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16th East Asia-Pacific Conference on Structural Engineering and Construction
Brisbane, Australia

2019.12.03-06

The 16th East Asia-Pacific Conference on Structural Engineering and Construction (EASEC 16) was successfully held in Brisbane, Australia from 3 to 6 December 2019. Prof. K. F. Chung, Dr. H. C. Ho, Dr. Y. F. Hu, Mr. M. Xiao and Ms. Y. B. Guo were invited to present latest research work of CNERC in a Technical Session on "Effective Use of High Strength S690 Steels in Construction" of the Conference.

EASEC was firstly held in Bangkok during 15-17 January, 1986. Thereafter, the Conference has been held in various countries and regions. The multi-disciplinary theme of EASEC-16 provided an excellent forum for professional engineers, academics and researchers to present recent research and development in structural engineering and construction. It was also a great platform for participants to renew friendships and establish new network and collaboration.

The following world renowned researchers were invited as keynote speakers of EASEC 16:

- Prof. J. N. Reddy
  Texas A&M University, U.S.A.
- Prof. Robert E. Melchers
  The University of Newcastle, Australia
- Prof. Jose L. Torero
  University College London, U.K.
- Prof. Yozo Fujino
  University of Tokyo, Japan.
- Prof. Ser Tong Quek
  National University of Singapore
- Prof. James Ding Jiemin
  Tongji Univeristy, China.
- Prof. D. A. Nethercot
  Imperial College London, U.K.
- Prof. Mark Bradford
  UNSW Sydney, Australua

Prof. Y. B. Yang and Prof. C. M. Wang delivering welcoming speech at the opening ceremony.

A group photo of all conference participants

Prof. J. N. Reddy

Prof. Y. Fujino

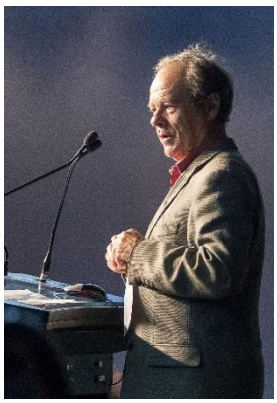
Prof. J. L. Torero

Prof. R. E. Melchers

Prof. S. T. Quek

Prof. J. M. Ding

Prof. D. A. Nethercot



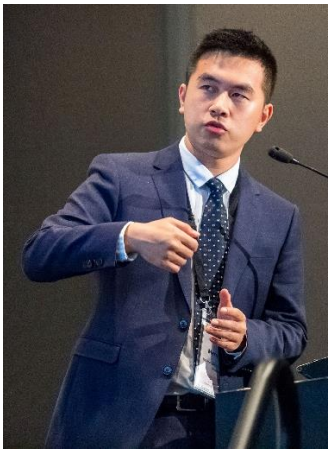
Prof. M. Bradford

On the afternoon of 4th December 2019, a special session on "Effective Use of High Strength S690 Steels in Construction" was held, and the CNERC delegates presented a total of 5 technical papers, and received good peer recognition from conference participants.

- Structural Adequacy of High Strength S690 Welded Sections with Various Heat Energy Input
  by Prof. K. F. Chung
- Correction of True Stress Strain Curves of Cylindrical and Funnel Shaped S690 Tensile Coupons After Onset of Necking
  by Dr. H. C. Ho
- Investigations into Compression Behaviour of T-joints Between S690 Circular Hollow Sections Under Brace Axial Forces
  by Dr. Y. F. Hu
- Structural Behaviour of S690 High Strength SHS Columns Under Axial Compression
  by Mr. M. Xiao
- Hysteretic Behaviour of S690 Steel Plates and Welded Sections Under Cyclic Tests with Various Loading Protocols
  by Ms. Y. B. Guo

Presentations were delivered by

Prof. K. F. Chung and Dr. H. C. Ho


Presentations were delivered by:

Dr. Y. F. Hu, Mr. M. Xiao and Ms. Y. B. Guo

Prof. W. H. Fok, Prof. K. F. Chung,
Prof. C. M. Wang and Dr. H. C. Ho

Prof. K. F. Chung and Prof. J. L. Torero

CNERC delegates with Prof. S. Kitipornchai

CNERC delegates with Prof. D. A. Nethercot

CNERC delegates with Prof. C. M. Wang and Prof. Johnny Ho

Abstract of CNERC Presentations

Paper Title: **Compression Tests on High Strength S690 Welded Sections with Various Heat Energy Input**

Author: **K. F. Chung, H. C. Ho, X. Liu, K. Wang and Y. F. Hu**

Abstract:

Over the past twenty years, conflicting research findings have been reported on mechanical properties of high strength S690 welded sections due to different welding procedures and parameters adopted during welding. In order to quantify adverse effects on mechanical properties of these S690 steel welded sections, a total of 12 spliced S690 welded H-sections with different heat input energy adopted in the welding processes have been conducted to examine their deformation characteristics under compression, in particular, their cross section resistances. It is demonstrated that by a proper control on the heat input energy during welding, it is possible to control or even eliminate any reduction to the mechanical properties of these spliced S690 welded H-sections under compression.

Keywords: *High strength steels; Welding; Welded H-sections; Heat input energy.*

Paper Title: **Transformation Rules on Engineering Stress Strain Curves of S690 Funnel-shaped Coupons**

Author: **H. C. Ho, K. F. Chung and Y. B. Guo**

Abstract:

Funnel-shaped coupons are widely adopted for various steels low cycle high strain cyclic tests to investigate hysteretic behaviour of structural steels under cyclic actions in order to avoid plastic axial buckling. However, a technical problem is induced that the engineering stress strain curves obtained from these funnel-shaped coupons are not comparable to those curves obtained from standard cylindrical coupons. Hence, it is essential to correlate the engineering stress-strain characteristics obtained from monotonic tensile tests using these two types of coupons. This paper presents a theoretical study into such a correlation on the stress strain characteristics between the funnel-shaped coupons and the standard cylindrical coupons. A series of transformation formulae are proposed for various deformation ranges, namely i) Elastic range; ii) Plateau range; iii) Hardening range and iv) Necking range. The proposed transformation formulae have been calibrated with tensile test results and FE models of the S690 funnel-shaped coupons. These test results provide strong evidence to the effectiveness of the proposed transformation rules for subsequent investigations into hysteretic behaviour of steel materials.

Keywords: *Tensile tests; Funnel-shaped coupons; S690 steels; Stress-strain characteristics.*

Paper Title: **Investigations into Compression Behaviour of T-joints Between S690 Circular Hollow Sections under Brace Axial Force**

Author: **Y. F. Hu and K. F. Chung**

Abstract:

This paper presents an experimental and numerical investigation into the compression behaviour of T-joints between S690 cold-formed circular hollow sections (CFCHS). A total of four T-joints between S690 CFCHS were tested under axial compression in brace members. A typical failure mode was observed that all joints failed in an interaction between the local plastification of the chords and overall plastic bending of the chords. Three dimensional finite element models with geometrical and material non-linearity have been established and verified after calibration against test results. Both measured geometrical dimensions and material properties of these CFCHS are incorporated into the proposed models. Both the experimental and the numerical results are compared with design resistances obtained from existing design codes, including EN 1993-1-8 and CIDECT Design Guide 1. The investigation will facilitate development of efficient design rules for resistances of T-joints between S690 CFCHS under brace axial compression.

Keywords: *High strength steel; T-joints; Circular hollow sections; Axial compression.*

Paper Title: **Structural Behaviour of High Strength S690 Cold-formed Structural Hollow Sections under Compression**

Author: **M. Xiao and K. F. Chung**

Abstract:

High strength steels are considered as efficient constructional materials due to their high strength-to-self-weight ratios. Over the past years, a large number of investigations into structural members made of high strength steels have proved that they meet various design requirements in both strength and ductility under various actions. However, the fabrication processes of these high strength steel sections are quite different from those made of normal strength steels, in particular, the presence of residual stresses due to both cold-forming and welding. In the current study, a total of eight cold-formed structural hollow sections (CFSHS) with different dimensions and fabrication methods are tested. The structural performance of these sections is examined with a total of 8 stocky column tests and 16 slender column tests. After comparing these measured resistances with the predicted resistances according to EN 1993-1-1, further works on improvements to the design method are suggested.

Keywords: *High strength steels; Cold-formed sections; Classification of cross-sections; Section resistances; Member resistances.*

Paper Title: **Structural Responses of High Strength S690 Welded Sections under Different Cyclic Actions**

Author: **Y.B. Guo, H. C. Ho, M. Xiao and K. F. Chung**

Abstract:

Structural engineers are constantly looking for high strength constructional materials as they face huge challenges in providing structural solutions to build heavily loaded structures, such as high-rise buildings and long span bridges. Applications of high strength S690 steels to building structures are very attractive owing to their high strength to self-weight ratios which often provide significant savings in costs and time. However, there are concerns on mechanical properties of welded S690 members, in particular, in both strength and ductility, and there is a lack of technical guidance on how to assess any adverse effect on these mechanical properties. This paper presents an experimental investigation into structural responses of S690 steel plates and welded sections under cyclic actions with both constant and varying strain amplitudes, and comparison on cyclic deformation characteristics of both steel plates and their welded sections is presented.

Keywords: *High strength steels; Welded sections; Cyclic tests; Hysteretic behaviour; Ductility.*