

**Expert Committee of *Technical Group Standard* on  
“Design standard for structures using high-strength 690 to 960 MPa steel” of  
China Steel Construction Society  
2024.05.16**

CNERC was invited by China Steel Construction Society (CSCS) to draft a *Technical Group Standard* entitled “Design standard for structures using high strength 690 to 960 MPa steel” for the China Steel Construction Industry owing to the success of CNERC in receiving the Grand Award of the “CSCS Science and Technology Awards 2022”. This important initiative was endorsed by the China Steel Construction Society in December 2023, and the Standard was expected to be completed in 2025.

On 16 May 2024, the Expert Committee of the CSCS *Technical Group Standard* was officially established at The Hong Kong Polytechnic University with the following members:

**Principal drafters**

- Prof. K. F. CHUNG The Hong Kong Polytechnic University
- Prof. Yongjiu SHI Tsinghua University
- Dr. H. C. HO The Hong Kong Polytechnic University
- Dr. Huiyong BAN Tsinghua University
- Dr. Y. F. HU The Hong Kong Polytechnic University
- Prof. Michael C. H. YAM The Hong Kong Polytechnic University
- Prof. T. M. CHAN The Hong Kong Polytechnic University

**Experts - China**

- Prof. Fulin ZHOU Guangzhou University
- Prof. Ailin ZHANG Beijing University of Civil Engineering and Architecture
- Prof. Mingxuan HE China Baowu Steel Group Corp.
- Mr. Lijun WANG Beijing Long'an Huacheng Consulting Co., Ltd.
- Prof. Zhan WANG South China University of Technology
- Mr. Tie XI Hebei Jinxi Iron and Steel Group Co., Ltd.
- Mr. Baowei DANG China Construction Industry Association (Steel and Wooden Structures Branch)
- Mr. Zhipan ZENG Fujian Provincial Institute of Architectural Design and Research Co., Ltd.
- Prof. Yuyin WANG Harbin Institute of Technology

- Mr. Linyin XIA China State Construction Engineering Corporation
- Prof. Lu YANG Beijing University of Technology
- Prof. Fei XU Chongqing University
- Prof. Yanbo WANG Tongji University
- Prof. Ke KE Chongqing University
- Prof. Liang ZONG Tianjin University
- Prof. Xuanding WANG Chongqing University
- Prof. Mingxiang XIONG Guangzhou University
- Prof. Cheng CHEN Southwest Petroleum University
- Prof. Fangxin HU South China University of Technology
- Mr. Gaoyang YANG China State Construction Engineering Corp.
- Dr. Juan WANG CapitaLand Co., Ltd.

### **Experts – Hong Kong**

- Jun KAN China Road and Bridge Corp.
- Alex KWAN Asian Infrastructures Solution
- Xianjun DUAN Beijing City Construction Group
- H. Y. LEE Hong Kong Constructional Metal Structures Co., Ltd.
- C. F. CHAN Gammon
- K. L. WONG AECOM
- William LUK Chun Wo

### **Experts – Representatives of steel fabricators**

- L. F. MA Zhenhua Port Machinery Company
- L. Y. XIA China Construction Steel Structure
- J. L. LIU Jinqiang Steel Structure
- C. C. HAU Gammon
- Y. H. NG TTJ Singapore
- Patrick YAN Yau Sang

The First Meeting of the Expert Committee was held in the morning of 16 May 2024 at The Hong Kong Polytechnic University, and it was hosted by Prof. K. F. Chung, Director of CNERC, and Dr. Y.F. Hu, Research Assistant Professor of CNERC. A total of 28 experts from China and Hong Kong, and 6 representatives from steel fabricators from Shanghai, Shenzhen, Fuzhou, Hong Kong and Singapore were present.



Expert Committee of CSCS *Technical Group Standard*  
“Design standard for structures using high-strength 690 to 960 MPa steel”

Prof. K. F. Chung introduced the background of the Standard and its potential applications in construction in China. Key challenges in design philosophy and materials specifications during drafting of the Standard were also presented. A comprehensive comparison on structural design of high strength steel structures among GB 50017, JGJ/T 483 and EN 1993-1 was presented by Dr. Y.F. Hu, in particular, various design philosophy and rules as well as differences in material specifications of high strength steel. It should be noted that Prof. Y.J. Shi reported to the Expert Committee about the work of JGJ/T 483, and highlighted key achievements achieved in JGJ 483, and also subsequent development in structural steel design of high strength steel which were specified in GB/T 1591 and GB/T 19879. A number of experts also expressed their suggestions to the proposed scope and the proposed methodology of the Standard as follows:

- a) It is important to follow the design philosophy of “strong columns and weak beams” in seismic structural design of structures in China. One of the practical design approach is the use of elastic design of columns, and all these columns should use S690 steel columns. For beams, the use of S355 and S460 steel will be appropriate. Moreover, no high strength S690 steel should be adopted in energy dissipating zones in structural systems. Instead, S355 steel should be used.
- b) The Global Elastic Analysis approach is considered to be highly effective in structural design of high strength S690 steel structures. When compared with S355 steel, the use of S690 steel gives an increase in both yield strengths and section resistances with a factor of about 2.0. In order to mobilize the full moment resistances of typical I-sections through plastic section design, the moment resistances of these sections will be increased by a factor 1.15 to 1.20.

It is important to note that by adopting the use of high strength S690 steel through the Global Elastic Analysis approach, a significance increase in the section resistances is readily achieved.

This is straightforward, and non-controversial, and hence, the Global Elastic Analysis should be adopted for practical design immediately. Nevertheless, the use of the Global Plastic Analysis should also be examined, and its adoption should be explored once sufficient technological development has been taken place.

- c) In China, there is a requirement in all structural steel to possess a certain ductility in seismic resistant structures, and this requirement is specified as a limiting value for the yield to tensile strength ratio, i.e.  $f_y / f_u$ , to be equal to or smaller than 0.85. While this value is readily achieved in S355 steel, no existing high strength S690 steel is able to satisfy this requirement.

It should be noted that this requirement is generally considered to be a requirement on materials, and the ratio is not used in structural design at all in assessing seismic resistances of steel members and systems. It is considered to be rational to re-examine the significance of this ratio, and explore possibilities of increasing the value to 0.90, and even further to 0.95, as those values adopted in European steel material specifications EN 10025.

- d) Owing to the imminent requirement to provide seismic isolation to all new building structures in regions with Seismicity Levels 7 and 8 in China, this allows the use of high strength S690 steel in these seismic isolated structures readily.

In the afternoon, experts visited the Structural Engineering Research Laboratory of PolyU, and Welding Laboratories of CNERC.

By dusk, experts visited the Cross Bay Link in Tseung Kwan O both on a coach crossing the Double Arch Steel Bridge, and on foot from afar to see the beautiful structure of the Steel Bridge.



A group photo in front of the Cross Bay Link, Tseung Kwan O

A total of 4,400 tons S690QL high strength steel were used in the Steel Bridge. The project was completed in December 2023, and it was open to the public since then.

On 17 May 2024, a Technical Seminar entitled “*Effective Use of High Strength Steel S690 in Construction*” was held in a hotel in the TST East area by CNERC and Hong Kong Constructional Metal Structures Association. All the Mainland and the local experts and representatives of steel fabricators were also invited to attend the Technical Seminar. The event was supported by Development Bureau of the Government of Hong Kong SAR, and the Construction Industry Council.

The Technical Seminar was organized as a platform for to disseminate research findings and experiences on advanced construction technology of high strength S690 steel with special emphases on practical applications. It also served as a focal point for renowned engineers to share experiences in adopting high strength S690 steel in their construction projects. It was attended by about 250 engineers, 16 Experts from the Mainland China, 8 Experts from Hong Kong, and another 6 representatives from steel fabricators.

Ir Ricky C. K. Lau, Permanent Secretary for Development (Works) of the Government of Hong Kong SAR was invited as Guest of Honour to give an Opening Speech, and Prof. Christopher Chao, Vice President (Research & Innovation) of The Hong Kong Polytechnic University was invited to give a Welcoming Speech.



A photo of honorable guests: Hon. Andrew S. L. Lam, Hon. Duncan Chiu, Hon. Dr. W. K. Lo, Prof. K.F. Chung, Ir Ricky Lau, Prof. Chris Chao, Mr. C. S. Wai, and Ms. Clarice Yu



Honorable Guests and Mainland Experts



Honorable Guests and Local Experts



Honorable Guests and Representatives of Steel Fabricators



The event was attended by about 300 engineers and experts



Prof. K. F. Chung, Direct of CNERC