”

The “G20 Principles for Quality Infrastructure Investment” consists of the following six principles:

Principle 1: Maximizing the positive impact of infrastructure to achieve sustainable growth and development

- Infrastructure investment with job creation and technology transfer will promote a virtuous circle of economic activities through capacity building, productivity improvement and private investment facilitation.
- Connectivity should be enhanced by promoting sustainable development through infrastructure investment in accordance with such factors as SDGs, while being consistent with national and local development strategies.

Principle 2: Raising Economic Efficiency in View of Life-Cycle Cost

- Quality infrastructure investment should attain value for money. It is important to take into account the total cost of construction of infrastructure, including its operation, maintenance and management (O&M). The risks of delays and cost overruns should be considered. Innovative technologies should be leveraged.

Principle 3: Environmental Considerations

- The impacts on factors such as ecosystems, biodiversity and climate should be considered. It is essential to improve disclosure of environment-related information, and thereby enabling the use of green finance instruments.

Principle 4: Building Resilience against Natural Hazards and Other Risks

- Natural disaster risk management and human-risk management should be considered when designing infrastructure. Well-designed disaster risk finance and insurance help incentivize resilient infrastructure.

Principle 5: Social Considerations

- Infrastructure should be inclusive, enabling economic participation and social inclusion of all. It is important to take into account open access to infrastructure services, safety, gender and those who may experience particular vulnerabilities.

Principle 6: Infrastructure Governance

- Openness and transparency of procurement, anti-corruption efforts, and access to information and data are important.
- In addition to project-level sustainability, macro-level debt sustainability needs to be considered.

https://www.mof.go.jp/english/international_policy/convention/g20/annex6_1.pdf

Japan promotes "Quality Infrastructure“, which includes resilience against natural disasters, inclusiveness which realizes the idea of leave no one behind, and sustainability in line with the social and environmental considerations. The "G20 Principles for Quality Infrastructure Investment" involves openness, transparency, economic efficiency and debt sustainability. Throughout the process from planning to construction, operation and maintenance, quality infrastructure enables a wide range of stakeholders, including not only governments and users but also local workers and residents, to benefit from improvement of the infrastructure, which significantly contributes to national and regional development.

“Quality Infrastructure” responds to social needs such as environmental consideration, financial discipline and anti-corruption.

Japan’s “Quality Infrastructure” has been highly appreciated and used by many people around the globe.

The following is a compendium of good practices for the “Quality Infrastructure”.

The “G20 Principles for Quality Infrastructure Investment” and “Quality Infrastructure” that Japan can provide

G20 Principles	Main value that Japan can provide
Principle 1: Maximizing the positive impact of infrastructure to achieve sustainable growth and development	■ Technology transfer, enhanced skills and institutional construction support
Principle 2: Raising Economic Efficiency in View of Life-Cycle Cost	■ Long life ■ Low life cycle cost
Principle 3: Environmental Considerations	■ Reliable technology backed by experience of development cooperation with consideration for the environment and disaster prevention
Principle 4: Building Resilience against Natural Hazards and Other Risks	
Principle 5: Social Considerations	■ Construction that considers the local community and safety
Principle 6: Infrastructure Governance	■ Appropriate operation, maintenance and management

The Purpose of “What ‘Quality Infrastructure’ Means to Our Country”

This pamphlet offers information on “Quality Infrastructure Investment” that has been achieved through partnerships with Japan, categorized by principle or infrastructure category. The pamphlet aims to disseminate and implement “Quality Infrastructure Investment” by providing good practices of how Japanese corporations have contributed to these initiatives.

Principle	Items	Case number	Case	Country	Page
Principle 1: Maximizing the positive impact of infrastructure to achieve sustainable grow th and development	Setting off a virtuous circle of economic activities -Job creation -Technology transfer -Enhanced skills	Case 1	The Project for the Rehabilitation of Kurgan Tyube-Dusti Road	Tajikistan	7
		Case 2	Matadi Bridge	Democratic Republic of the Congo	8
		Case 3	Lach Huyen Bridge	Vietnam	8
		Case 4	The Kanchpur, Meghna, and Gumti 2nd Bridges Construction and Existing Bridges Rehabilitation Project	Bangladesh	9
		Case 5	Nhat Tan Bridge	Vietnam	10
		Case 6	Pahang Selangor Raw Water Transfer Tunnel Project	Malaysia	11
		Case 7	Kensetsu-Komachi--Foreign female engineers w ho are the belles of construction sites	—	11
	Sustainable development and increased connectivity -Sustainable development -Connectivity	Case 8	Bosphorus Rail Tube Crossing Project	Turkey	12
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		Case 10	The Project for Improvement of Ghanaian International Corridors (Tema Motorw ay Roundabout)	Ghana	13
Principle 2: Raising Economic Efficiency in View of Life-Cycle Cost	Achieving Value for Money w ith infrastructure investment life cycles -Life cycle costs -Efficient maintenance and management	Case 11	Mombasa Port reclamation construction	Kenya	14
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		Case 13	Bangkok MRT Purple Line	Thailand	16
		Case 14	Osman Gazi Bridge (Izmit Bay Bridge) Project	Turkey	17
	Observing construction deadlines/Shortening construction period	Case 15	Noibai International Airport 2nd Passenger Terminal	Vietnam	18
		Case 16	Hanoi City Ring Road No.3 Construction (Ring Road elevated bridge)	Vietnam	19
Principle 3: Environmental Considerations	Environmental Considerations -Environmentally-friendly infrastructures -Consideration tow ards the ecosystem -Environmentally-friendly construction methods	Case 17	Changi Airport Terminal 4	Singapore	20
		Case 18	Nam Ngum 1 Hydropow er Station Expansion Project	Laos	21
		Case 19	Port Vila Lapetasi International Wharf Development Project	Vanuatu	21
		Case 20	Rehabilitation of the Chroy Changw ar Bridge	Cambodia	22
Principle 4: Building Resilience against Natural Hazards and Other Risks	Resilience -Resilience tow ards risks -Build Back Better	Case 21	Bangkok MRT Blue Line	Thailand	23
		Case 22	Sabo Dam at Mt. Merapi	Indonesia	24
		Case 23	The Program for Recovery from Nepal Earthquake	Nepal	24
Principle 5: Social Considerations	Cooperation with local communities -Consideration towards local communities -Inclusiv eness	Case 24	Relocation of citizens due to the Upper Kotmale Dam	Sri Lanka	25
		Case 25	Construction of Elementary and Secondary School Buildings and the Taungoo Education College	Myanmar	26
		Case 26	The Project for Improvement of the Institute of Child Health and Hospital for Children, Chennai	India	26
	Safety and health -Safety -Considerations tow ard traffic during construction	Case 27	Improvement of Tazara Intersection	Tanzania	27
		Case 28	Ulaanbaatar Railw ay Fly-Over Bridge Construction Project (Taiyo Bridge)	Mongolia	28
		Case 29	Marina Regional Expressw ay	Singapore	29
Principle 6: Infrastructure Governance	Private funds -Application of private funds -Risk-sharing betw een public and private sectors	Case 30	Support for transport projects/urban development projects by JOIN	—	30
		Case 31	Large-scale development complex at the center of Yangon City	Myanmar	30
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		Case 34	Manila Metro Rail Transit System 3	Philippines	32
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		Case 36	Operation of Sihanoukville Port	Cambodia	33
		Case 37	The Project for Improvement of Axle Load Control on Trunk Roads	Ethiopia	34
		Case 38	Special Course on MLIT Training Program for the Proper Development of the Construction Industries in Asian Countries	—	34
	Procurement and finance -Procurement openness and transparency -Financial sustainability	Case 39	Compliance Training	—	35
		Case 40	Conditions for Providing Yen Loans	—	35
Per category	Ports and harbors	Case 41	Development and operation of Thilaw a Port	Myanmar	36
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	Bridges	Case 44	Neak Loeung Bridge	Cambodia	39
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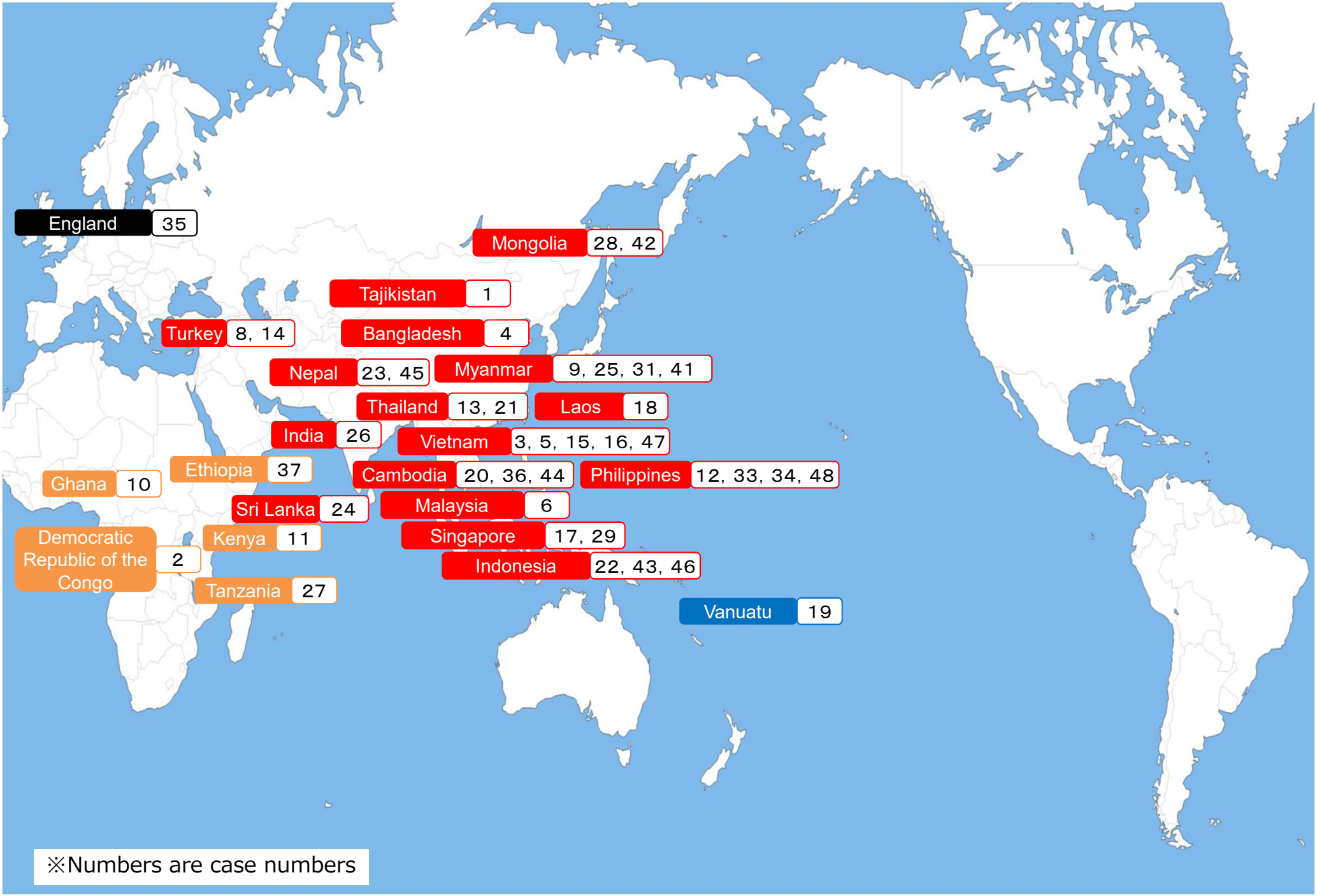
	Disaster Prevention	Case 48	Pasig-Marikina River Channel Improvement Project	Philippines	43

Location map



Column

Japan Construction International Award

The Ministry of Land, Infrastructure, Transport and Tourism established the “Japan Construction International Award (honored by the Minister of Land, Infrastructure, Transport and Tourism)” in 2017. It has been held three times up to the present day as a symbol of Japanese “quality infrastructure”, and commends construction projects that have demonstrated Japan’s strengths, along with small and medium-sized construction companies that have been playing leading roles overseas.
The Award aims to raise further awareness of “quality infrastructure” and promote global understanding of the Japanese companies’ competitiveness with the expectation of more projects to be carried out by Japanese companies.
Furthermore, there are hopes that this Award will boost interest in overseas construction industries in younger generations, by communicating within Japan on highly-regarded overseas construction projects and Japanese businesses that are active overseas.
Projects which have received the award are marked with the logo within this pamphlet.

Award targets (Construction Project Category)

Overseas construction projects with participation of designers, contractors, owners (for real estate development), manager/operators, construction managers, PPP or other investors, and technology providers from Japan are awarded.

Award history (Construction Project Category)

*Page numbers are displayed within parenthesis<>

<The First Awards>

- **Ulan Bator Elevated-Bridge Construction Project** (Mongolia)<p28>
-**”Senayan Square” Project** (Indonesia)<p41>
-**Thilawa SEZ Zone A Development Project** (Myanmar)<p36>
-**Neak Loeung Bridge Construction Project** (Cambodia)<p39>
-**Pahang Selangor Raw Water Transfer Tunnel Project** (Malaysia)<p11>
-**Hamad International Airport（Terminal complex at the Qatar Doha International Airport)** (Qatar)
-**Bosphorus Rail Tube Crossing Project Construction Work** (Turkey)<p12>
-**Marina Coastal Expressway Contract 485** (Singapore) <p29>
-**Mitsui Outlet Park** (Malaysia)
-**I-70 Twin Tunnels Widening Project** (U.S.A)

<The Second Awards>

- **The Project for the Rehabilitation of Kurgan Tyube-Dusti Road (Phase I and II)** (Tajikistan)<p7>
-**Singapore Changi Airport Terminal 4 New Construction** (Singapore)<p20>
-**SORA gardens I** (Vietnam) <p42>
-**Noibai International Airport 2nd Passenger Terminal** (Vietnam)<p18>
-**The Project for Safe Water Supply and Improvement of Hygiene Conditions in Rural Areas** (Senegal)

<The Third Awards>

- **Waterview Connection Tunnels and Great North Road Interchange Project** (New Zealand)
-**Osman Gazi Bridge (Izmit Bay Bridge) Project** (Turkey)<p17>
-**Sindhuli Road (Construction of Section III Phase 2 and Slope protection of Section II)** (Nepal) <p40>

◆In addition to the Construction Project Category, small to medium-sized Japanese businesses are also commended in the Small and Medium-sized Construction Companies Category for activities such as overseas construction, design, surveying, and provision of construction materials and equipment. Please visit the following link for details.
https://www.mlit.go.jp/JCIA/en/

Setting off a virtuous circle of economic activities
Quality infrastructure investment contributes to regional economic development through creating new jobs and transfer of advanced technology and know-how, to reinforce capacity and improve productivity for local economies through infrastructure construction, operation, maintenance and management.

<Commentary>
○**Job creation**: Various types of jobs are necessary for quality infrastructure investment, such as engineers for construction, operation/maintenance and management, technicians, and workers for material transportation and clerical workers for contracts and accounting. Japanese companies create local employment by hiring local workers for these occupations. In addition to this type of positive spillover effect of infrastructure, quality infrastructure investment also boosts private investments which promote economic development in the region through a virtuous circle.
○**Technology transfer**: Through quality infrastructure investment, know-how such as advanced technology, technology/skills for construction, administrative work for contracts, quality, and scheduling can be transferred through on-site OJT and lectures offered directly by Japanese engineers. Advanced technologies which have never been used before in the country can be introduced. By transferring Japanese technology, local engineers/technicians will be able to expect a boost in skills and capacity, along with other positive factors such as improved productivity. There are cases in which construction methods from Japanese corporations have been incorporated as a standard in other countries, which contributes towards improvement of that country's overall technical capabilities.
○**Enhanced skills**: Workers employed by Japanese companies will be able to polish their skills while learning construction technology and skills on-site. Those who learned techniques and skills at one site will be able to apply these skills at other projects. In this way, there have been many examples in which contributions towards a country's economic development continues after a construction project has ended.

Job Creation

Case 1: The Project for the Rehabilitation of Kurgan Tyube-Dusti Road (Tajikistan)

-Job creation and capacity development, while skilled workers were not available -

Project Summary

Rehabilitation of a 60-km highway, which had not been well maintained since the country's independence in 1991, between Dushanbe, the capital of Tajikistan, and the border of Afghanistan.

Key aspects as *quality infrastructure*

- **The Japanese company directly hired 120 workers for the long term and enhanced their skills necessary for road construction.**
  - Local workers benefited from capacity development through OJT (on-the-job-training) directly by the company on civil engineering technologies and knowhow such as formwork, paving methods, material management and quality & safety control.
  - The trained workers demonstrated their skills in other construction sites in Tajikistan, such as water supply projects and hospital construction.

(Photo) OJT for formwork and road paving on-site
(Courtesy of Dai Nippon Construction)

ODA Process	E/N・G/A: 2008, Start: 2009, Complete: 2013
Contractor	Dai Nippon Construction

Capacity development

Case 2: Matadi Bridge (Democratic Republic of the Congo)

--Handing down Japan's maintenance and management technology for 30 years

Project Summary

Matadi Bridge is a suspension bridge that spans 720m, constructed by Japanese ODA in 1983. Japanese companies, which constructed the bridge, participated in maintenance and management work until it had to be suspended due to domestic conflict.
Although the bridge had been kept in good condition for 30 years, in order to enhance its longevity, Japan's ODA provided support for preservation work such as addressing the corrosion of the bridge's main cable, and Japanese companies executed the work.

(Photo) Matadi Bridge
(Courtesy of IHI Infrastructure Systems)

Key aspects as *quality infrastructure*

- **<u>One-on-one human resource training in engineering and administration was conducted for future maintenance and management by Japanese companies.</u>**

• The OEBK (Organisation pour l'Équipement de Banana-Kinshasa) staff continued maintenance and management work on the bridge based on manuals and equipment which had been prepared by Japanese companies, enabling the continuous usage of the bridge and keeping it in good condition.

ODA Process G/A: 2014, Start: 2014, Complete: 2017

Contractor IHI Infrastructure Systems

Technology transfer

Case 3: Lach Huyen Bridge (Vietnam)

--Boosting career development for long-term human resources globally

Project Summary

Constructed 5.4km Lach Huyen Bridge over the sea to connect between a newly developed deep container terminal and the city of Hai Phong.

(Photo) Daily morning meetings (Courtesy of Sumitomo Mitsui Construction)

Key aspects as *quality infrastructure*

- **<u>The Japanese company committed to train the workers, considering their career development in the long term, not limiting the skill training to the short-term for a specific project.</u>**

• The Japanese company nurtured workers, expecting that they will become team leaders in future project sites.
• The company established their training center in the Philippines to provide training on construction technology and management. Those who gained any in-house qualification can mobilize their skills in other construction sites internationally.

ODA Process E/N・L/A: 2011・2014・2016, Start: 2014, Complete: 2017

Contractor Sumitomo Mitsui Construction

Technology transfer

Case 4: The Kanchpur, Meghna, and Gumti 2nd Bridges Construction and Existing Bridges Rehabilitation Project (Bangladesh)

--Transferring Japan's advanced technology to Bangladesh

Project Summary

Newly constructed the Kanchpur, Meghna, and Gumti bridges, while undergoing seismic strengthening, improvement and repairs work for existing bridges, which were originally constructed by Japanese companies.

Key aspects as *quality infrastructure*

- **Japanese corporations trained local engineers to develop their skills in construction processes, safety, and quality control during their daily work.**
  - Due to in-depth instructions from Japanese engineers, local engineers were able to carry out the "steel pipe sheet pile foundation work method", which is commonly used in Japan.
  - The success of such technology transfer was later highlighted when local companies implemented this method for other construction work.
  - "Launching erection method" was incorporated into the project for the first time in Bangladesh to minimize the impact on river transportation and neighboring existing bridges when erecting girders. The instructions of Japanese engineers enabled Japan's techniques to be successfully implemented by local engineers and workers.

(Photo) SPSP connection work (Courtesy of the Obayashi Corporation)


(Photo) The launching erection method (Courtesy of IHI Infrastructure Systems, for the following photos as well)


(Photo) Composite slab bridge construction


(Photo) PMB paving

ODA Process E/N・L/A: 2013・2017, Start: 2016, Complete: 2019

Contractors Obayashi Corporation, Shimizu Corporation, JFE Engineering Corporation, IHI Infrastructure Systems Co., Ltd.

Technology transfer

Case 5: Nhat Tan Bridge (Vietnam-Japan Friendship Bridge) (Vietnam)

--Transferring Japan's advanced technology to Vietnam

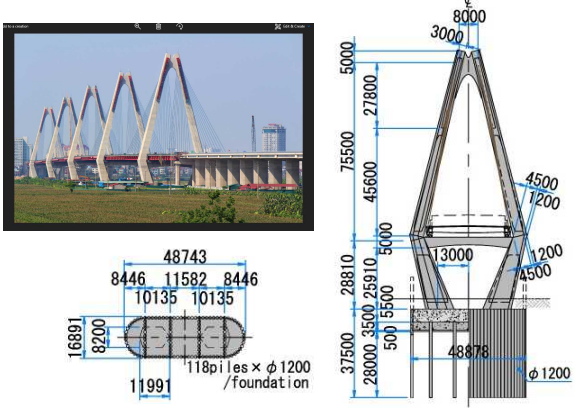
Project Summary

Constructed a new bridge, Nhat Tan Bridge, a cable-stayed bridge with six continuous spans (1,500m), with an approach span (1,580m), and main roads, to connect central Hanoi and the area of Noibai International Airport.

Key aspects as *quality infrastructure*

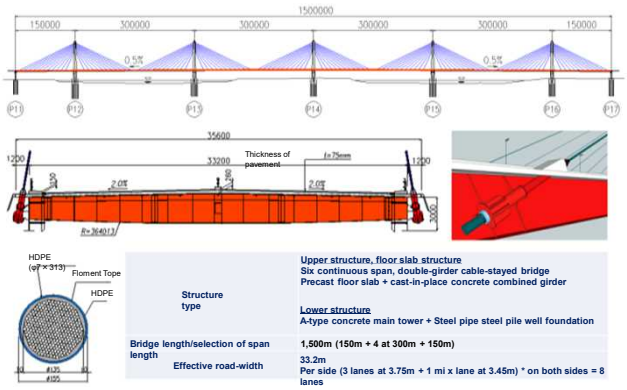
- **<u>Local companies learned project management methods that support Japan's cutting-edge technology.</u>**

- <u>The five large-scale foundations that support the main towers were developed in Japan and adopted in Vietnam for the first</u> time. It was constructed by incorporating the steel pipe sheet pile foundation method.
- Sharing manufacturing performance data from Japanese factories enabled Vietnamese factories to produce double I-girders (edge girder format) and precast RC decks which met the necessary manufacturing accuracy. It proved that <u>technology transfer for manufacturing know-how was successfully achieved</u>.



(Figure) The steel pipe sheet pile foundation for the main towers of Nhat Tan Bridge

(Photo) Main tower construction with self-ascending/descending work platforms (Courtesy of Sumitomo Mitsui Construction)



(Photo) Full balancing bridge construction (Courtesy of IHI Infrastructure Systems)

ODA Process E/N・L/A: 2006・2011・2013, Start: 2009, Complete: 2014

Contractors IHI Infrastructure Systems, Sumitomo Mitsui Construction

Technology transfer

Case 6: Pahang Selangor Raw Water Transfer Tunnel Project (Malaysia)

--Contributing to Malaysia tunnel technologies

Project Summary

Developed a water tunnel 45km long and 5.2m wide, at a maximum depth of 1,246m.

(Photo) Water transfer tunnel

Key aspects as *quality infrastructure*

- **Contribute to raising the standard of tunnelling works in Malaysia**

- Standards for tunnelling works were established during the construction period of this project, incorporating methods used in this project, leading to raising the standard of tunnelling works in Malaysia.
- The construction management method of this project was shared on the Malaysia Government Security Office's website. It was applied as a standard method at other construction sites in the country.

(Photo) Commemorating completion of the project (Courtesy of Shimizu Corporation)

ODA Process	E/N: 2003, L/A: 2005, Start: 2009: Complete: 2015
Contractors	Shimizu Corporation, Nishimatsu Construction

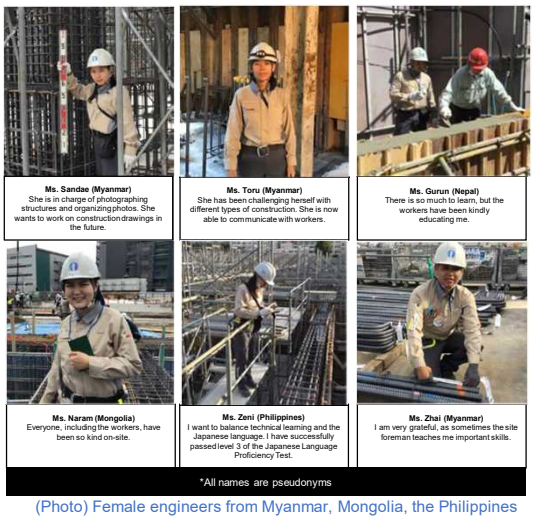
Enhanced skills

Case 7: Kensetsu-Komachi--Foreign female engineers who are the belles of construction sites

--Foreign female engineers trained in Japan play active roles in the industry

- **Many overseas female engineers have improved their skills through OJT at construction sites in Japan.**

- Female engineers from Myanmar, Mongolia, the Philippines, and Nepal, known as "Kensetsu-Komachi (builder belles)", are learning skills such as bar arrangement photography, interior finishing management, ICT and creation of work drawings, and playing an active role in Japanese construction sites.
- They are expected to play active roles in international projects while disseminating Japanese technologies.



(Photo) Female engineers from Myanmar, Mongolia, the Philippines and Nepal, who have become Kensetsu-Komachi (Courtesy of Sumitomo Mitsui Construction)

Sustainable development and increased connectivity
Quality infrastructure initiates sustainable development. It also increases connectivity of countries and regions and contributes to long-term economic development.

<Commentary>
○**Sustainable development**: Quality infrastructure has a positive impact on all aspects of life including the economy, environment, society and governance, and contributes to achieving SDGs. Through quality infrastructure, Japanese companies aim to invigorate the economy, set off a virtuous circle that is environmentally friendly, contribute to measures for global warming. They aim to make these infrastructures accessible and beneficial for all people, and to improve social unity and inclusiveness.
○**Connectivity**: "Connectivity" is an idea that aims for growth as a community through infrastructure development such as ports, airports, roads and railways to connect domestic and overseas cities. Overall social economies are guided towards prosperity and further development with the active flow of people and goods. Inland countries are able to distribute their goods outside of their region through development of roads and air routes to other countries and connecting ports.

Sustainable development

Case 8: Bosphorus Rail Tube Crossing Project (Turkey) Japan

--Reform of a transport network essential for the economy, society and environment

Project Summary

Constructed an underground subway that crosses the Bosphorus Strait and renovated existing railways (total railways: 75.7km; underground tunnel: 13.6km).

Key aspects as *quality infrastructure*

- This project substantially **shortened the time needed to cross the Bosphorus Strait. The subway only takes 4 minutes while ferries take 25 minutes.**
- Enhanced economic activities by improving transport efficiency.
- Improved connectivity between Asian side and European side of Istanbul.
- Anticipated reduction of greenhouse gases such as CO_2, and improvement of air pollutants by providing a method of mass transportation.

(Photo) Immersed tunnel element (Courtesy of Taisei Corporation)

ODA Process E/N・L/A: 1999・2005, Start: 2004, Complete: 2014

Contractor Taisei Corporation

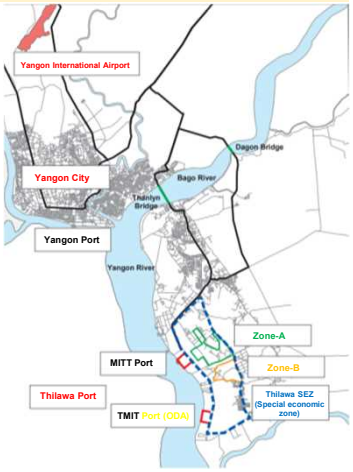
Sustainable development

Case 9: Thilawa SEZ Zone A Development Project (Myanmar)

--Reform of a transport network essential for the economy, society and environment

Project Summary

Joint ventures of a Japanese company, the Myanmar Government and Myanmar businesses have established a development company for industrial park development and management initiatives.



(Figure) Location of Thilawa
(Courtesy of Marubeni Corporation)

Key aspects as *quality infrastructure*

- **<u>Promote development of the manufacturing industry and create new jobs.</u>**

- Support livelihood for relocated citizens due to this project.
- High-quality and environmentally-friendly infrastructure development based on Japanese design standards.

(Photo) Thilawa SEZ Zone A Development Project (Courtesy of Penta-Ocean Construction)

Contractor Penta-Ocean Construction

Connectivity

Case 10: The Project for Improvement of Ghanaian International Corridors (Grade Separation of Tema Intersection, Ghana)

--Developing a "Growth Ring" in West Africa

Project Summary

Improvement of a nodal point for two international corridors, the "Abidjan-Lagos Corridor" connecting coastal West African cities, and the "Eastern Corridor" which connects Ghana and Burkina Faso.

(Figure) Location of the Tema intersection in West Africa's "Growth Ring" (JICA preparatory survey report)

Key aspects as *quality infrastructure*

- **<u>Smooth traffic flow was achieved at the two international corridors, thus, connectivity in the region has been improved .</u>**

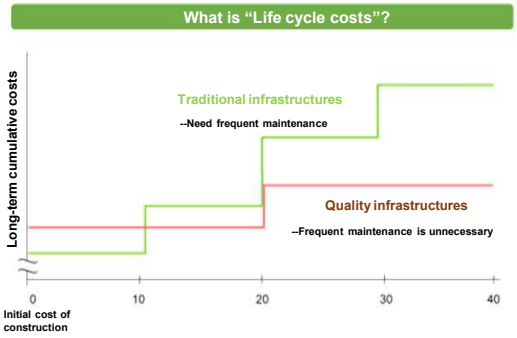
(Photo) The Tema intersection (Courtesy of Shimizu Corporation)

ODA Process G/A: 2017, Start: 2018, Complete: 2020

Contractors Shimizu Corporation, Dai Nippon Construction

Achieving Value for Money with infrastructure investment life cycles
Quality infrastructure investments attain value for money with life cycle costs which are calculated over operation, maintenance and management (O&M) phases.

<Commentary>
○**Life cycle costs**: Quality infrastructure investments may call for higher initial investments than traditional infrastructures. However, they have the advantage of needing less maintenance work and cost, making operation, maintenance and management (O&M) inexpensive. Japanese companies are able to provide infrastructures which have favorable life cycle costs.
○**Efficient maintenance and management**: ICT has been applied for efficient maintenance and management, which leads to recent minimizing of costs.



Life cycle costs

Case 11: Mombasa Port reclamation construction (Kenya)

--Long-lasting paint technology in a harsh environment

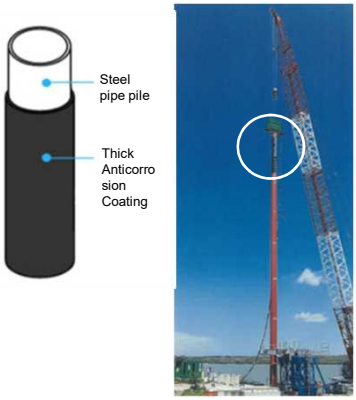
Project Summary

Development of a container terminal to facilitate logistics.

Key aspects as *quality infrastructure*

- **<u>The heavy-duty anticorrosion coating method was used to protect piles in seawater from corrosion when constructing a 900m berth at Mombasa Port.</u>**

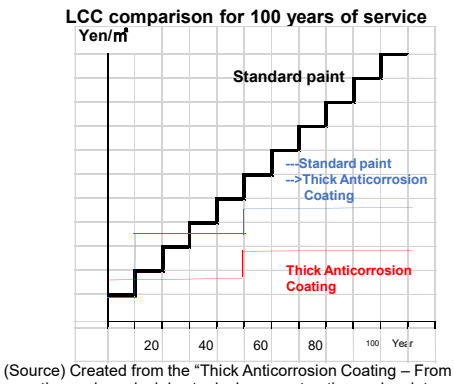
- The price of heavy-duty anticorrosion coated piles is more than normal coated ones, but <u>the boost in durability offers longer years of service, making it less expensive in the long-run</u>.



Example of piles without anticorrosion treatment

From the Research Group for Corrosion Protection & Repair Method webpage

(Photo) Thick anticorrosion coated pile (white area) used for the Mombasa Port reclamation construction project (Courtesy of Toyo Construction)



(Source) Created from the "Thick Anticorrosion Coating – From anticorrosion principles to design, construction and maintenance-- Japanese Society of Steel Construction"

ODA Process	E/N・L/A: 2007, Start: 2012, Complete: 2016
Contractor	Toyo Construction

Life cycle costs

Case 12: The Paranaque Wastewater Treatment facility (Philippines)

--Reduction of life cycle costs through a design-build proposal

Project Summary

Constructed the largest wastewater treatment facility in Paranaque City. Maynilad Water Services, the operator of this facility, considered life cycle costs as one of the most important evaluation criteria for the price evaluation process. A Japanese company was awarded the contract due to its outstanding proposal how to reduce the costs.

Key aspects as *quality infrastructure*

- **<u>The awarded Japanese company highlighted the reduction in life cycle costs by a design-build proposal, based on its experiences of building sewage treatment plants in the local market.</u>**

(Photo) Overall view at completion
(Courtesy of JFE Engineering)

*Important features to reduce life cycle costs (example)	Key impacts
(1) The time sewage sits in the reactor, which blows air into the sewage to stir it, was calculated based on the company's knowledge on sewage quality in this area. The company configured "five to six hours" is enough instead of the standard "six to eight hours".	• The size of the reactor was reduced by shortening the stay time. • Operation for air blowers was shortened, leading to decreased electricity fees.
(2) Sludge digestion tanks are installed in the sludge treatment line.	• Cost for sludge disposal can be reduced by stabilizing and sanitizing sludge while suppressing the generated sludge volume. • As for digestion gas that is emitted from the sludge digestion tank, applying this as supplement fuel for the sludge digestion tank heating boiler will minimize the necessary energy for sludge digestion.
(3) Making a three-layered final settling tank, and installing a "three-layered sludge collector".	• The space for final settling is reduced to one-third

Contractor JFE Engineering

Life cycle costs

Case 13: Bangkok MRT Purple Line (Thailand)

--Decreased life cycle costs through lightweight Japanese stainless steel cars

Project Summary

Developed the MRT Purple Line in Bangkok by ODA, opened in August 2016, with 16 stations and total length of 23km. This is the first MRT project in Bangkok which introduced Japan-made rail cars and this is the first case in overseas projects in which a Japanese railway operator engaged in maintenance services.

Key aspects as *quality infrastructure*

- The train cars introduced to the Purple Line are **Japan-made stainless steel cars that are lightweight, energy-saving, and reduce maintenance costs**

- A Japanese railway operator engaged in this project as a maintenance services provider has provided integrated knowledge and expertise related to Japanese maintenance methods, contributing to enhancing the railway technology capability of Thailand.

(Photo) Purple Line train cars

ODA Process E/N・L/A: 2008・2010, Start: 2009, Complete: 2016

Participating companies East Japan Railway Company, Marubeni, Toshiba, J-TREC, Meidensha, Tokyu Construction

Efficient maintenance and management

Case 14: Osman Gazi Bridge (Izmit Bay Bridge) Project (Turkey)

--An important bridge calls for efficient maintenance and management using ICT

Project Summary

Constructed a steel, three-span suspension bridge with a length of 2,682m and a main span of 1,550m, installing the world's first ever seismic reinforcement of main suspension towers, and the world's first common-use active damping device has been incorporated, mainly as a measure against wind.

Key aspects as *quality infrastructure*

- **The BOT project company intended to maintain and manage this bridge in good condition until the time of transfer after the 22-year and 4-month contract**.

- Measures for maintenance and management include the following:

  Example 1: Approximately 400 sensors of various types were installed for real-time monitoring of changes in the suspension bridge's conditions

  Example 2: If the surface temperatures of the main cables reach 300 to 400 degrees due to incidents such as vehicle fires, water cooling systems installed on the road surface will release water 25m up to the main cables.

(Photo) Water cooling system

(Photo) Overview of the Osman Gazi Bridge (Courtesy of IHI Infrastructure Systems)

Contractor IHI Infrastructure Systems

Principle 2: Raising Economic Efficiency in View of Life-Cycle Cost

Observing construction deadlines/Shortening construction period
Quality infrastructure investments demonstrate their function earlier and respond to infrastructure needs.

<Commentary>
○**Observing construction deadlines**: Quality infrastructure investments comply with construction schedules, if appropriate acquisition of land, removal of obstructive structures, coordination with a wide range of parties, procurement of materials and workers are executed on time. Keeping the schedule will suppress costs and ensure revenue prospects that result from the infrastructure.
Demonstrating the function of infrastructure earlier will contribute to invigorating local economies while responding to local infrastructure needs. Furthermore, it will minimize the impact that construction has on surrounding environments, and reduce hours of dangerous work as construction periods are shorter.

○**Shortening construction period**: Japanese companies take construction deadlines as one of their top priorities. With the entire team working together, they are sometimes able to shorten construction periods as well.

Shortening construction period

Case 15: Noibai International Airport 2nd Passenger Terminal (Vietnam) JaPaCon

--Schedule management that enabled an early airport opening

Project Summary

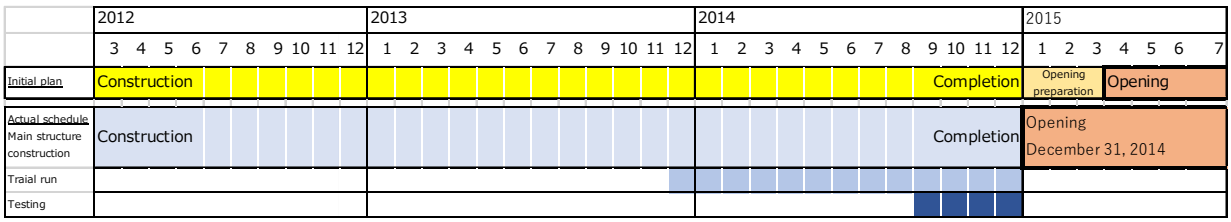
Constructed the second passenger terminal building at Noibai International Airport, the gateway to the skies for Vietnam.

(Photo) Noibai International Airport 2nd Passenger Terminal (Courtesy of Taisei Corporation)

Key aspects as *quality infrastructure*

- Japanese companies **<u>accelerated the opening schedule for the terminal building by three months</u>**.
- Comprehensive abilities and high management capabilities of Japanese construction companies in close cooperation with the procuring party realized the efficient construction schedule. For example, Japanese companies conducted an operation test by reproducing main airport facilities within the temporary building under the same conditions as the completed terminal, four months before the actual completion, leading to early opening.
- A committee of clients, the Japanese government and Japanese airport management companies was established to implement advanced Japanese know-how for customer satisfaction and efficient operation, maintenance and management.

Noibai International Airport 2nd Passenger Terminal Construction Schedule (Source) Taisei Corporation documents



ODA Process E/N・L/A: 2010・2012・2013, Start: 2012, Complete: 2014

Contractors Taisei Corporation, JFE Engineering（Sub-contractor）

Shortening construction times

Case 16: Hanoi City Ring Road No. 3 Construction (Ring Road elevated bridge) (Vietnam)

--Completed within half of the original schedule, using elaborate construction methods

Project Summary

Constructed a 2km elevated bridge to mitigate traffic congestion and facilitate logistics around Hanoi City and surrounding areas.

Key aspects as *quality infrastructure*

- Improvement and elaborately planned construction methods were mobilized to **complete the project in 15 months -- half of the originally planned 30-month period**, with close communication between the Japanese company and the procuring agency.
  - For the substructure, a simple, large-scale system was used for timbering, scaffolding, and molding.
  - Stable, large portal cranes with powerful lifting capacities were used to conduct heavy lifting of equipment and materials.
  - An on-site steam curing system was used for the superstructure pretension beams, cutting beam manufacturing work for local workers in half.

(Photo) Complete view of the completed Ring Road Bridge (Courtesy of Sumitomo Mitsui Construction)

ODA Process E/N・L/A: 2008, Start: 2011, Complete: 2012

Contractor Sumitomo Mitsui Construction

Principle 3: Environmental Considerations

Environmental Considerations
Quality infrastructure takes the ecosystem, biodiversity, low carbon, global warming and resource recycling into consideration.

<Commentary>
○**Environmentally-friendly infrastructures**: Quality infrastructure investment projects take the ecosystem, biodiversity, low carbon, global warming and resource recycling into consideration. As an environmentally advanced country, Japan has undertaken infrastructure development with superior environmental technologies.

○**Consideration towards the ecosystem**: Measures are introduced to reduce impact and maintain original ecosystems and biodiversity when developing infrastructures.

○**Environmentally-friendly construction methods (measures against waste, noise and air pollution, etc.)**: In recent years, measures that suppress waste, noise and air pollution during construction have been under the spotlight.

Environmentally-friendly infrastructure

Case 17: Changi Airport Terminal 4 (Singapore) Japan

--The world-renowned, environmentally-friendly airport

Project Summary

Constructed a new terminal building with an environmentally-friendly, open and transparent design, at one of the leading hub airports in Asia.

Key aspects as *quality infrastructure*

- The Terminal 4 building acquired Green Mark GoldPlus certification, the **highest level of environmental certification authorized by the Singapore Building and Construction Authority,** calling for “25% energy reduction”, “use of water-saving technology”, “use of environmentally-considerate technology/products”, and “achieving high-quality indoor environments”.
  - Reducing the quantity of solar radiation by high-performance multi-layered curtain walls
  - Introducing air conditioning/heat source systems with high energy efficiency
  - Use of daylight with skylights
  - Installing water-saving equipment
  - Reducing the amount of concrete
  - Active use of recycled products
  - Installing walls with rich greenery

(Photo) The completed terminal (Courtesy of Takenaka Corporation)

Contractor

Takenaka Corporation

Principle 3: Environmental Considerations

Environmentally-friendly infrastructure

Case 18: Nam Ngum 1 Hydropower Station Expansion Project (Laos)

--Expanding hydraulic power generation capacity by dam renovation

Project Summary

Expanded the generation capacity of the Nam Ngum 1 Hydropower Station.

Key aspects as *quality infrastructure*

- Drilling the embarkment body under operation upgraded the function of existing dam, **with less impact on the reservoirs and downstream.**

(Photo) Bored hole seen from the side (Courtesy of Hazama Ando Corporation)

(Image) White Paper on Water Resources 2019

ODA Process E/N・L/A: 2013, Start: 2017, Under Construction

Contractors Hazama Ando Corporation, Hitachi Zosen Corporation

Ecosystem considerations

Case 19: Port Vila Lapetasi International Wharf Development Project (Vanuatu)

--Mitigating environmental impacts with coral transfers

Project Summary

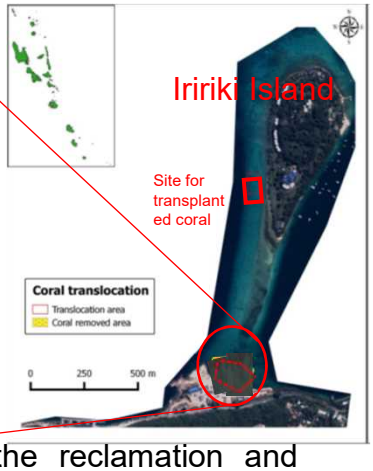
Constructed a multi-purpose wharf dedicated to handle international cargo and cruise ships.

Key aspects as *quality infrastructure*

- To minimize the impact on the ecosystem, **the Japanese company transferred 402 pieces of coral from the area around the reclamation point and transplanted them** at the west shore of Iririki Island, where there would be no effects from construction.

(Photo) Port Vila Lapetasi International Wharf (Courtesy of TOA Corporation)

(Photo) Area's coral was transferred



- In close communication with local, experienced divers, the reclamation and transplanting schedules were elaborately coordinated.

ODA Process E/N・L/A: 2012・2015, Start: 2015, Complete: 2018

Contractor TOA Corporation

Principle 3: Environmental Considerations

Environmentally-friendly construction methods (waste management measures)

Case 20: Rehabilitation of the Chroy Changwar Bridge (Cambodia)

--Reducing industrial waste by 1/50 during construction period.

Project Summary

Overall rehabilitation and reinforcement of the Chroy Changwar Bridge.

Key aspects as *quality infrastructure*

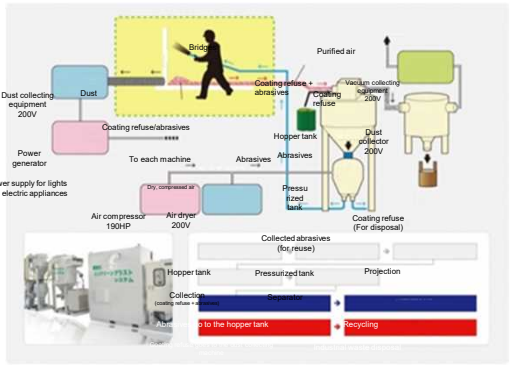
- **<u>Successfully reduced the amount of industrial waste</u>** by 1/50 using **<u>"Circulating Eco Clean Blast Method</u>**", which prevented hazardous paint from scattering to surrounding areas and reusing steel pieces.

• As the bridge's paint history showed that paint with lead had been used in the past, this method covered construction parts by sheets and steel abrasives were blasted to remove paint.

(Photo) Overview of the Chroy Changwar Bridge (Courtesy of Obayashi Corporation)

(Photo) The blast method (Courtesy of Obayashi Corporation)

Image of the Circulating Eco Clean Blast Method



（Source）The Circulating Eco Clean Blast Study Group webpage

ODA Process G/A: 2016, Start: 2017, Complete: 2019

Contractors Obayashi Corporation, Yokogawa Bridge Corporation（Sub-contractor）

Principle 4: Building Resilience against Natural Hazards and Other Risks

<Resilience>
Quality infrastructure investments build resilience against risks such as natural hazards.

○**Resilience against risks**: The risk of natural hazards around the world such as flooding and landslides has been increasing with climate change, caused by global warming. Vulnerability towards earthquakes and water hazards has become a major issue as the population in metropolitan areas increases.
Quality infrastructure investments are resilient against those types of risks. Having a resilient infrastructure during a disaster will mitigate the impact towards local economies and allow smoother recovery and reconstruction activities.

○**Build Back Better**: Japan is prone to natural hazards, including large-scale earthquakes, and frequent meteorological hazards such as typhoons. The disaster prevention know-how built on these experiences is able to contribute to the world significantly. “Build Back Better” (for better recovery) pronounced in the “Sendai Framework for Disaster Risk Reduction 2015-2030” adopted at the 3rd UN World Conference on Disaster Risk Reduction, is the history of Japan, and has been promoted by Japan globally.

Resilience against natural hazards

Case 21: Bangkok MRT Blue Line (Thailand)

--The subway did not suffer during Bangkok flooding

Project Summary

The Bangkok MRT Blue Line was constructed in the central area of Bangkok supported by ODA to provide alternative transportation to cars causing severe traffic jams and air pollution. Many Japanese companies were engaged in the project.

Key aspects as *quality infrastructure*

- The 2011 monsoon season brought a large amount of rainfall to northern and northeast Thailand, and downstream Bangkok suffered flooding. **The MRT Blue Line stations were not flooded regardless of their location in an inundated area and continuous operation was achieved**.
  - Measures such as elevating the subway entrance from pedestrian walkways to prevent water from entering the subway during flooding, designing subway entrances that allowed installation of water-shielding boards, installing air vents at a higher location, and installing drainage pumps.

(Photo) Entrance of the Bangkok Metro
(Courtesy of Shinichi Hisano/JICA)

ODA Process: E/N・L/A: 1996・1997・1998・1999・2000, Start: 1996, Complete: 2004

Contractors: Obayashi Corporation, Kajima Corporation, Nishimatsu Construction, Kumagai Gumi, Tokyu Construction, Hazama Gumi, Maeda Corporation

Principle 4: Building Resilience against Natural Hazards and Other Risks

Resilience towards risks

Case 22: Sabo Dam at Mt. Merapi (Indonesia)

--Application of Japan's sabo dam technology

Project Summary

Constructed sabo dams and rehabilitated evacuation roads.

Key aspects as *quality infrastructure*

- During the rainy season after Mt. Merapi erupted in October 2010, mud flows occurred at 15 major rivers. However, only four rivers suffered from disasters, and **the mud flow damage was minimalized by the approximately 250 sabo dams developed in the area**.

(Photo) Sabo dam (Courtesy of Shimizu Corporation)

ODA Process E/N・L/A: 2005, Start: 2009, Complete: 2013

Contractor Shimizu Corporation

Build Back Better

Case 23: The Program for Recovery from Nepal Earthquake (Nepal)

--A hospital damaged by the Nepal earthquake was "Build Back Better"

Project Summary

Reconstructed Paropakar Maternity Hospital and the Bir Hospital, which were damaged by an earthquake of magnitude 7.8 on April 25, 2015.

(Photo) Overview of the stricken Paropakar Maternity Hospital (upper photo) and the hospital interior (lower photo) (Courtesy of K.ITO Architects & Engineers)

Key aspects as *quality infrastructure*

- Hospital operation efficiency was enhanced by **integrating various functions (childbirth facilities, ICUs and training facilities) within the hospital. Emergency power generators**, **UPS systems and water tanks** were also installed **to ensure continued operation during a disaster**.

(Photo) Paropakar Maternity Hospital after reconstruction (Courtesy of Hazama Ando Corporation)

ODA Process E/N・G/A: 2015・2016, Start: 2017, Complete: 2019

Contractor Hazama Ando Corporation

(Photo) Bir Hospital after reconstruction

Principle 5: Social Considerations

Cooperation with local communities

Quality infrastructure investments take serious consideration of local communities that are affected by infrastructure development.

<Commentary>

○**Consideration towards local communities**: It is important to conduct thorough consultation with local communities that are affected by infrastructure development. Delayed expropriation of land or transfer of obstacles such as water pipes will cause overall project delays and may cause an increase in costs. It has been learned from Japan's experience that earnest and sincere correspondence with affected communities will lead to smoother construction progress, and the community will more favorably accept the completed infrastructure.

○**Inclusiveness**: Quality infrastructure investments must answer to the rights and needs of people, especially those in vulnerable situations such as women, children, the disabled, senior citizens, indigenous people, those in poverty, and those marginalized by society.

Considerations toward regional communities

Case 24: Relocation of citizens due to the Upper Kotmale Dam (Sri Lanka)

--Developed relocation sites through consultation with target citizens

Project Summary

Constructed a flow-in-type hydraulic power plant on the Kotmale River.

Key aspects as *quality infrastructure*

- **A Japanese contractor constructed more than 500 residential houses for relocated people**, along with necessary infrastructure for their new lives, such as **electricity and waterworks, schools, religious facilities and shops** which had existed in their former residential areas, based on a relocation action plan which was developed by the target citizens.

(Photo) Relocated housing development

(Photo) Relocated school (Courtesy of Maeda Corporation)

ODA Process E/N・L/A: 2002・2010, Start: 2005, Complete: 2012

Contractor Maeda Corporation

Principle 5: Social Considerations

Friendship with local communities

Case 25: Construction of Elementary and Secondary School Buildings and the Taungoo Education College (Myanmar)

--International cooperation for the local community through school construction

Project Summary

Constructed the new Taungoo Education College, which is one of the 21 teacher education schools in Myanmar and the core of “child-centric education”. The Japanese company which constructed the college donated classrooms for local elementary schools in collaboration with a Japanese NPO.

(Photo) Taungoo Education College, completed by ODA

Key aspects as *quality infrastructure*

- The Japanese company **regarded it as important to deepen friendships with local communities while donating classrooms.**
  - Due to accumulated consulting sessions with local communities and employment of young unemployed people for construction, communication between the company and communities continued after the completion.

(Photo) Children studying at a classroom donated by the Japanese company (Courtesy of Kumagai Gumi)

ODA Process	G/A: 2014, Start: 2015, Complete: 2016
Contractor	Kumagai Gumi（The Taungoo Education College）

Inclusiveness

Case 26: The Project for Improvement of the Institute of Child Health and Hospital for Children, Chennai (India)

--Enhancing inclusiveness by improving pediatric care

Project Summary

Built outpatient facility for the children’s hospital.

Key aspects as *quality infrastructure*

- The Japanese company which engaged in the construction **ensured the safety of people accessing the hospital during the construction period.**
- **The project aimed to enhance inclusiveness and ease of access for all users of the hospital.**
  - For example, ensuring compatibility with existing pediatric facilities, making examination rooms gender specific for people accompanying patients and establishing user-friendly toilets on every floor.

(Photo) Completed hospital (Courtesy of Fujita Corporation)

ODA Process	E/N・G/A: 2014, Start: 2015, Complete: 2016
Contractor	Fujita Corporation

Principle 5: Social Considerations

Safety and health

Quality infrastructure investments ensure workplace safety and the health of workers.

<Commentary>

○**Safety**: Environmental consideration at the workplace to ensure safety and health is crucial to infrastructure development. Cutting costs for safety and health may directly impact precious human life or generate a significant economic loss due to delays in construction, in the event of accidents and illness at the workplace or surrounding regions. Protecting the safety and health of workers will also result in improvement of skills and productivity of local workers.

Thorough implementation of safety measures such as ensuring safe scaffolding, along with safety and health education, are always top priorities in construction projects by Japanese companies.

○**Consideration towards traffic during construction**: Consideration towards the local community during construction is necessary, such as minimizing traffic congestion and generation of dust, noise and waste water. Many construction projects in urban areas especially need to minimize traffic congestion in cramped spaces.

Japanese companies have significant experience of taking consideration for traffic conditions during construction in domestic projects. They specialize in implementing short-term construction with minimal impact on traffic.

Considerations for traffic during construction

Case 27: Improvement of Tazara Intersection (Tanzania)

--Make work area as small as possible to minimize the impact on normal traffic

Project Summary

Improved the intersection, including construction of Tanzania's first ever flyover, along with improvement on linkage system of neighboring traffic signals.

(Photo) Completed Tazara intersection
(Courtesy of Sumitomo Mitsui Construction)

Key aspects as *quality infrastructure*

- **<u>Safety for passing vehicles and local citizens going to regional hospitals and shops has to be ensured.</u>**
- A Japanese company **<u>took measures to enable accident-free and on-time construction, such as</u>**
  - Secured 2 lanes for vehicles on each side, as well as 3m wide sidewalks on both sides for pedestrians.
  - Constructed a temporary gate to avoid over-sized vehicles' entrance into the intersection under construction.
  - Stationed traffic police officers and guards 24 hours a day to control traffic.

ODA Process G/A: 2013・2014・2015, Start: 2015, Complete: 2018

Contractor Sumitomo Mitsui Construction

Principle 5: Social Considerations

Safety and health

Case 28: Ulaanbaatar Railway Fly-Over Bridge Construction Project (Taiyo Bridge)(Mongolia)

--Safe construction with first-ever techniques used in Mongolia

Project Summary

Construct a bridge across Mongolian Railway lines to connect southern and northern areas of Ulaanbaatar city.

(Photo) Completed Taiyo Bridge

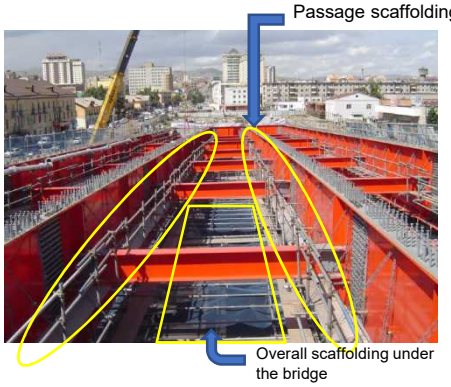
Key aspects as *quality infrastructure*

- A Japanese company **minimized impact on traffic and residential areas nearby, and successfully completed the construction safely without any accidents.**
- Resident Japanese experts conducted thorough safety and health training for local engineers and workers, implemented **safety measures based on Japanese standards** such as installing work handrails, measures to prevent falling during delivery of main girders, overall and walkway scaffolding, and nets to prevent falling items.

Examples of safety measures based on Japanese standards

Handrails for work were installed before unloading main girders

Main girders had four locations lashed per side to prevent falling during transportation.



Overall scaffolding was installed for areas over rail and roads, and passage scaffolding installed at the middle and end of main girders.

Nets to prevent items from falling were installed below all scaffolding

(Photo) Courtesy of JFE Engineering

ODA Process G/A: 2009, Start: 2009, Complete: 2012

Contractor JFE Engineering

Principle 5: Social Considerations

Safety and health

Case 29: Marina Regional Expressway (Singapore) Japan for

--Multilingual safety education

Project Summary

Constructed the Marina Coastal Expressway as a part of the Marina Bay area redevelopment. The areas constructed by a Japanese company totaled 700m, of which 420m were located underground at the river mouth of Singapore River, with a width of 55m (the yellow area on the right image).

(Photo) Location of the Marina Regional Expressway

Key aspects as *quality infrastructure*

- **<u>The construction site had staff and workers of various nations,</u>** including Singapore, Malaysia, Philippines, Thailand, Bangladesh, India, Indonesia, Australia, and China, with approximately 800 people working at peak periods. **<u>Comprehensive training was necessary, because the awareness and knowledge of safety and health differed between these workers.</u>**

  - On-site signage was in four languages--English, Chinese, Malay, and Hindi so that all workers can understand it.
  - <u>Details of work plans were shared at morning meetings and briefing sessions</u>, where health and safety was assured by consolidated efforts on-site.
  - <u>On-site education and training, safety events and emergency first aid drills were held regularly</u>.
  - Workers who contributed to safety and health management were awarded.

(Photo) Communication at daily morning meetings

(Photo) Awarded workers

(Photo) Information board promoting use of equipment in proper condition

- Since the construction site was adjacent to the Singapore Public Utilities Board (PUB) drinking water reservoir, a Japan-made antipollution film was used to prevent leaking of contaminated water during dredging.
- The construction project was published on the PUB webpage as a model construction project with consideration towards the environment.

(Photo) The Marina Coastal Expressway Contract 48 construction（Courtesy of Penta-Ocean Construction）

Contractor Penta-Ocean Construction

Principle 6: Infrastructure Governance

Private funds
Quality infrastructure investments effectively apply private funds.

<Commentary>
○**Application of private funds**: Public funding for infrastructure development is not sufficient, although the need for infrastructure has been growing around the world. Introduction of private funds become necessary for infrastructure construction, operation, maintenance and management.
○**Risk-sharing between public and private sectors**: On the other hand, it is important to have public and private sectors cooperate towards calling for private funding. PPP projects do not require private sectors to assume all risks from construction and operation to maintenance and management. The key to applying private funds is appropriate risk sharing between private and public sectors. Japan supports PPP projects with funding from organizations such as ODA and JOIN.

Mobilizing private fund

Case 30: Support for transport projects/urban development projects by JOIN

--Usage of private finance

The Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (JOIN) was established in 2014, to contribute to overseas infrastructure projects with hands-on support, such as provision of funds and introducing special knowledge, to support transportation and urban development projects overseas by applying Japan's accumulated knowledge, technology and experience. JOIN has been envisioned to support motivated private sectors apply private funds to overseas infrastructure development such as transportation and urban development. Support for 26 projects had already been decided by the end of fiscal 2019.

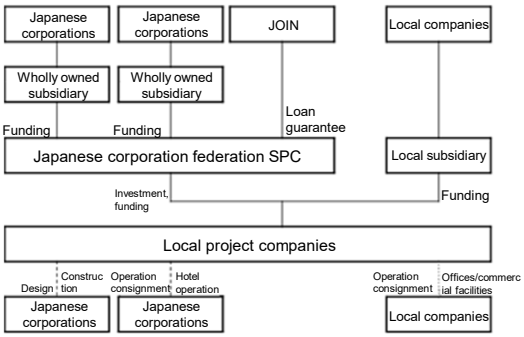
Mobilizing private fund

Case 31: Large-scale development complex at the center of Yangon City

--Japan's urban development technology coming alive in Yangon

Project Summary

Japanese companies have established a local project company with their own investments and investments from JOIN for the project to develop and operate commercial facilities and hotels within a top-quality office building at the heart of Myanmar's Yangon City.



Key aspects as *quality infrastructure*

- **<u>Mobilizing private fund contributed to improving debt sustainability in the country.</u>**
- <u>Advanced technological capabilities</u>, <u>product planning abilities</u> and <u>development/operation know-how for top-quality office/hotel services</u> fostered by Japanese companies was demonstrated in the project.

(Photo) Conceptional image of the completed facilities
(Courtesy of Fujita Corporation)

Contractor Fujita Corporation

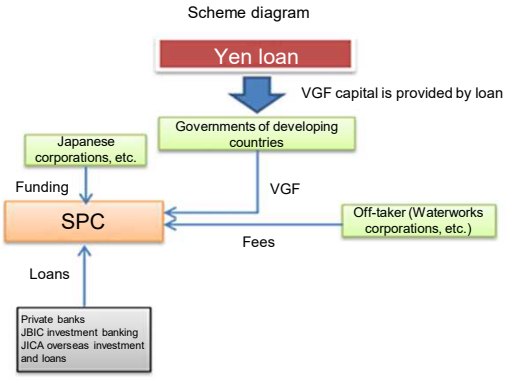
Principle 6: Infrastructure Governance

Risk-sharing between public and private sectors

Case 32: VGF Support

--Enhancing Public-Private Partnership by ODA

Japanese ODA supports infrastructure development by mobilizing private funding. One of the most notable methods is the support for Viability Gap Funding (VGF).
VGF is a mechanism to supplement the difference when an infrastructure project undertaken by the private sector is economically justified but not financially viable due to issues such as income revenue. This method is used in developing countries such as India and Indonesia where the demand for infrastructure needs as well as initiatives for private funding are high. Japanese ODA supports SPCs established by organizations such as Japanese companies by loans to supplement VGF capital.



(Source) JICA webpage

Principle 6: Infrastructure Governance

Operation, maintenance and management
Quality infrastructure implement appropriate operation, maintenance and management.

○**Appropriate operation, maintenance and management**: Robust governance throughout a project life cycle is necessary for an infrastructure project to exert its initially anticipated effects. To achieve this, it is crucial to have clear rules and established systems while developing employee capabilities. Even if high-level infrastructure is constructed, it will not live up to its full potential without appropriate maintenance and management.
Japan actively supports human resource development and establishment of systems related to infrastructure development, maintenance and management. Active technology transfer has been taking place by conducting operation, maintenance and management along with local companies.

Operation, maintenance and management

Case 33: Technical Assistance Project to Establish the Philippine Railway Institute

--Reinforcing operation capabilities through a long-term perspective

Project Summary

Japanese ODA supported the establishment of the Philippine Railway Institute (PRI) as an organization to train and supervise human resources. Japanese companies engage in its operation.

Key aspects as *quality infrastructure*

- **Japanese companies developed training facilities, established training guidelines, and carried out training to transfer experience and know-how accumulated in Japan on urban railway operation** for the railway lines in metropolitan Manila**.**

ODA Process	Start: 2018, Complete: 2023（expectation）
Participating companies	Tokyo Metro, Armec, Oriental Consultants Global

Operation, maintenance and management

Case 34: Manila Metro Rail Transit System 3 (Philippines)

--Developing a maintenance and management system

Project Summary

The MRT3 line had been conducting stable operation by Japanese companies for 12 years after opening. In 2012, the Philippine Government changed the maintenance and management tasks to local and non-Japanese companies. However, since appropriate maintenance and management was not implemented, Japanese companies were requested by the Philippine Government to carry out railway system rehabilitation and maintenance services from May 2019.

(Photo) Manila's MRT3 Line (Courtesy of the Sumitomo Corporation webpage)

Key aspects as *quality infrastructure*

- **The Japanese companies are conducting maintenance of train cars and facilities to realize safe and efficient operation.**

ODA Process	E/N・L/A: 2018, Start: 2019, Complete: 2022（expectation）
Participating companies	Sumitomo Corporation, Mitsubishi Heavy Industries Engineering

Operation, maintenance and management

Case 35: The Intercity Express Programme (England)

--Overcoming differences in specification to provide sustainable, safe and stable transportation

Project Summary

Fully replaced aging rolling stocks that had been running on the Great Western Main Line (GWML) and the East Coast Main Line (ECML), which connects London with other major cities.

Key aspects as *quality infrastructure*

- Japanese companies concluded **a long-term maintenance contract and established a maintenance base locally, offering sustainable safe and stable operation.**

Participating company Hitachi

(Photo) High-speed train cars (Courtesy of Hitachi)

Operation, maintenance and management

Case 36: Operation of Sihanoukville Port (Cambodia)

--An Operation supported through public-private partnerships

Project Summary

Japanese harbor transportation corporations and the Kobe-Osaka International Port Corporation both fund and participate in port operation.

(Photo) Sihanoukville Port

Key aspects as *quality infrastructure*

- **Support towards developing the Sihanoukville Autonomous Port employee capabilities and boosting efficiency of port operations are being implemented.**

Participating companies Kamigumi, Kobe-Osaka International Port Corporation

Operation, maintenance and management

Case 37: The Project for Improvement of Axle Load Control on Trunk Roads (Ethiopia)

--Maintenance and management for safe, long-term usage of roads

Project Summary

A project to improve approximately 253km of road was conducted in several stages for National Highway 3, along with replacing a bridge on National Highway 1 by a Japanese ODA.

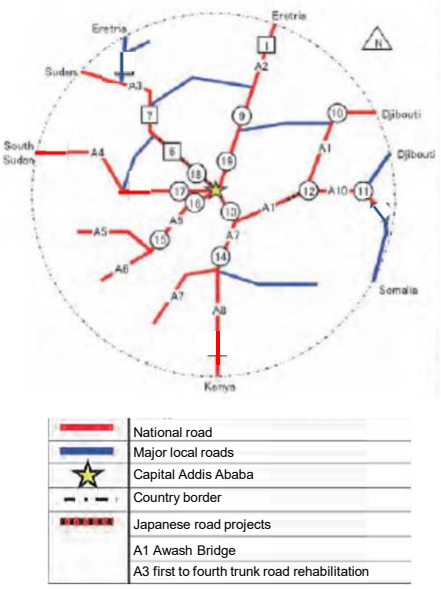
Support to install axle load meters and load indicators at checkpoints for overloaded vehicles followed the improvement project to enable safe and long-term usage of roads.

Key aspects as *quality infrastructure*

- **<u>Axle load measurement became efficient, thus, intensifying crackdowns on overloaded vehicles. As a result, the number of vehicles violating regulations was reduced.</u>**

(Photo) Measurement training (Courtesy of the JICA webpage)

(Photo) Axle load measurement readouts



(Image) Points where axle load meters were installed (excerpt and edited from JICA's preparatory survey report)

ODA Process	G/A: 2015, Complete: 2018
Participating company	Tone Engineering

Operation, maintenance and management

Case 38: Special Course on MLIT Training Program for the Proper Development of the Construction Industries in Asian Countries

--Improving the operation, maintenance and management capacities of government officials

<u>A training program for Asian government officials started in FY2017 to promote training for human resources that will be able to handle preparation and implementation of systems related to construction and land needed for infrastructure development, maintenance and management in developing countries including ASEAN countries. Government officials who were candidates for future executives in various ministries and agencies, which are responsible for land and construction policies, were invited to such program to learn land and construction systems in Japan. Its curriculum includes on-site technical visits and research presentations on policy issues related to sustainable infrastructure development</u>. A total of 41 people from 10 countries, with a focus on ASEAN countries, have participated in this program.
Of the participants in this program, some have taken part in the drafting of construction bills in their home country after training, and others have gone on to promote projects to support training of human resources in construction in their home country as well. Land and construction knowledge acquired through this program has been actively applied to establishing legal systems and human resource training in their own countries.

(Photo) Third training program (courtesy visit to Minister Ishii, local tour)

Principle 6: Infrastructure Governance

Procurement and finance
Quality infrastructure investments require open and transparent procurement practices and ensure financial sustainability.

<Commentary>
○**Procurement openness and transparency**: Ensuring openness and transparency of procurement is the foundation of achieving value for money with an infrastructure project. Efforts made to prevent corruption are also necessary.
○**Financial sustainability**: Infrastructure investments have a major impact on overall country and regional finances. A proper evaluation is indispensable to ensure financial sustainability.
The costs necessary for each infrastructure should be seriously considered from the stages of project formation. Funding costs or loan rates also become important. Sustainable operation, maintenance and management costs should be calculated with loan rates, and there is a necessity to verify whether future payment is feasible from a life cycle perspective.

Openness and transparency

Case 39: Compliance training

--On-site compliance training

Training for thorough compliance is implemented for workers and managers at construction sites of Japanese companies.

- At a construction site managed by Japanese companies, more than 200 workers and managers participated in compliance training, with guidance from lawyers on topics such as bribery regulations, competition laws, copyright (illegal software), standards of conduct and harassment, with the goal of preventing corruption and ensuring compliance.

Financial sustainability

Case 40: Conditions for providing yen loans

--Concessional loans

Conditions for yen loans are very concessional, being low-interest, long-term with long terms for grace periods, due to factors such as the current interest rate.

Special Terms for Economic Partnership (STEP) is more concessional, is applied to projects that call for and practically apply the technology and know-how of Japanese businesses, and answers to requests from developing countries.

Case 41: Development and operation of Thilawa Port (Myanmar)

Project Summary

○The Thilawa area is expected to develop rapidly with the expansion of the Yangon metropolitan area and the improvement of the Thilawa Special Economic Zone (SEZ). As a result, the amount of container goods has already started increasing; however, the existing port facilities do not have enough capacity to handle future cargo demand.

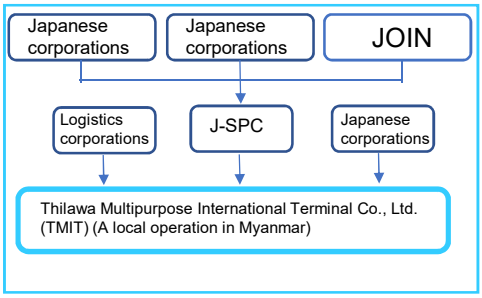
○ **Construction of a multi-purpose terminal** at Yangon Port was supported by Japanese ODA and Japanese contractors have implemented its construction.

○ TMIT (Thilawa Multipurpose International Terminal Co., Ltd.), the operator of the terminal, is composed of several Japanese companies and others. This fact gives assurance to Japanese manufacturers who intend to start operations in Thilawa SEZ, and the number of companies entering there has been increasing.

○ Contractors: Toyo Construction, JFE Engineering

○ Participating companies: Kamigumi,
Sumitomo Corporation,
Toyota Tsusyo Corporation

Current state of the Thilawa multi-purpose terminal



The structure of TMIT

Key aspects as *quality infrastructure*

Principle 1: Impact

○**Creation of work opportunity / Technology transfer**: Local workforce was employed and technology was transferred at each stage of surveying, design, construction and operation.

○**Sustainable development**: A gateway that supports Thilawa SEZ and promotes the economic growth of Myanmar.

Principle 2: Life Cycle Costs

○**Effective maintenance and management**: The facilities are protected from aging degradation by developing a seawall.

Principle 3: Environmental Considerations

○**Environmentally-friendly construction method**: Installation of silt protection at dredging and disposal, promotion of recycling and proper processing of waste materials

Principle 5: Social Considerations

○**Safety and health**: Thorough safety education for construction

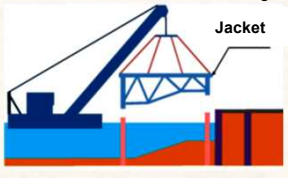
Principle 6: Governance

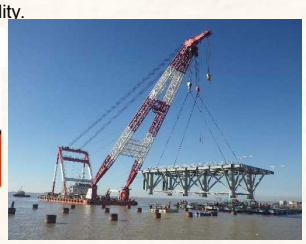
○**Appropriate operation, maintenance and management**: Efficient operation and management by TMIT

Principle 4: Resilience

○**Resilience against risks**: The earthquake-resistant jacket system helps the port function even in the event of an earthquake. Furthermore, with the participation of Japanese companies who experienced “the 2011 Tohoku earthquake and tsunami”, the knowledge about disaster response can be also shared.

Jacket method
A structure which connects to driven piles, the legs of three-dimensional, steel pipe truss structures by welding or other methods, which are anchored to the seabed. It is highly earthquake-resistant and has excellent horizontal rigidity.





(Photo) Jacket Method (Courtesy of Toyo Construction

Case 42 New Ulaanbaatar International Airport Project

Project Summary

○ As the old airport in the Mongolian capital Ulaanbaatar is surrounded by mountains on the south and east side, takeoff and landing is limited to the northern-west side of the airport. In addition, weather conditions such as wind direction often restrict takeoff and landing, thereby resulting in a low in-service rate in spite of yearly increasing aviation demand.

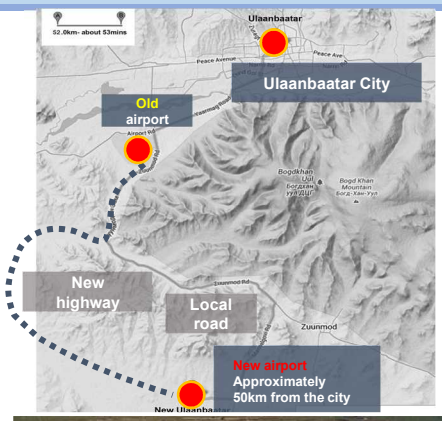
○ Construction of this new airport was financed by 【***yen loans***】, and Japanese companies carried out the design and construction in order to improve geographical limitations, safety and reliability, and proactively correspond to the increasing aviation demand.

○ Management of the new airport will be carried out by the Japan-Mongolia Joint Company established by the Japanese Consortium (51%) and the Mongolian Government (49%) .

○ Design Firms: Azusa Sekkei Co., Ltd.,
Oriental Consultants Global Co., Ltd.

○ Contractors: Mitsubishi Corporation, Chiyoda Corporation,
JFE Engineering Corporation (Sub-contractor)

○ Japanese Consortium: Mitsubishi Corporation,
Narita International Airport Corporation,
Japan Airport Terminal Co., Ltd. , JALUX Inc.



	Phase 1	Phase 2
Construction period	2013 to 2020	
Client	Mongolia Ministry of Road and Transport Development	
ODA	Loan assistance (STEP) 28.807 billion yen	Loan assistance (STEP) 36.850 billion yen

Key aspects as *quality infrastructure*

Principle 1: Impact

○ **Sustainable development**: The project contributes to sustainable development of the Mongolian economy.
○ **Enhanced skills**: Extensive technical cooperation led to enhance overall management skills, by covering a wide range of areas from the management system design of the new airport to the human resource development in the field of airport operation and air traffic control.
○ **Creation of new jobs**: Some staff working at the existing airport will be reassigned to the new airport. Locals will also be actively employed.

Principle 2: Life Cycle Costs

○ **Life cycle costs**: Energy cost will be reduced by incorporating air conditioning system with CO_2 sensors and lighting system with motion sensors.
○ **Efficient operation and maintenance**: Central control of facilities by Building Management System (BMS) for efficient operation will reduce operation and maintenance cost.
○ **Observing construction period**: Construction period was observed by well-managed efficient even within a limited period due to the cold winter season when outdoor construction is not possible.

Principle 3: Environmental Considerations

○ **Environmentally-friendly infrastructure**: Introduction of low-emission vehicles and a sewage treatment plant for airport wastewater.

Principle 4: Resilience

○ **Resilience to risks**: Resilience to risks will be reinforced by a stable management foundation to be established by expansion of airport revenues that will be brought about by high-quality services, active marketing toward expansion of the aviation network and development of attractive commercial facilities leveraging the know-how and experience of the Japanese Consortium.

Principle 5: Social Considerations

○ **Inclusiveness**: Application of the universal design in Japan to the facilities (Flow line plan that alleviates stress on passengers, installation of nursing rooms and washrooms for wheelchair users and the disabled).

Principle 6: Governance

○ **Appropriate management, operation and maintenance**: Four Japanese and three Mongolians designated as the directors of the Joint Company will conduct sound management with cooperation from both of the countries.
○ **Sustainable finances**: Utilization of STEP, which offers lower interest rates than other yen loan programs.

Per category --Railways

Case 43 Jakarta Mass Rapid Transit (MRT) South-North Line (Indonesia)

Project Summary

○The population of the capital city Jakarta is approximately 30 million people (2015) and steadily rising along with the number of commuters from neighboring states. Since the metropolitan area depended on road transportation, serious traffic congestion had been occurred with a deteriorating investment environment and air pollution.

○ Development of MRT, which is the first urban railway including subway in Jakarta, was carried out by Japanese ODA to achieve a modal shift from road transportation to public transportation in the Jakarta metropolitan area.

○ Contractors：Shimizu Corporation, Obayashi Corporation, Sumitomo Mitsui Construction, Tokyu Construction, MITSUI & CO・Toyo Engineering・Kobe Steel JV, Sumitomo Corporation（Nippon Sharyo)

	First construction area (Civil engineering)	Second construction area (Civil engineering)	Third construction area (Civil engineering)	Fourth construction area (Civil engineering)	Fifth construction area (Civil engineering)	Sixth construction area (Civil engineering)	Seventh construction area (E&M)	Fifth construction area (Cars)
Construction period	2013 to 2019		2013 to 2019	2013 to 2019		2013 to 2019	2015 to 2019	2015 to 2019
Client	MRT Jakarta							
ODA	Loan assistance Approximately 150 billion yen							

The opening ceremony (Courtesy of JICA)

Key aspects as *quality infrastructure*

Principle 1: Impact

○**Technology transfer/enhancing skills**

- Manuals/operating plans necessary for operations were prepared for MRT Jakarta, along with training and support for drivers and maintenance staff.
- Support for operating urban railway, necessary legal systems and improvement of staff capabilities were provided for Jakarta provincial government and MRT Jakarta.
- Japanese staff provided training and guidance around the clock for the excavation by shield machine and time schedule management, etc. An automated fare collection system was incorporated by applying FeliCa, which is the same system as Suica, for smoother fare collection

○**Sustainable growth**: Improved business environment and air pollution in Jakarta Metropolitan Area.


MRT train car (Courtesy of MRT Jakarta)

Principle 2: Life Cycle Costs

○**Efficient maintenance and management**: Light-weight train cars have been introduced, reducing life cycle costs with less maintenance because of installed signaling system on the assumption that there are no collisions.

Principle 4: Resilience

○**Resilience against risks**: Incorporating flood protection system such as mound-up entrance, water prevention panel to prevent water flowing into underground stations.

Principle 3: Environmental Considerations

○**Environmentally-friendly construction methods**: Reuse of excess soil generated by construction.

Principle 5: Social Considerations

○**Inclusiveness**: Each train car offers priority seats, and space for wheelchairs and baby strollers.

○**Safety**: Two security staff ride on each train and patrol the cars to ensure safety within train cars.

○**Impact on traffic during construction**: Construction in the main streets did not reduce traffic lanes and did not increase traffic congestion.

Principle 6: Governance

○**Sustainable finances**: Application of STEP, which offers lower interest rates than other yen loan programs.

Neak Loeung Bridge (Cambodia)

Project Summary

○Cambodia's National Route 1 is a major international highway. Along with the economic development of Cambodia and other countries in the vicinity, the traffic demand on National Route 1 also increased. However, as there was no bridge to cross the Mekong River on National Route 1, and there was no choice but to cross by ferry, it became a bottleneck traffic point with waiting times of 30 minutes during the off-season, and a maximum of seven hours during peak seasons.
○Development of the Neak Loeung Bridge at the crossing point of the Mekong River on National Route 1 (Neak Loeung) was supported by Japanese ODA and constructed by a Japanese company. The bridge is 640m long (main bridge, three continuous PC cable-stayed bridge), with a 1,575m east-west approach bridge and a 3,245m approach road.
○The Neak Loeung Bridge was officially named "Tsubasa Bridge" and its image was used for the new Cambodian 500 riel banknote.
○ Contractor: Sumitomo Mitsui Construction

	Bridge Construction
Construction period	2010 to 2015
Client	Ministry of Public Works and Transport.
ODA	Grant aid 11.94 billion yen

Tsubasa Bridge

(Photo) New 500 riel banknote (Courtesy of Sumitomo Mitsui Construction)

Key aspects as *quality infrastructure*

Principle 1: Impact

○**Creation of new jobs**: At peak times, more than 1,000 local engineers and workers were employed per day.
○**Technology transfer**: Young, local engineers (such as university graduates) were actively employed. Regular construction procedure briefings, safety events were carried out for human resource growth and technology transfer.
○**Connectivity**: Resolved the bottleneck issue of the south economic corridor.

Principle 2: Life Cycle Costs

○**Complying with construction deadlines**: Although construction halted for four months due to an explosion caused by unexploded ordnance, it was completed within the scheduled period.

Principle 3: Environmental Considerations

○**Environmentally-friendly construction methods**: Environmental monitoring was implemented before and during construction.

Principle 4: Resilience

○**Resilience against risks**: Durability and resilience toward future changes in the natural environment was ensured.

Principle 5: Social Considerations

○**Considerations toward local communities**: Consultations with local citizens were held in their native language from the route selection stages to obtain their understanding. Sales locations were provided in construction yards and employment opportunities were created for former ferry staff, salespersons and restaurant owners after construction completion.

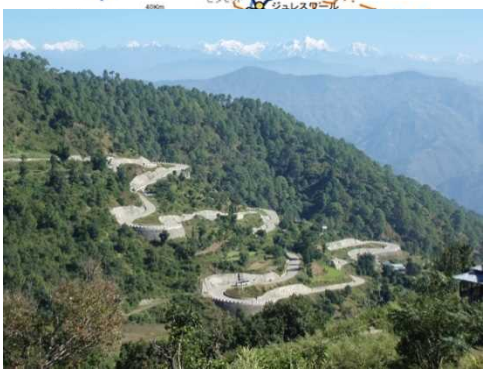
Principle 6: Governance

○**Efficient operation, maintenance and management**: After completion, the maintenance of roads and bridges by the Ministry of Public Works and Transport with the support of Japan was realized.

Sindhuli Road (Nepal)

Project Summary

○Ground transport between Kathmandu to the southern region took a long, roundabout route, and traffic was plagued by landslides in rainy seasons every year.
○Since 1996, Japan has been supporting the construction of Sindhuli Road, a total of 160km in 4 sections, with 1,300m difference in height, as a major road in the west which connects the farm belt near India's border with the outskirts of the Nepal capital.
○The road was completed in March 2015, after more than 20 years of work. In its 2nd section, which crosses over the mountainous zone, countermeasure work was undertaken in two areas where slope collapses occurred.
○Contractor: Hazama Ando Corporation



(Photo) Second construction area (Courtesy of Hazama Ando Corporation)

	First Section	Second Section	Slope collapse works in the second Section	Third Section	Fourth Section
Construction period	1995 to 1997	1999 to 2002	2013 to 2015	2012 to 2015	1996 to 2001
Client	Department of Roads, Ministry of Physical Infrastructure and Transport				
ODA	Grant aid 2.178 billion yen	Grant aid 2.513 billion yen	Grant aid 901 million yen	Grant aid 4.096 billion yen	Grant aid 3.794 billion yen

Key aspects as *quality infrastructure*

Principle 1: Impact

○**Creation of new jobs**: Jobs were created for 1,000 workers regularly, and more than 2,000 at peak times. More than half of such workers were those whose land or houses had been affected by this project.
○**Technology transfer**: 3-day seminars for slope monitoring were held for 32 government engineers in classrooms and on-sites. "Ninja Team" training to allow working with a safety rope on slopes, and other technology transfer for slope stabilization construction and retaining wall construction were conducted.
○**Sustainable development**: Transport distance and time between the metropolitan area and the southern farm belt were dramatically reduced.

(Photo) Training of the "ninja team"

Principle 2: Life Cycle Costs

○**Shortening construction period**: Divided construction sections and installed camps, facilities, such as heavy machines and plants in each section, so that construction work could continue, even if some sections were disrupted by civil unrest. As a result, the construction was completed earlier than the original schedule.

Principle 3: Environmental Considerations

○**Environmentally-friendly construction methods**: Cutting and filling soil was minimalized to blend in with the existing geography and to maintain the area's environment. Residue was collected at a dumping ground and used for a regional utility yard.

Principle 4: Resilience

○**Build Back Better**: The Sindhuli Road remained operational, even after the 2015 Gorkha Earthquake (M7.3). It played a major role as a primary road for transporting rescue and restoration supplies.

Principle 5: Social Considerations

○**Consideration for local communities**: A needs coordination mechanism was established with the local governments to cope with claims by local citizens. Sincere correspondence was made for relocation of citizens.

Principle 6: Governance

○**Appropriate operation, maintenance and management**: Technology guidance continued even after construction was completed, enhancing the maintenance and management capabilities of the national government.

Senayan Square Project (Indonesia)

Project Summary

○ Demand for office, hotel and commercial facilities was increasing in Jakarta, Indonesia's capital city, due to the country's economic growth. The government planned to redevelop the 190,000-square-meter site of the state-owned 1962 Asian Games athletes' village in the Senayan district on the southern border of the city center in the "Golden Triangle".

○ A Japanese company proposed a 40-year BOT lease to design, construct and operate what later became known as "Senayan Square".

○ With a lush green environment, the National Stadium at its center and located adjacent to a high-end residential area, Senayan district was expected to become the center of Jakarta's development.

○ Participating company: Kajima Corporation

1988 Acquisition of business rights for 40 years
1996 Opening of shopping mall
2015 Opening of hotel
<Completion of development phase>
2036 End of BOT period

(Photo) Overview of Senayan Square (Courtesy of Kajima Corporation)

Key aspects as *quality infrastructure*

Principle 1: Impact

○**Job creation**: 2,500 workers were employed at the peak of hotel construction. Today, approximately 16,710 people work at the complex, including 5,150 in the commercial facilities, 9,200 in the office towers, 560 at the hotel and 1,800 (outsourced) operating the facilities.

Principle 2: Life Cycle Costs

○**Efficient maintenance and management**: A long-term renovation plan is in place and the project is operated cost effectively.

Principle 3: Environmental Considerations

○**Environmentally friendly**: Greening of the entire site with rooftop landscaping on low-rise buildings and measures to reduce solar heat.

○**Environment friendly construction practice**: Activities that would cause traffic congestion such as removing excavated soil from the site were done at night.

Principle 4: Resilience

○**Resilience towards risks**: Back-up generators were provided in all buildings and large capacity water storage tanks were installed in case of unstable electricity and water supply.

Principle 5: Social Considerations

○**Consideration towards local communities**: Detailed planning and coordination was undertaken with utility providers to ensure timely opening. Traffic in the immediate locality was studied carefully to avoid congestion within the complex.

○**Inclusiveness**: Ramps and toilets for disabled persons and rooms for persons in wheelchairs were included in the hotel design.

○**Safety and health**: Construction safety was the highest priority and there were no serious accidents.

Principle 6: Governance

○**Private funds**: Funding from a Japanese company was used to design, construct and operate the project.

Case 47 Tokyu Binh Duong Garden City (Vietnam)

Project Summary

○ From 2014, the provincial capital of Binh Duong was relocated to the new city of Binh Duong, and new urban construction for approximately 1,000ha has started.

○The Japanese company mobilized its experience in Japanese real estate and public transit-oriented development to carry out urban development for integrated residential/commercial facilities, offices, and educational facilities there.

○ The project has successfully boosted the area's added value with the high-rise condominium "MIDORI PARK The VIEW", commercial facility "hikari", and low-rise residential housing "MIDORI PARK HARUKA Terrace", after the completion of the high-rise condominium "SORA gardens I".

○ Participating company: Tokyu Corporation

SORA gardens I


KAZE SHUTTLE (local bus)


MIDORI PARK The VIEW

2012 Establishment of the operational company
2014 Establishment of the bus company
2015 Completion of SORA gardens I
Opening of hikari
2019 Completion of MIDORI PARK The VIEW

Tokyu Binh Duong Garden City Conceptual Drawing

(Photo/images) Courtesy of Tokyu

Key aspects as *quality infrastructure*

Principle 1: Impact

○**Creation of new jobs**: Jobs for approximately 600 workers were created in its construction phase. After completion, jobs for approximately 1,000 workers were created for facility management and commercial facility operation.

○**Technology transfer**: Design, construction and quality control were taught by Japanese engineers by OJT.

○**Sustainable development**: Local buses connecting the new city and surrounding areas are being operated. Environmentally-friendly transportation and improved access were achieved.

Principle 2: Life Cycle Costs

○**Maintenance and management**: Paint more expensive and viscous than standard products was used on the external walls, which were prone to cracks and stains due to the high humidity and temperatures, maintaining the infrastructure life cycle and reducing repair costs

Principle 3: Environmental Considerations

○**Environmentally-friendly infrastructures**: Hanging gardens and wall greening were installed to create the "Garden".

○**Environmentally-friendly construction methods**: Construction sites were fenced by temporary walls 3 meters high to ensure safety and dust control.

Principle 4: Resilience

○**Resilience against risks**: Power generators were installed to supply electricity to public and private areas of condominiums to prepare for power outages.

Principle 5: Social Considerations

○**Safety and health**: Thorough checking of workers' clothing and equipment during construction.

Principle 6: Governance

○**Application of private funds**: Funding from the Japanese company was utilized for development, planning, construction and operation

Case 48 Pasig-Marikina River Channel Improvement Project (Philippines)

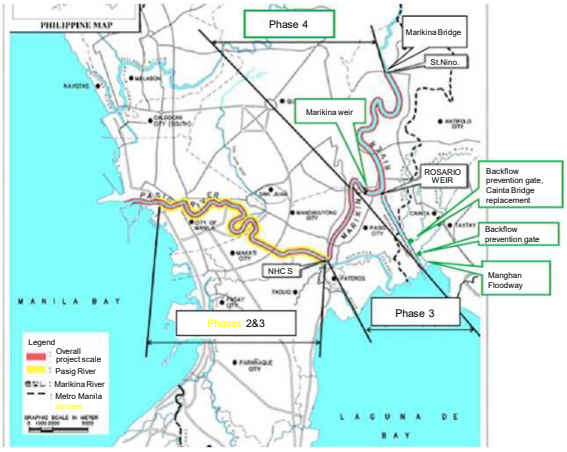
Project Summary

○Metropolitan Manila is the center of the Philippines with an approximate population of 13 million. However, the economic and social activities of the area have been affected severely by flooding because of its low elevation and location along a coast prone to typhoon damage.

○Japanese ODA has been supporting the flood management projects for Pasig-Marikina River since the 1970s. Support to further reinforce these measures has been implemented in recent years and Japanese contractors have carried out the construction.

○Tropical Storm Ondoy in 2009 brought rainfall that statistically occurs once every 180 years, and the whole of metropolitan Manila suffered from widespread flooding and inland inundation. However, although the low, coastal areas along Manila Bay suffered flooding including inland inundation, the percentage of victims made up only 2% of the total, and the death toll did not go over 16. The improvements up to this point prevented river flooding to divert the flood water from Marikina River into the Manggahan Floodway. Along with the pump expelling inland water to Pasig River and the construction of dikes along Pasig River, it contributed to mitigating the damage by the storm.

○Participating company: Toyo Construction,
Shimizu Corporation



Client	Republic of the Philippines Department of Public Works and Highways				
ODA	Pasig River Water Project	Pasig-Marikina River Channel Improvement Project			
		Phase 1	Phase 2	Phase 3	Phase 4
	1975	1999	2007	2012	2019
	Loan assistance (in parts untied) 5.112 billion yen	Loan assistance (tied between two countries) 1.167 billion yen	Loan assistance (STEP) 8.529 billion yen	Loan assistance (STEP) 11.836 billion yen	Loan assistance (STEP) 37.905 billion yen

(Photo) Manila City's Pasig River (Courtesy of Toyo Construction)

Key aspects as *quality infrastructure*

Principle 1: Impact **Principle 4: Resilience**

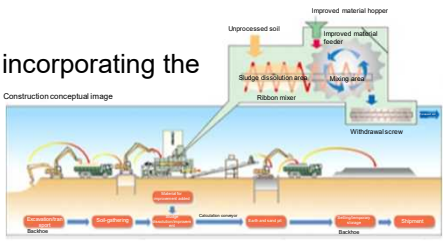
○**Sustainable development, resilience against risks**: The social and economic activities throughout metropolitan Manila was promoted by mitigating the damage caused by flooding in the central areas.

Principle 2: Life Cycle Costs

○**Shortening construction times:** Construction period was shortened by incorporating the "vibro method with water jet cutters".

Principle 3: Environmental Considerations

○**Environmentally-friendly construction methods**: Reducing the volume of industrial waste and enabling transport to the city as harmless soil with no adverse effects on neighboring citizens.



(Image) Image of the Tough-con System
(Courtesy of Toyo Construction)

Principle 5: Social Considerations

○**Considerations towards local communities**: Construction was executed in an environment which had crowded residential areas up to the riverbanks. Riverbank development was implemented not from the land side but from the river side, reducing the number of citizens who needed to relocate due to construction.

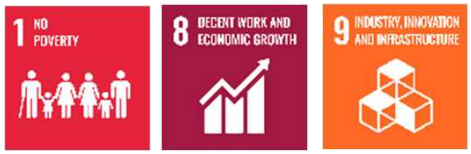
Principle 6: Governance

○**Sustainable finances**: Application of STEP, which offers lower interest rates than other yen loans.

<Relationship with Sustainable Development Goals (SDGs)>

Achieving the “G20 Principles for Quality Infrastructure Investment” contributes to the following:

Principle 1: Maximizing the Positive Impact of Infrastructure to Achieve Sustainable Growth and Development



Principle 2: Raising Economic Efficiency in View of Life-Cycle Cost

Principle 3: Environmental Considerations

Principle 4: Building Resilience against Natural Disasters and Other Risks

Principle 5: Social Considerations

Principle 6: Infrastructure Governance

URL for reference

International Policy Division・Overseas Project Division, Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism

https://www.mlit.go.jp/kokusai/kokusai_tk3_000202.html

The Overseas Construction Association of Japan, Inc.

https://www.ocaji.or.jp/en/