JPCI NEWSLETTER

No.13, March 2021

Japan Prestressed Concrete Institute

JPCI AWARD

Award for Outstanding Structures

● **Washimi Bridge**

Location : Gujo City, Gifu Prefecture.

Structure overview : The Washimi Bridge (Phase II) is a 490.0m long bridge on the Tokai-Hokuriku expressway. It was designed to run adjacent to the current Phase I bridge spanning a deep valley, using a four-span continuous rigid frame prestressed reinforced concrete (PRC) box girder design with corrugated steel webs on three tall piers, the tallest of which is 125 m high and the best height in Japan. Because the bridge is in a heavy snowfall region with severe weather conditions during construction, the rapid construction method was adopted in order to utilize precast elements during construction of the bridge piers. To speed up the construction of the superstructure, the rapid construction of corrugated steel webs method was used. This method boosts construction efficiency by installing the form traveler on the corrugated steel panels and enabling construction to progress on several blocks simultaneously.

Provider : Central Nippon Expressway Co., Ltd

Design : Japan Bridge & Structure Institute, Inc
Sumitomo Mitsui Construction Co., Ltd

Construction : Sumitomo Mitsui Construction Co., Ltd

● **The Second Komono Viaduct on the Shin-Meishin Expressway**

Location : Komono-cho , Mie

Outline of Structure : The Second Komono Viaduct is a 19-span, 1,103-meter-long viaduct comprised of a 3-span prestressed reinforced concrete continuous extradosed bridge, sandwiched by two continuous box-girder bridges with 5 spans and 11 spans. Concerning the design, an attractive appearance of the sub- and super-structure was importantin determining the form. Possessing a central span of 161 meters in length, the extradosed section of the viaduct has the nation's longest span as an extradosed bridge with a cross-sectional width wider than 20 meters, comprised of a single plane suspended section with concrete webs. To achieve this, the bridge structure employs 48S15.2B, which are the nation's heaviest load of cables for an extradosed bridge.

Provider : Central Nippon Expressway Co., Ltd.

Design : P.S. Mitsubishi Construction - Fuji P.S JV

Construction : P.S. Mitsubishi Construction - Fuji P.S JV

● **Yobaisan Viaduct**

Location : Takatsuki city, Osaka pref.

Type of the structure : Eastbound bridge: 12-span continuous PRC box girder bridge, Westbound bridge: 11-span continuous PRC box girder bridge (Each bridge consists of a combination of concrete and corrugated steel web structures.)

Bridge length and spans : Eastbound bridge: Main bridge: 1,106.5 m (104.5+125.0+9×90.5+58.5 m), Westbound bridge: Main bridge: 1,116.5 m (116.6+155.4+2×100.0+6×97.0+58.5 m)

Girder height : 3.000 m to 12.000 m

Provider : West Nippon Expressway Co., Ltd

Design : Oriental Consultants Co., Ltd
Sumitomo Mitsui Construction, Fuji P.S, Kyokuto Kowa Joint Venture

Construction : Sumitomo Mitsui Construction, Fuji P.S, Kyokuto Kowa Joint Venture

● **NIPPO headquarters**

Location : Tokyo Chuo-ku

Outline of Structure : The NIPPO headquarters building has acquired a very open space by planning the design, structure, and equipment in an integrated manner based on the concept of "junction" created from "extremely complicated location conditions" and "characteristics of NIPPO". At this head office, the pillar-shaped precast prestressed concrete (PCaPC construction) is adopted, which reduces the beam strain toward the northeast side where an open view can be obtained and increases the openness of the office space. In addition, the direct ceiling of the skeleton makes it a "space that attracts construction technology" unique to the construction company's headquarters.

Owner : Nippo Corporation

Design : NIHONSEKKEI,INC. + Nippo Corporation

Construction : Nippo・Dai Nippon Construction Joint Venture

Construction(PC) : Oriental Shiraishi Corporation

● **Kanda Holdings headquarters**

Location : Chiyoda-ku, Tokyo

Outline of Structure : A most characteristic point of this office building is that about 50 percent of floor area has been supported by the cantilever structure. Saving energy and enhancing a work environment are design concepts, and this building has a hemi-exterior space to minimize the environmental load and to develop a communication between people and people. A 6.8 meters portion in depth from a front façade has been realized by pre-stressed concrete cantilever walls at both sides, this portion hangs over a space on the ground to derive both of a parking space in a narrow construction site and a space opened to the outside. Hence this building has realized high environmental performances and comfortable work spaces by utilizing this hemi-exterior space, and which are sustainable to both of the society and workers in this building.

Client : Kanda Holdings Co., Ltd.

Design : Takenaka Corporation

Construction(Total) : Takenaka Corporation

Construction(PC) : P.S. Mitsubishi Construction Co., Ltd

● **Ashiya BayCourt Club Hotel & Spa Resort Chapel**

Location : Ashiya-city,Hyogo

Outline of Structure : By the prestress force introduced in the streamlined wall, we can make the seamless-shaped building without crack-inducing joint.

Because this building is constructed near the coast “Ashiya Marina”, this seamless-shaped wall enhance the durability of the building, having corrosion resistance to the salt damage.

To achieve the engaging chapel construction, all the people concerned have carefully researched and examined the method for controlling crack.

Owner : Resorttrust,Inc.

Design : Nikken Sekkei Ltd

Construction : Kajima Construction

Award for Outstanding Engineering Innovations

● **Waffle-Shaped UHPFRC Deck Slab**

Location : Osaka City, Osaka

Summary : Waffle-Shaped Ultra High-Performance Fiber Reinforced Concrete (UHPFRC) deck slabs, which show high fatigue durability, have been developed to alternate orthotropic steel deck slabs. These newly developed stabs are lightest of all concrete slabs for highway bridges. These slabs were applied to Shinamobashi rampway bridge for the first time in Japan. While originally designed conventional concrete slabs require three plate girders, waffle-shaped UHPFRC slabs require two plate girders for the bridge. In order to transfer large horizontal shear, UHPFRC is utilized as filler between the girders and slabs. Connection details between the precast panels are newly developed in order to replace accidentally damaged individual panels. These panels were prefabricated in a specially designed casting bed, which introduce bi-directional prestress. This combination of technologies assuredly improves service life of deck slabs for highway bridges.

Developer : Hanshin Expressway Company Limited and Kajima Corporation

Award for Outstanding Accomplishments of Constructions

● **Rapid replacement method for railway bridge using UFC hollow girder**

Location : Kitazawa, Setagaya-ku, Tokyo

Outline of Structure : The bridge near the Shimokitazawa Station of the Keio Inokashira Line is a three-spans PC railway bridge, 67m in length, which was replaced for the existing steel bridge above the Odakyu Line. The central span is a 37m long PC girder bridge and side spans are precast hollow girders of 17m and 13m in length. As it was necessary to replace the bridges within a very short time between the last train and the first train of the following day, the giders of the side span are made of the UFC (Ultra High Strength Fiber Reinforced Concrete) and erected using a mobile crane in two stages. The central span was constructed by the lateral movement method using hydraulic jacks.

Owner : Keio Corporation Co.,Ltd

Design : Fukken Engineering Co.,Ltd

Construction : Taisei Corporation Co.,Ltd

● **Widening works of Kirigataki Bridge (Kirigataki Bridge Widening Project)**

Location : Kameyama-city, Mie

Construction Summary : Widening of Kirigataki Bridge is required to increase the number of lanes connecting to the Nagoya-Ise rampway opened on December 2019. During the construction, the traffic was busy, therefore, two lanes were required to ensure the current traffic. The top slap of the bridge was expanded while the two lanes were used for the current traffic. The construction yard on the bridge was narrow and heavy equipment could not be installed, then a technical form traveler system for barrier removal and top slab building was used for the construction. For additional of the external prestressing tendons, the existing anchorage plate could not be used, thus the new plate made from Ultra High Performance Fiber Reinforced cement-based composites material was created.

Owner : Central Nippon Expressway Co., Ltd

Design : Japan Bridge & Structure Institute, Inc
Sumitomo Mitsui Construction Co., Ltd

Construction : Sumitomo Mitsui Construction Co., Ltd

●**Disaster Recovery Project of Kochi Expressway between Shingu IC and Otoyo IC**

Location : Otoyo-cho, Nagaoka-gun, Kochi prefecture

Outline of Structure : 63.5m long rebuilt Tajigawa bridge is three-span connected hollow slab while the original bridge was three-span continuous partially prestressed triple girder bridge that was swept away due to land slide caused by heavy rain in July 2018. In order to recover four-lane traffic as early as possible, SCBR method utilizing pre-tensioned precast hollow girders were adopted. Precast transverse girders were placed previously on the bearing pads to support all longitudinal hollow girders. The hollow girders were connected longitudinally on the transverse girders after erected as simple beams. Above erection procedure requires no additional support for the girders even after the completion. Consequently, the original substructures were used without any modification. Simultaneous works at the prefabrication factory and the erection site also shortened the recovery period. As the result, the bridge was rebuilt within one year after the disaster.

Client：West Nippon Expressway Company Limited, Shikoku Branch Office

Design : Nexco-West Consultants Company Limited

Construction : Kajima Construction

EVENTS

Annual Symposium
- The coming symposium -

The 30th Symposium on Developments in Prestressed Concrete

21th - 22th October 2021

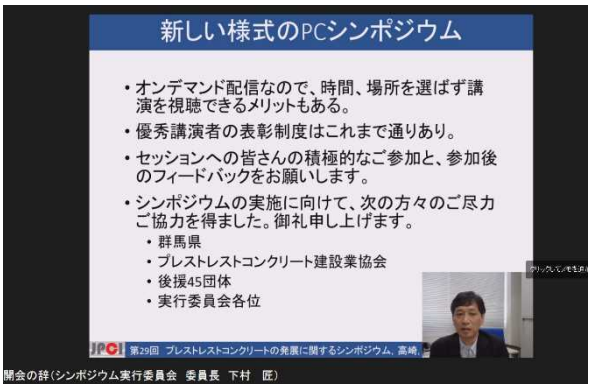
Hakodate, Japan

http://www.jpci.or.jp/eng-index.htm

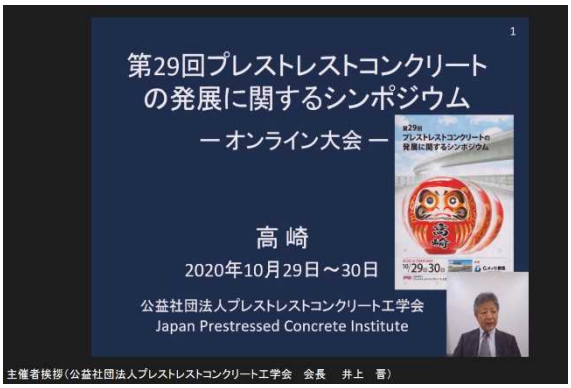
- The last symposium -

The last symposium, “the 29th Symposium on Developments in Prestressed Concrete”, was scheduled to be held at the G Messe Gunma, but it was changed to online and held on 29th and 30th October 2020. Some events, such as technical exhibitions, were canceled because the symposium was held at online instead of the conventional style. The on-demand video system was adopted and the online symposium was held. The purpose of the symposium is to attain further development of prestressed concrete technology by sharing valuable information among researchers.

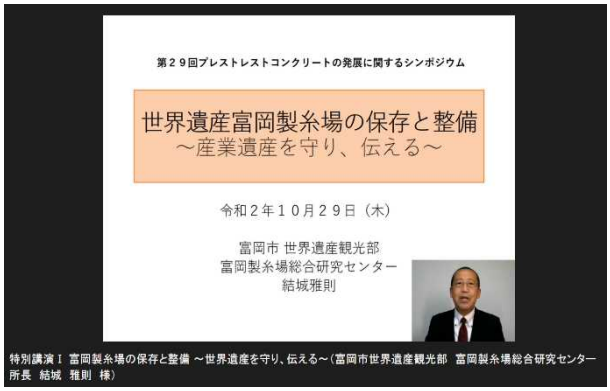
In the Opening Ceremony Dr. SHIMOMURA Takumi, professor of the Nagaoka University of Technology, the chairman of the Executive Committee of the symposium, gave an opening address.



Opening address



Opening speech



Mr. YUKI Masanori presentation

Dr. MATSUURA Toshitaka presentation

Dr. Takumi Shimomura described symposium style was changed from conventional style at the G Messe Gumma to online style, and summary of the on-demand video system. Dr. INOUE Susumu, professor of the Osaka Institute of Technology, the president of the JPCI, gave an opening speech. Dr. INOUE Susumu introduced that this symposium had been scheduled for the first symposium at Takasaki, as a History of the symposium. And as a next symposium venue, Hakodate was introduced. The main academic activities of the JPCI and the "PC Sustainability Declaration" that summarizes how PC technology should contribute were introduced.

Mr. YUKI Masanori, chief of Tomioka Silk Mill Research Center and Dr. MATSUURA Toshitaka, professor of Gunma Prefectural Women's University were invited and gave special lectures.

Mr. YUKI Masanori presented “Preservation and maintenance of the World Heritage Tomioka Silk Mill, Protecting and Taking over industrial heritage”. As a topic of the region of the venue, the preservation and maintenance project of Tomioka Silk Mill, a World Heritage Site in Gunma Prefecture, was introduced. The Meiji government has decided to build a government-owned model Silk-reeling factory for the purpose of spreading machinery silk reeling nationwide. As a result, Tomioka Silk Mill operated from April 1871 to March 1987. The silk industry from the Meiji era to the early Showa era was Japanese core industry and the foundation of the current automobile industry. Tomioka Silk Mill was designated as a historic site in 2005, an important cultural property in 2006, and a national treasure in 2014. Tomioka Silk Mill is also a World Heritage Site. Tomioka Silk Mill and Related Sites as the World Heritage Site consists of the Tomioka Silk Mill and the former residence of Tajima Yahei, the Takayama-sha, and the Arafune Cold Storage. Following two points are evaluation points of World Heritage registration.

- At the beginning of the 20th century, this heritage group was the main factor of Japanese domination of the world raw silk market.
- This heritage group was a model for mass production of raw silk.

The conservation management plan of Tomioka Silk Mill was formulated in 2008.

1) Preservation management policy

- Preservation and management of history and system of Tomioka Silk Mill

- Structures, underground remains, machinery and equipment, trees, furniture and furnishings are subject to preservation and management.

2) Maintenance and utilization plan (formulated in 2012)

- Basic policy of maintenance: Maintenance that emphasizes history and system of Tomioka Silk Mill
- Basic policy of utilization: Maximizing the value and attractiveness of Tomioka Silk Mill

Features of building are a timber-framed brick structure, a truss structure balcony and colonial style. The structure in the early Meiji era still exists. The seismic performance of West Cocoon Warehouse (Important Cultural Property) was diagnosed from 2009 to 2010, because the structural characteristics of timber-framed brick were unknown. In the seismic diagnosis, a static loading test (in-plane direction) and a shaking table test (out-of-plane direction) were carried out. As a result, a structural reinforcement plan was proposed. After the seismic diagnosis, West Cocoon Warehouse was repaired between 2014 and 2020. Seismic reinforcing, roof replacement and partial repairs were carried out as preservation repairment, and following are revealed at the result of the investigation that was conducted at the same time as preservation repairment.

- As a building that symbolizes the modernization of the Meiji era, it is in its original state.
- The inside of the cocoon storage building had been well-preserved.
- The documents have high value regarding system transition of the entire factory.

Based on these survey results, the preservation and repair policy was set as follows.

- Restored to the appearance of 1974 (the peak of the Tomioka Silk Mill) while maintaining the original appearance of the building.
- Implemented maintenance for utilization along with restoration
- Set up facilities for exhibition and management

Now, the silk industry is in a period of decline. However, local people are actively working to maintain the Tomioka Silk Mill. We came to feel that taking over the tradition to future generations is our mission, as the result of the registration as a World Heritage Site as an opportunity.

Dr. MATSUURA Toshitaka presented “Power Gunma, Dams and power plants in Gunma Prefecture”. Of the modernization heritage of Gunma Prefecture, the main concrete structure is the dam. Gunma Prefecture has the largest number of hydroelectric power plants in the metropolitan area. They had supplied electricity, which support high economic growth. Therefore, Gunma Prefecture was proudly called "Power Supply Gunma". As a result of the modernization heritage survey, the heritage of the silk

industry was the largest at 50% or more. However, transportation, electricity and public buildings were also recognized as modernization heritages.

Dr. MATSUURA Toshitaka introduced following "Heritages designated as a cultural property in Gunma Prefecture", and "Transition of hydroelectric power plants, which are the power heritage of Gunma Prefecture, and major hydroelectric power plants". And he closed his presentation with the phrase "Dams in Gunma prefecture are supported by concrete materials".

- Heritages designated as a cultural property in Gunma Prefecture

- 1991, Usui-sha Headquarters Main Building (prefectural important cultural property)
- 1992, Usui Pass Railway Facility (important cultural property)
- 2003, Marunuma Dam (important cultural property)
- 2006, Tomioka Silk Mill (national treasure, important cultural property, historic site)
- 2015, Former Shinmachi Waste Thread Spinning Plant (important cultural property, historic site)
- 2016, Former Nakajima Family Residence (important cultural property)
- 2017, Rinkokaku (important cultural property)

In addition, there is an existing check dam called Haruna-san Megalithic Dam, which was built in the early days.

- Transition of hydroelectric power plants, which are the power heritage of Gunma Prefecture, and major hydroelectric power plants

(1) The earliest stage

1) Characteristics of hydroelectric power plants in this period

- Small-scale Run-of-the-river hydroelectricity

2) Former Japan Textile Co., Ltd. Power plant site and brickwork (Kiryu City)

- The oldest private hydroelectric power plant in Gunma Prefecture
- Started power generation in 1890

3) Maebashi Electric Light Ueno Power Station Site (Maebashi City)

- The first hydroelectric power plant in Gunma Prefecture, which supplied to the private sector
- Use Tenguiwa water

(2) From Taisho era to early Showa period

1) Characteristics of hydroelectric power plants in this period

- Retention basin type power plant became mainstream
- Started long-distance power transmission to Tokyo
- Features are penstock and reinforced concrete power plant building

2) Retention basin type power plant

- TEPCO Saku Power Station
- Built by Asano Soichiro, the founder of Asano Cement Co.,Ltd.

- The output of 70,000 kWh was the best hydroelectric power plant in the Orient at that time.

3) Challenge to new technology

- Existing characteristic dams are Marunuma Dam (buttress dam; national important cultural properties), Kazawa Dam (earth dam), and Shibukawa power plant (lower siphon waterway).

(3) Postwar days

1) Characteristics of hydroelectric power plants in this period

- The hydroelectric power was main power supply
- The purpose of dams were supplying electricity and water to the Greater Tokyo Area
- For controling flood caused by typhoons, multipurpose dams (water source + electricity + flood control) were mainstream.

2) Development of the Tone River system

- Yagisawa Dam, Fujiwara Dam, Shimokubo Dam, Sonohara Dam, Aimata Dam, Kusaki Dam, Watarase Retarding Basin.

(4) After Heisei

1) Characteristics of hydroelectric power plants in this period

- Pumped-Storage Hydropower

2) Typical dam

- TEPCO Kannagawa Power Station
- Output is 282kWh (the largest class of pumped storage power plant in the world)
- Located in underground space (invisible from the outside)

In the last symposium, 38 contributed papers, 131 reports were presented in 18 sessions. Among them, 137 presentations have presentation videos. The participants were 490. From each session, the most excellent presenters were chosen and were given “Award of Excellent Presentation”. Prize winners are as follows.

Session 1: GOTO Keiichi, Railway Technical Research Institute
Session 2: FUJIMOTO Kentaro, P.S. Mitsubishi Construction Co., Ltd.
Session 3: KANEEDA Shunsuke, Nippon P.S Co., Ltd.
Session 4: TSUTOMU Watanabe, Railway Technical Research Institute
Session 5: FURUKAWA Shogo, Abe Nikko Kogyo Co., Ltd.
Session 6: NAKAGAWA Keisuke, IHI Construction Service Co., Ltd.
Session 7: Chunhe Li, University of Miyazaki
Session 8: YOSHIMATSU Hidekazu, Kawada Construction Co., Ltd.
Session 9: KOHARA Shougo, P.S. Mitsubishi Construction Co., Ltd.
Session 10: YASUDA Eiki, Taiheiyo Cement Corporation
Session 11: KONDO Takashi, Obayashi Corporation
Session 12: UMEDA Takaaki, Kawada Construction Co., Ltd.

Session 13: INOUE Eiji, Sumitomo Mitsui Construction Co., Ltd.
Session 14: TAKAHASHI Shuto, Kajima Corporation
Session 15: OBA Dai, Sumitomo Mitsui Construction Co., Ltd.
Session 16: SHINOZAKI Eiji, Kawada Construction Co., Ltd.
Session 17: KASAI Hironori, Nippon P.S Co., Ltd.
Session 18: KATAOKA Nao, Oriental Shiraishi Corporation

■This newsletter contents current information on the activities and topics of JPCI.

■ If you have any comments and suggestions, please contact us by sending e-mail to: *kaiinka27@jpci.or.jp*

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