

Development of design and construction technologies for long-span bridges and contributions to advancing bridge maintenance and management methods for local governments



Shin Narui
(Fujiken Engineering Design Center Co., Ltd.)

Reasons for the Award

After graduating from Hokkaido University, Shin Narui studied abroad in West Germany, earning his doctorate (Dr.-Ing.) under Professor Fritz Leonhardt at the University of Stuttgart. Concurrently, he translated Leonhardt's world-renowned masterpiece *Vorlesungen ueber Massivbau*, publishing it as the six-volume Leonhardt Concrete Lecture Series through Kashima Publishing. This work contributed significantly to the advancement of PC technology in Japan. Upon returning to Japan, he joined the Honshu-Shikoku Bridge Authority and devoted himself to the construction of the North-South Bisan Seto Ohashi Bridge and the Akashi Kaikyo Bridge. Recently, he has been actively contributing to the maintenance and management of bridges for local governments.

In developing design and construction techniques, he shifted bridge types from truss bridges to cable-stayed bridges, considering the scenic beauty of the Seto Inland Sea's archipelago, thereby creating and constructing long-span cable-stayed bridge technology. As a construction manager for suspension bridges, he oversaw detailed design, fabrication, and erection, contributing to the completion of world-class projects. Subsequently, he conducted inspections and diagnostics for numerous bridges in local municipalities, incorporating his findings into Fukushima Prefecture's Bridge Inspection Manual.

At the 2023 Annual Symposium of the PC Engineering Society held in Koriyama City, he delivered a keynote lecture titled "Learning Bridge Maintenance from Germany." He shared the latest insights with technical experts on issues such as stress corrosion in heat-treated PC strands in Europe and the application of new prestressing materials, leaving a profound impression.

As described above, the results of his continuous and enthusiastic activities have significantly contributed to the advancement of bridge technology, making him worthy of the Civil Engineering Society Tanaka Award.

Development of Design and Construction Techniques for New Structural Forms in PC Bridges and Their Contribution to International Expansion



Akio Kasuga
(Sumitomo Mitsui Construction Co., Ltd.)

Reasons for the Award

Akio Kasuga joined Sumitomo Construction Co., Ltd. (now Sumitomo Mitsui Construction Co., Ltd.) in 1980. As a prestressed concrete (PC) bridge engineer, he pioneered the development of concrete bridge construction technology in Japan and actively worked to advance and promote this technology both domestically and internationally.

He has consistently pursued challenges in new structures and technologies. Representative examples include establishing and implementing the design technology for an extradosed bridge at the Odawara Blueway Bridge, pioneering the application of a self-anchored PC composite truss bridge for road use at the Seoun Bridge, and developing the butterfly web structure using high-strength fiber-reinforced concrete to achieve lightweight and high-durability bridges, first adopted at the Terasako Butterfly Bridge. The implementation of these world-first bridge structures has been highly acclaimed both domestically and internationally. Each bridge received the Japan Society of Civil Engineers Tanaka Award in the Works Category. Furthermore, the Odawara Blueway Bridge won the FIP Award, while the Seoun Bridge and Terasako Butterfly Bridge became the first in Asia to receive the fib Award Grand Prize. For these achievements, he personally received the Fresnay Trophy and the Albert Caquot Prize from the French Society of Civil Engineers. He served as a long-standing member of the fib Presidium and became its President from 2021 to 2022, the first non-European or North American to hold this position.

Through these activities, his contributions to the technological advancement of PC bridge construction in Japan and the enhancement of Japan's international standing in bridge engineering are exceptionally significant. Consequently, he has been recognized as deserving of the Tanaka Prize from the Japan Society of Civil Engineers.

Contributions to the Development and Durability Improvement of Prestressed Concrete Bridges



Hiroshi Mutsuyoshi
(Emeritus Professor, Saitama University)

Reasons for the Award

Hiroshi Mutsuyoshi's achievements in prestressed concrete (PC) bridges can be divided into three main areas. The first involves research using new materials (FRP) as alternatives to PC steel, proposing design methods and other approaches. The second area concerns his work on externally cable-stayed PC bridges. He proposed analytical methods and design equations while elucidating the characteristics of externally cable-stayed PC bridges using precast members. Furthermore, he developed a highly eccentrically externally cable-stayed bridge, an evolution of the externally cable-stayed structure, and constructed the world's first such bridge in Hokkaido. The third area concerns PC bridge durability research, experimentally clarifying the load-bearing characteristics of actual PC girders after 40 years and the effectiveness of grout re-injection. For these research achievements, he has been awarded the Japan Society of Civil Engineers Yoshida Prize (3 times), the Tanaka Prize (2 times), the PC Engineering Society Paper Award, and the same Society's Technical Development Award. Furthermore, the research findings have been incorporated into the design manuals and guidelines of various academic societies. He is also highly regarded internationally, having chaired the publication of fib Bulletin 89, "Acceptance of Cable Systems Using Prestressing Steels" for the International Federation of Concrete (fib). In Vietnam, he has led seminars on bridges as the Japanese representative every two years since 2007, actively promoting the overseas transfer of Japanese PC technology.

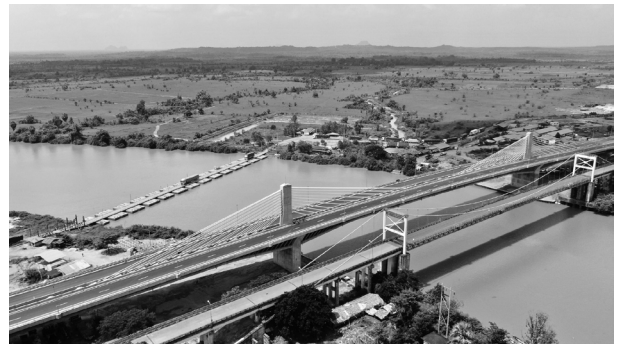
Through these activities, he has achieved significant research results in advancing PC bridges and enhancing their durability. Furthermore, his leadership role within academic societies and other organizations is exceptionally significant. For these reasons, he is recognized as deserving of the Tanaka Award from the Japan Society of Civil Engineers.

Jain Kokhla Bridge

Contractee	Ministry of Construction, Bridge Department, Republic of the Union of Myanmar
Designer	Central Consultant Inc., Eight-Japan Engineering Consultants Inc. Japan Bridge & Structure Institute, Inc., Katahira & Engineers International Co., Ltd. Dia Nippon Engineering Consultants Co., Ltd., TOP Engineering International
Constructor	Hazama Ando Corporation and PS Construction Co., Ltd. Joint Venture

Reasons for the Award

The Jain Kokhla Bridge is a seven-span bridge consisting of a main bridge with an integrated upper and lower deck structure (PC3 continuous corrugated steel plate web extradosed bridge) and approach bridges at its ends with an integrated upper and lower deck structure (steel 2-span continuous few-plate girder bridge). The main bridge features a central span length of 180m. Its single-sided suspension stays ensure unobstructed views from the deck while serving as a local landmark.



The main girders of the main bridge section adopt a double-cell box girder cross-section. To accommodate the wide deck slab (four lanes, 22,690m) with integrated upper and lower deck structures, external struts made of reinforced concrete (RC) are positioned to support the cantilevered deck slab from the lower edge of the outer web. Additionally, internal struts with PC reinforcement are positioned near the stay anchorages to distribute vertical shear forces from the stays from the middle web to the outer web. Furthermore, the adoption of corrugated steel plate webs lightens the superstructure, enabling the realization of a longer central span. The use of weather-resistant steel eliminates the need for repainting. The stay cables employ triple anti-corrosion specification, field-fabricated multi-strand cables (15.7 mm × 37 strands), ensuring high durability and consideration for future maintenance. For the cantilever construction of the main girders, large blocks up to 8m in length were used. Construction was performed using an ultra-large mobile construction vehicle (maximum capacity 22,500 kN·m), contributing to a shortened construction period.

As described above, this bridge is a large-scale structure even when compared to other bridges in Japan. Furthermore, its bridge design incorporates diverse domestic technologies. For these reasons, it was recognized as deserving of the Tanaka Award from the Japan Society of Civil Engineers.

Tanaka Award

Bridge Design and Construction Category

Futami Bridge (Phase II Line)

Contractee	West Nippon Expressway Company Limited Shikoku Branch
Designer	Eight-Japan Engineering Consultants Inc., KAJIMA CORPORATION, FUJI P.S CORPORATION Specific Construction Works Joint Venture
Constructor	KAJIMA CORPORATION, FUJI P.S CORPORATION Specific Construction Works Joint Venture

Reasons for the Award

Futami Bridge (Phase II Line) is a PC4 continuous balanced arch bridge spanning a steep valley with a total length of 232.3m. This bridge employs an inverted Langer configuration, where the stiffening girder's rigidity exceeds that of the arch ribs. To harmonize with the landscape



and surrounding environment, it adopts the same basic form as the existing line (Phase I Line): an upper-deck curved arch bridge. Furthermore, considering structural integrity, economy, and constructability based on the position of the substructure for the main span (P2 to P3) crossing the Ashigawa River, it was designed as an irregular balanced arch bridge with the P2 pier constructed using double cantilever launching and the P3 pier using single cantilever launching.

The superstructure was constructed using the truss cantilever erection method. For this method, a new mobile work vehicle was developed to enable the placement of scaffolding around the arch ribs. By applying an unprecedented technique where the stiffening girders were erected ahead of the arch ribs, safety and constructability were ensured during the construction of the steeply inclined arch ribs, which had a maximum slope of 46°. To reduce the construction schedule, the bottleneck process of erecting vertical members in the truss cantilever erection method was addressed by adopting a steel-reinforced concrete (SRC) construction method. This involved forming the truss with steel and advancing the cantilever erection, followed by encasing it with concrete.

For this bridge's construction, a digital twin utilizing virtual completion in a digital space via 4D-CIM (a 3D model depicting the timeline linked to the construction schedule) was employed. This facilitated the identification and preemptive resolution of construction issues, thereby accelerating the schedule.

As described above, the outstanding efforts in the design and construction of this bridge, utilizing advanced technologies, constitute a work that contributes to the future development of bridge construction. It is therefore recognized as deserving of the Tanaka Award from the Japan Society of Civil Engineers.

Large-scale renewal of the Tomei Tamagawa Bridge

Contractee	Central Nippon Expressway Company Limited
Designer	OBAYASHI CORPORATION, OBAYASHI ROAD CORPORATION, Tomei Expressway (Specific Renewal, etc.) Tomei Tamagawa Bridge Deck Replacement Construction Project Specific Construction Joint Venture, Construction Project Consultants, Inc.
Constructor	OBAYASHI CORPORATION, OBAYASHI ROAD CORPORATION, Tomei Expressway (Specific Renewal, etc.) Tomei Tamagawa Bridge Deck Replacement Construction Project Specific Construction Joint Venture

Reasons for the Award

The Tomei Tamagawa Bridge is located near the starting point of the Tomei Expressway and is a critical bridge on a major route with a traffic volume of approximately 100,000 vehicles per day. During the deck replacement work, minimizing social impact by avoiding traffic congestion was essential. However, widening the shoulders—a standard practice to maintain the number of lanes—was difficult due to nearby land constraints.



This bridge overcame these challenges by utilizing the following new technologies. It applied a five-part deck replacement in the width direction without widening, renewing the deck in a short time while maintaining the number of lanes.

① A deck joint structure using Ultra-High Strength Fiber Reinforced Concrete (UFC) was applied both along the bridge axis and perpendicular to it, reducing labor and shortening the construction schedule.

② For deck joints located in lanes requiring nighttime construction and daytime traffic reopening, a joint structure using precast (PCa) UFC slabs was adopted, enabling same-day traffic reopening.

③ PCa-made UFC composite deck slabs, featuring UFC with excellent density overlaid on concrete, were applied. This eliminated the need for on-site waterproofing work, shortening the construction schedule.

④ The self-propelled deck erection machine enabled installation, assembly, deck removal, and erection within a single lane closure zone, reducing work time.

⑤ The introduction of a virtual construction simulator optimized personnel, machinery, and procedures, enabling reduced labor and shorter on-site work times.

As described above, this outstanding approach to the design and rapid construction of bridge deck replacement utilizing advanced technologies contributes to the future development of bridge renewal and repair. It is therefore recognized as deserving of the Civil Engineering Society Tanaka Award.

Large-scale renewal of the Kire Uriwari Bridge

Contractee Hanshin Expressway Company Limited

Designer TAISEI-FUJI P.S-MMB Mixed-Type Construction Joint Venture

Reasons for the Award

The Kire Uriwari Bridge on the Hanshin Expressway Route 14 Matsubara Line was replaced from a PC3-span continuous hinged box girder bridge (Divider Bridge) to a steel 3-span continuous steel deck box girder bridge to ensure long-term durability and improve maintainability. The project involved closing a section of the expressway for two and a half years. Construction methods were employed to minimize disruption to residents' lives directly above a heavily trafficked urban intersection, enabling the removal of the PC box girder bridge and the erection of the new steel box girder bridge.



The PC box girder bridge removal employed a newly developed aerial-only removal technique, completing the removal of approximately 6,500 tons of concrete structures in about 21 months from the start of the closure. This method enabled removal with minimal disruption to traffic at the intersection directly below.

Furthermore, the installation of the new steel box girder bridge maximized the use of adjacent girders and the construction yard. By employing construction methods that minimized impact on the heavily trafficked intersection, utilizing multi-axle transporters, etc., the bridge deck work, including paving, was completed within approximately 9 months after the bridge removal was finished. This was achieved by implementing a total closure of the intersection directly below the bridge for a total of 4 nights.

The new steel box girder bridge is a steel deck box girder bridge. It adopts the structural detail of "high-performance replacement steel deck panels," which feature full-perimeter fillet welding at the intersections of longitudinal and transverse ribs. This ensures high durability as a steel deck. Furthermore, the use of high-strength plate-head bolts at the joints on the bridge deck improves pavement maintainability and ride quality.

As described above, this project represents a large-scale renewal at a major intersection on a heavily trafficked arterial road. Recognized as a work contributing to the technological advancement of future large-scale renewals, it was deemed worthy of the Tanaka Award from the Japan Society of Civil Engineers.