FIDIC Centenary Awards
Nomination Form

Please enter all information requested below for each entry (signatures by the submitting firm(s) and the client(s)/owner(s) are required). Names and information should be typed or printed.
Applications should be accompanied by up to 5 photographs (JPG format) of the project being nominated.

Please return this form by email as PDF for the attention of Italo Goyzueta, FIDIC Deputy Director at igoyzueta@fidic.org or by Fax at +41 22 799 4900

Note: Only FIDIC Members can submit nominations.

THE PROJECT

Project Name: Yoyogi National Stadiums

(as it is to appear in the award)

Project Location

Country: Japan

City: Tokyo

Purpose: To provide athletic facilities for Tokyo Olympic games in 1964

Year of completion: 1964

FIDIC Member submitting the nomination

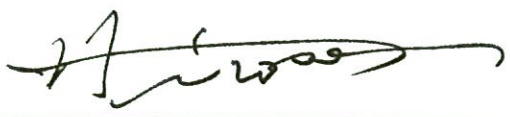
FIDIC Member, Association of Japanese Consulting Engineers (AJCE)

(name of the association or firm submitting the nomination)

hereby authorises submission of this project into the FIDIC Centenary Awards call for nominations.

Name of President or Managing Director: Noriaki Hirose

Title: President

Date and signature: Sept. 6, 2012, 

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Please tick beside the applicable options to confirm that this project is:

- [x] Internationally recognised
- [x] Demonstrate technical excellence
- [x] Demonstrate innovation
- [x] Is enduring and sustainable

Why do you think this project should receive an award? How does it meet the criteria of being internationally recognised, demonstrating technical excellence and innovation and being enduring and sustainable? Please use additional paper sheets if needed.

Please refer to the attached sheet for details

FIDIC 1913-2013 CENTENARY AWARDS

THE FIRM(S) SUBMITTING THE PROJECT

Firm(s): Kawaguchi & Engineers

Firm CEO: Mamoru Kawaguchi

Firm Representative: Mamoru Kawaguchi

Firm (s) Contact details

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THE CLIENT/OWNER(S) OF THE PROJECT

Client/Owner(s): National Agency for the Advancement of Sports and Health

hereby grant permission to enter the above mentioned project in the FIDIC Centenary Awards competition and authorise promotion and publication of its outstanding aspects according to the aims and conditions of the Awards.

Name of President or Managing Director: Mr. Ichiro Kono

Title: President

Date and signature: Sept. 6, 2012

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Yoyogi National Stadiums

Yoyogi National Stadiums

Outline of the Stadiums

The Yoyogi National Stadiums were constructed as the athletic facility for swimming competition (Stadium 1) and basketball competition (Stadium 2) for Tokyo Olympic games in 1964. As the site of the stadiums is adjacent to forest of Meiji Shrine, it was expected to symbolize spirit of sports, to lead guests smoothly into the stadium and to fully enjoy games in such a landscape. To achieve this objective, it was planned, designed and constructed to created functional, organic and dynamic space. This facility was designed by architect Kenzo Tange and Unban Architecture Design Institute. Dr. Yoshikatu Tsuboi, professor, University of Tokyo and his staffs in the University took charge of structural design. The complex; Stadium 1 (Pictures 1, 3), Stadium 2 (Pictures 2, 4) and associated facilities, was the largest in its scale as compared with others at that time. It should be stressed that structural designers realized such a large-span suspension structure through technical excellence and innovation. Even now, after 48 years of its completion, the structural complex has been receiving high reputation from architects and structural designers both in abroad and Japan as the modern architecture representing Japan because of excellent quality of design. The complex has been used for many international and domestic athletic, cultural and social activities.

Picture 1 Stadium 1

Picture 2 Stadium 2

1. World Recognition

With regard to Yoyogi National Stadium, architect (Kenzo Tange and Koji Kamiya), structural designer (Yoshikatu Tsuboi) and mechanical engineer (Uichi Ichikawa) received the following awards which represent proof of world recognition.

(1) Joint Prize

1) Special Award, Architectural Institute of Japan, 1964
"Planning, Design and Construction Supervision of Olympic Yoyogi Stadium and Komazawa Park" (Kenzo Tange, Yoshikatu Tsuboi, Uichi Ichikawa, Koji Kamiya, et.al)

2) Minister of Education Award, 1964
(Kenzo Tange, Yoshikatu Tsuboi, Uichi Ichikawa, Koji Kamiya)

3) BCS Award by Japan Federation of Construction Contractors, 1965
(Kenzo Tange, Yoshikatu Tsuboi, Uichi Ichikawa, Koji Kamiya)

(2) Kenzo Tange (Architect): Awards related to planning, design and supervision of Yoyogi Stadium

1) Distinguished Olympic Recognition Award, International Olympic Committee, 1964
2) Gold Medal, the Royal Institute of British Architects, 1965
3) Gold Medal, the American Institute of Architects, 1965
4) Order of Cultural Merit Award, Emperor of Japan, 1980
5) Grand Prize, Architectural Institute of Japan, 1986
"Establishment of modern architecture in Japan and contribution to international development"
6) Pritzker Architecture Prize, 1987
The international prize, which is awarded each year to a living architect for significant achievement, was established by the Pritzker family of Chicago through their Hyatt Foundation in 1979. This prize is often referred to as "architecture's Nobel" and "the profession's highest honor".
7) Praemium Imperiale, 1987
World cultural award commemorating His Imperial Highness Takamatsu, Japan
8) Legion d'honneur Decoration , 1996
Most honorable decoration in France.

(3) Yoshikatu Tsuboi (Structural Designer)

Awards related to structural design and supervision of Yoyogi Stadium

1) Grand Prize, Architectural Institute of Japan, 1976
2) Eduardo Torroja Medal, International Association of Shell and Spatial Structures, 1976
3) Special Pioneer Prize, 1984, Japan
4) Japan Academy Award, 1989

2. Technical excellence and Innovation

(1) Design Concept

At time of designing Yoyogi Stadium 1, suspension-roof structure was a quite innovative and unexplored structure. Suspension-roof structure can most reasonably and economically bring out advantageous characteristics of steel. It can provide not only an elegant geometric form but also expected to reduce cooling load as well as to provide good acoustic characteristics as the space created by this structure is relatively small as compared with others. Unique aspect of this project was the fact that the design period was extremely short, i.e., only one month due to late site possession. To overcome this constraint, all the parties involved formed a united team to most effectively design the Stadium from the beginning. Communication and discussions were carried out not by drawings or schematics, but by models and intuition. All the ideas were discussed and reviewed by models and revised models were presented in the next meeting. More than 10 models were created in the process of discussion. Through this process, design team could reach final design at an accelerating pace. Design studies started with Stadium 1 as the base. Then, Stadium 2 was designed by following the same concept.

Picture 3 Interior of Stadium 1

Picture 4 Interior of Stadium 2

(2) Structural Concept

1) Structure of Stadium 1 (Fig.1)

Structure of the Stadium 1 is composed of the following 3 systems.

a. Hanging roof surface: Created between suspension-roof structure and peripheral reinforced concrete structure

b. Central structure: Structure is similar to suspension bridge. Load from the roof is supported by balancing main suspension cables, main columns, steel hanging members, bracing cables,

anchorage and underground struts.

Two main cables of 126 m in length are supported by two main columns. Steel hanging members attached to the main cables by universal joints are placed at the interval of 4.5 m in transverse direction (normal to main cables). Bracing cables thread through steel hanging members at the interval of 1.5 m - 3.0 m in longitudinal direction. Pre-tension is applied on entire roof structure.

c. Peripheral reinforced concrete structure: Tension force from the roof and weight of spectators' stands are balanced by this structure

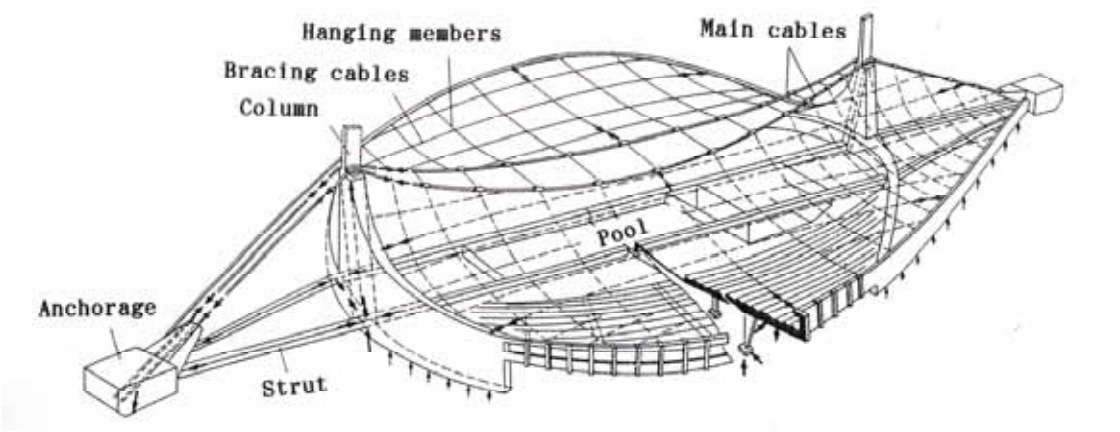


Fig. 1 Structural System of Stadium 1

2) Structure of Stadium 2 (Fig.2)

The Stadium 2 has a plan of 65 m in diameter. Main structure is composed of one main column and a main spiral pipe starting from the top of main column to the anchorage. Steel hanging members of truss shape are attached to the main pipe in radius direction. Roof surface is laid on the steel hanging members. Unlike Stadium 1, there are no wires net on roof.

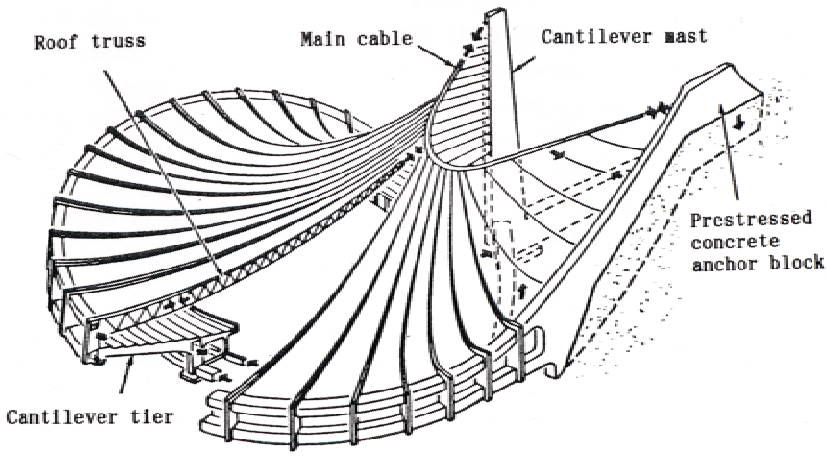


Fig. 2 Structural System of Stadium 2

(3) Innovation

1) Structural analysis

A set of governing equations for the analysis of the suspension-roof structure was developed and calculated. It should be mentioned that calculations were performed by mechanical-type calculator, so-called “Tiger calculator”, and it took significant amount of computation time.

2) Model testing

More than 10 scale models were created in the course of finalizing the structure to verify validity of structural calculations and to accelerate structural design. Typical models are

a. 1/30 scale “Wire Rope Model”

Used for testing effect of pressure on the roof surface. It can predict distribution of deflection on the roof surface for the various load conditions. This model was used for studying statical and

dynamic behavior of cable network.

A breakthrough idea was drawn from this test and analysis. Instead of using hanging cables that are reinforced by steel members, steel hanging members were used to attain necessary bending stiffness while keeping design curved shape of roof. It also provided structural strength against high mode of roof vibration.

b. 1/30 scale “Rigid Hanger Model” (Picture 5)

The Model was used to test rigidity of hanging members.

c. Vibration Test

1/30 and 1/100 (Picture 6) scale models were used for testing dynamic behavior of roof

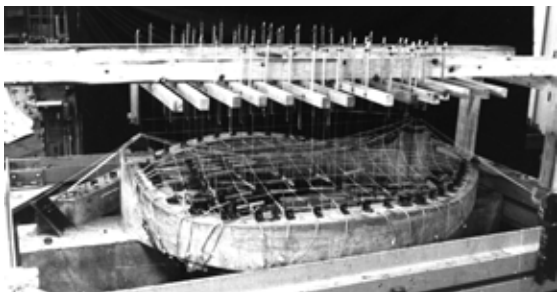
d. Wind Load Test

1/300 scale model was used to determine design wind loads.

e. Test on Dynamic Behavior and Flutter of Roof

Series of model tests were conducted to examine dynamic behavior of the roof due to pulsating wind and to see if such states as flutter would create critical condition

Picture 5 1/30 Scale Model Experiment



Picture 6 1/100 Scale Model Experiment

3) Construction

The following innovations were employed in the construction of Stadium 1.

a. Oil Dampers (Fig. 3)

To control unexpected dynamic vibration of the main cables, 6 oil dampers were installed near the top of each main column.

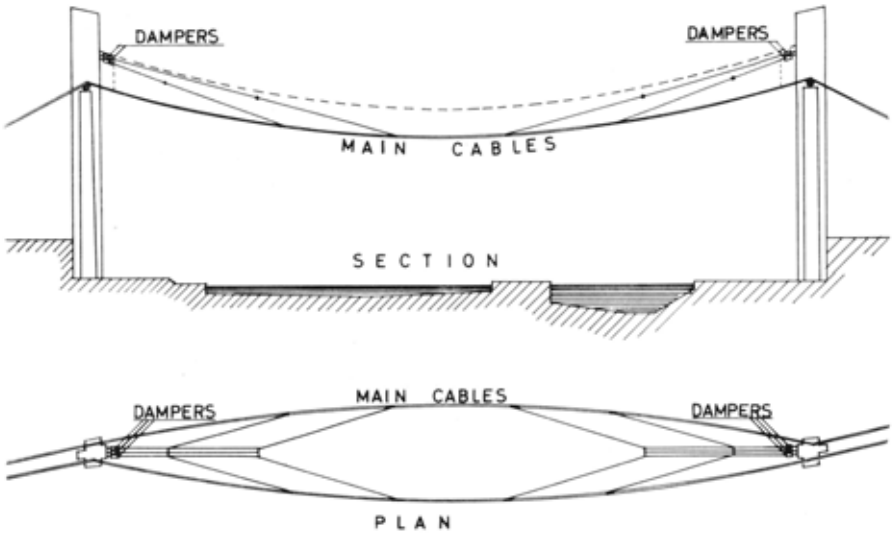


Fig.3 Main Cables Vibration Control System: Oil Dampers

b. Universal Joint (Fig. 4)

The main cables displace greatly during construction (2 m at the center of cables). This is the same for the joints connecting the main cables with the steel hanging members that are subject to complex 3-dimensional displacement during construction. To cope with this problem, universal joints were created to allow complex displacement during and after the construction.

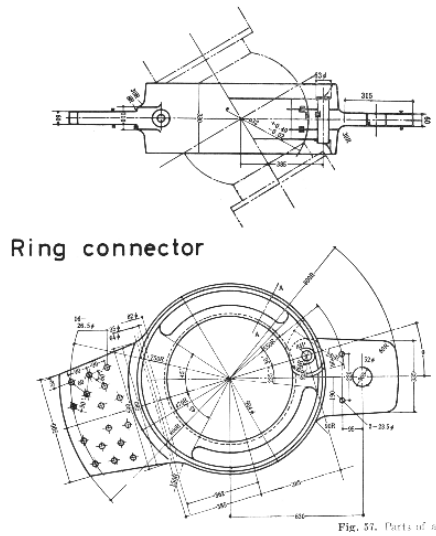
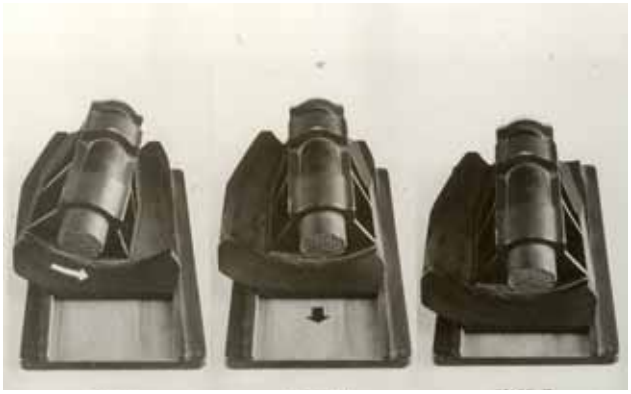
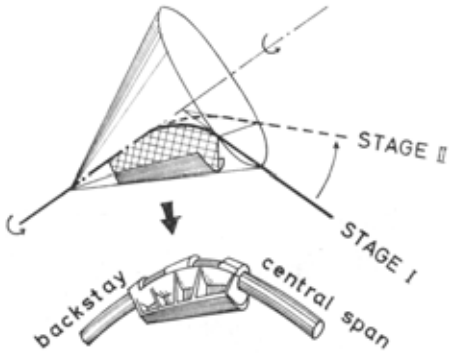


Fig.4 Universal Joint

c) Conically Revolving Saddle (Picture 7)

The center part of the main cables is widened to 16 m for securing space for natural light and lighting facilities, etc. In the process of widening the main cables, portion of main cables placed on the saddles near the top of main columns are subject to so-called “crank action” that may dislocate main wires on the saddles. To prevent main wires from dislocation, “Conically revolving saddles” were introduced to handle crank action.





Picture 7: Conically Revolving Saddle

3. Sustainability and Durability

Since its completion in 1964, Yoyogi Stadiums have been used for various international and domestic athletic competitions as well as for cultural and social activities. After nearly 50 years of completion, the Stadiums are in very good shapes, and are attracting people from the world. This is due to the deliberate design of the structures for durability as well as to the excellent maintenance works of the facilities that have been continuously made by the owner of the buildings. To illustrate this fact, some of the major and recent athletic activities are introduced in Table 1. In August and September 2012, 35 and 33 events are planned in the two Stadiums, respectively.

Based on the above facts and achievements, we recommend Yoyogi Stadiums for FIDIC Centenary Award.

Table 1. Major and Recent Athletic Activities in Yoyogi Stadiums

Type of Sports	Year	Description	Remarks
Basketball	1964	Tokyo Olympic games	International
	Every year	Nationwide Emperor/ Empress Cup	Japan
	Every year	Japan Pro-Basketball League (men, women)	Japan
	2012	The 88th Kanto College Basketball tournament	Japan
Swimming	1964	Tokyo Olympic games	International
	1979	FINA world cup swimming competition	International
Judo	2010	International Judo tournament	International
	2012	Grand slam Tokyo 2012	Japan
Volleyball	1977 1998, 2006	Second World Cup volleyball Men's World Volleyball competition (final)	International
	2010	Women's World Volleyball competition (final)	International
	2012	42nd all Japan junior-high school volleyball tournament	Japan
Tennis	1986, 1987, 1990	Toray Pan-pacific Tennis tournament (final)	International
Figure Skating	1995,	World Pro-figure skating championship	International
	2001	Grand prix final world figure championship	
	2009, 2012	World figure skating - nation tournament	
Pro Boxing	1994	WBA super-fly weight championship	International
	2008	WBA flyweight championship	
	2008	WBA feather and bantam weight championship	
	2009	WBA world super-feather weight championship	
Pro Wrestling	1990s	All Japan/ New Japan pro-wrestling tournament	Japan
Rhythmic Gymnastics	2012	Aeon-Cup world rhythmic gymnastics club tournament	International
Gymnastics	2012	The 66th all Japan gymnastic competition	Japan
Karate	2012	The 44th all Japan Karate tournament	Japan
Wrestling	2012	"Emperor Cup" all Japan wrestling tournament	Japan
Badminton	2012	Yonnex open Japan 2012	Japan
		The 23rd All Japan badminton tournament	
Fencing	2012	The 65th all Japan fencing tournament	Japan
Cheerleading	2012	Japan Cup 2012	Japan
		Cheerleading Japan competition	
		ICU Asian open cheerleading competition	International
Table Tennis	2012	Emperor/Empress cup tournament	Japan
		Junior all Japan tournament	