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Japanese Society of Steel Construction

JSSC President Prizes 2010

Development and Application of New Jack-down Demolition Method for High-rise Buildings

Prize Winner: Kajima Corporation

The demolition of high-rise buildings has thus far been carried out by starting from the upper stories and working downward to the lower stories. In the newly developed “jack-down method,” jacks are installed just beneath the 1st-floor columns, and the building is demolished beginning from the lowest story. Continuing upwards, the columns of each floor are cut and the floors are successively jacked down. In order to secure seismic safety during demolition, a reinforced-concrete “core wall” and a steel-structure “load transfer frame” are newly installed inside the building.

March 24, 2008 May 27, 2008 July 25, 2008

Photo 1 Demolition of 20-story office building

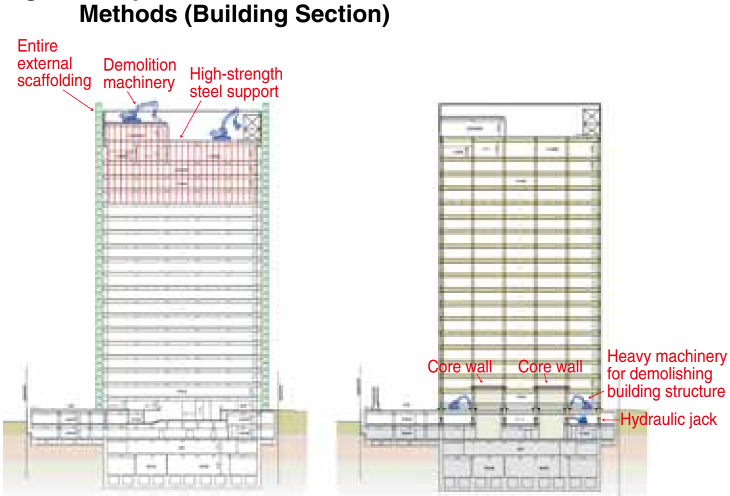
This new method was applied in the demolition of a 20-story office building, resulting in confirmation of the following merits:

- Demolition worksite was constantly surrounded, leading to less scattering of noise and dust.
- Demolition occurred only on the ground, thereby eliminating concern in neighboring areas.
- Waste matter was easily separated and recycled as useful resources.
- Recycling rate increased to 93% as opposed to about 55% using the conventional method.
- Recycling rate including that for the building structure reached 99%.
- High-rise work safety and safety from falling objects were improved.
- Time and labor required to unload demolished materials using tower cranes were reduced, leading to improved work efficiency.

The demolition cost of the new method is 5~10% greater than for the conventional method, but the demolition term can be reduced by about 15%. Using the new method, the demolition work is shorter, thereby allowing the subsequent new building construction to start earlier. Accordingly, because completion of new buildings can be hastened, economical advantages are realized throughout the entire process from demolition to new building construction.

While the building targeted for demolition was only a 20-story steel moment structure, extensive studies are underway to improve work efficiency and to reduce costs, with the goal of enhancing the general applicability of the jack-down method demolition for even taller buildings in the future.

Fig. 1 Comparison of Conventional and New Demolition Methods (Building Section)



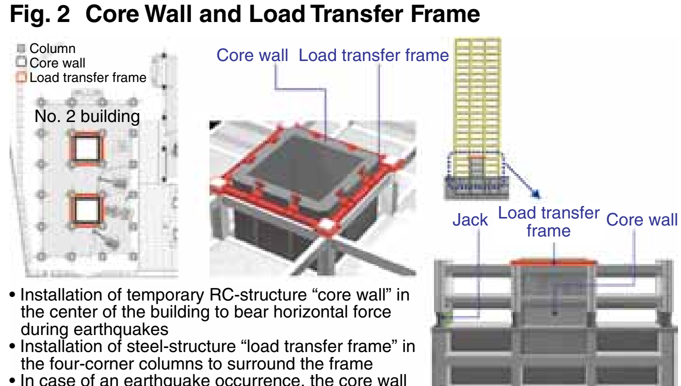
- Uplifting of heavy machinery to the upper section; crushing subsequently from the upper floor
- Demolished material: Throwing down through temporary opening
- Crane, high-strength steel support and external scaffolding are necessary
- Demolition subsequently from the upper floor
- High-rise work

a) Conventional method

- Installation of jack on lower floor
- Structuring of core wall
- Crane, high-strength steel support and external scaffolding are unnecessary
- Demolition subsequently from the lower floor
- Work on the ground surface

b) Newly-developed “jack-down method”

Fig. 2 Core Wall and Load Transfer Frame



- Installation of temporary RC-structure “core wall” in the center of the building to bear horizontal force during earthquakes
- Installation of steel-structure “load transfer frame” in the four-corner columns to surround the frame
- In case of an earthquake occurrence, the core wall and the aboveground steel frame are integrated via the load transfer frame to secure the seismic resistance similar to that of the building before demolition.
- Structuring of thoroughgoing fail safe system by means of seismoscope and emergency earthquake alarming system

Flat Plate Supported by Steel Bar Columns and Steel Capitals

Prize winners: Takenaka Corporation and Nippon Steel Corporation

Generally, building designers and owners tend to dislike heavy columns and any structure that protrudes from beneath the flooring slabs. In response to this, Takenaka Corporation and Nippon Steel Corporation have jointly proposed a new framing method: flat plate framing, which uses steel bars as columns to reduce column diameter to a minimum, and steel capitals that are embedded in the floor slabs (Fig. 1).

The new framing method is highly regarded as an approach to realizing indoor spaces that offer enhanced transparency. This method already has a richly documented record of application—40 examples of use in the construction of buildings of wide-ranging size and purpose (Photo 1).

Three technologies have been adopted to bring about the new framing method:

Very Slender Steel Bar Columns

The most slender columns available using contemporary technology are steel bars. In order to easily and legally apply steel bar columns, Nippon Steel obtained material approval in January 2006 for large-diameter round steel bars for building structures, which was a remarkable event that anticipated the stricter revisions of the Building Standard Law of Japan that came after 2006.

On-site Column-to-Column Joining of Steel Bar Columns

In applying the new framing method in the construction of multi-storied frames, one important and unavoidable technological task was on-site column-to-column joining.

Regarding the joining position, because the adopted coating finish lacks fire protection, joining must be undertaken within the slab in order not to expose the joining surface.

As for the joining method, several approaches such as partial penetration weld joining, weld-free spherical-support bearing joining and high-strength bolt flange joining have been adopted (Fig. 2).

Slab-embedded Steel Capitals

Slab-embedded steel capitals constitute the basic technology of the new framing method. The dynamic properties and the fracture mechanism of the current framing process were made clear by means of horizontal and vertical loading tests and analytical studies focused on establishing the design method and the design criteria. Further, the new framing method has undergone technical appraisal (GBRC performance appraisal No. 09-03) by the General Building Research Corporation of Japan, which has been essential for the practical and wider application of flat plate framing supported by steel bar columns and steel capitals.

Fig. 1 Flat Plate Supported with Steel Bar Column and Steel Capital

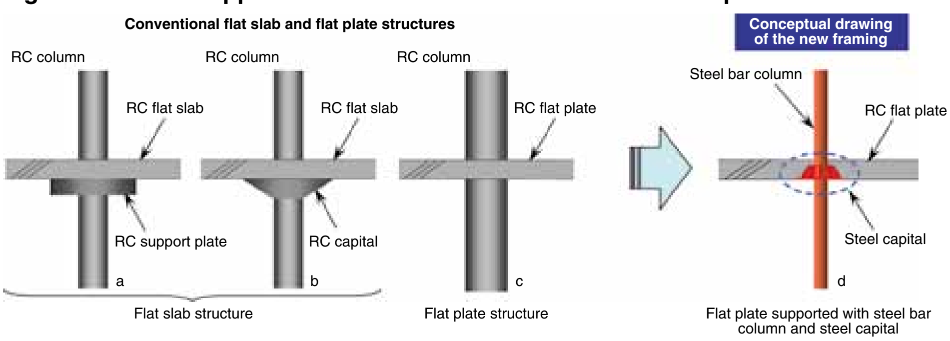
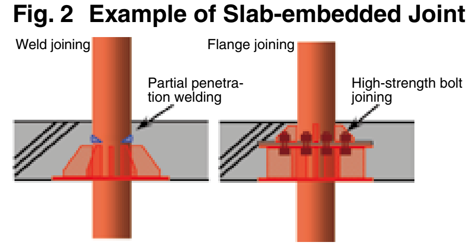


Photo 1 Examples of applications in buildings with various sizes and uses

Fig. 2 Example of Slab-embedded Joint



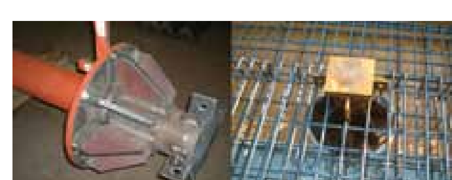


Photo 2 Example of steel capital (site welding)

Development and Practical Application of BHS: High Performance Steel for Bridges

Prize winners: Chitoshi Miki, Research Center for Urban Infrastructure of Tokyo Institute of Technology; and Hirofumi Kawasaki, Research Group on Steel for Bridges of the Japan Iron and Steel Federation

BHS (bridge high-performance steel) is a material in which the strength, fracture toughness, weldability, workability, weathering resistance and other performances required for bridge construction have been improved beyond conventional levels. In BHS, the performance values of the various characteristic features required for bridges have been enhanced to optimum levels.

The remarkable progress in thermo-mechanical control process (TMCP) technology has enabled finer control over the microstructures of recent structural steel products, which has brought about enhancements in the material qualities of these products. Specifically, these include improved weldability due to optimization of the carbon equivalent and weld crack sensitivity composition, minimization of impurities, and improvements in thickness- and width-direction properties—in addition to improved mechanical properties such as higher strength and higher fracture toughness. Consequently, the utilization of steel products making the most of these excellent properties is anticipated, and efforts are being made towards their development and practical use.

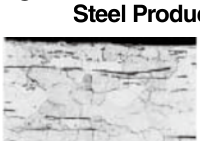
Development Concepts for BHS

Two concepts were worked out for the development of BHS.

- To develop high-performance steel that reflects the development of iron- and steel-making technology in Japan, and to provide steel with higher strength, toughness and weldability by using the latest TMCP technology to produce finer microstructure
- To contribute to the development of steel structures by maximizing the use of high-performance steel offering high economical advantages for bridge design and construction, as well as international competitiveness

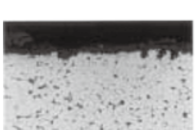
Notable progress in bridge steel products can be seen in the increasingly finer crystallization of microstructures (Photo 1). The latest BHS uses controlled rolling and cooling technologies to offer materials with a compatible mixture of weldability, strength and toughness.

Fig. 1 Transition of Microstructures of Steel Products for Bridges

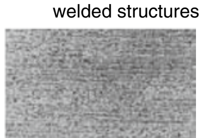


1882: Microstructure of wrought iron

1994: Microstructure of rolled steel for welded structures



1925: Microstructure of steel by ingot-molding method



Microstructure of BHS

Photo 1 On-site welding of truss joints employing BHS (courtesy: Kawada Industries)

Photo 2 En-block installation of the lower truss section with fully welded joints (courtesy: Kawada Industries)

Goal of BHS Development

In developing BHS, we noticed that lighter and more efficiently structured steel bridges can be designed by using BHS with higher strength and weldability than are found in commonly used SM steel products (JIS), and that the manufacture of bridge members can be streamlined by capitalizing on improved welding operations.

Practical Application of BHS

Innovative and economical steel bridges are anticipated by combining favorable member-manufacturing efficiencies (weldability, workability, etc.) made possible by the use of BHS with new designs that make the most of the high strength of BHS. For the Tokyo Gate Bridge (provisional name) that is now under construction, diverse new technologies have been adopted in its economical design, such as fully welded joint for the continuous steel truss bridge, which employs both BHS and load and resistance factor design.

Photo 3 Artist's sketch of Tokyo Gate Bridge (courtesy: Tokyo Port Office, Ministry of Land, Infrastructure, Transport and Tourism)

Table 1 Development of BHS (Bridge High-performance Steel)

Year	Content
1994~2000	Basic Study of BHS application potential for steel bridge member
2003	Proposal of BHS (BHS500, 700)
2004	BHS Registration in New Technology Information System (NETIS) of Ministry of Land, Infrastructure, Transport and Tourism
2005	Establishment of specifications for BHS500, 500W, 700W by the Japan Iron and Steel Federation
2006	First application in Nanboku Suiro Crossing Bridge (about 1,200 tons)
2007	Application in Tokyo Gate Bridge (about 17,000 tons)
2008	Official notice of JIS G3140 for SBHS500, 500W, 700. 700W
2009	Specifications for civil engineering materials (Construction Bureau, Tokyo Metropolitan Government)
	Revision of Steel and Composite Structures, Design Standards and Commentary for Railway Structures (Railway Technical Research Institute)

D-Runway at Haneda Airport: Construction of the World's First Steel Jacket-type Runway

Prize Winners: Joint Venture of D-Runway Construction Project; and Tokyo Airport Construction Office, Kanto Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism

The D-Runway, the fourth runway of Tokyo International Airport (Haneda Airport), was constructed in an area offshore from the existing airport. Because one-third of the entire runway lies within the mouth of the Tama River, the D-Runway was designed as a hybrid structure: reclaimed land and a pier structure that ensures uninterrupted flow of the river. The pier adopted a first-of-its-kind steel jacket structure made for use in airport infrastructure.

Because the pier section has a spacious flat area of about 520,000 m^2, many restrictions were imposed on its construction: the production and installation of a vast number (198) of jackets (steel products: about 260,000 tons) and 1,165 steel pipe piles (about 90,000 tons) in a relatively short period, realization of long-term durability for as many as 100 years, ensuring river flow, and providing fatigue strength capable of withstanding repetitive aircraft landings and take-offs. In spite of these restrictions, the new D-Runway was completed only in three and a half years.

The pier jacket structure offers the following main features:

- The jacket consists of an upper steel girder section and a lower truss section, the latter of which was designed without diagonal members in the areas above sea level. This configuration ensured river flow, reduced to a minimum level any restrictions on the lower structure attributable to temperature-induced expansion/contraction of the upper structure, and made possible a continuous integrated structure having an extremely spacious surface area.
- In order to secure sufficient fatigue strength to accommodate about 12 million takeoffs and landings of aircraft over a 100-year service life, FEM analysis was used in conjunction with conventional design methods to check fatigue in the special section. Further, two new approaches were fully introduced for member manufacture: improving weld fatigue strength by means of the ultrasonic impact treatment method (UIT) and conducting non-destructive inspection by means of ultrasonic automatic flaw detection (AUT).
- Advanced corrosion protection systems for steel products were adopted to optimize LCC and maintenance: cladding the upper girder section with titanium cover plates, controlling humidity with a dehumidifying system, and lining structures above the tidal and splash zones with stainless steel that is resistant to seawater corrosion.

Photo courtesy (front cover, page 4, back cover)
Joint Venture of D-Runway Construction Project

Fig. 1 Entire Structure of D-Runway

Fig. 2 Jacket Structure

Fig. 3 Integration of Upper and Lower Jackets

Fig. 4 Construction of Pier Section

Fig. 5 Full View of Jacket-type Pier

Thesis Prizes 2010

Research on the Flexural Shear Behavior of Short-span Beams with Preceded Shear Yielding

Prize winner: Yukihiro Harada and five other members

Yukihiro Harada

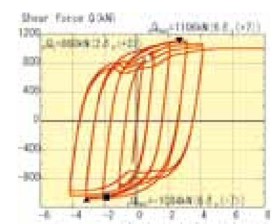
1995: Graduated from Graduate School of Engineering, Tokyo University
2007: Prof., Graduate School of Engineering, Chiba University

Following the Great Hanshin Earthquake of 1995, one important goal was to prevent the occurrence of brittle fracture and to secure plastic deformation capacity in the beam end welds of square steel tube columns and H-shape beam connections. This was attempted by disseminating and putting into practical use the haunched flange, which expands beam-end flanges in order to relax weld stress. However, for beams having small spans compared to their beam depth, cases exist where it is difficult to conduct member design that allows flexural yielding of beams to precede the fracture of beam-end connections, even using the width expansion method. This has been a major problem in beam-end fracture prevention design.

To resolve this problem, the author et al have proposed a new beam-end fracture prevention design method that uses shear yielding preceding beams that induce shear yielding in the beam webs prior to flexural yielding of the beams in order to relax stress in the beam-end welds. Then, a series of cyclic loading tests was conducted using shear yielding preceding beam specimens, including beam end welds to prove the validity of the new beam-end fracture prevention design method.

Fig. 1 Example of Ultimate State of Beams with Preceded Shear Yielding (Test Specimen F-1)

Fig. 2 Example of Relation between Cycling Loading and Deformation of Beams with Preceded Shear Yielding (Test Specimen F-1)



Study on Retrofit Measures in Welds of Vertical Stiffener Cutting Treating of the Semi-circular Notches in Orthotropic Steel Deck

Prize winners: Yoshihiko Takada and three other staff of Hanshin Expressway Company Limited

Yoshihiko Takada

1989: Graduated from Faculty of Engineering, Osaka City University
1990: Entered Hanshin Expressway Public Corporation
2010: Construction Technology Section, Hanshin Expressway Company Limited

Of fatigue cracks that occur in orthotropic steel decks, cracks in the fillet welds of deck plates and vertical stiffeners of main girder web are caused by concentrated local stress due to restrict deck deflection deformation by vertical stiffeners. This paper presents the results of studying on retrofit measures in welds of vertical stiffener cutting treating of the semicircle notches, to ease the concentration of stress in welds (Fig. 1).

In FEM analysis, it was observed that the occurrence of stress is reduced by providing semi-circular notches to about 1/2 at the deck-side toe and about 1/3 at the vertical stiffener-side toe.

Fatigue tests using specimens show the propagation of cracks slowed to almost nothing after notches are provided. In cases where a stop hole was provided for deck-penetrating cracks, the cracks showed no further propagation. The measurement stress on existing orthotropic steel deck is reduced to about 40% at the deck side and to about 30% at the vertical stiffener side after notches are added.

The current research makes clear that weld stress conditions are improved when notches are provided to improve fatigue durability and, at the same time, that the propagation of existing cracks can be suppressed.

Fig. 1 Semi-circular Notching

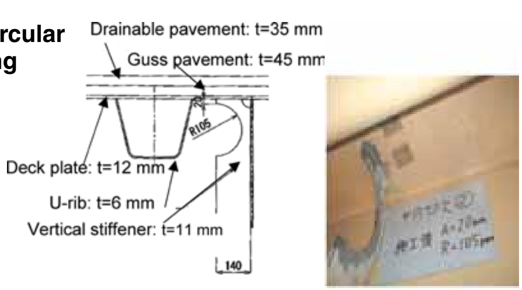
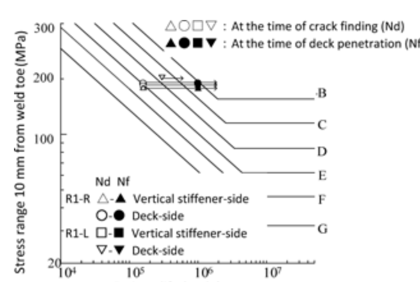


Fig. 2 Crack Occurrence and Fatigue Strength to Prevent Fracture



Basic Experimental Study on Seismic Uplift in Single-story Structures with Single-axis Asymmetry

Prize winners: Tadashi Ishihara and two other members

Tadashi Ishihara
National Institute for Land and Infrastructure Management, MLIT

Tatsuya Azuhata
National Institute for Land and Infrastructure Management, MLIT

Mitsumasa Midorikawa
Hokkaido University

The authors have conducted research that notices the effect of uplift on seismic response reduction. We conducted shaking table tests with the aim of clarifying the effect of eccentricity on seismic response reduction that had not yet been clarified.

In the preparation of the test specimens, due care was paid to the following three points (Fig. 1):

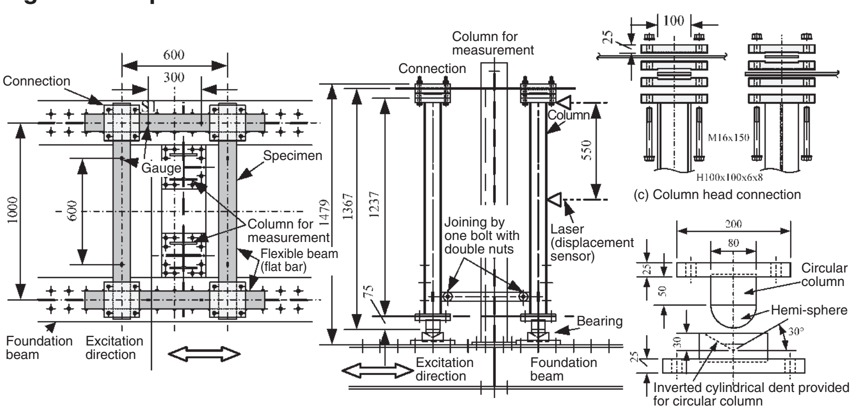
- Materialization of the assumption that the floor is rigid in its own plane
- Securing column rigidity and strength against collision and impact at the time of landing
- Compatibility for both specimen downsizing and the appropriate natural period

The test specimens consisted of rigid columns and flexible beams in a simple single-story structure containing only four columns.

Two specimen models were adopted: a non-eccentric model (N) and a model with single-axis eccentricity in the short-side direction (E). The eccentricity ratio of the E model was set at 0.48, a comparatively high level. The natural period in the short-side direction was 0.45 seconds for N and 0.54 seconds for E.

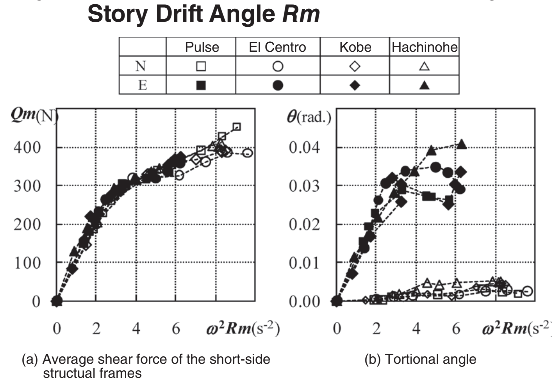
Fig. 2 shows the maximum response value, setting the average story drift angle *Rm* (normalized by multiplying by ω^2) of the short-side structural frames on the x-axis. It became clear in the current research that the average of the shear forces is nearly identical regardless of whether the model is eccentric or non-eccentric and regardless of the kind of seismic wave, and that uplift motion tends to limit the increase of the torsional angle to a certain level.

Fig. 1 Test Specimens



(a) Plan (b) Elevation (d) Bearing

Fig. 2 Maximum Response Value to Average Story Drift Angle *Rm*



(a) Average shear force of the short-side structural frames (b) Tortional angle

Evaluation on Behavior of Fatigue Crack through Thickness in 3D Structures by XFEM Analysis

Prize winners: Kazuki Shibanuma and four other members

Kazuki Shibanuma
2010: Graduated from Department of Civil and Earth Resources Engineering, Kyoto University
2010: Assistant Professor, Department of Systems Innovation, The University of Tokyo

Many fatigue crack damages have been reported in aged bridges. It is therefore urgently required to clarify the causes of these damages and to rationalize bridge maintenance. Numerical simulation of the fatigue crack propagation behavior is effective to solving these problems.

Cracks can be modeled independently from meshes by using the extended finite element method (XFEM). In this study, an code was developed that can easily and efficiently simulate crack propagation by implementing the PU-XFEM into general-purpose FEM analytical software. The PU-XFEM is the reformulation of the XFEM solving the incompleteness caused by the original XFEM. Further, the validity of the code was confirmed by simulating the propagation of fatigue cracks in the intermediate cross beam of I-girder bridge and the steel floor deck specimen using bulb rib. The results of fatigue crack simulations showed a good agreement with test results.

Fig. 1 Modeling of Crack in the PU-XFEM

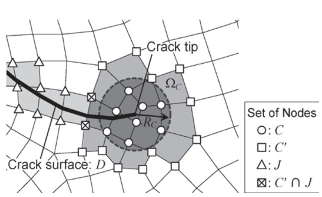


Fig. 2 Numerical Model of the Orthotropic Steel Deck Specimen

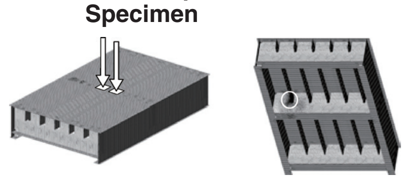
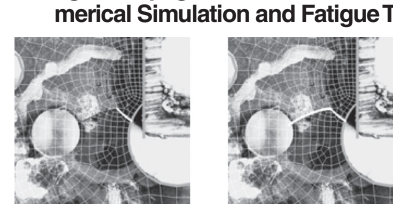


Fig. 3 Comparison of the Results of Fatigue Propagation Path in the Numerical Simulation and Fatigue Test



Steel Composite Structures and Railway Facilities

Railway Construction in Japan

Railways in Japan have a total length of about 20,000 km and are operated by six passenger railway companies and one freight company, which were privatized and divided from the government-owned Japan National Railways in 1987. About 2,200 km of these railway lines are operated as a network of high-speed passenger lines, the so-called Shinkansen. Shinkansen is an advanced system compared with conventional railway systems using narrow gauge lines. For example, Shinkansen basically adopts the standard gauge and new signal- controlling systems. The first 515 km of Shinkansen was opened to traffic in 1964, the year of Tokyo Olympics, as the first high-speed railway in the world. Since its opening, new high-speed lines have steadily been constructed until today.

Japan has a total population of 120 million in its narrow land (1/25 of the United States). Because of such situation, construction of Shinkansen has often faced severe conditions relating to the work space. Especially for bridges crossing rivers, roads and railways, it is not too much to say that the structural type of these bridges is selected depending on how to erect a bridge. Therefore, the opportunity has been increasing in which a bridge structure using mainly steel is selected because of its excellent performance in installation.

In this article, two topics are introduced. The first topic is the Matsubara Bridge as an example of steel-concrete composite girder bridge, which was constructed under a severe erection condition. The second topic covers the Hyugashi Station and the Kochi Station as examples of railway station buildings reconstructed employing steel-timber composite structures (both stations are for conventional railways).

Steel-Concrete Composite Bridges in High-speed Railways
— Matsubara Bridge: Erection under Severe Conditions —

By Kaoru Mitsugi, Special Project Director, Design and Technology Department, Japan Railway Construction, Transport and Technology Agency

Shinkansen Projects in Japan

As mentioned above, construction of the Shinkansen lines in Japan has been in progress on a sustained base. An outline of Shinkansen projects is shown in Fig.1 (a). The red lines in the figure show the recent construction of Shinkansen. The extension of the Tohoku Shinkansen to the northern part of Japan was completed in December 2010, and that of the Kyushu Shinkansen to the southern part of Japan is slated in March 2011. The inauguration of these new lines means that all regions from the northern area of Honshu to the southern area of Kyushu will be connected by high-speed railways, and thus the mobility is expected to significantly increase throughout Japan (note: Hokkaido Island will be connected by Shinkansen in 2015).

In the construction of the Shinkansen lines, steel bridges tend to be selected at sites with severe erection conditions. We focus on the Matsubara Bridge for which erection was most difficult in recent bridge construction for Shinkansen.

Matsubara Bridge

● Location and Outline of Structure

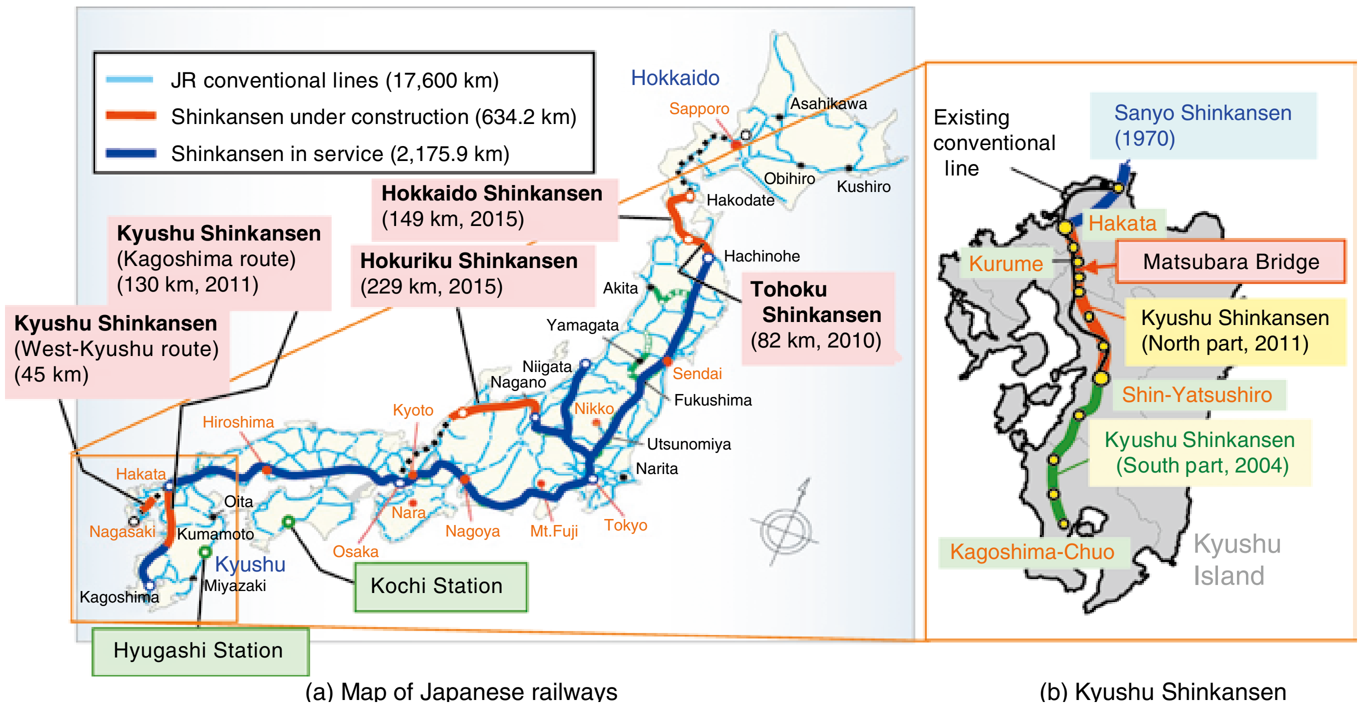
Construction of the Matsubara Bridge was promoted under the severest condition for the Kyushu Shinkansen bridge projects due to the constraints posed on construction space and work time. Fig. 1 (b) shows the Kyushu Shinkansen scheduled for opening in March 2011. The Matsubara Bridge was constructed near a large station of the conventional line.

Fig. 2 (a) shows an aerial view of the bridge. The new line leads to the downtown of Kurume city, which has a population of more than 300,000 in an area of approx. 200 km^2. The construction site is located between a highly industrialized area and a densely populated residential area. Therefore, the new line infrastructure had to be constructed in a narrow space above and around the existing railway line in service. Moreover, the construction site had a very limited workspace where buildings are overcrowded and existing tracks are too close. For these reasons, steel-concrete composite girder bridges and steel portal frame piers were selected as the structural type of the Matsubara Bridge, as shown in Fig.2 (b).

● Structure of Matsubara Bridge

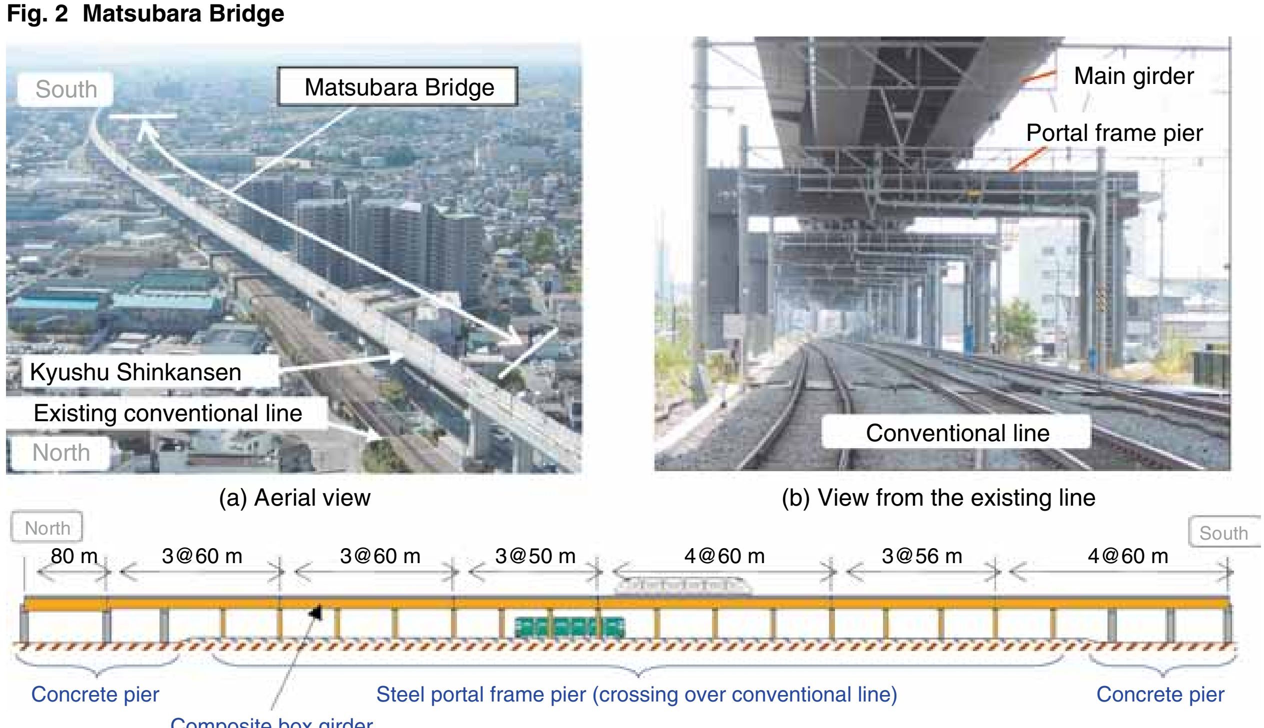
Fig. 2 (c) shows an outline of the structure of the Matsubara Bridge. This bridge is composed of a series of steel-concrete composite box girder bridges and its length reaches 1,243 m, the longest among other overpass bridges on existing railways in Japan. The superstructure consists of a simple box girder, 4 three-span continuous box girders, and 2 four-span continuous box girders. The simple girder has the one-box structure of 3.5 m web height and 85 m girder length for over passing the broad road. Other continuous girders have the two parallel-box structure of about 2.8 m web height and 60 m girder length. The substructure consists of 16 steel portal frame piers whose span is about 25 m for the part over passing the existing tracks and 6 reinforced-concrete piers for other part.

Fig. 1 Railways in Japan (Summer, 2010)



(a) Map of Japanese railways (b) Kyushu Shinkansen

Fig. 2 Matsubara Bridge



(a) Aerial view (b) View from the existing line

(c) Outline of bridge structure

● Constraints on Space and Time

The superstructure of the Matsubara Bridge had to be erected over the existing railway line. The existing line is very busy on which more than 340 trains run daily. In such a tight space, we had to carry out not only the erection work of the girders and the piers but also preparation work such as the assembly of parts for the superstructure. Furthermore, the erection work above the existing track had to be finished within 200 minutes in each night work. In this situation, scheduling and management were quite important because working time was not allowed to be extended and a small mistake or accident would severely affect the operation of the existing railway line operations.

● Balancing Rotation Method for Cross Beam of Portal Frame Pier

For the erection of the cross beams of the portal frame piers, enough workspace was unavailable around the existing tracks for the use of normal erection methods such as crane-bent erection method. The large block erection method was also impossible because the method needed a broad path to approach the site by a large crane. Furthermore, it was required to finish the erection work in a short night work time, as mentioned before.

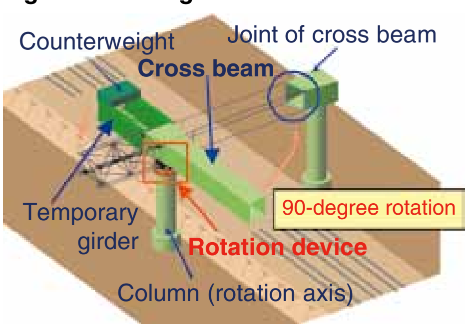
The balancing rotation method is a newly-developed method for this construction work, which enables the erection of the cross beams under such conditions. Fig. 3 shows an outline of the balancing rotation method. The cross beam was assembled parallel to the existing tracks in advance.

Fig. 4 shows the rotation devices. After connecting the assembled cross beam with the counterweight, the cross beams were supported by the pivot shoes, as shown in Fig.4 (a). Then the cross beam was rotated horizontally on the column using rotation devices. Rotation in the narrow space was available by use of the small device combined with the clevis jacks, which gave a force toward the rotating direction by the reaction of hydro-clamp device, as shown in Fig.4 (b). A symmetrical setting of two clevis jacks enabled the control only by applying the slight force.

After the rotation, the cross beam was connected to the column on the other side of the existing track. Field joints of the frame piers were mainly conducted by welding, but the bolt connection was applied for the joint of rotated cross beams to shorten working time above the existing tracks.

Fig. 5 (a) shows the assembly work of the cross beam. Fig. 5 (b) shows the rotation work. The rotation of the cross beam took only 30 minutes.

Fig. 3 Balancing Rotation Method



● Launching Erection Method for Superstructure

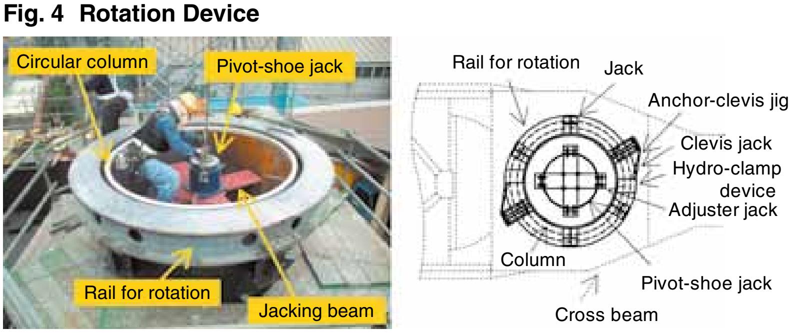
As mentioned, there was no enough space for installing superstructure by means of bent or large crane. The lateral transfer erection method was also impossible because it needs much time and a yard area beside the site. In such situations, we applied the launching erection method for the installation of the main girders.

Fig. 6 shows an outline of erection work of the superstructure. Firstly, the construction section was divided into two: 595 m and 648 m sections. At each section, the superstructure was assembled at the assembly yard on an already constructed neighboring superstructure in a daytime. The assembled girder was then launched from the assembly yard in a nighttime. The main girders were field-connected by welding with due consideration for landscaping, reduction of steel usage and ease of launching.

To enable continuous launching, the assembled girders were connected each other by means of temporary connection (Fig.7 (c)) into two large blocks. The connected girders were then pushed out from both sections toward the center of the bridge, as shown in Figs.7 (a) and (b). The total launching length is longest among Japanese railway bridges and also longest among Japanese box-girder bridges including highway bridges. Fig. 7 (d) shows the launching devices using caterpillar, which enabled launching in 120 minutes to push out each span. The girders included a 5,000 m radius curve, but the device was helpful in controlling the installation position of the superstructures. To secure the safety and accuracy of the work, we monitored the erection force, position, and reaction force in real time during installation, comparing with the calculated values of frame analysis in each step of the work. After erection, temporary connections were cut out and the girders were jacked-down into place as shown in Fig.7 (e).

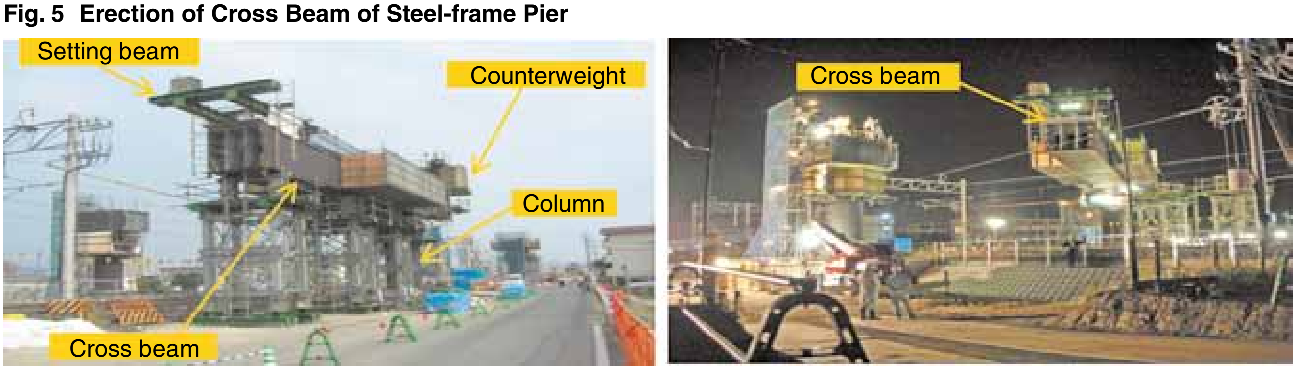
The assembly work needed about a month for one-span girder. The launching work of the girder needed a night for a span and took 21 nights in total. The total period of installation took 14 months.

Fig. 4 Rotation Device



(a) Device at the top of column (b) Plan view of device

Fig. 5 Erection of Cross Beam of Steel-frame Pier



(a) Assembly of cross beam (b) Rotation of cross beam

Fig. 6 Launching Erection of Superstructure

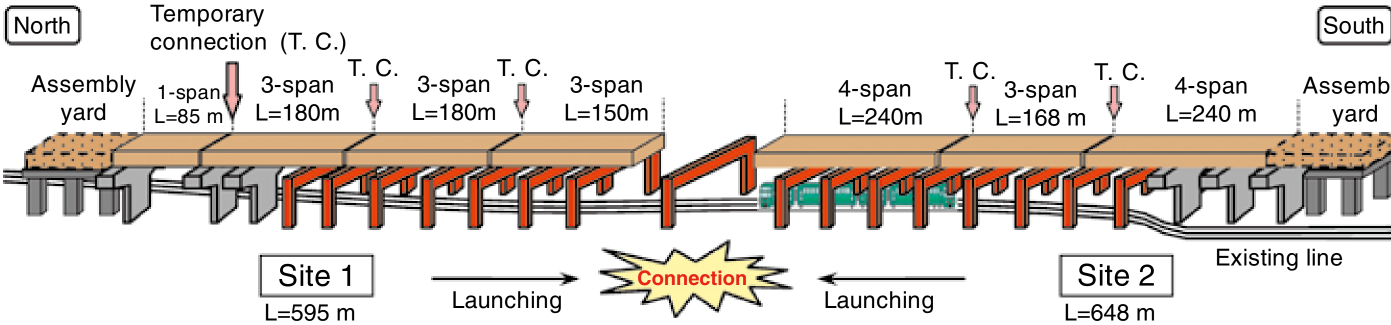
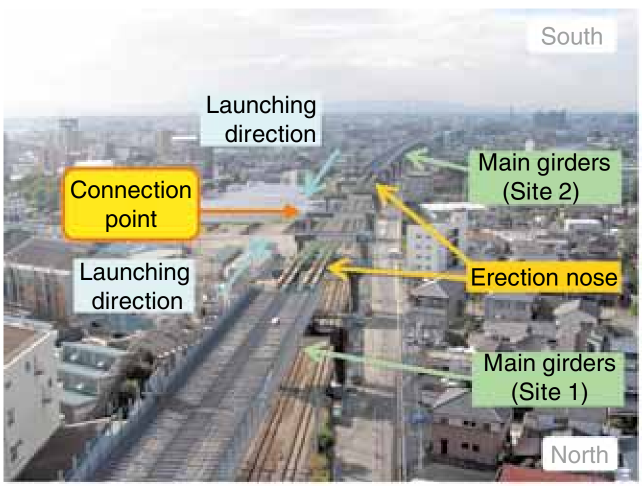
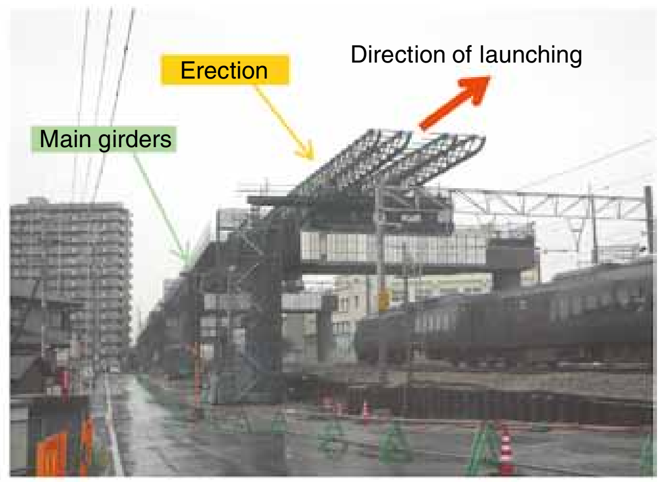


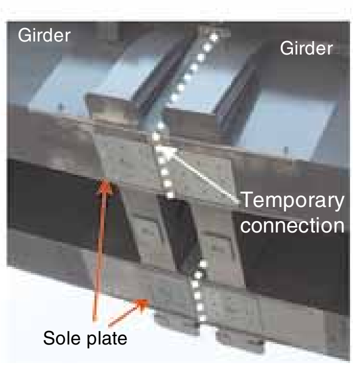
Fig. 7 Launching Erection of Superstructure



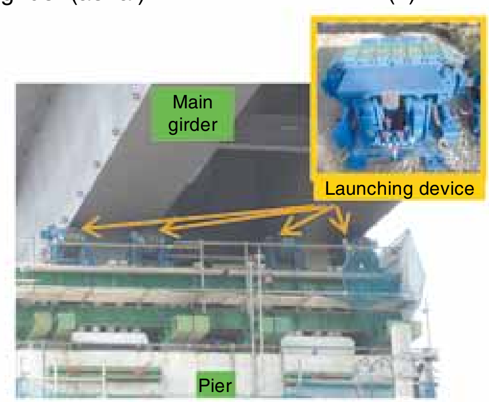
(a) Launching of main girder (aerial)



(b) Launching of main girder (bottom angle)



(c) Temporary connection



(d) Launching device with caterpillar

(e) Jacking down of main girder

Successful Completion by Use of New Installation Methods and Steel Composite Structures

In the recent construction of Shinkansen high-speed railways, main concerns in design have shifted from the structure itself to erection methods due to the tough surrounding conditions involved. By applying the balancing rotation method and the launching erection method, we successfully constructed the Matsubara Bridge safely and on schedule, and without stopping the service of the existing line. There had been no bridge in Japan that was constructed continuously in such a length above existing transportation lines.

Railway use has revived in the light of environmental conservation and needs for energy-efficiency. Since the inauguration of the first Shinkansen in 1964, many countries have constructed high-speed railways. There are also many countries which are planning high-speed railways. Needs for constructing bridges in populated areas are also increasing. We are sure that our experience obtained in the construction of the Matsubara Bridge will be quite helpful for many railway planners.

We are striving to expand the application range of steel structures that have excellent construction capability and high durability.

Structural Design of the Hyugashi Station Building

By Mamoru Kawaguchi
Emeritus Professor of Hosei University (Representative, KAWAGUCHI & ENGINEERS)

Two new trial approaches have been incorporated in the structural design of the Hyugashi station building in Miyazaki Prefecture.

One is the adoption of a wood-steel composite structure. The adoption of this structure allows the use of Japanese cedar, a distinctive product of Miyazaki Prefecture, as a visually attractive structural material that offers sufficient lightness, strength, rigidity and durability to form roof framing members that are capable of covering the open spaces of the station building. Such a structural design would be impossible using members solely of laminated wood.

The other technology is the adoption of laminated members consisting of multiple sections. While there are many examples of laminated members being used to form curved monolithic structures, the adoption of curved multipart laminated members is a new trial technology that is rarely, if ever, found in either station buildings or other general-purpose buildings.

Outline of Station Building

Hyugashi (Hyuga City), located in northern Miyazaki Prefecture, is the area's forestry center. The area has a warm climate, but is also known as a passageway for typhoons.

Architectural and urban studies were conducted with regard to the station building, the elevated railway and the town-building as well, in order to provide the visual transparency and lightweight structural design that would be worthy of symbolizing Hyuga City and that would be required for construction of the Hyugashi station building. As a result, it was decided that the structural plan for the station building shed would call for a fully-covered wooden structure with a span of about 17.2 m and a roof area of about 2,000 m^2 that would cover the entire 110-m length of express trains (Fig. 1). Further, canopies were planned that would run the length of the station building on either side, have large depths of 7~11 m and be connected to the elevated railway. Structurally, the canopies are supported by lightweight columns and are connected to the elevated railway in order to provide sufficient stability against strong winds and the horizontal forces generated by earthquakes. The canopy structures consist of wooden roof framing that extends outward on steel trusses and H-shape girders supported by two rows of steel pipe columns. The aesthetic arrangement of the canopies brings stability to the architectural configuration of the entire station building. (Refer to Photos 1 and 2)

Structural Types and Features

As the Hyugashi station building is a fully-covered station building having columns at the outer edges of the elevated railway, it imposes certain spatial restrictions, such as site border lines outside the building and railway limiting lines inside the building. In order to form a wood-steel composite structure and secure the rigidity and strength needed to resist strong winds and earthquakes under such restrictions, the major task was to determine the kind of structural system that should be adopted.

Diverse ideas were examined and, as a result, it was decided to adopt a composite frame with laminated members of Japanese cedar, a distinctive product of Miyazaki Prefecture, arranged in the section above the beams and supported from below by H-shape steel columns and steel tube diagonal members. The interval between the laminated framing members is 3 m.

Fig. 1 Section of Hyugashi Station Building

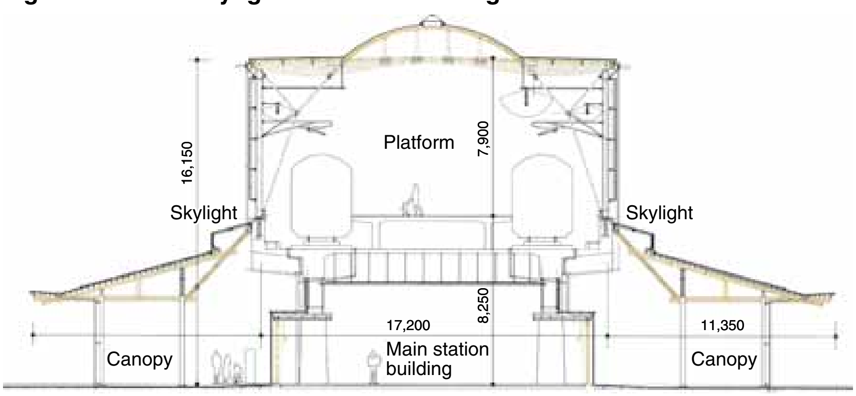


Photo 1 Appearance of Hyugashi station building

Photo 2 Inner view of platform

Fig. 2 Bending Moment of Beam Caused by Horizontal Force

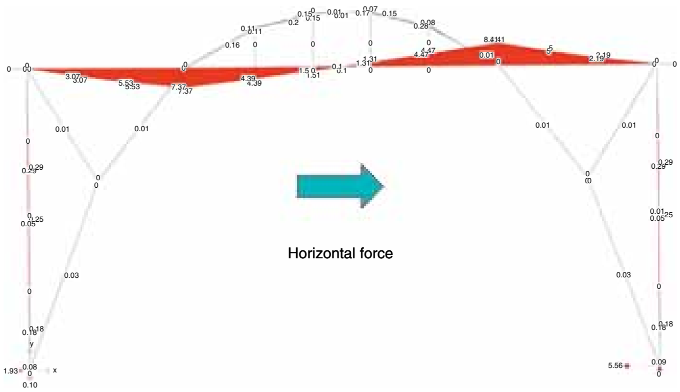
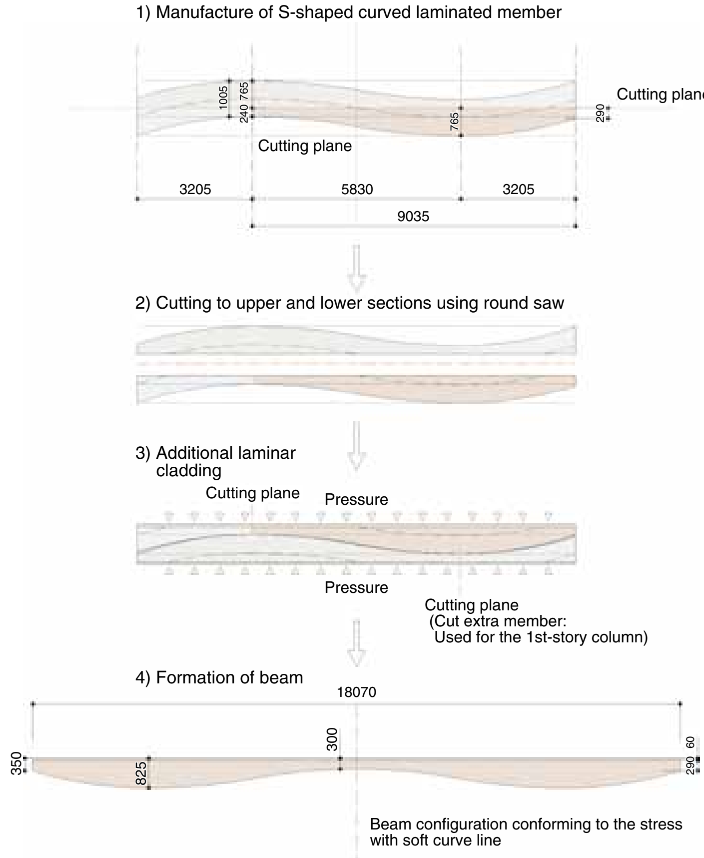


Fig. 3 Conceptual Drawing for the Method to Manufacture Curved Laminated Members with Varied Sections



The cylindrical roof is aesthetically located at the center of the wooden section. In order to design such a roof, arch-shaped members were required. For that purpose, attempts were made to reduce the burden placed on the horizontal beam members (bending members) at the span center by utilizing arches as thrusting resistance elements so that lightweight framing could be formed. The section below the horizontal beam members was configured using H-shape steel columns (H-300 × 150 × 6.5 × 9) and diagonal steel tube members (114.3 dia. × 6.0). The adopted structural plan has the angle brace framing aligned across the span and the brace structure aligned along the ridgeline, with the laminated members and the arches supported by the three-dimensionally configured diagonal steel tube members.

Under vertical loads, there is no occurrence of large bending moments in any of the structural members due to adoption of the above-mentioned wooden arches and angle brace framing. However, horizontal loads generated by earthquakes and wind cause large bending moments in the wooden beams (Fig. 2). To solve this problem, it is desirable for the beams to be configured in a manner that is rationally resistant to bending moments.

In order to produce the curved multi-part, laminated members thus required, the approach shown in Fig. 3 was applied:

1) First, the S-shaped members were manufactured using the commonly applied method.
2) The members thus prepared were cut linearly so as to divide them into two equal parts.
3) The upper part was placed under the lower part so that they would adhere to each other; a linear laminar was added to the edges of both the upper and lower parts to clad the two parts. Then, the clad member was cut at its narrowest point.
4) The two cut members were joined on-site at the cut-point to complete the beam.

The members thus manufactured were transported to the site, and assembled on-site with the arch members and struts (Photo 3). These assembled members were hoisted and attached to the steel angle brace framing (Photo 4). The entire framing of the station building shed was completed in this way.

Photo 3 Ground assembly of laminated member girder

Photo 4 Hoisting of laminated member

Rational Framing Capitalizing on Composite Structures

Realization of the framing method mentioned above has led to the formation of framing that offers sufficient rigidity and strength against not only vertical loads but horizontal loads as well, in both the direction of the span and the direction of the ridgeline.

Instead of certain spatial restrictions being imposed on the construction of a fully covered station building shed, it was possible to successfully create framing capable of satisfying both architectural and structural requirements using laminated cedar members that are low in strength and rigidity. It can be said that success was largely attributable to the application of a wood-steel composite structure in a manner consistent with the principle: "right materials for right places."

Structural Design of the Kochi Station Building

By Mamoru Kawaguchi
Emeritus Professor of Hosei University (Representative, KAWAGUCHI & ENGINEERS)

Kochi City is located in the center of Kochi Prefecture and in the midst of a prospering forestry industry. While the city benefits from a warm climate, it is also known to lie in the pathway of typhoons. Thus, in planning structural design, it is important to pay ample consideration to the wind.

The basic design of the Kochi station building highlights a large vault-shaped frame that spans the elevated tracks from the south side of the tracks to the upper section of the north-entrance canopy (a steel-reinforced concrete composite rigid frame) that stands in the station plaza independently of the elevated railway. The structural design of the building was premised on the use of Japanese cedar produced in Kochi Prefecture.

Further, the south-entrance canopy is a steel structure with a great depth of 13.5 m that is located on the south side of the elevated railway. The canopy was designed to connect to the elevated railway, and because the elevated structure provides stability against horizontal forces caused by earthquakes and strong winds, the canopy was designed to be supported with light columns.

Fig. 1 Section of Kochi Station Building

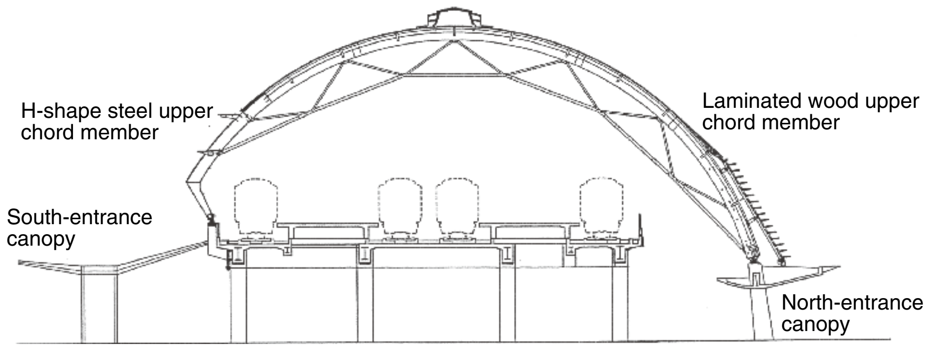


Photo 1 Appearance of Kochi station building

Structural Outline

The roof of the Kochi station building has a vault-shaped configuration with a span of about 39 m and a length of about 60 m, and a maximum height of 23.4 m. The upper chord members that constitute the vault are installed at intervals of 4.5 m and rise from the north-entrance canopy. Because the construction work had to be conducted so as not to suspend railway operations in the area where the south-side canopy was to be placed, a structural type was adopted whereby the arch legs on the south side would not extend to the ground but would be affixed to the elevated structure supporting the tracks.

Meanwhile, in order to secure the required clearance for the trains, a dogleg shape was adopted for the roof on the south side of the elevated structure, giving the roof as a whole an arched asymmetric shape (Fig. 1 and Photo 1). The lower chord members run between two upper chord members and forks into two branches near the end to join with the upper chord arch. However, on the south side of the elevated structure, the lower chord members connect to the upper chord members near the fold point of the dogleg in order to preserve the required clearance for the trains. To secure the horizontal resistance of the structure in the east-west direction below this point, a system composed of x-braces is provided to include this level for the three bays near the east and west ends of the structures, respectively. (Refer to Photo 2)

Photo 2 Interior view of large roof

The maximum depth of the arch is 2.8 m, and the upper and lower chords are assembled three-dimensionally using lattice members. The upper chord members are composed of laminated cedar, excluding the dogleg, and the lower chords and diagonal members are made of steel tubes.

Structural Systems and Features

Wooden structures are generally less efficient at transferring tension and bending stresses at joints than they are at transferring compression stress. Accordingly, the following approach was adopted. Namely,

Fig. 2 Assembly and Detailed Drawings for North-side Column Leg

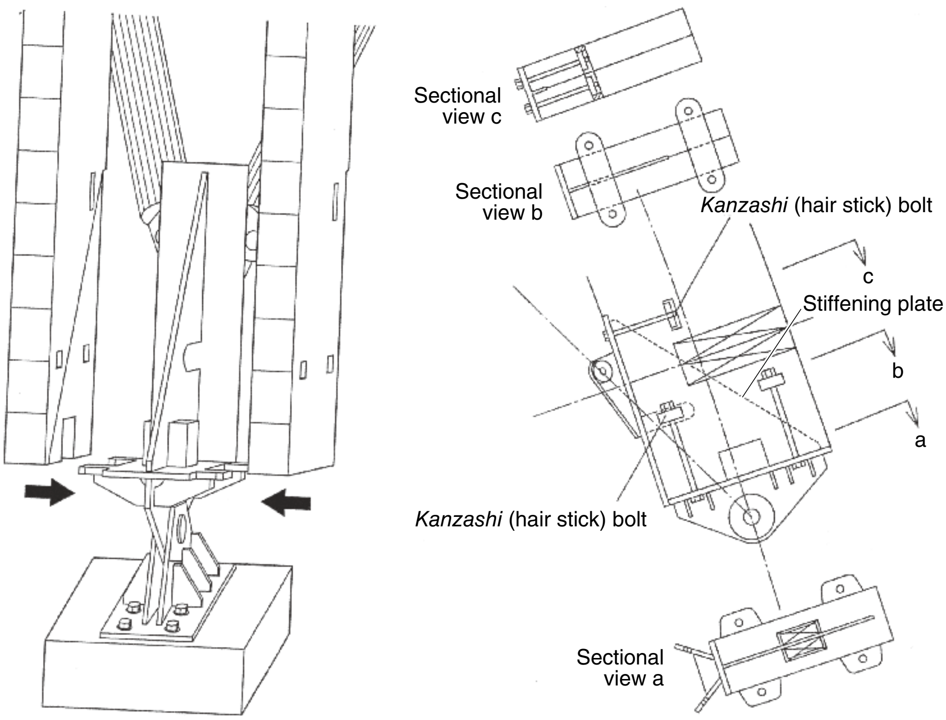


Photo 3 North-side column leg

laminated cedar members (150 × 900, in a double-wall structure) were used for the upper chord members where compression force is dominant; H-shapes (H-800 × 250 × 16 × 25; varied sections) were adopted to handle the large bending stresses at work around the dogleg on the south end of the arches; and steel tubes (190.7 in dia. × 23 for chord; 114.3 in dia. × 15 or 9 for diagonal member) were used for the lower chords and diagonal members where tension force dominate.

In this way, a composite structure of wood and steel was adopted in a manner consistent with the principle "right materials for right places" in which steel is paired with wood to cope with large amounts of tension and large bending moments against which wood is not strong enough.

In the station building, because three-dimensionally assembled diagonal members serve as both roof in-plane braces and seismic-resistant braces, the horizontal forces that are at work during wind loading and earthquakes are smoothly transferred to the elevated railway structure in both transverse and longitudinal directions.

In order to smoothly transfer forces between the upper chord cedar members and the steel members, special details were designed. While compression force occurs in the north leg of the laminated member arches during vertical loading, there are cases in which tension force can occur during earthquakes and wind loading, thereby necessitating the safe transfer of this force to the metal anchor fittings at the base of the columns. In such cases, it is general in conventional joining methods to insert a steel plate with multiple holes in the timber members into which bolts, drift pins or other kinds of steel bars are inserted, allowing the transfer of force between the wood and steel members via the shear and bending of the inserted steel bars.

In the Kochi station building, such a conventional approach was rejected in favor of a new method whereby a thick steel plate is inserted into a rectangular hole cut into the bottom of each wooden member; the steel plate is then fastened with bolts to a metal anchor fitted to the outside of the wooden member (Fig. 2, Photo 3). This joining method allows the wooden members to demonstrate reasonably large bearing force.

Joining of the laminated wood members and the lattice members was conducted using detail fittings based on the same concept mentioned above. A protruding cross-shaped member was weld-joined to the steel plate where the lattice members are attached; notches conforming to the cross-shaped protrusions were cut in advance into both sides of the laminated members; and the protrusion was then sandwiched between the two laminated members. The steel plate was tension-joined to the laminated members using bolts in a manner similar to that used for the north end of the legs mentioned above. (See Fig. 3, Photo 4).

Fig. 3 Assembly and Detailed Drawings for Laminated Wood-Lattice Joint

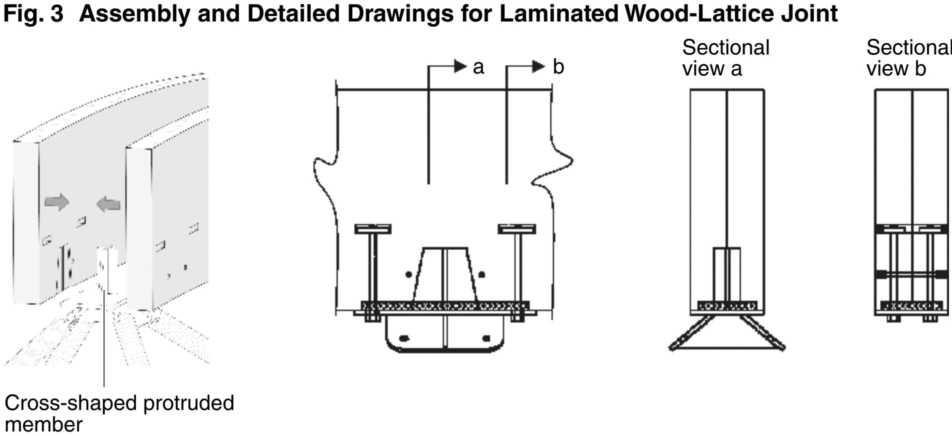


Photo 4 Laminated wood-lattice joint

Connection Design of Steel-Concrete Hybrid Structures

By Koichi Minami, Prof., Faculty of Engineering, Fukuyama University
Toshiyuki Fukumoto, Building Structure Group, Kajima Technical Research Institute
Kenji Nishiumi, Technical Development Bureau, Nippon Steel Corporation

Design Guidebook for Connections in Steel-Concrete Hybrid Structures

A hybrid structure is composed of different materials or various structural members and systems in a manner consistent with the principle: "right materials for right places." Compared to conventional structural systems, a hybrid structure offers enhanced freedom in structural configuration vis-à-vis safety, productivity, economical advantages, architectural space and structural landscaping.

Because hybrid structures require the joining of diverse structural materials, members and systems to complete the composite construction, many connecting methods have been proposed. However, neither a force transfer mechanism model nor a structural performance assessment method common to or fundamental for hybrid structures has been established. Thus, verification of structural safety currently depends on experimentation.

To resolve this situation, the Japanese Society of Steel Construction has created a "Working Group on the Preparation of a "*Design Guidebook for Connections in Hybrid Structures*" aimed at establishing a common or fundamental method to assess the structural performances (strength, deformation capacity, force transfer, etc.) of connections used in steel-concrete hybrid structures in the fields of building construction and civil engineering. As a first step, the Group organized the existing technologies and design specifications in those fields and examined the shear connector and structural performance assessment methods common to these two fields in order to find which of them could be applied to the connections of future hybrid structures.

Based on these organizational efforts and on examinations thus far completed, the Group published the *Design Guidebook for Connections in Steel-Concrete Hybrid Structures*. It consists of three parts: connections in hybrid structures (shear connector, bond) common to both building construction and civil engineering; connections in hybrid structures used in building construction; and connections in hybrid structures used in civil engineering. The *Guidebook* is outlined below.

Part 1: Connections in Hybrid Structures common to both Building Construction and Civil Engineering

Hybrid structures are defined and classifications are made. Hybrid structures are roughly classified into two types: composite and mixed. "Composite structure" is a general term for structures composed of composite members, and "composite member" denotes a member in which two different materials, steel and concrete, are integrated at the cross sectional level. On the other hand, "mixed structure" generally denotes structures in which different members are connected.

Next, taking longitudinal and transverse connections to be connections similar to those used in building construction and civil engineering, a comparison was made of the connection design methods used in these two fields. The force transfer mechanisms for longitudinal connections are classified into those that employ bearing and friction forces using lever force and those that employ shear connectors. The former is generally adopted in building construction, and the latter in civil engineering. The major reason for this difference lies in the fact that the resistance mechanism changes depending on the rigidity of the steel members and the confined condition of the reinforced-concrete members. This means that in building structures with comparatively more heavy-wall sections and high confined force, the first mechanism is dominant, and that in civil engineering structures with more thin-wall sections and low confined force, the latter dominates.

On the other hand, force transfer mechanisms in transverse connections are classified into those that form concrete compressive strut and bearing strength when the confined force is sufficient and those that use shear connectors and shear-reinforcing steel members when the confined force is insufficient. The former is generally adopted in building structures, and the latter in civil engineering structures. However, when expanding the range of applications of both structures, it is effective to adopt the mechanism that incorporates the needed features in both fields.

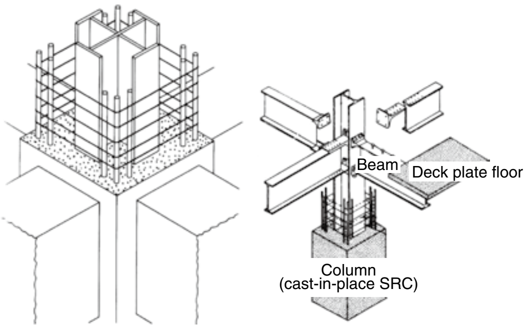
In addition, a design method pertaining to bond (friction and shear connector) and bearing, the two force transfer elements at connections, is introduced and an arrangement of this approach to assess the load bearing of shear connectors using numerical analysis is made.

Part 2: Connections in Hybrid Structures in Building Construction

The contents of the design specification prepared by the Architectural Institute of Japan were systematically organized to introduce experimental research results and a structural performance assessment method as the latest research achievements. The target connections are for steel-reinforced concrete (SRC), composite steel tube and concrete, and concrete-filled steel tube (CFT) composite structures; composite beams, hybrid beams; and mixed structures composed of RC columns and steel beams.

For SRC-structure connections, data on beam-to-column connections (Fig. 1), column bases, joints and bond for reinforcing bar and steel were organized and examined. Composite steel tube and concrete structures (Fig. 2) are generally classified into three types according to the type of column members used: the filled type in which concrete is placed into the tube, the encased type in which reinforced-concrete is wrapped around the exterior of the

Fig. 1 Beam-to-Column Connection of SRC Structure



(a) SRC column and SRC beam[1)] (b) SRC column, SRC beam[2)]

Fig. 2 Beam-to-Column Connection of Composite Steel Tube and Concrete Structure[3)]

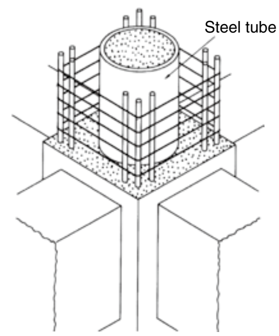


Fig. 3 Beam-to-Column Connection of CFT Structure

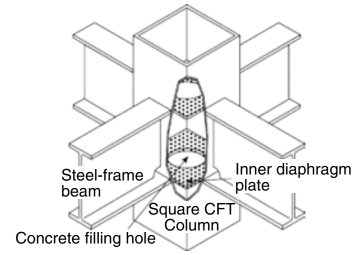


Fig. 4 Beam-to-Column Connection of RC Column-Steel Frame Beam Mixed Structure[4)]

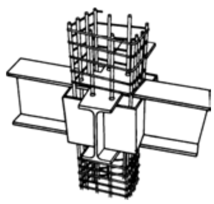


Fig. 5 Corrugated Steel Web PC Bridge

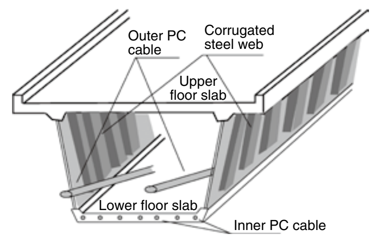
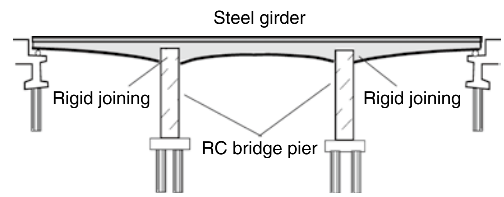


Fig. 6 Hybrid Rigid-frame Bridge



tube, and the encased/filled type. The filled type is known as CFT, and accordingly the beam-to-column connections of the encased and encased/filled types were taken up in the *Guideline*. CFT structures are increasingly being adopted for high-rise buildings due to their superior structural properties and economical advantages. Data on beam-to-column connections (Fig. 3), column bases, joints and bond for steel tube in CFT structures were organized and examined.

For hybrid beams, the design of the force transfer mechanism is introduced for the connections of composite beams in which steel-frame beams and RC floors are integrated using a headed stud (shear connector) to form T-shaped beams. The design of the force transfer mechanism is also introduced for the connections of long steel beams in which both ends of the beams are formed using RC structures (or SRC) and the center section retains its steel-frame structure. Further, data regarding the structural performance of and design method for beam-to-column connections in RC column-steel beam structures (Fig. 4)—mixed structures using different material members in a manner corresponding to "right materials for right places"—were organized and examined.

Part 3: Connections in Hybrid Structures in Civil Engineering

Because the design specifications for composite girders and columns in the field of civil engineering have already been determined by the Japan Society of Civil Engineers and other related organizations, a method of assessing structural performance based on recent research and actual applications of the connections in new hybrid structures that are seeing growing use is introduced. The target structures include composite section girders, mixed-structure bridges, hybrid rigid-frame bridges and hybrid foundations.

As regards composite section girders, two examples are cited: a PC composite steel truss bridge and a corrugated steel web PC bridge (Fig. 5), in which PC slabs are adopted for the upper and lower floors and steel truss members or corrugated steel plates are used for the web. The mixed-structure bridge targets bridge structures such as mixed cable-stayed bridges, mixed extradosed bridges and mixed-girder bridges, in which steel girders and concrete girders are connected in the bridge longitudinal direction. The hybrid rigid-frame bridges (Fig. 6) targets mixed structures in which steel girders and RC piers are rigidly joined. The hybrid foundations covers mixed foundation structures in which steel columns (composite columns) and RC pile foundations are connected. The types of connections in these targeted bridges were classified and the design method for each connection type is introduced.

The *Guideline*: Comprehensive Framework for Connection Design

The Working Group organized and examined existing technologies, design specifications and guidelines pertaining to the connections used in hybrid structures, the results of which were incorporated in the *Design Guidebook for Connections in Steel-Concrete Hybrid Structures*. In the *Guidebook*, design guidelines have not yet been determined for the structural design of every connection of every hybrid structure that will be developed in the future. However, it is considered that a comprehensive framework for connection design has been proposed in the *Guideline* through the organization and systematization of current guidelines and the sampling of future tasks.

In the future development of new connections for use in hybrid structures, it will be vital that structural design guidelines be developed that can assess the structural performance of these new connections without testing.

Source of figures

1) *Architectural Institute of Japan: Teaching Material for Structures, Revised 2nd Version, Feb. 25, 1995*
2) *Concrete Engineering, Vol. 21 No. 12 "Special Feature: Concrete and Composite Structures, Design Examples (1)," December 1983*
3) *Architectural Institute of Japan: Teaching Material for Structures, Revised 2nd Version, Feb. 25, 1995*
4) *Concrete Engineering, Vol. 33 No. 1 "Combination of RC Members and S Members," January 1995*

International Events and Symposium

Anton Tedesko Medal Awarded to JSSC President Takanashi

The Anton Tedesko* Medal is an important award given by the IABSE (International Association for Bridge and Structural Engineering) Foundation in recognition of achievements in structural engineering. The award has two categories: notable contributions to the development of structural engineering and organization of a study leave abroad for a young promising engineer outside his/her home country with prestigious engineering firms. Dr. Koichi Takanashi, President of the Japanese Society of Steel Construction, was presented this prestigious medal in recognition of his "notable contribution to structural engineering and his efforts to nurture many young researchers in that field."

Dr. Takanashi mentored students at the University of Tokyo and Chiba University who have attained great achievements of their own. His major fields of research fields are plastic design and seismic design. Many graduates who attended Dr. Takanashi's lectures play active roles in many regions of the world, and their research has contributed greatly to the sound development of steel structures the world over.

Dr. Takanashi's contributions to the field of structural engineering are diverse. He served as chairman of the Structural Committee of the Architectural Institute of Japan for four years and as chairman of the Committee to Evaluate High-rise Buildings of the Building Center of Japan for eight years and, further, was the guiding hand in organizing and establishing the national qualification system for earning the license: First Class Structural Design Architect. Recently, he was extensively involved in promoting a collaborative project between government agencies known as New Structural Systems Employing Innovative Structural Materials (for details, refer to issue No. 28 of *Steel Construction Today & Tomorrow*). His achievements were introduced in IABSE reports.

Further, Dr. Takanashi has contributed greatly to the development of IABSE, including the presentation of papers at symposiums and congresses sponsored by IABSE and the delivery of keynote addresses and invitational lectures at those meetings. He served as vice president of IABSE from 1997 to 2005 and participated in many IABSE committee operations.

*Structural designer: Though born in Germany, he is active in the US and is called the father of the thin-wall concrete shell.

Dr. Takanashi receives medal from Mr. Klaus Ostenfeld, Chair of IABSE Foundation Council

The 9th Pacific Structural Steel Conference

The Pacific Structural Steel Conference (PSSC) is an international conference on steel structures, held by 10 nations: U.S.A., Australia, Canada, China, Chile, Japan, Korea, Mexico, New Zealand and Singapore. Since the first conference was convened in 1986, it has been held once every three years.

The latest conference was the ninth of the series and was held in Beijing, China, for three days from October 20, 2010 under the auspices of the China Steel Construction Society. Although Chile and Mexico did not participate in the conference, the U.K., South Africa and Hong Kong did take part. The total number of participants exceeded 600, and a total of 266 papers were presented. The keynote addresses and paper presentations covered a wide range of themes pertaining to bridges and buildings: design, construction, fabrication, materials, maintenance and new technologies. During the conference, advanced technical information regarding the respective nations was exchanged.

Prior to the conference, the Pacific Council of the Structural Steel Association (PCSSA) met and decided to hold the next PSSC in Singapore in 2013.

Conference scenes

JSSC Symposium 2010 on Structural Steel Construction

The Japanese Society of Steel Construction (JSSC) held the JSSC Symposium 2010 on Structural Steel Construction on the 18th and 19th of November 2010, with the co-operation of its membership, JSSC's various committees and related organizations.

In the panel session, the winners of the JSSC President Prize and Thesis Prize were introduced. With the total number of participants exceeding 500, the symposium served as a venue for exchanges between researchers and engineers involved in steel construction and for the collection of information. The major events are outlined below.

Session: The Increasing Role of Stainless Steel

Long-term durability is being cited as one of the excellent environmental performance characteristics essential for social infrastructure. Stainless steel, due to its high corrosion resistance, is attracting attention as a structural material that can remain sound when applied in severely corrosive environments, in environments where maintenance is difficult and in other diverse environments. This has lead to the growing use of stainless steel in a wide range of social infrastructure construction.

In the session titled "The Increasing Role of Stainless Steel," the definition, features and diversity of applications for stainless steel were introduced from the aspect of the material. Further, examples of the practical application of stainless steel in energy-related facilities, stainless steel reinforcing bars, exterior decorative building members, and civil engineering/building structures were introduced.

Engineering Session: High-strength Bolt Joining Technologies

The objectives for establishing the Working Group on High-strength Bolt Joining and for the group's operations were introduced. Among the topics introduced at the session were the historical development of high-strength bolt joining technologies and their application in the US and the development of high-strength bolt joining in Japan in reference to the US. In addition, recent technological topics were discussed—ultrahigh-strength bolts; higher slip factors; stress transfer in front of bolt holes; local tearing fracture strength assessment; high-strength bolt joining and tension introduction; assessment of the relation between frictional resistance/friction surface treatment and the friction coefficient; and a high-strength bolt joining method (strength rating method).

November 18, 2010

Engineering Session Friendship Party	Stainless Steel and Academy Sessions International Committee Meeting Lectures		
Panel Exhibition: JSSC President Prize-winning Performances	Structural Framing (building construction)	Stainless Steel: Increasing Role in Construction	Fatigue (civil engineering)
		Board of Directors' Meeting	
Technology/ Standardization Committee Meeting	Design, Composite Structures (building construction)	Awarding of JSSC Prizes Awarding Ceremony Prize Winners' Lectures	Bridges (civil engineering)
		Special Lectures	International Committee Meeting
Friendship Party			

November 19, 2010

	Structural Members (building construction)	Vibration, Vibration Control (building construction)	Repair, Reinforcing (civil engineering)
	Materials, Joining (1) (building construction)	Vibration, Seismic Resistance (civil engineering)	Maintenance (1) (civil engineering)
	Materials, Joining (2) (building construction)	Structural Analysis (building construction and civil engineering)	Maintenance (2) (civil engineering)

PSSC 2010

For details, refer to the "9th Pacific Structural Steel Conference" on the previous page.

Academy Session

JSSC has annually published *the Journal of the Japanese Society of Steel Construction* since 1993. In conjunction with the publication, a lecture meeting is held as an academy session, which is used as a venue for the presentation of papers and the exchange of information among researchers, engineers and students involved in steel construction.

The current session was the 18th in the series and included the lecture meeting for 2010 and the presentation of the Thesis Prize.

Special Lecture: Success in Vibration Collapse Tests for Full-scale Steel-structure Building

This presentation described a full-scale 4-story building collapse that was conducted at the D-Defense as the subject of a complete collapse test, the procedures for examining excitation and measurement methods at the preparation stage and the decisions made on the test date that led to the world's first successful test in which a full-scale building was collapsed by means of shaking tables. Specifically, "experimental knowhow" that could not be read from the written report was explained. In this regard, Associate Professor Tetsu Yamada of the Tokyo Institute of Technology delivered a lecture on reference information in challenging new tests for steel construction in addition to the above test.

Greeting by JSSC President Koichi Takanashi

Special lecture meeting

Friendship party

To Our Readers

Masatsugu Nagai
Chairman, International Committee of JSSC
(Prof., Nagaoka University of Technology)

Starting with issue No. 26 of Steel Construction Today & Tomorrow, the International Committee of the Japanese Society of Steel Construction (JSSC) assumed responsibility for the editorial planning of one of the journal's thrice-annual issues. Since its inauguration, JSSC has promoted surveys, research and technological development supporting the expanded use of steel construction and to improve steel construction technologies. At the same time, JSSC regularly extends cooperation to related international organizations.

Following with the merger of JSSC with the Stainless Steel Building Association of Japan in April 2010, JSSC's fields of operation now include not only carbon steel but also highly corrosion-resistant stainless steel. Consequently, we intend to actively transmit information throughout the world related to a wider range of steel construction areas.

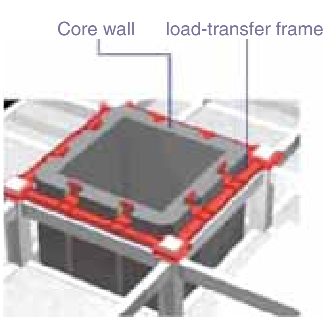
As was true in issue No. 29, the current issue, No. 32, leads with the announcement of the JSSC President Prize and Thesis Prize winners. Other major topics in this issue include the design of composite structure joints; awarding of the Anton Tedesko Medal to JSSC President Koichi Takanashi and the Pacific Structural Steel Conference for 2010, an international conference attended by ten Pacific region nations; and JSSC Symposium 2010 on Structural Steel Construction, an annual event held with support from the JSSC membership and related committees and organizations.

In addition, there is a special feature on railway facilities built with steel composite members. Given the active promotion of infrastructure improvement/development in emerging nations, this feature introduces steel-concrete composite railway bridges and steel-wood composite station buildings that have recently been completed in Japan.

The International Committee, while working on multiple responses to the internationalization of steel construction codes, promotes exchanges of technical information and personnel with overseas organizations. As a link in these operations, we hope that this annual issue will inform our readers of JSSC operations, trends in steel construction, and the technologies and technological development involved in planning, designing, and building steel structures in Japan.

If you wish to obtain more detailed information about the various articles that are contained in this issue or to receive related technical information, please do not hesitate to contact JSSC staff member Hiroshi Sugitani (h.sugitani@jssc.or.jp).

JSSC President Prize-winning works



Core wall and load-transfer frame for new jack-down building demolition method

Strong Building employing flat plate

Artist's sketch of Tokyo Gate Bridge

Steel pier section for New D-Runway at Tokyo International Airport

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