

# Steel Bridge

## Japanese Sophisticated Technology

6<sup>th</sup> March 2025



Yokogawa Bridge Corp.

Overseas Business Dept.



Japan Bridge Association

Overseas Business Development Committee

**Susumu INOKUCHI**

# Agenda

---

1. Introduction of **Japan Bridge Association** (JBA)
2. Monumental **Experience** by Japanese Technology
  - Domestic Project
  - Overseas Project
3. **Fabrication** process of Steel Bridge
4. **Erection** process of Steel Bridge
5. **Features** of Steel Bridge
6. Remarkable **Technology** of Steel Bridge
7. Example of **Cost Comparison** between Steel Bridge and Concrete Bridge

# 1. Introduction of Japan Bridge Association

# 1. Introduction of Japan Bridge Association



## 1. Profile of Japan Bridge Association (JBA)

- **Inaugurated:** 1964
- **Objective:** “Contributing to the promotion of public welfare by helping to guide the development of national land through the sound growth of the steel bridge construction industry.”
- **Firms:** Engaged in the fabrication, construction and maintenance of steel bridges.

These steel bridge manufacturers have their own independent resources for the design, fabrication / construction, and maintenance of bridges, together with expert staff and engineers.

## 2. Line of Business

- **Survey, research** and **testing** of technologies,
- **Collecting, editing** and **publishing** the information related to bridge construction
- **Education** and **Public relations** of technologies used in bridge construction.
- **Proposals, suggestions** and **representations of opinions** to Governmental agencies, public organizations, academics instructions, etc.

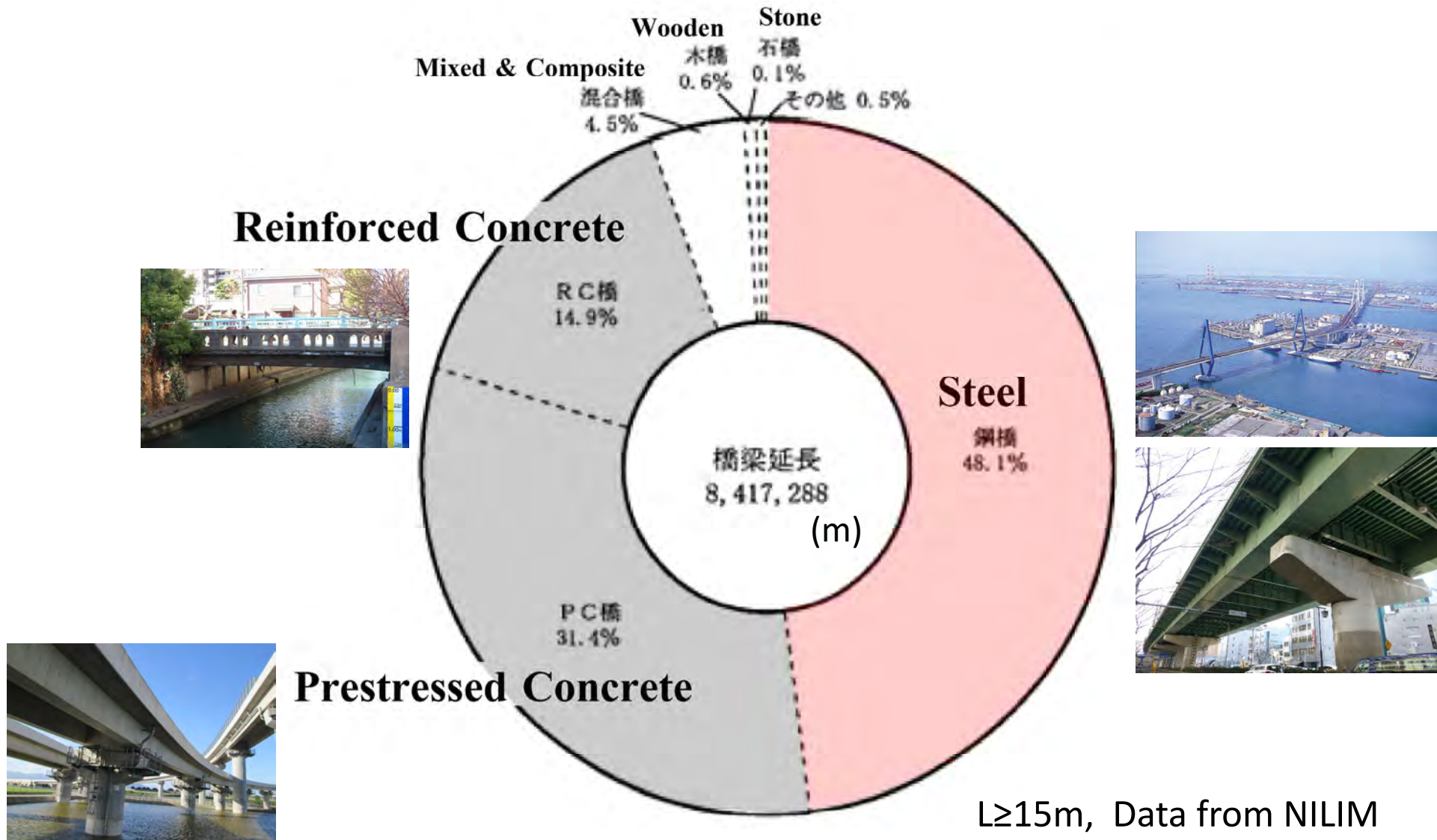
## 3. Member Companies

**Thirty-one** (31) companies



# 1. Introduction of Japan Bridge Association

## Materials of Bridge Superstructure



## 2. Monumental Experience by Japanese Technology

### **Domestic Project in Japan**



## Suspension Bridge



### **Akashi Kaikyo Ohashi**

**Open:** 1997 / **Bridge Type:** 3-span Suspension Bridge

**Length:** 3,911m (Main Span: 1,990m)

**Remarks:** When opened, the longest suspension bridge in the world.



# Cable Stayed Bridge



## Kesen-numa "Kanae" Ohashi

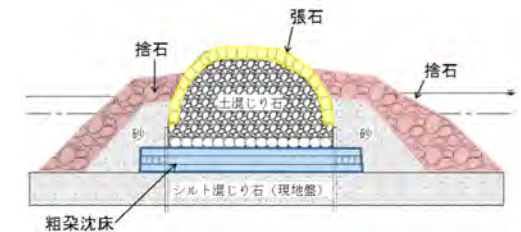
**Open:** 2021 / **Bridge Type:** 3-span Cable Stayed Bridge + 10-span Box Girder Bridge

**Length:** 1,344m (Main Span: 170m)

**Remarks:** The largest cable-stayed bridge in East Japan, built for reconstruction from a large earthquake



# Arch Bridge



Embankment



## Ariake Chikugawa Ohashi

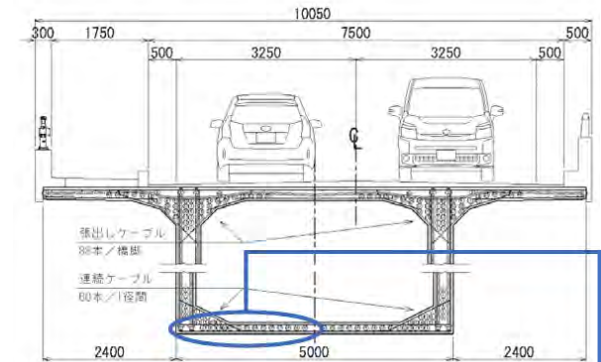
**Open:** 2020 / **Bridge Type:** 4-span Single Chord Lohse Bridge

**Length:** 450m (Main Span: 170m)

**Remarks:** An arch bridge in which single rib splits into two on the pier. The first bridge type in Japan.



# Truss Bridge



Source: Report of MLIT Takada Branch in 2025

## Myoko Ohashi

**Open:** 2021 / **Bridge Type:** 2-span Continuous Truss Bridge

**Length:** 203m

**Remarks:** Prestressed concrete bridge damaged by salt damage was replaced with a steel bridge.

# Box Girder Bridge



## Tamagawa Sky Bridge

**Open:** 2022 / **Bridge Type:** 3-span Continuous Box Girder Bridge

**Length:** 602m (Main Span: 240m)

**Remarks:** Composite rigid-frame structure consisting of RC piers and steel girders. The maximum span length of 240 m is one of the largest composite rahmen bridges in Japan

## 2. Monumental Experience by Japanese Technology

### **Overseas Project**



# TURKEY OSMAN GAZI BRIDGE (Suspension Bridge)

## Basic Information

Employer · Completion year	<b>NOMAYG JV · 2016</b>
Funds	Private Funds (PPP scheme)
Bridge Length · Steel Weight	1,550m (Middle Span), 566m (Side Span) · 18,000t (Main Tower), 36,000t (Main Girder), 18,750t (Cable)
Design Feature	The bridge construction across the sea has shortened the distance of the access route by 140 km compared to the existing route that bypassed the bay to cross the opposite shore. And the transit time to the opposite shore was shortened by 3 hours too. Although <b>the construction environment for the substructure was difficult in this project, the bridge was efficiently constructed by securing a long span</b> . From the viewpoint of seismic design, a steel main tower was adopted.





# Taiwan Kao-Ping His Bridge (Cable-stayed Bridge)

## Basic data

Client/ Completion year	Taiwan District National Highway New Construction Engineering Bureau, Ministry of Transportation, Taiwan (TANEEB), Completed in 2000
Funding	Local funding
Bridge length/ Steel weight	510m (180m (PC box girder) + <b>330m (Steel box girder)</b> ) Steel/concrete composite cable-stayed bridge • 6,200t
Features	Both banks of Kaoping River (bridge area), have a height difference of 60m. In order to adapt to changes in topography and scenery while also considering the economic efficiency and workability, an asymmetrical compound cable-stayed bridge that allows spanning over <b>a long distance</b> was adopted. For the erection, in order to avoid damage due to flooding during the typhoon season as a result of swollen river with driftwood, a hanging construction method that does <b>not require bents or temporary piers in a river</b> was adopted.



Transportation by hanging carrier



Change to a lifting traveler



## South Sudan Nile River Bridge (Arch Bridge)

### Basic Data

Client · Year of Completion	Ministry of Roads and Bridges of South Sudan · 2021
Fund	Japanese Government ODA (grant aid)
Span · Weight	5span continuous non composite steel plate girder 29.4m + 3@30m + 29.4m Non composite simple steel Langer bridge 85.6m x 4 bridges 2span continuous non composite steel plate girder 2@29.4m Gross weight:2,489 t
Features, etc.	This was a construction project to build a new 560-meter bridge over the White Nile River, which runs north-southeast of Juba, the capital of the Republic of South Sudan in Africa, as a distribution hub for the Republic of Uganda. An arch bridge was adopted to <b>lower the road surface height by keeping the girder height low</b> , and to secure an 87.5 m span length to allow the river water to flow safely down the bridge. The arch shape is also suitable for the landscape and serves as a landmark. It took 8 years to complete the construction, which was interrupted a total of three times by the civil war and coronavirus.



Source: Granted by Tekken Corp.

### 3. Fabrication Process of Steel Bridge



# Fabrication Process of Steel Bridge

## Bridge Fabrication Factory

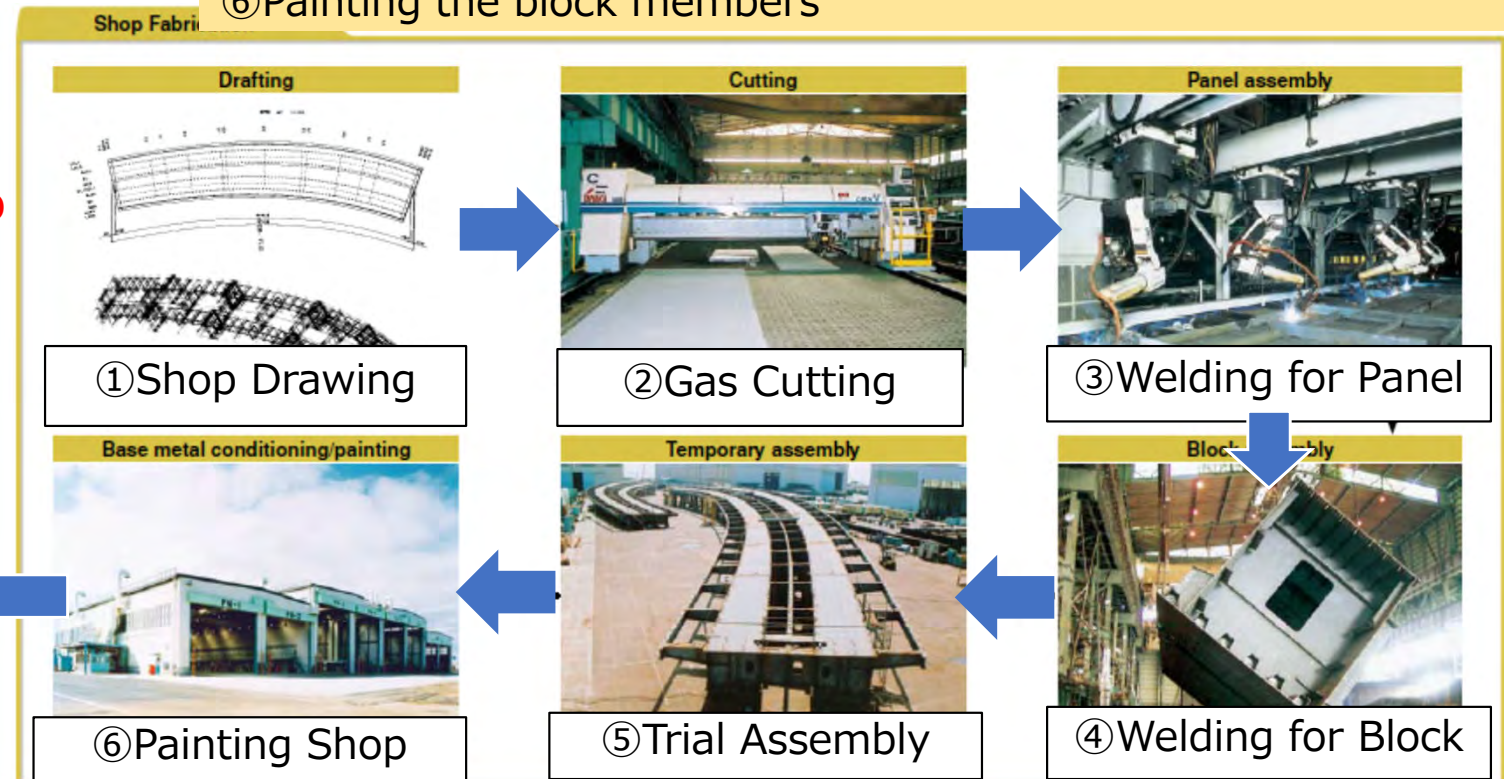


- ① Preparing shop drawings for fabrication in a factory
- ② Cutting steel plates supplied from steel mills by gas (or laser, plasma) cutting machines.
- ③ Steel plates being cut are assembled by mainly automatic welding system to produce panel or small members.
- ④ Panel and small members are assembled into the block members.
- ⑤ Trial assembly of final whole bridge shape to check the accuracy.
- ⑥ Painting the block members

Block transporting to the site



⑦ Transportation



# Fabrication Process of Steel Bridge

Fabrication at the workshop realized

## **1) Made to order**

Covering the order of an individually design and manufacture

## **2) High Quality**

High level quality management by the strict inspections with several method at the stage

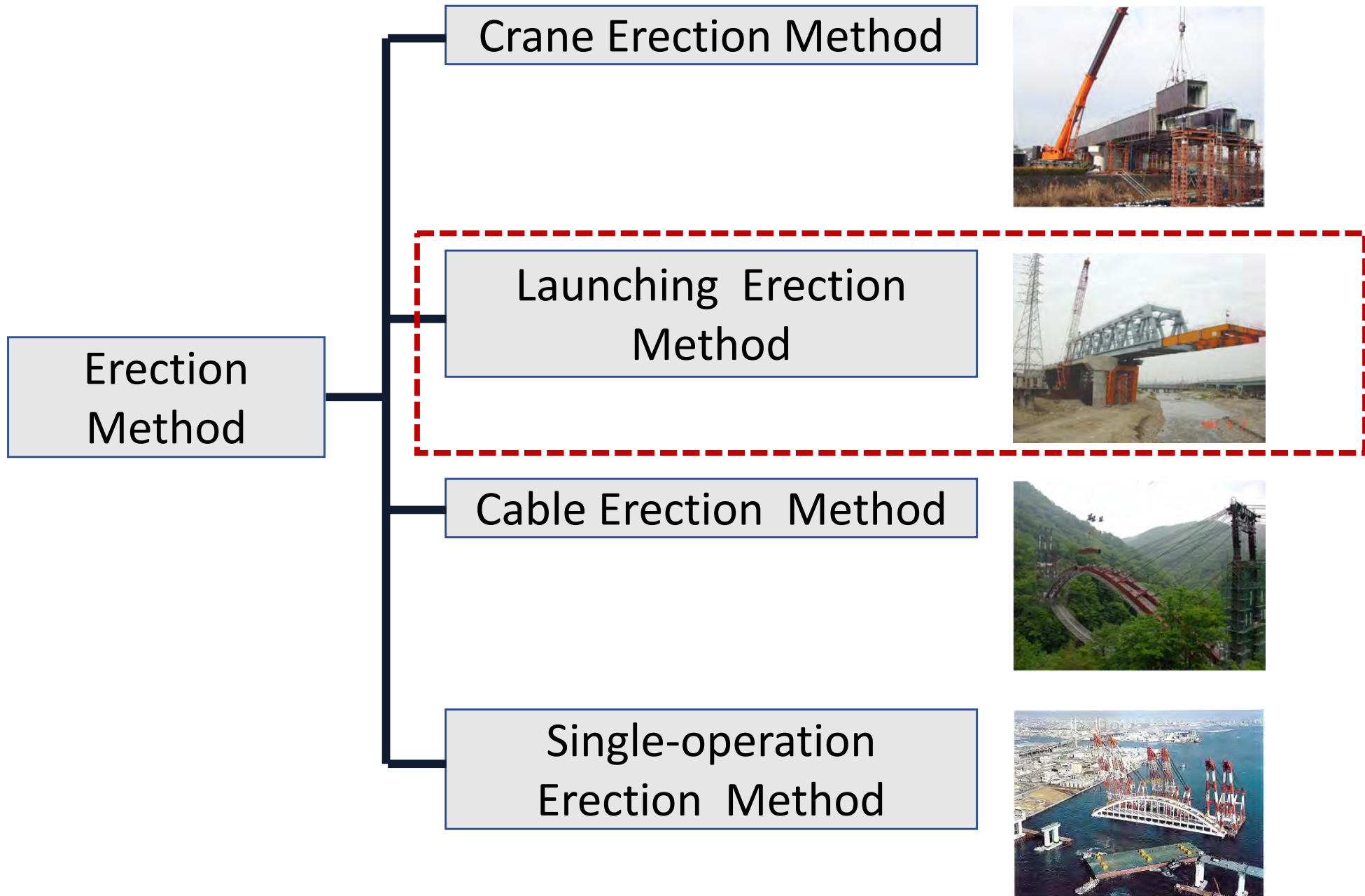
## **3) Process management and on-time delivery**

High level process management independent with weather condition etc.

## 4. Erection Process of Steel Bridge



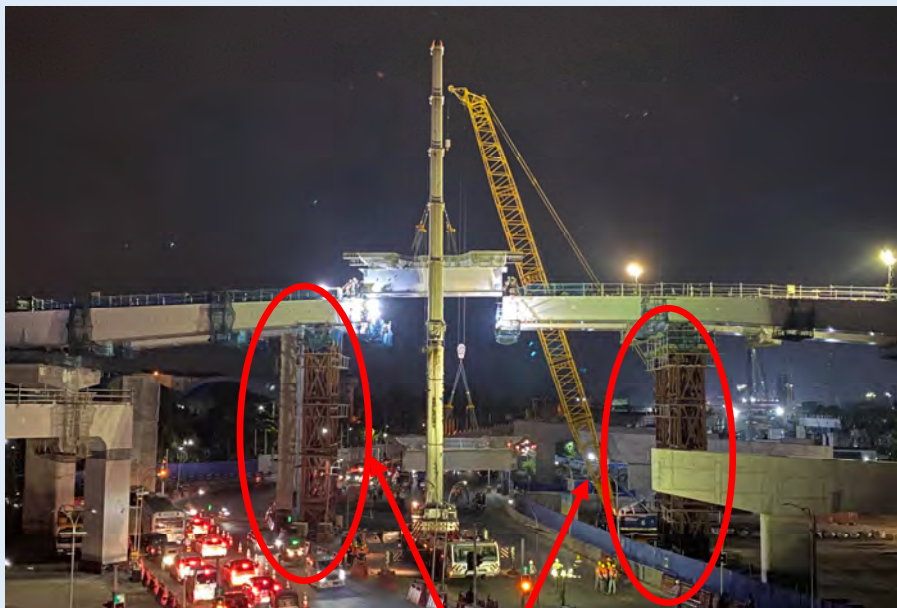
# 4. Erection (Installation) of Steel Bridge



Features of this construction method:

- Generally, temporary supports are erected between the main piers and the segmented blocks are sequentially erected.
- The launching method is effective at sites where it **is difficult to install the temporary support** or where the installation of the temporary support would **significantly interfere with existing traffic**.
- This method uses temporary girders (Launching girder) instead of erecting temporary supports to reach the next pier.

### Typical Erection Construction Method



with temporary support

### Erection by Launching Method



without temporary support



Launching girder

## Taiwan Shinkansen C250 Construction Zone (Truss Bridge)

Basic Data	
Client • Year of Completion	Taiwan High Speed Rail Corp. (THSRC) • 2004
Fund	Local funds
Span • Weight	410m (150m+120m+140m) 3 span continuous through-truss bridge, 3 bridges, 26,803t
Features	Under the complicated construction conditions where <b>rivers, national highways, and expressways intersect</b> , a truss bridge was adopted because high strength was required while keeping the height of the structure low as a railroad bridge. It was erected using the <b>launching method</b> and the slide method.



# An erection method that minimizes impact on existing traffic



launching method  
over a highway



no temporary supports on  
the existing highway

## Only one night erection on an in-service highway



on the highway

simultaneous erection of  
multiple blocks over an  
existing highway



complete construction by  
only one night traffic  
control



5. Features of Steel Bridge



## 5. Features of Steel Bridge

### 1) **Long Span**

Lightweight, applicable for long span

### 2) **Rapid Construction**

Factory product, short on-site installation period

### 3) **High Flexibility of Design**

High flexibility of design for complex road alignments

### 4) **High Resistance for Earthquake**

Lightweight, less load strain on the substructure

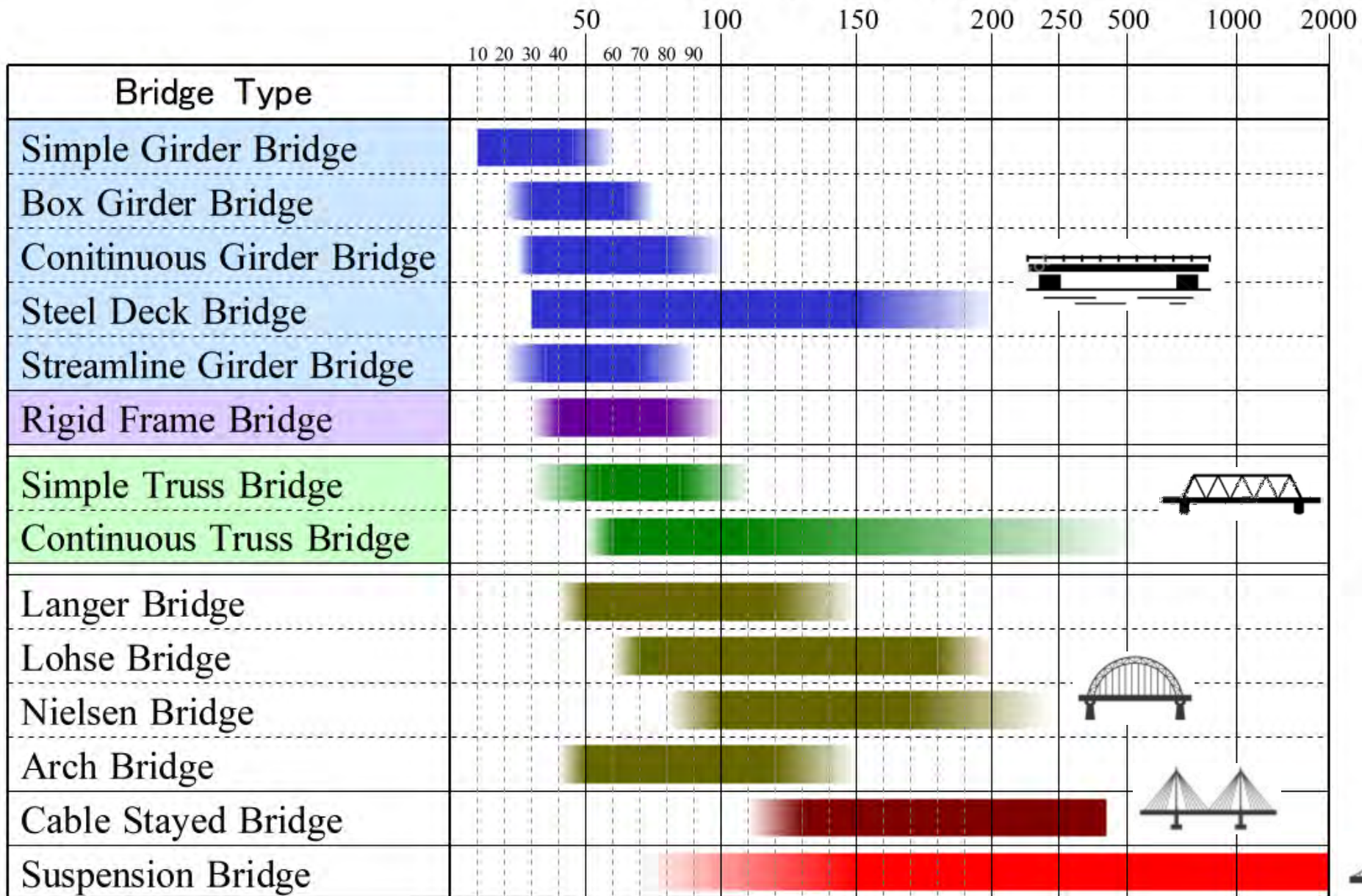
### 5) **Long Life & Service**

Maintenance of anti-corrosion technology & advantage of the characteristics of steel



# 1) Long Span

Bridge Span Length (m)



# 1) Long Span

Span (m)		20	50	100	150	200	300	500	1000	2000
Steel	Composite slab	—	—							
	I girder	—	—							
	Box girder		—	—	—	—	—	—		
	Rahmen		—	—	—	—	—			
	Truss		—	—	—	—	—	—		
	Arch		—	—	—	—	—			
	Cable-Stayed				—	—	—	—	—	
	Suspension				—	—	—	—	—	—
concrete	Slub	—	—							
	I girder	—	—							
	T girder		—	—						
	Box girder		—	—	—	—				
	Rahmen		—	—	—	—	—			
	Truss		—	—	—					
	Arch		—	—	—	—	—			
	Extradosed			—	—	—	—			
	Cable-Stayed			—	—	—	—	—		

## 2) Rapid Construction

Steel bridges have a shorter construction period because the production of bridge girders (fabrication in factory) can proceed alongside the construction of foundations and piers at site.

### Steel Bridge

In case of Steel Bridges	1st Year				2nd Year			
Work	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
Design	↔							
Foundation · Pier	←→							
Girder Factory Production	←→							
On-site erection of bridge				←→				
Pavement construction · Installation								↔

### Concrete Bridge

In case of Concrete Bridges	1st Year				2nd Year				3rd Year			
Work	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
Design	↔											
Foundation · Pier	←→											
Girder Factory Production												
On-site erection of bridge				←→								
Pavement construction · Installation									↔			



## 2) Rapid Construction



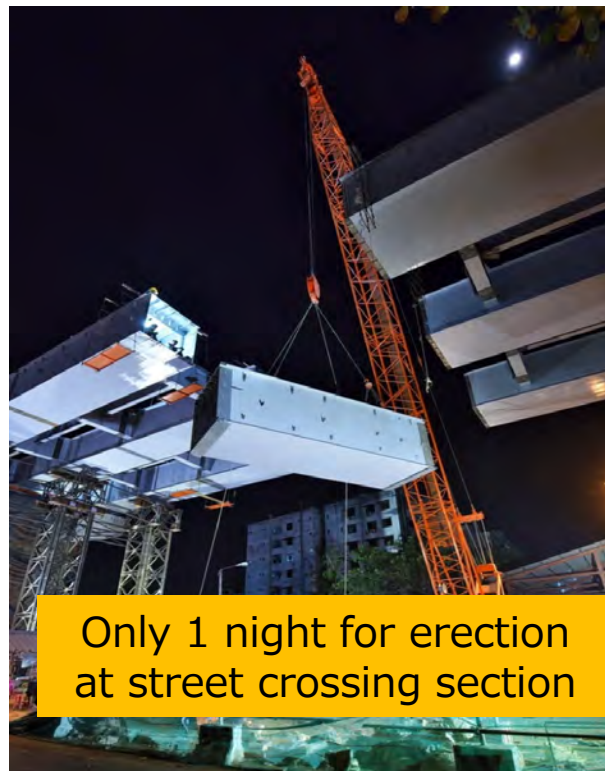
### Myaynigone Flyover in Myanmar

Only 8 months construction period from design to commencement of operation for 714m long Flyover

Strong Point of Steel Bridge:

○ Shorter construction period can be achieved because **bridge girder can be produced in the factory in the parallel** with the construction of piers and abutments etc. in the site .

○ Minimization of the adverse effect to the present traffic flow can be achieved because temporary support for erection work is unnecessary.



### 3) High Flexibility of Design

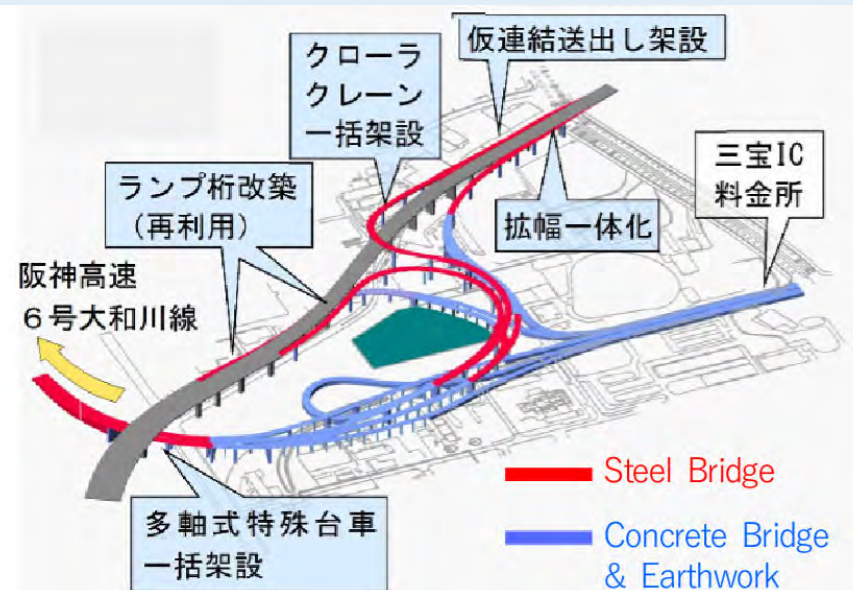
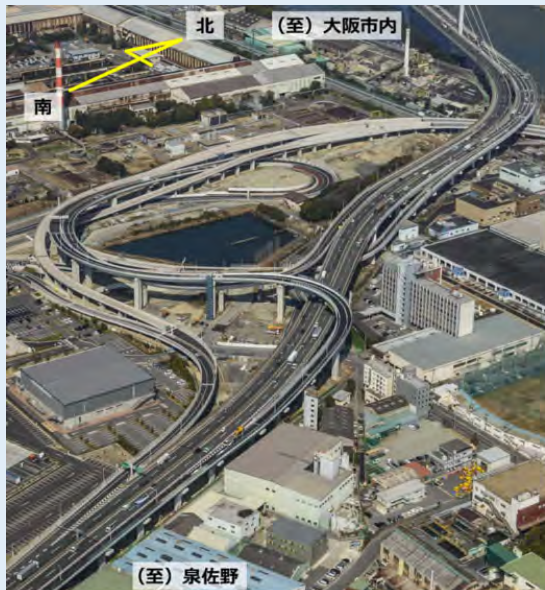
#### Land Acquisition and Alignment Design for Bridge Piers in Urban Viaducts

**Concrete designed urban elevated columns and beams have large cross-sections and occupy sidewalks**

**Urban viaduct designed with steel Both columns and beams have a small cross section, and the foundation position of the pier can be freely selected.**



# 3) High Flexibility of Design

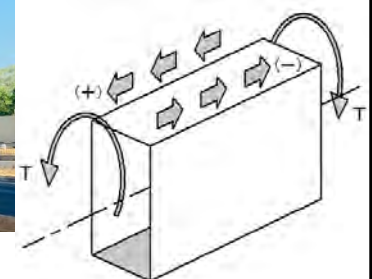




# Sri Lanka Kelani Bridge Package 1 (Box Girder Bridge)

## Basic data

Client/ Completion year	Sri Lanka Road Development Authority, Completed in 2021
Funding	Japanese Government - ODA (STEP)
Bridge length/ Steel weight	Bridge length: about 3.5km in total, Steel superstructure (box girder bridge): 14,000t, Steel pier: 4,000t, Composite slab: 40,000m <sup>2</sup>
Features	<b>In order to minimize land acquisition</b> and minimize the impact of construction on existing road traffic, a steel bridge, steel piers, and composite floor slabs, which can be <b>constructed quickly</b> , were adopted. Box girder bridges are suitable for curved roads and ramps due to their high torsional rigidity.



# 4) High Resistance for Earthquake

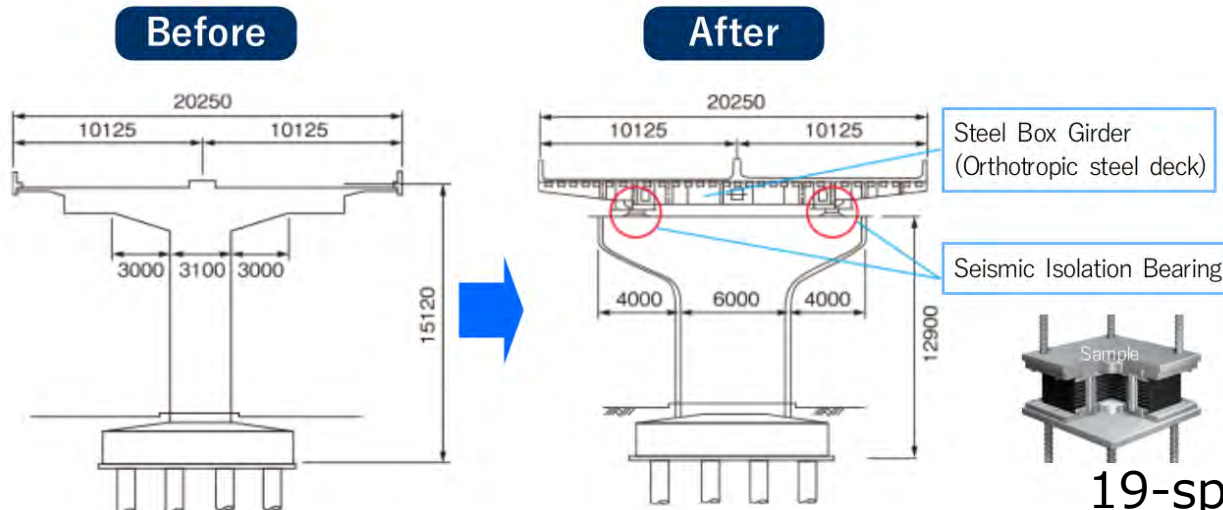
Rapid recovery from large-scale earthquakes and improved earthquake resistance

## The Great Hanshin-Awaji Earthquake (January 1995)

Collapsed viaduct → Pilz (mushroom) Structures



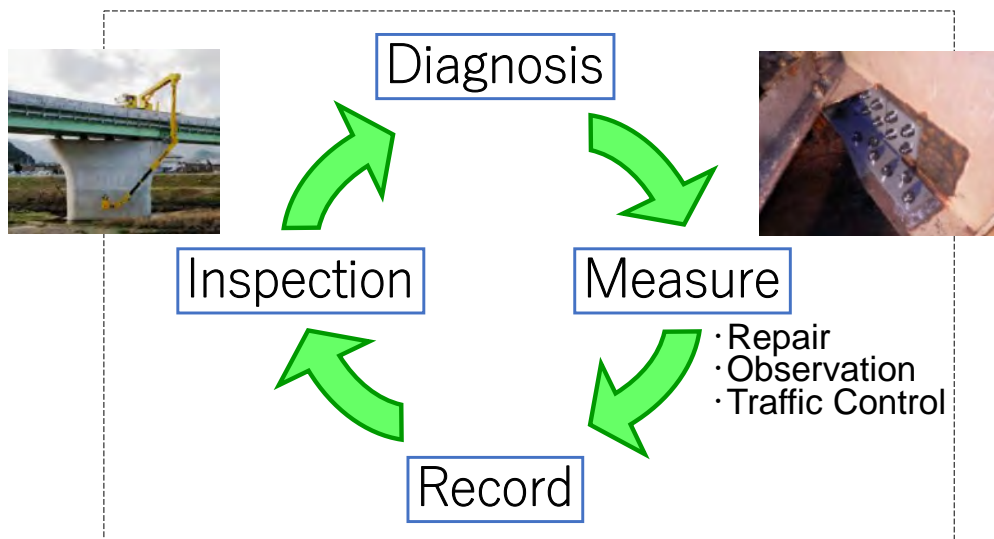
Source: Digital Archive of Japan Society Civil Engineers



19-span Continuous Rahmen Viaduct

## 5) Long Life & Service

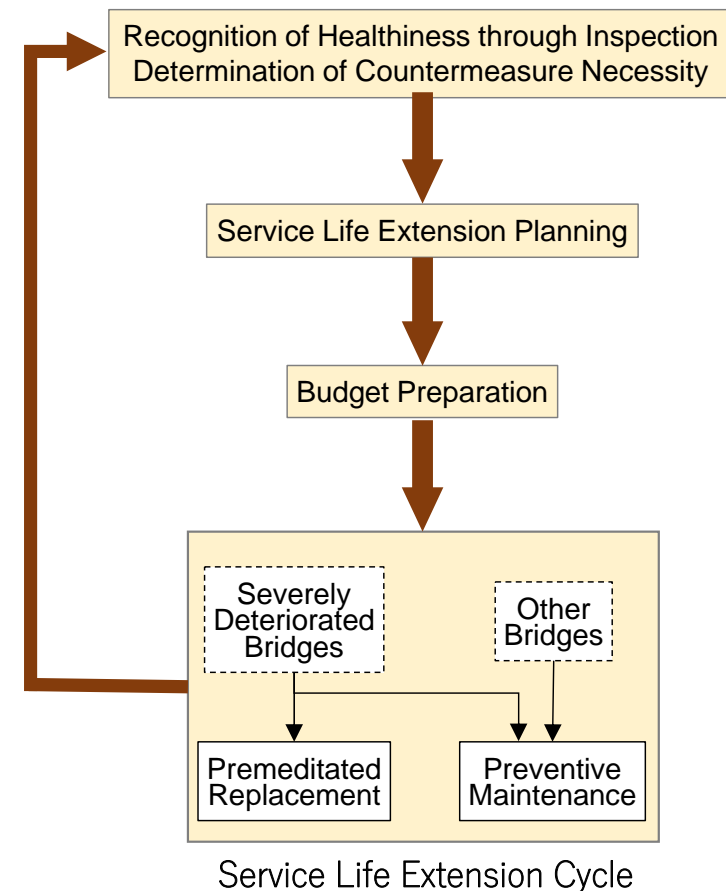
- Since the bridges built in Japan **meet specification requirements in design and erection and initial quality is ensured**, extension of service life will be possible through appropriate maintenance.
- To keep the bridge in service, extension of service life is possible through appropriate inspection, preventative repair and reinforcement.



Reflection  $\rightleftarrows$  Substantiality

**Life Extension Plan**

Maintenance Cycle and Life Extension Plan

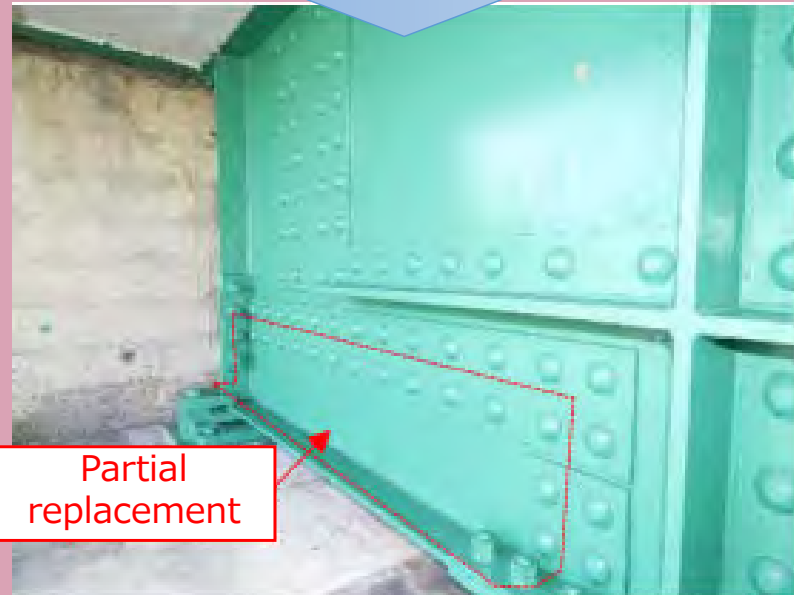


# Strong Point of the Steel Bridge for Maintenance Aspect Partial repair can be applied.



Concrete Bridge: Maintenance is very difficult

Steel bridge: maintenance and rehabilitation can be achieved.



Partial replacement



# SAIKAWA BRIDGE, JAPAN (101 years old)



National Highway  
Route 157  
Kanazawa city  
Ishikawa Pref.

1924 Open to traffic  
1966 Repainting  
1969 Loading test  
1975 Repainting  
1978 Main girder repair  
1984 Loading test,  
Main girder repair, etc.

1993 Repainting,  
Main girder repair, etc.  
2009 Main girder repair, etc.  
2013 Concrete deck repair

101 years old



# KACHIDOKI BRIDGE, JAPAN (85 years old)

## Basic Data

Bridge Name	<b>Kachidoki Bridge (over Sumida River, Tokyo)</b>
Year of Construction	1933 construction start, 1940 completion
Bridge Type Bridge Length	Movable part – Chicago Type Double Leaf Bascule Bridge Fixed Part – Solid Rib Steel Tied Arch Bridge Length 246m
Features	One of the few movable bridges (bascule bridge) in Japan. Both side spans are arch bridges and the center span could open upwards. The maximum angle of opening was 70° and fully opened in approx. 70 seconds. In 1980, the movable parts were locked and cannot be opened even now.

Present



The last opening ceremony in 1970



# Modification Correspond to Epoch Demand's Variation (Kachidoki Bridge)

**in 1940  
at completion**



**At present  
Stop opening function  
Sidewalk widening  
Replace bridge deck**





# KIYOSU BRIDGE, JAPAN (97 years old)

## Basic Date

Bridge Name	<b>Kiyosu Bridge (over Sumida River, Tokyo)</b>
Year of Construction	1925 construction start, 1928 completion
Bridge Type Bridge Length	Self-Anchored Steel Suspension Bridge Bridge Length 186.3m
Features	It is an elegant design which was called "Flower of Earthquake Recovery" as a recovery project from Kanto Great Earthquake. The steel reinforced concrete foundation is covered with 50cm thick granite to prevent chloride attack. <b>Ducol steel</b> (low-manganese steel), which had been produced for the Japanese Navy, was used for bridge for the first time in the world to <b>increase strength</b> .



## 6. Remarkable Technology of Steel Bridge

## II. The type and technology of steel bridges according to various needs

Population : 127,000,000 persons

Geographical features :

4 main + 6,850 islands

About 70% is mountain area

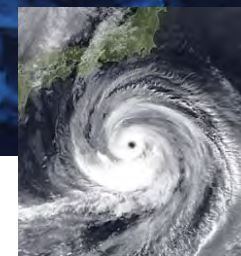
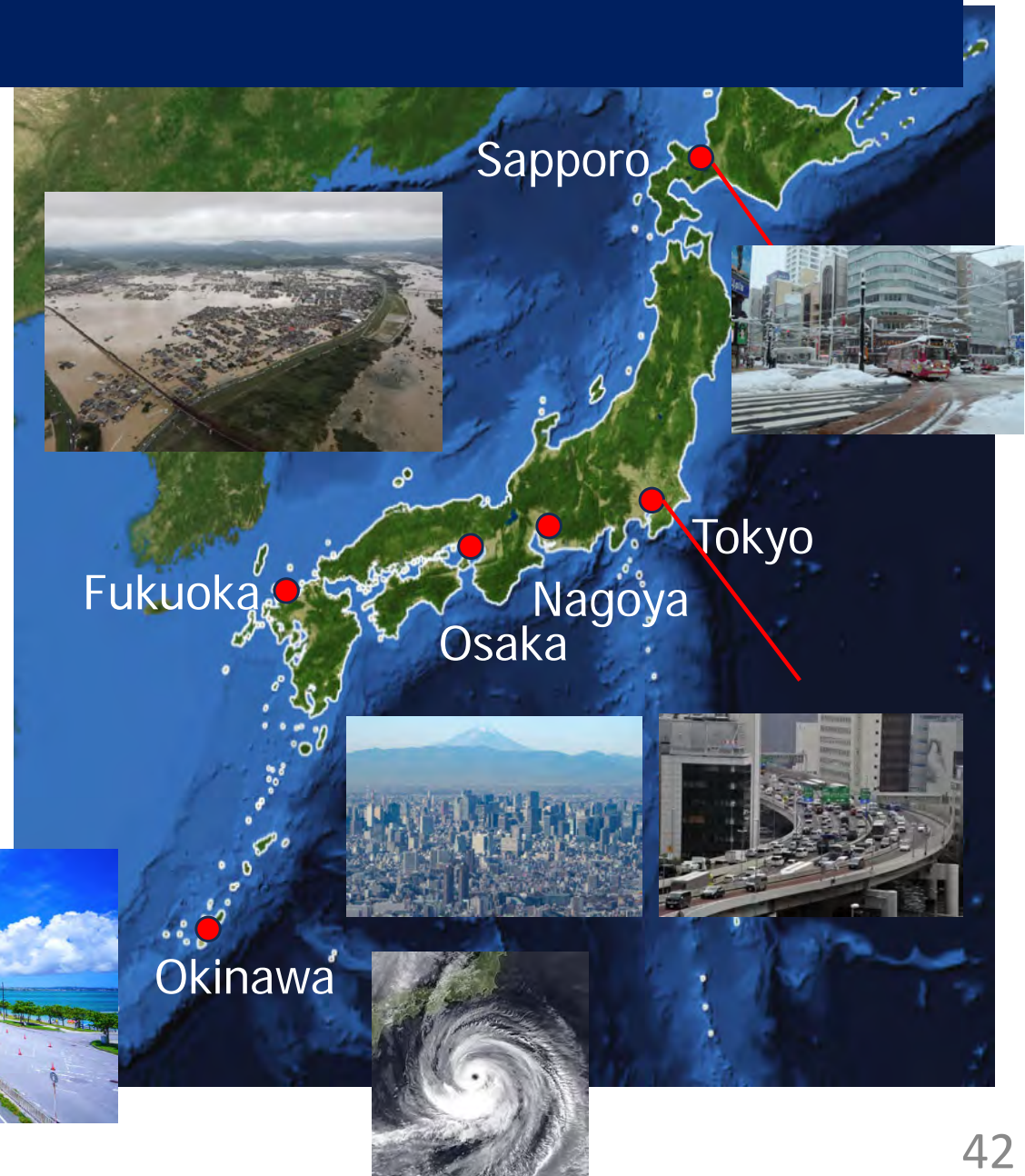
Climatic features :

Four seasons

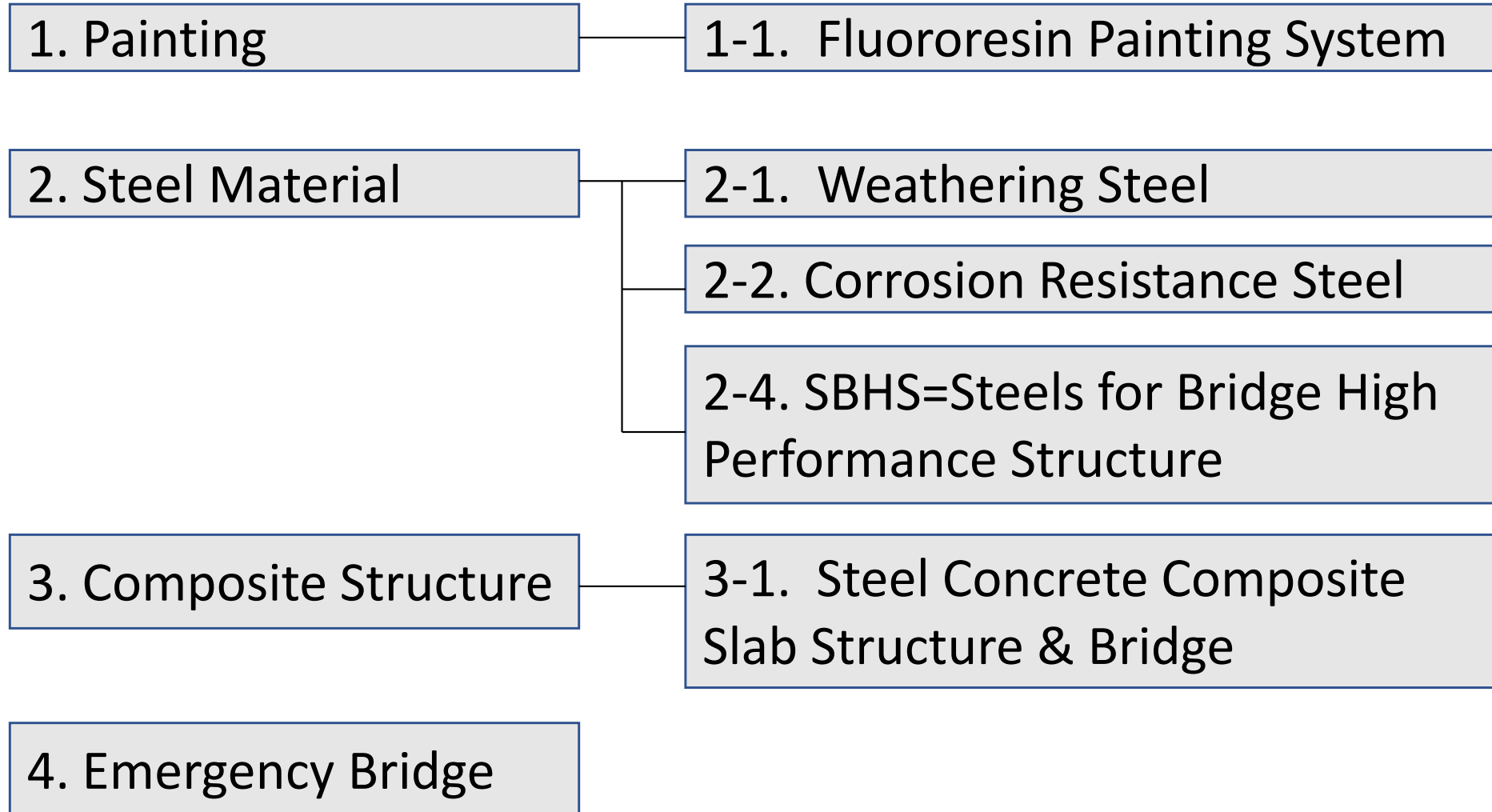
North area : Heavy snow

Typhoon, Long & heavy rain

Summer : High temperature & humidity

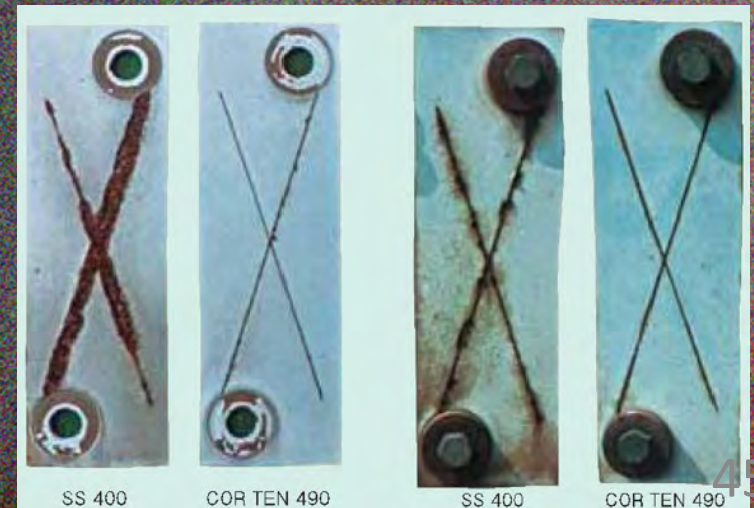


## The type and technology of steel bridges according to various needs



# 1. Painting

# 1-1 Fluororesin Painting System



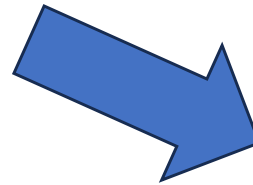
# 1-1 Fluororesin Painting System



Paint peeling



Paint chalking



Re-painting work

# 1-1 Fluororesin Painting System

## First Mukaiyama Bridge; Comparison of Paint System



Oil Alkyd Resin Paint:  
After 16 years, Paint peeling is intense



Fluororesin Paint:  
After 28 years, the Gloss Retention is 95.2%  
There is not observed any chalking.

# 1-1 Fluororesin Painting System

## Fluororesin coating in Real Bridge Monitoring

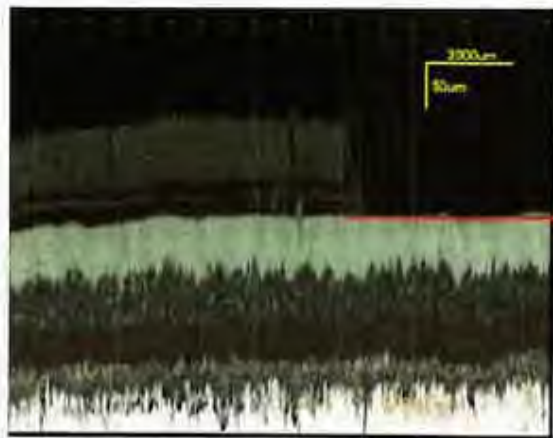


Fluorine paint at Web after 20 years



Fluorine paint at Web after 27 years

As a result of the 15 years exposure test, the amount of coating wear was  $0.0 \sim 0.1 \mu\text{m}$  for the fluororesin coating, and  $22 \sim 28 \mu\text{m}$  for the polyurethane resin coating. As a result of the inspection, chalking occurred after 2 years for the polyurethane resin coating.



Paint film thinning

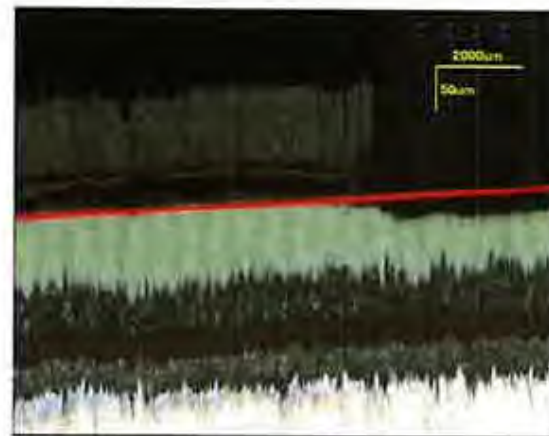
$0 \sim 1.1 \mu\text{m}$

/15 year

15 years exposure

Painting Spec :  
Fluorine paint

(1/20 scale horizontal axis)



Paint film thinning

$22 \sim 28 \mu\text{m}$

/15 year

Painting Spec :  
Urethane paint

About 20~30 times thinning = Deterioration

## 2. Steel Material

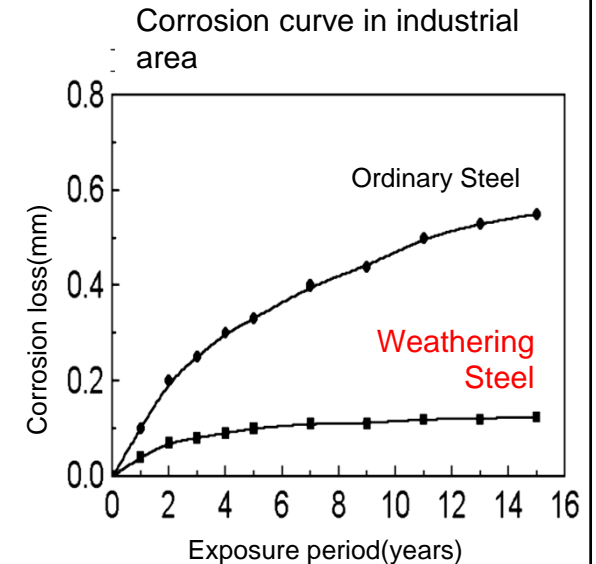
# 2-1 Weathering Steel



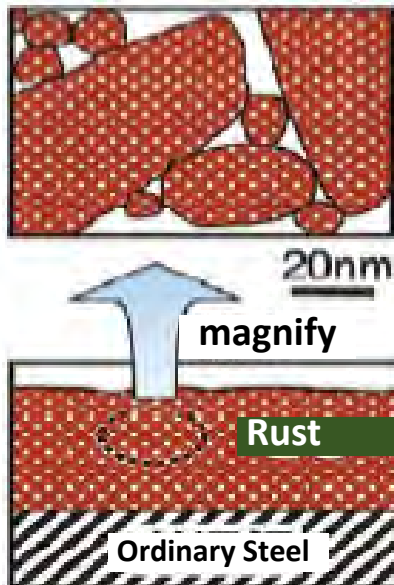
# 2-1 Weathering Steel

## What is the Weathering Steel ?

- ✓ Steel material that intentionally generates a **protective layer of rust** on the surface and uses it as a substitute for paint. Rust does **not penetrate further** behind that layer.
- ✓ Contributes to **reduce LCC** because no painting is required.

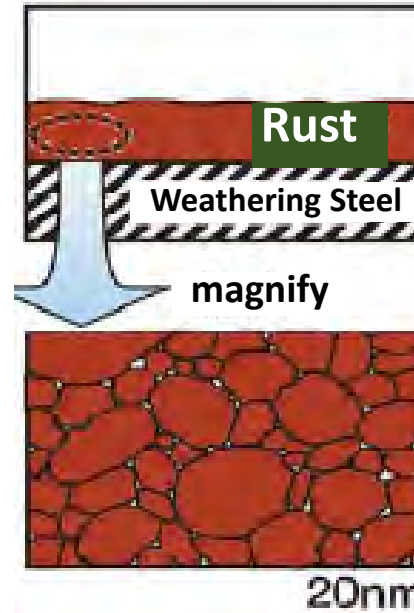


Ordinary Steel



- Coarse rust with large void and progressive to spread around (Rust grows speedy)  
⇒ **Non protective rust**

Weathering Steel



- Dense rust (Rust grows slowly)  
⇒ **Protective rust**

# 2-1 Weathering Steel

## Stable Appearance Change of steel surfaces

Exposure to the atmosphere and rain over the years gives the surface a **beautiful brown color**.



## Rust Stabilizer Paint



### Okinohata-gawa Bridge

Client	Fukuoka Prefecture
Complete	2016 year
Type	Box Girder Bridge
Weight	4,400 t
Anti-corrosion	<b>Surface rust stabilization treatment</b>

By applying **rust stabilizer paint** on the weathering steel, even color of the rust of steel surface can be maintained from the time of construction completion.

# 2-1 Weathering Steel

## Experience of Weathering Steel Bridges



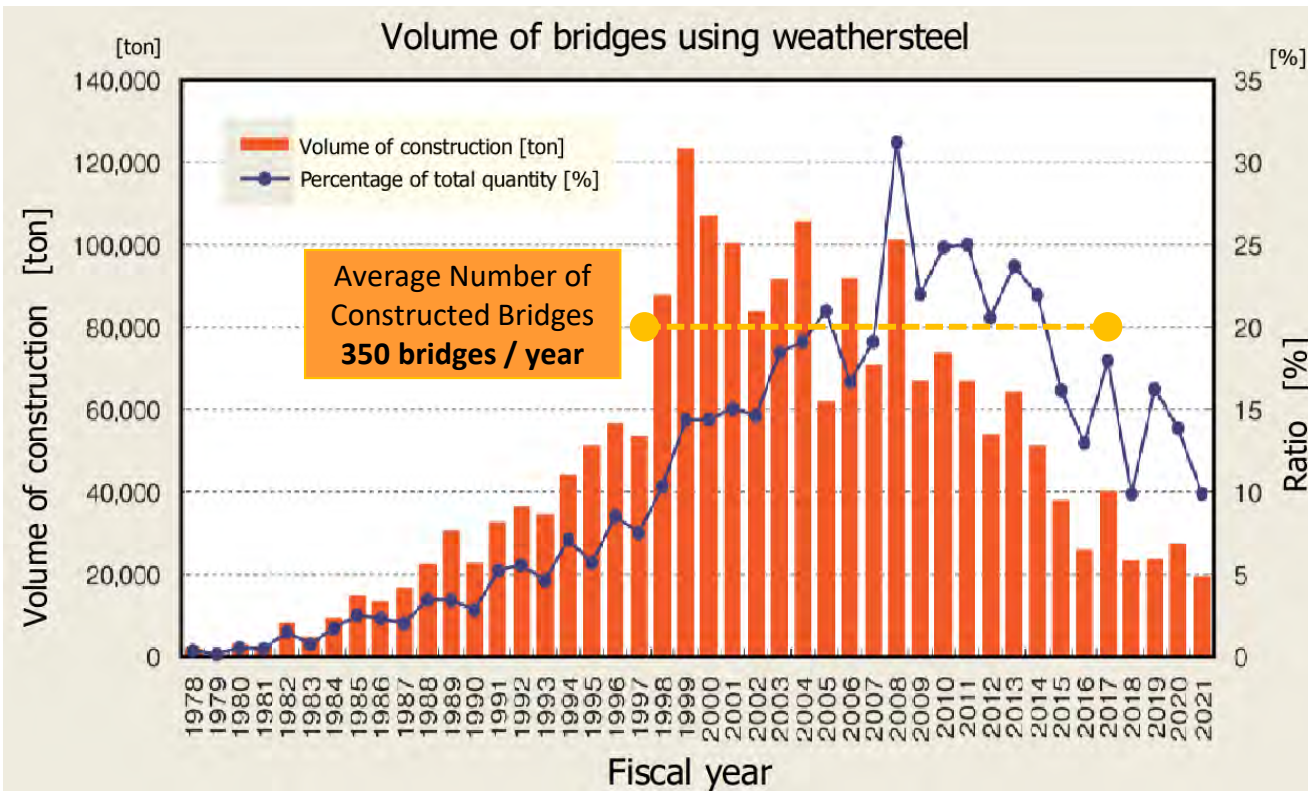
Mitsugi-gawa Viaduct (2007)



Hommyou-gawa Bridge (2008)



Gumain Bridge (2008)



**Ratio of Weathering Steel Bridge in Japan.**  
It is used considering LCC(Life Cycle Cost), recently, it has been increasing.

Quoted from "Eco-friendly weathering steel bridge" issued by Japan Bridge Association

# 2-1 Weathering Steel

## Design of Weathering Steel Bridges

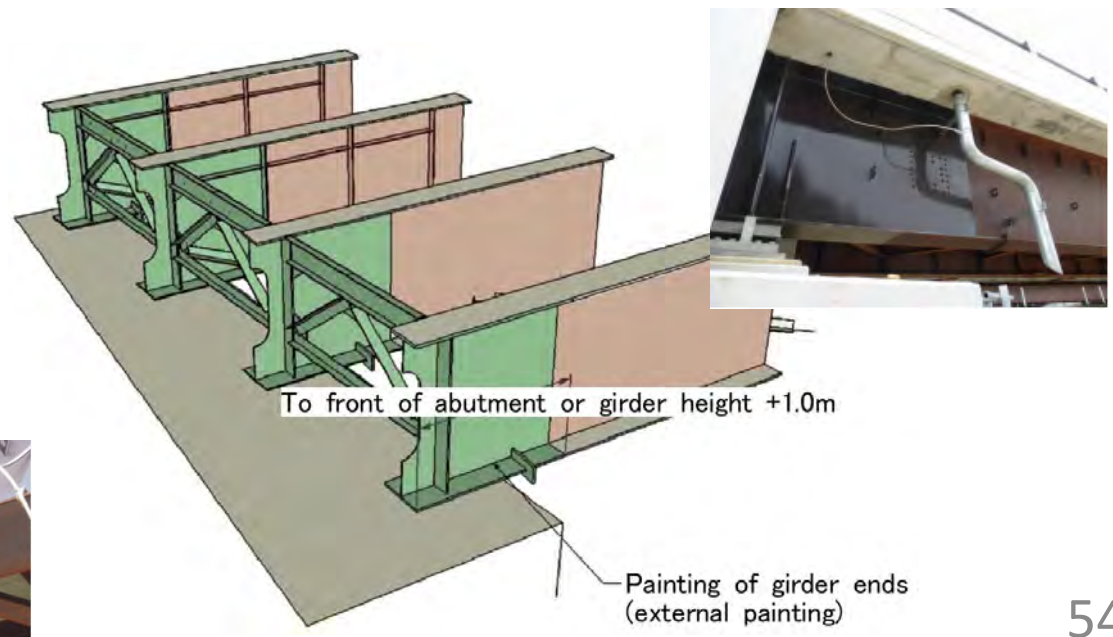
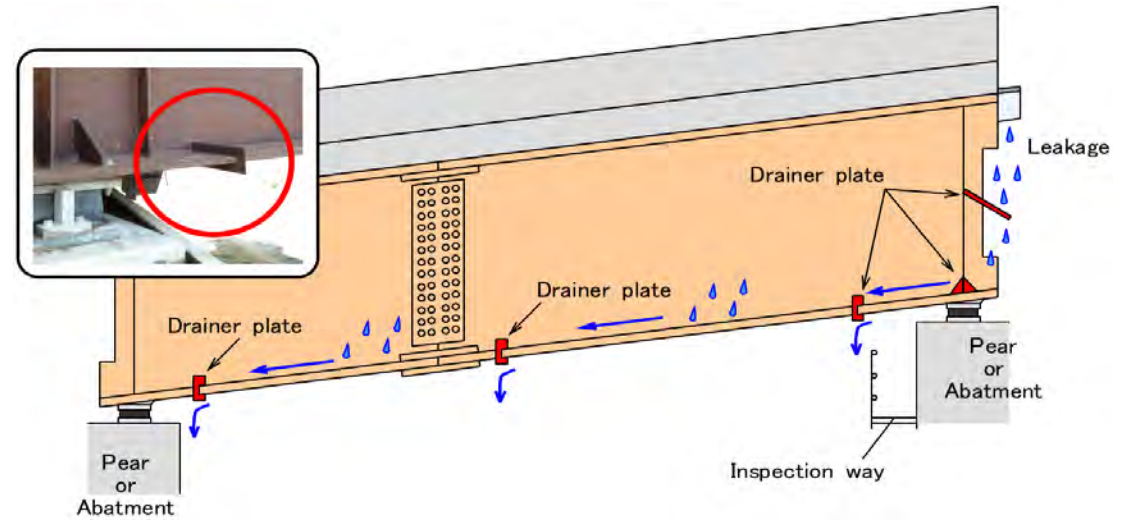
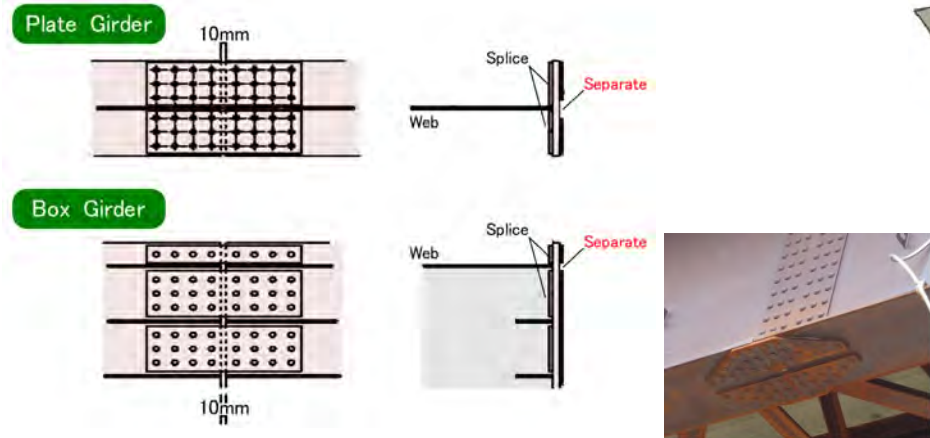
耐候性鋼の橋梁への適用  
Application of Weathering Steel in Bridges

耐候性鋼橋の手引き  
(改訂4版)

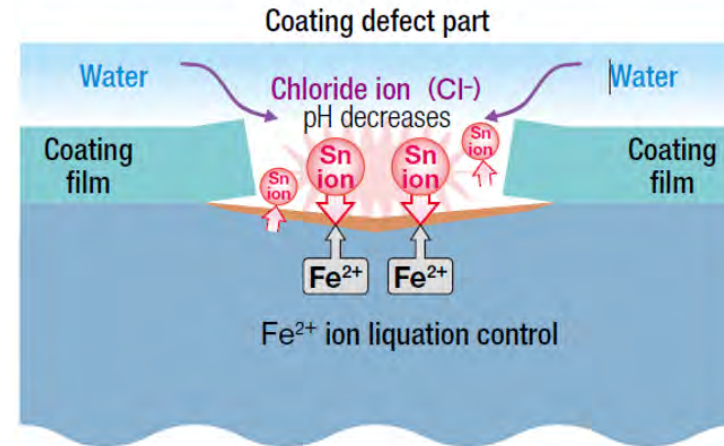
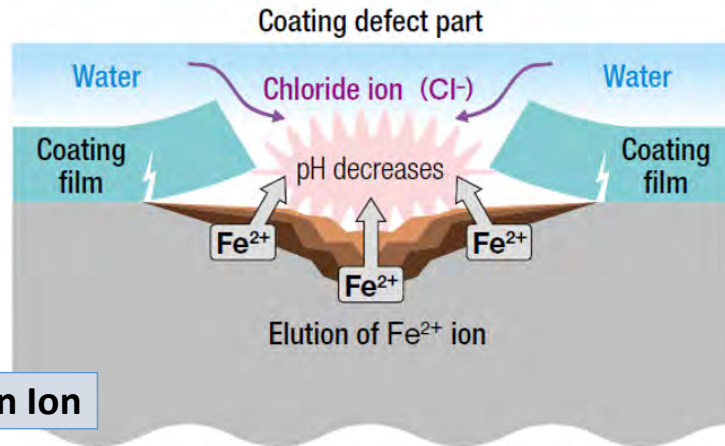
2021年11月

日本橋梁建設協会  
Japan Bridge Association Inc.

### Guidelines of Weathering Steel Bridges

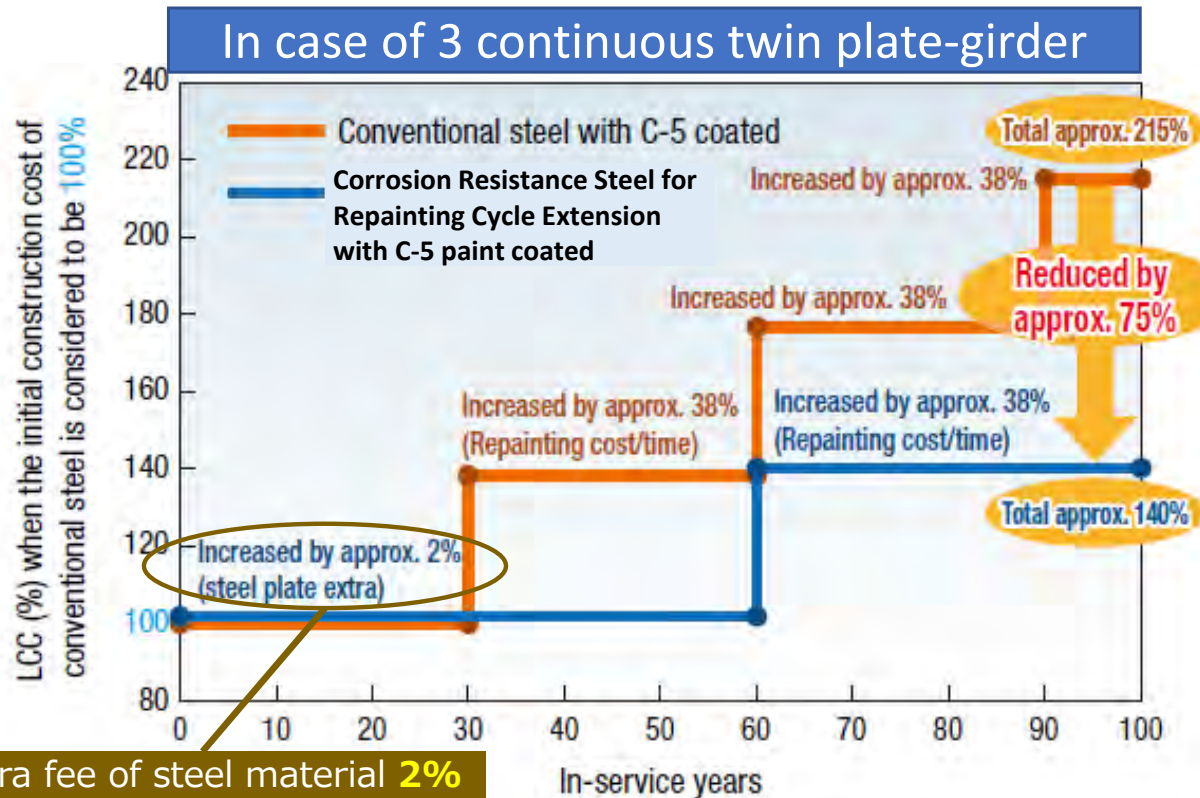


## 2-2 Corrosion Resistance Steel for Repainting Cycle Extension Steel



Fe : Iron Ion

Sn : Tin Ion



- ① Repainting Cycle Extension Steel can maintain **double period of repainting cycle** comparing with the one of normal steel plate and can **reduce the life cycle cost**.
- ② For all of the Japan Industry Standard steel plate, this character can be arranged and specialized welding material and bolt is available.

Extra fee of steel material **2%**

## 2-2 Corrosion Resistance Steel for Repainting Cycle Extension Steel

- Coating System is simulated fluorine resin coating (C5)
- Base steel is exposed by incising the coating film in an X-shaped state
- Cycle corrosion test (SAE J2334)**

### 〈Coating specifications〉

	Coating material	Film thickness
First layer	Inorganic zinc	15 μm
Second layer	Back coat of epoxy resin coating material	60 μm
Third layer	Back coat of epoxy resin coating material	60 μm
Fourth layer	Middle coat of fluorine resin coating material	30 μm
Fifth layer	Middle coat of fluorine resin coating material	25 μm
	Total	190 μm

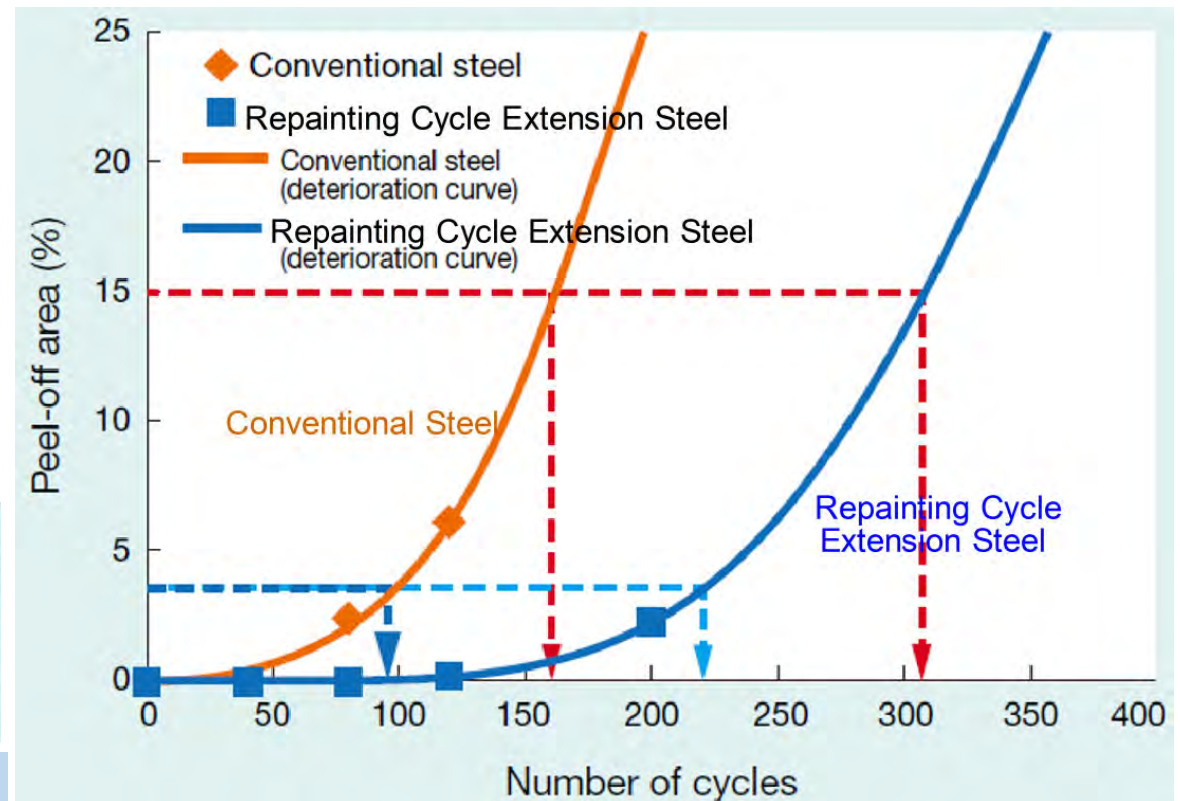
Re-Painting Cycle Extension Steel, approximately Twice time longer term that of conventional steel



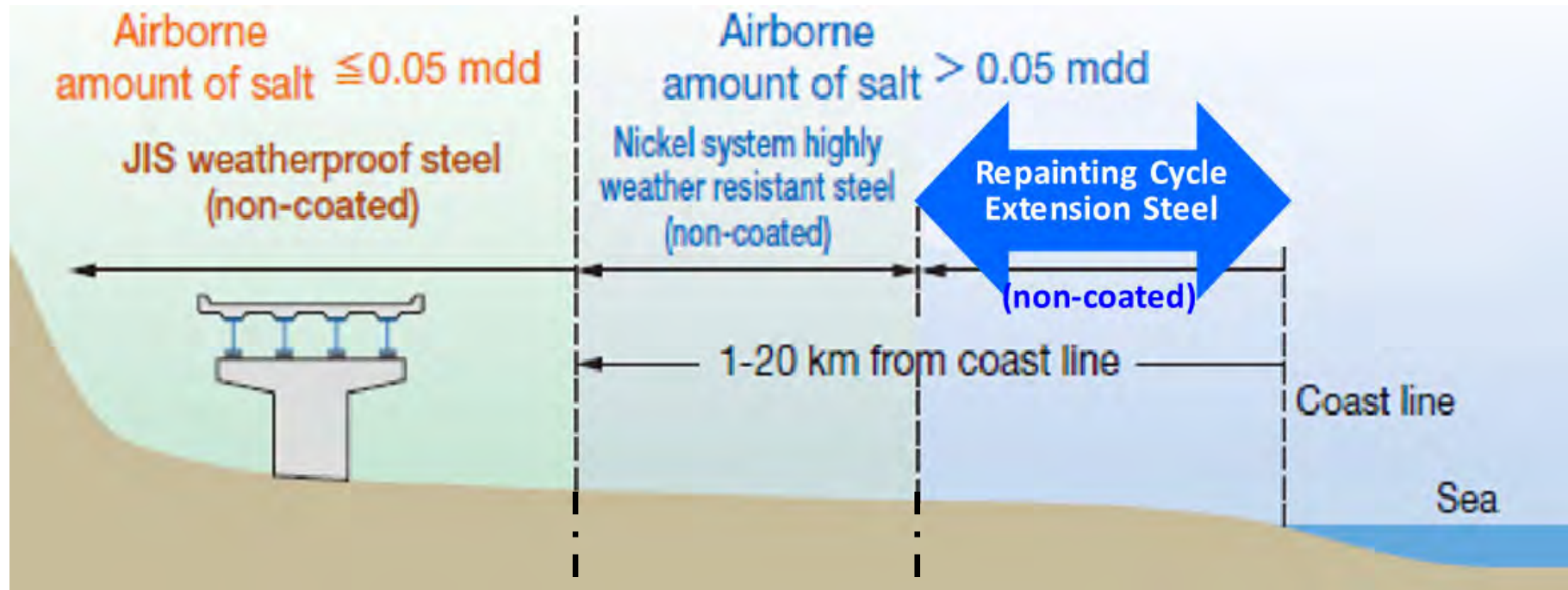
Conventional



RCE Steel



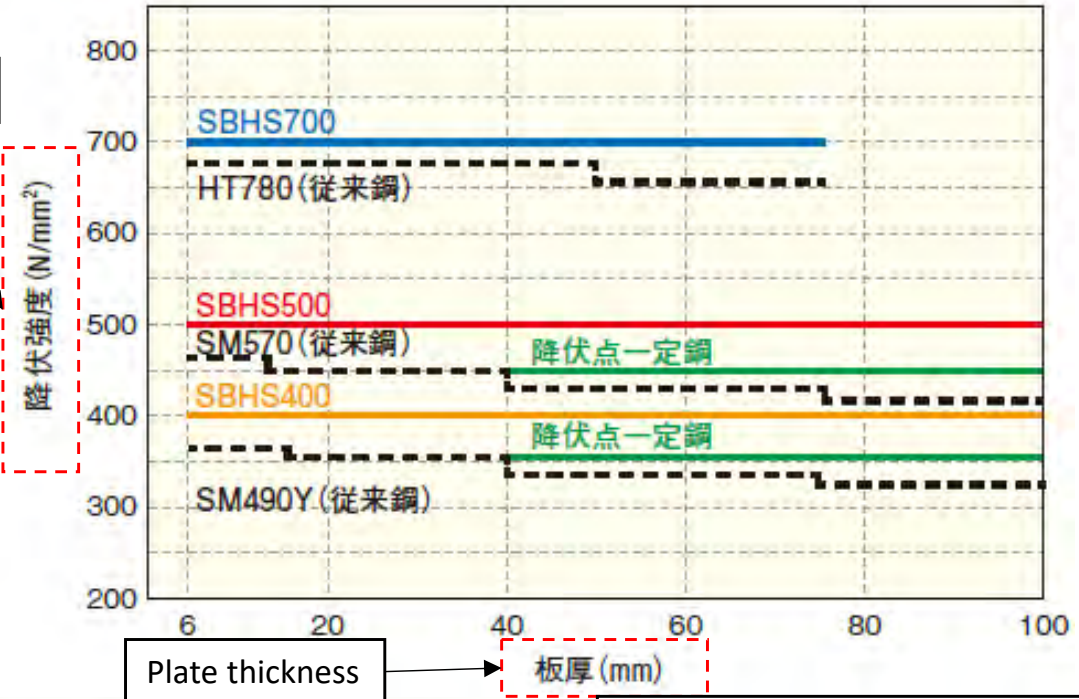
## Image of applying “Repainting Cycle Extension Steel”



# 2-3 SBHS=Steels for Bridge High Performance Structure



Yield strength



- ① SBHS steel has superior performance in terms of strength, toughness and ease of welding compared to conventional steels.
- ② **Higher strength than conventional steel, contributing to reduced steel weight**
- ③ SBHS improves fabrication and on-site weldability as it does not require residual heat control or reduces residual heat for welding.

Improved yield strength then conventional steel

従来鋼よりも降伏強度を向上	Yield Strength	Improvement	Value
・ 490N/mm <sup>2</sup> 級 [SBHS400 (W)]	Yield Strength	10~23% UP	(+35~75N/mm <sup>2</sup> )
・ 570N/mm <sup>2</sup> 級 [SBHS500 (W)]	Yield Strength	9~19% UP	(+40~80N/mm <sup>2</sup> )
・ 780N/mm <sup>2</sup> 級 [SBHS700 (W)]	Yield Strength	2~ 5% UP	(+15~35N/mm <sup>2</sup> )

加工性・溶接性が従来鋼よりも優れ、予熱省略、予熱温度低減が可能！

Workability and weldability are superior to conventional steel, preheating can be omitted and preheating temperature can be reduced

"High performance steel for bridges":  
Quoted from the Japan Iron and Steel Federation

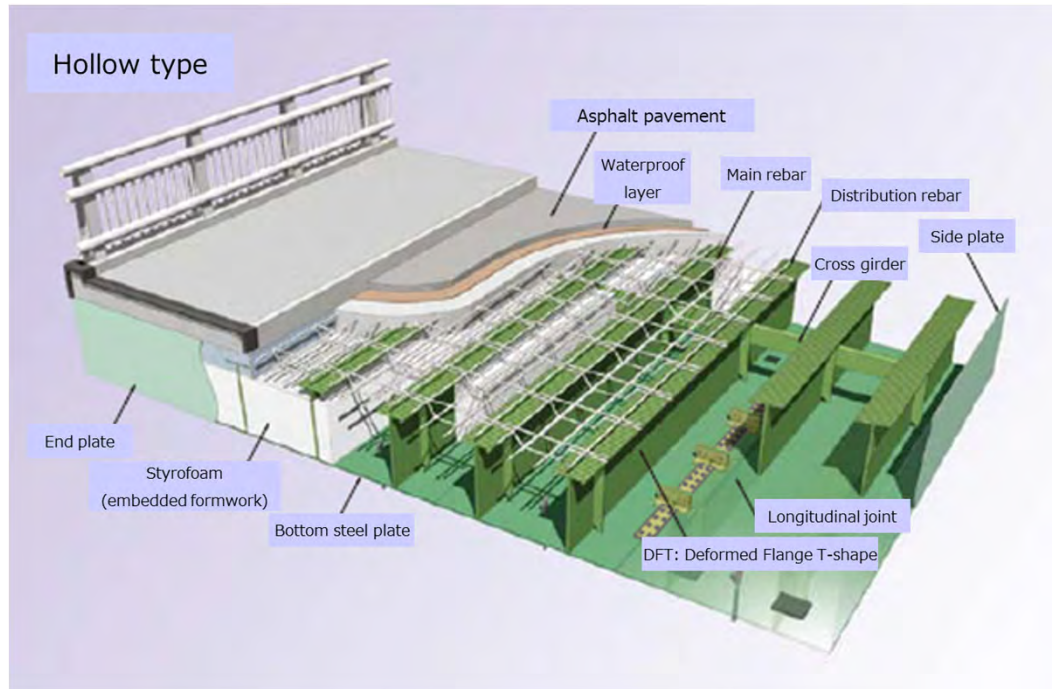
**鋼重削減および施工コスト低減への寄与大**

Great contribution to reduction in steel weight and construction cost

## 3. Composite Structure

Composite with Steel and Concrete

# 3-1. Steel Concrete Composite Bridge



Features :

○ Possible to make the height of the bridge girder very thin (minimum of about 30cm)

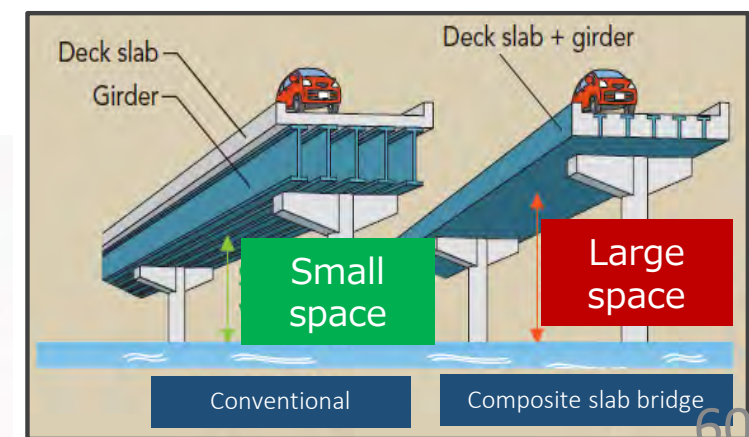
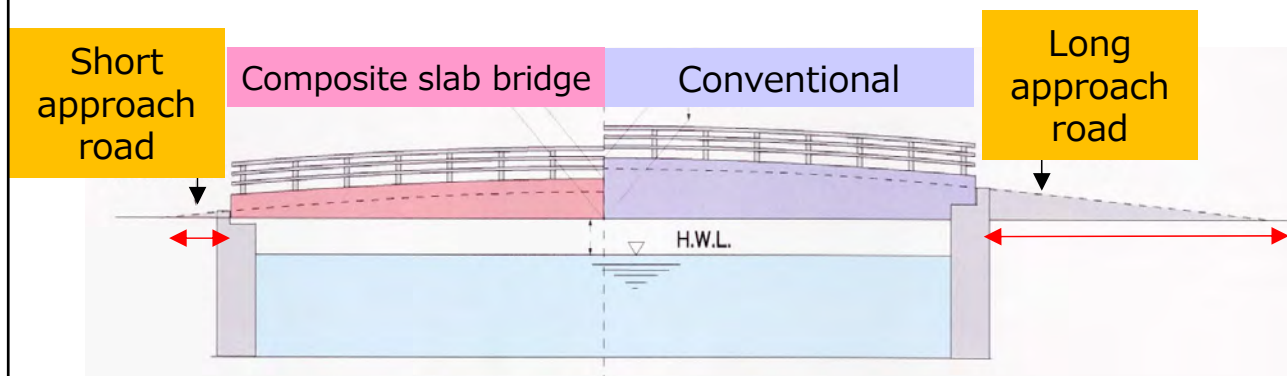
⇒ possibility of Shortening the approach road.

(Reduction of construction costs and land acquisition costs)

⇒ When the height of the road surface is the same as that of the conventional type, a large space can be secured under the bridge girder.

(Ideal for grade crossings when securing a route)

○ Reduction in on-site construction period is possible by 30% since formwork is not required for floor slab construction



## Laos National Highway No. 9 bridge (Composite Slab Bridge)

Basic data	
Client/ Completion year	Ministry of Public Works and Transport, Government of Laos, completed in 2019
Funding	Japanese Government - ODA (Grant Aid)
Bridge length/ Steel weight	Xe Kum Kam Bridge : 90m : 3 * 30m ( 3 span continuous composite slab bridge), 270t. Xe Tha Mouak Bridge : 160m : 4 * 40m ( 4 span continuous composite slab bridge), 760t.
Features	A synthetic slab bridge was adopted to reduce the girder height and <b>shorten the approach road</b> . Weather-resistant steel materials were used to eliminate the need for repainting during maintenance.



Xe Tha Mouak Bridge



Xe Kum Kam Bridge

# Japan Tokiwa Bridge (Composite Slab Bridge)

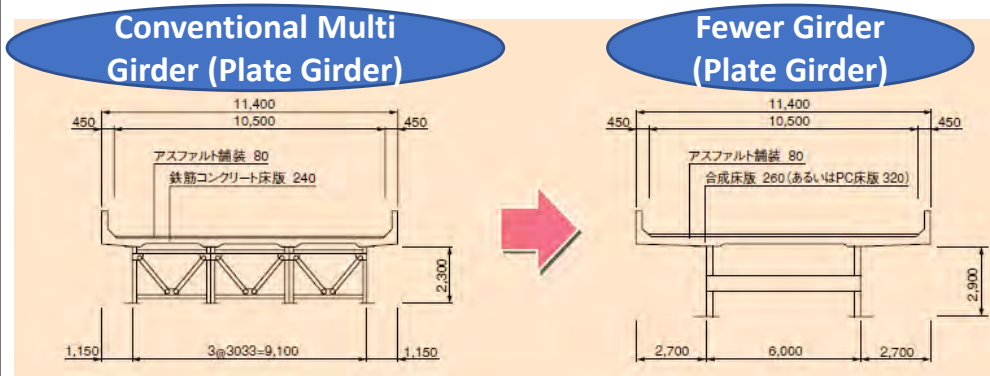
## Basic Data

Client Year of Completed	Niigata Prefecture • 2009
Fund	Public Works
Span	107m : 37m+33m+37m (3 span continuous composite slab bridge)
Weight	630t
Features, etc.	Composite slab bridge was adopted to minimize girder height and <b>secure space under the girder</b> to account for rising water level.



# Rationalized Bridge with Steel Concrete Composite Deck Slab (SCCD)

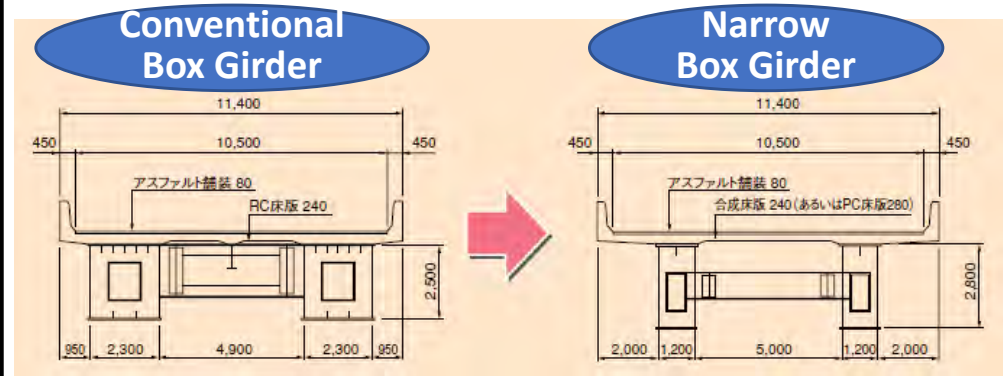
## Fewer Girder Bridge (Plate Girder)



### Fewer Girder Bridge

- Reduce number of main girders by extending deck span using steel concrete composite deck (SCCD) or pre-stressed concrete deck.
- Simplify or omit crossbeams and/or lateral bracings.
- Advantageous in construction period and economical aspect compared with conventional multi-girder bridge.
- **Steel concrete composite deck have higher durability.**

## Narrow Box Girder Bridge



### Narrow Box Girder Bridge

- Simplify box composition by incorporating narrow web intervals and thicker flange plates (reduce longitudinal ribs, omit cross ribs).
- Omit floor systems by extending deck span using steel concrete composite deck (SCCD) or pre-stressed concrete deck.
- Advantageous in construction period and economical aspect compared with conventional box girder bridge.

\*Quoted from "Birth of New Steel Bridges II Revised Edition" Japan Bridge Association.



# Independent State of Papua New Guinea

## New Britain National Road Bridge

(Case in land of earthquakes)

### Basic Details

Employer · Complete Year	Department of National Planning and Monitoring : DNPM) /2019
Finance	Japan ODA (Grant Aid)
Length /Steel Weight	Aum Bridge : $38+38=76\text{m}$ (2-span continuous I-girder bridge)/215t Kapiura Bridge : $45.65+46+45.65=137.3\text{m}$ (3-span continuous I-girder bridge)/350t
Special feature	The I-girder bridge was chosen because it is the most common steel bridge type for small and medium-sized bridges with applicable span lengths of 40 to 50 m. <b>The I-girder bridge is light in steel weight, has excellent seismic resistance due to the continuous girder, and has little effect on foundation works.</b> The upper-road type is considered advantageous in preventing damage to members due to vehicle collisions.



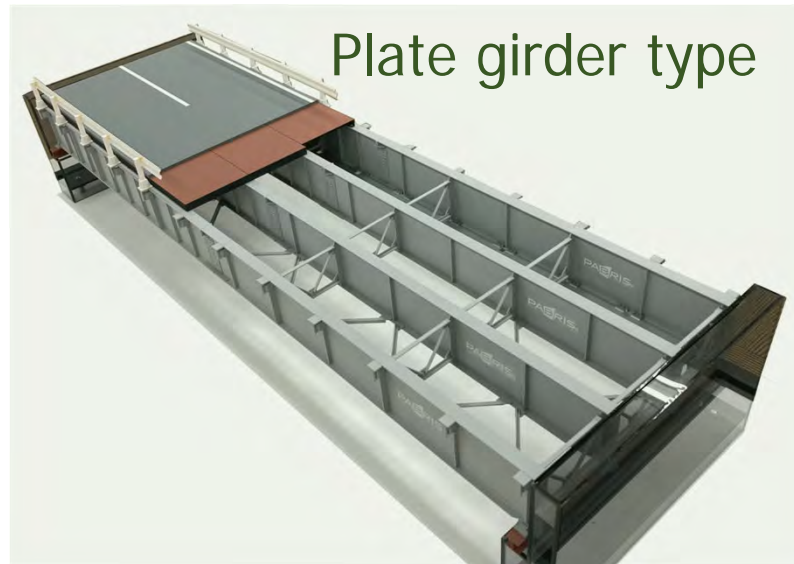
Aum Bridge



Kapiura Bridge

## 4. Emergency Bridge

## 4. Emergency Bridge



In addition to its high functionality and economic efficiency as an emergency bridge also has the flexibility to meet various needs. An emergency temporary bridge has already proven its high potential in many application.



Reroute for replacement construction



Temporary bridge for construction road



Emergency bridges in times of disaster



Temporary Jetties for cranes and other work

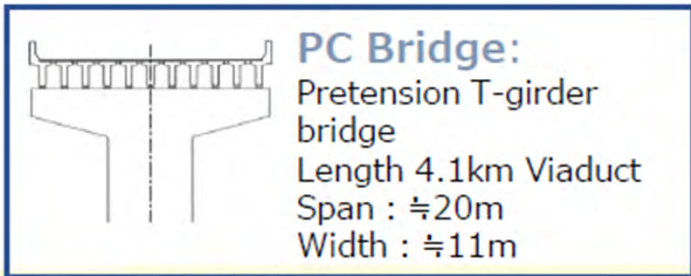


Temporary bridge for pedestrian walkway

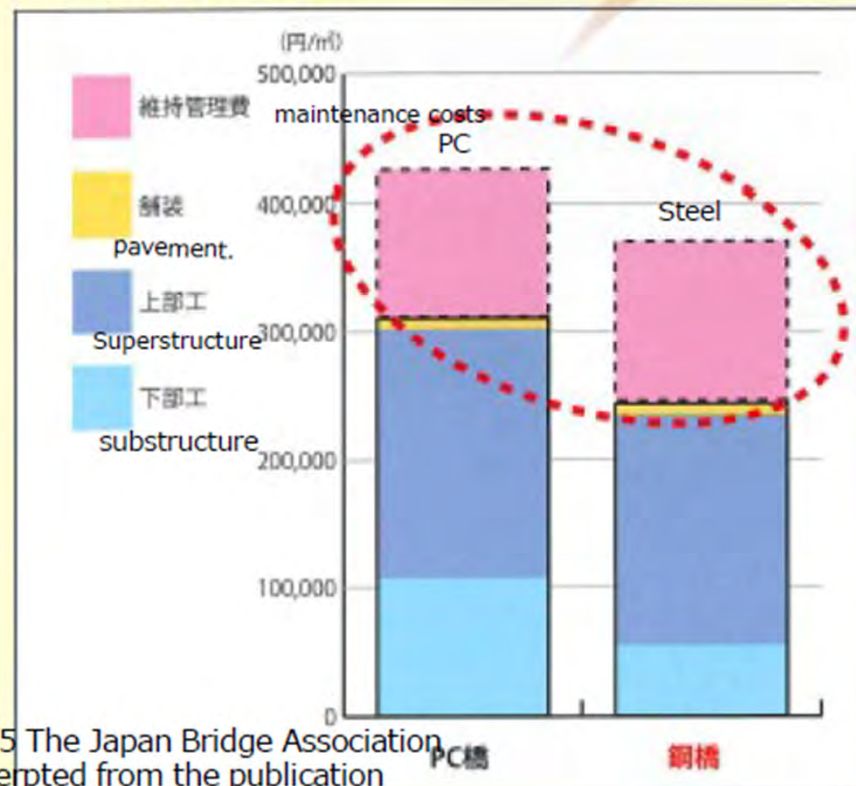
## Example of Cost Comparison between Steel Bridge and Concrete Bridge

## II. Cost Comparison

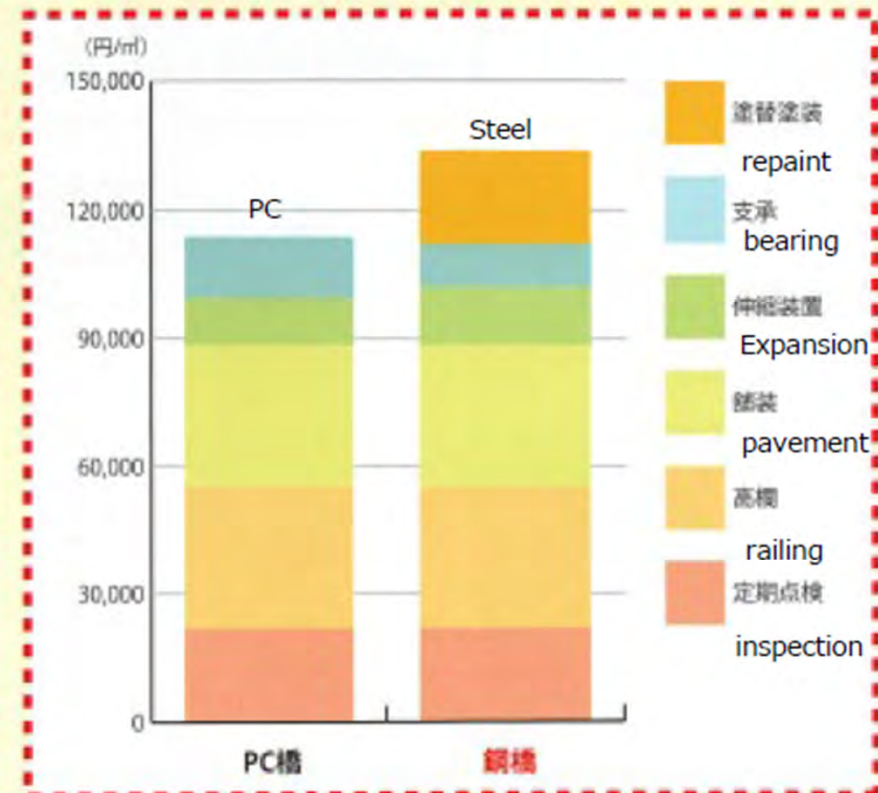
The following are reference values based on examples in Japan. Please refer to the following reference values, although they are not necessarily comparable to those of construction projects in developing countries under the same conditions. ⇒For example, while unit labor costs are high in Japan, it is possible to construct with a smaller number of workers than in developing countries.



Comparison of Estimated Prices  
 積算価格比較グラフ



maintenance cost  
 維持管理費内訳(100年LCC)

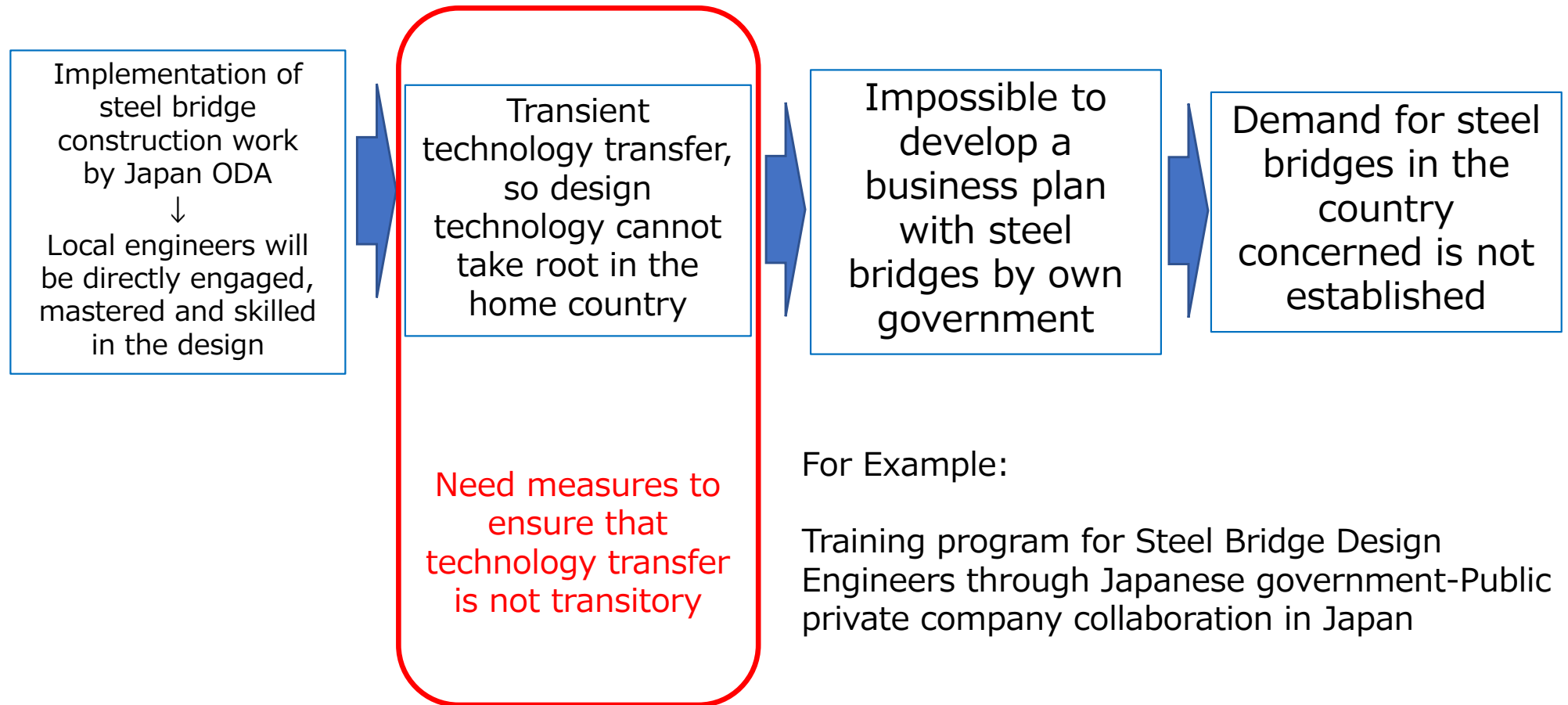


2019.9.5 The Japan Bridge Association  
 Excerpted from the publication  
 "The Appeal of Steel Bridges"

# III. Proposal & Recommendations

## -Establish design technology in your country -

### Current events in Japan ODA projects



For Example:

Training program for Steel Bridge Design Engineers through Japanese government-Public private company collaboration in Japan

## <Contact Details>

(General Incorporated Association)



***The Japan Bridge Association***

*Overseas Business Development Committee*

Secretary-General : Daisuke MUSHIMOTO (Mr.)  
[mushimoto-daisuke@jfe-eng.co.jp](mailto:mushimoto-daisuke@jfe-eng.co.jp)

Deputy Secretary-General : Shunsuke MACHINO(Mr.)  
[machino1588@ihi-g.com](mailto:machino1588@ihi-g.com)

Deputy Secretary-General : Susumu INOKUCHI(Mr.)  
[s.inokuchi@yokogawa-bridge.co.jp](mailto:s.inokuchi@yokogawa-bridge.co.jp)



**Thank you for your attention**