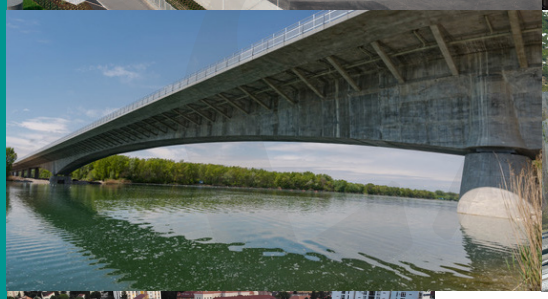
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Bulletin

fib
CEB-FIP

104










2022 *fib* Awards for Outstanding Concrete Structures

Presented at the 2022 *fib* Congress in Oslo

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fib CEB-FIP Bulletin

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June 2022

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COVER PICTURES Winners, Special Mention recipients, and Exceptional Recognition recipients of the 2022 *fib* Awards for Outstanding Structures, from left to right:

- Rever Holdings Ryogoku (Japan), Buildings Winner
- Helsinki Olympic Stadium (Finland), Buildings Winner
- Rose Fitzgerald Kennedy Bridge over the River Barrow (Ireland/Spain), Civil engineering Winner
- The Bridge Over the Rowing Course on D4 Motorway in Bratislava, Slovakia (Slovakia), Civil engineering Special Mention
- New Coastal Road viaduct on Reunion Island (France), Civil engineering Special Mention (photo credit: © Sébasten Marchal)
- FHNW-CAMPUS (Switzerland), Buildings Special Mention (photo credit: © Martin Stollenwerk)
- Chau Chak Wing Museum (Australia), Buildings Special Mention
- BT Headquarters (Romania), Buildings Special Mention
- CarboLight Bridge (Germany), Civil engineering Exceptional Recognition
- Bessodani Bridge (Japan), Civil engineering Exceptional Recognition

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First published in 2022 by the International Federation for Structural Concrete (*fib*).

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ISSN: 1562-3610
ISBN: 978-2-88394-160-1
https:// doi.org/10.35789/fib.BULL.0104
Design, layout and editing: Marie Reymond (*fib* Secretariat)

Printed by DCC Document Competence Center Siegmar Kästl e.K., Germany

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2022 *fib* Awards for Outstanding Concrete Structures

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The *fib* – a Bridge between Research and Practice



The *fib* website allows you to keep track of...

...our latest publications (including our bulletins and the *fib* journal *Structural Concrete*)...

...our upcoming events (Congresses, Symposia, PhD Symposia and supported events)...

...the current working groups (Commissions, Task Groups and Working Parties)...

...and our updated membership benefits.

fib-international.org

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President's Foreword



The *fib* has two major missions now. One is to work toward the publication of the Model Code 2020, and the other is to respond to the global movement toward carbon neutrality. While the former is steadily progressing toward completion, the latter will require significant efforts for generations to come.

As we all know, cement, the primary material for concrete, is a sector that accounts for 8.5% of the world's CO_2 emissions. And the structural concrete that *fib* handles consume 60% of that. In other words, we need to know the reality that our structural concrete is emitting 5% of the world's CO_2.

From now on, *fib* members, suppliers, designers, builders, owner's engineers, and academic researchers will be asked how to solve this difficult problem. In general, most of the CO_2 emissions in the life cycle of structural concrete come from the production stage of materials and the use stage after construction, i.e. A1 to A3 and B1 to B5 processes as defined in EN15978.

Cement and steel sectors, which are the main materials for structural concrete, are expected to take various measures to achieve zero carbon in their respective sectors by 2050. Until then, we must deal with the transition with our low carbon technologies. Regarding the production stage, the *fib* has recently launched TG4.8 "Low carbon concrete". And the latest low carbon technologies will be discussed there.

On the other hand, in the use stage, there is very little data on the relationship between durability and intervention and maintenance so far. The data accumulation here is the work of the *fib*, a group of various experts on structural concrete. Through-life management using highly durable structures and precise monitoring will enable to realize minimum maintenance in the use stage and to minimize CO_2 emissions.

Furthermore, it is also possible to contribute to the reduction of CO_2 emissions in the further stage after the first cycle by responding to the circular economy, that is, deconstruction (C), reuse, and recycle (D). However, the technology in this field is still in its infancy, and further research and development is expected in the future.

As described above, structural concrete can be carbon neutral in all aspects of its conception, and it can make a significant contribution when it is realized. The *fib* will have to address these issues in the future. Of course, it will not be easy, and it will take time. However, if we do not continue our efforts as the only international academic society on structural concrete in the world to achieve carbon neutrality, the significance of our very existence may be questioned.

Long before Portland cement was invented, Roman concrete, made of volcanic ash and other materials, was the ultimate low-carbon material, and is still in use 2'000 years later because of its non-reinforced structure and lack of deterioration factors. Reinforced concrete, which made it possible to apply concrete to structures other than arches and domes, is only 150 years old. Prestressed concrete is even younger, with only 80 years of history.

Now that we think about it, we realize that Roman concrete, which is non-reinforced low carbon concrete, is one of the examples of problem solving that we are trying to achieve. We have new materials, such as coated reinforcement, FRP, and fiber reinforced concrete, which can be used in any structural form. To overcome this challenge with all our wisdom would be to live up to the feat the Romans accomplished 2'000 years ago.

Realizing highly durable and elegant structures with low-carbon concrete is the key to meet the demands of the world in the future. I hope you will enjoy reading this AOS brochure showing the Outstanding Concrete Structures Awards at the *fib* 2022 Congress in Oslo. And I also hope you will find some clues for the challenges we are facing.



Dr Akio Kasuga

fib President

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About the Awards

The *fib* Awards for Outstanding Concrete Structures are attributed every four years at the *fib* Congress, with the goal of enhancing the international recognition of concrete structures that demonstrate the versatility of concrete as a structural medium. The award consists of a bronze plaque to be displayed on the structure, and certificates presented to the main parties responsible for the work.

Applications are invited by the *fib* secretariat via the National Member Groups. Information on the competition is also made available on the *fib*'s website, and in the newsletter *fib*-news published in *Structural Concrete*.

The submitted structures must have been completed during the four years prior to the year of the Congress at which the awards are attributed. The jury may accept an older structure, completed one or two years before, provided that it was not already submitted for the previous award attribution (Melbourne, 2018).

The submitted structures must also have the support of an *fib* Head of Delegation or National Member Group Secretary in order to confirm the authenticity of the indicated authors.

Entries consist of the completed entry form, five representative photos of the whole structure and/or any important details or plans, and short summary texts explaining:

- the history of the project;
- description of the structure;
- particularities of its realisation (difficulties encountered, special solutions found, etc.).

A jury designated by the Presidium selects the winners. The awards are attributed in two categories, Civil Engineering Structures (including bridges) and Buildings. Two or three 'Winners' and two to four 'Special Mention' recipients are selected in each category, depending on the number of entries received.

The jury takes into account criteria such as:

- design aspects, including aesthetics and design detailing;
- construction practice and quality of work;
- environmental aspects of the design and its construction;
- durability and sustainability aspects;
- significance of the contribution made by the entry to the development and improvement of concrete construction.

The decisions of the jury are final and cannot be challenged. They are unveiled at a special ceremony during the *fib* Congress in Oslo.

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Chairman of the Jury's Foreword



Every one of us needs structures for housing, infrastructure, industry, and recreation. The most common structural material is concrete.

The *fib* works hard to make concrete structures better, more environmentally friendly, safer, and more economical to build and maintain. This work of the *fib* is performed voluntarily by academics, professional builders, and designers from across the world.

As part of the *fib*'s ambition, it is important to show outstanding concrete structures. What is possible to design and construct. What are the histories of the structures, and how are they created?

The FIP initiated the Award for Outstanding Structures in 1990. The *fib* continues the tradition and invites participation in the Outstanding Structures competition every fourth year. The awards are presented during the *fib* Congress.

There are two categories, Buildings and Civil Structures.

In addition to a detailed description of their project, competitors must have support from their respective National *fib* Group.

The nominees are then evaluated by a jury composed of all previous *fib* presidents and the *fib* Presidium. The members of the jury have various backgrounds and know concrete structures well. They also know the *fib* very well.

This year there were 22 nominees, 13 in Buildings and 9 in Civil.

All nominees have qualities of their own. The people behind every nominated structure wanted to show their project and have received their respective National *fib* Group's support for that. Therefore, it is an acknowledgement to be a nominee. Accordingly, the *fib* has prepared this nice Bulletin that includes all the nominated structures.

However, this is a competition. Therefore, the jury evaluates some of the entries better than others, and these are designated winners. Additionally, some projects receive special mention or exceptional recognition.

It is a sincere wish that the readers of this Bulletin get a positive experience in realizing the versatility of the concrete material to achieve good projects. We also hope that this Bulletin inspires good quality work in the future.



Tor Ole Olsen
Chairman of the Jury

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Previous Awards

Buildings

2018 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- La Laguna Cathedral roof & dome replacement, Spain
- R·Torso·C, Japan

SPECIAL MENTIONS

- Manta, Austria

2014 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Centro Ovale Concrete Shell, Chiasso, Switzerland
- Park City Musahi Kosugi, Kawasaki, Japan
- Bella Sky Hotel, Copenhagen, Denmark

SPECIAL MENTIONS

- Shenzhen Vanke Center, Shenzhen, China
- Trollstigen View Point, Trollstigplataaet, Norway

2010 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- National Portrait Gallery, Parkes ACT, Australia
- Island Tower Sky Club, Fukuoka, Japan

SPECIAL MENTIONS

- Gyldendalhuset, Oslo, Norway
- Grand Rapids Art Museum, Michigan, USA
- Doha High Rise Office Building, Doha, Qatar

2006 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Turning Torso, Malmo, Sweden
- Shawnessy Light Rail Transit Station, Calgary, Canada

SPECIAL MENTIONS

- Forsterstrasse Apartment House, Zurich, Switzerland
- Tomorrow Square, Shanghai, China

2002 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Tower at La Défense, Paris, France
- The Scientia, University of New South Wales, Australia

SPECIAL MENTIONS

- City Library, Roermond, The Netherlands
- Engineering Design and Research Centre, Chennai, India

The *fib* awards continue the tradition of the former FIP Awards for Outstanding Concrete Structures, attributed from 1990 to 1998.

1998 FIP Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Waterfront Hall, Belfast, Northern Ireland
- Municipal Central Gymnasium, Osaka, Japan

SPECIAL MENTIONS

- Indoor swimming arena, Osaka, Japan
- Indoor stadium, Bangalore, India
- Laakhaven Hollands Spoor parking garage, The Hague, The Netherlands

1994 FIP Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Administrative building, Chennai, Tamil Nadu , India
- Tennis center, Yale University, USA

SPECIAL MENTIONS

- Auditorium, Hyderabad, India
- ANA Hotel, Sydney, Australia
- Hassan II mosque, Casablanca, Morocco
- Ministry of Social Affairs Building, The Hague, The Netherlands

1990 FIP Awards for Outstanding Concrete Structures

WINNING STRUCTURE

- La Grande Arche, Paris, France

SPECIAL MENTIONS

- New Parliament House, Canberra, Australia
- Thorp Receipt and Storage Facility, UK
- Sludge fermentation installation, Bottrop, Germany

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Buildings Category

The Buildings nominees show a variety of solutions to sometimes similar challenges. This is one of the assets of our construction industry. This array of projects will hopefully inspire other projects and solutions.

We have several sports arenas among the nominees, and these have a different set of constraints compared to traditional buildings. And again, different solutions are presented.

This year, there was a strong focus on sustainability among the jury members that is in line with the strong efforts of the *fib* in making sustainability a central part of design and construction.

One of the winners was a rehabilitation project. The jury sees a trend in this direction in the coming years. The concrete industry needs this.

The other winner shows exceptional geometry.

Tor Ole Olsen
Chairman of the Jury











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Rever Holdings Ryogoku

Structural design and construction of organic workplace with reinforced wall and spider web structure

Tokyo, Japan

This project involved the reconstruction of the head office building of Rever Holdings Corporation, a group company engaged in recycling and waste disposal, to commemorate its 100-year anniversary. The building is located in Ryogoku, Tokyo, where it was founded.

Although the word "waste" is easily associated with a negative image, the owner considers waste to be "resources" and is making efforts with a strong sense of mission to break down or change the boundaries between waste and resources. In proceeding with this project, the company served to achieve circular economy at which the world aims, setting the following themes:

- Advanced workplace where promotion of communication and a new way of working is introduced.
- Harmony with the surrounding environment making use of natural light and airflow.
- Harmonizing with the global environment through positive use of recyclable materials.

In order to realize the above listed themes, this project uses the concrete's excellence in formability which makes both the inside and outside of the building have organic forms that blend in with the environment, unlike conventional offices.



By designing the activities of the workplace and the environmental characteristics in close relation to each other, the building plan was formed parametrically by manipulating the shape of the walls and the atrium to maximize the range of light that would fit within the set illuminance while reducing the luminance contrast and cooling load. As a result, the atriums have a different shape on each floor and by using them for natural ventilation, we made it possible to feel not only the light but also a gentle breeze.

By arranging the stairs in the atrium, we aimed to make the movement itself a pleasant experience, allowing the users to feel the difference in their environment. In addition, by making the temperature and humidity of various places in the building visible to users, they can choose the best place for themselves.

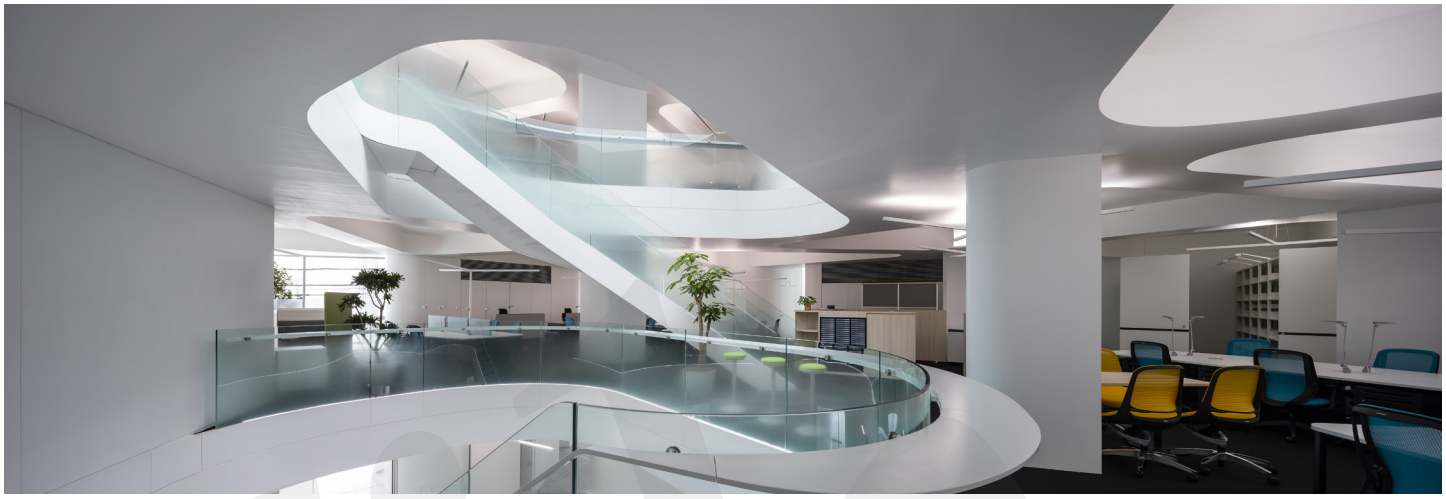
Facilitating a grouping regardless of desk arrangements and increasing communication opportunities by developing a furniture layout with no differentiation between master and subordinate circulations. Curved walls are erected on the periphery of the plan, which bring in light softly through the window slits in between. It provides people an intermediate area between the inside and the outside.



In terms of contribution to the global environment, we actively utilize natural energy. This is the latest environmentally friendly office building that has achieved 50% efficiency improvement compared with the standard buildings and has received the highest rank in the Building Energy Conservation Labeling System (BELS) in Japan.

The inner framing structure supports only the vertical force. We developed a structural plan inspired by spider web to determine the

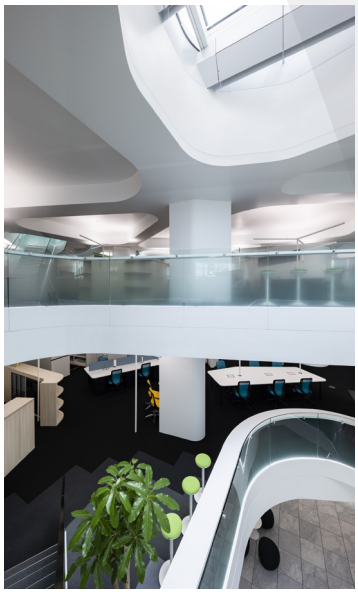
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column and girder positions suitable for the complex plane shape surrounded by the outer peripheral walls and provided in its inside with a large irregular void. The layout of beams and the width is decided by optimization technique.

The optimization of a web frame is only an analytical solution. Difficulties in rebar arrangements were not considered in the framework obtained in the analysis. Thus, we have decided to provide the joints with rectangular capitals and anchor the main bars of the beam ends into the capitals, not in the columns. Bending moments of the girders, connected from each direction to the capitals are transferred through mechanical anchorage, and the capitals are designed to have sizes and bar arrangements enough to resist the large bending moments and shear force.

We made efforts toward reducing the environmental loads by using recyclable materials for interior and exterior finishing and minimizing the number of the building materials to be used.



Therefore, paint finish was applied to the exterior walls while only the inside of the exterior walls was finished for thermal insulation, and concrete monolithic surface finish was applied under the interior columns, beams and slabs. Since paint with low crack followability was applied to thick exterior walls, considerations were given to design as well as drying shrinkage in choosing concrete material.

The non-drying shrinkage type concrete (Fine Lead: Japanese Patent No. 6192208) used for this project is produced by using air-entraining and high-range water-reducing admixture with shrinkage reducing performance, expansive additive and crushed limestone. This concrete expands at the early stage of hardening to the degree that it does not affect the various performances of concrete, and then makes the total shrinkage strain almost zero because of reduced drying shrinkage.

Because this building hardly has the concept of grid lines, it was almost impossible to mark the wall positions on each floor level at the distances in the X-/Y- directions from the reference points, which became the biggest barrier in constructing. That triggered us to introduce the “next-generation marking” in the construction of this building. This method, which provides accurate marking from the BIM model and the marker’s (prism) position on the tablet screen, has made it possible for one person to perform markings at the site, in principle, even for an intricately shaped building like this work, and become a technique indispensable in realizing this work in terms of both efficiency and accuracy.

With the development of the analysis techniques and materials, free-shaped buildings that were never imagined before have come into existence all over the world. However, there must be only a few buildings which were born in further consideration of “how to work there” and the “global environment,” the interesting shapes being not their ultimate goal. We hope this work will contributes to the development and improvement of concrete constructions.

OWNER Rever Corporation
MAIN AUTHORS Satoshi Kawamura & Naoto Kamoshita
OTHER PARTICIPANTS Ikuya Hanaoka, Toshiyuki Sato & Kazumasa Inoue
CONTRACTOR Takenaka Corporation
COMPLETION February 2020

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The Helsinki Olympic Stadium

The Helsinki Olympic Stadium is a treasure trove of different structures
Helskinki, Finland



The original, year 1938, load bearing frame of the Stadium as well as the intermediate and base floors were typically of ferroconcrete (a term commonly used at the time) and naturally cast in place. In the original project, the intermediate floors were also concrete structures, with the exception of the eastern stand which featured wooden floors, while external walls are brick, block and concrete walls. The structural system of the stands consists of column and beam frames that support stepping slab structures. The frames are joined together via curved plate-type frame beams and walls. The canopy overhang of the grandstand, on the other hand, is built of concrete slabs between the bottom surfaces of the concrete beams with a wooden roof structure between the slabs. In the renovation project, the south and north curves of the Stadium were covered with a canopy of steel construction. In the curves, the upper and the lower stand consist of frame structures and expansion joint sections built at different times. With the increase in loads, mainly due to the wind loads acting on the canopy, the frame structures of the stand were joined together to make the overall construction more rigid and to distribute the loads over a larger area.

Naturally the increased loads also had to be taken account of in the foundations which also needed to be tied together for rigidity purposes. The existing foundations were reinforced in areas where loads increased from what they were before. Part of the foundations were extended downwards due to the large new facilities excavated under the old Stadium in this gigantic project, including an area for a 400 m track and expansive logistics facilities.

A condition survey conducted just over ten years ago showed the old concrete structures to be mostly in good condition. The structures of the grandstand canopy were assessed to have been exposed to frost weathering. However, they hardly showed any weathering owing to having had sufficient moisture protection the whole time. Cracks caused by loading were in the condition survey detected in the transverse bearers of the grandstand, on the other hand. The crack width was diminished according to the implemented rework plan by installing adhesive carbon fibre reinforcement on the main beams, i.e., the longitudinal spreader beams, as well as on the top surface of transverse beams. Otherwise, the repairs were implemented using conventional concrete rework methods. The load bearing concrete structures of the grandstand were also reinforced with carbon fibre reinforcement, 60-80 mm wide and 1-2 mm thick, glued on the structure's surface. The loads acting on the grandstand canopy are not caused only by its own weight and snow loads, but also by the wind conditions which have changed due to the new steel canopies. Based on wind tunnel tests conducted to determine the wind loads acting on the canopy, a wind pressure value of 0.3-0.8 kN/m2, depending on wind direction, was used as input data in structural calculations.

The upper and lower stands on the south and north curves have been built at different times from frame structures and expansion joint sections. With these separate structures now joined together, the downward forces acting on the new steel canopy are distributed over a wider area. The columns of the same frame, however, required additional 120-150 mm thick underpinning. The underpinning layer was provided with rebars and self-compacting concrete was used due to the dense reinforcement. The frame beams of the curves were also provided with underpinning, 150 mm thick, with the main bars anchored using the new foundation reinforcements on the



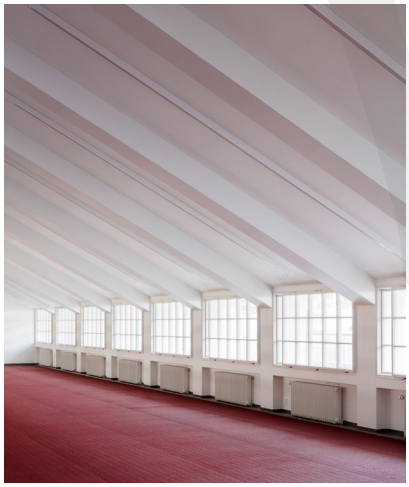
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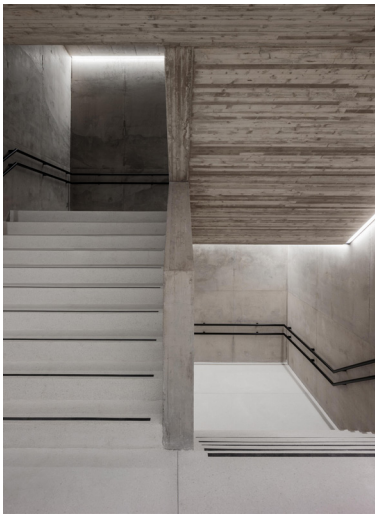
inner curve as well as rock anchorage. Thermal insulation was also increased in the old structures. A special feature of the old structures is cork which had been used as thermal insulation in the grandstand. Thermal insulation was now improved by replacing old insulation with more effective, modern insulation. The Sports Museum housed in the Stadium was also renovated, and three different materials were used for thermal insulation: mineral wool, polyurethane thermal insulation panels and expanded aggregate concrete.

The new steel canopy was joined with the old reinforced concrete frame structures using specially manufactured structural bearings. Part of the massive bearings were intended to only transmit vertical loads, while others are designed

to transmit also horizontal loads in one or two directions. The bottom diameter of the bearing is ca. 1.5 m and the top diameter 1 m. They will receive a maximum compressive load of 14 MN and a maximum tensile load of 4 MN. After installation, the voids between the bottom bearing surfaces and concrete structures were filled with high strength grouting concrete.

The foundations of the stand frames had to be reinforced at the steel canopy's main columns, in the front part of the joined stand frames on the side of the field as well as on points where the foundations are subjected to tension in the rear part of the stand frames. The design age defined for these was one hundred years, as for other key structures. The old foundations had been designed to withstand simultaneously loads from the original structures. The foundations had to be reinforced now due to the additional loads transmitted from the new steel canopy. Reinforcing was necessary against both compressive and tensile loads. To improve the reinforcement of the foundations of the stand frames joined together in the project, the tensile reinforcement of the frame beams provided with underpinning was extended to withstand the full tensile force and the tensile force acting on the rebars was anchored to the rock. The compressive stresses acting on the foundations are now transmitted to the rock via grouted anchors. Supporting the old load bearing structures from underneath was a particular challenge. Supporting was needed due to the new facilities excavated under the old structures. The installation of drilled piles was the first step. Steel beams were then mounted on them for the fixing of the U channel sections installed on the sides of the columns. The old structures' own weight was transmitted to the drilled piles by prestressing threaded rods between the steel beams and the U channel sections, and in some places by means of hydraulic jacks. After jacking up, the jacks were enclosed with welded steel boxes and then removed. As the excavations progressed, a grid tower of steel pipes and angle bars was welded between the drilled piles. The transfer of the old service kiosks for the duration of the project was another special feature. They were supported on steel grates built around them for the transfer. After the project, they were erected on top of new base slabs in their old place in the north square.





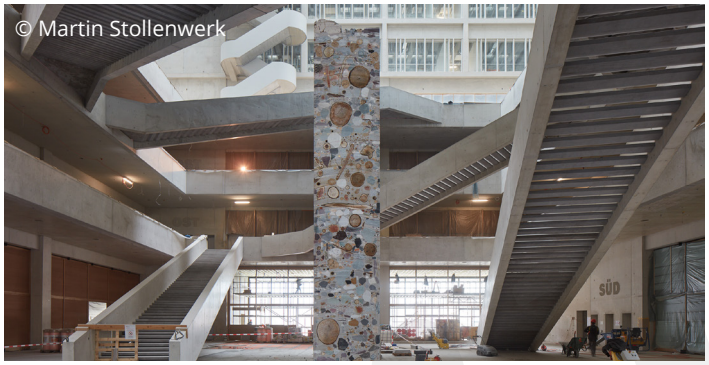
When designing sports facilities, functionality is the most important guiding force from the biggest outlines to the smallest details. In the Helsinki Olympic Stadium, the key objective was to ensure that the conservation and revitalizing responds to all future requirements of international sport events as well as preserves the cultural values of the heritage.



OWNERS City of Helsinki Urban Environment Division & The Stadium Foundation
MAIN AUTHORS K2S and NRT architects, principle designers Kari Raimoranta and Kimmo Lintula, Sweco, Structural design Jaakko Yli-Säntti
OTHER PARTICIPANTS White Arkitekten (Sweden), Wessel de Jonge (Holland) & The Finnish Heritage Agency
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SUBCONTRACTOR/SUPPLIER Rudus Oy
COMPLETION 2020

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FHNW-CAMPUS
Muttenz, Switzerland



Driven by a culture that promotes innovation, the University of Applied Sciences and Arts Northwestern Switzerland (FHNW) established a new campus in Muttenz in 2018. It serves as the new home for the Schools of Architecture, Civil Engineering and Geomatics, Life Sciences, Social Work, and Education, and for the Mechatronics Trinational course at the School of Technology, which to date have been spread across 36 locations. The new location with its 34'500 square meters of service area provides a study and work area for approximately 3'700 students and 800 staff.

In May 2011, architects pool Architekten in conjunction with structural engineers Schnetzer Puskas Ingenieure won the selective project competition. The project is characterised by a cubic building with a minimal footprint and a spacious adjoining park.

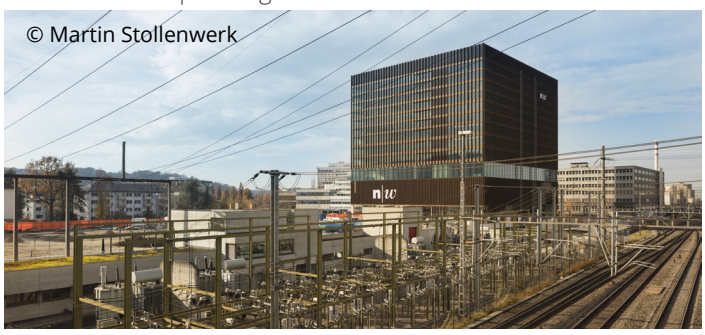
The main building has two floors at basement level, a ground floor and 12 upper floors and is approximately 64 meters in height with floor dimensions of 63 by 70 meters, so that it resembles a cube. The base of the main building, from the ground floor to the third floor, comprises public spaces with lecture halls, an auditorium, the canteen, the library and space for third party use, while the fourth to the twelfth floors comprise the offices, laboratories and seminar rooms of the various faculties. The top floor is used mainly for technical equipment. The basement floors comprise various laboratories and workshops and also storerooms and plant rooms. Adjacent to this is an underground area that is approximately 10 meters high and approx. 28 by 63 meters in size with a double gymnasium, a construction hall, workshops and storage rooms.

The upper floors are designed as a consistent skeleton construction with four stabilising access cores, floor slabs and prefabricated concrete columns. With two courtyards, the floor plan shows a 14 meters wide ring of slabs along the façade and a central wing. To achieve maximum flexibility of use, there are spans in one direction, each 14 meters wide, that are bridged with prefabricated ribbed plates with a concrete overlay. In the other direction along the



edges of the roof, the support grid with one edge beam is 7 meters. The thickness of the concrete, taking impact sound requirements into account, is determined in such a way that most of the floor coverings were laid directly bonded.

On the fourth floor, the inner wing, referred to as the central wing, is supported by a storeyhigh bridge structure made in part of discontinues shear walls and prestressed in situ concrete flat slabs, to allow for the atrium below that is over 20 meters high. The first and second floors are supported using the same principle, allowing for the creation of a 42 meters wide, column free main entrance. In addition, prestressed flat slabs allow for the construction of generous cantilevered galleries around the courtyard above the ground, the first and the second floors. Together with a monolithic ground slab, slabs and concrete walls, the basement floors create a rigid box in which the horizontal stiffening access cores are clamped. In situ bored piles transfer concentrated loads on the cores and main columns into the bedrock, which also prevents unusual subsidence of the subgrade due to doline formation in karstified gipskeuper. Secondary columns that only transfer basement floor loads and are not required for the overall stability of the building, are shallow founded with strip footings.



OWNER Kanton Basel-Landschaft Bau- und Umweltschutzdirektion
MAIN AUTHORS David Leuthold, Andreas Sonderegger & Stefan Bänziger
OTHER PARTICIPANTS Lukas Schweingruber & René Kümmerli
CONTRACTOR HRS Real Estate AG
SUBCONTRACTOR/SUPPLIER Anliker AG Bauunternehmung
COMPLETION 2018

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Chau Chak Wing Museum
Sydney, Australia



The Chau Chak Wing Museum is located directly opposite the Great Hall, the University of Sydney's main ceremonial hall and the oldest university building in Australia. This prominent location reinforces the museum's broader role beyond hosting exhibitions and teaching, but also as the new front door for the University.

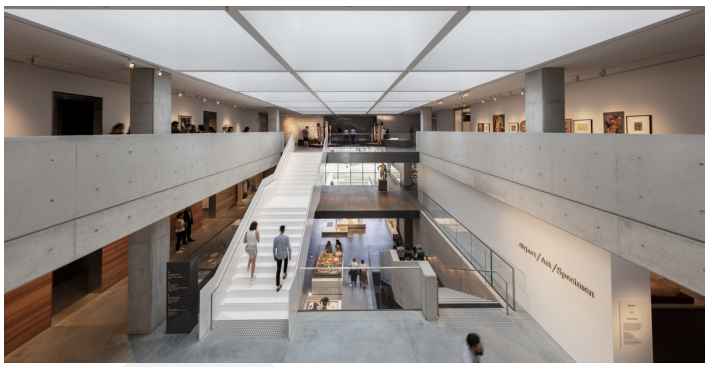
The brief for the new museum was simple but with the highest expectation that the building be still around and be just as good in another hundred years. The University sees the Chau Chak Wing Museum enduring long after other parts of the campus have been redeveloped. The project was delivered to a modest construction budget, costing less per square metre than comparable museum or university teaching spaces.

Concrete in its various forms was ideal in meeting the complex technical challenges in making this possible and meeting the need for longevity. It provided a unifying material, from the larger precinct scaled elements through to the fine-grained details of the building.

The building takes form as a series of cascading terraces beneath a generous, protected and shaded overhang. It was built with the technology and the concerns of our time, and yet remains timeless allowing the building to weather gracefully, robust yet easy to maintain.

The construction required reimagining concrete construction from the ground up – borrowing techniques from high rise jump form, design criteria from bridge construction along with a daunting temporary works solution to form the 400 thick reinforced prestressed walls 7m above the sloping site below.





Major challenges included the requirement for a 100-year design life; large cantilevers soaring out over 14m to the east; control of cracking in the restrained box – being the primary structural element, it could not have joints; achieving high quality finish to tall, heavily reinforced walls; complex temporary works and working around tree roots

Not one of these problems could be solved in isolation to the others – a collaborative effort was required between the contractor, architect, structural engineer, concrete technologist, concrete supplier, formwork & temporary works contractors and reinforcement fixers. Together, we understood what risks can be managed and why it is worthwhile, making this seemingly simple structure possible.

The structural solution to both the resolving the structural design of the cantilevered elements and controlling cracking involved the introduction of both conventional post tensioned strands into the wall elements as well as high strength large diameter post tension bar and traditional reinforcement. The sequencing of the walls for access to allow stressing became a critical consideration – as well as timing of the stressing to avoid cracking while providing a practical construction programme.

Every aspect of the structural design was thoroughly considered, not only from a structural perspective but also the aesthetic implications like controlling micro crack widths and the exceptionally long design life which involved design guidance outside of the scope of AS3600. The reinforcement detailing was fully developed to ensure concrete hoses and vibration equipment could fit between reinforcement bars to achieve the quality finish required.

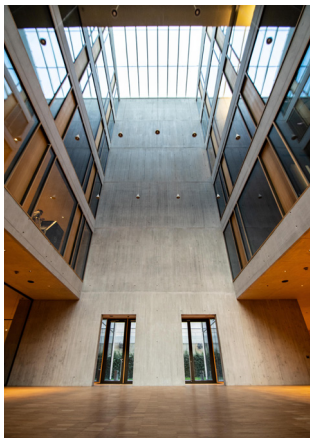
OWNER The University of Sydney
MAIN AUTHORS Kiong Lee, Graeme Dix & Aaron Hughes
OTHER PARTICIPANTS Peter MacDonald & David Mahaffey
CONTRACTOR FDC Construction
CONTRACTORS/SUPPLIERS Azzuri Concrete, Precast Concrete Group & Boral Concrete
COMPLETION 2020

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BT Headquarter
Cluj, Romania



The eight stories tall structure of the building (counting three underground levels) is housing 13'035 m² office space for 1'200 working posts, including connected facilities and services, like an auditorium and a restaurant. In addition to technical spaces, the underground levels accommodate 8'732 m² parking for 229 cars and 142 bicycles, and a bomb shelter. The auditorium and restaurant, which are also located at second and first underground levels, adjoining a lowered green garden, are connected through a public circuit to the main ground floor lobby, that includes reception, cafe, and lounge. These three main public spaces (lobby, restaurant and auditorium) represent the base of the three atriums, all linked by the auditorium foyer which unfolds at the lowest point seen from the ground floor lobby, namely at the second underground level. The main elevator core is reached after crossing over the auditorium foyer on a post-tensioned prestressed concrete pedestrian bridge, after passing by main lobby reception. The upper floors are designed as flowing open spaces, pulsating around six concrete cores, which accommodate three enclosed evacuation stairs, elevators and technical spaces compressed at the minimum, serving the smooth and proper operation of the entire building installations. On the other side of the concrete walls which represent the backbone of the three atriums, three open stairs unfold ensuring a walkable interconnection towards the lowered green garden.



The large, exquisitely finished exposed concrete surfaces play a major role in creating the proper interior climate. Out of all electronic systems, only the sensors and the lighting fixtures of the circulations have been cast into concrete. Synchronizing these with the post-tensioning tendons of the large span slabs and with plastic pipework configured in serpentine layout for the heating/cooling system was maybe the major technical challenge facing the design and construction team.

Incorporated systems in the slab required precise coordination between the disciplines both in office and on site. The active cooling system incorporated in each exposed concrete soffit floor works with the thermal mass effect, obtained during favorable nighttime conditions. It proved to be highly effective already during the first cycle of use. Studies prove that in a few years, amount of energy used for cooling buildings in Eastern Europe will exceed the energy used for heating. Ensuring a proper thermal mass for the building will help securing it against the effects of a changing climate. A compensation by an office-cool type system, blowing a dynamic airflow directly into the raised floor is installed in the building. This way it was possible to banish all the necessary piping and ventilation systems to a few enclosed spaces – where these can also be freely serviced – and forgo tiled ceilings and fan-coil vents.

Since concrete floor slabs are exposed at office areas, careful analysis of slab deflections had been made in order to fit glass partition walls with small tolerances. To limit deflections, unbonded posttensioned gravity framing system was chosen. Posttensioning is not common in Eastern European construction, but it's high efficiency in slab thickness reduction and embodied carbon cut (when compared to conventional reinforced framing systems) proved to be worthwhile. The folded reinforced concrete roof melts into the city skyline, offering meantime floating exposed soffit for the office. At corners where the slab cantilever exceeds 5.0 m, a column capital is integrated into the roof shape.



OWNER Banca Transilvania
MAIN AUTHORS Arnold Macalik, Anca Mihai & Jácint Virág
OTHER PARTICIPANTS MOSSFERN (architecture), LAMINA (structure), QMECK WORKS (MEP)
CONTRACTORS KÉSZ Romania, MIMO Group & GEI
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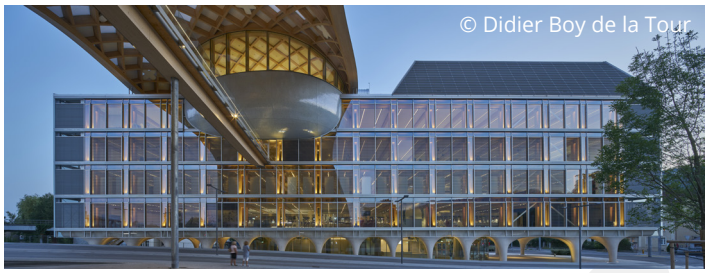
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Nominees

Buildings

Cité du Temps
Biel, Switzerland



The Cité du Temps houses, among other facilities, two independent museums of the Swatch and Omega brands. The seven-storey hybrid building consists of five upper storeys, a ground floor und an underground technical storey. The upper floors are designed as a timber construction and stand on a vaulted base level made of reinforced concrete that is partially outside of the building shell in the cold area and serves as a public common area. The primary structural element of the reinforced concrete structure are the 14 frames that stretch in the transverse direction. They transfer both the major proportion of the vertical loads and the horizontal forces in the transverse direction. In the longitudinal direction, there are in each case 13 arches along the facade levels that are linked together.

The verification of structural safety and serviceability of the vaulted structure required comprehensive structural modelling. In addition to the structural challenges, issues relating to structural implementation were decisive. Unlike the construction of common concrete members, no actual formwork drawings had to be prepared for the vaulted structure. The geometry was carefully built up in advance in a 3D model, reviewed and sent directly to the formworker. A detailed coordination and a direct flow of information within the entire "exposed concrete team" during the execution was paramount. The project demonstrated that the boundaries of design and technical possibilities can be pushed further even in traditional in-situ concrete construction with digitized planning and innovation.



OWNER The Swatch Group Ltd
MAIN AUTHORS Shigeru Ban, Jan Stöcker & Jan Stebler
OTHER PARTICIPANT Christoph Meier
CONTRACTORS ARGE Frutiger / Marti AG
SUBCONTRACTOR/SUPPLIER Frutiger AG
COMPLETION 2019

Narendra Modi Stadium
Ahmedabad, India



World's largest cricket stadium having 110'000 seat capacity, 10'000 seats more than Melbourne cricket stadium, Australia. Architecture marvel stadium created with two large seating bowls and single large podium. The structural steel spoke wheel concept roof with tensile fabric placed over the upper bowl looks like an impressive crown over the stadium. Unique Architecture design of single large podium separating upper and lower bowls providing 360 degree obstruction free view of the field of play area to spectators. Stadium structure is designed with 100 years life period. Due to repetitive nature of stadium's structural element, more than 50% of the structure was done in precast for rapid construction and high quality concrete finishes. More than 15'000 precast elements were used in the structure. Precast elements weighing from 3 MT (minimum) to 280 MT (maximum) were used. Connection of precast elements joints which are to be done at the higher elevation were made with steel embedment at the joint and grouted with high strength grout. Intricate geometrical shape portal frame rising from podium level were converted into large size and heavy weight precast elements. The elements were discretised with minimum joints with complex geometries. Single precast Y shaped element having with 35M high and 280 MT weight was used and innovative structure design and execution activities were worked out for casting, transporting, lifting and erection stages. India's first green rated stadium with IGBC "Gold Rating".



OWNER Gujarat Cricket Association
MAIN AUTHORS Andrew James & R. Eswaran
OTHER PARTICIPANTS Viral Patel & Marco Grigoletto
CONTRACTOR L&T Construction
COMPLETION February 2020

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Intempo Building
Benidorm, Spain



Intempo's Building Structure (Benidorm, Alicante) is designed with reinforced concrete, and consists in a 52 floor tower above ground level, and three basement-levels (190 meters of total height).

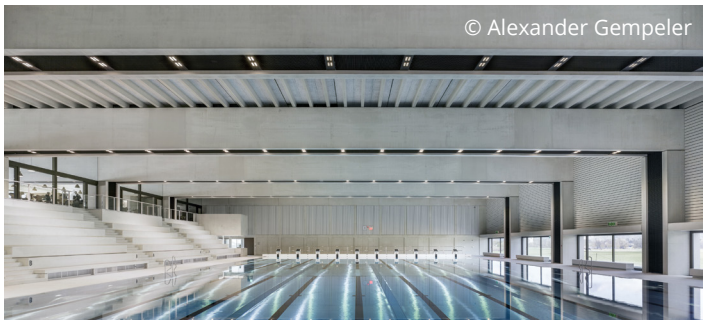
It's worth pointing out its peculiar geometric design, which consists in two straight parallel towers with a separation of 20 meters, linked at the top with an elliptical reversed cone with a height of 9 stories. This cone is held up by a metallic truss which was launched from one tower to another (at 150 meters high), and is supported by the external shear walls of exposed concrete of the two towers.

In addition of the structure typology's own features (and its unusual order of magnitude), the basic characteristic of the building lies in the high slenderness (being the value of the ratio between height and the minimum dimension of the floor plan equal to 10.8), which determines both the compound's architectural perception and its structural materialization.



OWNER Teach Speire
MAIN AUTHORS Enrique Gutiérrez de Tejada Espuelas & Florentino Regalado Tesoro
OTHER PARTICIPANTS Roberto Pérez-Guerras & Celestí Ventura
CONTRACTORS Kono Estructuras & Dragados
SUBCONTRACTORS/SUPPLIERS URSSA & VSL (CTT-Stronghold,S.A.)
COMPLETION June 2021

Sports Arena Campus Sursee
Sursee, Switzerland



The two sports halls designed by Rolf Mühlethaler and Schnetzer Puskas Ingenieure for Campus Sursee form independent volumes of monolithic character, underlined by the seamless exposed concrete façade. They are arranged at right angles to each other and enclose a triangular square that opens up to the landscape. The materialization in exposed concrete and the prefabrication form the basis of the structural concept of the Sports Arena. The three parts of the building were structurally designed as units. The defining structural elements are the prefabricated roof structure, the pillars and the exterior exposed concrete walls. In addition, the rhythm of the roof structure is reflected in the design of the jointless façade and the structure of the square.

The largely prefabricated roof structure for the swimming pool and sports hall consists of simple "beams" that are braced and prestressed on one side and arranged in such a way that one double beam always provides the accessible space for the building services installations. Due to the large spans of up to 40 meters, the great room heights and the tight schedule, a high degree of prefabrication of the supporting structure was aimed for. The structural work from the floor slab onwards could be completed within nine months - a time reduction of around two months compared with a conventional solution using in-situ concrete.



OWNER Stiftung Campus Sursee
MAIN AUTHORS Rolf Mühlethaler, Matthias Schilling & Tivadar Puskas
OTHER PARTICIPANTS Ruedi Egli, David Gadola & Peter Mocek
CONTRACTOR Implenia Schweiz AG
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Nominees

Buildings

Kama City Hall
Kama City, Japan



The most distinctive feature of this building is its grid-like outer frame composed of reinforced concrete flat beams and columns. The three-dimensional appearance generated by this outer frame invokes the beauty of concrete while being surrounded by greenery and the Onga River. Furthermore, it reflects and guides sunlight into the room and carries the wind in various directions within the unique environment of the basin.

The interior of the building is composed of exposed concrete, and the interior of the chamber is composed of locally produced cedarwood, which creates a beautiful fusion of concrete and wood. In the office, a slab with steel pipe void and PC steel wire is used to realize an open space with a large ceiling height and a large span with a low floor height without a beam form. Exposed ceiling design and a seismic isolation structure was adopted as a countermeasure for earthquakes to ensure safety and security. Furthermore, in case of flood damage, disaster prevention measures such as raising the floor height on the first floor has been taken to ensure the functionality is not impaired.



Kama City Hall is an unconventional building, different from typical Japanese government buildings and successfully integrates design, structure, and environmental design through multiple creative methods.

OWNER Kama City
MAIN AUTHORS Mitsutoshi Fukuda, Takayuki Nagano & Tetsuya Fukuda
OTHER PARTICIPANTS Shotaro Shimizu & Tomonari Suda
CONTRACTOR Asanuma Corporation
SUBCONTRACTOR/SUPPLIER Sakahira Co., Ltd.
COMPLETION March 2020

Under
Lindesnes, Norway



Under has become an international attraction which shows the limitless possibilities with concrete. Images of the concrete shell and its iconic shape has been published in media all over the world. The restaurant is the only one of its kind in Europe, and the largest in the world. Here, you can experience architecture, Michelin-star quality food and marine biology.

The building is located at the southernmost tip of Norway, with the North Sea at its doorstep, giving the building rough conditions to handle. You enter the tube-shaped building via a walkway and descends to the restaurant, seven meters below sea level. A massive, 35 square meter window gives a stunning view to the life in the sea, and makes a magic atmosphere for an unforgettable meal.



OWNER Kanton Lindesnes Havhotel
MAIN AUTHORS Rune Grasdal & Terje Raanes
OTHER PARTICIPANTS Lukas Schweingruber & René Kümmerli
CONTRACTOR Leif Lans
SUBCONTRACTOR/SUPPLIER Johnny Christensen & Unicon Mandal
COMPLETION March 2019

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Statue of Unity
Kevadiya colony, India



The Statue of Unity is an Art using Tall Structures as a medium to express Scale & Importance of Unity. It is a testimonial to the life of one of India's National Leaders Sardar Vallabhbhai Patel, a role model of Unity and Statesmanship. To commemorate his service to the nation, Government of India envisaged to build his statue as the "World's tallest Statue" which would symbolise a Global icon for Unity.

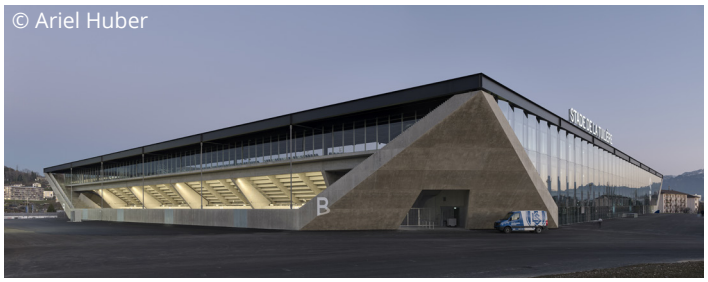
The design life of the Structure is 100 years. 182 m (597 feet) tall Statue of the Sardar in a walking pose facing the Sardar Sarovar Dam. 13 months for designing; 33 months for construction. Material used for construction. 210'000 m^3 of concrete. 18'500 tons of reinforcement steel. 6'500 tons of structural steel. 1'700 tons of bronze cladding, 8 mm thick, 550 macro-panels & 6'300 bronze micro-panels. A viewing gallery at 135 m level that visitors can reach in 34 seconds from the base level. 2 tuned mass dampers each weighing 200 MT to help withstand wind speeds upto 180 kmph. Entire steel is zinc-coated using hot gip galvanization to enhance its life and withstand corrosion

The Project also includes an exhibition centre at its base showcasing the life and achievements of Sardar Patel.. A 320 m long designer bridge connecting Sadhu Hill to the mainland. A memorial and visitors' centre with Garden, Unity wall and service building. 4-lane approach road of 5.88 Kms with two minor bridges. A 3-star hotel (Shresta Bharat Bhavan) and Parking Area. Projection Mapping & Laser Show on Statue Exhibition Hall/Museum in Statue Base.



OWNER Sardar Vallabhbhai Patel Rashtriya Ekta Trust (SVPRET)
MAIN AUTHORS S.Veeramani, Damien Friel & Jairam Panch
OTHER PARTICIPANTS Gopinath Virassamy, Sundhar C & Prasanna Chandrasekaran
CONTRACTOR Larsen & Toubro Limited
SUBCONTRACTOR/SUPPLIER Larsen & Toubro Limited
COMPLETION October 2018

Stade de la Tuilière
Lausanne, Switzerland



The new "Stade de la Tuilière" in Lausanne presents itself as a perfect unity of architecture and structure with a high recognition value. The number of components is reduced to a minimum and is limited to the indispensable structural elements. The load-bearing elements, which are left visible, also take on architectural functions.

In close interdisciplinary cooperation, the structural engineers and architects succeeded in consistently carrying the original basic design idea through to the execution. The construction characteristics of the simple basic form with the folded corners and the slender prestressed concrete girders result from an intensive "dialogue of the designers" and the constant search for structural efficiency, functionality and economy.

The recourse to the proven principles of prestressed concrete enabled the engineers to achieve a very functional loadbearing structure and a special spatial effect.

The structural elements of the "Stade de la Tuilière" were built using various reinforced concrete construction techniques. Depending on the different structural requirements, passive reinforcement, prestressed strands, post-tensioned tendons, precast elements, in-situ concrete, precast elements, facing concrete, etc. were used. These countless construction possibilities are further proof of the high architectural, structural and economic potential of modern concrete construction.



OWNER Direction des sports et de la cohésion sociale, Ville de Lausanne
MAIN AUTHORS D. Meyer, Dr. A. Bassetti, P. Tanner, D. Di Giacinto, L. Bögli & I. Sollberger
OTHER PARTICIPANTS E. Baeni & C. Smith
CONTRACTORS Dentan Frères SA (Groupe Zuitton SA)
SUBCONTRACTOR/SUPPLIER Elements AG
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Previous Awards

Civil Engineering Structures

2018 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURE

- Takubogawa Bridge, Japan

SPECIAL MENTIONS

- Utsikten Viewpoint, Norway
- Viaduct over River Almonte, Spain
- Footbridge in Čelákovice, Czecg Republic

EXCEPTIONAL RECOGNITION

- Yavuz Sultan Selim Bridge, Turkey

2014 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Egg-Graben Bridge, Valley of Grossarl, Austria
- Térénez Bridge, Rosnoën (Brittany), France

SPECIAL MENTIONS

- Hoover Dam Bypass, Clark Count Nevada, USA
- Kalisindh Thermal Power Project, Jhalawar, Rajastan, India
- Pedestrian Bridge Albstadt Lautlingen, Albstadt Lautlingen, Germany
- Sustainable Modular UHPFRC Bridge, Rotterdam, The Netherlands

2010 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Svratka River Pedestrian Bridge, Brno, Czech Republic
- Third Millennium Bridge over the Ebro River, Zaragoza, Spain
- Wadi Abdoun Bridge, Amman, Jordan

SPECIAL MENTIONS

- Ferney Tunnel, Geneva, Switzerland
- Navia Viaduct, Asturias, Spain
- Adriatic LNG Terminal GBS, near Rovigo, Italy

2006 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Rion-Antirion Bridge, Gulf of Corinth, Greece
- Floating Breakwater, Monaco
- Seiun Bridge, Tokusima, Japan

SPECIAL MENTIONS

- New Svinesund Bridge, Norway-Sweden
- Flaz River Bridges, Samedan (Grisons), Switzerland
- Infante Dom Henrique Bridge, Porto, Portugal

2002 *fib* Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Bras de la Plaine Bridge, La Réunion, France
- Vltava River Metro Tunnel, Prague, Czech Republic
- Sart Canal Bridge, La Louvière, Belgium

SPECIAL MENTIONS

- Tensho Bridge, Miyazaki, Japan
- TGV Viaducts, Avignon, France
- Ticino Bridge, Villa Bedretto, Switzerland

The *fib* Awards for Outstanding Structures continue the tradition of the former FIP Awards for Outstanding Concrete Structures, attributed from 1990 to 1998.

1998 FIP Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Normandy Bridge, France
- Great Belt East Bridge, Denmark

SPECIAL MENTIONS

- Lerez River Bridge, Spain
- Heidrun tension leg platform, Norway
- Odawara Blueway Bridge, Japan

1994 FIP Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Skarnsundet Bridge, Norway
- Vranov reservoir footbridge, Czech Republic
- Breakwater jetty, Sakai, Japan

SPECIAL MENTIONS

- Bray Viaduct, North Devon, UK
- Helgeland Bridge, Leir Fjord, Norway
- Bridge over the Isère, France
- Kikki Pedestrian Bridge, Japan

1990 FIP Awards for Outstanding Concrete Structures

WINNING STRUCTURES

- Pedestrian Bridge across the Altmühl River, Germany
- Oosterschelde storm surge barrier, The Netherlands
- Gullfaks C oil platform, Norway

SPECIAL MENTIONS

- Parana River Bridge, Argentina/Paraguay
- Beppo Myoban Bridge, Japan
- Ekofisk Oil Drilling Platform protecting wall, Norway
- Elbe River Bridge at Podebrady, Czech Republic

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Civil Engineering Structures Category

All the nominated projects are bridges this year. Unlike previous years, there are no dams, offshore structures or recreational structures. This is a consequence of the focus on what is happening in the world, which the construction industry must relate to.

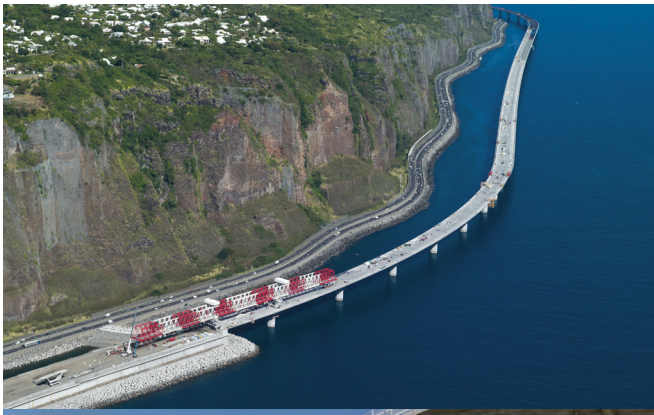
The aesthetics of a bridge is appreciated by many and is therefore important. The aesthetics criterion is clear for the jury. Less clear are maybe some of the other benefits of the bridge, such as bringing people closer to a hospital, closer to job opportunities and so on.

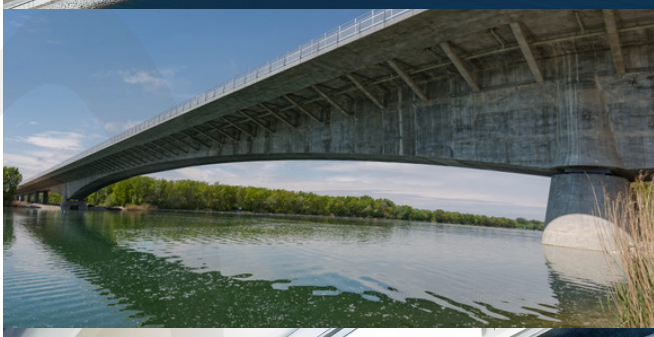
Novel construction methods influence the cost and are therefore also important.

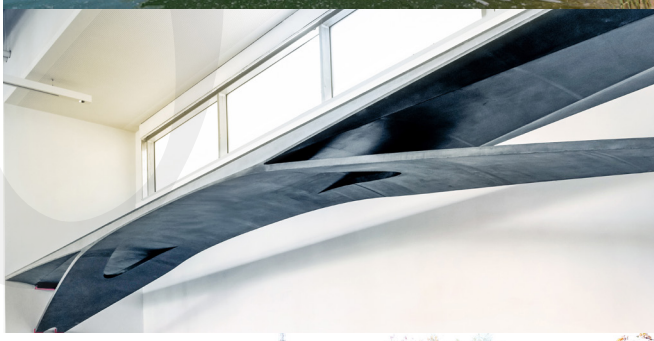
And again, the sustainability aspect is crucial.

It is a relief that the construction industry manages to produce outstanding structures like the ones shown in this Bulletin, based on a set of criteria. It gives optimism also if the criteria change. That is what designers and contractors are there for.

Tor Ole Olsen
Chairman of the Jury











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Following the need for model calibrations for current and future *fib*'s Model Codes, as well as other international standards, there is an international necessity to agree on representative test data and to provide it in Open Access as findable, accessible, interoperable and reproducible (FAIR). These data, independently validated and organized in the form of databases can be used in a transparent manner by multiple teams of researchers.

To date, numerous databases exist on different topics, such as shear, bond, shrinkage and creep. These existing databases are, however, mostly offline and static, and do not allow simple and simultaneous access, preventing their collaborative use. In addition, multiple instances exist on a single topic (with potentially different interpretations of the same test data).

Since February 2021, the *fib* is working on establishing a number of harmonized databases, with the following objectives:

- To create a *fib* database with a common data structure, that can be used for different types of tests;
- To have easy (automated) import of data from existing databases;
- A common data structure allowing for data mining across task groups, generating potentially useful data for other purposes;
- To provide access to the sources of the data;
- To have commonly-agreed databases by the scientific community, useful for code calibration;
- To provide continuity and preserve the efforts of *fib*'s task groups and their members, merging efforts from a global community of researchers;
- To have the results publicly and freely available under Open Access and FAIR principles;
- To produce scientific publications;
- Data will be collected by stable groups and not by individuals, making data collections more transparent but also persistent.

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CFC & ARUP
STRUCTURAL DESIGNER
of the
ROSE FITZGERALD KENNEDY BRIDGE
OVER THE RIVER BARROW NEAR NEW ROSS
IRELAND



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Rose Fitzgerald Kennedy Bridge
N25, New Ross Bypass, Ireland



The process of designing the Rose Fitzgerald Kennedy Bridge over the River Barrow spanned over 20 years from concept to completion.

The River Barrow Bridge provides the latest crossing point for the River Barrow which is at least 300 m wide at any point south of the town of New Ross. Located 30 km away from the sea, the bridge has been an engineering target for decades in Ireland. It provides a vital piece of infrastructure in the eastern corridor of the national roads network. Its completion removed a significant proportion of heavy traffic from the town of New Ross, enhancing the quality of life of the local communities while providing a much-needed reduction in long haul journey times in the south-east region.

The project was developed by Transport Infrastructure Ireland and their Technical Advisors Mott MacDonald Ireland in multiple stages. Between late 1998 and 2008, a concept design was developed during the planning and environmental studies stage and several alternatives were considered; from cable stayed to arches and balanced cantilevers, with a final preference for a three-tower extrados bridge which provided the right balance of slenderness and modest height towers. Tender for construction in a Public-Private Partnership (PPP) format took place in 2014, the contract was awarded in 2016 and the road was opened to traffic in January 2020.

The project, which includes a 12km long dual carriageway bypassing New Ross town, was tendered as a PPP Contract and awarded to BAM Iridium PPP Co with a team consisting of Dragados + BAM Ireland as contractors and Arup and Carlos Fernandez Casado S.L. as designers.

The design and value engineering of the structure was constrained by the requirements already established during planning as part of the Environmental Impact Statement and covered in Construction Requirements (critical documents in the Irish planning and tendering process). The following constraints, amongst others, were established as fixed:

- The exact position of the three towers (thus fixing the main spans to 230m).
- The height of the pylons (causing the bridge to be an extrados structure and limiting the cable angle to less than 12 degrees).
- The clear envelope for the navigational river channel (117m wide and 36m high over Mean High-Water Spring).
- The requirement for a full concrete section for the deck and pylons (at least the outside surfaces) and the requirements of a "closed" section with inclined webs without props or ribs.
- The maximum deck depth at the central pylon of 8m and at midspan of 3.5m.
- The position of a central pylon and a central plane of cables in cross section.
- The maximum height of the abutments over ground level of 10m.

With all the above constraints, the number of variables to optimise the design was limited to the cable spacing, number and size, along with the cross-section configuration for the main spans. There was also room to tweak the road design, both in plan and elevation, on the approaches and the configuration of the side spans.

Working within the challenging constraints listed above, the detailed design phase aimed to optimise the preliminary design concept of the structure for structural efficiency and material savings. To achieve a world record span in concrete for an extrados structure with a significant slenderness, the following changes were made:

The cross section was modified from inclined outer webs to two vertical webs 8m apart, substituting the outer webs with precast panels to maintain the appearance of a closed section. The precast panels contribute to the transversal behaviour but there is a gap of 20mm between each panel longitudinally, so they do not contribute to the longitudinal direction.



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The initial proposal of three parallel cables was substituted by a single cable, spaced 6.5m longitudinally and with a maximum size of 127 strands. Saddles were proposed for the cable detail passing on the pylons, allowing the pylon width to be reduced from 2.6m to 1.6m, to enable the minimum possible deck width.

To maintain a relatively light deck, the web and slab thickness were minimised using high strength concrete, where required. C80/95 concrete was used in the main spans and C60/75 in the side spans where the compression required this strength, while the approach spans were designed as C50/60.

Finally, minor adjustments to the side spans were implemented to optimise the longitudinal behaviour. The road alignment was also modified to reduce the bridge width on both ends to achieve a constant width cross section, where possible, and reducing the bridge length from 905m to 887m by changes in the vertical alignment.

The bridge's final configuration, after the minor span changes during tender, resulted in a total length of 887m, as already indicated, with an arrangement of 36 + 45 + 95 + 230 + 230 + 95 + 70 + 50 + 36m. In this way, the structure is characterised by 9 spans with 8 intermediate piers – P1 to P8 – and the 2 abutments – A1 and A2. The plan alignment is straight along 440m located approximately in the central part of the bridge and then curved with a transition from a radius of 720m to the straight alignment at both ends. The height of the deck above the ground or over the river reaches 40m and the height of the towers above the deck is 27.0m for the central tower (P4) and 16.2m for the two lateral ones (P3 and P5). These values imply tower height to span ratios of 0.07L for the side towers and 0.117L for the central tower (with L being the central span length). These are low values which lead to a classic extrados cable arrangement. In addition, the deck is only 3.5m deep at midspan (L/65), 8.5m at the central tower (L/27) and 6.5m at the side towers (L/35). These are quite slender parameters. It is also important to highlight the implication of the different heights of the towers. This leads to an asymmetric distribution of the cables along the main spans (8 from the side towers and 18 from the main tower). This asymmetry on the cable


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support on the main spans leads to different cantilever lengths during construction, the 8 cables from the lateral towers support approximately 90m while the main tower supports the remaining 140m of each span, resulting in a cantilever length during construction of 140m which would have equated to a 280m equivalent main span.

This asymmetry and the presence of a central tower also affect the contribution of the cable system under traffic loads, as the central tower provides relatively low contribution when asymmetric spans are loaded.

The Rose Fitzgerald Kennedy Bridge over the River Barrow is a milestone in the design and construction of bridges of this typology. As a world record breaker span with a full concrete deck, its design and construction represented a significant challenge. This was not only due to its size, but also the slenderness achieved and the geometrical constraints derived from the Environmental Impact Statement. The fact that this structure presents a very slender deck affects the load distribution between this element and the cable system. This leads to a behaviour more closely related with cable stayed bridges in comparison with other extrados bridges. From an aesthetic point of view, this bridge is also unique due to the difference in height between the central tower and the side towers. This creates an asymmetry in the cable arrangement in relation to the central spans. Because of the slenderness of the deck, 3.5m deep at the tip with a maximum cantilever of 140m and extremely shallow cables angles (10 degrees with the deck), the geometric deflection control during construction was especially complicated, with the added difficulties of early age properties of the high strength concrete mix used in the project.

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SUBCONTRACTORS/SUPPLIERS Tensa, Rubrica, Roadstone & Banagher
OPENED TO TRAFFIC January 2020

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Orientkaj Station, Copenhagen

ARUP


Crown Princess Marys Bridge, Frederikssund

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Challenge to low carbon technology

Ultra-highly durable bridge system using non-metallic technology can eliminate CO_2 emissions after construction.

Bessodani Bridge （Dura-Bridge）





Tadeno-daini Bridge （Dura-Slab）

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New Coastal Road Viaduct on Reunion Island
Réunion Island, France



Exceptional in terms of its size, its location and above all the majesty of the landscapes it runs alongside and gives to see, the viaduct will certainly be a major reference among the great maritime structures.

It is perfectly useless here to try to compete with the site or to organize any architectural chatter that would not be on the scale of the place anyway. Also, we seek above all to give this structure a maritime character, in line with its function and carrying a reassuring aesthetic in the face of natural elements.

This maritime character is based first on the choice of a flexible and sinuous route, closest to the corrugations of the coastal cliffs. The longitudinal profile is also modulated to offer an ever-changing view of the ramparts and its major elements: capes, ravines, and waterfalls.

Then, it is the structure of the bridge deck itself that is designed, taking inspiration from shapes from naval architecture: monohull hull or ribs forming couples of a frame. The viaduct of the new coastal road is a stationary ship, an elegant hull resting on supports that keeps it moored. The piers, of eminently hydraulic shape, are of great simplicity and sobriety, robust and humble anchors effectively and unpretentiously defying the renewed assaults of the ocean.

The Nouvelle Route du Littoral ("NRL" for "New Coastal Road" in French) is a 12 km-long infrastructure that links the city of Saint Denis capital of La Réunion Island to Le Port, the main economic area. It combines embankment sections and concrete viaducts. The main offshore viaduct 5'400 m long is composed of 7 consecutive decks each one with five standard spans of 120 m and two end spans of 86.5 m.

The island administration, Région Réunion, and project owner, entrusted the comprehensive program management (design studies and works supervision) to the engineering company Egis and to Lavigne-Chéron architectural firm to replace the existing link located at the foot of the cliffs - and thus regularly exposed to several natural hazards such as rock fall, large landslide, and frequent wave submersion – by the New Coastal Road.

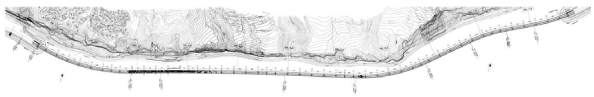


The decks, located from 20 to 30 m above sea level, is made of extremely large two webs box girder which supports a 2x3 lane carriageway.

Why such a 28.9 m wide unique single box girder deck? This choice was driven to enable a large panel of options of carriageway dispositions starting with a 2x3 lane immediately after the construction which will be later possibly transformed into a 2x2 lane + 1 or 2 lanes for mass public transport. This versatility imposes a transversally continuous deck. A more classical solution consisting of two box girders tied together was studied but discarded due to unacceptable torsion moments resulting from train loads.

Three options were opened to tenderers: A constant height 4 webs box girder with 100 m spans, a variable height 2 webs box girder with 120 m spans and the possibility to propose a other post-tensioned concrete deck alternative. The second option, which was expected to be the less expensive one has been selected by the tender winner.

The design of the piers is driven both by the ship impact and by the cyclonic wave surge impact. Three modelling approaches were used to estimate the hydrodynamic wave forces on the piers: analytical, digital and physical 3D scale model tests.The risk of a ship impact both to the pier and to the deck has been assessed considering the current traffic in the vicinity of the island, its probable change over time, the existence of a mooring area near the port, the frequency of damage observed, and the possibilities of intervention by the port towing company.



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SUBCONTRACTORS/SUPPLIERS Teralta, CERIB & LMDC
COMPLETION February 2021

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Bridge over the Rowing Course on D4 Motorway Bratislava, Slovakia



The bridge is one of 4 bridges of the D4 motorway viaduct crossing the Danube branch - Jarovce, the rowing and canoeing tracks, the Danube River, and the Danube branch - Biskupice. It is the second bridge of the viaduct from the right embankment therefore is supported by 4 piers.

It was designed as a 465 m long continuous 3-span single cell box girder post-tensioned concrete structure with the span length of 127.5 + 210.0 + 127.5 m. The bridge is supported by the deep foundations on all 4 piers (intermediate and end-most). The balanced cantilever method was used for the construction of the 210 m long main span crossing the rowing and canoeing course.

The deck consists of single cell concrete box core with concrete overhangs on both sides supported by steel-concrete struts. The post-tensioned concrete superstructure of C50/60 is prestressed in both directions – longitudinally and transversely. The box girder depth varies from 4.30 m in midspan to 13.00 m at two intermediate bridge piers. The deck width of 34.5 m is constant along the bridge and is supported by the spherical steel bearings with the fixed bearing at the pier D2.

The each of two end-most piers shared by the other bridge structures of the viaduct has one pier foundation. The shared piers consist of the pairs of columns with dimensions of 3.15 m x 2.10 m connected at the bottom by a wall which was designed to enable the proper seismic behaviour. The shared end-most piers are supported by 20 m long concrete piles of 1.2 m diameter. The intermediate piers are designed as inclined pier shafts embedded in 5 m high footing. At the top in the transverse direction, the pier shafts are connected by 2.5 m deep stiff beam to achieve frame effect. The deck is supported by a pair of bearings on top of the pier cap. The intermediate piers are supported by 29 m long concrete piles of 1.8 m diameter.



The bridge of 210 m long span constructed by balanced cantilever method required special approach to design, identify and account for potential hazards in construction details. Therefore, various models were implemented to achieve actual behaviour of the structure.

The deck segment length was from 3.9 m to 5.0 m. The deck is prestressed in longitudinal direction by bonded tendons of 31 strands of 15.7 mm and in transverse direction by bonded tendons of 12 strands of 15.7 mm or 4 strands of 15.7 mm.

The most outstanding structural feature is the main span length of 210 m for, which is not usual, and it is almost in the boundary of balanced cantilever construction method use. Another outstanding feature are deck depth and width especially in connection with the span length.

The most challenging design part was to calculate camber values for each segment to construct cantilevers. The maximal cantilever length before joining the segments to form the span was 103.5 m.



OWNER Ministry of Transport and Construction of the Slovak Republic
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COMPLETION May 2021

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CarboLight Bridge
Munich, Germany





The CarboLight Bridge was designed as a filigree construction consisting of two slightly inclined columns and a three-section superstructure with a length of 9.50 m and a width of 1.20 m. The design and constructional possibilities of lightweight constructions made of high performance concretes are demonstrated above all by the slender V-shaped columns and the construction weight of only 2.1 t, respectively 185 kg/m². The force-flow-optimized shape and the sandwich structure of the superstructure play a major role here. The three-layer cross-section varies in height between 60 and 160 mm. The biaxially curved underside and the flat top layer are made of only 20 mm thick carbon reinforced concrete. In between is infra-lightweight concrete with a density of less than 800 kg/m³, the composition of which was designed by HeidelbergCement AG.

For planning and optimisation, a fully parameterised 3D model of the bridge was created with the software tool Grasshopper in connection with Rhino. By programming an interface to the FEM programme RFEM, it was also possible, in the sense of Building Information Modelling, to transfer the geometry and material data as well as loads from Grasshopper quasi-simultaneously into a FEM model. Special attention was paid to the columns, which were only 50 mm thick by a length of 3.0 m. To avoid any tensile stresses and for buckling safety a slight camber in longitudinal direction was chosen as well as a circular ring segment with a radius of 3.0 m for the cross-section of the columns.

Based on the 3D modelling of the bridge, the formwork was manufactured from milled plywood. In a laboratory test at the Otto Mohr Laboratory of the Technische Universität Dresden, an identical prototype of the bridge withstood a live load of almost three times its self-weight and more than ten times the load required by the Deutsches Museum. The construction method was to prefabricate partial elements and cast the two upper layers of the superstructure on site. For this purpose, the 20 mm thick lower carbon reinforced concrete layer was divided into three precast elements and the two columns were prefabricated as well.

The prefabricated segments were transported to the installation site at a height of approx. 3 m to the Deutsches Museum in München. By means of a variably adjustable support system, the segments were aligned and the infra-lightweight concrete and the carbon reinforced concrete top layer were casted on site. About four weeks later, the temporary supports were removed. The immediate deflection was only 10 mm, which indicates a high stiffness of the supports and good constructional execution. Finally, all surfaces were cleaned and impregnated, which further improved the appearance of the filigree construction.

The optimised interaction of carbon concrete and infra-lightweight concrete in the hybrid construction ultimately enables significant resource savings and thus CO_2 reduction compared to a reinforced concrete construction of comparable load-bearing capacity.

The CarboLight Bridge stands as a demonstrator for the Priority Programme SPP 1542 “Concrete light”, which was funded by the German Research Foundation DFG. Special thanks goes to the Deutsches Museum München for the opportunity to display this unique construction in this setting and for the support by the transport and assembly. The company HICONFORM for the formwork construction and Heidelberger Beton GmbH, which provided the infra-lightweight concrete, were also a great help. Last but not least, thanks go to all those involved from the TU Dresden and the supporters from TU München for the realisation of this challenging project.

OWNER Deutsches Museum München
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FUNDER Deutsche Forschungsgemeinschaft
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COMPLETION April 2021

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Bessodani Bridge
Tokushima, Japan





Concrete structures were originally made from a highly stable material that is extremely long lasting, as demonstrated by structures built in the time of the Roman Empire that are still in use today. However, since the invention of the principle of reinforced concrete structure about 150 years ago, corrosion of the steel embedded inside the concrete has become a common problem and has lowered the inherent durability of concrete structures.

Bessodani Bridge is the world's first application to highways of a non-metallic bridge. It is a structure that was developed to regain the high durability originally possessed by concrete structures while keeping the superior properties of modern structures provided by prestressing. The non-metallic bridge structure is a box girder bridge made of high-strength fiber reinforced concrete. That structure was developed about 30 years and there were several material and structural challenges. To reinforce against the tensile stress generated by bending moment and axial tension, aramid FRP rods are used as prestressing tendons and completely eliminated the use of steel prestressing tendons and reinforcing bars. That is also adopted a butterfly web structure using butterfly-shaped concrete panels for the web, in order to provide an effective way to reduce weight while acting as shear reinforcement. The construction work was carried out using plant-fabricated precast segments in order to improve the quality, save on manpower at the construction site, and enable rapid construction. Moreover, the bridge parapet was designed as a concrete structure reinforced only with glass fiber FRP rods, which makes this a completely non-metallic structure that can be used on highways.



Bessodani Bridge is the world's first application of non-metallic bridge to highways. It is a 25.5 m long single-span bridge, with a width of 11.55 m and a girder depth of 2.8 m, and was constructed using plant-fabricated precast segments. The bridge consisted of 12 segments, with each segment produced by independently fabricating the butterfly webs, installing them in a formwork, and pouring concrete for the upper and lower deck slabs. Because of transport weight limits on public roads, the segment weight was set to less than 30 tons. The girders were made as light as possible by adopting a ribbed deck slab structure, butterfly web structure, and diagonal webs, and the number of segment sections was reduced. The end-support segments were fabricated in three sections, transported to the site, and then joined together by tensioning transversely tensioned rods. Cast-in-place concrete was used at the construction site to fill the end-support crossbeams and construct the deviator partition walls.

Bessodani Bridge does not incur CO_2 emissions from the use of steel since it does not use any steel for rebars or prestressing tendons, but there are emissions incurred through use of a polymer in the aramid FRP rods. Likewise, the use of the butterfly web structure reduces self-weight by around 10% compared to conventional bridges, but the unit cement content increases slightly because of the use of higher strength concrete. Taking all these into account, the amount of CO_2 emissions during construction is broadly the same as the amount from conventional PC bridges. However, the non-metallic bridge does not require maintenance or regular renovations during its service life since it does not have deleterious elements. It will only require renovation of the bridge deck pavement. Hence, comparing CO_2 emissions over 100 years, using the non-metallic bridge can approximately cut CO_2 emissions in half. This shows that a structure that does not have deleterious elements can greatly contribute to reducing carbon for a decarbonized society.

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COMPLETION October 2020

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Nominees

Civil Engineering Structures

Loko Oweto Bridges
Benue River, Nigeria



The Loko Oweto bridges, crossing the Benue River, are two 1'835 meters long each and are divided into 22 spans. The width of the river and the water level throughout the seasons change dramatically (level of the river varies between seasons eight meters in height) and that impacts every aspect and the construction stages had to be planned to provide access to the different bridge dependant on the water level.

The Bridge piles are cast in the river water using steel casing pipes. In order to cast the pile caps above water level prefabricated concrete molds were designed to be installed in prominent parts on the casing pipes above the river. For casting of Pier Segments above the columns, a temporary support girder system was designed leaning on the column shoulders.

The bridge is divided into three sections along it. The Expansion Joints at mid-span, in order not to leave two cantilevers from both sides, was designed to allow free movement in the axial direction but provide continuity for moment, shear and torsion. The solution selected was two steel girders installed inside the deck which are fixed at one edge of the deck and at the other end are installed inside steel sleeves that allow the girder to slide, a similar situation to a piston.



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COMPLETION June 2021

Lafnitz Bridge
S7 motorway, Austria



A new construction method that enables considerable savings in material usage was applied for the first time to build the Lafnitz Bridge and the Lahnbach Bridge in Austria in the years 2019 and 2020. The balanced lowering method consists of building the bridge girders in a vertical position and of rotating the bridge girders into the final horizontal position. In order to rotate the bridge girders, additional structural elements, in this case compression struts, are required. In some topographical situations it will be more efficient to produce the bridge girders with this innova-tive method than with the traditional incremental launching method or the balanced cantilever method. In the final state the spans of the bridge girders are reduced by the compression struts which enables considerable savings in construction materials. The good cooperation of the pro-ject participants allowed for the successful first-time application of the method for the two bridg-es. The unproblematic application of the balanced lowering method for the post-tensioned con-crete bridges with 2.0 m high bridge girders proved that considerable savings in resources and costs were possible compared to the originally planned steel-concrete-composite bridges with 4.2 m and 4.6 m high bridge girders. Because of the reduction of the environmental impact Lafnitz Bridge as well as Lahnbach Bridge are sustainable structures.



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SUBCONTRACTORS/SUPPLIERS Franz Oberndorfer GmbH & Co KG & KB Vorspann-Technik GmbH
COMPLETION December 2020

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New railway bridge over the Nosice dam

District of Puchov and Povazska Bystrica, Slovakia



The bridge is part of the modernization of the Púchov - Žilina line for speed up to 160 km/h. It runs the railway line from the right bank of the Nosice Water Reservoir to the left bank. On the right bank it crosses the state road II/507 Púchov - Považská Bystrica, on the left bank the bridge ends near the road III/5171 Milochov - Považská Bystrica. This bridge allows the navigability of the Váh with two navigable widths in spans 3 and 4.

The first multispan railway bridge designed as combination of technology free cantilever method and movable scaffolding system with an electrically isolated tendons in Slovakia. Ten from overall eleven piers were founded in dam with typical complexity of hydrogeological condition of the area. For ensuring the deflection reduction external extradosed cables were used per each pylon. Due to these conditions this object is the biggest one and the most complex bridge on this track section.



OWNER Slovak Railways
MAIN AUTHORS Martin Kardoš & Libor Konečný
CONTRACTORS Doprastav, a.s.
COMPLETION September 2020

Farrisbrua / The Farris bridge

Larvik, Norway

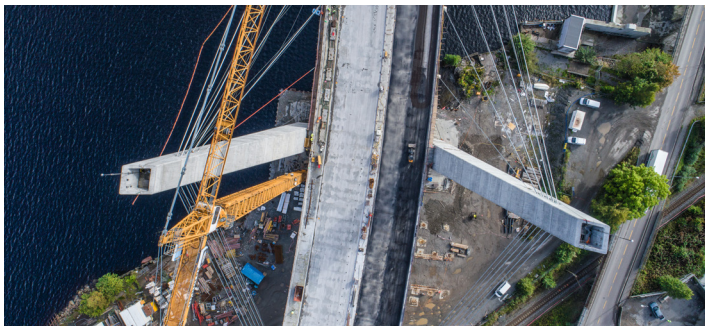


The Farris bridge is a motorway bridge spanning over the outlet of the lake Farris, nearby the city of Larvik, Norway. It has two 70 meter high concrete towers which are tilted in two directions, forming a V, giving the cable-stayed bridge a distinct look. The bridge has become a landmark for the city.

The Farris Bridge is part of a 7 km long section of the new four-lane motorway E18 in the municipality of Larvik, in Vestfold, Southern Norway. It has been designed as a long horizontal curve passing over both Farris Lake and the railway line connecting Larvik with Skien. The lake has a small dam at the outlet to regulate the water flow and is built on the very first concrete construction built in Norway back in 1762.

In order to upgrade the E18 to four lane motorway several alternatives of crossing the lake Farris were discussed. The chosen alternative crossed the lake almost at the outlet. It also crosses a railroad track and local roads.

The bridge consists of two large abutments, a 280 m long Viaduct East, a 120 m long cable-stayed main span and a 170 m long Viaduct West. Together those components are giving the bridge a total superstructure length of 570 m and an “end to end” project length of 620 m.



OWNER Statens Vegvesen (Norwegian Road Authority)
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CONTRACTOR Implenia and PNC
COMPLETION March 2018

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The *fib* has ten commissions, each with corresponding task groups and working parties, grouped into four principle areas of activity: planning and execution, materials and production, sustainability and durability, and education and publications.

fib Commission 1 *Concrete Structures*: It seeks to encourage and develop good practices in the design of concrete structures, with a special emphasis on innovation and imagination. Its work should complement national, regional (e.g. Eurocodes), as well as international codes (e.g. the *fib* Model Code for Concrete Structures 2010), which in principle give only design specifications.

fib Commission 2 *Analysis and Design*: Analysis and design are understood as core tasks of structural engineering. Today, the analysis – i.e. the detailed investigation of the stress and strain state – has gained in importance. Refined and physically-based models and calculation procedures are therefore required. On the other hand, the design of new structures (comprising conception, dimensioning and detailing) still is fundamental for practicing engineers. In general, the respective approaches should be one and the same for the two levels of detail, but more practical and easier to apply for the latter case. COM2 supports and follows this line of development of structural engineering.

fib Commission 3 *Existing Concrete Structures*: The goal of COM3 is to define appropriate and reliable procedures to establish the safety of existing structures and any associated requirements for interventions to extend the safe operation or working life of such structures.

fib Commission 4 *Concrete and Conrete Technology*: The overall motivation of COM4 is to make theoretical and practical developments in the field of concrete and concrete technology, and to present these developments in an understandable and code-type formulated manner. COM4 positions itself at the forefront of new technologies and techniques by considering both fundamental research and practical issues.

fib Commission 5 *Reinforcements*: It gathers a balanced mix of experts coming from various fields (academics, owners, suppliers, government agencies and testing laboratories) who are volunteering their work into several task groups aiming to provide knowledge and information to students and the professional workforce for the best use of concrete.

fib Commission 6 *Prefabrication*: Prefabrication plays an important role in the construction of concrete structures worldwide and is evolving continuously to cope with current society's habits and needs related to housing, commercial buildings and civil engineering works. In fact, industrialised construction may result in cost efficiency, good quality and environmentally friendly solutions, as well as the ability to adapt to market demands.

fib Commission 7 *Sustainability*: Concrete is the most used material for the construction of buildings and civil structures. Concrete and concrete structures should contribute to the development of a sustainably built environment in a socially, environmentally and economically responsible manner. There is no general methodology for sustainability design and assessment of concrete structures covering all important sustainability aspects and all life cycle phases from acquisition of materials, through production of concrete and concrete components, construction, operation of structure, up to demolition and recycling.

fib Commission 8 *Durability*: It aims to identify concrete-related durability issues, consider and review current information available on the topic, and provide guidance on materials and methods that will assist in optimal durability design of new structures and restoration design of existing structures.

fib Commission 9 *Dissemination of Knowledge*: Up-to-date technical information is needed to construct the best concrete structures. The newest information is necessary when it comes to material properties, design methods as well as construction methods. By recognising its importance, the *fib* decided to create a separate commission on the dissemination of knowledge.

fib Commission 10 *Model Codes*: A central aspect within the mission of the *fib* is the release of model codes on concrete structures and related subjects. These codes should serve worldwide as the guiding science-based documents offering in a code-type version the state of the art knowledge on the planning, design, construction, execution, operation or in service performance, maintenance, rehabilitation and dismantlement of new and existing concrete structures, respectively. The model codes should meet the latest requirements and technologies in view of aspects related to safety, serviceability, durability, resilience and to fulfil the resilience and sustainability of structures, recognising economic and aesthetic needs of different societies.

fib Young Members Group: The YMG aims to build a framework that will allow young engineers to participate in the activities of the association and to bring their ideas to the working groups and the decision bodies.

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A central element of the *fib*'s mission is the development of model codes for concrete structures and related subjects. These international science-based guidance documents provide state-of-the-art knowledge for new and existing concrete structures in respect of their planning, design, construction, execution, life-cycle management, operation, adaptation and extension of service life. These aspects incorporate the management of in-service performance including maintenance, rehabilitation, circularity issues and dismantlement activities.

Against this background COM10's mission consists of initiating and coordinating *fib*'s work on model codes and related documentation. Its activities draw upon the knowledge and expertise of *fib* relating to concrete structures and structural materials, and the great diversity of aspects those topics represent. This mission has involved meetings and workshops held at different places around the world in order to gather the latest scientific knowledge, new ideas and visions and to actively involve the worldwide technical society.

Commission 10 and its first task group TG10.1 "Model Code 2020 (MC2020)" began work in 2016. MC2020 is the overarching model code for concrete structures, taking sustainability and the performance-based approach as key foci for its approach to the design and the life-cycle management of both new and existing concrete structures.

MC2020 is a single code dealing with both the design of new structures and the various activities associated with the assessment, interventions upon and the life-cycle management and care of existing concrete structures. To that end, MC2020 takes sustainability as a fundamental requirement, based upon a holistic treatment of societal needs and impacts, life-cycle cost and environmental impacts (the well-known 'three pillars of sustainability'), with these being aligned with the United Nations Sustainable Development Goals.

MC2020 seeks to advance current approaches to the sustainable design, construction and life-cycle care of concrete structures. Central to this is how we formulate and verify performance requirements for concrete structures within a holistic sustainability framework utilising the widely-accepted 'three pillars of sustainability' of social, environmental and economic performance. Such an approach should also able to recognise the great benefits concrete structures provide to humankind's global society, along with their positive impacts on that society and the wider environment, as well as their economic cost and returns.

Adopting this integrated life-cycle approach, the requirements for social performance have defining implications for subsidiary performance requirements critical to structural design and assessment procedures. These include matters such as human and environmental safety, structural reliability, design service life, durability, serviceability and other social aspects, such as aesthetics, adaptability, maintenance, etc. Based upon the wider social context, there may be requirements for specific performances such as the robustness of the structure, the resilience of its functionality, etc.

Discussions about the potential nature and coverage of MC2020 have highlighted the rapid pace of technical development in many areas including those relating to materials, design, numerical analysis, structural assessment, monitoring, construction and interventions, to mention just a few. It is anticipated that the pace at which such technological developments occur will continue to increase. The performance-based approach adopted by MC2020 allows it to be future looking. As such it should be able to accommodate and not hinder future technological progress, thereby facilitating the ongoing evolution of concrete and reinforcing materials, associated technologies and the structural forms which might potentially be created using them.

However, the implications of the potential developments in intervention materials and associated technologies for protection, repair, rehabilitation and enhancement of the current condition

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and performance of existing concrete structures should not be forgotten. These are fertile areas of technological advance.

In addition to the above, there are also the important needs of resilient communities to consider. These communities aspire to have the ability to do several things. Firstly, they must be able to effectively mitigate against a prospective disaster. Mitigation means taking measures which avoid, reduce, resist and aid recovery from extreme short-term events or incidents. Secondly, a resilient community or society must be able to adapt to longer-term changes in use, environment or other circumstances. Examples of this would be societal changes or the effects associated with climate change. Two key observations are:

- Societal resilience is achieved through the preservation and restoration of essential functions provided by the built environment and societal organisation; and
- A resilient built environment involves designing to mitigate the effects of hazards. It is also able to adapt to longer-term changes in use or the environment.

Structural resilience is the ability to rapidly resume the use of buildings and other structures following a shock incident or event. To successfully do this, it is essential to embrace all the associated aspects of:

- Avoidance, diminution or removal of identified threats or hazards;
- Preparation for disaster event scenarios;
- Resistance to the effects of disaster events; and
- Recovery following such an event.

Structural adaptation is the ability to meet gradually changing circumstances or the evolution of performance requirements. It needs to encompass the ability of a system or structure to sustainably accommodate such changing circumstances. Longer-term adaptions might include the changing demands placed upon a structure – such as the ongoing environmental changes arising from climate change, as well as evolving societal and functional needs and/or performance requirements (eg. higher physical and environmental loads and actions).

In relation to other aspects of the scope of MC2020, it shall be:

- a model code with fundamental principles and a safety philosophy based on reliability concepts, which takes advantage of the understanding of uncertainties and of the risk acceptance and risk differentiation concept to set target verification criteria for both new and existing structures for different levels of approximation,
- a model code that consequently makes use of the performance-based concept to close the gap between material engineers and structural engineers and to remove specific constraints for novel types of concrete and reinforcing materials,
- a model code with fully integrated provisions based on generalised models and implementation of the level of approximation approach applicable for both the design of new structures and all the activities associated with the assessment, interventions and the through-life management of existing concrete structures,
- a model code that allows full advantage to be taken of information that can be acquired by testing and monitoring of existing structures, both with regard to the assessment and to the through-life management of existing concrete structures, which includes prediction and updating of reliability and durability for deteriorating structures and use of information from in-situ testing and monitoring.

Stuart Matthews (TG 10.1 Convener)
Agnieszka Bigaj-van Vliet (TG 10.1 Deputy-Convener)
Gerrie Dieteren (TG 10.1 Secretary)

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- a representative to the General Assembly,
- nomination of a member to a designated Commission or Task Group,
- upon request, up to two copies of all bulletins and the *Structural Concrete* journal published during the year of membership (all documents are sent to the company),
- nomination of up to five persons as their individual representatives (IRs) in the *fib*.

IRs receive the same benefits as subscribing members through the company subscription (all documents are sent to the company). The coporate IR benefits are detailed below. CHF 2'700.00 / year

CORPORATE INDIVIDUAL REPRESENTATIVES RECEIVE THE FOLLOWING BENEFITS:

- one copy of the *fib* journal *Structural Concrete* (6 issues per year),
- online access to the *fib* journal *Structural Concrete*,
- one paper copy of all the *fib* bulletins published during the year of membership (which are extremely valuable information developed by the *fib*),
- 50% discount on the purchase of any other *fib* bulletin,
- one paper copy of the membership directory (published every two years),
- online viewer access to the *fib* Bulletins,
- online viewer access to the CEB Bulletins and FIP reports,
- up to five free publications from the CEB bulletins or FIP reports,
- online viewer access to browse and download *fib* proceedings, the membership directory and some free documents,
- online viewer access to browse and download the *fib* journal *Structural Concrete*,
- reduced registration fees when attending *fib* congresses or symposia,
- possibility to become Commission member and Task Group/Working Party Convener,
- access to the *fib* intranet Network, which includes shared documents and a platform to communicate with other *fib* members and persons active in working groups. Possibility to have working groups webmeetings within the network,
- up-to-date news about the *fib* work.

For more information and to become an *fib* member, please visit: www.fib-international-org

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2022 *fib* Awards for Outstanding Concrete Structure

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ISBN 978-2-88394-159-5
ISSN: 1562-3610

A Bridge between Research and Practice
International Federation for Structural Concrete
Fédération internationale du béton
www.fib-international.org