CA 6014

Bridges

JFE

JFE Engineering Corporation

Overseas Business Division
Steel Structure Engineering Sector
2-1, Suehiro-cho, Tsurumi-ku, Yokohama 230-8611, JAPAN
Tel: +81-45-505-7385   Fax: +81-45-505-8938
https://www.jfe-eng.co.jp/en

Notice : The material contained in this brochure is for general information only. It is not intended as a substitute for the competent professional assistance which is a requisite to any specific application. While every effort has been made to insure its accuracy, JFE makes no express or implied warranty of any kind with respect to the information contained in this publication or the materials referred to therein. Anyone making use of the information or material contained herein does so at their own risk and assumes any and all liability resulting from such use.

JFE_BSY'25.3-⑥-0.2.JFE_BSY.A   Printed in Japan

JFE

JFE Engineering Corporation

Responsive, High-Quality Global Engineering

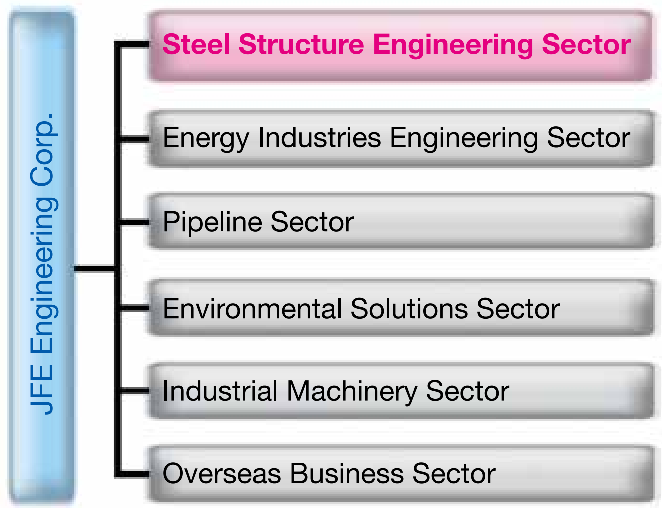
JFE Engineering was established on April 1, 2003 as a general engineering company of the JFE Group.

Since the foundation of the former Nippon Kokan K.K., our company has inherited the passions of people who have built renowned bridges in Japan and abroad by making the most of its comprehensive technological capabilities cultivated through steel and engineering businesses.

JFE Engineering intends to respond to customer needs with the best technologies and optimal solutions by striving to develop new technologies and new methods while keeping looking to the future. In addition, we pursue to contribute to society while continuing to create bridges connecting the communities, countries and the earth to the future by utilizing the world's best technologies.

About JFE Engineering Corporation

Consisting mainly of six sectors, our company has continued to provide various infrastructures to society. The bridge construction business is operated by the Steel Structure Engineering Sector, which is one of the six sectors.



Name of "JFE Group"

In the name "JFE Group," "J" stands for Japan, "F" represents steel (element symbol "Fe" of iron), and "E" means "Engineering." Thus, "JFE Group" indicates that it is a "future-oriented" enterprise group representing Japan" (Japan Future Enterprise) whose core businesses are steel and engineering.

JFE

Contents

Chapter 1: History of Bridges of JFE

From the Inception Period to the Postwar Reconstruction Period

Our company's bridge business started with the Tsukiji-bashi Bridge, which was ordered by the former Tokyo City Hall in the year Taisho 12 (1923). With the coming of the Showa era (1926-1989), the company constructed the Umaya-bashi Bridge (1928, former Tokyo City), which is among the renowned bridges on the Sumida River, the Bansui-bashi Bridge (1931, former Home Ministry), the Daishi-bashi Bridge (1936, Kanagawa Prefecture), etc., and the annual order volume at the peak before the War recorded over 4,000 tons. In the postwar reconstruction period, the company resumed the business in full swing with the Tsurumi-ohashi Bridge (1948, Yokohama City), Taihei-bashi Bridge (1950, former Construction Ministry), etc. In 1953, the company built the Tsurumi-gawa Bridge (former Construction Ministry), which was a composite girder bridge in the earliest period. In addition, in the Sagami-ohashi Bridge (1953, Kanagawa Prefecture), the company adopted 490 N/mm^2 class high-tensile steel for the first time in Japan. Thus, the company contributed to the development of bridge technologies and welding technologies also as a steel manufacturer.

High Economic Growth Period

Starting with large-scale bridges such as the 113th Zone Viaduct weighing 2,100 tons (1962, Metropolitan Expressway Public Corporation) and the continuous composite girder Tomei-Tamagawa Bridge weighing 2,500 tons (1964, Japan Highway Public Corporation), our order volume steeply increased, and we achieved an annual total order of 20,000 tons in 1966.

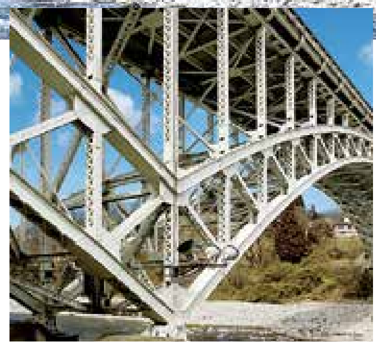
In addition to such volume expansion, the company started a pioneering approach toward maintenance-free bridges by adopting weather-resistant steel, which we individually developed, for the 1st Ryogoku-bashi Bridge (1969, our Fukuyama Works). In addition, in erecting the 113th Zone Viaduct, the 1st Ryogoku-bashi Bridge, etc., we implemented a far-sighted, large block erection method using a floating crane. Backed by accumulation of these technologies, we constructed bridges such as the Oshima-ohashi Bridge (1973, Japan Highway Public Corporation) and the Suehiro-ohashi Bridge (1973, Tokushima Prefecture), which was Asia's longest cable-stayed bridge at the time of construction, to lay the foundation for our subsequent construction of long-span bridges.

Long-span Bridge Construction Period

In 1977, we received an order from the Honshu-Shikoku Bridge Authority for the main tower of the Innoshima-ohashi Bridge, as the first of the Honshu-Shikoku Bridges for our company, and have since then participated in the construction of a number of global-scale, long-span bridges including the Honshu-Shikoku Bridges. Our company's technologies are demonstrated also in the Yoshima-bashi Bridge (truss bridge), the Hitsuishijima-bashi Bridge (cable-stayed bridge) and the Shimotsuiseto-ohashi Bridge (suspension bridge) on the Kojima-Sakaide Route, which is the world's longest group of road-rail bridges, the Tatara-ohashi Bridge (world's largest cable-stayed bridge), the Innoshima-ohashi Bridge and the Kurushima-ohashi Bridge (both suspension bridges) on the Onomichi-Imabari Route, and the Akashikaikyo-ohashi Bridge (Kobe-Naruto Route, adopting reduced preheating type 780 N/mm^2 class high tensile steel), which is a suspension bridge with the world's largest span. In addition, we also constructed well-known landmark bridges such as the Yokohama Bay Bridge, the Tsurumi-tsubasa-bashi Bridge (both cable-stayed bridges, Metropolitan Expressway Public Corporation), the Meiko Triton bridge (cable-stayed bridge, Japan Highway Public Corporation), and the Hakucho-ohashi Bridge (cable-stayed bridge, Hokkaido Regional Development Bureau).

Umaya Bridge (in Tokyo, Japan)

Employer : Tokyo Metropolitan Government
Bridge Span : 45.6+54.8+45.7m
Bridge Type : triple through type tied arch
Completion : 1929
Bridge Length : 151.4m
Width : 16.6m (Carriageway)+2@3.7m (Footpath)
Steel Tonnage : 2,550 tons

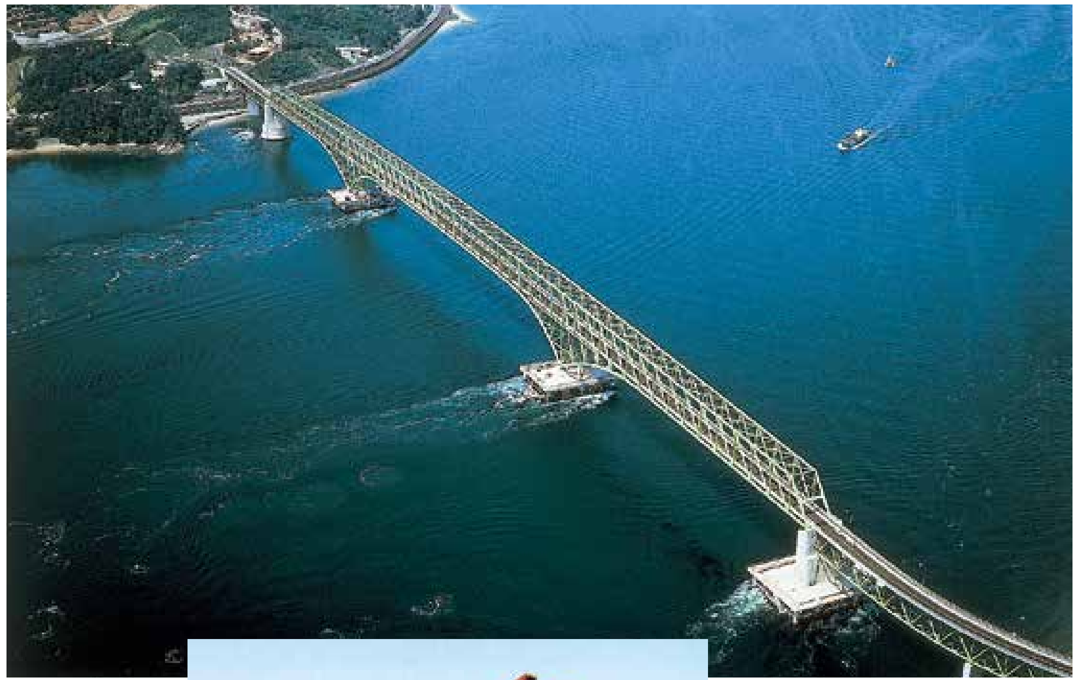


Bansui Bridge (in Tochigi, Japan)

Employer : Interior Ministry
Bridge Length : 127.8m
Bridge Span : 28.0+70.0+28.0m
Width : 8.7m
Bridge Type : Deck type 3-span balanced arch
Steel Tonnage : 734 tons
Completion : 1932

Suehiro Bridge (in Tokushima, Japan)

Employer : Tokushima Prefectural Government
Bridge Span : 106.3+250.0+106.3m
Bridge Type : Cable Stayed Bridge
Bridge Length : 470.0m
Width : 2@7.25m (Carriageway)
Steel Tonnage : 4,120 tons
Completion : 1975



Oshima Bridge (in Yamaguchi, Japan)

Employer : Japan Highway Public Corporation
Bridge Length : 1,020.0m
Bridge Span : 200.0+325.0+200.0m
Width : 6.0m (Carriageway)+1.5 (Footpath)
Bridge Type : Through type 3-span continuous Truss Bridge, etc.
Steel Tonnage : 6,200 tons
Completion : 1975

Kurushima Bridge (Third Kurushima Kaikyo Bridge) (in Ehime, Japan)

Employer : Honshu-Shikoku Bridge Authority
Bridge Length : 1,030.0m
Bridge Span : 1,020.0m
Width : 2@9.5m (Carriageway)+2@2.5 (Footpath)
Bridge Type : Suspension bridge
Steel Tonnage : 29,278 tons
Completion : 1998

New Technologies That Will Support Traffic in the Future

To reduce the cost for public works and lower the lifecycle cost, we have pursued the development of unconventional new technologies. In particular, in the field of concrete composite structure, JFE is highly evaluated for an open-section box girder bridge using composite slabs, minimized main girder plate girder bridge, rapid integrated bridge, corrugated web PC bridge, etc. In addition, the whole Group has worked on the development of a comprehensive maintenance technology that extends from various inspections and diagnoses to repair and reinforcement. Other than bridges, JFE Engineering has constantly developed its sphere of activities including the development of a steel shell for MMST (Multi-Micro Shield Tunnel), which is a new method for urban tunnels (Kawasaki Jukan Line, Metropolitan Expressway Company).

JFE Engineering intends to support traffic in the future with new technologies by continuing to swiftly incorporate the needs of society.

From NKK to JFE

- 1912 Nippon Kokan K.K. was founded. [Japan's first private company exclusively for seamless steel pipes]
- 1916 Yokohama Dockyard was founded (renamed Asano Dockyard the same year). [core company of the Asano Group]
- 1925 The name NKK was created.
- 1936 Asano Dockyard was renamed Tsurumi Iron Works Dockyard.
- 1940 Nippon Kokan and Tsurumi Iron Works Dockyard were merged.
- 1942 Shimizu Shipyard began operation.
- 1956 Tsurumi Shipyard Namamugi Steel Structure Factory began operation.
- 1959 The land-based business of Tsurumi Shipyard was separated, and Nippon Kokan Koji Corp. was founded.
- 1962 The Steel Structure Factory of Shimizu Shipyard began operation.
- 1969 Tsu Shipyard began operation.
- 1970 The Steel Structure Factory of Tsu Shipyard began operation. BRISTLAN began operation. [numerical controlled master drawing system using a computer]
- 1979 The Shipyards were renamed Works.
- 1990 New-BRISTLAN began operation.
- 1992 Modernized facilities of Tsu Works began operation. [automatic production line for box girder panels, etc.]
- 2003 JFE Engineering Corporation was founded. [succeeding the engineering business of NKK Corp.]
- 2008 Kawatetsu Bridge and Steel Structure Corp. was integrated into JFE Engineering Corporation.
- 2009 JFE Koken Corp. was integrated into JFE Engineering Corporation.

Chapter 2: Types and Structures of Bridges

Girder Bridges

The origin of girder bridges is the log bridge, which is the simplest type of bridge. In girder bridges, steel members are assembled into girders with an "I" section or a box section, which are called plate girder bridges and box girder bridges, respectively. Girder bridges are an old-established type. Box girder bridges having thin stiffening structure with particular focus on rationality began with the Cologne Deutz Bridge (1948) in Germany. The girder bridge with the world's largest span is the Costa e Silva Bridge (Brazil, 1973), which has a span length of 300m.

A girder bridge consists of a slab, on which vehicles or people pass, and a main girder, which supports the slab. Slabs are divided into RC slabs, composite slabs, PC slabs, steel plate decks, etc. A structure in which a concrete slab is integrated with the main girder to resist the load is called a composite girder bridge, while a structure where only the main girder resists the load is called a non-composite girder bridge. A structure in which a steel slab made of steel is integrated with the main girder is a steel plate deck girder bridge.

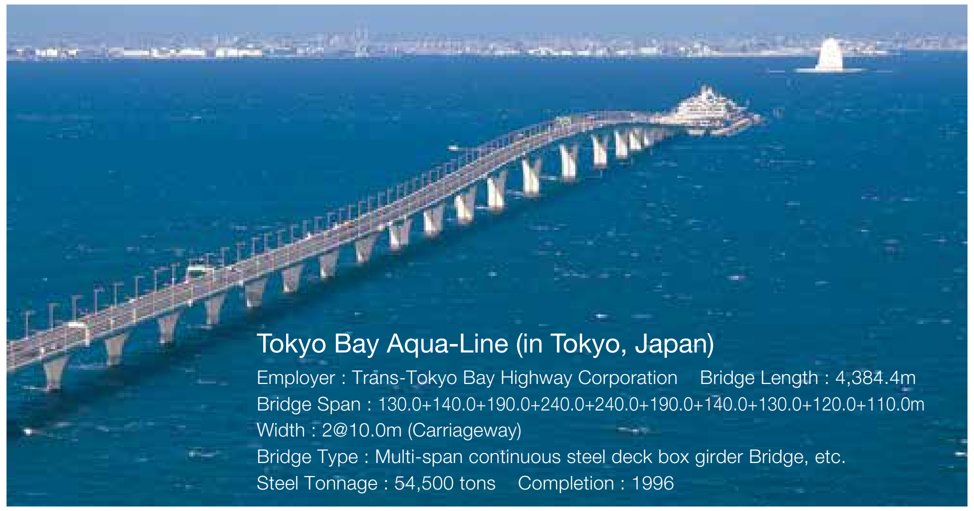
Plate girder bridges generally have simple structures and are lightweight. Therefore, they are excellent in economic efficiency including the construction cost, and are the most common type of bridge. In recent years, an increasing number of minimized-main-girder bridges, which use composite slabs or the like with excellent load bearing capacity and have fewer main girders, are adopted.

Box girder bridges have large bending rigidity, and therefore, allow longer spans than that of plate girder bridges. Box girders are also used in curved bridges and loop bridges, which take advantage of the large torsional rigidity.

Steel plate deck girder bridges are lighter than concrete deck girder bridges, and therefore allow the girder height to be reduced and the span to be increased. Since the load on the substructure is small, they excel in seismic resistance and are suitable for soft ground. Another feature of them is that since they do not require the placing of deck slab concrete, the construction period on the site can be substantially shortened.

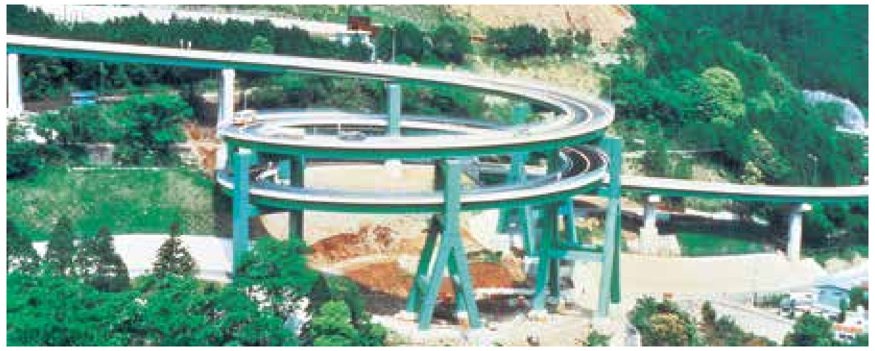
General Applicable Span Length

- Simple plate girder bridges: 25 to 45m
- Continuous plate girder bridges: 30 to 60m
- Simple box girder bridges: 30 to 65m
- Continuous box girder bridges: 40 to 80m
- Steel plate deck girder bridges: 30 to 150m



Tokyo Bay Aqua-Line (in Tokyo, Japan)
Employer : Trans-Tokyo Bay Highway Corporation Bridge Length : 4,384.4m
Bridge Span : 130.0+140.0+190.0+240.0+240.0+190.0+140.0+130.0+120.0+110.0m
Width : 2@10.0m (Carriageway)
Bridge Type : Multi-span continuous steel deck box girder Bridge, etc.
Steel Tonnage : 54,500 tons Completion : 1996

Minatomachi South Exit (in Osaka, Japan)
Employer : Hanshin Expressway Public Corporation Bridge Length : 485.5m
Bridge Span : A-Line 24.9+82.5m+(57.0+71.1m)+(32.6+55.4+29.9m)
B-Line 84.7+42.2m (extension to existing bridge)
Width : 10.2~4.9m (Carriageway)
Bridge Type : 3-span continuous steel deck box girder Bridge, etc.
Steel Tonnage : 1,979 tons Completion : 1995



Nanadaru Viaduct
(in Shizuoka, Japan)
Employer : Shizuoka Prefectural Government
Bridge Length : 998.7m
Bridge Span : 41.4+41.9+41.4m
Width : 9.0m (Carriageway)
Bridge Type : Sextuple 3-span continuous Box girder Bridge, etc.
Steel Tonnage : 3,669 tons
Completion : 1982

Kashiogawa Bridge
(in Kanagawa, Japan)
Employer : Yokohama City
Bridge Length : 238.6m
Bridge Span : (30.6+50.0+49.4m)+38.7m+(21.8+22.5+21.75m)
Width : 10.6m
Bridge Type : 3-span continuous non-composite box girder Bridge, etc.
Steel Tonnage : 556 tons
Completion : 2001
Features : Grading deck slabs used

Rigid Frame Bridges

Structures of rigid frame bridges are divided into a Vierendeel structure as a superstructure girder bridge, and a superstructure-substructure integral structure.

Rigid frame bridges of superstructure-substructure integral structure include braced rigid-frame bridges and elevated bridges in urban areas. Braced rigid-frame structures are frequently adopted for small-to-medium span bridges that cross deep valleys and roads, and formally resemble deck arch bridges. However, the distribution profile of bending moment is close to that of a continuous girder, and therefore, it can be said that they are a type of continuous girder bridge.

The joint between the beam and the column, or between the girder and the pier, of a rigid-frame bridge is called a corner angle. Since the direction of the force rapidly changes at a corner angle, it is particularly important to give design considerations to smoothly transmit the force.

General Applicable Span Length

- 40 to 80m

Toyoyama (No.5) Section (in Aichi, Japan)
Employer : Nagoya Expressway Public Corporation
Bridge Length : 325.0m
Bridge Span : 94.3+134.0+95.3m
Width : 9.0-17.5+15.3-9.0m (Carriageway)
Bridge Type : 3-span continuous Steel deck rigid-frame Bridge
Steel Tonnage : 6,608 tons
Completion : 2000

Nishizawa Bridge (in Yamanashi, Japan)
Employer : Yamanashi Prefectural Government
Bridge Length : 360.0m
Bridge Span : 14.8+100.0+105.0+95.0+44.8m
Width : 7.8m (Carriageway)+2.5m (Footpath)
Bridge Type : 5-span continuous V-pier rigid-frame Bridge
Steel Tonnage : 3,025 tons
Completion : 1995

Ohashi Junction (in Tokyo, Japan)
Employer : Metropolitan Expressway Co., Ltd.
Bridge Length : (Ramp B)310.0m, (Ramp D)214.0m
Bridge Span : (Ramp B)72.0+52.4m, 24.3m, 59.3m, 33.3m, 19.9+19.7+25.1m
(Ramp D)24.1m, 34.1m, 24.3m, 59.3m, 33.3m, 19.5+14.9m
Width : 13.1m
Bridge Type : 4-span continuous Steel deck Box girder Bridge (double-deck structure)
Steel Tonnage : 1,927 tons
Completion : 2010
Feature : Large-scale junction construction in an urban area via single-operation erection of large blocks at night

Truss Bridges

An Italian architect Palladio in the 16th century described truss bridges in his literally works, and is called the father of the truss. In the American western frontier period, a large number of truss bridges using ample wood resources were built. Types of truss bridges were named after their patent holders, and various types such as Howe truss, Platt truss, Fink truss and Bollman truss, etc. were invented. Nowadays, Warren truss is most frequently used. The world's largest truss bridge is the Quebec Bridge with a span length of 549 m (Canada, 1917).

The truss bridge is an extremely rational and efficient type of bridge in which the lengthy web plate section of the girder bridge is eliminated, and has a structure converted through combining thin members that transmit the force only with the axial force. According to the positions of the main structure and the road surface, truss bridges are classified into deck truss bridges, semi-through truss bridges and through truss bridges.

Both the size and weight of a single member are smaller than those of other types of bridges. Therefore, the features include: it is easy to transport members to the erection site and handle them at the site; small cranes can be used; and a relatively large load bearing capacity can be ensured with light steel weight.

In through truss bridges, the height from the road surface to the girder bottom can be smaller than the span length. Therefore, through truss bridges are effective in places where girder heights are limited. By contrast, if a deck truss bridge is adopted in mountains etc., the bridge pier can be lowered by the height of the main structure, and therefore, the superstructure and substructure as a whole can be an economically efficient bridge.

General Applicable Span Length

- Simple truss bridges: 50 to 90m
- Continuous truss bridges: 60 to 110m

Sky Gate Bridge (connected to Kansai International Airport)

Employer : Kansai International Airport Land Company, Ltd.
Bridge Length : 3,750.0m
Bridge Span : 149.0+150.0+149.0m
Width : 29.5-31.5m (Carriageway), electric train track (double track)
Bridge Type : Sextuple 3-span continuous truss Bridge (Combined bridge for railway/road), etc.
Steel Tonnage : 57,200 tons
Completion : 1994

Yoshima Bridge (in Kagawa, Japan)

Employer : Honshu-Shikoku Bridge Authority
Bridge Length : 585.0m
Bridge Span : 175.0+245.0+165.0m
Width : 23.6m (Carriageway)
Bridge Type : 3-span continuous truss bridge (Combined bridge for railway/road)
Steel Tonnage : 25,200 tons
Completion : 1998
Features : 780N/mm^2 grade high tensile steel used

Arch Bridges

In ancient Rome, stone arch bridges were built. In China, a stone arch bridge named Zhaozhou Bridge built in the 7th century is still in existence. Iron Bridge (England, 1779), the world first iron bridge, and Eads Bridge (U.S.,1874), the world's first full-scale steel bridge, are also arch bridges. The world's largest arch bridge is the New River Gorge Bridge with a span length of 518m (U.S.,1977).

In arch bridges, both ends of the arc-shape main member are supported not only vertically but also horizontally. According to the positions of the road surface and the arch, arch bridges are divided into deck arch bridges, semi-through arch bridges and through arch bridges, and categorized into the following representative types.

Arch bridges have a structure in which the bending, shear and axial forces are all supported by arch ribs, and require a good ground capable of withstanding the horizontal reaction force. For through bridges, tied arch bridges, in which the horizontal reaction force generated at both fulcrums is offset by being pulled by the girder, are generally used.

Langer bridges have a structure in which the bending and shear forces are supported by the girder, and the arch ribs only receive the axial force, and are lighter than other types. If trusses are used for vertical hangers of a Langer bridge, a long span can be achieved.

Lohse bridges have a structure in which the arch rib and the girder have large rigidity to share the bending, shear and axial forces, and their frameworks are elegant and robust.

The Nielsen bridges are a type of Lohse bridges in which vertical hangers are replaced with diagonal tension members (e.g., cables). Since the diagonal members substantially contribute to controlling the shear deformation, smaller deflection than normal arch bridges can be achieved.

General Applicable Span Length

- Arch bridges: 50 to 120m
- Langer bridges: 50 to 120m
- Lohse bridges: 70 to 180m
- Nielsen bridges: 100 to 170m

Kushimoto Bridge
(in Wakayama, Japan)

Employer : Wakayama Prefectural Government
Bridge Length : 290.0m
Bridge Span : 23.3+6.0+230.0+6.0+23.3m
Width : 7.25m (Carriageway)+3.0m (Footpath)
Bridge Type : Half-through type 2-hinged arch Bridge
Steel Tonnage : 2,479 tons
Completion : 1999

Waguura Bridge (in Mie, Japan)

Employer : Mie Prefectural Government
Bridge Length : 234.0m
Bridge Span : 232.0m
Width : 12.5m
Bridge Type : Nielsen-Lohse girder Bridge
Steel Tonnage : 2,697 tons
Completion : 2004
Features : Marine single-operation erection using barge

Shinkitakami Bridge (front) (in Iwate, Japan)

Employer : Iwate Prefectural Government
Bridge Length : 482.1m
Bridge Span : 136.0+208.0+136.0m
Width : 19.0m (Carriageway)+2@3.0m (Footpath)
Bridge Type : 3-span continuous balanced tied arch Bridge
Steel Tonnage : 4,659 tons
Completion : 2003

Kitakami Bridge (back) (in Iwate, Japan)

Employer : Iwate Prefectural Government
Bridge Length : 204.4m
Bridge Span :100.6m
Width : 5.5-7.7m
Bridge Type : Through type tied arch Bridge
Steel Tonnage : 458 tons
Completion : 1938

Cable Stayed Bridges

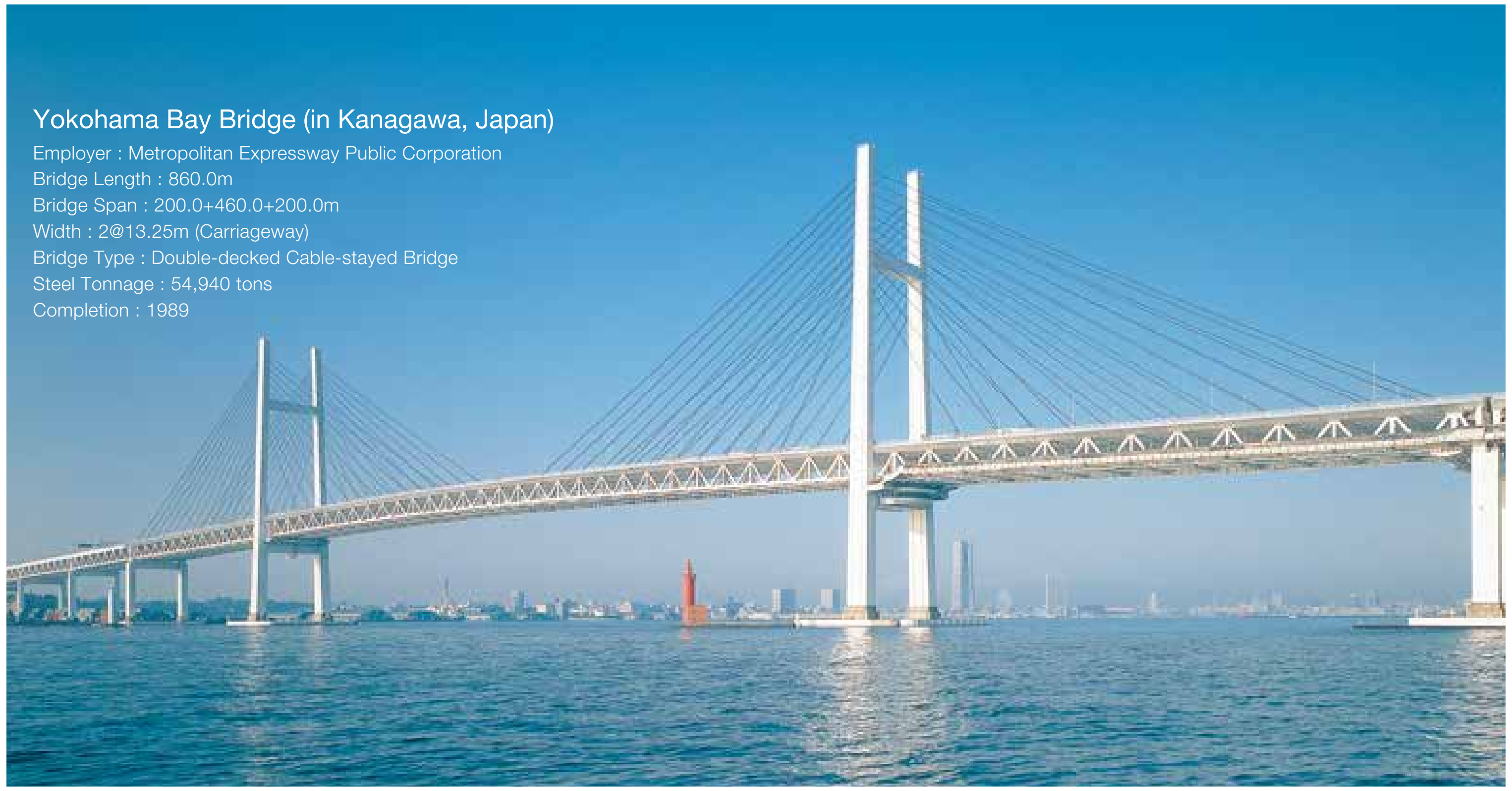
The idea of supporting the girder with diagonal hangers has long been existed. Verantius of Italy proposed a cable-stayed type of bridge in 1617. Modern cable stayed bridges began with the Strömsund Bridge (1955) in Sweden. However, they are regarded as a type that has developed especially in Germany. The world's largest cable stayed bridge is the Tatara-ohashi Bridge (1999) with a center span of 890m.

Their structure is supported diagonally upward by cables at several points in the span of the girder, and consists of main towers, cables and girders. Types of main tower include single-column, double-column, H, A, reverse-Y portal and diamond. Cable-stretching methods are divided into single-plane suspension, double-plane suspension, fan-shape and harp-shape. In this type, various unique shapes are available.

In cable stayed bridges, the bending moment of the girder can be reduced by suspending the girder with cables, and the bending moment of the girder can be further improved by introducing prestressed cables. Thus, the steel weight of the girder can be reduced. On the other hand, because of the soft structure suspended by cables, it is necessary to take care to secure wind-resistant stability. The girder's sectional shape is determined through a wind tunnel test.

General Applicable Span Length

- 130 to 500m



Yokohama Bay Bridge (in Kanagawa, Japan)
Employer : Metropolitan Expressway Public Corporation
Bridge Length : 860.0m
Bridge Span : 200.0+460.0+200.0m
Width : 2@13.25m (Carriageway)
Bridge Type : Double-decked Cable-stayed Bridge
Steel Tonnage : 54,940 tons
Completion : 1989

Shonan Ginga Bridge (in Kanagawa, Japan)
Employer : Kanagawa Prefectural Government
Bridge Length : 520.3m
Bridge Span : 106.9+242.0+106.9m
Width : 2@7.25m (Carriageway)+ 2@3.0m (Footpath)
Bridge Type : Cable-stayed Bridge
Steel Tonnage : 7,880 tons
Completion : 1996

Daishi Bridge
(in Kanagawa, Japan)
Employer : Kawasaki City
Bridge Length : 547.0m
Bridge Span : 119+202.3m
Width : 19.0m (Carriageway) +2@3.0m (Footpath)
Bridge Type : Cable-stayed Bridge
Steel Tonnage : 6,578 tons
Completion : 1996

Tatara Bridge
(in Hiroshima, Japan)
Employer : Honshu-Shikoku Bridge Authority
Bridge Length : 1,480.0m
Bridge Span : 2@50.0+170.0+890.0+270.0+50.0m
Width : 2@9.82m (Carriageway)+ 2@2.5m (Footpath)
Bridge Type : Cable-stayed Bridge
Steel Tonnage : 37,355 tons
Completion : 1998

Egyptian-Japanese
Friendship Bridge
(Suez Canal Bridge)
Employer : Arab Republic of Egypt
Bridge Length : 730.0m
Bridge Span : 41.8+50+70+404+70+50 +41.8m
Width : 2@8.15m (Carriageway)
Bridge Type : Steel–concrete composite Cable-stayed Bridge
Steel Tonnage : 8,115 tons
Completion : 2001

Shinminato Bridge
(in Toyama, Japan)
Employer : Ministry of Land, Infrastructure, Transport and Tourism Hokuriku Regional Development Bureau
Bridge Length : 600.0m
Bridge Span : 60.0+60.0+360.0+60.0+60.0m
Width : 15.0m
Bridge Type : 5-span continuous composite Cable-stayed Bridge
Steel Tonnage : 1,457 tons
Completion : 2011
Features : Cantilever erection by floating crane and traveler crane. One of the longest cable-stayed bridges on the Sea of Japan side.

Suspension Bridges

Suspension bridges, which are intended to allow passengers to cross to the other side using ropes extended between the sides, are said to have originated in ancient China. In Japan, the Kazura-bashi Bridge in Iya is famous. The first modern suspension bridge was erected by Finlay of the United States in the early 19th century. Initially, suspension bridges used eye bar chains. After the steel wire was invented, record-breaking long suspension bridges including the famous Brooklyn Bridge (1883, center span 486m) in New York were constructed one after another in the United States. The suspension bridge is a type that may always be adopted for super long bridges. Currently, the world's largest suspension bridge is the Akashikaikyo-ohashi Bridge with a center span of 1,991m. Outside Japan, a 3,000m class bridge is also planned.

A suspension bridge consists of main towers, cables, stiffening girders and anchorages. Stiffening girders are divided into a truss girder type, which is mainly adopted in the United States, and a lightweight box girder type, which was developed in England and applies aerodynamics. As with cable stayed bridges, it is necessary to take much care to secure wind-resistant stability. The wind-resistant stability of the girder and the tower is verified through a wind tunnel test. The anchorage is a huge concrete weight for settling the cables. There is also a type called self-anchoring suspension bridge, which does not use any anchorage.

General Applicable Span Length

- 150 to 2,000m

Akashi Kaikyo Bridge (in Hyogo, Japan)

Employer : Honshu-Shikoku Bridge Authority
Bridge Length : 3,911.1m
Bridge Span : 960.0+1990.8+960.3m
Width : 2@13.25m (Carriageway)
Bridge Type : Suspension Bridge
Steel Tonnage : 194,033 tons
Completion : 1997
Features : 780 N/mm^2 grade high tensile steel with low weld crack sensitivity used

Hakucho Bridge (in Hokkaido, Japan)

Employer : Hokkaido Regional Development Bureau
Bridge Length : 1,380.0m
Bridge Span : 330.0+720.0+330.0m
Width : 2@6.75m (Carriageway)
Bridge Type : Suspension Bridge
Steel Tonnage : 23.105 tons
Completion : 1996

Shimotsui-Seto Bridge

Employer : Honshu-Shikoku Bridge Authority
Bridge Length : 1,400.0m
Bridge Span : 230.0+940.0+230.0m
Width : 22.5m (Carriageway)
Bridge Type : Double-decked suspension Bridge (road traffic-railway bridge)
Steel Tonnage : 65,000 tons
Completion : 1988

Akinada Bridge (in Hiroshima, Japan)

Employer : Hiroshima Prefectural Government
Bridge Length : 1,175.0m
Bridge Span : 255.0+750.0+170.0m
Width : 2@3.75m (Carriageway)+ 2@2.0m (Footpath)
Bridge Type : Suspension Bridge
Steel Tonnage : 15,700 tons
Completion : 1999

Fatih Sultan Mahmet Bridge (Second Bosphorus Bridge) (in Turkey)

Employer : Turkey
Bridge Length : 1,090.0m
Bridge Span : 1,090.0m
Width : 28.0m (Carriageway)+2@2.8m (Footpath)
Bridge Type : Single-span Suspension Bridge
Steel Tonnage : 32,025 tons
Completion : 1988

New Traffic Systems/Monorails

Yurikamome (in Tokyo, Japan)

Employer : Tokyo
Bridge Type : New transportation system double-track continuous Box girder Bridge
Completion : 1992

Osaka Monorail (in Osaka, Japan)

Employer : Osaka
Bridge Type : Monorail double-track continuous Rail girder Bridge
Completion : 1998

Railroad Bridges

Tsukuba Express Tonegawa Bridge

Employer : Japan Railway Construction Public Corporation
Bridge Length : 897.0m
Bridge Span : 127.5+129.0+127.5m
Width : Double track
Bridge Type : through type 3-span continuous double truck truss Bridge, through type 2-span continuous double truck truss Bridge (double)
Steel Tonnage : 5,000 tons
Completion : 2003

Izumino Line Kanjo No.4 Over-Road Bridge (in Kanagawa, Japan)

Employer : Sagami Railway Co., Ltd.
Bridge Length : 60.4m
Bridge Span : 57.0m
Width : Double track
Bridge Type : Nielsen Bridge
Steel Tonnage : 353 tons
Completion : 1997

Pedestrian Overpasses/Pedestrian Decks

Yumenoohashi (in Tokyo, Japan)

Employer : Tokyo Water Front City Construction Corporation
Bridge Length : 360.0m
Bridge Span : 114.2+130.0+114.2m
Width : 38.4m
Bridge Type : 3-span continuous steel deck Box girder Bridge
Steel Tonnage : 8,543 ton
Completion : 1994

Iwase Canal Pedestrian Deck (in Toyama, Japan)

Employer : Toyama Prefectural Government
Bridge Length : 42.8m
Bridge Span : 41.8m
Width : 4.0m
Bridge Type : steel deck Box girder Bridge
Steel Tonnage : 80 ton
Completion : 1996

Kirari-Deck (Mizonokuchi Station Pedestrian Deck) (in Kanagawa, Japan)

Employer : Kawasaki city
Bridge Length : 117.0m
Bridge Span : (4.5+10.4+15.6+1.4m)+(23.4+19.6+37.0+4.7m)
Width : 8.5m
Bridge Type : Simple steel deck rigid frame Bridge
Steel Tonnage : 1,891 tons
Completion : 1998

Movable Bridges

Teiko Movable Bridge (in Kochi, Japan)

Employer : Kochi Prefectural Government
Bridge Length : 32.8m
Bridge Span : 24.1+7.6m
Width : 7.0~9.0m (Carrigeway)+2.0m (Footpath)
Bridge Type : Simple steel deck box girder Bridge (bascule bridge)
Steel Tonnage : 216 tons
Completion : 2002

New Structural Types

1. Improved Cross Sectional Arrangement of Plate Girder Bridge

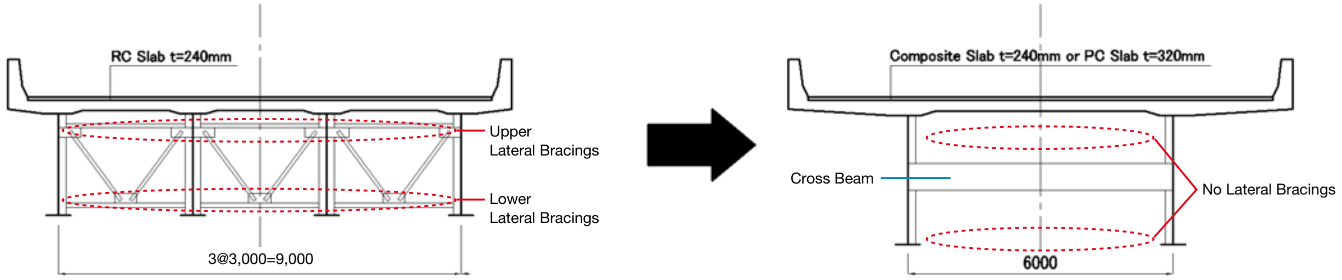
Rationalized structure, widening girder spacing and simplifying cross girders and lateral members by applying high stiffness steel-concrete composite deck slab or PC slab, to greatly reduce steel weights and welding works.

General Applicable Span Length

- 40 to 80m

Senryo Ohashi Bridge (in Nagano, Japan)

Employer: Nagano Prefectural Government
Bridge Length: 254.5m
Bridge Span: 61.2+64.0+64.0+63.7m
Width: 11.0m Steel Tonnage: 708 tons
Completion: 2000



Conventional Profile

Rationalized Profile

2. Narrow-Width Box Girder Bridge

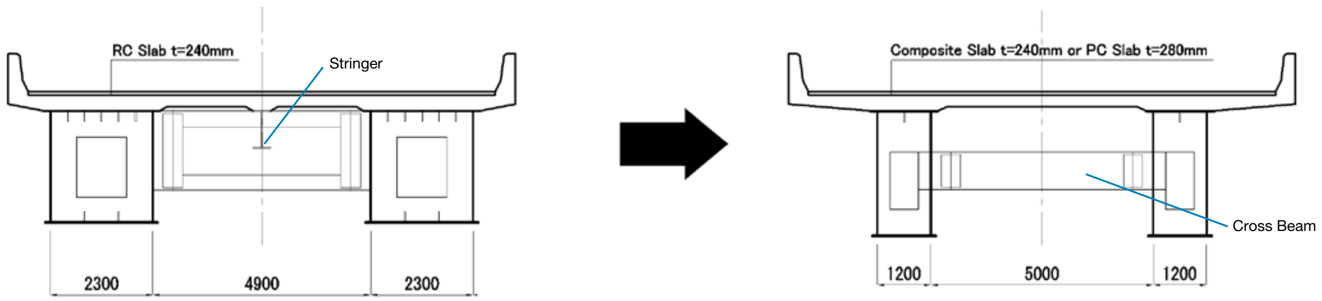
Narrow down the box width by half, meanwhile, simplify box structure such as reduction of the number of stiffeners by thickening flange plates. Furthermore, floor system enables to be drastically simplified by applying the steel-concrete composite deck slab.

General Applicable Span Length

- 60 to 110m

Shinkatsushika Bridge (in Tokyo, Japan)

Employer: Tokyo Metropolitan Government
Bridge Length: 442.0m Bridge Span: (4@55)x2m
Width: 22.65m Steel Tonnage: 1,852 tons
Completion: 1965



Conventional Profile

Rationalized Profile

3. Open Box Girder Bridge

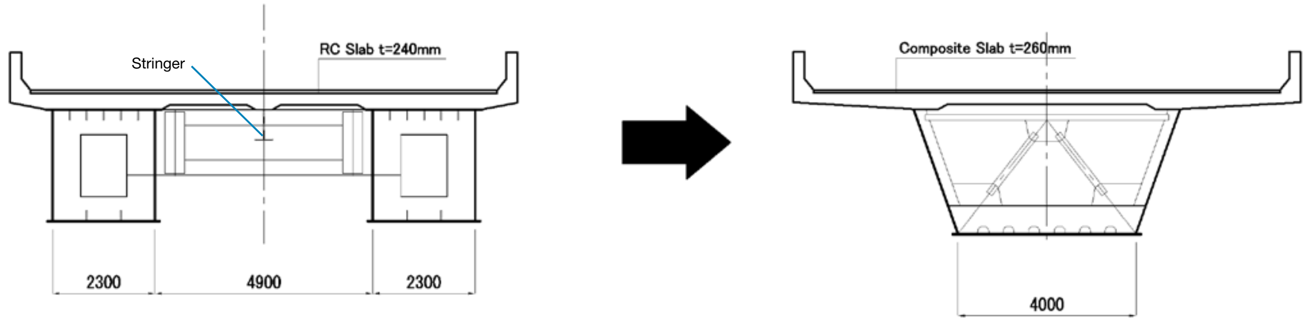
Fabric of upper flanges rationally similar to plate girders; the open box girder structurally combined with high stiffness steel-concrete composite deck slab. Floor system enables to be drastically simplified by applying the composite deck slab.

General Applicable Span Length

- 50 to 90m

Kizugawabashi Bridge (in Kyoto, Japan)

Employer: Ministry of Land, Infrastructure, Transport and Tourism Kinki Regional Development Bureau
Bridge Length: 435.5m
Bridge Span: 54.7+80.5+81.0+81.0+80.5+55.2m
Width: 13.75-24.10m
Steel Tonnage: 5,516 tons Completion: 2002



Conventional Profile

Rationalized Profile

4. Hybrid Rigid Frame

Hybrid rigid frame consists of rigidly connected frame structures between steel girder superstructure and RC piers, the seismic adequacy of which is quite improved. Additionally,support free erection method such as cantilever erection method can be applied and discard significant effects of site condition.

General Applicable Span Length

- 60 to 90m

Kohtsuki Bridge (in Ehime, Japan)

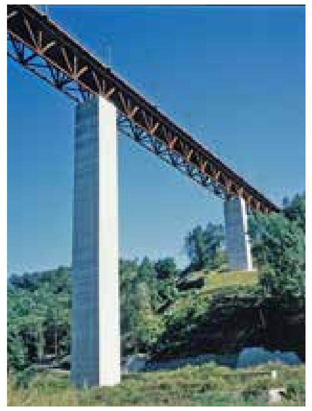
Employer: Japan Highway Public Corporation
Bridge Length: 124.8m Bridge Span: 38.0+47.5+38.0m
Width: 9.56m Steel Tonnage: 249 tons Completion: 2003

5. Rationalized Truss Bridge

Floor system comprising of stringers and brackets, can be removed or simplified by high stiffness steel-concrete composite deck slab or PC slab. Furthermore, upper lateral bracings also can be removed because the slab has enough capability to resist transversal loads.

Itabashigawa Bridge (in Nagano, Japan)

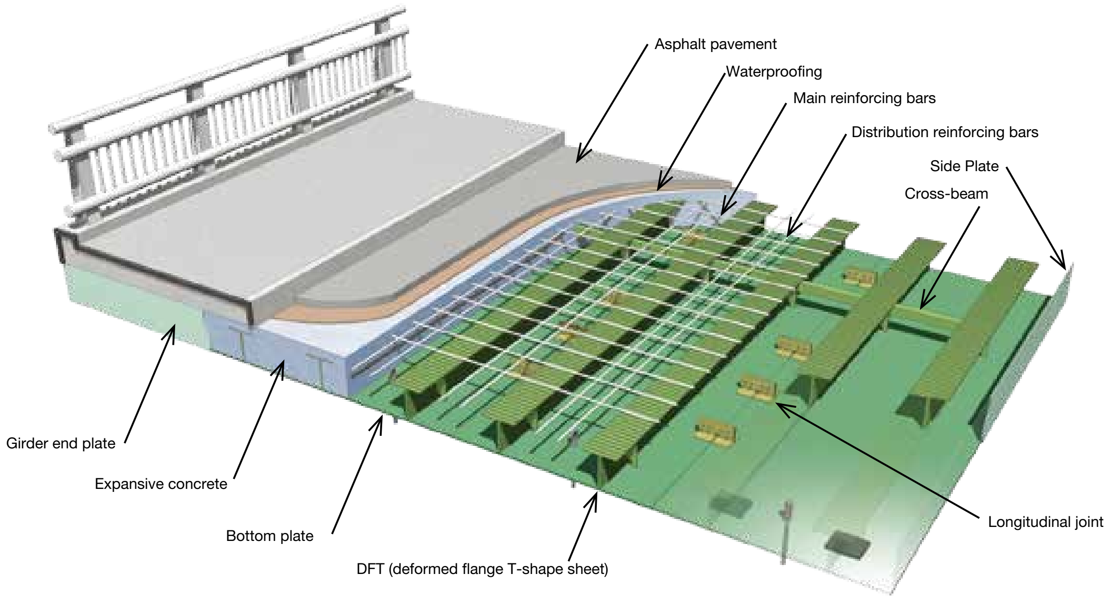
Employer: Nagano Prefectural Government
Bridge Length: 412.0m
Bridge Span: 72.8+3@88.0+72.8m Width: 10.25m
Steel Tonage: 1,420 tons Completion: 2002



River Bridge

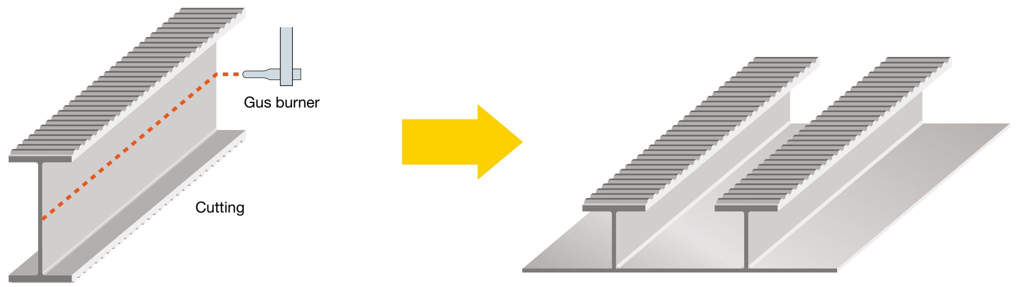
Advantage of River Bridge

River Bridge is a steel-concrete composite slab bridge system developed by JFE Engineering. By making the most of the advantage of steel and concrete materials, it realizes a low structure height that would be impossible with steel bridge or PC bridges. Over the past quarter century since the first bridge was constructed in 1981, our River Bridges have been adopted for replacement of old bridges and newly built bridges in urban rivers associated with river improvements,and for road bridges, bridges across railroad and pedestrain overpasses. We have a track record of successful erection of a total of more than 450 River Bridges throughout Japan from Hokkaido to Kyushu and Okinawa. The applicable span is approximately 10 to 40 m ,and recently, continous girders have also become available.



Overview of Structure

The most important feature of River Bridge is its low structure height. With River Bridge, it is possible to reduce the span length/height ratio to 1/30 - 1/42 and reduce the end of girder height to a minimum of approximately 30cm. The dead load before composite action of the composite structure is resisted by the steel cross-section. After composite action, the dead load and live load are resisted by the composite cross-section. With River Bridge, the steel-concrete composite action is produced by the binding force of the concrete with the DFT projections. DFT (deformed flange T-shape) is a type of T-shape steel produced from H-shapes (DFH: deformed flange H-shape) with cleat-like transversal projections on the outer flange surfaces,which are formed by rolling. DFT are manufactured by cutting DFH longitudinally in the height direction. The main girder height is adjusted by welding nesessary web plate.



Deformed Flange H-Shape rolled in mill

Deformed Flange T-Shape

Designability

Thanks to its low girder height, River Bridge has a slender, attractive appearance. Moreover, effective landscape improvement design is possible.

Workability and Safety on Site Work

With River Bridge, the erection weight is overwhelmingly lighter than with concrete-type bridges, enabling use of smaller construction equipment.
Because the structure is simple,fabrication,erection is easy and speedy.
Scaffoldings are not required because the bottom steel plate also serves as scaffoldings, except for wheel guard, increasing the safety of site workers.

Sustainability

Wooden form is not required because the bottom steel plate also serves as the deck from,except for wheel guard,contribute to the preservation of environment.

Economic Efficiency

As a composite of high tensile strength steel and high compressive strength concrete, the structure is durable. Futhermore with River Bridge's minimum maintenance specification(use of unpainted weathering steel for bottom and side plates) and low initial cost, Life Cycle Cost can be held to absolute minimum.

Construction Sequence

Placement of rubber bearings

Assembly

Erection

Re-bar work

Pouring of deck concrete

Paving

Examples of River Bridge

Kaisei Rittai Bridge (in Kanagawa, Japan)

Employer: Kanagawa Prefectural Government
Bridge Length: 115.0m
Bridge Span: 34.4+45.0+34.5 m
Width: 17.3m
Bridge Type: 3-span continuous composite slab bridge
Completion: 2013
Note: Bridge over Odakyu Electric Railway

Amasagi Bridge (in Saitama, Japan)

Employer: Urban Renaissance Agency
Bridge Length: 35.8 m
Bridge Span: 34.9 m
Width: 29.8 m
Bridge Type: Composite Slab Bridge
Completion: 2010
Note: landscape structure type, girder end expansion

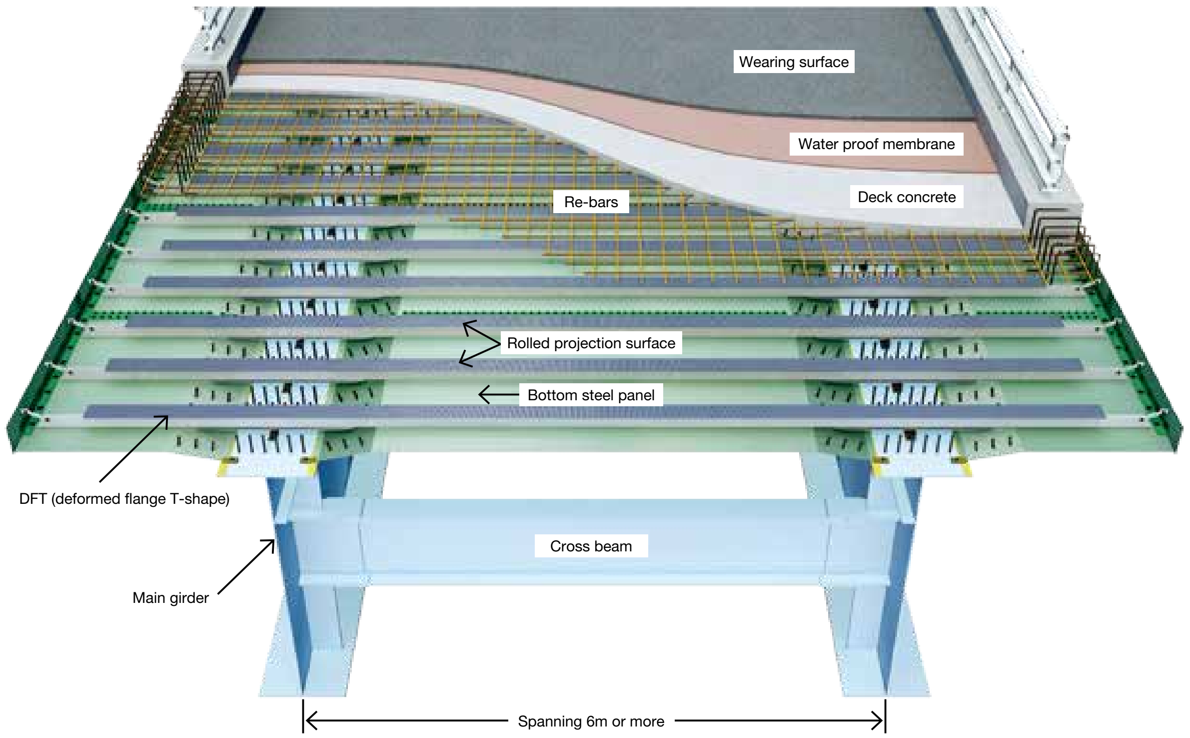
Koyama-Sengen Bridge (in Chiba, Japan)

Employer: Chiba Prefectural Government
Bridge Length: 37.0 m
Bridge Span: 36.1 m
Width: 17.8 m
Bridge Type: Composite Slab Bridge
Completion: 2009
Note: Bridge over JR railroads

River Deck Steel-Concrete Composite Deck Slab

Advantages of River Deck

River Deck is a steel-concrete composite bridge deck, using deformed flange T-shapes (DFT) for reinforcement of bottom steel panel and as shear connectors between concrete and steel member.
Rolled projection of DFT itself works as shear connectors against slippage of steel and concrete, therefore,it is unnecessary to install stud bolts on the top flange.
Composite action between concrete and DFT has been studied for 30 years. Based upon such study, River Deck was developed and employed for more than 400 bridge projects. River Deck was developed with the technology stemming from River Bridge and has been employed for 90,000m^2 bridge decks as the structure featuring reliability and safety.



Designability

High performance of River Deck enables the deck span to be wider than 6m and is an integral component of improved plate girders bridges and narrower width box girder bridges

Workability and Safety on Site Work

Steel deck panel is far lighter than pre-cast concrete deck panel. Its light weight enables to minimize the size of erection equipment. In addition, bottom steel panel works as formwork for concrete casting. No need of additional wooden formwork and scaffolding achieves shorter construction period as well as preservation of environment.

Fatigue Resistance

This River Deck has the fatigue resistance property equivalent to or more than PRC50 which is recognized as high fatigue resistance deck slab.

PRC50: One of the prestressed concrete deck slabs designed with less PC cables and under full prestressing.

Economic Efficiency

The high strength of River Deck enables the thinner deck slab which results in the reduction of steel weight of the main girders. Steel-concrete composite structure is effective to minimize the life cycle cost through appropriate maintenance work.

Periodic moving wheel load test

On-site Operations

Sealing a upper flange

Installing and adjusting a panel

Jointing a bottom plates at a site (one-side bolting)

Installing reinforcing bars

Concreting

Completion of work

Track Records of Construction

Ami Viaduct of KEN-O Expressway

Employer: Kanto Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Slab Span: 7.0 m Slab Area: 2,730 m^2 Rustproofing: C-2 paint
Bridge Type: Continuous rationalized plate girder bridge
Completion: 2006

Section 504 (Hashimoto Viaduct) of Fukuoka-Kitakyushu Expressway

Employer: Fukuoka-Kitakyushu Expressway Public Corporation
Slab Span: 6.0 m Slab Area: 4,000 m^2
Rustproofing: Zinc aluminum spray
Bridge Type: Continuous narrow-width box girder bridge
Completion: 2009

Shin-Ipponsugi Bridge of Route 47

Employer: Tohoku Regional Development Bureau, MLIT
Slab Span: 2.5 m Slab Area: 2,600 m^2 Rustproofing: C-5 paint
Bridge Type: Continuous curved box girder bridge
Completion: 2010

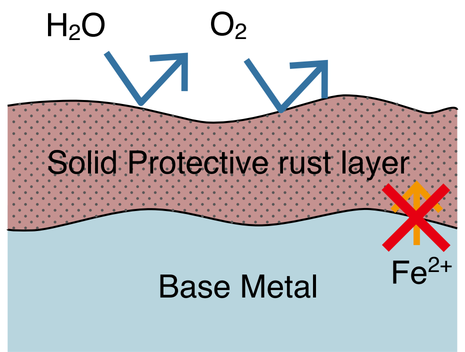
Taiyo Bridge (in Mongol)

Employer: Mongolian Government
Slab Span: 5.2 m Slab Area: 4,800 m^2 Rustproofing: C-5 paint
Bridge Type: Continuous rationalized plate girder bridge
Completion: 2011

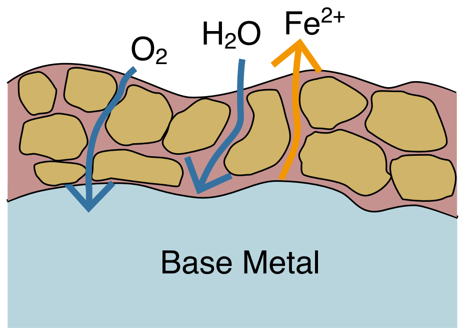
Unpainted Weathering Steel Bridge

1. Weathering Steel

Weathering steel is a high strength low alloy steel containing corrosion resistant elements such as Cu, Cr and Ni. It is developed to eliminate the need for painting, and form a stable rust-like appearance if exposed to the weather for several years.



Weathering Steel



Conventional Steel

2. Unpainted Weathering Steel Bridge

Corrosion rate of weathering steel is far smaller than conventional steel in appropriate environmental condition. Unpainted weathering steel bridge can achieve an expected service life with nominal maintenance under suitable conditions.

3. Benefits of Unpainted Weathering Steel Bridge

3-1 LifeCycle Cost Benefits

(1) Initial Cost Benefits
Cost savings from the elimination of the protective paint system outweigh the additional material costs.

(2) Maintenance Cost Benefits
Unpainted weathering steel bridges are free from burden of periodical repainting work which is essential for the conventional painted steel bridges.

3-2 Shorter Construction Period

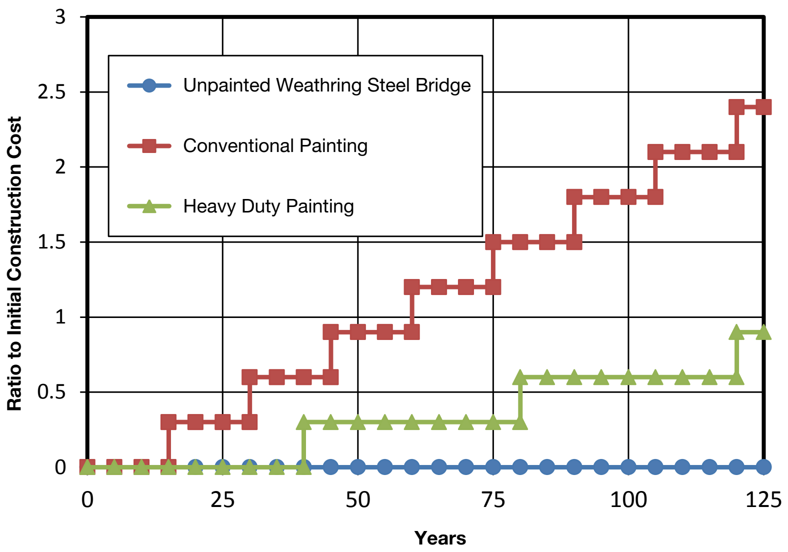
Overall construction period can be shorter, because both shop and site painting operations are eliminated.

3-3 Environmental Benefits

There are low emission of hazardous materials related both site painting and repainting work.

3-4 Safety Benefits

There are virtually no work at height for painting at working platform, and there are no access for future repainting work.



Jyougakura Bridge
(in Aomori, Japan)
Employer: Aomori Prefecture
Bridge Length: 360m
Bridge Span: 31.0+3.0+255.0+3.0+33.0+33.0m
Width: 12.3m
Bridge Type: 2 hinged arch bridge
Steel Tonnage: 3,300 tons
Completion: 1994

Yozan Bridge (in Tottori, Japan)
Employer: Tottori Prefecture
Bridge Length: 86m
Bridge Span: 42.5+42.5m
Width: 7.7m
Bridge Type: 2-span continuous plate girder bridge
Steel Tonnage: 150 tons
Completion: 2005

Nishibu Bridge
(in Fukushima, Japan)
Employer: Hokuriku Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Bridge Length: 104m
Bridge Span : 102.6m
Width: 6.2m
Bridge Type: Langer truss
Steel Tonnage: 345 tons
Completion: 2013

Overseas Bridges


Gumain Bridge (in Philippines)

Employer : Bases Conversion and Development Authority
Bridge Length : 360.0m
Bridge Span : 5.3+4@60.6+59.3m
Width : 23.0m
Bridge Type : 6-span continuous small-number main girder Bridge
Steel Tonnage : 1,930 tons
Completion : 2008
Feature : Weather-resistant steel used

Skypark (in Singapore)

Employer : Marina Bay Sands
Bridge Length : 340.0m
Bridge Span : Truss Bridge 51.0m (between Tower1 and Tower2, Tower2 and Tower3), Box Girder Bridge 54.6m (Tower3)+67.7m (Canitlever)
Width : 40.0m
Bridge Type : Box girder Bridge, etc.
Steel Tonnage : 8,056 tons
Completion : 2010
Feature : Skypark lies at a height of 200 meters atop three skyscraper towers. The steel structures has a variety of elements featuring building frames and bridge girders.

Bhumibol Bridge No.1&No.2 (in Thailand) (Industrial Ring Road)

Employer : Ministry of Transport Kingdom of Thailand
Bridge Length : No.1 702m,No2 578m
Bridge Span : No1,68.6+83.5+398+83.5+68.6m, No2,50.6+74.5+326+74.5+50.6m
Width : 36m
Bridge Type : Steel-Concrete Hybrid Cable-stayed Bridge
Steel Tonnage : 6,879 tons
Completion : 2006

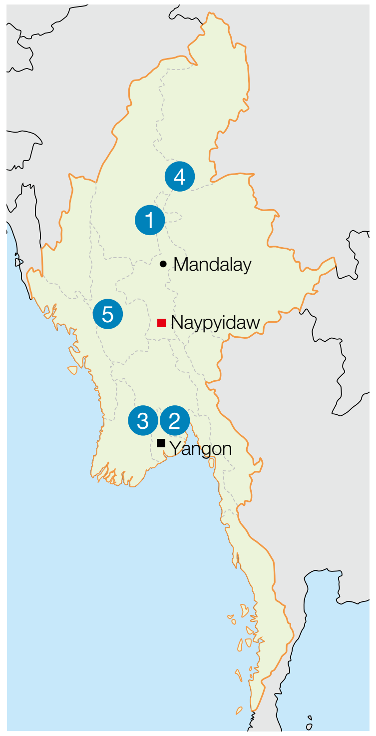
Taiyo Bridge (in Mongol)

Employer : Ministry of Road and Transport Mongolia Bridge Length : 262.0m Bridge Span : 29.5+47.0+50.0+55.0+50.0+29.5m
Width : 21.5m Bridge Type : 6-span continuous composite steel girder Bridge Steel Tonnage : 2,000 tons Completion : 2012
Feature : Largest Steel Bridge in Mongol, Composite Slab (River Deck) used

Bridges in Myanmar

1 Htee Gyaint Bridge (in Sagaing)

Employer: Ministry of Construction
Bridge Length: 1,800m
Bridge Span: 3@120m x 5 bridges
Width: 9.42m
Bridge Type: 3-span Continuous truss bridge
Steel Tonnage: 9,000 tons
Completion: 2015



2 MyayNiGone Flyover (in Yangon)

Employer: Yangon Regional Government
Bridge Length: 490m
Bridge Span: Span length 30 ~ 60m
total 11 spans
Width: 14.6m
Bridge Type: 3-span Continuous box girder, etc.
Steel Tonnage: 1,900 tons
Completion: 2015

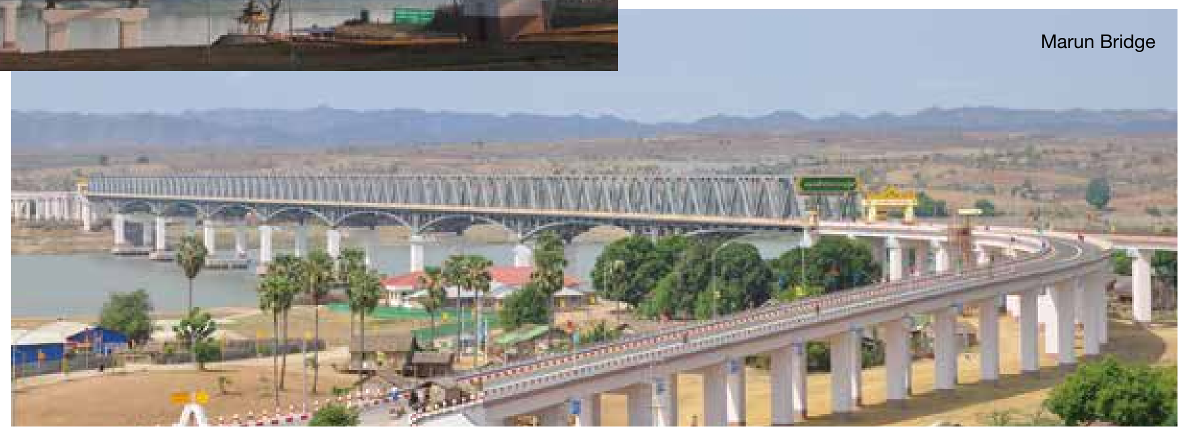
3 ShweGoneDaing Flyover (in Yangon)

Employer: Yangon Regional Government Bridge Length: 481m Bridge Span: Span length 30 ~ 46m / total 12 spans Width: 14.84m
Bridge Type: 4-span Continuous box girder, etc. Steel Tonnage: 1,500 tons Completion: 2013

Sinkhan Bridge

4 Sinkhan Bridge (in Kachin)
5 Marun Bridge (in Magwe)

Employer: Ministry of Construction
Bridge Length: 982m
Bridge Span: 96.0+2@112.0m, 3@112.0m, 2@112.0+96.0m
Width: (Road way) 9.1m, (Rail way) 4.3m
Bridge Type: 3-span Continuous truss bridge
Steel Tonnage: 9,170 tons
Completion: 2012 (Shinkhan Bridge),
2013 (Marun Bridge)
Feature: Combined bridge for railway/road



Marun Bridge

Chapter 3: Shop Fabrication and Site Erection

Shop Fabrication

(1) New-BRISTLAN

The work of preparing a fabrication drawing while taking into account the deflection due to the bridge's own weight and the elongation through fabrication (e.g., welding shrinkage, cutting margin) is called drafting, and it is a process where the manufacturer's unique fabrication know-how is condensed. At our company, each fabrication drawing is prepared by converting all information indicated in the design drawing into a database using New-BRISTLAN, which has evolved from computer-based numerical control system, BRISTLAN, we developed in-house in 1970.

The features of New-BRISTLAN are not only its ability to prepare fabrication drawings, but also its capability to integrally handle data on cutting of members and movements of a welding robot, and was an industry-leading innovative system at the time of start of its operation.

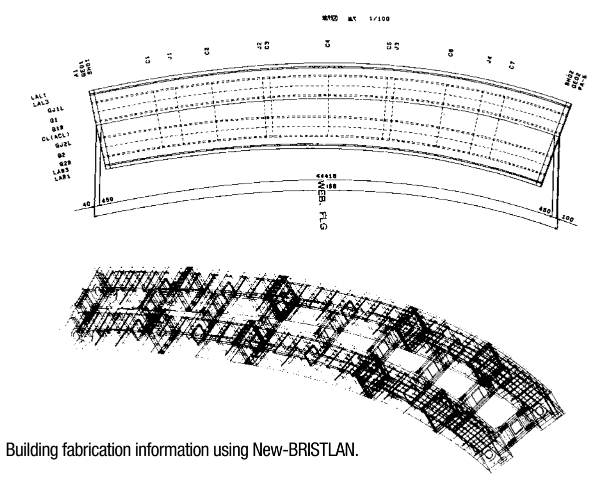
(2) Automated Equipment

In addition to New-BRISTLAN as the "brain," we have introduced various pieces of NC equipment as tools such as an automated box girder panel fabrication line and an automated plate girder fabrication line, which combine a laser cutting machine, welding robot, straightening machine and drilling machine, thus pursuing labor saving and higher quality structures. The achievement of these efforts was highly regarded, and in 1996 we received a Japanese Society of Steel Construction Award.

In addition, a high speed rotating arc welding method that we have developed in-house and is adopted in a welding robot not only is capable of performing high-current high-speed welding, but also has functions for automatically copying weld lines and automatically sensing the end by using an arc sensor. This is a creative technology that eliminates many of the teaching processes required for ordinary automated equipment (we received a "Minister of International Trade and Industry Invention Prize" of the National Invention Award in 1994).

Shop Fabrication

Drafting



Building fabrication information using New-BRISTLAN.

Cutting

Laser cutting machine: cutting members with complex shapes with high accuracy.

Panel assembly

Automated box girder panel fabrication line
Performing high-accuracy, high-quality welding using a welding robot.

Block assembly

Assembling panels into a box shape using a large overhead crane with a capacity of 50 to 150 tons.

Temporary assembly

Assembling the fabricated members, and checking the shape.

Base metal conditioning/painting

Paint shop: performing high quality painting using a function for adjusting temperature and humidity.

Site Erection

Representative methods for erecting superstructures of steel bridges include bent method, cable erection method, launching method and single-operation erection. We not only use these conventional methods, but also pursue to develop the following methods and technologies, which involve more advanced techniques.

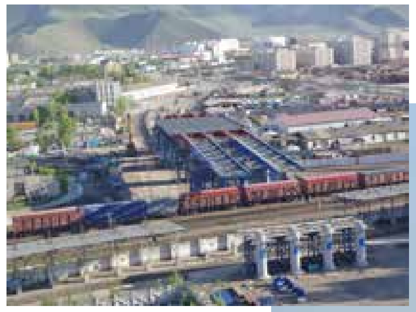
- Launching method using an air caster
- New erection methods for mountain bridges (swing method, LL method, BR method, SL method)
- Overhang erection method and swing erection method with suspension directly under the main girder of suspension bridge
- Rapid replacement method for urban viaduct
- Rapid grade separation erection technology with superstructure-substructure integrated bridge
- System for driving cable-stayed bridge cables
- Mobile formwork system for PC slabs

Site Erection

Cable erection method

Swing erection method for main girder of suspension bridge

Rapid erection with heavy lift



Launching erection method

Cantilever erection method

Chapter 4: Maintenance

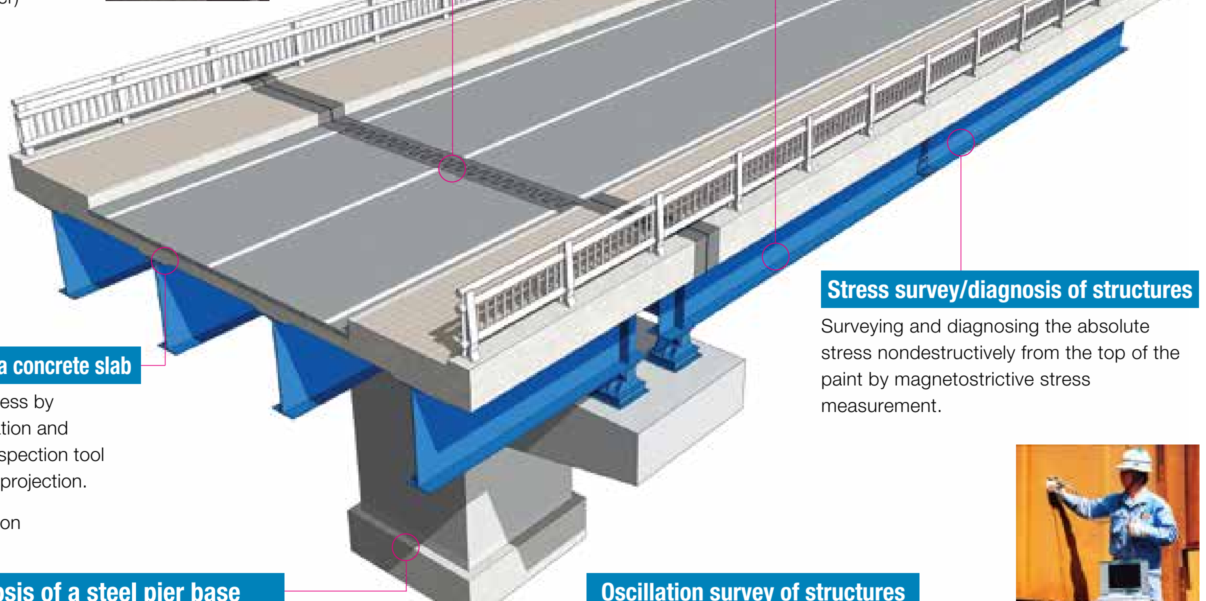
The basics of maintenance are to survey and grasp the present state of the bridge. The service life of a structure can be extended by understanding the state of damage through periodical survey (inspection, measurement and monitoring), and performing repair or reinforcement based on appropriate diagnosis and evaluation.

The JFE Group has established a system for responding to any need by utilizing a broad range of technologies in civil engineering, construction, and electrical, chemical, and mechanical engineering, etc., for survey, diagnosis and repair techniques.

Flow from Survey to Repair

Survey (inspection, measurement and monitoring) → Diagnosis/Evaluation → Planning/Design → Execution (repair / reinforcement)

Examples of Survey, Diagnosis and Repair Techniques



Survey/diagnosis of a steel expansion joint

Diagnosing the soundness using an IR heating image processing method, focused ultrasonic inspection and tapping measurement technologies.

- Expansion joint replacement (made of steel, rubber)

Survey/diagnosis of coating deterioration

Surveying the coating deterioration before rust development, and proposing a repainting timing.

Stress survey/diagnosis of structures

Surveying and diagnosing the absolute stress nondestructively from the top of the paint by magnetostrictive stress measurement.

Survey/diagnosis of a concrete slab

Diagnosing the soundness by measuring a crack location and dimensions using an inspection tool based on optical scale projection.

- Repair by resin injection

Survey/diagnosis of a steel pier base

Diagnosing a steel pier base by measuring the depth and sectional area of corrosion using a powerful ultrasonic flaw detector.

- Corrosion prevention and repair using a light curing resin (UV curing resin)

Oscillation survey of structures

High-frequency oscillation or the like occurring on a structure can be remotely measured using an LDV (laser Doppler velocimeter).

Examples of Reinforcing Technologies

Seismic performance improvement

Installation of a bridge collapse preventing system, shoe replacement, girder coupling, pier reinforcement, etc.

Load bearing capacity improvement (TL25 support)

Deck reinforcement through girder addition and steel plate bonding, conversion to steel plate deck, etc.

Bridge collapse preventing system, shoe replacement

Deck reinforcement through girder addition and steel plate bonding

Chapter 5: Works

Tsu Works

At Tsu Works where fabrication machines and equipment are efficiently arranged on an industry-leading vast land, various pieces of automated equipment such as an automated box girder panel fabrication line are operating, and a system for fabricating large steel structures such as bridges, building frames, water gates / penstocks, and jackets has been established.

Tsurumi Works

Tsurumi Works has been developed as a central entity of the Keihin industrial area since its establishment in 1916, and has served to function as the engineering center with technical development sections, design sections and public works sections.

J&M Steel Solutions Co., Ltd

J&M Steel Solutions is a joint venture set up by JFE Engineering Corporation and the Ministry of Construction of Myanmar. J&M Steel Solutions has been contributing to the infrastructure development not only in Myanmar but also in the Indian Ocean Rim region by supplying high quality steel structures since April 2014.