Proceedings of the First

ASIA-PACIFIC CONFERENCE ON FRP IN STRUCTURES

- APFIS 2007 -

APFIS 2007

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

12-14 December 2007
Hong Kong, China

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Organised by:
The University of Hong Kong

and

IIFC Working Groups on "Bond Behaviour of FRP in Structures", "FRP-Strengthened Metallic Structures" and "FRP Bridge Decks"

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PREFACE

The inaugural Asia-Pacific Conference on FRP in Structures, APFIS 2007, was held in Hong Kong on 12-14 December 2007. It was the first official Asia-Pacific regional conference of the International Institute for FRP in Construction (IIFC) on the research and use of fibre reinforced polymer (FRP) composites in civil engineering structures. APFIS 2007 was organised by the Department of Civil Engineering, The University of Hong Kong, as well as the IIFC working groups on "Bond Behaviour of FRP in Structures", "FRP-Strengthened Metallic Structures" and "FRP Bridge Decks".

This two volume set of APFIS 2007 proceedings contains 6 keynote papers and 156 contributed papers which have been authored by a combined total of 351 authors from 26 different countries. Each contributed paper was rigorously peer reviewed by at least two reviewers who were drawn from a large pool of Organising and International Scientific Committee members as well as other experts in the field.

The APFIS conference series was born in Hong Kong in July of 2005 while I was visiting Professor J.G. Teng from the Hong Kong Polytechnic University for a short sabbatical leave; at the time I was working in Australia but since moved to the University of Hong Kong in January 2007. The two of us were commenting how there were several FRP conference series held around the world in predominately European and North America cities with much less conference activity in the Asia-Pacific region. It was therefore logical to create a new conference series for the Asia-Pacific region. With the approval of the IIFC Executive Committee of the time, APFIS became one of the official IIFC regional conference series with the intention for it to be held every odd numbered year in the Asia-Pacific region. APFIS compliments the IIFC biennial global conference series CICE (FRP Composites in Civil Engineering) which, since the second conference in 2004, is held in even numbered years.

The construction and maintenance of a built environment that is safe and healthy for the community and also conducive to economic development is important for any developing or developed nation. Advanced fibre-reinforced polymer (FRP) composites are playing an increasingly important role in the built environment around the world, not just for the strengthening, repair, rehabilitation and retrofitting of existing structures, but also for new construction as well. Research and application of FRP in construction is rather widespread in not just the Asia-Pacific region but indeed the world. For example, in the Asia-Pacific region, construction has been identified as being one of the biggest composites markets in the booming Chinese composites industry. It is therefore important for our research efforts to focus not just on theoretical development but also on practical applications. We must address important practical issues, such as fire, durability and monitoring in more detail than is currently being reported and advertise these findings to industry via such conferences such as APFIS, as well as via design guidelines and eventually standard codes of practice. Furthermore, research and development of all FRP as well as hybrid FRP structures are also fruitful areas to progress which have seen limited progress to date.

APFIS 2007 would not have been possible without the strong support of numerous organizations and individuals. Thank you to all the authors as well as invited guests, keynote speakers, session chairs, and presenters at APFIS 2007 for making this event such a success. Special thanks to the IIFC past and present Executive Committee for entrusting me with the honour to host this inaugural conference and for supporting the best paper awards. Thank you to the Chairs of the three IIFC working groups (WG) who organised many special sessions in this conference: Dr J.F. Chen and Prof. J.G. Teng for the WG of 'Bond Behaviour of FRP in Structures', Prof. X.L. Zhao for the WG of 'FRP-Strengthened Metallic Structures', and Prof. T. Keller for the WG of 'FRP Bridge Decks'. Thank you also to the Organising and Scientific Committee members, including Prof. J.G. Teng the Chair of the International Scientific Committee, and all those extra volunteers who reviewed papers so rigorously.

I am extremely grateful for the strong administrative support given by the Department of Civil Engineering, The University of Hong Kong, and in particular to the department head, Mr P.K.K. Lee, for mobilizing such support especially during the conference. A special thank you must also be extended to Ms Aggie Sung of the Department of Civil Engineering who handled a lot of the day-to-day administrative duties. The support of all the institutional sponsors is gratefully acknowledged, namely the Hong Kong Institution of Engineers (Structural Division) (HKIE), China Civil Engineering Society (CCES), Engineers Australia (EA), Australian Composite Structures Society (ACSS), Korea Concrete Institute (KCI), Japan Concrete Institute (JCI), Japan Society for Composite Materials (JSCM), American Concrete Institute (ACI), American Society of Civil Engineers (ASCE) Hong Kong Section, American Composites Manufacturers Association (ACMA), and the Canadian Research Network on Intelligent Sensing for Innovative Structures (ISIS). In addition, generous contributions from the industrial sponsors and exhibitors, namely High Gain Industrial Ltd., Freyssinet Hong Kong Limited, FYFE (Hong Kong) Ltd., Yeung's Fibreglass Company, VSL Structural Preservation Division - Asia Pacific, and Chinagrate Composite Structures (Nantong) Ltd., are also gratefully acknowledged. Thank you also to the administrative and media support given by Ta Kung Pao (HK) Ltd. which was facilitated by its General Manager, Mr Stephen Fung.

Last but definitely not least, I would like to thank my dearest wife Xia-Ping (Lisa) and son Kaiden for their love and unwavering support.

Dr Scott T. Smith
The University of Hong Kong, China
December 2007

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Accepted Abstract Submissions

Paper ID	Paper Title	Authors (# = Corresponding Author)	Affiliation of Corresponding Author	Country	Working Group
APFIS-111	Experimental Research of Concrete Beams and Masonry Walls Reinforced with GFRP Wires	Z. Soric# T. Kisicek J. Galic	University of Zagreb	Croatia	
APFIS-112	Strengthening of Wooden Beams with FRP Materials	Cristina Bernardini# Lino Credali Giuseppe Pistone	Turin Politecnico	Italy	
APFIS-113	Flexural Behavior of Hybrid FRP Composite Girder with Concrete Deck	Allan Capilar Manalo# Hiroshi Mutsuyoshi Thiru Aranvithan Shingo Asamoto Kenji Suzukawa	Saitama University	Japan	
APFIS-114	On the Bending of GFRP Reinforced Glass Element	E. Speranzini# P. Neri	University of Perugia	Italy	
APFIS-115	Methods and Design Equations for Pretension of Externally Bonded FRP Sheets for Flexural Reinforcement of RC Beams	Gorgio Monti# Marc' Antonio Liotta	University of Rome "La Sapienza"	Italy	
APFIS-116	Strengthening of Structures by Bi-directional Carbon Fibres Fabric Composite (TFC)	Tommy Wong#	Freyssinet	Hong Kong	
APFIS-117	On the use of the EC3 and AISI Specifications to Estimate the Ultimate Capacity of FRP-Strengthened Cold-Formed Steel Columns	Nuno Silvestre Dinar Camotim# Ben Young	Technical University of Lisbon	Portugal	Metal
APFIS-118	Design of Concrete Bridge Deck Slabs using Different Types and Diameters of GFRP Bars	Sherif El-Gamal# Brahim Benmokrane	Université de Sherbrooke	Canada	
APFIS-119	On the Application of Cohesive Zone Modelling in FRP Strengthened Timber Structures	K.U. Schober# K. Rautenstrauch	Bauhaus-University of Weimar	Germany	Bond
APFIS-120	Behaviour of Sandwich Columns Under Edgewise Compression Loading	T. Omar# T. Aravinthan G. Van Erp	University of Southern Queensland	Australia	
APFIS-121	Innovative All Composite Multi-Pultrusion Truss Systems	T. Omar# G. Van Erp T. Aravinthan P. Key	University of Southern Queensland	Australia	
APFIS-122	Strengthening of a RC Bridge (2nd decade of XX century) for Weight Loads with FRP (Unidirectional Carbon Fibres).	Giuseppe Pistone#	Turin Politecnico	Italy	
APFIS-123	Moisture Concentration Effect on the Reliability of a Graphite/Epoxy Plates under Variable Climatic Conditions	B. Boucham# A. Chateauneuf E.A. Adda Bedia	University Djillali Liabes of Sidi Bel Abbès	Algéria	
APFIS-124	Debonding Failure Mechanism in RC Beam Strengthening with CFRP	Hamid Varastephour# Patrice Hamelin	WPHTI	Iran	
APFIS-125	Investigation of Peel Stresses in Adhesively Bonded GFRP Joints	H.K. Lee# S.H. Pyo B.R. Kim	Korea Advanced Institute of Science and Technology	Korea	Bond