公益社団法人 土木學會 Japan Society of Civil Engineers

Committee on Steel Structures

No. 2, 2025

Newsletter

Contents

Contents ... 1

Message from the Committee ... 1

Publications ... 3

- Technology to make Maintenance compatible with Aesthetics in Steel Bridge (Steel Structures Series 38) ... 3
- Renovation, Renewal, and Disaster Restoration of Steel Bridges - Examples and Commentary - (Steel Structures Series 39) ... 3
- Maintenance and Management Technology for Orthotropic Steel Bridge Decks - Retrofitting, Fatigue strength evaluation, Application to replacement deck panels - (Steel Structures Series 40) ... 4
- Recommendations for Erection Design and Construction of Steel Structures - 2024 ... 4

Research ... 5

- About Subcommittees ... 5
- List of Reports on This Issue ... 5
- Summary of “Research Report on the Approach to Public Relations” ... 5

Awards ... 8

- Introduction to JSCE Award Related to Steel Structures: The Tanaka Award ... 8
- The Tanaka Award (Division of Professional Bridge Engineer Recognition) ... 9
- The Tanaka Award (Division of Outstanding Research Publication) ... 13
- The Tanaka Award (Division of Outstanding Bridge Design, Construction and Retrofit, New Construction) ... 14
- The Tanaka Award (Division of Outstanding Bridge Design, Construction and Retrofit, Existing Bridge) ... 20
- The Tanaka Award (Division of Outstanding Bridge Technologies) ... 24
- References on The Tanaka Award ... 29

For More Information ... 29

From the Last Issue ... 29

Disclaimer ... 29

Editors ... 30

Message from the Committee

Advancing Steel Structure Research for a Sustainable Infrastructure Future

Mr. Kazuyuki Mizuguchi, Yokogawa Bridge Corporation

Former Chair, Committee on Steel Structures, JSCE

Note: Mr. Kazuyuki Mizuguchi served as the former chair of Committee on Steel Structures of Japan Society of Civil Engineers, during which time he proposed this newsletter, leading to its publication.

Committee on Steel Structures of Japan Society of Civil Engineers conducts research and surveys on steel materials and steel structures within the field of civil engineering and collaborates with other associations to contribute to the advancement of academic knowledge and technology.

Japan is a small island nation densely populated by 100 million people, supporting high-density economic activity. Particularly during the period of rapid economic growth in the 1960s, the development of infrastructure such as roads and railways supported the increase in freight transport, while the development of ports and airports supported imports and exports with overseas markets. This enabled Japan's economy to achieve remarkable development. During this time, research and technological development in the field of steel structures made significant contributions to the construction of long span bridges.

Times have changed, and Japan now faces an era of infrastructure renewal. Bridges built in the 1960s and 1970s have been in service for over 50 years, and an increasing number require major structural updates like replacement or deck renewal. A characteristic of Japanese passenger and freight transportation is a heavy reliance on major arteries like expressways and bullet trains. For example, highways like the Tomei and Meishin, built in the 1960s, handle daily traffic volumes of up to 100,000 vehicles. Major disruptions to these highways due to disasters or other incidents would cause significant societal disruption. This reality means that even when renewing aging structures, it is essential to minimize closures and traffic restrictions, striving to maintain current traffic conditions as much as possible during the renewal process. While this constraint in structural maintenance imposes significant cost burdens, the need for renewal within limited time and space has driven extensive technological development in areas like precast construction and rapid construction methods. Although various advancements in rapid construction technology have been reported, further development is anticipated, including improvements in cost efficiency and safety.

Additionally, research on steel structures has shifted from focusing solely on new infrastructure construction to encompassing maintenance activities like inspection, repair, and renewal. This research now aims to contribute to sustainable societal activities, such as reducing environmental impact, protecting natural environments, and achieving carbon neutrality. Steel structures, by addressing fatigue and corrosion issues, can withstand long-term use beyond their design service life and offer significant advantages in terms of recyclability. Alongside research on extending service life and enhancing durability, we will advance studies on structures and maintenance methods aimed at minimizing Whole Life Carbon. This will help achieve the United Nations' goal of carbon neutrality by 2050.

We also hope that by disseminating various research findings on steel structures through this newsletter, we can contribute to global research in this field.

Yours sincerely,
Kazuyuki MIZUGUCHI
Former Chair, Committee on Steel Structures, Japan Society of Civil Engineers (JSCE)

Deck replacement work on the six-lane section of the Chugoku Expressway

Publications

Committee on Steel Structures published: Technology to make Maintenance compatible with Aesthetics in Steel Bridge (Steel Structures Series 38) in June 2023 (Figure 1), Renovation, Renewal, and Disaster Restoration of Steel Bridges - Examples and Commentary - (Steel Structures Series 39) in October 2024 (Figure 2), Maintenance and Management Technology for Orthotropic Steel Bridge Decks - Retrofitting, Fatigue strength evaluation, Application to replacement deck panels - (Steel Structures Series 40) in November 2024 (Figure 3), and Recommendations for Erection Design and Construction of Steel Structures - 2024 in January 2025 (Figure 4). These publications are introduced below.

Technology to make Maintenance compatible with Aesthetics in Steel Bridge (Steel Structures Series 38)

Figure 1 Technology to make Maintenance compatible with Aesthetics in Steel Bridge

The importance of maintenance for steel bridges is increasing, with mandatory inspections becoming standard. However, the installation of necessary maintenance equipment can significantly impact on the aesthetics and value of bridges, necessitating careful consideration. Therefore, through the investigation of the latest technologies and existing cases both domestically and internationally regarding facilities, this document introduces influences on the value from the point of maintenance and aesthetics. Concretely, this document deals with drainage facilities, inspection equipment, suspended scaffolding fittings, lighting equipment, guardrails and handrails, as well as seismic resistance components and repair and reinforcement materials. The aim is to propose appropriate utilization methods and implementation through a case study format. This document will serve as a useful reference for consideration at each stage of steel bridge planning, design, construction, and maintenance.

Renovation, Renewal, and Disaster Restoration of Steel Bridges - Examples and Commentary - (Steel Structures Series 39)

Figure 2 Renovation, Renewal, and Disaster Restoration of Steel Bridges - Examples and Commentary –

A new publication featuring the latest case studies and explanatory documents on the renewal, renovation, and disaster recovery of steel bridges has been released. When carrying out renewal or renovation work on existing bridges, there are often strict constraints on construction methods, and the construction process becomes highly complex. Additionally, ensuring safety and usability at each construction step requires advanced and multifaceted technical expertise. This book investigates and organizes recent large-scale cases of steel bridge renewal, renovation, and disaster recovery, clearly summarizing the considerations for selecting construction methods, design principles, specific construction techniques, and the technologies and innovations employed to overcome constraints. We highly recommend this book to all engineers involved in the renewal, renovation, and disaster recovery of existing steel bridges.

Maintenance and Management Technology for Orthotropic Steel Bridge Decks - Retrofitting, Fatigue strength evaluation, Application to replacement deck panels - (Steel Structures Series 40)

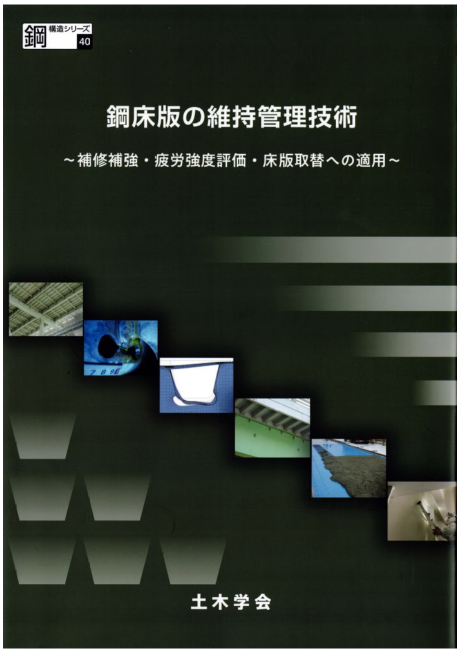


Figure 3 Maintenance and Management Technology for Orthotropic Steel Bridge Decks

The findings of Subcommittee on Maintenance and Renewal of Orthotropic Steel Decks have been compiled. This report consists of three parts. Part 1, "Maintenance and Management of Orthotropic Steel Decks," introduces repair and reinforcement methods for fatigue damage to orthotropic steel decks that are being established by expressway companies and other organizations, along with actual examples. Part 2, "Fatigue Strength Evaluation Methods for Welded Joints of Orthotropic Steel Decks," compiles research examples related to fatigue strength evaluation of orthotropic steel decks and presents fatigue analysis cases targeting actual bridges. Part 3, "Replacement of Steel Orthotropic Steel Decks," introduces cases of replacing aging reinforced concrete slabs with orthotropic steel decks, and outlines considerations from the perspectives of planning, design, and construction. This book is intended as a reference for bridge engineers involved in the maintenance of orthotropic steel decks or the renewal of reinforced concrete slabs.

Recommendations for Erection Design and Construction of Steel Structures - 2024

Figure 4 Recommendations for Erection Design and Construction of Steel Structures - 2024

We have made significant revisions of "Recommendations for Erection Design and Construction of Steel Structures" to incorporate latest technical standards and findings. Since the previous revision in 2012, major accidents during steel bridge construction have highlighted the need for further safety measures. Additionally, "Specifications for Highway Bridges" in Japan have undergone a significant change in design methodology, shifting from the allowable stress design method to the limit state design method using a partial factor format. This revision takes these changes into account, introducing and enhancing safety measures from the initial stages of construction planning, and providing detailed explanations of the specific application methods of the partial factor method in construction design, along with calculation examples. On the other hand, considering that the allowable stress design method may continue to be used for temporary structures, the revised guidelines include updated versions of the previous verification methods and calculation examples as supplementary materials.

Research

About Subcommittees

Committee on Steel Structures establishes subcommittees as necessary to conduct surveys and research, and holds lectures and symposiums as needed, and presents research results.

List of Reports on This Issue

The following report was published in 2024 and briefly introduced on this issue.

Category	Other
Report	Research Report on the Approach to Public Relations
Committee	Subcommittee on Public Relations Methods Research in Steel Structure Committee

Other reports (in Japanese):

http://library.jsce.or.jp/Image_DB/committee/steel_structure/index.html

Summary of "Research Report on the Approach to Public Relations"

This subcommittee was established in September 2020 to investigate the approach to civil engineering public relations. Members include civil engineering academics and experts, as well as individuals with experience in information sharing within the communications field. They have repeatedly discussed the issues and ideal state of civil engineering public relations. A major problem with civil engineering public relations is that much like distributing research papers at movie theaters, the target audience is often undefined, consequently, many efforts lack a clear strategy.

A major problem facing the civil engineering industry is the "decline in young people's interest in civil engineering." The number of young people entering civil engineering departments and pursuing careers in the field is decreasing year by year, raising concerns about a shortage of personnel to support civil engineering. Universities are finding that unless they change the name of their civil engineering departments, they cannot attract students necessarily. Why does the appeal of Civil Engineering—designing structures and creating cities—not resonate with young people in Japan? Regarding society's perception of civil engineering, the minutes from the founding period of Japan Society of Civil Engineers record a pointed remark by its president, Professor Yasoshima: "Why are architectural engineers called in Japanese 'KENCHIKU-KA', yet civil engineers are only called 'DOBOKU-YA'?". He likely believed civil engineering should be called "DOBOKU-KA" who oversee a discipline's technologies, rather than "GIJUTSU-YA" who sell individual skills at a shopfront.

Some people view the purpose of civil engineering public relations as merely a means of information exchange among society members, but this is a significant misconception. Public relations are "building good relationships with the public or society through information disclosure." The essence of public relations lies in building good relationships through two-way communication with external stakeholders. Civil engineers (those perceived as such), as the disseminator, must not only convey their achievements to the recipients—people unfamiliar with civil engineering—but also consider how to foster an appreciation for civil engineering as "a technology that supports people's lives". To achieve this, we have organized the public relations strategy as follows: first, determining the target audience; next, selecting the information they want; and finally, choosing the methods and means to effectively communicate it.

This report consists of seven chapters and appendices. Chapter 1 explains the "Role of Civil Engineering Public Relations." The role of civil engineering public relations is to share the enjoyment of civil engineering with those unfamiliar with it, and this chapter explains how to achieve that. Chapter 2, "Assessment of the Current Situation", identifies the current state and challenges of public relations efforts by organizations like Japan Society of Civil Engineers and Committee on Steel Structures, pointing out areas needing change. The key point is to "define targets and pursue information sharing strategically and continuously." Chapter 3 presents examples of strategic public relations initiatives in civil engineering. Public relations strategies should vary depending on the audience. Several case studies are presented in boxes, explaining their key success factors. Chapter 4 is "Information Selection." In information sharing, it is crucial to discard unnecessary information and share necessary information. This chapter explains how to select information that is valuable to the audience (Figure 5).

Figure 5 The image of distinguishing between those who need information and those who are unaware they need it

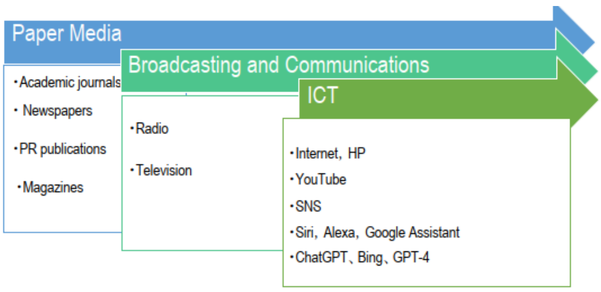


Figure 6 Changes in Communication Methods

Figure 7 Examples of displays at events such as university open campuses

Chapter 5, "Public Relations Methods," presents specific methods for information sharing and provides the theoretical framework for the public relations case studies introduced in Chapter 2. Public relations methods have significantly changed in response to the recent shift towards a networked society (Figure 6).

Traditionally, success was measured by whether the recipient noticed and read the message, but can't we expect others to take action to become interested and search for information themselves? When recipients empathize and become information disseminators themselves, the information spreads further. This type of information-diffusion-based public relations has emerged. In here, the role of "ambassadors" who facilitate communication, referred as influencers on network, becomes crucial.

Furthermore, Chapter 6 compiles PR case studies aimed at "building empathy with young people," a key target audience for civil engineering PR (Figure 7).

Chapter 7 synthesizes the content from Chapters 1 to 6 into proposals regarding the approach to PR for Committee on Steel Structures. This report primarily offers proposals for PR methods to share the appeal of civil engineering with those unfamiliar with the field, particularly younger generations.

Throughout, it is crucial to remember that the foundation of public relations lies not in "targets, selection, and methods," but in the "interesting nature of the content itself," and it is vital that the audience 'relates' to this content. To achieve this, narrative explanations that make the audience feel the "story of civil engineering" is a problem relevant to them and that they are participants are considered effective. For instance, even when reporting on bridge construction, instead of simply stating "AA Bridge completed, see Figure X," conveying how the bridge connects to people's lives—why a bridge was needed now, how it changes one's daily life—and incorporating human interest stories can foster empathy. Techniques for creating such empathy through public relations are emphasized in Chapter 3. As mentioned in Chapter 5, among the "8 Public Relations Capabilities," new competencies are now required, such as information creation capability (the ability to share and internalize one's own appeal within the organization, develop it into a narrative, and communicate it), public relations organizational capability, and relationship-building capability (the ability to establish positive relationships with others) , beyond merely appealing to external audiences. Organizational information analysis, public relations evaluation, and feedback should also be prioritized. Organizational information analysis, evaluation of public relations, and feedback should also be focused on.

Finally, the appendices in the report include examples of event-typed PR initiatives conducted externally by society and feedback received from participants. Appendix 1 contains the report from Japan Society of Civil Engineers Discussion Meeting “Awareness of Young People in Civil Engineering.” Appendix 2 outlines the discussion meeting “The Appeal, Future Development, and Potential of Civil Engineering.” Appendix 3 presents the paper “Analysis of the Current State of JSCE Public Relations Events and Direction for Events Targeting High School Students.” Appendix 4 introduces the planning and feedback for a summer school program for junior and senior high school girls. Furthermore, Appendix 5 contains a public relations proposal titled “Building Good Relationships,” created within this committee. We hope these reports serve as a reference for new civil engineering outreach that shares the appeal of civil engineering with those unfamiliar with the field.

Link to the report (in Japanese):
http://library.jsce.or.jp/Image_DB/committee/steel_structure/bklist/66134.html

◇ ◇ ◇

Awards

Introduction to JSCE Award Related to Steel Structures: The Tanaka Award

The late Dr. Yutaka Tanaka, the first head of Bridge Division of Board of Capital Reconstruction / Bureau of Reconstruction during the reconstruction of the capital following the Great Kanto Earthquake in 1923, is widely known even today as the man responsible for the construction of many famous bridges familiar to the general public that have become symbols of Tokyo. These include the Eitaibashi and Kiyosubashi bridges spanning the Sumida River. At that time, Dr. Tanaka was an authority on bridge and structural societies. In light of his achievements, it would be fitting to call him the father of Japan's bridge and steel structure industries.

After the passing of Dr. Tanaka, his family contributed to Japan Society of Civil Engineers (JSCE) a fund for the purpose of promoting his profession. In 1965, following the earlier initiative by volunteers, it was proposed to set up a venture to commemorate the professor's achievements, 'Dr. Yutaka Tanaka Commemorative Foundation'. Since then, numerous individuals and groups have contributed further donations to the fund. Using these donations, JSCE, on behalf of the Commemorative Foundation, decided to award an annual prize, 'Japan Society of Civil Engineers Tanaka Award, for excellence in bridge and steel structure engineering, In 1966, the awarding of The Tanaka Award, which is just one of the JSCE Awards, was started. Over the last fifty years or more, numerous volunteers, together with the assistance and cooperation from many other people, have helped establish this award as one of extremely high honor and value, and have also contributed greatly to the dissemination of bridge engineering technology.

The Tanaka Award is made up of the following four awards:

(1) Division of Professional Bridge Engineer Recognition (Engineer Division)

Awarded in recognition of outstanding achievement for the advancement and development in the field of bridge engineering. This Award was created in 1993, so it is relatively new, but has already established itself, having been awarded to some of the most eminent bridge engineers in the country.

(2) Division of Outstanding Research Publication (Paper Division)

This Award is selected of a paper (thesis or academic report) presented in a JSCE publication, relating to the planning, design, fabrication, construction, maintenance administration, invention of devices, or history etc. of bridges, and which is recognized for the significant contribution it makes to the development of bridge engineering.

(3) Division of Outstanding Bridge Design, Construction and Retrofit (Project Division)

A bridge, or related structure, whose planning, design, construction, retrofit or otherwise, is selected in recognition of its special features. This Award, acknowledging that the collaboration of many people is involved in producing a bridge, is different from other JSCE Awards in that it is not awarded to a single individual, but rather to the grouping of the developer, designer, contractor and entire organization responsible for producing the work.

(4) Division of Outstanding Bridge Technologies (Technology Division)

Aimed at recognizing outstanding or innovative technologies applied to bridges or similar structures, which exhibit distinctive features in aspects such as planning, design, fabrication, construction, maintenance, renovation, restoration, demolition, and removal, and contribute to the advancement of bridge engineering.

Reference (in Japanese):
https://committees.jsce.or.jp/tanaka_sho/node/3

The Tanaka Award (Division of Professional Bridge Engineer Recognition)

"Contribution to the Development of New Design and Construction Technologies for PC Bridges and Their Global Deployment"

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

Dr. Akio Kasuga joined Sumitomo Construction Co., Ltd. (now Sumitomo Mitsui Construction Co., Ltd.) in 1980 and has since played a leading role as an engineer specializing in prestressed concrete (PC) bridges, contributing significantly to the advancement of concrete bridge construction technologies both in Japan and internationally.

Throughout his career, Dr. Kasuga has consistently pursued challenges in up-to-date structural designs and construction methods. Notable achievements include the establishment and implementation of design techniques for extradosed bridges in the Odawara Blue Way Bridge, the first application of a self-anchored PC composite truss bridge to a road bridge in the Seiun Bridge, and the development of the butterfly web structure, which aims at reducing weight and enhancing durability using ultra-high-strength fiber-reinforced concrete, first adopted in the Terasako Chocho Bridge.

These pioneering bridges, the first ones in the world, have garnered acclaim not only in Japan but also abroad. All of the above-mentioned bridges have received The Tanaka Award, Project Division, from Japan Society of Civil Engineers (JSCE). Additionally, the Odawara Blue Way Bridge won the FIP Award, while both the Seiun Bridge and the Terasako Chocho Bridge received the fib Award for Outstanding Concrete Structures—the first time such honors were awarded to projects from the Asian region.

Dr. Kasuga's individual contributions have also been recognized globally. He has received the Freyssinet Trophy and the Albert Caquot Award from Association Française de Génie Civil (AFGC). He served for many years as a Presidium Member of Fédération Internationale du Béton (fib) and was appointed its President for the 2021–2022 term, becoming the first non-Western individual to hold the position.

Through these achievements, Dr. Kasuga has made outstanding contributions to the development of PC bridge construction technology in Japan and to the enhancement of Japan's international standing in bridge engineering. His accomplishments are deemed highly worthy of The Tanaka Award of Japan Society of Civil Engineers.

◇ ◇ ◇

"Contribution to the Advancement and Durability Enhancement of Prestressed Concrete Bridges"

Hiroshi Mutsuyoshi (Professor Emeritus, Saitama University)

Professor Hiroshi Mutsuyoshi has made significant contributions to the development of prestressed concrete (PC) bridges in three primary areas. First, he conducted pioneering research on the use of new materials such as fiber-reinforced polymers (FRP) as substitutes for traditional prestressing steel, proposing appropriate design methodologies. Second, he achieved notable advancements in external prestressed concrete bridges by developing analytical and design techniques and clarifying the behavior of such bridges when precast members are employed. He also developed the innovative concept of the large eccentric external cable system and led its first-ever implementation in a bridge constructed in Hokkaido, Japan. Third, his work on the durability of PC bridges included experimental investigations into the load-bearing capacity of real PC girders after 40 years of service and the effectiveness of regrouting for durability enhancement.

In recognition of these research achievements, Professor Mutsuyoshi has received numerous honors, including three JSCE Yoshida Awards, two Tanaka Awards, the JSCE and Prestressed Concrete Engineering Association (PCEA) Paper Awards, and the PCEA Technology Development Award. His research has also been incorporated into technical standards and guidelines issued by academic and professional societies.

Internationally, he has been highly regarded and served as the chairperson responsible for the publication of fib Bulletin 89, "Acceptance of Cable Systems Using Prestressing Steels." Since 2007, he has played a central role in promoting Japanese PC bridge technology abroad by organizing biennial bridge engineering seminars in Vietnam as the representative from Japan. As a result, he has focused on transferring Japanese PC technology overseas.

Through these extensive contributions, Professor Mutsuyoshi has greatly advanced the technical development and durability of PC bridges while also demonstrating leadership in academic and professional circles. His accomplishments are deemed highly worthy of The Tanaka Award of Japan Society of Civil Engineers.

◇ ◇ ◇

" Contribution to the Development of Design and Construction Technologies for Long-Span Bridges and Advancement of Bridge Maintenance Practices in Local Governments"

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

Dr. Shin Narui graduated from Hokkaido University and pursued further studies in West Germany, earning a doctoral degree (Dr.-Ing.) under Professor Fritz Leonhardt at the University of Stuttgart. During this time, he translated Leonhardt's globally renowned work Vorlesungen über Massivbau, which was published in Japan as the six-volume series Concrete Lectures by Leonhardt by Kajima Publishing, significantly contributing to the development of Japan's prestressed concrete (PC) technology. Upon returning to Japan, he joined the Honshu-Shikoku Bridge Authority and devoted himself to the construction of the North–South Bisan-Seto Bridge and the Akashi Kaikyo Bridge. More recently, he has actively contributed to the maintenance of municipal bridges.

In the area of design and construction technology development, he played a pivotal role in shifting bridge types from truss bridges to cable-stayed bridges, taking into account the scenic beauty of the Seto Inland Sea's many islands. This led to the creation and establishment of long-span cable-stayed bridge technology. As a construction manager for a suspension bridge project, he oversaw detailed design, fabrication, and erection work, contributing significantly to the successful completion of a world-class project. Subsequently, he conducted inspections and diagnoses for many municipal bridges, contributing to the Fukushima Prefecture's Bridge Inspection and Survey Manual.

At the 2023 Annual Symposium of the Prestressed Concrete Engineering Association held in Koriyama City, he delivered a keynote lecture titled "Learning Bridge Maintenance from Germany." There, he shared cutting-edge insights with professional engineers, including issues of stress corrosion in heat-treated PC wires in Europe and the application of new tensioning materials, leaving a strong impression on attendees.

In recognition of his continuous and enthusiastic efforts, which have made significant contributions to the advancement of bridge engineering, Dr. Narui is deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.

◇ ◇ ◇

"Technical Guidance for Road Bridge Administrators, Revisions of Technical Standards, and Publication of Technical Books on Bridges"

Minoru Fujiwara

Since joining the Ministry of Construction in 1967, Mr. Minoru Fujiwara has been engaged in numerous bridge-related surveys and research at the Bridge Research Laboratory of the Public Works Research Institute and in the field, refining his technical expertise. Based on these accomplishments, he has consistently responded to the technical requests of road administrators. He also played a central role in the development of the Specifications for Highway Bridges, the key technical standard for road bridges in Japan, by conducting necessary research and investigations, and coordinating with relevant organizations through discussions within the Japan Road Association's Bridge Committee and other forums.

He has participated as a member or chairperson in over 15 technical committees for major bridge projects, including the Honshu-Shikoku Bridges, the Trans-Tokyo Bay Highway, the Hakucho Bridge, the Isewangan Expressway, and the Tokyo Bay Entrance Road. Moreover, following the March 1991 Hiroshima New Transit Bridge Girder Collapse Accident, he contributed to formulating countermeasures as a member of the investigation committee. He also conducted on-site inspections and provided guidance on safety measures for over ten bridges with potential safety concerns, including the Oumi Bridge in Yamaguchi Prefecture and the Minato-Shinbashi Bridge at Nagoya Port, playing a key role in enhancing structural safety.

In 2024, Mr. Fujiwara published two highly valuable reference works: Notes on the Structural Forms of Modern Bridges and A History of Bridge Types, both of which are recognized as important contributions to bridge engineering literature.

Given his leadership in Japanese road bridge engineering over more than half a century, and the profound impact of his work, Mr. Fujiwara is recognized as a highly deserving recipient of The Tanaka Award from Japan Society of Civil Engineers.

◇ ◇ ◇

The Tanaka Award (Division of Outstanding Research Publication)

Preventive Maintenance Measures Against Fatigue Cracks at Welded Joints of Sole Plates of Steel Bridges

Yuichiro NIWA[1], Kazuo TATEISHI[2], Takeshi HANJI[2], Masaru SHIMIZU[2] ([1] West Japan Railway Company, [2] Nagoya University): Japanese Journal of JSCE, No.80, Vol.5, 23-00234, 2024.

https://doi.org/10.2208/jscejj.23-00234

This paper focuses on toe cracks and root cracks that occur at the front face of sole plate welds and examines preventive maintenance measures against both types of cracks. Based on stress measurements near the front face of sole plate welds in 377 actual bridge bearings under train passage, the study investigates countermeasures using finite element analysis and fatigue test. It demonstrates that peening treatment is effective in preventing toe cracks, while controlling the displacement gap between the sole plate and lower flange using tapped bolts (tapped bolt method) is effective in preventing root cracks.

Furthermore, the authors quantitatively evaluate the fatigue life of sole plate welds when both methods are applied. For toe cracks, peening treatment satisfies fatigue limit of B-class design curve; for root cracks, a fatigue design curve is proposed using displacement gap size as a parameter.

The novelty of this study lies in proposing simple preventive maintenance measures for fatigue cracks in sole plate welds, which have previously been addressed only with post-failure interventions. In particular, the originality is evident in demonstrating that fatigue life can be extended by suppressing the displacement near the root using tapped bolts. In conclusion, this paper is both pioneering and innovative. It establishes preventive maintenance techniques for fatigue damage in existing bridges and presents highly practical approaches that can be applied in the design of new bridges. Accordingly, the paper is recognized as a valuable contribution to the advancement of bridge engineering and is deemed deserving of The Tanaka Award from Japan Society of Civil Engineers.

Study on Limit State of Steel Girders Subjected to Shear Forces from Functional Aspect, Focusing on the Behavior of the Corner Angles of Steel Girder Panels

Kenta ONO[1], Mamoru SAWADA[1], Takeshi MIYASHITA[2], Takashi TAMAKOSHI[3] ([1] Public Works Research Institute, [2] Nagoya Institute of Technology, [3] National Institute for Land and Infrastructure Management): Japanese Journal of JSCE, Vol. 79, No. 10, 22-00310, 2023.

https://doi.org/10.2208/jscejj.22-00310

This paper presents a shear loading test conducted on steel I-girders and investigates the behavior corresponding to Limit State 2, as defined in the Specifications for Highway Bridges. A mechanical model representing this state is proposed, and based on parametric analyses using the model, a strength evaluation formula for Limit State 2 is derived.

Research on steel I-girders subjected to shear force was actively conducted in the 1960s and 1970s, primarily aimed at proposing ultimate strength formulas. However, little progress has been made since then. This study is novel in that it is the first to focus on Limit State 2, which lies between Limit State 1 (elastic limit) and Limit State 3 (ultimate limit). The paper introduces a new mechanical model representing the resistance mechanisms at this state, including tensile resistance due to diagonal tension fields, compressive resistance at steel panel corner zones, and the resistance of a framework composed of flanges, stiffeners, and cooperating web plates. The validity of this model is verified through shear loading tests.

Furthermore, the proposed strength evaluation formula derived from the model is confirmed to be accurate through parametric analyses, demonstrating its practical applicability. These findings contribute significantly and academically to the fields of structural mechanics and bridge design.

In conclusion, the paper makes a substantial academic and practical contribution to the realization of rational design of steel bridges based on the limit state design method and is deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.

The Tanaka Award (Division of Outstanding Bridge Design, Construction and Retrofit, New Construction)

Futami Bridge (Phase II Line)

Client:
Shikoku Branch, West Nippon Expressway Co., Ltd.

Designer:
Joint Venture of Kajima Corporation and Fuji P.S Corporation, and Eight-Japan Engineering Consultants Inc.

Contractor:
Joint Venture of Kajima Corporation and Fuji P.S Corporation

The Futami Bridge (Phase II Line) is a 232.3-meter-long, four-span continuous prestressed concrete balanced arch bridge constructed across a steep valley.

This bridge adopts an inverted Langer-type configuration in which the stiffness of the stiffening girder surpasses that of the arch ribs. To harmonize with the surrounding landscape and environment, it follows the basic form of a deck-type curved arch bridge similar to the existing Phase I line. In consideration of structural characteristics, cost-effectiveness, and constructability—particularly with regard to the location of the substructure across the Ashitani River—the design incorporates an asymmetrical balanced arch: the P2 pier features cantilevers on both sides, while the P3 pier is cantilevered on one side only.

The superstructure was constructed using the truss cantilever erection method. A newly developed movable platform enabled safe access around the outer circumference of the arch ribs, allowing the application of an unprecedented technique in which the stiffening girders were erected prior to the arch ribs. This ensured safety and efficiency even with the steeply inclined arch ribs, which reached a maximum gradient of 46 degrees. To address a common bottleneck in the truss cantilever erection process—the construction of vertical members—an SRC (steel-reinforced concrete) structure was used. Steel members were first used to form the truss during cantilever erection, and concrete was cast later, resulting in a shortened construction timeline.

During the bridge’s construction, a digital twin was employed by means of 4D-CIM (a time-sequenced 3D model synchronized with the construction schedule), allowing virtual completion within a digital space. This enabled early identification and resolution of potential construction issues, thus expediting the overall project.

Given its outstanding initiatives in the design and construction of the bridge using advanced technologies, this project is recognized as a significant contribution to the future development of bridge construction and is therefore deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.

◇ ◇ ◇

Izushima Bridge

Client:
Onagawa Town; Road Division of the Department of Civil Engineering, Miyagi Prefecture; Eastern Civil Engineering Office, Miyagi Prefecture

Designer:
JFE Engineering Corporation, Dia Nippon Engineering Consultants Co., Ltd.

Contractor:
JFE Engineering Corporation, Hashimototen. Co., Ltd., Higashi Nihon Concrete Co., Ltd.

The Izushima Bridge is a 364-meter-long steel through-arch bridge connecting Izushima Island, an isolated island in Onagawa Town, Miyagi Prefecture, with the mainland. With a main span of 314 meters, it is the largest of its kind in eastern Japan. The concept for this bridge dates back nearly half a century, but the necessity of the bridge as a "lifeline" was reaffirmed after residents were isolated for a prolonged period due to the Great East Japan Earthquake. The project was launched in 2015.

Implemented through a design-build contract, the project aimed to improve quality while reducing costs. The bridge was designed with a focus on enhanced durability and maintainability. Durability measures include the use of metal spraying combined with heavy-duty protective coatings for external surfaces, improved salt protection through on-site welding, and the adoption of aluminum accessories. For maintainability, the design minimized the number of structural components, set structural heights and member arrangements conducive to inspection, and optimized the placement of inspection facilities.

To ensure resilience against disasters, the lower end of the arch rib was positioned above the planned tsunami height to avoid collision with tsunami-borne debris. Given the high volume of marine traffic in the construction area, a sea-based bent was installed to minimize regional impact. After constructing the side spans, the 2,800-ton main span was erected in a single block using the float-in method (FC method). Despite the approximately 7-kilometer towing distance from the assembly yard and the challenging meteorological and oceanographic conditions of the open sea, the erection was safely completed.

In conclusion, this bridge project not only realized a high-quality infrastructure deeply rooted in the local community as a "lifeline bridge" following the disaster, but also stands as a significant contribution to future bridge construction practices. It is thus deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.

Gyaing-Kawkareik Bridge

Client:
Department of Bridge, Ministry of Construction, Republic of the Union of Myanmar

Designer:
Central Consultant Inc., Eight-Japan Engineering Consultants Inc., Japan Bridge & Structure Institute, Inc., Katahira & Engineers International, Dia Nippon Engineering Consultants Co., Ltd., TOP Engineering International

Contractor:
HAZAMA ANDO CORPORATION and PS Construction Co., Ltd. JV

The Gyaing-Kawkareik Bridge comprises a main bridge with a three-span continuous PC extradosed girder using corrugated steel webs and an approach bridge consisting of two-span continuous steel plate girders. Both the main and approach bridges feature an integrated superstructure accommodating both traffic directions, totaling seven spans. The main span reaches 180 meters, and the single-plane cable stays not only ensure clear panoramic views from the bridge deck but also serve as a landmark in the region.

The main girder of the central bridge is a twin-cell box girder supporting a wide deck (22.690 m, four lanes) with integrated directional flow. Reinforced concrete outer struts are installed to support the cantilevered sections extending from the lower edges of the outer webs. To distribute vertical shear forces from the stay cables from the inner to the outer web, post-tensioned concrete inner struts are installed near the cable anchorages. The use of corrugated steel webs reduces the overall weight of the superstructure, enabling a longer central span. Additionally, weathering steel is used to eliminate the need for repainting, enhancing durability.

For the stay cables, multi-strand (15.7 mm × 37 strands) site-fabricated cables with triple-layer corrosion protection are employed to ensure high durability and facilitate future maintenance. In the cantilever erection of the main girder, large blocks up to 8 meters in length were used, and an ultra-large movable scaffolding system (maximum capacity of 22,500 kN·m) enabled efficient construction and reduced the construction period.

In summary, the Gyaing-Kawkareik Bridge is a large-scale infrastructure project even by domestic standards, incorporating a diverse array of advanced Japanese technologies. As such, it is recognized as a highly deserving recipient of The Tanaka Award from Japan Society of Civil Engineers.

◇ ◇ ◇

The Tanaka Award (Division of Outstanding Bridge Design, Construction and Retrofit, Existing Bridge)

Kire-Uriwari Bridge Major Renewal

Client:
Hanshin Expressway Co., Ltd.

Designer and Contractor:
Taisei, Fuji P.S, and MMB Joint Venture for Construction Work of Different Types

The Kire-Uriwari Bridge on the Hanshin Expressway Route 14 Matsubara Line was replaced from a PC three-span continuous rigid frame box girder bridge (Dywidag bridge) to a steel three-span continuous steel box girder bridge, aiming to ensure long-term durability and improve maintainability. The project required a full closure of a section of the expressway for two and a half years. Despite being located above a heavily trafficked urban intersection, the removal of the existing PC box girder and the installation of the new steel box girder were accomplished with minimal disruption to civic life.

For the removal of the PC box girder, a newly developed aerial dismantling method was employed, completing the removal of approximately 6,500 tons of concrete structures within 21 months of road closure. This method allowed for the demolition to be conducted with minimal interference to the traffic at the intersection below.

The new steel box girder was erected using a method that made full use of adjacent girders and construction yards. Heavy-duty transporters and other equipment enabled the erection of the superstructure over four nighttime full closures of the intersection below. Pavement and other deck work were completed just nine months after the demolition was finished.

The new steel deck structure adopted a high-durability "High-Performance Steel Deck Panel for Replacement," featuring full fillet welds at intersections of longitudinal and transverse ribs. On the deck surface, countersunk high-strength bolts were used for splices, enhancing maintainability and drivability.

Given the large-scale renewal over a critical intersection with extremely high traffic volume, and the application of advanced engineering techniques, this project is recognized as a significant contribution to the advancement of bridge renewal technologies. Therefore, it is deemed worthy of The Tanaka Award from Japan Society of Civil Engineers.

Tomei-Tamagawa Bridge Major Renewal

Client:
Tokyo Regional Head Office, Central Nippon Expressway Co., Ltd.

Designer:
Joint venture of Obayashi Corporation and Obayashi Road Corporation for Construction of Tomei Tamagawa Bridge, Construction Project Consultants, Inc.

Contractor:
Joint venture of Obayashi Corporation and Obayashi Road Corporation for Construction of Tomei Tamagawa Bridge

The Tomei-Tamagawa Bridge is located near the starting point of the Tomei Expressway, one of the most critical routes in Japan, carrying approximately 100,000 vehicles per day. The deck replacement project aimed to minimize the social impact by avoiding traffic congestion. However, widening the shoulders—normally done to maintain the number of lanes during construction—was infeasible due to land constraints near the site.

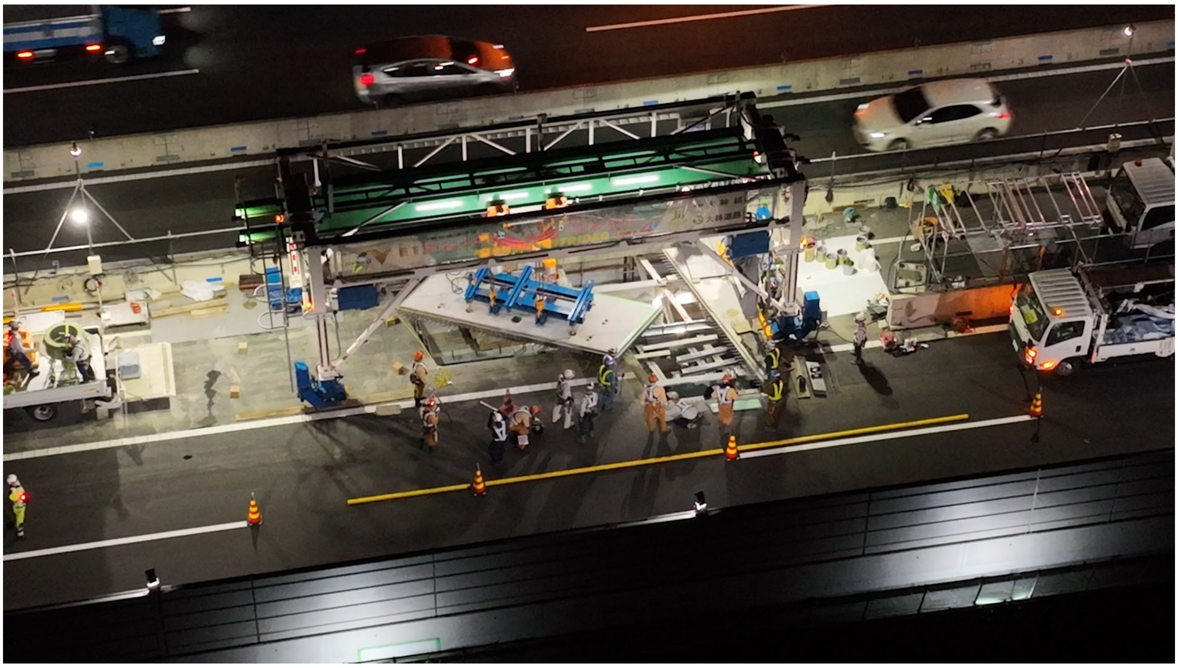
To overcome this challenge, the project implemented the following advanced technologies, enabling the replacement of the deck in five transverse segments without widening and while maintaining the number of lanes. This allowed for rapid deck renewal within a limited time frame:

1. Ultra-high strength Fiber-reinforced Concrete (UFC) joints were applied both longitudinally and transversely to reduce on-site work and shorten the construction schedule.
2. For deck joints located in lanes that required daytime traffic access following night work, precast UFC panels were used, enabling same-day traffic reopening.
3. Composite precast UFC deck panels, with a highly dense UFC top layer, eliminated the need for waterproofing work on-site, further shortening the construction time.
4. A self-propelled deck erection machine, operable within a single-lane closure, enabled efficient removal and installation of deck panels, minimizing work time.
5. A virtual construction simulator was introduced to optimize worker assignments, equipment usage, and procedures, leading to reduced labor requirements and construction time.

This innovative application of advanced technologies in the design and rapid execution of deck replacement work is recognized as a significant contribution to the future of bridge renewal and

rehabilitation. Accordingly, the project is deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.

Given the large-scale renewal over a critical intersection with extremely high traffic volume, and the application of advanced engineering techniques, this project is recognized as a significant contribution to the advancement of bridge renewal technologies. Therefore, it is deemed worthy of The Tanaka Award from Japan Society of Civil Engineers.



The Tanaka Award (Division of Outstanding Bridge Technologies)

Seismic Retrofit Technology for BP Bearings

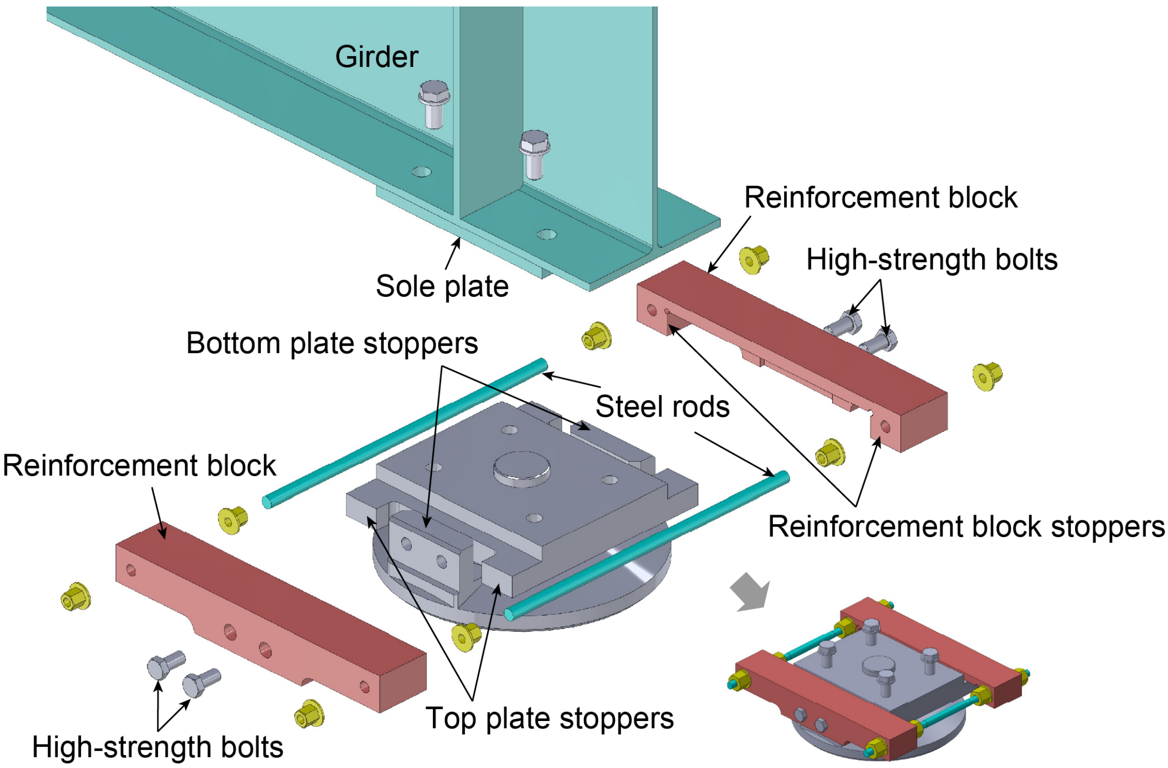
Developers:
Metropolitan Expressway Co. Ltd., Shutoko Technology Center, Nippon Chuzo K.K.

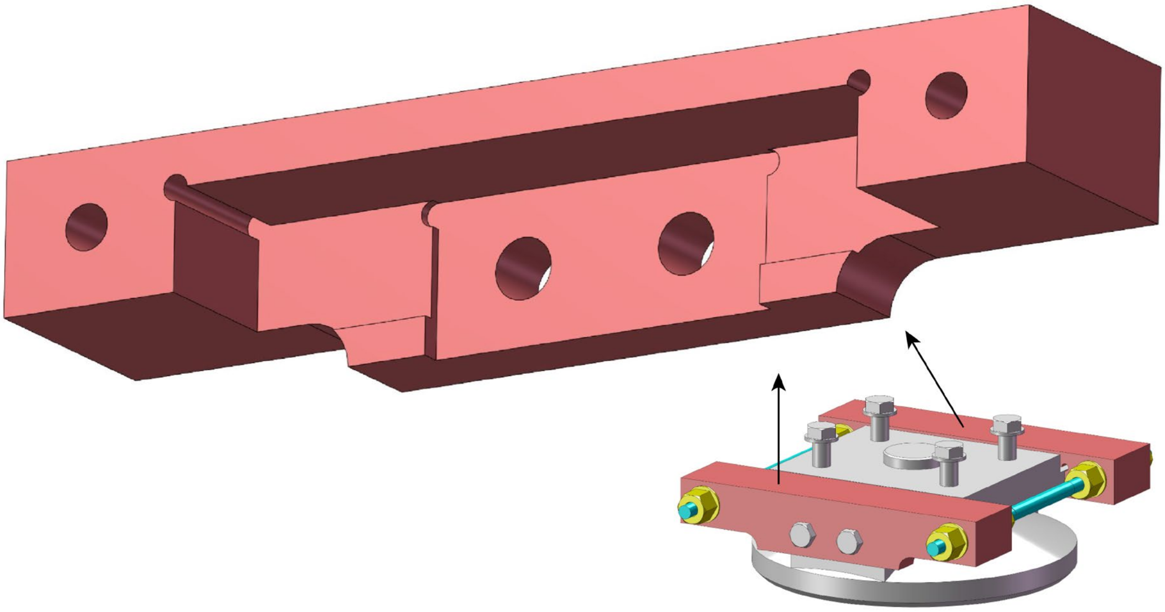
BP bearings, designed to withstand Level-1 seismic motion, are incapable of resisting more severe Level-2 seismic motion. Conventionally, they have been replaced with new bearings designed for Level-2 seismic motion. Bearing replacement typically requires jacking up the superstructure while maintaining traffic flow, which entails installing jacking brackets, reinforcing girders, removing existing bearings, installing new bearings, and subsequently adjusting the distribution of reaction forces after replacement. These operations must be performed in tight spaces, resulting in poor workability, extended construction time, and increased costs.

However, visual inspection of removed BP bearings revealed no apparent damage, and performance verification tests confirmed that they retained sufficient vertical load-bearing capacity and rotational function. Based on these findings, a new retrofit technology was developed to enhance seismic resistance without replacing the BP bearings.

This technology involves attaching newly developed reinforcement blocks to the side blocks of the BP bearing using high-strength bolts, and interconnecting the reinforcement blocks on both sides using steel rods. Whereas conventional BP bearings resist horizontal force in only one direction via a single side block, this retrofit allows both side blocks to act in unison, significantly enhancing the bearing’s horizontal resistance. Since the retrofit only requires the installation of reinforcement blocks, both construction time and cost are substantially reduced compared to full bearing replacement.

Given the increasing urgency of preparing for major earthquakes, this technology is expected to greatly contribute to improving the seismic resilience of BP bearings, which are widely used in bridges across Japan. For these reasons, the project is deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.





◇ ◇ ◇

Development of a Backward-Rotating, Self-Propelled Dismantling Machine of Launching Girders

Developers:
Yokogawa Bridge Corporation

The backward-rotating, self-propelled dismantling machine is mounted on a launching girder used for incremental launching construction. At the final launching position, it detaches the front removal block of the launching girder, rotates it 180 degrees backward, mounts it onto a self-propelled trolley system, and transports it back in the launching direction.

Incremental launching is often used for steel bridge superstructure erection over rivers or railways. In recent years, however, minimizing environmental impact during construction has become increasingly important. This newly developed device enables dismantling of the launching girder at the final launching point without requiring temporary piers or barges, making it a valuable system from the perspective of environmental preservation.

The device is composed of existing equipment such as self-propelled trolleys, rail clamp jacks, main jacks, sub-jacks, and winches, along with a custom-fabricated tower. After advancing a removal block (7.2 m), the block is rotated backward and dismantled in a repeated cycle, with all dismantling work completed on a dedicated working platform above bridge piers. This configuration significantly improves safety during construction.

This innovation makes incremental launching feasible even under constraints such as limited space for dismantling yards in urban or river environments. It is also expected to be useful in girder replacement during Major renewal projects in confined construction conditions. For these reasons, this development was recognized as a significant contribution to future advancements in bridge erection technologies and deemed highly deserving of The Tanaka Award from Japan Society of Civil Engineers.

◇ ◇ ◇

◇ ◇ ◇

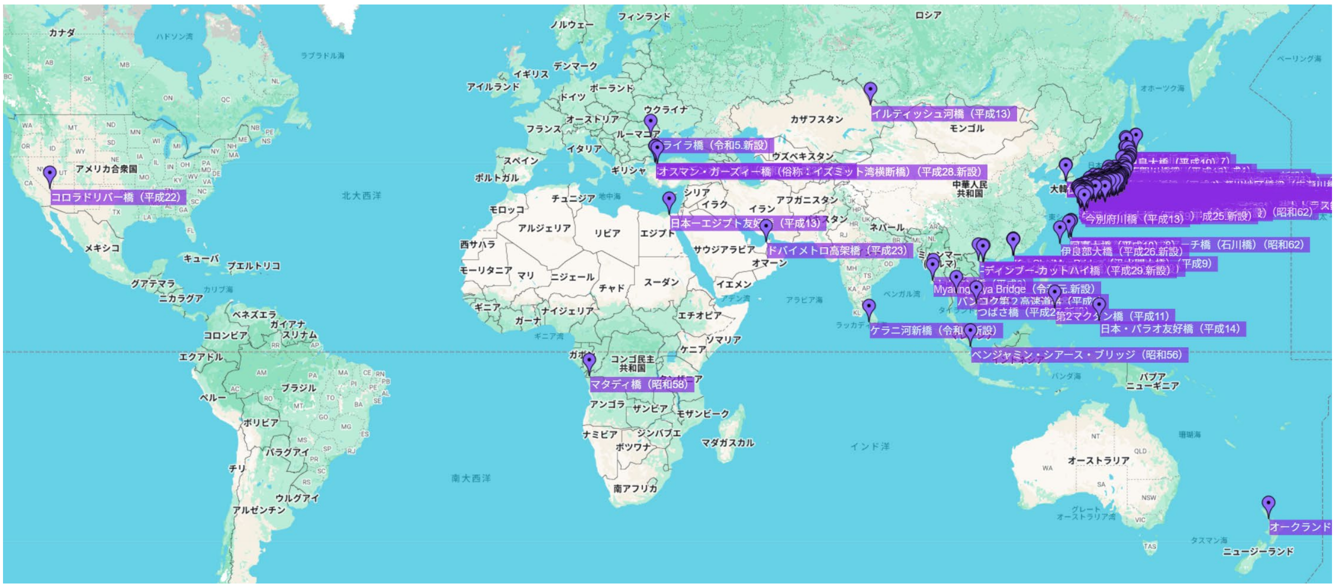
令和6年度田中賞 作品・技術部門受賞関連資料

投稿者：事務局 投稿日時：月, 2025-05-19 13:57

受賞作品	部門	関連資料
ジャイン・コーカレー橋	作品・新設	内容説明動画
出島大橋	作品・新設	内容説明動画 YouTube 女川町公式チャンネルURL（架設動画など） 出島大橋 パンフレット
双海橋（II 期線）	作品・新設	内容説明動画 双海橋（II 期線）パンフレット
東名多摩川橋の大規模更新	作品・既設	内容説明動画 東名多摩川橋の大規模更新パンフレット 東名多摩川橋の大規模更新パンフレット（英語版）
喜連瓜破橋大規模更新事業	作品・既設	下記リンク先にパンフレット、事業概要動画、完成ドキュメンタリー動画を掲載しています。 https://www.hanshin-exp.co.jp/renewal/kireuriwari/gallery.html
BP支承の耐震補強技術	技術	内容説明動画 BP支承の耐震補強技術パンフレット 関連した情報が掲載されているHP https://www.shutoko.jp/ss/tech-shutoko/save/BP-A.html
後方回転・自走式手延機解体装置	技術	愛知県庁・土木[公式YouTube]

Figure 8 Materials related to The 2024 Tanaka Award winning bridges (in Japanese).

(a) Japan



(b) World

Figure 9 Map of The Tanaka Award winning bridges

References on The Tanaka Award

Materials related to The 2024 Tanaka Award for Division of Outstanding Bridge Design, Construction and Retrofit (Figure 8, in Japanese):
https://committees.jsce.or.jp/tanaka_sho/node/102

Map of The Tanaka Award winning bridges for Division of Outstanding Bridge Design, Construction and Retrofit (Figure 9, in Japanese):
https://committees.jsce.or.jp/tanaka_sho/map
https://soumu.jsce.or.jp/tanaka_award/

The JSCE Awards (in Japanese):
https://www.jsce.or.jp/prize/index.shtml

For More Information

This newsletter and the back issues are available at JSCE website:
https://committees.jsce.or.jp/steel47/.

Please email the editors for more on the contents of this newsletter.

From the Last Issue

Here are some articles from the last issue. The last issue is available here.

Message from the Committee Chair

- Professor Takashi Yamaguchi, Osaka Metropolitan University

Publications

- Introduction of Standard Specifications for Steel and Composite Structures

Research

- Summary of “Report on Research and Study on Seismic Performance Verification of Steel Bridges Using High-Precision Numerical Analysis Methods”
- Summary of “Activity Report of the Research Subcommittee on Innovation Technologies for Obtaining Condition Information on Steel Structures”

Awards

The Tanaka Award (Division of Professional Bridge Engineer Recognition)

- Takeshi Mori (Professor Emeritus, Hosei University)
- Masamichi Tezuka (Director of Quality Control Department, Sun Environmental Planning Co., Ltd. (Former Executive Officer at Oriental Shiraishi Co., Ltd.))

The Tanaka Award (Division of Outstanding Research Publication)

- Dynamic Response Characteristics of Continuous Girder Bridge during Train Passage and its Simple Evaluation Method
  Munemasa Tokunaga, Manabu Ikeda (The Railway Technical Research Institute): Japanese Journal of JSCE, No.79, Vol.1, 22-00185, 2023.
  https://doi.org/10.2208/jscejj.22-00185
- Study on Application of CFRP to Emergency Bridge for the Self-Defense Forces
  Hiroshi Suzuki, Junichi Yamada, Tomotaka Ichikawa, Toshikatsu Mayama, Taichi Asakura, Mitsuhiro Nakata (Ground Systems Research Center, Acquisition, Technology & Logistics Agency): Japanese Journal of JSCE, Special Issue (Hybrid Structures), Vol. 79, No. 14, 22-14007, 2023.
  https://doi.org/10.2208/jscejj.22-14007

The Tanaka Award (Division of Outstanding Bridge Design, Construction and Retrofit, New Construction)

- Kuzuryu River Bridge / Shin-Kuzuryu Bridge
- Braila Bridge

The Tanaka Award (Division of Outstanding Bridge Design, Construction and Retrofit, Grand Prize, Existing Bridge)

- Daishi Bridge renewal project
- Large-scale renewal of the Higashimeihan Expressway Yatomi Viaduct (down line)

Disclaimer

The English content of this newsletter has been machine-translated by the editors from the original Japanese source. Please check the original Japanese source for the exact content.

Editors

This newsletter has been edited and released by Subcommittee on International Relations, Committee on Steel Structures, Japan Society of Civil Engineers.

Chair: Takashi Matsumoto

Member: Hiroki Aoi

Biehn Baik

Takeya Inoue

Yasuo Kitane

Takeshi Miyashita

Tomonori Nagayama

Eiichi Sasaki