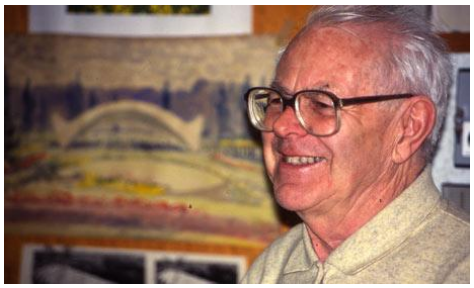
FRP INTERNATIONAL

the official newsletter of the International Institute for FRP in Construction

Vol. 8, No. 2, April 2011

Editor's Note

We start this issue with IIFC President, Professor Lawrence Bank's, CICE 2010 Keynote address. This address was both insightful - drawing upon Larry's experience as a researcher, a National Science Foundation Program Director, and now as an Associate Provost for Research - and provocative. The latter is what drew me to ask Larry to write the article up for *FRP International*. As a research community, we need to lead our industry in innovative, yet rational directions; in Larry's words: "we must not continue publishing papers proving what we already know." I would like to encourage the IIFC membership to respond to this article: *FRP International* is your forum.



Swiss Engineer and FRP pioneer Heinz Isler (1926-2009) [photo: guardian.co.uk]

I am also initiating a new feature in *FRP International* highlighting the history of FRP in construction. Here we will focus on an earlier generation of architects, engineers and scientists: those giants on whose shoulders we all stand (often without realising it). Professor Urs Meier has provided our first feature discussing the innovative career of Swiss engineer Heinz Isler. (For those interested in Isler's work with concrete shells, John Chilton has a brief article and remembrance in the February 2011 (Vol. 21, No. 1) IABSE journal *Structural Engineering International*.) I am actively soliciting other articles fitting this mould; ideas and articles are welcome.

Finally, *FRP International* belongs to the IIFC membership. Please let me know what you think. Volunteer an article, agree or disagree with Professor Bank, complain about the new format, anything… I would like to hear from you so that we can improve the utility of *FRP International*. Besides, it's lonely being an editor.

Kent A. Harries
University of Pittsburgh
newsletter.editor@iifc-hq.org

Become an *FRP International Author…*

As IIFC grows, we also hope to expand the utility and reach of *FRP International*. The newsletter will continue to report the activities of IIFC and focus on IIFC-sponsored conferences and meetings. Nevertheless, we are also soliciting short articles of all kinds: research or research-in-progress reports and letters, case studies, field applications, or anything that might interest the IIFC membership. Articles will generally run about 1000 words and be well-illustrated. Submissions may be sent directly to the editor. Additionally, please utilize *FRP International* as a forum to announce items of interest to the membership. Announcements of upcoming conferences and abstracts from newly-published PhD dissertations are particularly encouraged. *FRP International* is yours, the IIFC membership's forum. The newsletter will only be as useful and interesting as you help to make it. So, again, *please become an* FRP International *author*.

The following article is based on the keynote lecture given by Professor Larry Bank at the 5th CICE Conference in Beijing China on September 27, 2010.

A Personal Perspective on the Past, Present and Future of FRP in Construction

This keynote talk was based on my personal experiences as the project lead on three pultruded composite research and development projects conducted over the last two decades by me and my colleagues and students. The purpose of the talk was to review some of the lessons learned from the three projects and to make some observations on a path forward for composites for construction in the next two decades.

Lawrence Bank, PhD, PE, President IIFC
Professor of Civil Engineering
The City College of New York

Pultruded Composite Material Highway Guardrail (1992-2002)

The design concept for the pultruded composite guardrail was a) to enable progressive failure of a multicellular tubular section (Fig. 1) that would provide the same energy absorption and tensile load carrying capacity as the conventional steel "W-beam" guardrail undergoing plastic straining while b) decreasing the weight by 50% and maintaining the same envelope so that existing posts and hardware could be used with the composite rail while being equal in installed cost.

The 10 year research and development programme consisted of laminate design, die design, prototype pultrusion, prototype installation (Fig. 2), materials testing, rail testing, implicit and explicit finite element simulation, and full scale crash testing with a 2000 kg truck at 100 km/hr (Fig. 3) (Bank and Gentry 2001). The research was funded by the US DOT in University Research Grants and an SBIR award to an industrial partner.

Following the unsuccessful crash testing of the prototype (Fig. 4) the research and development program was effectively terminated. The industrial partner decided to change direction and produce an open section thrie-beam design that weighed more than the steel rail and was considerably more expensive. The multicellular guardrail design was issued a US patent (USTPO 2000) but has never been mass produced or installed in any locations. The lessons learned from this failure to commercialize a composite guardrail can be summarized as follows: a) unrealistic weight and cost objectives; b) underfunded and overambitious program that did not provide for the design-development cycle; c) failure to focus on the fundamental susceptibility to brittle failure of the tensile elements (even though the progressive failure of the tube junctions did work); d) over reliance of the results of explicit finite element simulation; and, e) blind optimism in the pultruded system in the face of what, in retrospect, were clear signs that the prototype would not survive the crash testing!

Pultruded Composite Material Floating Causeway System (1993-2001)

The design concept for the pultruded composite material causeway system for the US Navy was based on a modular system of pultruded elements that could be assembled into large standard ISO container-sized units and connected at sea. The composite system was expected to deliver increased durability over steel units that rust and puncture under impact with vessels. The system also offered reduced weight of significantly larger units in comparison with the current system thus enabling handling with existing equipment. The research and development consisted of developing a design basis for the composite materials, laminate design, laminate pultrusion and testing, element design, 5/8 scale mock-ups (Figs 5 and 6), lift testing, long

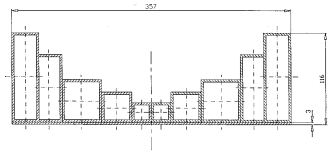


Fig. 1 Cross-section of pultruded guardrail.

Fig. 2 Prototype installation (circa. 2000).

Fig. 3 'Before' crash test.

Fig. 4 'After' crash test.

Fig. 5 Fabrication of the causeway mock-up.

Fig. 6 Assembly of the test module.

Fig. 7 Long-term load testing of the test module.

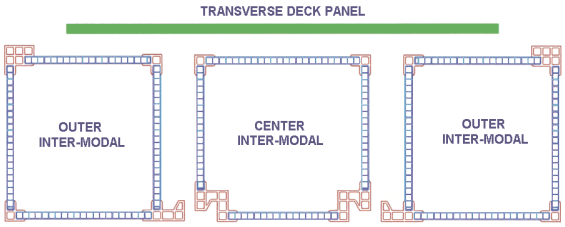


Fig. 8 Conceptual design for the components of the pultruded causeway.

term testing (Fig 7) (Smith et al. 2000 and Bank et al. 2000), system design (Fig 8), connection designs, and impact testing of prototype wall sections. The research was conducted in a number of phases culminating in a design for a hybrid composite and steel modular system. The design was in competition with a redesigned steel system designed by another team. At the end of the eight year program the US Navy awarded the contract to the steel system. Issues that hampered and eventually resulted in this research and development program unsuccessfully competing with a more conventional design were as follows: a) an *a priori* commitment to manufacture by pultrusion when pultrusion technology was not (and is still not) able to produce items large enough for the required application; b) a focus on fabrication technology and load testing of the non-representative prototype made with off-the-shelf parts because the pultruded parts needed to test the prototype could not be manufactured within the budget; c) a focus on testing under loads that were not the critical loads (concentrated wheel loads and wave loads); d) continuously changing design objectives in terms of weight and size of the units; and, e) blind ambition to deliver a composite competitor to the steel system when, in retrospect, it was clear that it was not possible to make appropriate connections between the composite modules without significant use of steel inserts and components.

Pultruded Grid Reinforcement System for Concrete Slabs (1990-present)

The design concept for the pultruded grid system for reinforcing concrete slabs was based on the assumption that prefabricated pultruded grating, commonly used for walkway platforms, would facilitate rapid installation that would lower labor and equipment costs, in addition to increasing durability, of FRP reinforcement for concrete slabs. The research started in 1990 (Bank and Xi 1993) and culminated in the development of a viable and cost effective system for construction of FRP reinforced bridge decks that, to date, has been applied in three highway bridge demonstration projects in North America (Matta et al. 2006). A software package (Bank et al. 2009) to assist bridge designers in performing deck designs without their being experts in FRP design has also recently been released. The success of this research and development program was due to the following factors: a) the pultruded gratings had a long history of materials and manufacturing refinement that only needed to be 'tweaked' slightly to develop the system; b) from the beginning of the program, testing was conducted on full-scale slabs with gratings from multiple manufacturers; c) critical funding for real demonstration projects (Figs 9 and 10) was provided by the FHWA Innovative Bridge Research Construction (IBRC) and the NSF IUCRC programs at just the right time (Berg et al. 2006, Bank et al. 2006, Matta et al. 2006); d) laboratory testing focused on the most critical details of the system (the overlap splice between the grids); e) manufacturers were persuaded to push the reasonable limits of their existing fabrication methods to make the required 14 m long grids; f) at each iteration of the development of the improved system new tests were conducted to investigate design changes keeping existing proven components thus not reinventing the wheel every time; and, g) feedback from contractors who used the system was favorable and positive.

Fig. 9 Pultruded grid during first bridge construction in 2003.

Fig. 10 Pultruded grid and stay in place form during a 2006 construction.

Summing Up

Based on these three representative long-term research and development projects I have been involved in over the last two decades, I make the following observations. It is my personal opinion that, if composites are to compete for large infrastructure projects, such as large long span bridges and tall buildings, in the latter half of the 21st century, we in the FRP composites research and development community must:

- Not continue to do tests (and publish papers) that prove what we already know.
- Not continue to assume cost, durability, fire protection and brittle failure are our weaknesses (because they are not weaknesses – many existing materials have similar "weaknesses").
- Not continue to ignore FRP size, manufacturability, impact resistance, and visual appearance (because these are our real weaknesses – many other materials have overcome these "weaknesses.")
- Think of material and structural systems and not only composite parts (particularly how to effectively connect composite parts).
- Push the venture capital industry and governments to think big (and provide sufficient funding to really launch the infrastructure composites industry).

References

Bank and Gentry (2001) Development of a Pultruded Composite Material Highway Guardrail, *Composites Part A: Applied Science and Manufacturing*, **32** 1329-1338.

Bank and Xi (1993) Pultruded FRP Grating Reinforced Concrete Slabs, in *Fiber-Reinforced-Plastic for Concrete Structures - International Symposium*, SP-138, American Concrete Institute, 561-583.

Bank, Gentry, Nuss, Hurd, Lamanna, Duich and Oh (2000) Construction of a Pultruded Composite Structure: A Case Study, *ASCE Journal of Composites for Construction*, **4**(3) 112-119.

Bank, Oliva, Brunton and Hanus (2009) Design Procedures and Detailing Guidelines for FRP Pultruded Grid Reinforced Bridge Decks, *9th International Symposium on FRP in Reinforced Concrete Structures*, July 13-15, Sydney, Australia.

Bank, Oliva, Russell, Jacobson, Conachen, Nelson and McMonigal (2006) Double Layer Prefabricated FRP Grids for Rapid Bridge Deck Construction: Case Study, *ASCE Journal of Composites for Construction*, **10**(3) 204-121.

Berg, Bank, Oliva and Russell (2006) Construction and Cost Analysis of an FRP Reinforced Concrete Bridge Deck, *Construction and Building Materials*, **20** 515-526.

Matta, Nanni, Ringelstetter and Bank (2006) Rapid Construction of Concrete Bridge Deck Using Prefabricated FRP Reinforcement, *Third International Conference on FRP Composites in Civil Engineering* December 13-15, Miami, FL, USA, 151-154.

Smith, Bank, Gentry, Nuss, Hurd, Duich and Oh (2000) Analysis and Testing of a Prototype Pultruded Composite Causeway Structure, *Composite Structures,* **49** 141-150.

USTPO (2000) Composite Material Highway Guardrail Having High Impact Energy Dissipation Characteristics, Lawrence C. Bank and T. Russell Gentry, United States Patent No. 6,149,134.

Charleen Choboter

Charleen Choboter keeps the wheels of IIFC moving and the activities of IIFC Council and EXCOM on track, nevertheless, few members know her. Meet Charleen Choboter, IIFC Administrator:

Charleen joined ISIS Canada in 2003 and over the years has held various positions in which she plays a key role in the network's success. As Office Manager, her responsibilities include oversight of the overall operations and management of the ISIS Administrative Centre including overseeing the administration and financials of ISHMII, IIFC and the ISIS Network Association.

Charleen has her Business Administration diploma with a major in Office Management from Red River College in Winnipeg and is currently working on obtaining her Certified Administrative Professional (CAP) designation. Prior to working at ISIS Canada, she was Administrative Coordinator for the College of Licensed Practical Nurses of Manitoba.

In her spare time Charleen enjoys spending time with her family and dogs at their family farm, biking, exercising, sewing and other various crafts, cooking, and snowmobiling and ice fishing with her future husband.

Case Study: Seismic design and construction of large pultruded FRP structure

Prof. Salvatore Russo, Iuav University of Venice
russo@iuav.it

The Santa Maria Paganica Church partially collapsed in the 2009 L'Aquila earthquake (Figure 1). Although almost completely rebuilt following a devastating earthquake in 1703, the church's façade remains the oldest in the city of L'Aquila and incorporates two 13th century portals from an older medieval church. Restoration is anticipated to last through 2014 or beyond.

Fig. 1 Santa Maria Paganica Church partially collapsed in the 2009 L'Aquila earthquake. (AP Photo/Alessandra Tarantino)

To accommodate restoration activities, a freestanding space frame structure, 32 m (105 ft) in height and covering 1000 m² (10,800 ft²), was erected using pultruded glass fibre reinforced polymer (PFRP) elements (Figure 2). The entire structure weighs only 100 KN (22,500 lbs). The structure consists of primary members each composed of four PFRP channel sections bolted to bag-moulded GFRP gusset plates. Steel bolts were used for all connections (Figure 3). The freestanding canopy is essentially a rectilinear space frame. The PFRP members are embedded into lightly reinforced concrete pedestals supported on the church floor.

One primary reason that PFRP was considered and used for this structure is that it significantly reduced erection loads and the possibility/magnitude of accidental loads inside the already damaged and vulnerable church. Seismic resistance was also a concern since failure or excessive deflection of the structure is not only a safety concern but could also lead to additional damage to the church it was intended to protect. There is no available guidance for the seismic design of PFRP structures; indeed, the governing code (CNR 2007) limits the use of such elastic-brittle structural systems and materials in seismic zones. Nonetheless, research has demonstrated that PFRP sections have a number of favourable mechanical and dynamic properties which may be leveraged in seismic design. The dynamic properties of PFRP are characterized by low frequency and consequently high structural period (Boscato and Russo 2009). PFRP member stiffness does not decay prior to failure and their light weight and high deformability help to mitigate effects of seismic loading (Russo and Silvestri 2008).

Fig. 2 Freestanding PFRP space frame structure.

Related papers by Dr. Russo appear in Volume 1 of the *Proceedings of CICE 2010:*

GFRP Structures Subject to Dynamic Loading (page 127)

GFRP Members in Free Vibration Field, Dynamic Parameters of Profiles and 3D Structures (page 131)

Fig. 3 Details of PFRP frame and connections

Although intended to be a temporary structure, seismic design was carried out as though the structure was permanent. An ultimate limit state design was carried out using both linear and nonlinear approaches. Load combinations considered wind and snow loads in addition to the high seismic loads prescribed for L'Aquila. The lack of specific guidance resulted in a conservative design approach being taken, highlighting the need for further research in this area. The first complication encountered involved the selection of the structure-dependent coefficient required to define the elastic response spectrum and damping coefficient. Such values had only been previously defined for simply supported beams and a simple frame (Boscato and Russo 2009). In this instance, the structure response coefficient was calculated based on the governing Italian code (NTC 2008) with an additional conservative correction. The damping coefficient was assumed to be 5% taking into account the mechanical characteristics of the PFRP. Nonlinear analysis was used to assess the buckling performance of compression elements. The ratio of Young's modulus to shear modulus (E/G) for PFRP is approximately 2 to 3 times that of steel. As a result, the critical load for PFRP compression members is lower than that typically calculated for steel members. Design of the steel-bolted joints was dominated by the behaviour of the GFRP gusset plates. The lack of plasticity results in connection designs very different from those typical of steel structures. Due to lower bearing resistance and stiffness, gusset plate thickness is increased and an ultimate limit states design is controlled by local failure of the GFRP gusset plate.

Extensive *in situ* study of the PFRP canopy structure is planned. Dynamic evaluation to determine both appropriate structural and damping coefficients will be conducted. Study of the mechanical efficiency of the bolted connections and durability at the interface between reinforced concrete and PFRP elements in the embedded footings will also be conducted.

References

Boscato and Russo (2009) Free Vibration of Pultruded FRP elements: Mechanical Characterization, Analysis and Applications, *ASCE Journal of Composites for Construction*, **13**(6) 565-574

CNR (2007) *CNR-DT 205/2007 Istruzioni per la progettazione, l'esecuzione ed il Controllo di Strutture realizzate con profili Sottili pultrusi di materiale composito fibrorinforzato (FRP)*.

NTC (2008) *Nuove norme tecniche per le costruzioni*, D.M. 14/Gennaio 2008, G.U. 4/2/2008

Russo and Silvestri (2008) Perspectives of Employment of Pultruded FRP Structural Elements In Seismic Engineering Field, *Seismic Eng. Int. Conf. Commemorating the 1908 Messina and Reggio Calabria Earthquake, MERCEA08*, Reggio Calabria, July 8-11, 2008, pp1103-1112.

[copy edited by Kent A. Harries]

History of FRP in Construction

Heinz Isler: world famous for his concrete shells - however little-known for his pioneering work in FRP

Prof. Urs Meier, EMPA, Swiss Federal Laboratories for Materials Science and Technolology
urs.meier@empa.ch

Single and double curved shell structures made of masonry or unreinforced Roman concrete (*Opus Caementitium*) have been used to cover large spans in civil construction for over two millennia. Prominent examples include the Pantheon in Rome and the Hagia Sophia in Istanbul. The French invention of steel reinforced concrete allowed in the twentieth century the design of much thinner shells. Engineers like Franz Dischinger, Ulrich Finsterwalder, Eduardo Torroja, Robert Maillart, Felix Candela, Heinz Isler and others were masters of this demanding field. Heinz Isler was not only an outstanding engineer but also a very effective builder. More than one thousand four hundred of his concrete shells have been realised all over Europe.

Heinz Isler was born at Zollikon, near Berne, Switzerland, on July 26, 1926. His family later moved to Zurich. During his high school time he had a keen interest in painting and observations in nature. In 1946 he entered ETH, the Swiss Federal Institute of Technology in Zurich to be trained as a civil engineer. In 1950, the year he gained his diploma, he accepted a position as teaching and consultancy assistant with Professor Pierre Lardy at ETH. In this time he was also enrolled at the Arts College of Zurich and he passed the very difficult entrance examinations of the Academy of Fine Art in Munich. Finally he decided to continue his professional life as an engineer or better, as we will see, as an artist in shell design.

His master's thesis was about shells. During his time as assistant to Lardy he learned from him: "a) that we have a sense for esthetics; b) that we have the right to use it; c) that we are allowed to mention our opinion; and, d) that we can find and express it in our projects." (Billington1980) It was also during this time at ETH that Isler was exposed to the use of model experiments as a method of exploring the behavior of structures. Later he built his own laboratory for experimental statics. Model and full scale experimental studies were a key for his success in his engineering career.

Isler left ETH 1953 and worked as a freelance designer for two consulting offices designing concrete shells. He lived in Burgdorf near Berne in a low cost attic room. In 1954, he drafted for the first time, a pneumatically shaped thin concrete shell and presented his new concept at an international congress in Amsterdam. Many conference papers followed in the coming years.

Swiss business people started to appreciate his economic and attractive standard hump shells. They used them initially mostly for industrial buildings. These standard shells had square plans with side lengths between 15 and 60 meters. The shells have been arranged alongside one another. Within these projects was one root of his earlier FRP activities. The customers asked for natural lighting as this was popular with shed roofs. Isler developed light domes made of glass fiber-reinforced polymers (GFRP) as large "windows" on top of his concrete shells.

Heinz Isler, renowned for his concrete shell constructions had his eureka moment in 1955: the observation on a building site of a sodden, hanging piece of sacking led him to the discovery of the "hanging-membrane reversed" method (Billington 1980). After the shape was frozen and turned over, its shape represented the ideal shell form. This was the beginning of Isler's experiments with non-mathematically determined shell shapes. Today his unmistakable concrete roofs arch over factories, garages, store houses, exposition halls, tennis and garden centers, motorway restaurants and swimming pools.

The experience with frozen woven fabrics as model shells was another root for Isler's FRP activities. To be independent of the outside temperature he successfully replaced frozen water by unsaturated polyester resins.

Isler started his GFRP activities with shells; his first GFRP applications were light domes for his concrete shells. The required diameters were too large for Plexiglas. Based on a full scale gypsum model, a GFRP mold was produced. The first domes in 1955 had a diameter of 5 m and a thickness of only 3.5 mm. The laminates were built up as a sandwich structure with glass woven fabrics as skins and glass mats as the core. The largest domes had a diameter of 8 m. All these GFRP domes had a high degree of translucency.

Some of the mountains of the Swiss Alps have holes like cheese. These are military remains of World War II and the Cold War. On one side there are/were fortresses and on the other side warehouses for important

strategic goods. In 1956 Isler received a large contract to build GFRP housings within such galleries to protect pharmaceuticals from humidity. The master mold for this double curved shell was made of sand. The next step was a cast made of GFRP. The cast was refined and polished in the factory and served finally as a mold for the serial production (Figure 1). The span was 6 to 9 m and the thickness 1.5 mm. The elements were glued and screwed together (Figure 2).

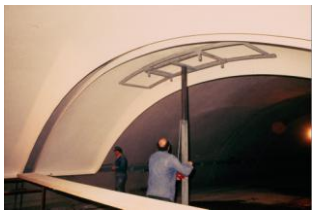


Fig. 1

Fig. 2

Surprisingly, Isler's most impressive FRP structures are not shells but "flat plates". What was Isler's reason for this decision? Although the double curved shells allowed Isler to overcome the stability problems due to the relative low modulus of elasticity of GFRP, larger shell diameters required thicker GFRP wall thickness. This was in conflict with the demand for translucency. What was his concept for "flat plates"? First he considered corrugated GFRP plates; the disadvantage was the limited span perpendicular to the corrugation. Isler's successful solution was something like a honeycomb plate. He used, in opposition to the classical honeycomb core material, not small hexagonal cells but large square coffers as shown in Figure 3.

Fig. 3

We follow now step by step the construction of a plate for the translucent coffer roof of a gas station with the dimensions of 14 by 22 m and a depth of 0.5 m. This work was conducted in 1960. Workers placed on the even and clean concrete floor a precast membrane of unsaturated polyester resin (Figure 4). They applied on this membrane a layer unsaturated polyester resin, layed-up glass mats as the bottom skin and rolled them carefully to impregnate them with the resin and to remove air voids (Figure 5). The lower parts of the prefabricated coffers were distributed over the wet resin surface (Figure 6). The webs of the coffers near the loading points around the columns received additional shear reinforcement. At this instant the top coffers were glued to the bottom coffers (Figure 7). The joint gaps were carefully closed with a spackling compound (Figure 8). Now there was a flat surface on top of the 1280 coffers for the application of resin-impregnated glass mats for the top skin. Before the 319 m² plate was lifted into its final position (Figure 9), it was successfully subjected to a loading test. The owner was extremely satisfied with the completed translucent roof (Figure 10). In 1960 this was the largest GFRP plate in the world.

Fig. 4

Fig. 5

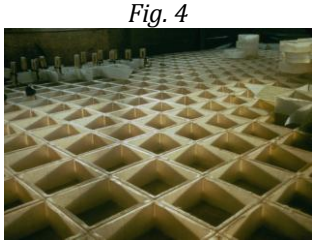


Fig. 6

Fig. 7

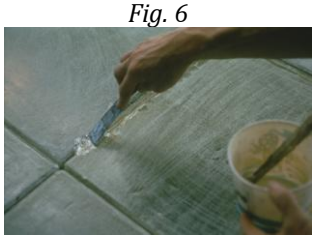


Fig. 8

Fig. 9

Fig. 10

There were several follow-on projects having similar patterns. Isler designed and built these structures mostly in co-operation with the FRP producer Eschmann in Thun. In 1965, they installed five translucent movable roofs - each of 140 m² - above the

generators of the hydroelectric power plant across the river Rhine in Saeckingen along the Swiss-German border. These plates remain in service today having resisted not only snow and wind loads without any problems, but also having been subjected to 5.7 billion (5.7×10^9) small amplitude fatigue load cycles due to the vibrations of the five generators. Figure 11 demonstrates the excellent translucency of such a roof.

In 1967 Isler designed and built out of such "flat plates" a folded structure with spans of about 20 m based on triangles covering the yard of the Realschule (middle school) in Geisslingen/Baden Wuerttemberg/Germany (Figures 12 and 13).

Fig. 11

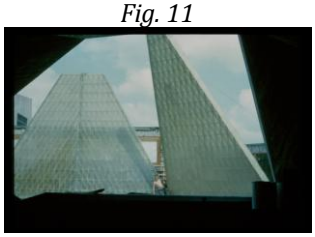


Fig. 12

Fig. 13

Isler was not only an outstanding structural engineer, an ingenious creator of structural sculptures and a good businessman. He was also a gentleman. In 1975 I undertook a difficult task: I had to organize the conference "Plastics in Civil Engineering" for the structural engineers of SIA, the Swiss Society of Engineers and Architects. Plastics had, at that time in Europe (unlike in North America), a poor image in the engineering community. This was largely a prejudice remaining from World War II. It was my goal to affect a change. When I asked the well known and famous Heinz Isler for help, he immediately supported me, the young greenhorn. Thanks to Isler and Alfred Puck, another GFRP pioneer, the conference was a great success. I also recieved Isler's selfless support in teaching for my ETH course "Engineering Design with Polymers and Advanced Composites" in the 1970's.

Isler's work with his unique free-form concrete shells is well documented because of Billington, Ramm, Schunk and many others. This is much less the case for his FRP structures. He wrote himself the comprehensive FRP paper "Anwendungsbeispiele fuer tragende Bauteile" for the 1975 conference. Since there were not yet venues like the "Journal of Composites for Construction" it was never published in English. The 1975-proceedings are out of stock. An electronic version of the printed article including 121 figures is available (see box). Genzel and Voigt presented in their book eight case studies of his GFRP applications.

Isler (Figure 14 and page 1) received tremendous international recognition for his oeuvre, especially for his concrete shells, less for his FRP pioneering work. In 1983 he was awarded and greatly appreciated a doctor honoris causa from his Alma Mater, ETH and the title of Professor at KIT, the Karlsruhe Institute of Technology, the oldest technical university in Germany. At the fib congress in 2006 he was awarded the Freyssinet Medal for his outstanding technical contributions in the field of structural concrete.

Fig. 14

Heinz Isler passed away unexpectedly on June 20, 2009. All of his important GFRP creations are meanwhile between 44 and 56 years old and demonstrate outstanding long-term performance under outdoor weathering conditions. Similar to glass roofs, they need from time to time to be washed and it may be that some of them will require a new layer of gel coat in the coming decades.

[Figures 1 to 13: courtesy Heinz Isler; Figure 14: courtesy Katrin Pügerl, D-69117 Heidelberg]

Selected Literature and Internet Links

Billington (2003) http://mcis2.princeton.edu/swisslegacy/engineers_6.html

Billington (2004) The Art of Structural Design: A Swiss Legacy http://mitworld.mit.edu/video/232

Billington (1980) *Heinz Isler as Structural Artist*, Princeton University Press, New Jersey, p 9-24

Chilton (2000) *Heinz Isler* (Engineer's Contribution to Architecture), Thomas Telford Publishing

Genzel and Voigt (2005) *Kuststoffbauten: Teil 1 - Die Pioniere*, Bauhaus-Universitaet Weimar, p 73-87 (in German)

Isler (1975) *Anwendungsbeispiele fuer tragende Bauteile*. In: Meier Urs (ed) Kunststoffe im Bauingenieurwesen (SIA), 17/18 October 1975, Zurich-Dubendorf, p 10-64 (in German)

Ramm and Schunk (2002) *Heinz Isler Schalen*. vdf Hochschulverlag AG, Zurich, (in German)

Kim Archer, 1963-2011

It is with great sadness that we must report that Lucille Kim Archer passed away suddenly on Thursday, February 17, 2011, she was 48. Kim was the Managing Director of ISIS Canada at the University of Manitoba and provided significant support to IIFC since IIFC administration was moved to Winnipeg.

Kim was born in Fort William, Ontario in 1963. Her family moved to Winnipeg in 1973, where she attended Oak Park High School. Following graduation, she worked at Mercury Press and then was hired by ISIS Canada. Kim started at ISIS Canada as an accountant, and then moved upward through the ranks as an office assistant, manager and finally becoming the managing director.

Kim married the love of her life in 1981. She and Gerry lived a good and rich life, enjoying one another's companionship and sharing a deep love. They spent many fun and interesting years together, going on long motorcycle trips to places such as California, Banff and Vancouver. When their daughter Stacey came along, the three of them focused on what was most important in life: being with family and creating a warm and comfortable home together. When Gerry passed away in December 2009, a heartbroken Kim focused her life on her beloved daughter. They spent the past year travelling and spending much quality time together, and she enjoyed watching Stacey flourish and develop her creative skills. Kim spent more time on her hobbies, which included gardening, sitting on her deck, reading and enjoying nature. Perhaps her most enduring legacy that close friends will always hold in their hearts is that Kim always strove to live life the way she wanted to live, making decisions to do things in a way that made sense to her, a free and caring spirit. She will be greatly missed.

Kim was predeceased by her husband Gerry and brother Darrel; she is survived by her daughter Stacey; her parents, Frank and Sara Dueck and her sister Pat Loewen.

News from the IIFC Executive Committee

At CICE 2010 in Beijing, China, the 6-year terms of the following IIFC Advisory Committee Members were reached: Prof. A. Machida, Saitama University, Japan; Prof. A.A. Mufti, University of Manitoba, Canada; and Prof. A. Nanni, University of Miami, USA. On behalf of all IIFC members, these outgoing Advisory Committee Members are thanked for their service and invaluable insight and leadership. The 6-year term of Prof. S. Rizkalla, North Carolina State University, USA, was also reached; Prof. Rizkalla was re-elected to a second term by the IIFC Executive Committee.

The IIFC Executive Committee is most pleased to announce the following new members of the Advisory Committee, which were elected from the eligible Fellows of the Institute: Prof. T.C. Triantafillou, University of Patras, Greece; Prof. L.P. Ye, Tsinghua University, China; and Prof. X.L. Zhao, Monash University, Australia. The full list of current IIFC Advisory Committee Members may be found at the end of the newsletter.

IIFC at ACMA

The IIFC was again well represented at the American Composites Manufacturers Association (ACMA) Composites 2011 Exhibition and Convention held in Ft. Lauderdale, Florida, 2-4 February 2011. The ACMA is the largest composites trade association in the world and Composites 2011 attracted over 3,000 industry professionals from the United States and 47 other countries. There were 221 exhibitors and 79 educational sessions. As part of our outreach effort, IIFC had a booth in the university pavilion on the exhibit floor, which was provided by ACMA at no charge. It is estimated that over 100 interested industry representatives visited the booth which was staffed by IIFC President Larry Bank and IIFC Secretary Rudi Seracino (at right). Promotional IIFC materials were distributed at the booth which attracted many industry professionals interested in expanding their operations into the growing FRP in civil infrastructure market.

In related news, IIFC Executive Committee Vice-President Renata Kotynia and IIFC member-at-large Emmanuel Ferrier are coordinating similar outreach activities with European based organizations. Look for updates on these activities in future editions of *FRP International*.

Upcoming Conferences and Meetings

FRPRCS-10 ***10th International Symposium on Fiber Reinforced Polymer Reinforcement for Reinforced Concrete Structures,*** April 2-4, 2011 Tampa, Florida USA. Hosted by the American Concrete Institute and its Committee 440. frprcs10.eng.usf.edu

---

CDCC 2011 ***4th International Conference on Durability and Sustainability of FRP Composites for Construction and Rehabilitation*****,** July 20-22, 2011, Quebec City, Canada.
www.civil.usherbrooke.ca/cdcc2011

Early Registration: before May 1, 2011

APFIS 2012 ***Third Asia-Pacific Conference on FRP in Structures,*** February 2-5, 2012, Sapporo, Japan. http://www.eng.hokudai.ac.jp/labo/maintenance/APFIS2012

Abstracts due: March 31 2011
Papers due: July 31 2011

ACMBS-VI ***Advanced Composite Materials in Bridges and Structures***, May 22-25, 2012, Kingston, Canada. civil.queensu.ca/documents/ACMBS2012.pdf

Abstracts due: May 15, 2011

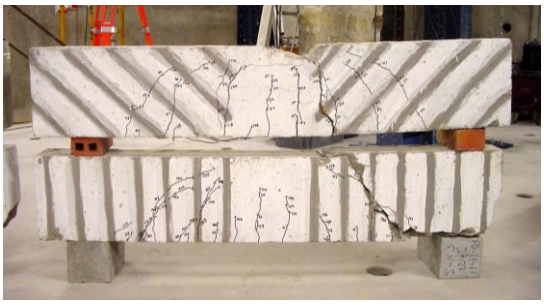
CICE 2012 ***6th International Conference on FRP Composites in Civil Engineering***, June 13-15, 2012, Rome, Italy. www.cice2012.it

Abstracts due: April 2011
Papers due: December 2011

CICE 2014 ***7th International Conference on FRP Composites in Civil Engineering***, August 2014, Vancouver, Canada.

Research Note

The research group coordinated by Dr. Joaquim Barros has launched a webtool, designated DABASUM (dabasum.civil.uminho.pt), a data base for FRP-based shear strengthening of reinforced concrete beams. In the present version - containing 442 examples of externally bonded and 69 examples of NSM repair - the collected information is used to assess the predictive performance of the fib, ACI, CIDAR and CNR design guidelines for the prediction of the contribution of FRP shear strengthening systems. DABASUM is also a forum where scientists and engineers doing research in this area can share and discuss ideas.



Beams strengthened with inclined and vertical NSM CFRP laminates, both without steel stirrups, failed in flexure and shear, respectively
(Dias and Barros; 2005 IIFC Photo Competition)

Joaquim Antonio Oliveira de Barros
barros@civil.uminho.pt

Dr. Elias Saqan (AUD) and Prof. Masoud Montavalli (EMPA) co chairs of SMAR 2011.

SMAR 2011 - Dubai, February 8-10, 2011

The first Middle East Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures, SMAR 2011, was successfully held in Dubai February 8-10, 2011. The conference was organized by The American University in Dubai (AUD) and the Swiss Federal Laboratories for Materials Science and Technology (EMPA). 164 papers and 6 keynote lectures were presented over three days; 186 papers appear in the proceedings.

The Mirko Ros Silver Awards for the best conference papers were awarded in the damage control, repair and strengthening category to Galati and Alkhradaji, *Strengthening of RC Chimneys with FRP Composites*; and in the structural health monitoring category to Tozser, Elliot and Garcia, *Acoustic Monitoring used to Manage the Life of Cable Supported Bridges*. The paper awards committees were chaired by Dr. Raafat El-Hacha and Professor Masoud Motavalli, respectively. The Mirkro Ros Silver Awards are named in honour of former EMPA director Mirko Ros, who led the organization from 1924 to 1949 and established its worldwide reputation.

International Institute for FRP in Construction

Membership Application

Dr./Mr./Ms./Prof. _____ Surname: _____

First/Middle Names: _____ Title: _____

Employer/Company: _____

Address: _____

City: _____ State/Prov: _____ Postal/Zip Code: _____ Country: _____

Telephone: _____ Fax: _____ Email: _____

Education/Experience: ***Please attach a current resume or CV***

I/we wish to join the International Institute for FRP in Construction (IIFC) as a (please tick one box)

☐ Fellow (US$100) ☐ Member (US$100) ☐ Associate Member (US$50) ☐ Student Member (US$25)

☐ Collective Member* (US$750) ☐ Patron Member (US$1500)

If applying for a Collective Membership, please nominate two representatives to receive the privileges:

Dr./Mr./Ms./Prof. _____ Surname: _____

First/Middle Names: _____ Title: _____

Telephone: _____ Fax: _____ Email: _____

Dr./Mr./Ms./Prof. _____ Surname: _____

First/Middle Names: _____ Title: _____

Telephone: _____ Fax: _____ Email: _____

METHOD OF PAYMENT (Payable in US Funds) Cheques and money orders to be made payable to "IIFC"

☐ Check / Money Order

☐ Visa ☐ Mastercard

Credit Card No. *Expiration Date*

Name on Credit Card

Signature of Cardholder

For Office Use Only

Date of Receipt: _____

Application Outcome: _____

Membership Number: _____

Date of Approval: _____

Transaction Date: _____

Amount: _____

Authorization No: _____

Invoice No: _____

Journal Entry No: _____

Submit to: IIFC Administrative Center c/o University of Manitoba
Agricultural and Civil Engineering Building • A250-96 Dafoe Road
Winnipeg, Manitoba, R3T 2N2, Canada
Tel: 1 (204) 474-8506 • Fax: 1 (204) 474-7519
Email: iifc@iifc-hq.org • Website: www.IIFC-hq.org

By submitting this application you agree to share your contact information with fellow IIFC members and any conference/organization associated with IIFC.

FRP INTERNATIONAL

the official newsletter of the International Institute for FRP in Construction

UNIVERSITÉ DE SHERBROOKE

Second Announcement and Registration

CDCC' 2011

Fourth International Conference on Durability & Sustainability of Fibre Reinforced Polymer (FRP) Composites for Construction & Rehabilitation

July 20-22, 2011
Loews Le Concorde Hotel
Quebec City, Quebec, Canada

www.civil.usherbrooke.ca/cdcc2011

Introduction

CDCC is a series of conferences held every four years approximately and focusing on the durability, sustainability and field applications of Fiber Reinforced Polymers (FRP) for construction of structures (bridges, buildings, marine structures, etc.). With this new edition, we hope to continue the tradition of success initiated by the preceding conferences held in Sherbrooke in 1998, Montreal in 2002, and Quebec City in 2007 with the expected participation of more and more engineers and researchers from every part of the world.

The conference will focus on durability of structures newly constructed, repaired and strengthened with FRP composites. Moreover, it will provide a unique opportunity for researchers, engineers, consultants, owners, and FRP manufacturers to exchange the up-to-date knowledge on durability and sustainability of FRP composites in construction.

Quebec City

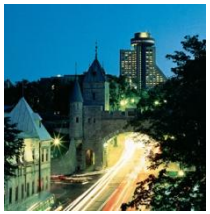
Perched atop Cap Diamant, surveying the St. Lawrence River, Québec City is one of the landmarks of North American history.

The cradle of French civilization in North America, it is today a busy seaport, an important centre of services and research, a cultural hot spot and, of course, the provincial capital. The remarkable parliament buildings (Hôtel du Parlement) are well worth a visit.

Papers are being received on the following themes:

- Effect of materials on the durability of FRP products
- Effect of environment on the durability of FRP reinforcements, repair patches, and structural shapes
- Durability of FRP composites and systems under cyclic and sustained loading (fatigue, creep)
- Alkali resistance of glass fibre reinforcement
- Influence of adhesive type and load on long-term bond
- Material resistance factors and design criteria
- Fire and thermal cycling
- Durability modelling and test methods
- Durability data from field studies
- Behaviour of FPP structures under blast loading
- Monitoring durability performance in field applications
- Sustainability of FRP Composite structures
- Design approaches for durable FRP structures
- FRP field applications and case studies
- Service life prediction and life cycle cost

The venue



The Conference will be hosted at the Loews Le Concorde Hotel, which can accommodate up to 1200 guests with its numerous rooms located on several floors for a combined area of more than 28,000 square feet.

Technical program

The three-day technical program will consist of keynote lectures, invited papers and contributed sessions. For updated information on the technical program, please visit the Conference web site at:
www.civil.usherbrooke.ca/cdcc2011

Important deadlines

Submission of abstracts	September 30, 2010
Notification of acceptance	October 15, 2010
Submission of manuscripts	February 1, 2011
Notification of acceptance of manuscripts	March 1, 2011
Submission of final manuscripts	April 1, 2011

Social program

A variety of interesting and entertaining events are planned for participants and accompanying persons. Detailed information will be available in the final invitation and in the Conference web

Social events

Cocktail Reception: July 19 (6:00 PM to 8:00 PM)
Banquet: July 21 (6:00 PM to 10:00 PM)
Luncheons: On every day during the conference.

Correspondences and Inquiries

Dr. Brahim Benmokrane, P. Eng., FACI, FCSCE
NSERC & Canada Research Chairs Professor
Department of Civil Engineering
University of Sherbrooke
Sherbrooke, Quebec, Canada J1K 2R1
Tel: (819) 821-7758 Fax: (819) 821-7974
E-mail: Brahim.Benmokrane@USherbrooke.ca
Web site: **http://www.civil.USherbrooke.ca/CDCC2011**

Organizing Committee

Honorary Chair of the Conference
Daniel Bouchard, Ministry of Transportation of Quebec

Chair of the Conference
Brahim Benmokrane, University of Sherbrooke

Co-chairs of the Conference
Charles E. Bakis, Pennsylvania State University
Nemkumar Banthia, University of British Columbia
John Myers, Missouri University of Science & Technology

Members of the national organizing committee

- Nemkumar Banthia, University of British Columbia
- Brahim Benmokrane, University of Sherbrooke
- Omar Chaallal, École de technologie supérieure
- Gérard Desgagné, Ministry of Transportation of Quebec
- Mario Desroches, Sika Canada
- Bernard Drouin, Pultrall Inc.
- Raafat El-Hacha, University of Calgary
- Ehab El-Salakawy, University of Manitoba
- Darrell Evans, P.E.I. Department of Transportation
- Garth Fallis, Vector Construction Group
- Mark Green, Queen's University
- Pierre Labossière, University of Sherbrooke
- David Lai, Ministry of Transportation of Ontario
- Aftab Mufti, University of Manitoba
- Kenneth Neale, University of Sherbrooke
- John Newhook, Dalhousie University
- Ghani Razaqpur, McMaster University
- Murat Saatcioglu, University of Ottawa
- Shamim Sheikh, University of Toronto
- Khaled Soudki, University of Waterloo
- Allan Wiseman, Public Works Canada (PWGSC)

International Scientific Committee

L. Bank, USA
N. Banthia, Canada
J. Barros, Portugal
B. Benmokrane, Canada
L. Bisby, UK
O. Chaallal, Canada
J.F. Chen, UK
O. Cosenza, Italy
C. Dolan, USA
M.A. Erki, Canada
A. Fam, Canada
H. Fukuyama, Japan
H. GangaRao, USA
P. Hamelin, France
T. Hamilton, USA
K. A. Harries, USA
V.M. Karbhari, USA
T. Keller, Switzerland
K. Kobayashi, Japan
J.J. Lesko, USA
A. Machida, Japan
I. Mahfouz, Egypt
U. Meier, Switzerland
S. Morita, Japan
G. Monti, Italy
A. Mufti, Canada
A. Nanni, USA
K. Neale, Canada
D.J. Oehlers, Australia
R. Razaqpur, Canada
S. Rizkalla, USA
R. Sen, USA
C. Shield, USA
J. Sim, Korea
S.T. Smith, China
L. Taerwe, Belgium
B. Taljsten, Demark
K.H. Tan, Singapore
J.G. Teng, China
R. Tepfers, Sweden
T. Triantafillou, Greece
Z.S. Wu, Japan

Exhibit Program

To familiarize the conference attendees with their products and services, several companies will open exhibition stalls at the conference venue. These exhibitions stalls will show samples of and provide information on different products related to FRP reinforcing bars and prestressing tendons for concrete structures, FRP ground anchors, FRP sheets and laminates, FRP tubes, FRP composite bridge decks, and fibre optic sensors for structural health monitoring. The exhibition will be open daily from 8:30 AM to 5:00 PM. Refreshment breaks will be held in the exhibition area. The registration form for the exhibit program is available at the conference web site: www.civil.usherbrooke.ca/cdcc2011

Sponsors

CDCC'2011 is organized under the auspices of the University of Sherbrooke, ISIS Canada (the Canadian Network of Centers of Excellence on Intelligent Sensing for Innovative Structures), IIFC (the International Institute for FRP in Construction), CRIB (the Research Center on Concrete Infrastructures), CSCE (the Canadian Society for Civil Engineering), CREPEC (the Research Center on Polymers and Composites), CI-ASCE (Construction Institute of the American Society of Civil Engineers), and ACMA (American Composites Manufacturers Association). There are also a number of industrial organizational sponsors.

Accommodation

A block of rooms has been reserved at the Loews Le Concorde Hotel at a special conference rate. A hotel reservation form is available at the conference website at www.civil.usherbrooke.ca/cdcc2011. Please mail or fax a completed form directly to the hotel as soon as possible to ensure your accommodation.

Conference Registration

A registration form is available at the conference website and also in this pamphlet. Please fill out a form and send or fax it to the CDCC 2011 Secretariat before May 1st, 2011 so that you may take advantage of a reduced registration fee.

CDCC'2011 *Registration form*

July 20-22, 2011, Quebec City, Quebec, Canada

Surname: .....

First Name: .....

Title (Prof/Dr/Mr/Mrs/Ms): .....

Organization: .....

Address: .....
Number Street
.....
City Province/State
.....
Postal/Zip Code Country

Tel.: .....

Fax: .....

Email: .....

Registration Fees

Authors and Delegates	
Before May 1st, 2011	725 $ (CAN)
After May 1st, 2011	825 $
Students	250 $
One-Day Registration	450 $
Additional Proceedings	100 $
Extra banquet ticket	85 $
Extra IIFC membership fees	100 $
Total payment	

A cancellation charge of $150 will be deducted if notified before June 15, 2011. After June 15, no refund will be given.

Payment

Cheque ☐ or

Credit card

Visa ☐ MasterCard ☐

_____

Credit card number Expiry date

Signature: _____

Date: _____

Payable to :**Université de Sherbrooke - CDCC 2011**

Send this form with fees in full to

Secretariat du CDCC 2011

Université de Sherbrooke

Département de génie civil

Sherbrooke, Québec, Canada J1K 2R1

Fax: (819) 821-7974; E-mail: cdcc2011@USherbrooke.ca

First Announcement

APFIS 2012
The Third Asia Pacific Conference on FRP Structures

The Official Regional Conference of
the International Institute for FRP in Construction
(IIFC) for the Asia-Pacific Region

2-4 February 2012
Sapporo, Japan

Organized by

Japan Concrete Institute

in collaboration with

Japan Society of Civil Engineers

Japan Society for Composite Materials

Hokkaido University

www.eng.hokudai.ac.jp/labo/maintenance/APFIS2012/

About APFIS 2012

APFIS 2012 is the third IIFC Asia-Pacific regional conference on the research and application of fiber reinforced polymers (FRP) in civil and architectural engineering structures to be held in Sapporo, Japan from 2 to 4 February 2012. APFIS 2012 aims to continue the success of the preceding conferences held in Hong Kong, China in 2007, and Seoul, Korea in 2009 with expecting participation from the Asia-Pacific region and various parts of the world.

Aim and Scope

The aim of APFIS 2012 is to share the latest developments in research and application of FRP in civil and architectural engineering areas. Papers dealing with fundamental research and application of FRP composites to civil and architectural engineering structures will be considered for publication in the conference proceedings and for presentation at the conference. Topics include but are not limited to:

- Materials and products
- Strengthening of concrete, metallic, timber and masonry structures
- Bond behavior and debonding failures
- Confinement and seismic retrofit
- Concrete structures reinforced or prestressed with FRP
- Durability and long-term performance
- Fire, impact and blast loading
- Structural health monitoring and intelligent sensing
- Field applications and case studies
- Codes and standards
- Hybrid structures and all FRP structures

Call for Papers

Prospective authors are invited to submit an abstract of not more than 300 words with paper title, authors' name and affiliation, name and e-mail address of contact person by 31 March 2011. Abstract is to be submitted by e-mail to the following address:

apfis2012@eng.hokudai.ac.jp

Key Dates

300 words abstract:	31 March 2011
Full paper for review:	31 July 2011
Final manuscript:	31 October 2011
Early bird registration:	30 November 2011
Conference:	2-4 February 2012

Technical Program

Three days technical program includes invited lectures, keynote lectures, parallel sessions and poster sessions by young researchers. Post conference technical tour is planned after the three days program.

Official Language

English is the official language of the Conference.

Proceedings

A soft cover book containing one-page abstracts will be published. Full papers will be included in CD-ROM.

Awards

Best paper awards will be given to excellent papers presented at the conference. Competition of poster presentation is tentatively planned.

Social Program

Welcome reception and banquet will be arranged. Accompanying persons' program will be planned on demand.

Registration fee

Participant:	JPY 40,000 (before 1 December 2011)
	JPY 50,000 (after 30 November 2011)
Student:	JPY 20,000 (before 1 December 2011)
	JPY 25,000 (after 30 November 2011)

Banquet and welcome reception ticket: JPY 10,000

International Scientific Committee

L.C. Bank, USA (Chairman)

R. Al-Mahaidi, Australia
T. Aravinthan, Australia
C.E. Bakis, USA
N. Banthia, Canada
J. Barros, Portugal
L.A. Bisby, UK
J.F. Chen, UK
L. De Lorenzis, Italy
R. El-Hacha, Canada
A. Fam, Canada
P. Feng, China
E. Ferrier, France
M. Griffith, Australia
M. Guadagnini, UK
I.E. Harik, USA
K.A. Harries, USA
A. Ilki, Turkey
V.M. Karbhari, USA
A. Katz, Israel
T. Keller, Switzerland
R. Kotynia, Poland
P. Labossiere, Canada
A. Machida, Japan
F. Matta, USA
G. Monti, Italy
M. Motavalli, Iran
A.A. Mufti, Canada
H. Mutsuyoshi, Japan
H. Nakamura, Japan
A. Nanni, USA
K.W. Neale, Canada
M.D.G. Pulido, Spain
S.H. Rizkalla, USA
H.M. Seliem, Egypt
R. Seracino, USA
J. Sim, Korea
S.T. Smith, China
T.J. Stratford, UK
L. Taerwe, Belgium
K.H. Tan, Singapore
J.G. Teng, China
T.C. Triantafillou, Greece
T. Uomoto, Japan
Y.F. Wu, China
X.L. Zhao, Australia

Organizing Committee

Chairman:
T. Ueda, Hokkaido University

Members:
T. Kanakubo, University of Tsukuba
Y. Sato, Hokkaido University
T. Shimomura, Nagaoka University of Technology

J.G. Dai, The Hong Kong Polytechnic University
Y. Goto, Hokkaido University
M. Iso, University of Fukui
A. Kamiharako, Hirosaki University
Y. Kurihashi, Muroran Institute of Technology
A. Kobayashi, Nippon Steel Materials Co., Ltd.
T. Matsumoto, Hokkaido University
K. Nakano, Niigata Institute of Technology
H. Nishi, Civil Eng. Research Institute for Cold Region
I. Nishizaki, Public Works Research Institute
Y. Takahashi, Hokkai-Gakuen University
F. Taguchi, Civil Eng. Research Institute for Cold Region
Z. Wu, Ibaraki University
K. Yamaguchi, Kyushu University
S. Yamada, Toyohashi University of Technology
K. Yonemaru, Shimizu Corporation

Conference Venue

APFIS 2012 will be held at Conference Hall, Hokkaido University, Sapporo, Japan.

Hokkaido University started out in 1876 as Sapporo Agricultural College, the first modern academic institute in Japan. Its curriculum which combined agricultural and civil engineering disciplines was developed following that of the Massachusetts Agricultural College and classes were taught by foreign experts. Since the Japanese government's purpose of setting up SAC was to develop Hokkaido, an untamed land, using the advanced knowledge of foreign faculty and subsequently SAC graduates, civil engineering education in Japan started in earnest at SAC.

http://www.hokudai.ac.jp/en/

Hokkaido University's School of Engineering

Sapporo Snow Festival

The event began in 1950 when six students built snow statues in Odori Park. The idea caught on and today teams of talented professional sculptors come from around Japan and the world to create hundreds of statues and sculptures from ice.

These amazing creations range from small, intricate pieces to huge structures the size of multi-storey buildings.

There's a support program of concerts and cultural events, and at night the sculptures are beautifully illuminated with colored lighting.

The 63rd Sapporo Snow Festival will be held from February 6 (Mon.) through 12 (Sun.) in 2012.

http://www.snowfes.com/english/

About Sapporo City

Sapporo is the fifth largest city of Japan with a population of more than 1.8 million. It developed as the main urban center of Hokkaido, the northern island of Japan and became well known internationally when in 1972 it became the first Asian city to host the Winter Olympics. Sapporo is also famous for its annual Snow Festival, in which massive ice sculptures adorn Odori Park in the city center.

Sapporo residents are friendly and the city itself is rich in natural environment. One can enjoy the magnificent view of mountains, which are covered with lush greenery in summer, vibrant colored leaves in autumn and white snow in winter. Sapporo is generously endowed with parks and gardens and laid out in an easy-to-follow grid plan. The mountains that attract skiers and snowboarders rise up to its south, while the coast is less than thirty minutes away.

Hokkaido is home to a rich variety of foodstuffs, and Sapporo is a great place to find fresh seafood, dairy and agricultural products. Nationwide surveys con-sistently rank Sapporo as one of Japan's most desirable places to live.

http://en.visit-hokkaido.jp/

The New Chitose Airport, 30 minutes by train to Sapporo, is linked to numerous airports within and outside Japan.

http://www.new-chitose-airport.jp/en/

Call for Papers

Authors can submit abstracts through the conference web site

www.cice2012.it

Deadlines to remember:

30 April 2011 – Abstract submission

31 December 2011 – Paper submission

31 March 2012 – Early bird registration

Acceptance of abstracts and papers will be provided within one month from submission.

For additional information, please contact:

info@cice2012.it

Welcome to the Eternal City!

After the successful conferences in Hong Kong 2001, Adelaide 2004, Miami 2006, Zurich 2008, and Beijing 2010, the 6th International conference on Fiber Reinforced Polymer (FRP) Composites in Civil Engineering is to be held in Rome, Italy, in June 2012.

CICE 2012, an official conference of the International Institute for FRP in Construction (IIFC), aims to provide an international forum where researchers and practitioners in the field of FRP composites in civil engineering can exchange and share recent advances and future perspectives.

CICE 2012

Rome

SAPIENZA
UNIVERSITÀ DI ROMA

Giorgio Monti

Conference Chair
Sapienza Università di Roma
Via Antonio Gramsci, 53 – 00197 Roma, Italy

13-15 June 2012

The 6th International Conference on FRP Composites in Civil Engineering

About Rome

It has been said that all roads lead to Rome.
In Rome, every road leads to eternity.
Its history spans over 2,700 years and it is a spectacular encyclopedia of living history, including Vatican City, an independent city-state located entirely within Rome.
Tours are plentiful and often based on themes of history, food and wine, art, and religion. The whole experience is so powerful as to be almost overwhelming.
After all, Rome wasn't built in a day!

Topics

- FRP Strengthening of Concrete Structures, Historic Structures, Masonry Structures, Timber Structures and Metallic Structures
- FRP in Seismic Retrofitting
- Bond and Interfacial Stresses
- Confinement of Concrete
- Hybrid FRP Structures
- Concrete-Filled FRP Tubes
- All-FRP and Smart FRP Structures
- Prestressing with FRP
- Fire, Impact and Blast Loading
- Durability and Long-Term Performance
- Inspection and Quality Assurance
- Field Applications and Case Studies
- Codes and Design Guidelines

Committees

National Organizing Committee

G. Monti (chair), M.A. Aiello, L. Ascione, V. Bianco, M. Liotta, G. Manfredi, N. Nisticò, M. Pecce, A. Prota, S. Russo, M. Savoia.

International Scientific Committee

R. Al-Mahaidi, B. Bakht, C.E. Bakis, L.C. Bank, N. Banthia, J.A. Barros, B. Benmokrane, L. Bisby, F. Ceroni, J.F. Chen, J.G. Dai, L. De Lorenzis, R. El-Hacha, A. Fam, P. Feng, E. Ferrier, H. Fukuyama, M. Green, J. Grenestedt, M. Griffith, X.L. Gu, M. Guadagnini, I.E. Harik, K. Harries, P.Y. Huang, A. Ilki, A. Katz, T. Keller, R. Kotynia, H. Li, L.L. Luo, S. Matthys, U. Meier, M. Motavalli, A. Nanni, D.J. Oehlers, J.P. Ou, S.H. Rizkalla, R. Seracino, W. Sebastian, J.S. Sim, S.T. Smith, B. Taljsten, K.H. Tan, J.G. Teng, T. Triantafillou, L. Taerwe, T. Ueda, G. Van Erp, P. Waldron, Y.F. Wu, Z.S. Wu, Y. Xiao, Z.M. Xue, W.C. Xue, J. Yao, X.L. Zhao.

Registration

The program will consist of keynote lectures and general sessions. The IIFC general meeting and council meeting will be held during the conference. Technical tours and social programs will be arranged. Products and services exhibition will be open during the conference. If you are interested in a display booth, please contact us at: info@cice2012.it.

Registration before 31 March 2012
€ 700 (regular)
€ 450 (student)

Registration after 31 March 2012
€ 900 (regular)
€ 550 (student)

Registration covers IIFC Membership, attendance at the conference, conference proceedings, welcome reception, banquet, refreshments, all lunches and social dinner. Technical tours and social programs are not included.