



FEATURE STORY

Prof. K. F. Chung bestowed a Medal of Honour for contributions to engineering in Hong Kong

Prof. Kwok-fai Chung, Director of Chinese National Engineering Research Centre for Steel Construction (Hong Kong Branch) and Professor in Department of Civil and Environmental Engineering at The Hong Kong Polytechnic University, has been bestowed a Medal of Honour which was presented by Mr. John Lee, Chief Executive of the Hong Kong Special Administrative Region at the Government House on 25 November for his exemplary contribution to engineering in Hong Kong.



Prof. Chung received the Medal of Honour as presented by Mr. John Lee, Chief Executive of the Government of Hong Kong SAR

Prof. Chung has successfully conducted research and technology transfer on high strength S690 steel structures. The high strength S690 steel is applicable in long span foot bridges and roof structures, highways noise closure, steel piles supporting heavily loaded structures, and supporting members in road bridges. This construction technology achieves significant savings in construction materials and time, manpower demand, and carbon footprints.



Prof. Chung was also honored with "National Award for Excellence in Innovation" in May 2023 and "The HKIE Grand Award 2023 - Grand Prize on Innovative Application" in March 2023 for his significant contributions to the field of engineering.



A group photo taken at “The 2023 Honours and Awards Presentation Ceremony” held in the Government House on 25 November 2023. From left: Mr. Eddie Lam, Council Member of Construction Industry Council, Prof. K. F. Chung, Director of CNERC, Ir Ricky C.K. Lau, Permanent Secretary for Development (Works), Ms. Winnie W.Y. Ho, Secretary for Housing, Mr. Paul W.Y. Poon, Council Member of Hong Kong Baptist University and Mr. Rocky Poon, Council Member of Construction Industry Council.

NEWS

Showcase of CNERC research achievement in Hong Kong Science and Technology Parks

Prof. Chung was invited by the Government of Hong Kong Special Administration Region to present our work on "effective use of high strength S690 steel in construction" to President Xi Jinping at the Hong Kong Science and Technology Parks on 30 June 2022. It was part of the official celebration to the 25th Anniversary of establishment of the Hong Kong Special Administration Region to showcase innovation and technology achievements of Hong Kong.



During fabrication of the Double Arch Steel Bridge of the Cross Bay Link in Tseung Kwan O, a total of 4,400 tons of the high strength S690 steel were used, leading to a reduction of about 11,200 tons of eCO₂ for the construction project.



CNERC test specimens on typical welded sections of 50 and 70 mm thick S690 steel plates were exhibited in the Experience Center of HKSTP since May 2023

NEWS

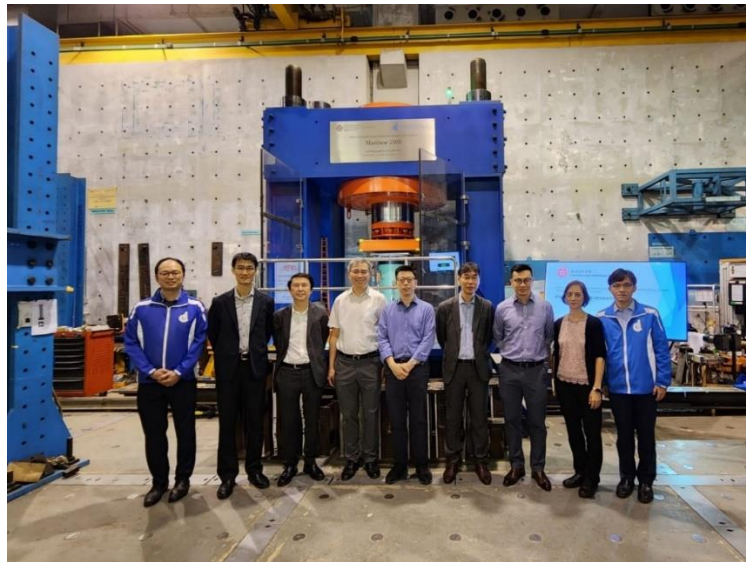
Geotechnical Engineering Office of the Government of Hong Kong SAR – Technical Meeting on “Effective Use of S690 socketed H-piles in Hong Kong”

Ir Dr. Raymond W. M. Cheung, Head of Geotechnical Engineering Office (GEO), led his team to visit CNERC on 25 September 2023. The Delegation Team of GEO consisted of:

- Ir Dr. Raymond Cheung, Head of GEO
- Ir Sammy Cheug, Deputy Head of GEO (Island)
- Ir Thomas Hui, Deputy Head of GEO (Landslip Preventive Measures)
- Ir Lawrence Shum, Deputy Head of GEO (Mainland)

The Geotechnical Engineering Office is one of seven constituent offices of the Civil Engineering and Development Department of the Government of Hong Kong SAR.

The GEO Delegation Team visited the Structural Engineering Research Laboratory of the PolyU, and inspected various research and testing capabilities for large scale structural tests. It was also introduced to a number of research and development projects on effective use of high strength S690 and S960 steel in construction.



Group photo of GEO Delegation Team and CNERC representatives

In addition, Dr. Andy Y. F. Leung, Laboratory-in-charge of CNERC Laboratory for Soil-structure Interaction with High Performance Construction Materials made a presentation entitled “Effective Use of S690 socketed H-piles in Hong Kong” to the GEO Delegation Team to explore technical collaboration between CNERC and GEO.

Collaborative investigation on the following topics will be explored:

- Load transfer mechanisms in S690 socketed H-piles through laboratory and site tests
- Measurement on soil-grout and rock-grout shaft resistances in piles
- Engineering data for enhancement to the current practice on foundation design

NEWS

13th Pacific Structural Steel Conference & Annual Conference of China Steel Construction Society 2023

The 13th Pacific Structural Steel Conference (PSSC 2022) together with the Annual Conference of China Steel Construction Society 2023 were held from 27 to 29 October in Chengdu, China. Prof. K. F. Chung, Director of CNERC, Dr. H. C. Ho, Deputy Executive Secretary, Dr. Y. F. Hu, Research Assistant Professor, Dr. P. F. Men, and PhD candidates Ms. M. F. Zhu, Ms. M. F. Li, and Ms. Y. Ding, were invited to attend this Conference. During this two-day event, CNERC representatives made a total of five technical presentations to report various research achievements in high strength steel and composite structures. They had also extensive technical discussions and exchanges with world-renowned professors and researchers.



Prof. Chung and Dr. Hu with
Academician Prof. X. H. Zhou and his research team from Chongqing University



Group photo of CNERC delegates

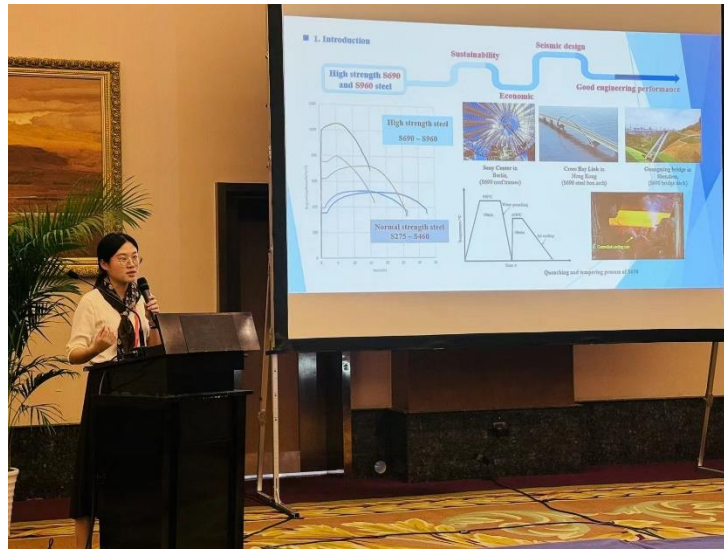
Five technical presentations were presented by CNERC delegation during the PSSC 2022 Conference on 28 October 2023 as follows:



“A Comparative Study on Hysteretic Characteristic of S355 and S690 Welded Sections under Cyclic Actions with Constant Magnitudes” by Prof. K.F. Chung



“Experimental Study into Stub Circular Concrete-filled Steel Tubes under Uniaxial Compression” by Dr. P. F. Men



“Experimental Investigation into Compression Resistance of S690 and S960 Box Sections under a Controlled Welding Process” by Ms. M. F. Zhu



“Determination of True Stress-strain Relationship of High Strength S690 Steel using Extended Bridgman's Method” by Ms. M. F. Li



“Structural Behaviour of High Strength Bolted Shear Connections for Simple On-site Assembly of Composite Beams” by Ms. Y. Ding

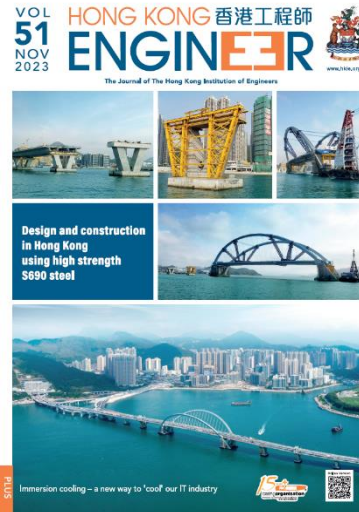
In the morning of 29 October 2023, CNERC delegates attended the Opening Ceremony of the Annual Conference of the China Steel Construction Society 2023. The Opening Ceremony was hosted by Mr. Y. Liu, Executive Vice President while Academician Prof. Q. R. Yue, President made a report on various work of the Society conducted in 2023 together with key results and achievements. An outlook for the work and goals of the Society for 2024 was also presented.



A photo taken during the Annual Conference of China Steel Construction Society 2023

NEWS

Cover Story of “The Journal of The Hong Kong Institution of Engineers” (Vol. 51, Nov 2023)

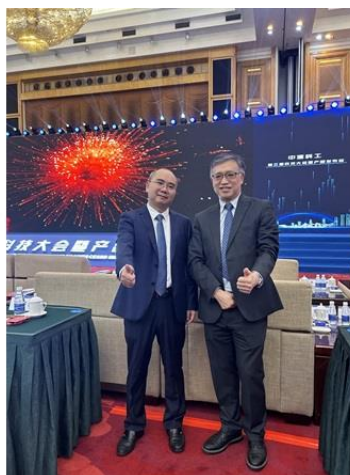


The research work of CNERC on “Design and construction in Hong Kong using high strength S690 steel” was published as Cover Story of “The Journal of The Hong Kong Institution of Engineers” (Vol. 51, Nov 2023). For details, please refer to: https://www.polyu.edu.hk/cnercsteel/-/media/department/cnercsteel/events/2023/hkie-journal-cover-story_nov_2023_en.pdf

NEWS

Third Technology Conference of China Construction Science and Industry Corporation Ltd.

Prof. Chung was invited by China Construction Steel Structure Co., Ltd. to attend the Third Technology Conference of China Construction Science and Industry Corporation Ltd. in Shenzhen on 3 November 2023. Prof. Chung discussed with Mr. L. Y. Xia, General Manager of CSCEC STEEL, about a collaboration in high strength steel industry chain for the Greater Bay Area.



NEWS

The 11th International Conference on Advances in Steel Structures

The International Conference on Advances in Steel Structure is a distinguished international conference series initiated in 1996 at The Hong Kong Polytechnic University, and it is organised every two to three years in different parts of the world. Previous conferences were held in Hong Kong, Shanghai, Singapore, Nanjing, Lisbon, and Chengdu. This conference is intended to provide a forum for researchers and professionals to discuss and disseminate recent advances in analysis, behaviour, design and construction of steel and composite steel-concrete structures. The 11th International Conference on Advances in Steel Structures (ICASS'2023) have been held from 5 to 7 December in Kuching, Sarawak, Malaysia. Dr. H. C. Ho, Deputy Executive Secretary, Dr. P. F. Men, and PhD candidates Ms. M. F. Li, and Ms. Y. Ding, attended the Conference, and made various technical presentations on recent research and development work of CNERC.



Main venue scene of ICASS'2023



Group photo of keynote speakers



Group photo of CNERC delegates

During this two-day conference, delegates from CNERC gave a total of three technical presentations to report CNERC's research achievements in high strength steel and composite steel-concrete structures through experimental and numerical investigations. They also had thorough communications with conference delegates, and discussed frontier technologies and challenges of steel construction.



“Experimental Study into Stub Square Concrete-filled Steel Tubes under Uniaxial Compression”
by Dr. P. F. Men



“Ductile Fracture Behaviour of S690 and S960 High Strength Steels under Monotonic Tensile Actions”
by Ms. M. F. Li



“Structural Behaviour of High-strength Bolted Shear Connections for Simple On-site Assembly of Composite Beams” by Ms. Y. Ding

VISITS



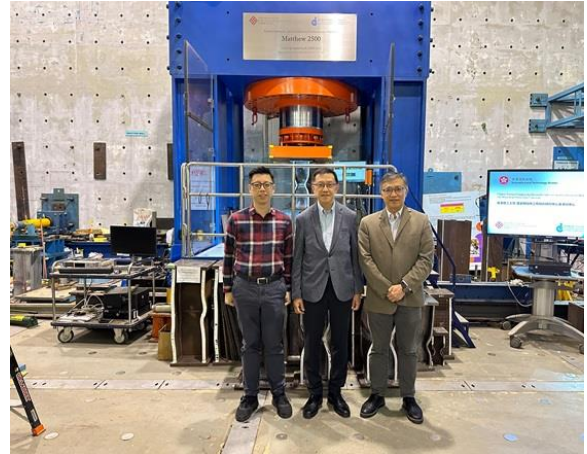
Prof. Jeffrey Packer, Fellow of the Canadian Academy of Engineering, The University of Toronto visited CNERC on 12 October 2023, and gave a presentation on “Research and Development Priorities for Hollow Structural Sections in North America”.



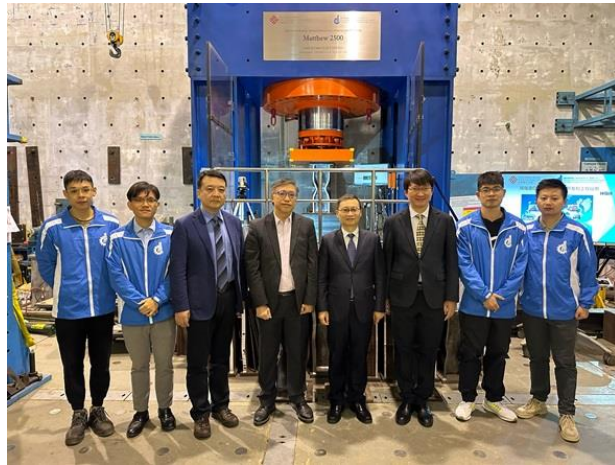
Mr. Matt Byatt, President, and Ms. Yasmin Becker, Chief Executive Officer of The Institution of Structural Engineers, UK and Prof. James C.W. Lau, Chairman of Hong Kong Region visited the Structural Engineering Research Laboratory at PolyU on 1 November 2023.



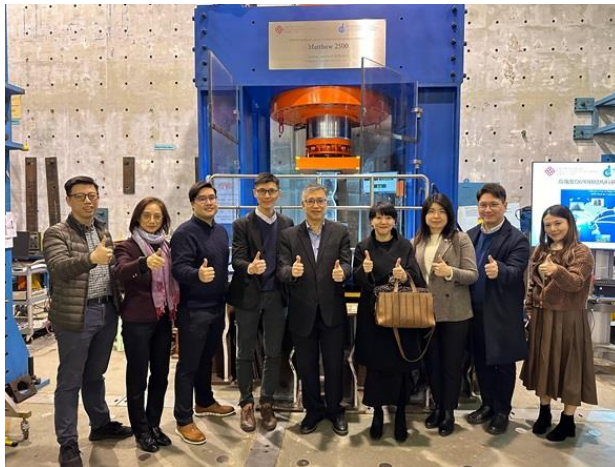
Prof. Michael Anson, Emeritus Professor and his wife, Mrs. Elaine Anson visited CNERC on 30 November 2023.



Ir Edwin Tong, Council Member of Construction Industry Council visited Structural Engineering Research Laboratory at PolyU and CNERC on 4 December 2023.



Academician J. C. Han, President of Harbin Institute of Technology and a group of representatives visited the Structural Engineering Research Laboratory at PolyU and CNERC on 7 December 2023.



Mrs. Susanne Wong, Principal Assistant Secretary (Works) of Development Bureau and Mr. George Wong, Senior Manager - Industry Development of Construction Industry Council together with their colleagues visited the Structural Engineering Research Laboratory at PolyU and CNERC on 20 December 2023.

CNERC RESEARCH

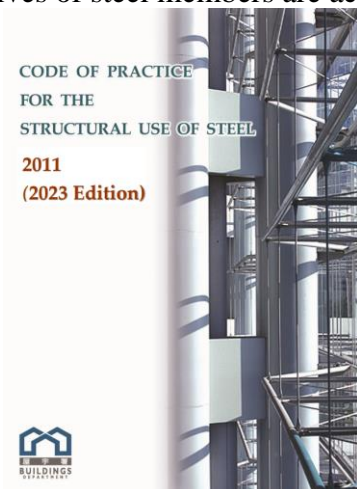
The CNERC Newsletter incorporates research articles from our researchers in aim to share the latest findings in their research work. Should there be any question or comment in these research works, you may send an email to: cnerc.steel@polyu.edu.hk or contact the researchers directly.

The researchers' contact information is available right at the end of each article.

RESEARCH

Evaluation of Atmospheric Corrosivity with ACM sensors

The atmospheric corrosivity of exposed steelwork is a significant concern in Hong Kong. According to Code of Practice for the Structural Use of Steel 2011 (2023 Edition) issued by The Buildings Department of the Government of Hong Kong SAR, the service life of any buildings should be at least 50 years [1]. Quantifying atmospheric corrosivity is crucial to ensure the design service lives of steel members are achieved.



1.2.5 Limit State Design

Limit state design considers the functional limits of strength, stability and serviceability of both single structural elements and the structure as a whole. See clause 2.2.

Ultimate limit states consider the safety of the whole or part of the structure. Examples of ultimate limit states are **strength** including yielding, rupture, buckling and forming a mechanism, **stability** against overturning, sliding, uplift and overall lateral or torsional sway buckling, **fire** leading to deterioration of mechanical properties at elevated temperatures and thermal actions, **fracture** caused by brittle material behaviour or by fatigue.

Serviceability limit states correspond to limits beyond which specified in-service criteria are no longer met. Examples are **deflection**, wind-induced **vibration**, human-induced **vibration** and **durability**.

1.2.6 Economy

Whilst the ultimate limit state capacities and resistances given in the Code are to be regarded as limiting values, the purpose of a design should be to reach these limits in as many parts of the structure as possible, to adopt a layout such that maximum structural efficiency is attained and to rationalize the steel member sizes and details in order to obtain the optimum combination of materials and workmanship, consistent with the overall requirements of the structure.

1.2.7 Design working life

The Code assumes a design working life of 50 years. This is considered to be appropriate for normal buildings and other common structures. The design working life should be clearly identified in the design documentation.

Where a design working life of more than 50 years is required, particular requirements on design and on quality control of materials and construction will need special consideration and specification.

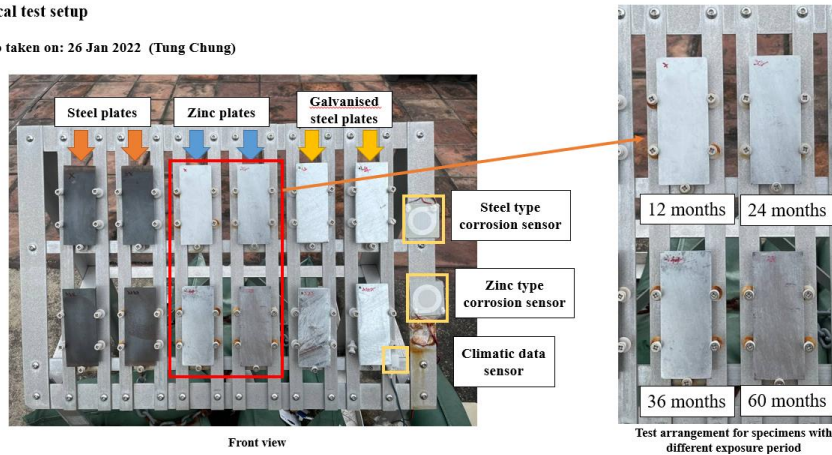
The objective of this project is to investigate the atmospheric corrosivity of exposed structural steelwork in Hong Kong and develop an effective quality control scheme to achieve their design service lives. The research methods employed in this project include mass loss testing on exposed metallic plates and collection of real-time corrosion data using Atmospheric Corrosion Monitor (ACM) sensors.

To estimate the corrosion rate of steel and galvanized coatings in local environments, a 1-year atmospheric exposure test was conducted in five different sites of Hong Kong in accordance with ASTM G50-10. Mass loss measurements were taken on exposed metallic plates after the exposure test to calculate the corrosion rate of the samples. The measurements were calculated according to BS EN ISO 8407:2009 and BS EN ISO 8565:2011.

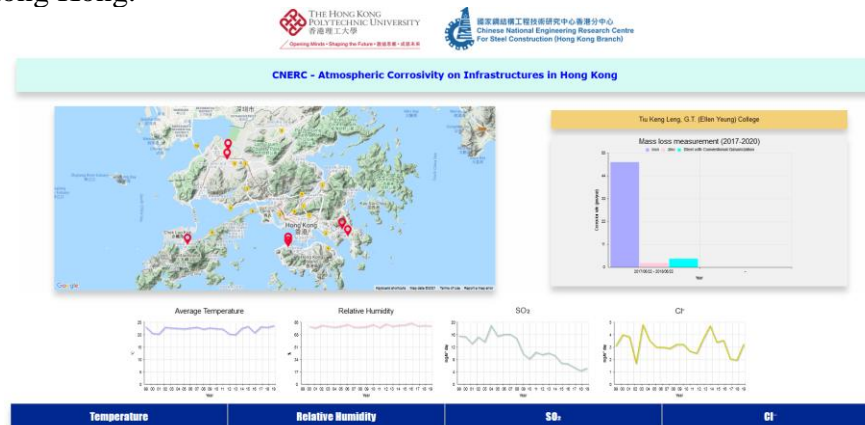
In addition to the mass loss testing, ACM sensors were used to collect real-time data on atmospheric corrosivity. The sensors can directly measure the corrosion current of metal electrochemically generated by environmental factors. Steel and zinc type ACM sensors were installed at five different test sites in Hong Kong to obtain real-time data on temperature, relative humidity, corrosion rate of steel, and corrosion rate of zinc. The measurements taken by the ACM sensors were calibrated against the mass loss measurement of the exposed metallic plates.

Typical test setup

Photo taken on: 26 Jan 2022 (Tung Chung)



Key findings of the project provide critical insights into the atmospheric corrosivity of exposed steelwork in Hong Kong and its influential climatic and environmental factors. The results also shed light on the atmospheric corrosion rates of bare steel and galvanized steel. In addition, an online corrosion map has been created to show the climatic data and corrosion rate of metals in various locations. This map will prove to be a useful tool in the design of structural steelwork in Hong Kong. In conclusion, this study contributes to the advancement of the understanding of atmospheric corrosivity and provides useful information for future design and maintenance of steel structures in Hong Kong.



Corrosion map (<https://www.hkcmsa.org/sensor/>)

[1] Buildings Department, the Government of Hong Kong SAR. (2023). Code of Practice for the Structural Use of Steel 2011 (2023 Edition). Retrieved April 4, 2023, from <https://www.bd.gov.hk/doc/en/resources/codes-and-references/code-and-design-manuals/SUOS2011.pdf>

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