

STEEL CONSTRUCTION

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Special Issue

Japanese Society of Steel Construction

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Japanese Society of Steel Construction

JSSC Commendations for Outstanding Achievement in 2025—Outstanding Construction of Large-section Tunnel with Sakusaku JAWS Method

Prize winners: Japan Railway Construction, Transport and Technology Agency and Toda Corporation

Outline of Sakusaku JAWS Method

The *Sakusaku* JAWS (joint all water shutting) method is a non-open cutting tunnel construction technology of the outer shell preceding construction type, which aims at forming underground space just beneath the road mainly in urbanized areas (refer to the figure). With the JAWS method, the outer shell structure is constructed first and then the earth and sand within it are excavated and removed to construct the tunnel.

Even in the case of constructing a large-section tunnel, the individual construction section of steel elements is small when they are arranged employing the jacking method, and therefore the impact on the surrounding ground during construction can be sup-

pressed and safer construction work can be undertaken even in downtown areas. In addition, high water-stopping performance is demonstrated due to the adoption of the JAWS joint with the original water-stopping mechanism (refer to the figure), and thus the need for ground improvement can be eliminated in the tunnel construction below the underground water level.

The steel shell-concrete composite structure can be prepared by filling high-fluidity concrete inside the shell structure, and the outer shell structure can be directly adopted as the main structure of the tunnel.

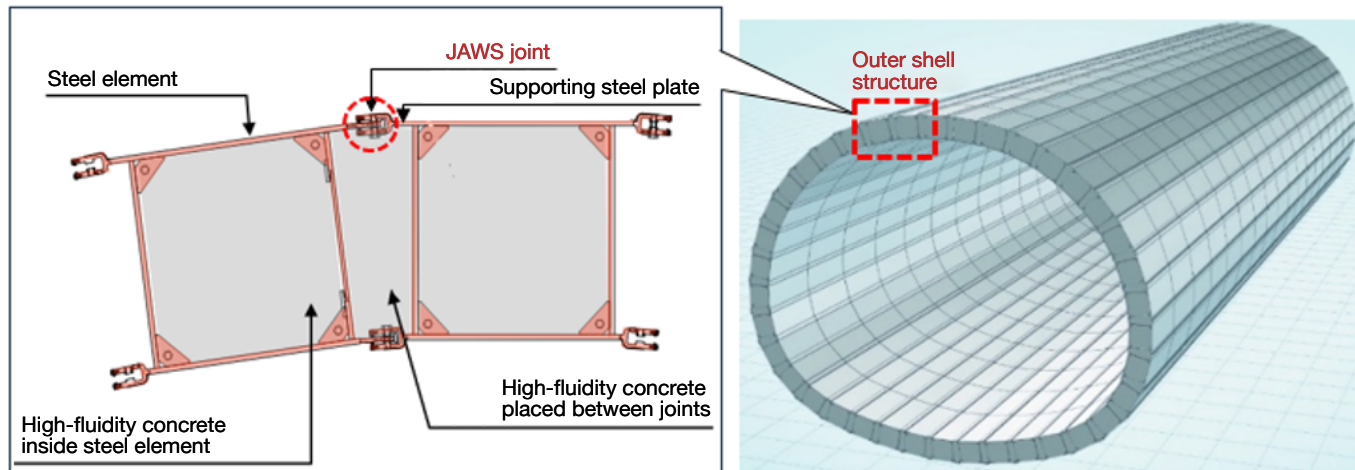
Application of Sakusaku JAWS Method

The *Sakusaku* JAWS method was applied in the construction of the Tsu-

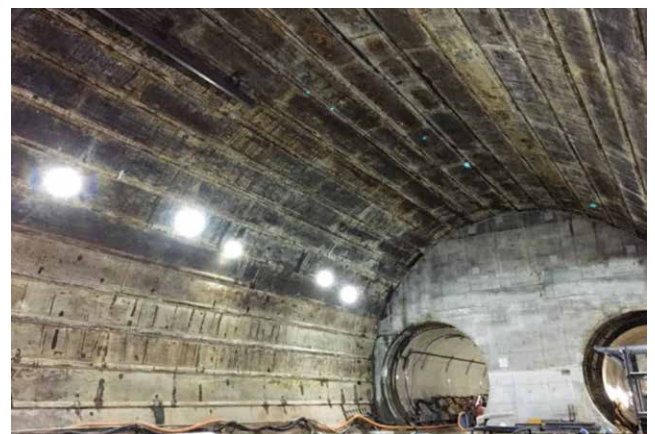
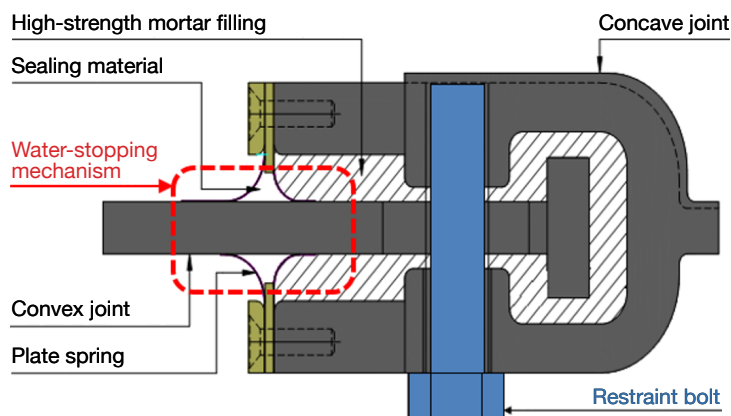
nashima Tunnel on the Sotetsu-Tokyu Connecting Line in Yokohama. The plan called for the construction of a horseshoe-shaped large-section tunnel (sectional area: 224 m²) that accommodates the station platform on the line. The outer shell structure was formed by connecting 42 steel elements (section: 1.0 m×1.0 m; length: 34.5 m) in which JAWS joints were arranged.

In order to cope with the difficult construction conditions such as high underground water pressure and hard ground, all available measures were tried by means of advanced performance tests, which led to the successful completion of the tunnel with no remarkable issues. Currently, the tunnel constructed by the use of the *Sakusaku* JAWS method (see the photo) is used by many people.

Outline of Tunnel Structure



Structure of JAWS Joint



Completed tunnel on Sotetsu-Tokyu Connecting Line

Bridge to Freedom in South Sudan! Freedom Bridge

Prize Winners: *CTI Engineering International Co., Ltd, Dai Nippon Construction and Yokogawa Bridge Corp.*

Freedom Bridge

South Sudan is a young nation that gained independence from Sudan in 2011. Before independence, the country endured a prolonged civil war that severely hindered the development of its transportation infrastructure. The only bridge spanning the Nile River in South Sudan was a temporary structure built more than 50 years ago, which frequently suffered damage and posed a constant risk of collapse. Despite these limitations, the temporary bridge served as the sole route for transporting goods from neighboring countries to Juba City via the Northern Corridor—an international trunk road—making it a vital lifeline for the nation’s reconstruction efforts.

As traffic congestion worsened and urban planning needs grew to accommodate future population increases, the decision was made to construct a new permanent bridge 1.8 km upstream from the temporary structure.

Construction of Freedom Bridge

The new bridge features the longest span of 560 m among all steel bridges spanning the Nile River. Its main span (river section) consists of four consecutive Langer bridges, while the side spans are composed of plate girder bridges.

In developing countries where experienced bridge engineers are scarce, it is essential to systematically enhance the technical skills and capabilities of local engineers and workers. For the side spans located on land sections, the project employed the simple “bent erection method,” designating this phase as Stage 1 for improving construction techniques and practical skills. After gaining experience with plate girder bridge erection and confirming sufficient skill development, the project advanced to the next stage: the “lateral sliding erection method” for the Langer bridges. Through this structured approach to guidance and training, the project contributed significantly

to the improvement and dissemination of local construction technology.

Symbol of Piece for South Sudan

After overcoming numerous challenges, the opening ceremony for the bridge was held in May 2022—nine years after construction began. The inauguration of the country’s largest bridge brought tremendous joy not only to the citizens of Juba but to all South Sudanese people. The ceremony was attended by both the President and Vice President, who had previously been in opposition, symbolizing that this bridge had become a literal “bridge” to peace.

Affectionately called the “Freedom Bridge” by local residents, it embodies their hopes for peace, freedom, and a brighter future for South Sudan. It is our sincere hope that this bridge will continue to serve as a lasting symbol of peace for the nation.



Erection of Freedom Bridge with the main span composed of Langer bridge



Completed bridge with a long span of 560 m



First Lateral Transfer Ceremony

Joint Pavilion Iida Group×Osaka Metropolitan Univ. at Expo 2025 Osaka

Prize winners: Shin Takamatsu Architect and Associates Co., Ltd. and Shimizu Corporation

The Largest Building Wrapped in Jacquard Fabric

The Joint Pavilion Iida Group×Osaka Metropolitan Univ. at Expo 2025 Osaka is an exhibition structure clad in Nishijin-brocade exterior members. It embodies thoughts and hopes for “life,” the theme of the Expo, in the shape of a “Mobius” strip and symbolizes the future and tradition as well as sustainability.

“Skew Arch *senbon-goshi* Lattice” to Support Membrane

In order to support the membrane with irregular 3D curved surfaces, the “skew arch *senbon-goshi* lattice” (many lattices of evenly-spaced vertical timber bars used in façades) was worked out. As its name implies, the *senbon-goshi* lattice is a façade structure seen in traditional townhouses in Kyoto. The membrane was formed by inclining the *senbon-goshi* lattice and fitting it into the curved surface of the membrane.

In order to treat with the 3D stress including twisting moment and to further form the framing in accordance with the membrane configuration so as to maximize the pavilion space, bent steel tubes were applied as the structural member.

For the end of the 12 main arches, top and bottom rings were arranged to efficiently resist thrusts. In order to vertically support the skew arch *senbon-goshi* lattice, unidirectional rigid-jointed frames were erected to achieve a pavilion configuration that conforms to the exhibition plan.

The main arch configuration with 3D curves was closely resembled by connecting single-curvature bent steel tubes while twisting them at multiple sections. The main arch curvature switching section with twisting angle was settled by sandwiching plates between pipes so as to surely transfer the stress. Branch joints were adopted to connect the sub arch and the main arch with the primary priority

placed on the rational execution of fabrication. In order to precisely and smoothly undertake the steel-frame erection, the following methods were adopted for on-site sub arch joining—flange joints, which are high in on-site erection efficiency, for one end and weld joints, which are excellent in erection precision, for the other end.

Establishment of Design/ Fabrication Processes to Realize “Skew Arch *senbon-goshi* Lattice”

In order to support a close tie-up among designers, steel-frame fabricators and builders, Rhinoceros (3D modeling software) was utilized as the common language in every process in erecting the skew arch *senbon-goshi* lattice from the geometric settlement of ridges to the decision of steel-frame configuration and the preparation of detailed models used for examining steel-frame fabrication and erection.

Photo: Katsuhisa Kida/FOTOTECA



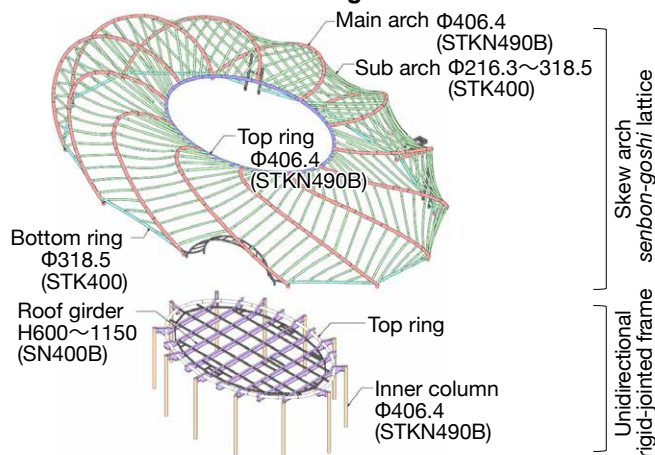
“Skew arch *senbon-goshi* lattice” (steel-frame erection underway)

Photo: Katsuhisa Kida/FOTOTECA

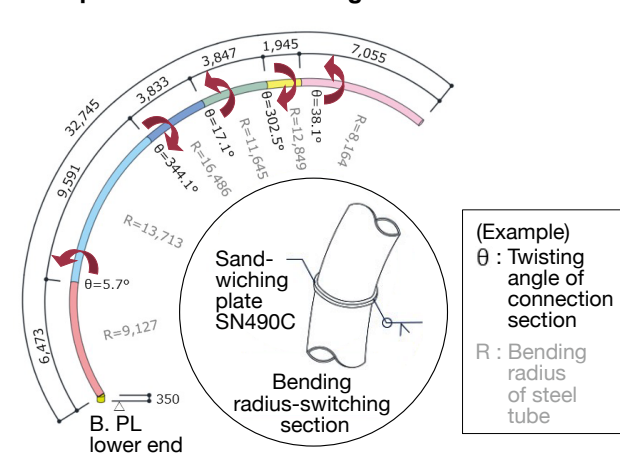


Nishijin-textile membrane erection underway

Outline of Structural Framing Plan



Example of Main Arch Configuration



Kobe Suma Sea World

Prize winner: Takenaka Corporation

New Aquarium in Kobe

Kobe Suma Sea World is an aquarium constructed under the renewal plan of the former Suma Aqualife Park KOBE. Because the aim of this project was to renew the former aquarium loved for many years by the citizen of Kobe, the birthplace of aquariums in Japan, it was required for the renewed aquarium to serve as a new landmark of the City of Kobe.

For the roof covering the stadium space in the aquarium in particular, a curved configuration was adopted that is full of lively movements that evoke the dynamism of living creatures. This finely-curved configuration was realized by the use of steel framings with fine appearance.

Structural Outline

What was essential for the realization of these steel framings was that a simple rule of “expanding a free curve in one direction” was imparted to the roof configuration itself. With this rule, the cut surface of the steel framings in two directions (expanding direction and orthogonal direction) was fixed, leading to the securement of a uniform framing arrangement.

The roof finishing members were composed of lightweight folded plates bent in conformity with the free curve, thereby bringing about a structural expression that shows shade and shadow. These roof steel framings were composed of two kinds of framings (R-shaped framing and straight line-shaped framing) arranged in conformity to these two directions, which support the large roof of 50 m × 25 m.

Erection Outline

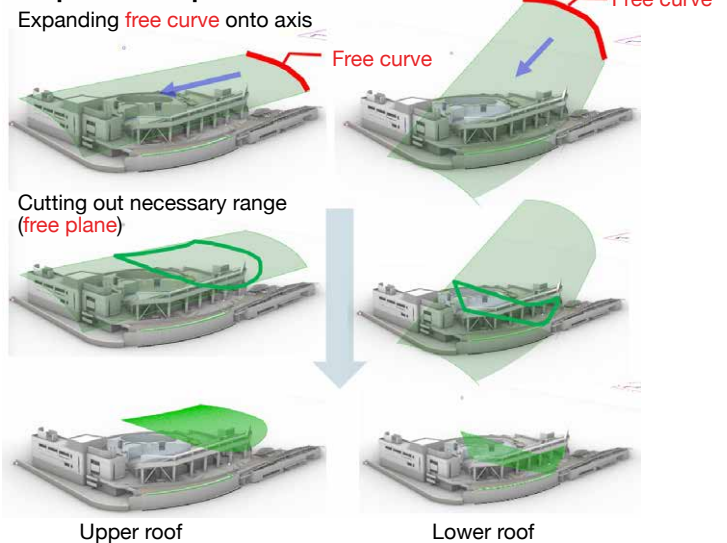
The new aquarium was constructed in a park famous for its pine trees. In order to preserve these pine trees as much as possible, the small unit erection method was adopted, for which a great number of timber supports were arranged to 136 sites. The biggest task posed in the roof construction was how to jack-down a great number of timber supports.

As for the jack-down procedure, the best solution was derived from among 12,000 solutions obtained by means of optimization analysis that makes full use of computer technologies. Further, the deformation and reaction force of timber supports occurring during the jacking-down process were grasped by means of measurement monitoring, which led to the safe and elaborated erection of Kobe Suma Sea World.

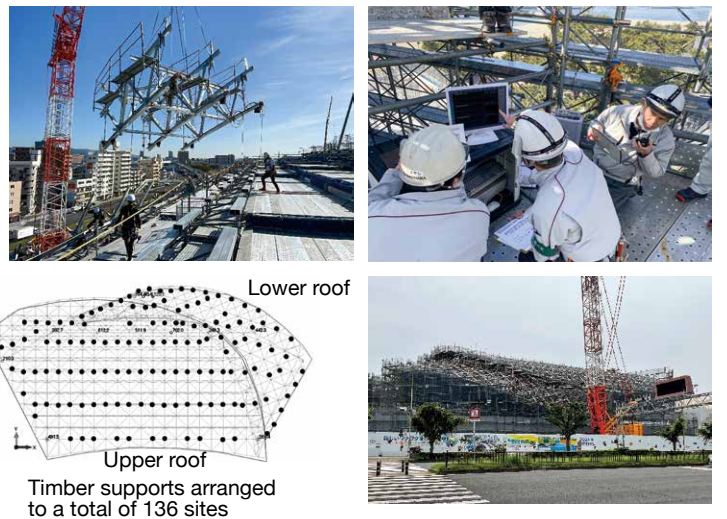


Inside view of the orca stadium (composed of two roofs—upper roof and lower roof)

Simple Rule Imparted to Roof Erection



Erection Condition



Azabudai Hills Mori JP Tower

Prize winners: Mori Building Co., Ltd., Nihon Sekkei, Inc. and Shimizu Corporation

Building Outline

The Azabudai Hills Mori JP Tower is one of three high-rise buildings being constructed in the Toranomon-Azabudai area urban redevelopment project in Tokyo. It consists of the high-rise section centered on offices and apartment houses and the low-rise section of commercial facilities and various schools.

Structural Outline

The Azabudai Hills Mori JP Tower demonstrates Japan's largest-class scale of 64 stories above ground and Japan's top-class height of about 330 m. The aboveground section is composed of a rigid moment-frame structure with steel braces, where a seismic response-control structure was adopted that absorbs seismic and wind energy with the seismic response-control members arranged in the core section. CFT columns were adopted for floors 1 to 52. The 53rd floor between residential and office floors serves as the structure-switching floor, where the braces were arranged on an entire floor to form the truss framing and the column span was switched from that in other floors. On the rooftop section, active mass dampers were installed to improve habitability against the wind.

The outer configuration of the tower describes a gentle curve. Because the plane configuration at each floor changes in the height direction according to the elevation configuration, the peripheral columns were bent at the several column-beam connections in a way that conforms to the curve of the tower's outer configuration.

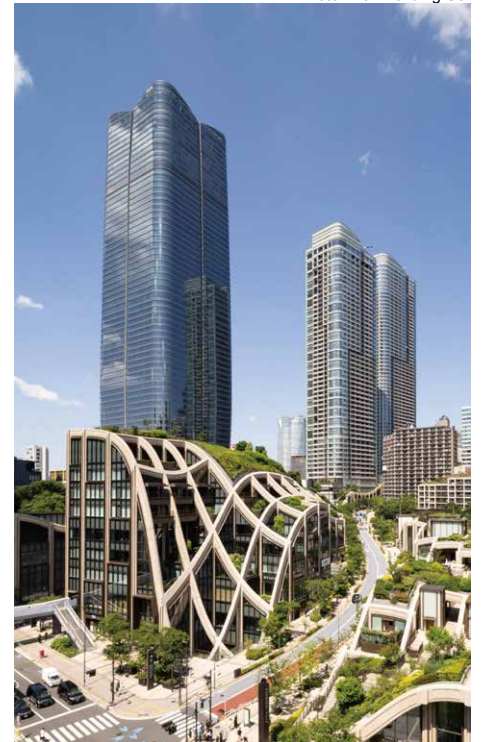
High-strength steel members were positively applied, and those members with a strength rating of 550 N/mm² or more accounted for about 40% of the total steel member usage.

From the perspective of business continuity, the goal was set for the tower to have seismic resistance that will allow for the maintenance of its main functions even after a mega earthquake, and as a result the tower demonstrates high seismic resistance that will cause almost no damage in the event of an extremely rare earthquake. On top of this, taking into account the effect of long-period seismic motion and wind on the habitability assessment, the structural rigidity is secured with a primary natural period of building set at approximately 7 seconds or less.

In the Azabudai Hills Mori JP Tower, a rational building structure having high seismic resistance and taking into account favorable habitability against wind-induced vibrations was realized by adopting not only a rigid-moment frame structure with steel braces in which braces were arranged in the core section but also

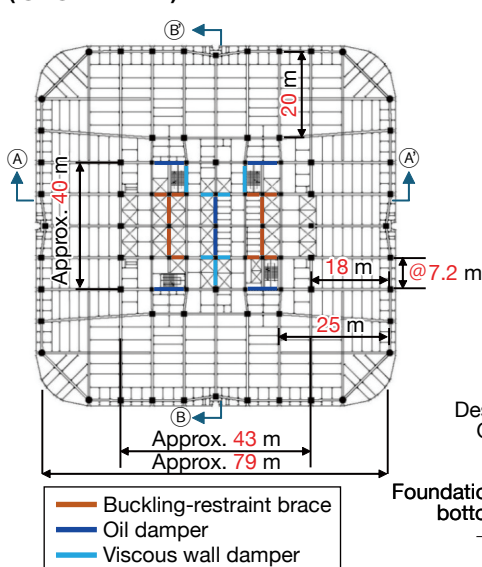
so a seismic response-control structure in which dampers were optimally arranged.

Photo: Mori Building Co.

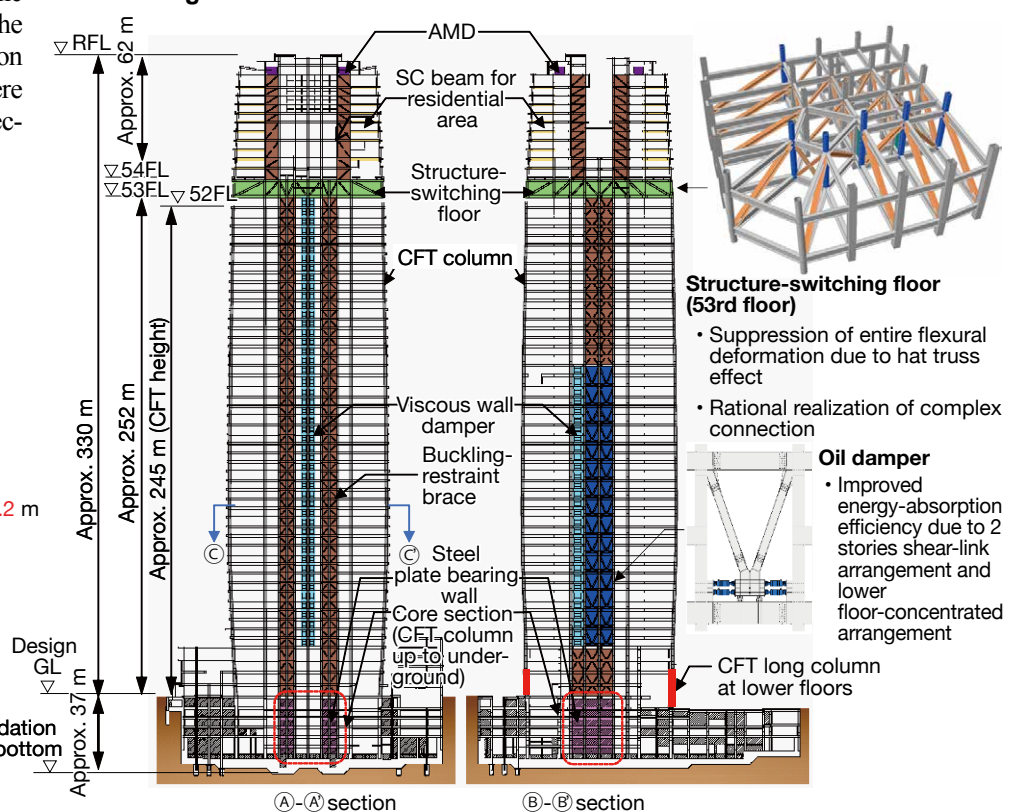


Azabudai Hills Mori JP Tower of Japan's largest-class scale

Framing Plan at Standard Floor (C-C section)



Framing Elevation



Stress Concentration Reduction for Drilled Crack-arrest Holes Using Patch Plates with High-strength Bolts under Axial and Shear Loads

Prize winners: Shogo Kiyokawa, Kazuo Tateishi, Takeshi Hanji, Maoling Zhao and Takayuki Kawakami



Shogo Kiyokawa
2000-present: Yokogawa Bridge Corp.
2018: D.Eng. Nagoya University

This paper discusses the crack arrest-hole method as a countermeasure against the fatigue cracking of steel structures and a patch-plate reinforcement method using high-strength bolt applied together to improve the effect of the countermeasure. While these two methods have been widely applied as a countermeasure against the fatigue cracking of steel bridges, their rational design methodology has not yet been established. In this paper, noticing the effect of the use of patch plates on the reduction of stress concentration, examinations were made of the effect of combined stress in which the axial stress and the shear stress simultaneously work as is forecast to occur in a practical bridge.

In this examination, the four-point

bending test was carried out on a girder-shaped test specimen prepared by simulating the practical bridge (Photo 1). Specifically, five patch plate-splicing sections were provided for the test specimen, and the local strain occurring at respective crack arrest-holes was measured. As a result, it was known that the maximum strain occurrence position and the maximum strain value at the crack arrest hole differ due to the ratio of the nominal bending stress to the nominal shear stress ($\lambda = \tau_n / \sigma_n$) as shown in Fig. 1.

Next, the parametric finite element analysis, in which patch plate structural dimensions were changed, was carried out employing the partial analytical model where reproducibility of test results was confirmed, and the influence of λ on the reduction effect β of the stress concentration coefficient at crack-arrest holes was quantitatively clarified from the examination results (Fig. 2).

Based on these results, we proposed the correction formulas for stress reduc-

tion coefficients (1) and (2) employing λ and the geometric parameter of patch plate-applied repair section. The proposed formulas were able to estimate the analytical value within an error rate of about 10% (Fig. 3).

$$\frac{\beta}{\beta_{\lambda=0}} = \left(\frac{1-3^{-\lambda}}{1+3^{-\lambda}} \right) \left(\frac{\beta_{\lambda=\infty}}{\beta_{\lambda=0}} - 1 \right) + 1 \quad (1)$$

$$\frac{\beta_{\lambda=\infty}}{\beta_{\lambda=0}} = 0.76 + 2.18 \left(\frac{M}{l_c} \right) + 0.32 \left(\frac{l_c}{P} \right) - 0.30 \left(\frac{W_E}{W_S} \right) + 0.10 \left(\frac{t_s}{t_M} \right) \quad (2)$$

where,

β : Ratio of stress concentration coefficient at crack-arrest hole before and after applying the patch plate; M : Diameter of crack-arrest hole; l_c : Crack length; P : Bolt pitch; W_E : Effective width of main plate; W_S : Width of patch plate; t_s : Thickness of patch plate; t_M : Thickness of main plate



Photo 1 Four-point bending test specimen

Fig. 2 Influence of Shear Stress Ratio λ on Stress Concentration Coefficient Reduction Effect β

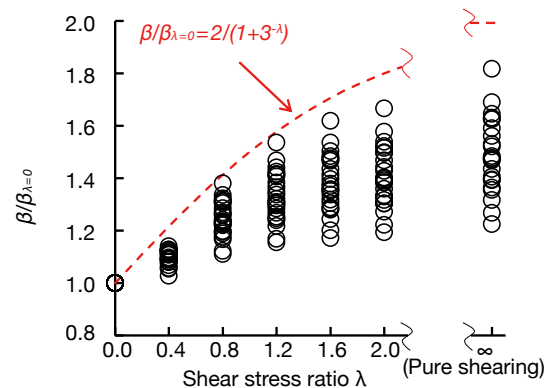


Fig. 1 Distribution of Strain at Crack-arrest Hole

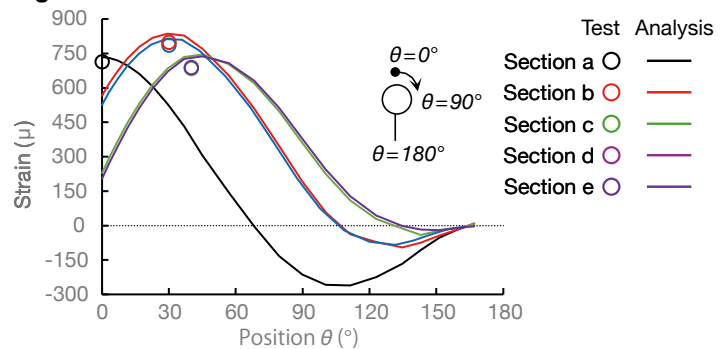
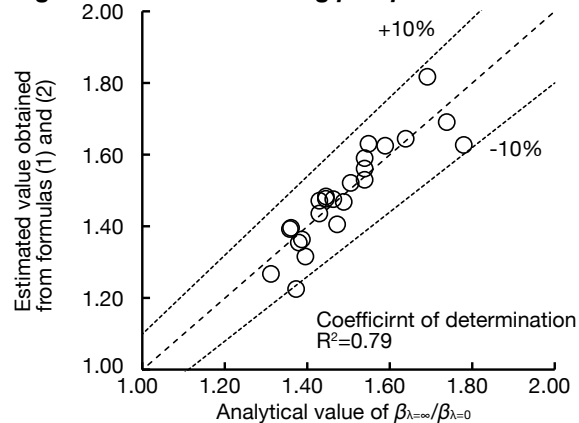


Fig. 3 Result of Estimating $\beta_{\lambda=\infty} / \beta_{\lambda=0}$



Effect of Welding Methods for Connecting Columns with Through-diaphragm on Plastic Deformation Capacity of Cold-formed Rectangular HSS Columns

Prize winners: Ryota Tsuyuki, Yu Ichikawa, Hayato Asada, Tsuyoshi Tanaka, Toshiomi Itatani and Mototsugu Tabuchi



Hayato Asada
 2011: Dr. Eng from Tokyo Institute of Technology
 2011-2021: Assistant professor at Kobe University
 2021-present: Professor at Shibaura Institute of Technology

This paper presents an experimental investigation of the plastic deformation capacity of cold-formed rectangular steel tube columns with low corner toughness ($\nu E_0 = 9\text{J}$, measured at 0°C). The research focuses on 45-degree cyclic bending tests conducted on cantilever-type specimens (see Fig. 1), in which the welding method (robotic welding and semi-automatic welding) and the column-side weld-toe flank angle at the tube corner were adopted as the principal test variables (the definition of flank angle θ_f is illustrated in Fig. 2). The objective is to clarify how these parameters influence the ductile deformation capacity of cold-formed tube columns and to establish rational welding guidelines for practical column-end connections. The steel tubes examined correspond to grades such as BCR295 and BCP325, which fall under the Japanese structural steel specification defined by

MLIT Notification No. 594 (2007).

The results show that the weld metal strength at the corner regions was consistently lower than the cold-formed base-metal strength. Nevertheless, ductile crack initiation occurred within the softened heat-affected zone (HAZ) adjacent to the weld toe on the column side. The cumulative plastic deformation ratio at fracture, η_u , increased with the weld-toe flank angle θ_f and exhibited an approximately linear relationship with θ_f under similar material toughness conditions (see Fig. 3). Furthermore, comparison with previously tested specimens having higher corner toughness revealed that η_u was greater at the same θ_f when the toughness level increased, demonstrating that deformation capacity depends on both weld geometry and material toughness. No measurable influence from the welding method was identified, indicating that weld-toe geometry governs the ductile performance of the welded column more strongly than weld-metal strength matching.

The experimental findings indicate that, during fabrication, the weld-toe flank angle should not be allowed to become excessively small. The required θ_f value depends on the plastic deformation

demand of the column. For applications requiring $\eta_u \geq 28$, θ_f should be maintained at approximately 120° or greater. Conversely, when the required ductility level is approximately $\eta_u \approx 20$, stringent control of θ_f is not essential provided that θ_f does not decrease to values near 90° .

In addition, the results indicate that the stringent heat-input and interpass-temperature control requirements prescribed in current welding practice standards, which are intended to compensate for strength increases caused by cold forming, are unnecessary for column-end joints. Welding may therefore be performed under conditions similar to those applied to non-cold-worked structural steels. For the corner region, direct monitoring of heat input and interpass temperature is not required; however, appropriate control of the weld-toe flank angle remains essential to ensure adequate ductile performance.

Overall, this study provides practical and rational welding recommendations for cold-formed rectangular steel tube column joints, supporting economical fabrication and reliable structural performance without imposing unnecessary welding restrictions.

Fig. 1 Experimental Setup

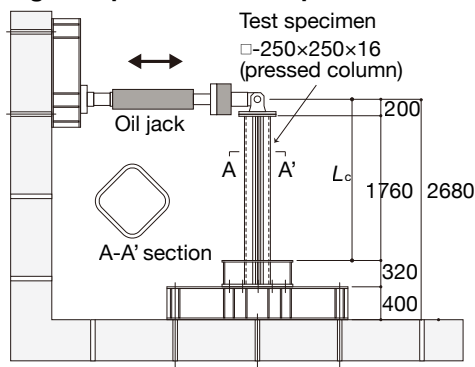


Fig. 2 Flank Angle θ_f at the Column-side Weld Toe

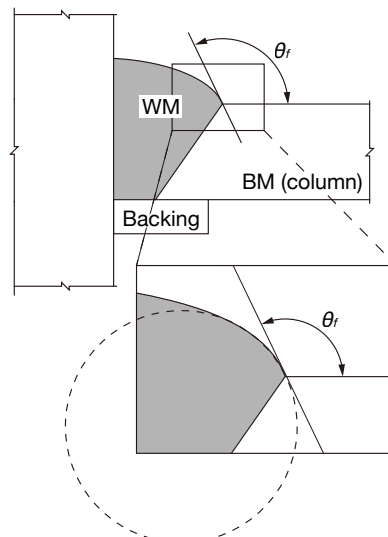
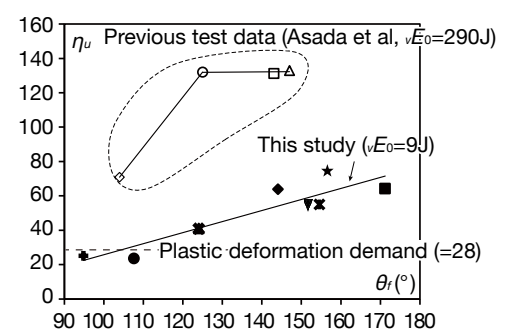


Fig. 3 Relationship between Cumulative Plastic Deformation Ratio at Fracture η_u and Weld-toe Flank Angle θ_f



Trends in the Operation of Design Data for Steel Bridges

Hisatsugu Tsuda

Japan Bridge Association (IHI Infrastructure Systems Co., Ltd.)

This article reviews the evolution from Computer-Aided Design (CAD) to Building Information Modeling/Construction Information Modeling (BIM/CIM) in the context of steel bridge design in Japan. It discusses recent initiatives aimed at automating data linkage through design information attribute files, and examines future prospects for enhancing productivity and efficiency in steel bridge construction by means of digital technologies.

Initiatives to Improve Productivity

Since 2016, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan has actively promoted the “i-Construction” initiative to address the projected shortage of workers in the construction industry. This initiative seeks to improve productivity by 20% across all construction phases—from surveying and design to manufacturing, inspection, maintenance, and

renewal—through the proactive adoption of information and communication technology (ICT). In 2025, the launch of i-Construction 2.0¹⁾ further emphasized the comprehensive utilization of digital technologies to automate construction processes, thereby fostering highly productive worksites that require fewer personnel and offer safer, more comfortable working conditions. A central measure in this initiative is the automation of data linkage across the entire construction process using BIM/CIM, including pilot projects for the direct use of design data in factory production via intermediate files.

This article reviews the transition from CAD, introduced in the 1990s, to BIM/CIM in steel bridge construction, and introduces current efforts to link design information attribute files for BIM/CIM-based operations.

Transition from CAD to BIM/CIM²⁾

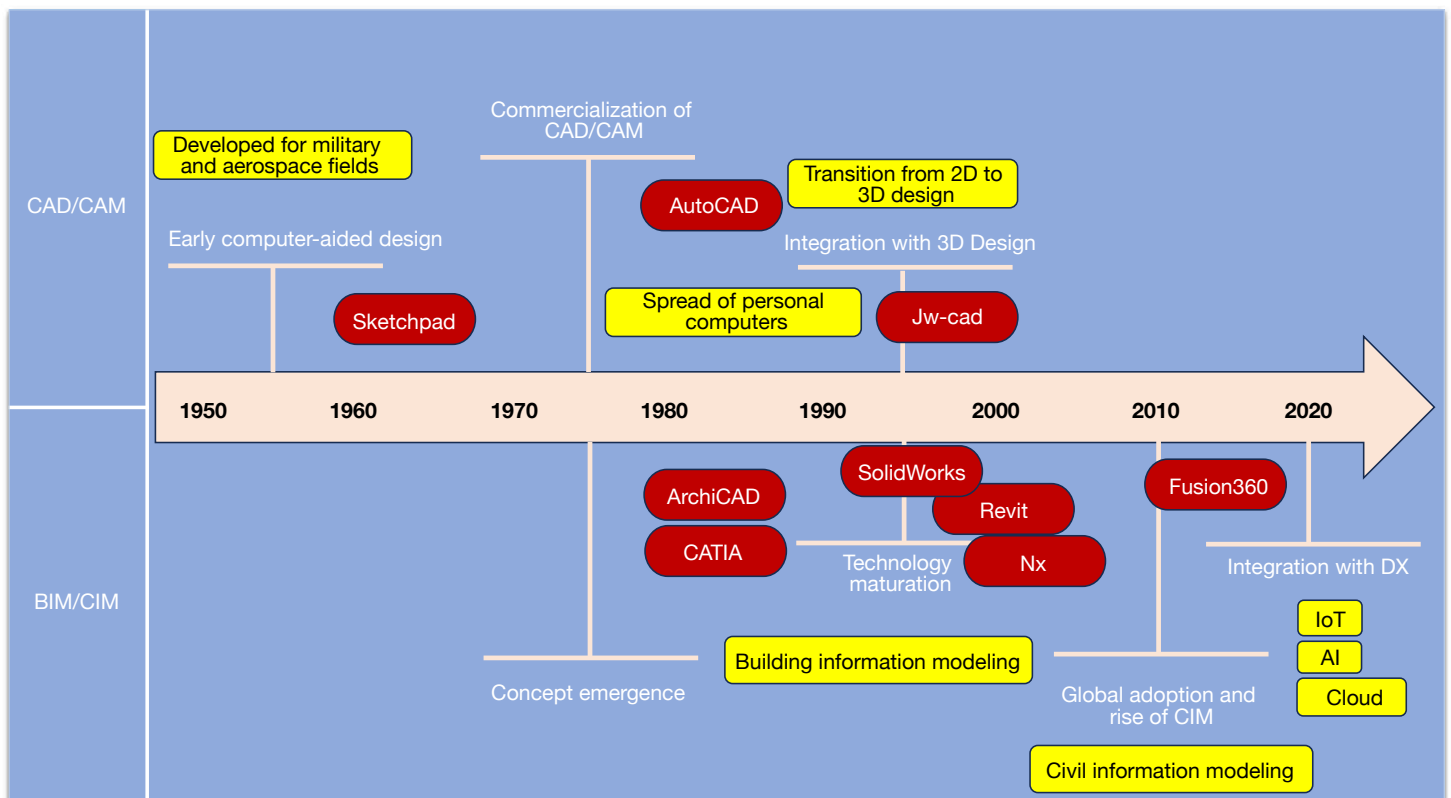
In Japan, the initial introduction of ICT

into steel bridge projects during the 1990s primarily targeted improvements in administrative efficiency. However, focusing exclusively on these indirect departments proved insufficient for accommodating real-time changes in design and scheduling at factories and construction sites, resulting in issues such as rework and management oversights.

Simultaneously, CAD systems were adopted for design and manufacturing processes, yielding notable gains in efficiency. Nevertheless, CAD drawings, comprising merely lines and text, necessitated manual interpretation and re-entry into subsequent systems, which led to redundant tasks and increased the likelihood of errors. Furthermore, essential information pertaining to material procurement and product estimation was not integrated into the CAD data, thereby limiting the overall efficiency of management operations.

Recent technological advancements

Fig. 1 The Evolution of CAD



have facilitated the practical application of product models, wherein objects (components) and their attributes (physical properties) are represented within BIM frameworks. These models encapsulate comprehensive information, enabling seamless transfer to subsequent processes and thereby improving overall efficiency. While BIM has achieved widespread adoption in Europe and the United States—particularly in the United Kingdom, where government-led infrastructure projects employ BIM, Japan initiated full-scale efforts under the term “CIM” in 2012, later unified as “BIM/CIM” in 2020. In steel bridge construction, product models have been partially implemented, especially for manufacturing tasks. However, Japan’s contract system, which separates design and manufacturing, presents challenges to the transfer of product model information, in contrast to the integrated approach found in the United Kingdom.

Promotion of BIM/CIM Operation Using Design Information Attribute Files

Since fiscal year 2023, MLIT has adopted a policy promoting the application of BIM/CIM, with the aim of expanding its use and exploring advanced methods for data utilization. In the

field of steel bridge construction, the Japan Bridge Construction Association and the Construction Consultants Association jointly announced their commitment to implementing data linkage in bridge engineering in April 2023. As illustrated in Figure 2, this approach facilitates the transfer of data from the designer’s “automatic design system” to the contractor’s “automatic manufacturing system” through an intermediate “design information attribute file,” rather than relying solely on 3D model data. This enables the appropriate use of both 3D models and attribute information—such as quantities and specifications—at each stage of operation, thereby enhancing productivity via BIM/CIM.

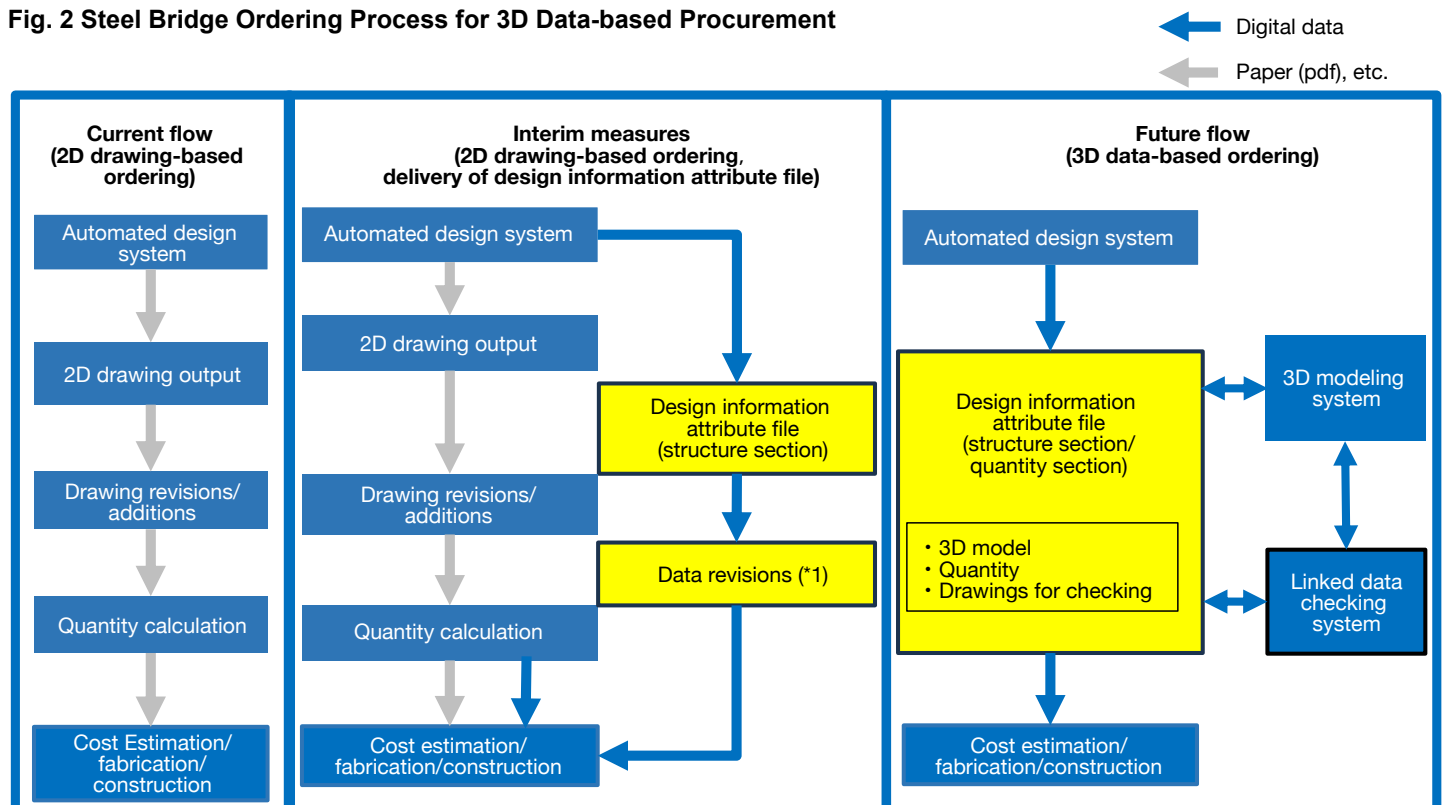
Figure 3 presents the implementation schedule. System development for plate girders was completed in the first half of FY2024, followed by trial projects conducted by MLIT in the latter half to assess effectiveness. Future plans include expanding the system to encompass box girders and additional plate girder types, thereby broadening the scope and further promoting operational efficiency. Currently, a total of 13 trials are underway, with feedback from these projects being utilized to address challenges and drive further improvements.

Beginning in FY2025, MLIT aims to establish a target vision for data linkage between design and factory production for steel bridges (see Figure 4), eliminate manual verification procedures “red-yellow checks” currently used for design confirmation, and develop systems for digital verification of data linkage reliability. Concurrently, efforts will focus on standardizing structural and attribute information and reducing reliance on 2D drawings, thereby advancing efficiency and digitalization.

Toward Improved Efficiency in Construction Processes

In steel bridge construction, the adoption of design information attribute files enables automated transfer of 3D models and associated attribute data throughout the project lifecycle, thereby improving operational efficiency. Future objectives include extending the application of these technologies to transportation, erection, and maintenance processes, as well as promoting the export of Japanese BIM/CIM data linkage methodologies, with the aim of establishing them as mainstream practices within the global steel bridge sector.

Fig. 2 Steel Bridge Ordering Process for 3D Data-based Procurement

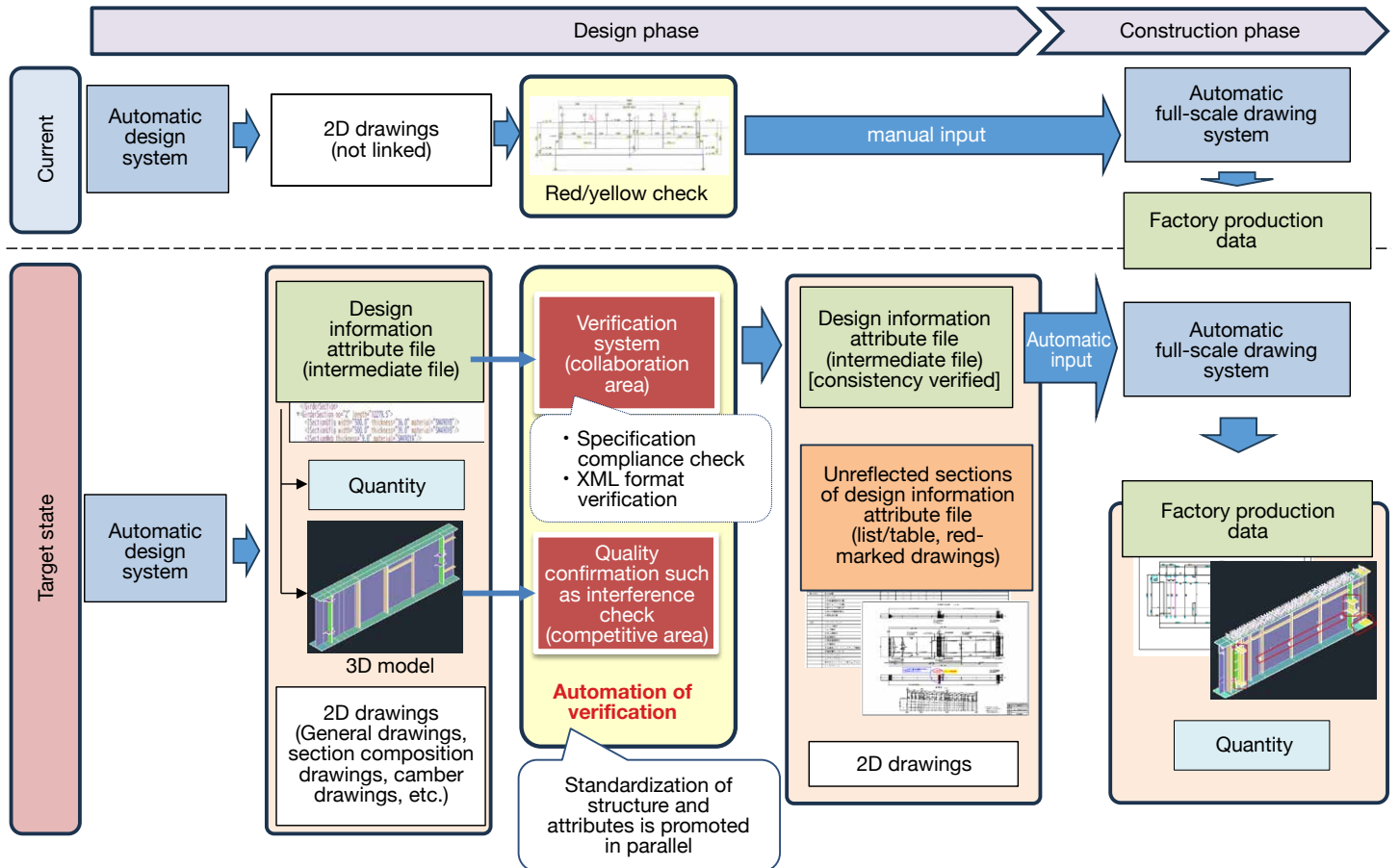


(*1) For the time being, clarification materials for unrevised data sections will be used as substitute.

Fig. 3 Data Integration Implementation Schedule

Item		FY2022			FY2023			FY2024			FY2025			FY2026			FY2027					
		1-2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q		
System development	Structural data	Definition of design information attribute file and quantity data																				
		Plate girder (rationalized girder)	Output of design information attribute file																			
			Import into manufacturing information system																			
			Effect verification through pilot projects																			
			Effect verification by contractor-requested type																			
		Plate girder (conventional plate girder)	Output of design information attribute file																			
			Import into manufacturing information system																			
			Effect verification by contractor-requested type																			
			Adoption by contractor-requested type																			
		Box girder	Output of design information attribute file																			
			Import into manufacturing information system																			
			Effect verification by contractor-requested type																			
			Adoption by contractor-requested type																			

Fig. 4 Data Integration between Design and Factory Fabrication of Steel Bridges (The Ideal Approach for the Time Being)



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Stainless-Steel Lattice Screens at Tokuyama Deck Gallery

—Exploring the Potential of Stainless Steel as a Carrier of Regional Identity—

Shoji Oshio

Partner, KENGO KUMA AND ASSOCIATES

This project began with a simple yet demanding question: *Can stainless steel—an inorganic, industrial material—be endowed with the same sense of regional breath and cultural depth as wood or stone?*

We set out to challenge the perception of metal as cold and uniform, seeking instead to give it the warmth, texture, and narrative quality of natural materials, and through this transformation, to discover an expression that could be described as distinctly “Japanese” in sensibility.

The site is a small gallery of approximately 33 m², located at the entrance of a commercial complex directly connected to Tokuyama Station, in western Japan. Open widely toward a public plaza, the space is constantly exposed to the flow of people and urban activity. It was therefore required to function both as a welcoming threshold and as a place that conveys the cultural richness of the region. Responding to the client’s aspiration to “create an architectural gallery that revitalizes the community,” we envisioned a space where architectural exhibitions could help rediscover local values, encourage dialogue, and suggest new possibilities for the future of regional industries.

Space as a Storyteller

Architecture is not merely an enclosure



Appearance of stainless-steel lattice screen

defined by walls and boundaries. The materials used within it actively shape the character of the space and tell its story. In this project, regional materials and techniques were employed consistently—from the flooring and walls to the lattice screen, *shoji*-like panels, and furniture—so that the entire interior would function as a narrator of local culture. Rather than relying on explicit explanations, the space communicates through the textures, weight, and presence of its materials.

Regional Materials and Craftsmanship

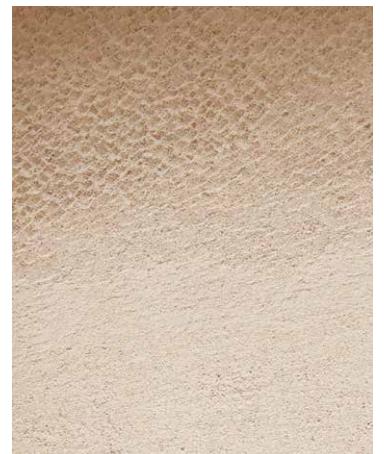
The floor is finished with *seika*, a rare stone quarried in Akiyoshidō, a well-known local stone-producing area. This stone, used during the Tokyo Olympics sixty years ago—a symbolic turning point in modern Japanese society—carries a strong historical resonance. Its flame-like patterns give the surface a vivid rhythm, and even in small quantities it asserts a powerful presence, anchoring the space both physically and



Interior of stainless-steel lattice screen



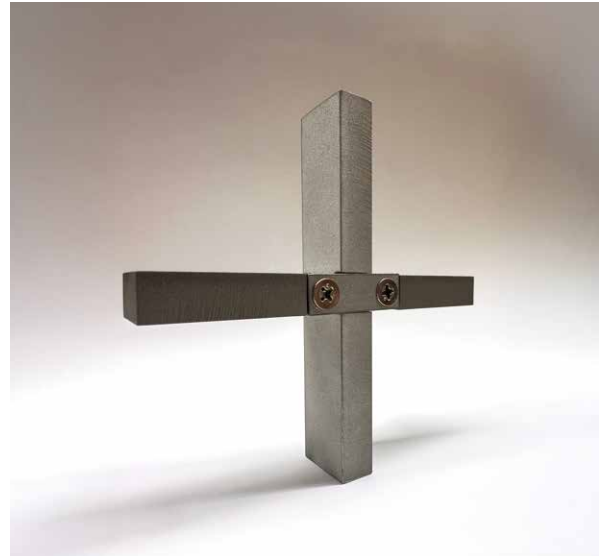
Stone member *seika*



Wall finished with local soil and *susa* fiber



Stainless-steel lattice screen



Stainless-steel lattice member with texture

symbolically.

The walls are finished with a mixture of local soil and *susa* fibers, applied by plaster artisan Naoki Kusumi using traditional hand techniques. The surface is characterized by the overlapping of fine, subtle undulations and larger, more generous movements. When touched, it conveys warmth, allowing visitors to sense the climate, soil, and temperament of the land through their hands as well as their eyes.

Innovation in Stainless-Steel Lattice Design

At the heart of the gallery stands the stainless-steel lattice screen, developed in close collaboration with a local factory. Referencing the traditional *ichimatsu* checkered pattern, the screen softly filters views between the exterior and the interior, allowing glimpses of the exhibition beyond without fully revealing it.

What distinguishes this screen is the deliberate decision to preserve the traces of industrial processes. Laser-cut marks and the roughness resulting from acid pickling—normally removed in pursuit of a perfectly uniform finish—were intentionally retained. By embracing these imperfections, the stainless steel was transformed from a purely industrial product into a material with a handcrafted, organic quality, resonating with the Japanese aesthetic of *wabi-sabi*.

Each member of the lattice was proportioned with the delicacy of *shoji* frames and assembled with the precision of traditional *kumiko* woodworking. Laser marks appear on the visible edges, while the inner faces retain the matte texture of acid washing. The changing orientation of surfaces produces subtle

variations in texture and reflection, allowing the material to respond sensitively to light and movement. Through this process, stainless steel—typically rigid and anonymous—was reimagined as a tactile, expressive material akin to something grown or shaped by hand.

Light and the Expression of “Wa”

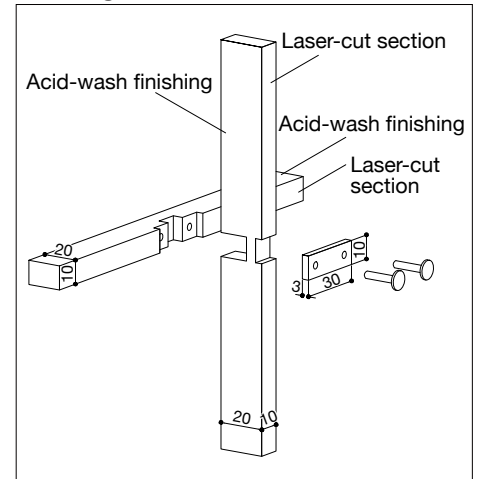
Within the *ichimatsu* lattice, translucent panels were inserted, made by embedding locally produced pine-needle tea (*matsubacha*) into clear acrylic. These panels gently diffuse light, allowing the atmosphere of the interior to faintly appear through the screen. The softness of the natural fibers and the subdued glow of light interact with the metallic shimmer of the stainless steel, whose roughness has been carefully preserved.

The result is a unique luminous environment in which natural and industrial elements coexist. Light is neither fully transparent nor fully blocked; instead, it hovers, suggesting presence rather than exposing it. This layered quality of light evokes a sense of “*wa*”—a harmony rooted in restraint, ambiguity, and balance.

Conclusion

Stainless steel has long been regarded as a cold, inorganic material, valued primarily for its functional performance. This project challenges that conventional understanding. By combining local manufacturing techniques with architectural design, it demonstrates how an industrial material can become a bear-

Drawing of Lattice Member



Pine-needle tea (*matsubacha*) panel

er of regional culture and memory. The gallery at Tokuyama Deck offers one possible future image: a space where natural and artificial materials resonate with one another, and where materials themselves participate in telling the story of place.

In the blindfold panel installed in the penthouse, the opening rate is generally set at 30% or more so that the outside can be seen through punched holes from the inside in the daytime, and this level is attained by assuming a hole diameter of 10φ or more. In the punched panel applied in the current project, the hole diameter was narrow, at 4φ, and the opening rate was 22.5%. In spite of these unfavorable conditions, it was demonstrated that the

punched stainless steel member thus adopted was fully effective in seeing the outside through punched members from the inside.

Furthermore, when verifying the punched stainless steel panel used as the outer shell, the double skin-structure composed of glass and punched stainless steel was expected to demonstrate a significant effect in terms of thermal-insulation performance. Specifically, in the experiments conducted

by our company, it was shown that in the case of an outside air temperature of 30.5°C, the room temperature was 30.25°C for a single-skin structure, but 28.8°C for a double-skin structure. This shows that the double-skin panel structure is of use as an energy-saving means.



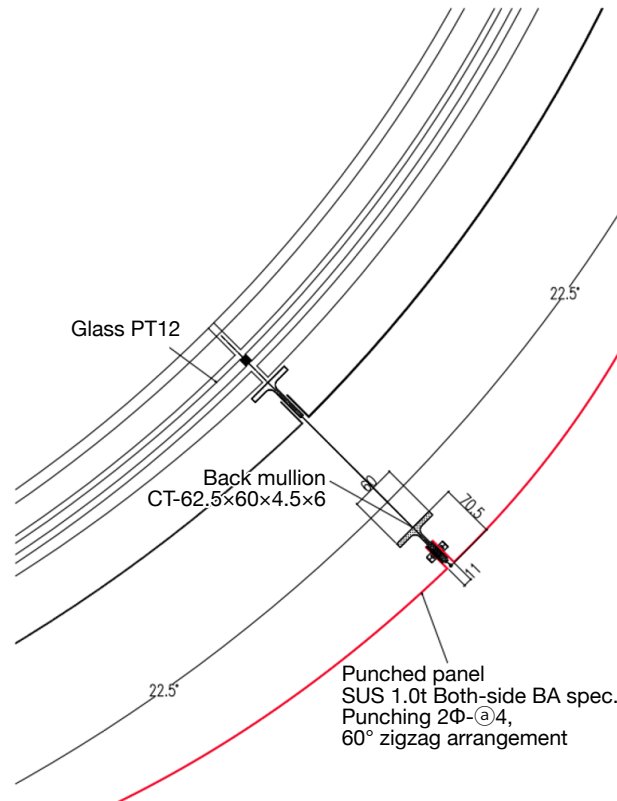
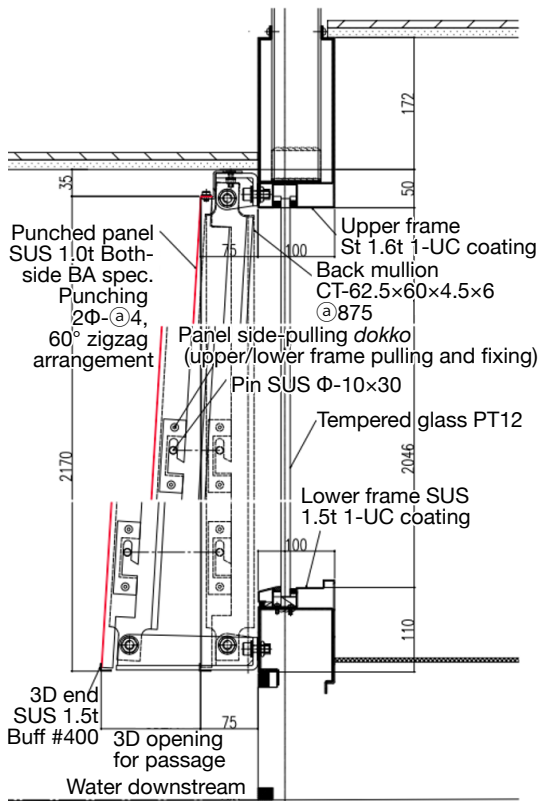
Outside view of "room for working from home" (the interior is not see-through)



Inside view of "room for working from home" (the outside is see-through)

Drawing of Vertical Section of Punched Panel

Drawing of Horizontal Section of Corner



ISSS-PSSC 2025 in Jeju, Korea

Dr. Yoshiharu Sato

Assistant Professor, Graduate School of Engineering, The University of Tokyo

An international symposium ISSS-PSSC 2025 was held in Jeju, Korea for four days from November 19 to 22, 2025. The 13th International Symposium on Steel Structures (ISSS) and the 14th Pacific Structural Steel Conference (PSSC) were jointly held at this symposium under the auspices of the Korean Society of Steel Construction. The ISSS has been held approximately every two years since its first symposium was held in 2000, and the PSSC has been held approximately every three years since its first conference was held in 1986. This was the first time that the ISSS and PSSC were jointly held.

On the first day, the meeting of the Pacific Council of Structural Steel Association (PCSSA), a steering committee of the PSSC, was held, to which President Mitsumasa Midorikawa of the Japanese Society of Steel Construction (JSSC) and Chairman Hiroshi Katsu-

chi of JSSC's International Committee participated as representatives from Japan. At the meeting, the host country for the next PSSC 2028 was discussed. Singapore announced its candidacy, which was finally approved. Photo 1 shows the group photo of PCSSA members at the meeting.

Outline of ISSS-PSSC 2025

At the ISSS-PSSC 2025, a welcome reception was held on the first day, technical papers were presented at the symposium venue on the second to third days, and a technical tour was held on the fourth day. Photo 2 shows a scene from the welcome reception.

In the presentations at the symposium venue, a total of 272 papers were presented—22 papers at the PSSC session, 130 papers at the organized session, 102 papers at the general session and 12 papers at the poster session in addition to 6

Number of Participants to ISSS-PSSC 2025 by Country

Country	Number of participants
Korea	160
China	86
Hong Kong	4
Japan	80
India	4
Netherlands	1
New Zealand	1
Poland	1
Thailand	3
USA	1
Congo	1
Total	342

keynote lectures. The table above shows a summary of the number of persons by country who participated in the ISSS-



Photo 1 Group photo of PCSSA members



Photo 2 Scene from welcome reception



Photo 3 JSSC President Midorikawa delivering a speech at the banquet



Photo 4 Scene from opening ceremony of ISSS-PSSC 2025

PSSC 2025. When counting the number of papers by country of affiliation of the first authors listed in the proceedings, papers from China numbered 88, those from Korea 87, and those from Japan 76. There were a large number of participants from Japan, reflecting the high vitality and strong momentum of research on steel structures in Japan. On the evening of the second day, a banquet was held, where JSSC President Midorikawa delivered a speech (Photo 3).

Photo 4 shows a scene from the opening ceremony. The keynote lectures were delivered by celebrated researchers and an industry leader from Korea, the US, Japan, China, New Zealand and the Netherlands. Regarding the keynote lecture from Japan, Prof. Takashi Yamaguchi of Osaka Metropolitan University delivered a lecture titled “Emerging Research Topics on Connections and Joints in Steel Bridge Members in Japan”—his latest research on high-strength bolt friction joining in which Prof. Yamaguchi has been actively involved (see Photo 5).

The venue for delivering the keynote lectures was large, and many par-

ticipants came together. The keynote lectures provided participants with an opportunity to touch on the latest research on steel structures from around the world, and were also very informative about the latest developments in steel structures.

At the symposium venue, three PSSC sessions, 20 organized sessions and 15 general sessions were held. The organized sessions on the theme of “Steel Bridge Rehabilitation,” “Steel Structure Monitoring,” “Metal 3D Printing” and “Cyclic Behaviors” were planned by Japanese participants. The author jointly with Associate Prof. Jiao Yu of Tokyo City University sponsored the session on the theme of cyclic behaviors titled “Cyclic Behaviors of Materials and Members: Testing and Modeling.”

Unfortunately, this session included only one participant from other countries, and as a result, most of the presentations were from within Japan. However, this session provided a valuable opportunity to disseminate the author’s research on cyclic behaviors overseas. Photo 6 is a group photo after the end of

this session, and Photo 7 shows a scene from the organized session “Metal 3D Printing.”

◆◆◆

I had no experience of participating in international conferences in my school days, and the first international conference in which I participated was the ISSS 2023. Many of the students I currently work with participated in the ISSS-PSSC 2025 and experienced their own presentations there. I was encouraged to see them actively enjoying international conferences.

In the ISSS-PSSC 2025, I was able to again meet the professors I got to know at ISSS two years ago and spend some meaningful time with them. Prof. Sang-Hoon Oh of Pusan National University and Prof. Tae Soo Kim of Hanyang University, former members of the same laboratory, invited me to a social gathering and took us to a black pork barbecue restaurant in Jeju, Korea (Photo 8). I sincerely hope to continue to sustain these kinds of exchanges in the future and to link them with the further development of research while also broadening international perspectives.



Photo 5 Keynote lectures by Prof. Takashi Yamaguchi of Osaka Metropolitan University



Photo 6 Group photo after the end of the organized session



Photo 7 Scene from the ISSS-PSSC session



Photo 8 Social gathering of ISSS-PSSC participants

2025 China-Japan-Korea Tall Building Forum in Busan, Korea

Dr. Masayoshi Nakai

Director of CTBUH Japan Structures Committee, International Committee of Japanese Society of Steel Construction

This forum is an international conference organized primarily by academic experts and structural engineers from China, Korea, and Japan as part of the initiatives of CTBUH (Council on Tall Buildings and Urban Habitat, renamed to Council on Vertical Urbanism (CVU) on October 6, 2025) in Asia. Since its inception in Shanghai in 2014, it has been held annually except for 2020 when it was canceled due to the COVID-19 pandemic, and this marks 11th forum.

The 2025 forum was hosted by Korean Council on Tall Buildings and Urban Habitat (KCTBUH), co-organized by the Committee of High-rise Habitat Environment—The Architectural Society of China and CTBUH Japan Structures Committee, and held on Friday, September 26, 2025, at the convention hall of Pukyong National University in Busan. Twelve participants from China and eight from Japan visited Busan, and together with Korean core members, speakers, and general participants, approximately 50 people attended this forum.

At the opening of the forum, Prof. Jong-Soo Cho from Konkuk University, President of KCTBUH, gave an opening address as the host, followed by greetings from Prof. Guo-qiang Li from Tongji University representing China and Dr. Masayoshi Nakai from Takenaka Corporation, representing Japan, expressing their gratitude for the hosts' well-organized preparation and hospitality.

Subsequently, there were three sessions with three speakers each from China, Japan and Korea, and a total of nine presentations were delivered in the morning and afternoon sessions.

Presentations from Three Nations

The summaries of three presentations from China are as follows:

- Development of a seismic steel frame system using “Multiple-Rocking-Column System (MRCS)” featuring energy absorption through friction joints and self-centering mechanism via gravity, inspired by the snake-dancing mode of ancient Chinese pagodas was presented. The presentation included performance verification results through progressive shaking table tests from small-scale to full-scale specimens, demonstrating low-damage performance of main

structures during major earthquakes.

- In the “Guangzhou SANY Twin Towers (heights of 204 m and 181.5 m)” designed by SOM, high-friction materials are sandwiched at the intersections of hexagrid perimeter CFT frame to achieve efficient energy absorption through local sliding, thereby reducing stress in CFT columns. Manufacturing methods and quality control of architecturally exposed structural steel (AESS) diagrid were also introduced.
- The China Construction Institute of Advanced Technology provided a comprehensive report on smart construction utilizing AI, IoT, and robotics deployed in 500 m-class super high-rise buildings in China, including technological innovations such as synchronous top-down construction for above- and under-ground structures, construction integrated platforms, innovative tower cranes, construction robots for unmanned material transport, concrete placement, and 3D printing, as well as digital construction systems.

The outlines of three presentations from Korea are as follows:

- A Performance-Based Wind Design (PBWD) method for high-rise buildings was proposed, which predicts actual building behavior through linear and non-linear time-history response analyses using time-history wind force data based on concurrent wind pressure measurements from wind tunnel experiments. Performance evaluation is conducted at three levels: occupant comfort (1-year return period), operation (50-year return period), and

continuous occupancy (500/900-year return period). Application cases to two high-rise buildings in Busan were introduced.

- Regarding progressive collapse resistance performance of precast concrete structures,



Photo 1 Lecture delivery from Prof. Takagi



Photo 2 Lecture delivery from Mr. Hotta



Photo 3 Lecture delivery from Mr. Byakuno



Photo 4 Group photo in front of the convention hall of Pukyong National University

1/4-scale structural experiments assuming single column failure were conducted to verify the effects of topping slabs and tendon reinforcement. A strength evaluation model was developed based on these results, and it was explained that the evaluation formula has been incorporated into design guidelines for progressive collapse prevention.

- Focusing on “Speed Core” concrete-filled steel plate shear walls, the presentation introduced cases of high-rise buildings in the US that achieved significant construction period reduction compared to conventional RC core walls, along with its treatments in AISC standards and Korean Design Standard. Case studies of Speed Core stiffness and fire resistance performance for high-rise buildings in Korea and mockup fabrication status were also explained.

Furthermore, the summaries of three presentations from Japan are as follows:

- Prof. Jiro Takagi from Tokyo Metropolitan University introduced research cases on obtaining “Superior Design Solutions (SDS)” that minimize steel material quantities from combinations of design variables using “Multiple Start Local Search (MSLS)” method. Based on comparisons between Japan’s Space Frame Systems (SFS) and US Perimeter Frame Systems (PFS), comprehensive and objective evaluation results are demonstrated, including applications to design methods (allowable stress design, push-over analysis, capacity spectrum method, time-history response analysis) and optimal arrangement of buckling-restrained braces and oil dampers (Photo 1).
- Mr. Yusuke Hotta from Mitsubishi Jisho Design Inc. explained the structural planning and design of “Tamachi Tower” (29 stories above ground, 156 m height) completed in Tokyo. This building adopts a “sliding core damping system” where the core section of the lower floors (basement 2F to 5F above ground) is placed on sliding bearings, separated from the surrounding steel frame, and efficiently absorbs energy

through oil dampers utilizing large relative displacements between the core and frame during earthquakes (Photo 2).

- Mr. Yasuki Byakuno from Obayashi Corporation reported on the design of Japan’s first pure-timber and fire-resistant high-rise building “Port Plus” (11 stories above ground, 45 m height). This building features a superstructure where all structural members including columns, beams, slabs, and walls are composed of timber materials such as glulam, CLT, and LVL, rigid connection units without metal, a seismic isolation system installed in the basement to enable these innovations, and proprietary 2-hour timber fire-resistant technology (Photo 3).

After all presentations concluded, closing remarks were delivered by Prof. Akira Wada (Chairman of CTBUH Japan Structures Committee), Prof. Guoqiang Li, and Dr. Kwang-Ryang Chung (President of CNP Dongyang) representing Korea, expressing gratitude for the meaningful discussions held with all participants gathered together, and the forum concluded successfully (Photo 4).

Technical Tour

On the afternoon of the day before the forum (September 25), a technical tour was organized, and visits to the following two

construction sites in Busan were conducted.

- “Busan North Port Tower” (59 stories, approximately 210 m height) consists of reinforced concrete twin towers connected at the top approximately 10 floors by steel trusses called sky trusses (Photo 5). It was explained that this connection portion was constructed using lift-up methods with digital twin technology after both towers were completed to the top. The structural and finishing work of this building, primarily serving as serviced apartments, was nearly completion, and participants were able to go up to the rooftop for a panoramic view of Busan city.
- The “Busan Opera House” designed by Norwegian architectural firm Snøhetta is a facility with a total floor area of approximately 49,000 m² featuring a theater with about 1,800 seats, with construction progressing toward completion by the end of 2026. The building is characterized by its curved triangular lattice glass facade around the perimeter. At the construction site, participants were able to observe the erection of folded and twisted lattice frameworks using circular and rectangular steel tubes utilizing 3D BIM models, as well as the construction status of the building’s interior structure including the theater (Photos 6 and 7).



Photo 5 Exterior views of the “Busan North Port Tower”

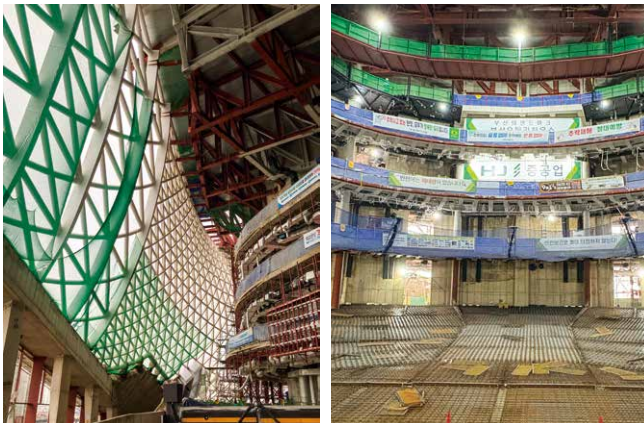


Photo 6 Interior construction status of the “Busan Opera House”

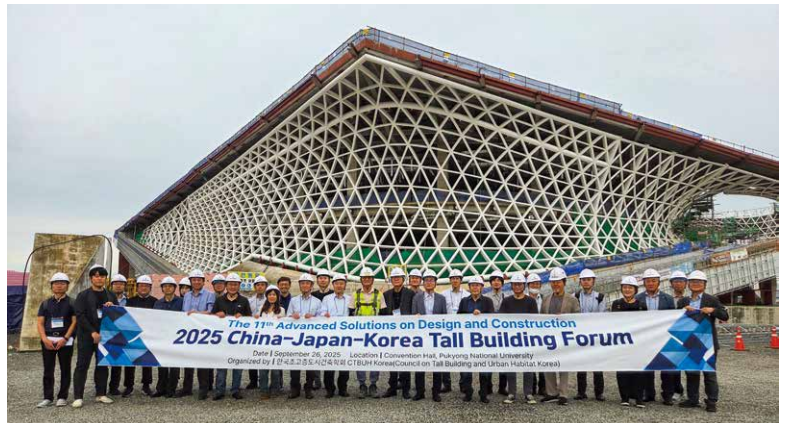


Photo 7 Group photo of tour participants at the “Busan Opera House”

Message from the President of the Japanese Society of Steel Construction

Mitsumasa Midorikawa

President, Japanese Society of Steel Construction
(Professor Emeritus, Hokkaido University)



The Japanese Society of Steel Construction held its 60th anniversary in 2025 and this year marks the beginning of its 11th three-year medium-term program. The “innovation of steel-structure production systems” is the cornerstone of the medium-term program. In response to the decreasing birthrate and the shortage of construction workforce,

“DX (digital transformation)” is also attracting attention in the construction sector. The main focus is not merely on the introduction of digital technologies, but on fundamentally reforming conventional frameworks and ways of working.

Meanwhile, on the standpoint of the “circular economy,” the need for resources recycling in structures is emerging as a new challenge. Thus, in order to achieve lower burdens on the environment, there is a growing de-

mand for construction methods that do not rely on the traditional destructive demolition of structures, but consider the reuse of structural materials and members from the design stage.

Based on such social demands, the JSSC’s medium-term program focuses on the maximum use of the strengths and characteristics peculiar to steel structures, while thus pursuing the ideal future course of steel structure production systems.

Message from the Chairman of the International Committee

Hiroshi Katsuchi

Chairman, International Committee
(Professor, Yokohama National University)



The Japanese Society of Steel Construction (JSSC) has conducted a wide range of activities pertaining to steel construction—surveys and research, technological development, the spread of steel construction in Japan and overseas and the improvement of steel construction technologies. In addition, JSSC has promoted tie-ups with related overseas organizations. As a link of these activities, aiming at spreading Japan’s steel construction technologies overseas and developing new markets, the JSSC’s International Committee has taken charge of editorial planning and compiled Issue No. 76 of *Steel Con-*

struction Today & Tomorrow.

In the feature article of Issue No. 76, the utilization of DX in the design of steel bridges is taken up. In this feature article, the transition from CAD introduced in the 1990s to BIM and CIM in the field of steel bridges was examined, and the ongoing application of BIM and CIM by means of the data linkage that makes use of design information attribute files was introduced. In the special article on stainless steel, two articles are introduced—stainless steel lattice screens at Tokuyama Deck Gallery and application of stainless steel punched panels in architectural metal products.

In addition, this issue introduces the JSSC Commendations for Outstanding Achievements in 2025 in the field

of steel construction (five projects) and technical papers (two papers).

In the pages about JSSC International Events, two articles—the ISSS-PSSC 2025 held in Jeju, Korea and the 2025 China-Japan-Korea Tall Building Forum held in Busan, Korea—are introduced.

The Japanese Society of Steel Construction held its sixtieth anniversary in 2025. Aimed at raising Japan’s presence in the field of steel construction both in Japan and overseas, JSSC is determined more than ever before to further promote international activities destined for the steady diffusion of steel construction. We would like everyone to understand the activities of JSSC and would also like to hear your opinions at any time.

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URL <https://www.jisf.or.jp/en/index.html>

Japanese Society of Steel Construction

3F Aminosan Kaikan Building, 3-15-8 Nihonbashi, Chuo-ku, Tokyo 103-0027, Japan

Phone: 81-3-3516-2151 Fax: 81-3-3516-2152

URL <http://www.jssc.or.jp/english/index.html>

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