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## Wei-Wen Yu Center for Cold-Formed Steel Structures (1990-2020)

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# research report

## **Wei-Wen Yu Center for Cold- Formed Steel Structures (1990-2020)**

**RESEARCH REPORT RP20-9**

**December 2020**



**American Iron and Steel Institute**

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**Final Report**

**WEI-WEN YU CENTER FOR COLD-FORMED STEEL STRUCTURES**

**By**

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**and**

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**1990 - 2020**

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## I. INTRODUCTION

The Wei-Wen Yu Center for Cold-Formed Steel Structures (CCFSS) was established at the University of Missouri-Rolla (now the Missouri University of Science & Technology) in May 1990 under the sponsorship of the American Iron and Steel Institute and the University of Missouri-Rolla.

The CCFSS has garnered continuous sponsorship funding for 30 years. The current sponsors of the CCFSS (and the dates they became sponsors) are:

- Founding Sponsors:
  - AISI: American Iron and Steel Institute (1990)
  - MS&T: Missouri University of Science & Technology (1990)
- Association Sponsors:
  - SDI: Steel Deck Institute (1992)
  - MBMA: Metal Building Manufacturers Association (1993)
  - RMI: Rack Manufacturers Institute (1995)
  - CFSEI: Cold-Formed Steel Engineers Institute (2007)
  - SFIA: Steel Framing Industry Association (2011)
- Corporate Sponsors:
  - Simpson Strong-Tie (2011)

The SSMA, Steel Stud Manufacturers Association, was a member from 1998 to 2014 and the MCA, Metal Construction Association, was a member from 1997 to 2018.

The primary objective of the CCFSS has been to encourage and promote the use of cold-formed steel construction through technical services, engineering education, research, and professional activity. The key role of the CCFSS has been to serve the cold-formed steel industry by providing a unique, comprehensive information resource for manufacturers, designers, educators, researchers, students, and users.

With the support of the sponsoring organizations, in October 2000, the CCFSS was named Wei-Wen Yu Center for Cold-Formed Steel Structures. The naming was in recognition of Dr. Yu's many contributions to the cold-formed steel community. In January 2001, Wei-Wen Yu was named Founding Director and Roger LaBoube was named Director.

In 2020, the decision was made to close the CCFSS. This report summarizes CCFSS activities over the past 30 years and provides a vision on how its legacy will live on into the future.

## II. LOCATION AND ORGANIZATION

In 2003, the CCFSS office and library were moved to the new Civil, Architectural and Environmental Engineering building. The CCFSS has been located in Room 301, Butler-Carlton Hall, Missouri University of Science & Technology. This office space was made possible through the generous contribution of Dr. and Mrs. Wei-Wen Yu.

The CCFSS personnel included a Director, Dr. Roger LaBoube; Founding Director, Dr. Wei-Wen Yu; and Administrative Assistant, Christina Stratman, who joined the CCFSS in 2000.



The CCFSS has been guided by a Steering Committee that was composed of representatives from sponsoring organizations. Current and past members of the Steering Committee are as follows:

- A. AISI  
Rick Haws, Chair  
Helen Chen  
Jay Larson  
Roger Brockenbrough,  
Past Chair  
Sam Errera  
Al Johnson
- B. SDI  
Tom Sputo  
John Mattingly  
Steve Roehrig
- C. MBMA  
Lee Shoemaker
- D. RMI  
Jim Crews  
Anupam Bose  
John Nofsinger  
Wes Midgley
- E. CFSEI  
Robert Wills  
Maribeth Rizzuto  
Sutton Stephens
- F. SFIA  
Pat Ford
- G. Simpson Strong-Tie  
Clifton Melcher  
Randy Daudet
- H. SSMA  
Rahim Zadeh  
Don Allen
- I. MCA  
Dave Fulton  
John Mattingly
- J. Missouri S&T  
Roger LaBoube  
Wei-Wen Yu

### III. CENTER ACTIVITIES

The CCFSS activities included technical services, engineering education, research and professional activity. Subsequent sections briefly describe these items. Also included are additional CCFSS activities related to research, specialty conference, and short course on cold-formed steel structures.

#### A. TECHNICAL SERVICES

- (a) Technical Library. The CCFSS Technical Library was established in August 1990. The library included more than 5300 volumes of design specifications, design manuals, conference proceedings, textbooks, engineering journals, manufacturers' catalogs, research reports, committee documents, reference publications, technical papers, and student dissertations/theses. In 2004 the library began to add electronic copies of final research reports to its collection.

An ongoing project to digitize the CCFSS collection has been performed in conjunction with the University's library. The digitized collection is maintained on the University's Scholar's Mine web page. The digitized collection includes an on-line searchable PDF database of publications that are available in the CCFSS Technical Library. A link to the website for accessing the CCFSS Technical Library was on the CCFSS web page. In 2015 the University library adopted a new vendor's platform for their on-line library and the CCFSS collection was migrated to the new platform. The new platform had much improved search options and data collection (e.g., number of user searches completed). There have been over 884,190 total downloads from the CCFSS collection since 2015.

- (b) Newsletters and Technical Bulletins. At the 2009 Steering Committee meeting it was decided that beginning in 2010 the CCFSS Newsletter and Technical Bulletin would be discontinued as a semi-annual publication. Using the CCFSS database news items (including the AISI Steel Code Update newsletter and pertinent AISI press releases) were distributed as requested by the Sponsors. Technical Bulletins continued to be issued as requested by the Sponsors and approved by the Steering Committee. All past Newsletters and Technical Bulletins remain available at the on-line Technical Library.
- (c) Web page. The latest CCFSS web page (<http://ccfssonline.org>) was completely redesigned and became operational in 2015. It has contained the following information: (a) About the Center, (b) Continuing Education, (c) Link to the CCFSS Technical Library, (d) Publications (e) Sponsors, (f) Contact Us (g) Frequently Asked Questions and (h) Cold-Formed Steel for Students.
- (d) Development of Design Criteria. Through memberships on various AISI committees, the CCFSS personnel have actively participated in the development of new and revised design criteria and design standards for cold-formed steel structures. Roger LaBoube has also participated in the SJI and SDI Canvass Committee balloting.
- (e) Inquiries and Technical Information. Numerous technical inquiries have been received and addressed from engineers, researchers, manufacturers, educators, students, and others requesting technical assistance and/or publications.

## B. ENGINEERING EDUCATION.

- (a) Educational Webinar and Seminar Programs. The CCFSS personnel have actively participated in cold-formed steel educational programs. These continuing education programs were varied in length, one-hour to eight-hours, and content but always focused on cold-formed steel design standards and their applications. Some of the sponsors of these webinars and seminars were:

- AISI
- ASCE
- Corps of Engineers
- MBMA
- SK Ghosh
- SE University
- CFSEI
- SEA of AZ
- SEA of TX
- SEA of CA
- SEA of MO & KS
- SEA of TN
- SEA of OK
- SEA of AL
- SJI
- NASCC
- Butler Manufacturing
- Varco Pruden Buildings
- Alpine Engineered Products
- Dietrich Design Group
- SEA of Costa Rica
- MASFA
- ICC
- City of Newport Beach
- Klingner & Assoc.
- University of MN
- University of KS

Roger LaBoube developed a curriculum for a 1.5 hour “Lunch and Learn” seminar that was used as an in-house training program. This set of slides was also made available and shared with interested engineering firms for their use.

- (b) Textbooks and Handbooks. The CCFSS personnel have been actively involved in the preparation of teaching and reference materials. Wei-Wen Yu’s third edition of the book, *Cold-Formed Steel Design*, was published by John Wiley & Sons in June 2000. The fourth edition of the book, co-authored by Wei-Wen Yu and Roger LaBoube, was published in 2010. The 5<sup>th</sup> edition of the book was developed and published in 2020. The co-authors of the 5<sup>th</sup> edition are Wei-Wen Yu, Roger LaBoube and Helen Chen. The book was sold through the CCFSS at a discounted price.

Roger LaBoube has authored and reviewed numerous CFSEI Technical Notes.

- (c) Specialty Conference Proceedings. Researchers and engineers are increasingly interested in the papers presented at the International Specialty Conferences on Cold-Formed Steel Structures and published in the proceedings. Papers from past International Specialty Conference proceedings are digitized and offered as searchable downloadable PDFs as part of the ongoing CCFSS library digitizing project. Although a total of 24 Conferences were held since 1971, CCFSS organized 15 of those conferences. The following summarizes key statistics:



| Conference<br>Year | Number of<br>Papers | Countries<br>Represented | Number of<br>Participants <sup>1</sup> |
|--------------------|---------------------|--------------------------|--|
| 1990               | 40                  | N.A.                     | N.A.                                   |
| 1992               | 40                  | N.A.                     | N.A.                                   |
| 1994               | 43                  | N.A.                     | N.A.                                   |
| 1996               | 42                  | N.A.                     | N.A.                                   |
| 1998               | 40                  | N.A.                     | N.A.                                   |
| 2000               | 43                  | N.A.                     | N.A.                                   |
| 2002               | 56                  | 19                       | 105                                    |
| 2004               | 48                  | 15                       | 95                                     |
| 2006               | 45                  | 13                       | 88                                     |
| 2008               | 43                  | 12                       | 88                                     |
| 2010               | 42                  | 8                        | 75                                     |
| 2012               | 56                  | 19                       | 80                                     |
| 2014               | 59                  | 15                       | 89                                     |
| 2016               | 61                  | 18                       | 113                                    |
| 2018               | 61                  | 18                       | 85                                     |
| Total              | 719                 |                          | 818                                    |

<sup>1</sup> N.A. indicates data not available prior to CCFSS.

In 2012, student awards were first presented for the Wei-Wen Yu Outstanding Student Paper and two Wei-Wen Yu Student Scholar awards (see item f). This conference was also the first conference to be named the “Wei-Wen Yu International Specialty Conference on Cold-Formed Steel Structures” in honor and recognition of his many contributions to the cold-formed steel community.

- (d) Engineering Education. In February 2000, CCFSS conducted a survey on teaching cold-formed steel design in engineering schools located in North America. A summary was prepared and submitted to the Steering Committee and the Education Subcommittee of the AISI Committee on Specifications in May of 2000, which used the survey results to guide their strategic planning.

Roger LaBoube’s graduate course PowerPoint slides, videos and other materials were shared with university professors to assist with the teaching of cold-formed steel.

- (e) Short Course on Cold-Formed Steel Structures. A total of 26 biennial Short Course on Cold-Formed Steel Structures were held and the CCFSS organized 14 of the courses as summarized by the following table:

| Year  | Number of<br>Participants <sup>1</sup> |
|-------|--|
|       |  |
| 1991  | N.A.                                   |
| 1993  | N.A.                                   |
| 1995  | N.A.                                   |
| 1997  | N.A.                                   |
| 1999  | N.A.                                   |
| 2001  | 36                                     |
| 2003  | 24                                     |
| 2005  | 19                                     |
| 2007  | 38                                     |
| 2009  | 15                                     |
| 2011  | 21                                     |
| 2013  | 18                                     |
| 2015  | 22                                     |
| 2017  | 31                                     |
| Total | 224                                    |

<sup>1</sup> N.A. indicates data not available prior to CCFSS.

- (f) Wei-Wen Yu Fellowship. The Wei-Wen Yu Graduate Fellowship was established in 1992. A total of \$27,000 was awarded to seventeen graduate students who had conducted research on cold-formed steel structures. This Fellowship was financially supported by Dr. Yu, alumni, and the CCFSS continuing education programs. It was administered by the CCFSS and the Department of Civil, Architectural and Environmental Engineering. During the International Specialty Conference funds from the Fellowship were used to award the Wei-Wen Yu Outstanding Student Paper and support travel for two Wei-Wen Yu Student Scholars.
- (g) STRUCTURE Magazine. The CCFSS staff served on the Editorial Board as the liaison for articles related to cold-formed steel structures that appeared in STRUCTURE Magazine.
- (h) Student Capstone Design Website. This website was developed to assist students engaged in their senior capstone projects as well as practitioners interested in learning more about the basics of cold-formed steel applications and design. The Student Website was a link from the CCFSS website.

### C. RESEARCH

- (a) International Cooperation Program. During the past 30 years, contact was maintained with other universities and research organizations that were conducting research on cold-formed steel structures.

- (b) Review of Papers and Proposals. The CCFSS personnel reviewed technical papers for several engineering journals as well as research proposals for AISI and NSF.

#### **D. PROFESSIONAL ACTIVITY**

The CCFSS monitored the activities of various committees involved with cold-formed steel structures. The CCFSS monitored developments and technical activities of the following committees and conference:

AISI Committee on Specifications

AISI Committee on Framing Standards

CFSEI Technology Development Committee

ASCE Committee on Cold-Formed Members

ASCE Committee on Stainless Steel Cold-Formed Section Standards

SDI Technical Committee on Steel Deck (Roger LaBoube has served on the Standards Canvass Committee)

Task Group on Thin-Walled Metal Construction of the Structural Stability Research Council

Steel Joist Institute (Roger LaBoube has served on the Standards Canvass Committee)

### **IV. FUTURE ACTIVITY**

While the CCFSS formally closed in 2020, its legacy is expected to live on in the following ways:

#### **A. TECHNICAL SERVICES**

1. The offering of documents made available through the on-line digitized library will continue and grow, as Missouri S&T maintains the collection and AISI, other CCFSS sponsors, and others continue to contribute research reports and other technical documents to the collection and include links to the collection on their webpages. The library will be re-branded as the Wei-Wen Yu Cold-Formed Steel Library. Also, each sponsor would have the option to have a direct liaison with the Missouri S&T library. Depending on the financing and other parameters, some sponsors might have higher interest, and some might opt out.
2. Roger LaBoube will continue to participate in the development of new and enhanced design criteria and design standards. Most notably, Roger plans to serve as Chair of the AISI Committee on Framing Standards for its 2021-26 standards development cycle.

3. Elements of the CCFSS web page deemed relevant will be incorporated in the webpages of CCFSS sponsors. CFSEI plans to become the “caretaker” of the content on Continuing Education and FAQs.
4. Elements of the student website for cold-formed steel design, a resource for capstone design courses and the general education of structural engineers, will be incorporated in the web pages of CCFSS sponsors. CFSEI plans to become the “caretaker” of the content on CFS for Students.
5. Roger LaBoube will continue to be a resource for practitioners with questions pertaining to cold-formed steel design through his own notoriety in the industry and his connection to the CFSEI hotline and “ask an expert” webpage.

## **B. ENGINEERING EDUCATION**

1. The face-to-face Wei-Wen Yu International Specialty Conference on Cold-Formed Steel Structures planned for 2020, which would have been the 25<sup>th</sup> conference in this series, was cancelled due to COVID-19. In response, the Cold-Formed Steel Research Consortium (CFSRC) inaugurated a first ever, fully remote, international conference named the CFSRC Colloquium. It is anticipated that the legacy of the CCFSS Conference will live on through the CFSRC Colloquium in the years to come.
2. The course materials of the last biennial Short Course on Cold-Formed Steel Structures are available. It is expected that CFSEI will facilitate the course’s delivery in the future. AISI, other CCFSS sponsors, and others will find ways to continue the CCFSS legacy of providing intensive education on CFS design to practitioners entering this specialty field of engineering.
3. The fifth edition of the book, *Cold-Formed Steel Design*, was published and it will continue serve as the authoritative textbook on cold-formed steel design in the United States and throughout the world. It is anticipated that the co-authors will periodically update the textbook, as needed.
4. Roger LaBoube will continue to share seminar and course material upon request, helping the next generation of cold-formed steel educators to develop.
5. Roger LaBoube will continue to be available to offer seminars and webinars upon request to engineering firms and organizations, helping the next generation of cold-formed steel designers to develop.

## **V. ACKNOWLEDGMENTS**

During the past 30 years, the Wei-Wen Yu Center for Cold-Formed Steel Structures was financially supported by the American Iron and Steel Institute, the Cold-Formed Steel Engineers Institute, the Metal Building Manufacturers Association, the Rack Manufacturers Institute, the Steel Deck Institute, the Steel Framing Industry Association, the Steel Stud Manufacturers

Association, Metal Construction Association, Simpson Strong-Tie and Missouri University of Science and Technology.

Appreciation is expressed to all members, current and past, of the Steering Committee for their guidance and support.

For the past 20 years much credit for the success of CCFSS programs is due to the excellent administrative and secretarial support provided by Mrs. Christina Stratman. Chris' invaluable contributions are gratefully acknowledged.

The CCFSS also acknowledges the technical support of the AISI Committee on Specifications, AISI Committee on Framing Standards, and the Missouri S&T Department of Civil, Architectural, and Environmental Engineering. Special thanks are also expressed to staff members of the Department for assistance provided to the CCFSS.



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