NANYANG TECHNOLOGICAL UNIVERSITY

INTERNATIONAL SYMPOSIUM
ON
ADVANCES IN STEEL AND COMPOSITE STRUCTURES

7 PDUs
(To be confirmed)

Lecture Theatre No. 7
North Academic Complex, NTU
19 May 2006 (8.30 am – 5.30 pm)

Organized by:
Centre for Advanced Construction Studies
School of Civil and Environmental Engineering
Nanyang Technological University (NTU)

Supported by:
Building and Construction Authority
Singapore Structural Steel Society

Sponsored by:
Corus International Asia
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About the International Symposium

Advances in steel and composite structures are important to many practicing engineers due to the potentially huge demand for infrastructural developments in Singapore and the region over the next decade. Steel and composite construction is very often adopted in high-rise buildings, long-span bridges and roof structures due to its speed and ease of construction, inherent ductility, and structural efficiency with large strength-to-weight ratios as well as large flexural rigidities against instability and serviceability problems. It is important for engineers to keep abreast with its latest innovations and technical developments to maintain your competitiveness in this region. This international symposium provides a technical forum for the dissemination of recent advances in steel and composite construction technology. It is also an excellent opportunity for interaction with the experts who will present their latest research findings and share their invaluable experiences with you.

Symposium Programme

0830 hrs ***Registration***

0900 hrs ***Welcome*** *by Director, Centre for Advanced Construction Studies, NTU*

0915 hrs ***Recent Advances in Design and Construction of Composite Beams*** *by Professor Chung Kwok-Fai, Hong Kong Polytechnic University, Hong Kong*

Two and three dimensional non-linear finite element models of simply supported and continuous composite beams are established. Shear connectors are modelled as a series of horizontal and vertical springs, and nonlinear load slippage curves with different flexibility and ductility are incorporated in the models. After careful calibration against test data, finite element studies of simply supported composite beams under sagging and hogging moments as well as continuous composite beams exhibiting moment re-distribution are presented. The proposed numerical models are considered to be simple enough and yet effective tools to assess the structural performance of composite beams with practical geometrical configurations and loading conditions. Engineers are strongly encouraged to employ these models in their practical design work to exploit the full advantages offered by composite construction.

0955 hrs ***Advances in Steel and Composite Structures in Australia: Applications, Design and Research*** *by Professor Brian Uy, University of Wollongong, Australia*

Some of the more innovative uses of composite construction in the Australian construction industry include the use of high strength steel in composite slabs, thin-walled concrete filled steel columns and very large span steel-concrete composite beams. In addition, the use of composite trusses has also been evident in a few recent high profile projects. The use of high strength structural steel has been predominately for use in columns and trusses in tall buildings and the recent use of high strength steel in trusses has been undertaken with very significant benefits. The innovative applications of steel and composite structures in the Australian construction sector will be highlighted; in particular, a selection of case studies will be presented to elucidate the significant innovations that have galvanized much of the research efforts over the last decade. Previous and ongoing research to deal with the application of these innovations and the current state of play in terms of design standards for steel and steel-concrete composite structures will also be highlighted.

1035 hrs ***Q & A Session***

1045 hrs **Morning Refreshment Break**

1100 hrs ***Fire Performance of Concrete-Filled Steel Tubular Columns*** *by Professor Han Lin-Hai, Tsinghua University, Beijing, China*

The fire resistance, residual strength, seismic behavior and structural repair of concrete-filled steel tubular (CFST) columns after exposure to fire are presented. Both theoretical and experimental studies have been carried out. Some new research work on concrete-filled columns with emphasis on fire resistance and post-fire behaviors is summarized. The fire protection methods used in several actual high-rise buildings with CFST columns are also introduced.

1140 hrs ***Novel Sandwich Composite Structures*** *by Professor Richard JY Liew, National University of Singapore*

Sandwich composite structure is gaining ground in wide scopes of applications. If a structure is subjected to significant bending moment, cyclic loading and potential large impact loading, it will find steel-concrete-steel sandwich system an appealing alternative. This presentation describes a novel sandwich composite structure which can be utilized in the civil and offshore engineering applications. Various aspects including the structural behavior under impact loading, shear connectors and interfacial bonding strength between steel face plate and concrete core will be presented.

1220 hrs ***Q & A Session***

1230 hrs **Buffet Lunch**

1330 hrs ***Practice of Fire Safety Evaluation and Design of Steel Structures in China*** *by Professor Li Guo-Qiang, Tongji University, Shanghai, China*

The Chinese Code on fire safety design of steel building structures was developed to prevent collapse, ensure safe evacuation of its occupants and reduce the repair cost to the structure damaged by fire. The main contents of the Code is presented including the fire duration requirements and fundamental requirements on fire safety design of steel components, temperature increase of atmosphere and components in fire, loading effect and capacity of the various components in fire and procedure for fire-resistant design of steel components. The analytical approach employed in the Code and the effectiveness of the Code is validated through experiments and application to various actual steel buildings in practice.

1410 hrs ***Ductility of Steel and Composite Beams under Fire Conditions*** *by Professor Tan Kang-Hai, Nanyang Technological University*

The Cardington tests on steel and composite structures under simulated fire conditions have significantly improved the understanding of structural behavior at elevated temperatures. However, some issues remain relatively obscure. At several locations, the beams near to the beam-column junction deformed extensively in the form of local buckles, or shear buckles, or a mixture of the two. This provides the basic motivation for the research work to better understand the basic mechanisms that cause such form of localized deformation. This is important as the sections are hot-rolled sections which by conventional wisdom should not exhibit this form of local buckling. The occurrence of local buckling has direct bearing on the rotational capacity of steel and composite beams. The experimental, numerical and analytical works to investigate the shear bucking, local buckling and lateral torsional buckling mode that may impinge on the full limit of rotational capacity available at ambient temperature are presented. As this has not been addressed sufficiently in the current EC3 Part 1.2 design code, engineers are alerted to such failure modes and how to deal with such issue.

1450 hrs ***Design and Behavior of Cold-Formed Stainless Steel Tubular Structures*** *by Professor Ben Young, The University of Hong Kong*

The findings of a series of research projects on cold-formed stainless steel tubular structures are presented. The tubular structures included circular, square and rectangular hollow sections subjected to axial compression, bending and web crippling. The stainless steel of austenitic stainless steel type 304, high strength austenitic (HSA) and duplex were investigated. The investigation focused on the design and behaviour of stainless steel tubular members. The test strengths were compared with design strengths calculated using the American, Australian/New Zealand and European specifications for cold-formed stainless steel structures. Design equations for cold-formed stainless steel tubular members have been proposed.

1530 hrs ***Q & A Session***

1545 hrs **Afternoon Refreshment Break**

1600 hrs ***Residual Strength and Risk Assessment of Damaged Steel Structures*** *by Professor Lie Seng-Tjhen, Nanyang Technological University*

The acceptance level of cracks or defects present in welded structures makes the study of structural integrity an important subject. There have been considerable efforts made in this field of research for the past decades, resulting in several theories describing the behaviour of such structures containing cracks or defects. The most widespread and successful assessment approach is the failure assessment diagram (FAD) approach. This approach simplifies the treatment of a structure containing defects by bypassing the post yield fracture mechanics theories. It assumes the failure occurs by one of the two mechanisms. The first is the fracture failure under conditions where linear elastic fracture mechanics (LEFM) can adequately describe the behaviour. The second is the ultimate plastic collapse of the structure taking account of the presence of the crack. An interpolation curve is then constructed to connect the two assessment lines. Based on this approach, API RP579, BS7910 and R6 codes of practice give guidance for assessing the acceptability of defects in these welded structures.

1640 hrs ***Some Key Aspects of Steel Connection Design*** *by Professor Chiew Sing-Ping, Nanyang Technological University*

Steel connection design is generally more complex and its design rules more easily misinterpreted compared to member design. However, connection behavior and detailing are important and they affect overall structural performance. Structural members seldom fail in a sudden manner but joints fail frequently in this manner. Most structural failures initiate from the connections as a result of poor detailing in the joints. Four connection design cases, namely the strut-waler connection, overlap rectangular hollow section tubular K-joint, plate girder end post and stiffener and column web panel under shear are presented to highlight the importance of proper and safe connection design.

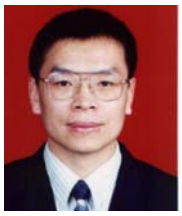
1720 hrs ***Q&A Session***

1730 hrs ***Concluding Remarks & Adjournment***

CVs of Symposium Speakers

Chiew Sing-Ping is an Associate Professor in the School of Civil and Environmental Engineering, NTU. He is a Past President of the Singapore Structural Steel Society, Council Member of the Institution of Engineers, Singapore and Vice-Chairman of the Singapore Division of the Institution of Structural Engineers. He has served as consultant to external organizations and currently a member of the panel of expert advisors of the Land Transport Authority. His major areas of research interest are in structural stability, tubular construction, steel and composite structures, and he has published more than 80 technical papers in various journals and conferences. He received the Merit and Distinguished Awards from the National Standards Council of Singapore in 1995 and 1997 respectively for his contribution to the national standardization programmes.

Chung Kwok-Fai is a Professor in the Department of Civil and Structural Engineering, Hong Kong Polytechnic University, Hong Kong. He is a chartered structural engineer with established expertise in steel and composite design and construction in both UK and Hong Kong. He has published extensively on steel and composite construction in both research and professional journals including over 100 journal and conference papers and 5 SCI Design Guides on advanced steel and composite construction technology. He is also active in services to professional communities and serves both the Hong Kong Institution of Engineers and the Hong Kong Institution of Steel Construction in various capacities. He is a frequent speaker in various professional seminars and technical conferences.



Han Lin-Hai is a Professor of Structural Engineering in Tsinghua University, Beijing, China. He has published 38 refereed international journal papers and 40 refereed international conference papers. He is one of the outstanding Young Researchers awarded by the National Natural Science Foundation of China. He is widely consulted by the industry and government authorities on a wide range of structural engineering projects. He has played a leading role in drafting several designing codes on steel-concrete composite structures in China. His current research interests include steel-concrete composite and hybrid structures under different loadings, such as static, dynamic, fire, etc.

Li Guo-Qiang is a Professor of Structural Engineering in Tongji University, Shanghai, China. Serving as a Vice-Chairman for Chinese Association for Steel Construction and the Chairman for the Chinese Association for Fire Safety of Steel Construction, he concentrates his research on behavior and design of multi-storey steel buildings and fire-resistance of steel structures. He has published 8 books in Chinese and over 200 journal papers in Chinese and English relevant to his research topics.

Lie Seng-Tjhen is an Associate Professor in the School of Civil and Environmental Engineering, NTU. He obtained his BSc degree from University College London in 1978, his MSc/DIC from Imperial College London in 1979, and his PhD from University of Manchester in 1983. His specialized field of research and teaching is in steel structures. For the past 20 years, his main research interests has been consistently in the fatigue and fracture of on-shore and offshore tubular welded structures, analysis of welded structures containing cracks and defects using boundary/finite element methods and estimation of the ultimate strength of damaged welded joints. He is a Member of The Welding Institute in the UK, and he has published more than 100 conference and journal papers on numerical and experimental aspects of fatigue and fracture of welded structures. He also conducts lectures to Master of Science graduates in the Offshore Engineering programme at NTU.

Richard JY Liew is Associate Professor and Director of the Structural Engineering Programme in the Department of Civil Engineering at the National University of Singapore. He has authored four books and published more than 160 technical papers and book chapters related to stability analysis and design of frame structures, composite structures and lightweight space frame systems. He also authored more than 12 book chapters in engineering handbooks, design guide books and international/national standards. His main specialties are on high-rise steel buildings, large span structures, steel-concrete composite systems and fire safety design and forensic engineering of structures. He is a Chartered Engineer (CEng), Member of the Institution of Structural Engineers (MIStructE) and a Professional Engineer in Singapore. He is active professionally by providing advisory services and organizing advanced courses. He is an expert in international codes of practices including Europe and Asia. He served in the editorial boards of five renowned journals related to steel and composite structures.

Tan Kang-Hai is an Associate Professor in the School of Civil and Environmental Engineering, NTU. Prior to joining NTU, he worked with Ove Arup & Partners, UK. He won the Institution of Structural Engineers' Henry Adams Award for original research conducted on structural sandwich panel. He has written over 60 international journal papers on a fairly wide range of topics, ranging from fire resistance analysis and testing of steel and composite members, heat transfer through protected or composite steel members, structural sandwich panels and strut-and-tie modelling of concrete structures. As Principal Investigator, he has obtained research grants from the Ministry of Education, Defence Science Technology Agency, Building Construction Authority and university grants totalling over S$2.5 million. He is a member of Engineering and Physical Sciences Research Council (EPSRC) Peer Review College, the main source of advice for the UK government funds of around £500m. He received a Merit Award from Standards Council of Singapore. He has been in the technical committees for both prescriptive and performance-based building fire codes in Singapore. He is also one of 3 external panel members for the selection of Fire Safety Engineers in Singapore.

Brian Uy is a Professor of Structural Engineering in Steel Structures and Head of the School of Civil, Mining and Environmental Engineering at the University of Wollongong, Australia. He has been involved in research in steel and steel-concrete composite structures for over fifteen years and he has published more than 200 articles. Much of his research has been underpinned by competitive grant research funding from the Australian Research Council and industry. Brian currently serves on the Australian Standards Committee for Composite Structures (BD 32), the AISC Task Committee 5 on Composite Construction, ASCE Technical Committee on Composite Construction and the IABSE Working Commission 2 for Steel, Timber and Composite Structures. He also holds roles on the Editorial Board for seven major international journals in steel and composite structures. Brian also served as an International Advisor to the Limit States Design version of the Hong Kong Steel Code, released in September 2005. He is a chartered civil and structural engineer in Australia, the UK and the USA.

Ben Young is an Associate Professor in the Department of Civil Engineering, The University of Hong Kong. He received his BSc, BEng and PhD degrees from the University of Sydney in 1991, 1993 and 1998 respectively. Prior to joining the University of Hong Kong in January 2005, he worked in Nanyang Technological University, Singapore and the Hong Kong University of Science and Technology as Assistant Professor for 6 years. He was one of the code writers of the "Hong Kong Code of Practice for the Structural Use of Steel" for the Buildings Department, Hong Kong Government. He was also involved in the development of the Singapore Standard on the "Cold-formed Welded Steel Structural Hollow Sections" for the Productivity and Standards Board of the Singapore Government. His research interests include cold-formed steel structures, testing and design of steel structures, stainless steel structures, aluminium structures, structural stability and fire resistance of metal structures

Symposium Details

Date	19 May 2006, Friday	**Time**	8.30 am – 5.30 pm
Venue	Lecture Theatre 7 (LT7) Level 2, North Academic Complex Nanyang Technological University		
Fees	**S$80/- per person** • Fees include 5% GST, refreshments, lunch and bound symposium proceedings. • Please send the registration form with payment at least 10 working days before the commencement of the short course. • There will be no refund of fees for any cancellation made. However, a replacement can be made at no extra charge. • Registration will only be confirmed upon the receipt of the payment.		

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