



The Hong Kong Institute of Steel Construction was established in November 2000. It has been registered as a non-profit making organization with its board members from universities, consultants, contractors and regulatory agents in Hong Kong. The HKISC serves the steel construction industry in Hong Kong and the region and carries the following specific missions:

- Channeling of technology transfer between academic and industry for improved quality in design, analysis and construction;
- Organizing seminars for local and overseas experts for dissemination of their latest technological know-how;
- Organizing international conferences for sharing of expertise between local and overseas researchers and engineers;
- Steering university researches to be more practical and useful for practitioners;
- Disseminating new technology worldwide among members ; and
- Developing and fostering friendship among members.

Further information about the HKISC can be obtained at the HKISC web address:

<http://www.hkisc.org/>

### Contact

The Hong Kong Institute of Steel Construction  
c/o TU743, Dept. of Civil & Structural Engineering  
The Hong Kong Polytechnic University  
Hung Hom, Kowloon, Hong Kong  
Tel: (852) 2766 6020  
Fax: (852) 2334 6389

### Disclaimer

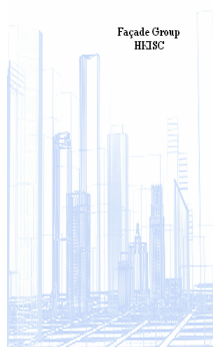
No responsibility is assumed for any injury and / or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein.

### Copyright © 2006 reserved by

#### **The Hong Kong Institute of Steel Construction**

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic mechanical, photocopying, recording or otherwise, without the prior written permission of the publisher.

Printed by The Hong Kong Polytechnic University  
ISBN-13: 978-988-99140-0-4  
ISBN-10: 988-99140-0-X



THE HONG KONG POLYTECHNIC UNIVERSITY  
DEPT. OF CIVIL AND STRUCTURAL ENGINEERING  
香港理工大學  
土木及結構工程系



香港  
鋼結構學會  
Hong Kong Institute of  
Steel Construction

**Symposium**  
**Advanced Facade Engineering and Technology 2006**  
**Friday, 21<sup>st</sup> April 2006**

<b>Date:</b>	21 April 2006, Friday
<b>Venue:</b>	Harbour Plaza Hong Kong No. 20, Tak Fung Street, Hung Hom, Kowloon
<b>Time:</b>	8:45 am (registration) for 9:00 am to 5:30 pm

Time	Program	Session Chairmen
8:45 am	Registration	
9:00am	Welcoming Speech by Ir Professor JM Ko, Vice-President, HKPolyU	Ir Prof. S.L. Chan HKPolyU
9:10 am	Opening remark by Ir Dr. Greg Wong, President, HKIE	
<b>Lecture 1</b> 9:20 am	State-of-art in Facade Engineering <b>Ir Dr. Andy Lee, Arup Facade Engineering</b>	Ir Dr. CM Koon, Buildings Department
<b>Lecture 2</b> 9:50 am	Concept of nonlinear analysis and design of glass panels <b>Dr. Andrew So RED Facade Consultants Limited</b>	
10:20 am	<b>Tea Break</b>	
<b>Lecture 3</b> 10:50 am	Wind Directionality effects on Design Wind Pressures of Hong Kong Buildings <b>Professor C.W. Li, HKPolyU</b>	Ir C.T. Wong Architectural Services Department
<b>Lecture 4</b> 11:20 am	Design and implementation of Curtain Wall System <b>Mr. Johnny Choi, Permasteelisa Hong Kong Limited</b>	
<b>Lecture 5</b> 11:50 am	Wind Effect on Pedestrians <b>Ir Dr. Johnny Yu, RED Consultants Ltd.</b>	
12:20 pm	<b>Lunch</b>	
<b>Lecture 6</b> 1:50 pm	Mechanics for plate buckling in thin-walled metal structures <b>Ir Professor KF Chung, HKPolyU</b>	Ir Tony Mak, Housing Department
<b>Lecture 7</b> 2:20 pm	Practice and testing of stone cladding in Hong Kong <b>Mr J.Y.H. Yu, FacadeTech Laboratory Limited</b>	
2:50 pm	<b>Tea Break</b>	
<b>Lecture 8</b> 3:20 pm	Local buckling & shift of effective centroid of slender sections <b>Dr. Ben Young, HKU</b>	Ir W.C. Fu Buildings Department
<b>Lecture 9</b> 3:40 pm	Product Certification of Heat Soaked Tempered Glass to PNAP 239 and EN 14179-1 <b>Ir CK Cheung, HOKLAS</b>	
<b>Lecture 10</b> 4:10 pm	Basic structural design considerations and properties of glass and aluminum structures <b>Ir Professor S.L. Chan, HKPolyU</b>	
<b>Closing remark</b> 4:40 pm	<b>Ir Prof. M.K. Tong, Architectural Services Department</b>	Dr. A.K.W. So RED Consultants Ltd.
5:00 pm	<b>End</b>	

# CONTENTS

	Pages
Symposium Schedule	i
Contents	ii
Foreward	iii
<b>State-of-art in Facade Engineering</b> Ir Dr. Andy Lee, Arup Facade Engineering	1
<b>Concept of nonlinear analysis and design of glass panels</b> Dr. Andrew So, Red Facade Consultants Limited	7
<b>Wind Directionality effects on Design Wind Pressures of Hong Kong Buildings</b> Professor C. W. Li, Hong Kong Polytechnic University	25
<b>Design and implementation of Curtain Wall System</b> Mr. Johnny Choi, Permasteelisa Hong Kong Limited	35
<b>Wind Effect on Pedestrians</b> Ir Dr. Johnny Yu, Red Consultants Ltd	46
<b>Mechanics for plate buckling in thin-walled metal structures</b> Ir Professor K. F. Chung, Hong Kong Polytechnic University	83
<b>Practice and testing of stone cladding in Hong Kong</b> Mr. J. Y. H. Yu, Facade Tech Laboratory Limited	100
<b>Local buckling and shift of effective centroid of slender sections</b> Dr. Ben Young, Hong Kong University	116
<b>Product Certification of Heat Soaked Tempered Glass to PNAP 239 and EN14179-1</b> Ir C. K. Cheung, HOKLAS	130
<b>Basic structural design considerations and properties of glass and aluminum structures</b> Ir Professor S. L. Chan, Hong Kong Polytechnic University	141

## Foreword

Facade engineering has emerged to be an important branch of engineering during the past decade. These days, nearly all modern buildings have external facade that carries a wide range of functions. External facade must bear the external loads and transmit them to the main structure, transmit daylight to the interior but protect against glare, facilitate cooling and heating, prevent rain from penetrating into the building and provides a safe indoor environment. The materials of construction must be durable under the local environmental extremes. Last but not least, the facade projects the architectural image of the building and reflects the class of its Owner.

Facade engineering involves a vast number of materials and technologies that are evolving at a tremendous pace. It has become far more than merely the successful installation of the systems. It is now the successful integration of different technologies to form a seamless system that performs to the expectations of the society.

Despite the important role of external facade has in the success of building projects and that external facade often takes up a large proportion of the total building construction cost, the design and construction of external facade have often been overlooked by building professionals in the past.

This symposium draws on the expertise and experience from academic researches and practicing professionals in order to capitalize on the knowledge that has been distilled over the years on the design and construction of external facade. To this I would like to express my sincere gratitude to all the speakers, guest of honors and session chairmen for their contribution to this symposium. On behalf of the Facade group, we further wish that we could continue our contribution in advancing the facade industry and profession, and to promote greater awareness of this new field of engineering in the society.

Ir Dr. Andy Lee  
Chairman of Facade Group  
The Hong Kong Institute of Steel Construction

April 2006