Aug 17th, 12:00 AM - Aug 18th, 12:00 AM

AISI Committee on Framing Standards Enabling the Widespread and Economic Useof Steel Framing

Kevin R. Bielat

Jay W. Larson

Sixteenth International Specialty Conference on Cold-Formed Steel Structures
Orlando, Florida USA, October 17-18, 2002

AISI Committee on Framing Standards Enabling the Widespread and Economic Use of Steel Framing

Kevin R. Bielat[1] and Jay W. Larson, P.E., F.ASCE[2]

Abstract

The American Iron & Steel Institute launched the Committee on Framing Standards in 1998 with the mission to eliminate regulatory barriers and increase the reliability and cost competitiveness of cold-formed steel framing through improved design and installation standards. Building on the internationally recognized AISI Specification, and working closely with the Steel Framing Alliance, Light Gauge Steel Engineers Association, Steel Stud Manufacturers Association and Canadian Sheet Steel Building Institute, this relatively new organization has developed and published four new ANSI-accredited consensus standards. Topics include General Provisions, Truss Design and Header Design, as well as a comprehensive Prescriptive Method for One and Two Family Dwellings. This paper provides an overview of these significant documents and describes the ongoing work of the committee.

Introduction

AISI has long had a role in standards development, beginning with the sponsorship of research at Cornell University under the direction of Professor George Winter and the first publication of the AISI Specification in 1946. This initial work was started because "the acceptance and the development of cold-formed steel construction in the United States faced difficulties due to the lack of an appropriate design specification. Various building codes made no provisions for cold-formed steel construction at that time." (Yu, 1996) Since those early beginnings, AISI has engaged a committed group of professionals from industry, including suppliers, manufacturers, engineers, researchers and professors, to expand the body of knowledge and enhance the Specification (AISI, 1996).

Starting in the mid-1990's, there began an increased interest in cold-formed steel for residential and light commercial framing. These applications include wall, floor and roof framing in a number of building types. Although the AISI Specification had gained acceptance and was in widespread use by that time, there were a number of design issues that were not adequately addressed for this emerging market.

As AISI considered the needs of the light framing industry, it assessed the scope, limitations and complexity of its Specification and noted that the emphasis was on member design, primarily for traditional C and Z shapes. However, within typical light framing applications there were

[1] Program Manager, American Iron & Steel Institute, Washington, DC, U.S.A.
[2] Development Engineer, Bethlehem Steel Corporation, Bethlehem, PA, U.S.A.

many applications where the members would be used in systems not explicitly addressed by the Specification, such as built-up headers and shear walls. New design rules were needed to recognize the efficiencies inherent to these systems.

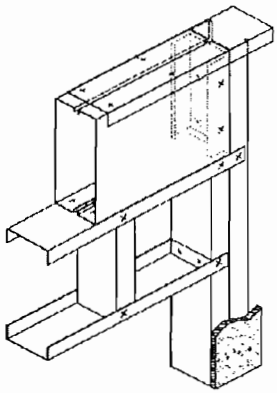

Figure 1: Typical Box Header Assembly

Also, light-gauge steel truss systems were emerging with complex chord shapes that were developed to better optimize the combination of material, fabrication, transportation and installation cost. Unfortunately, these shapes were not explicitly addressed by the Specification.

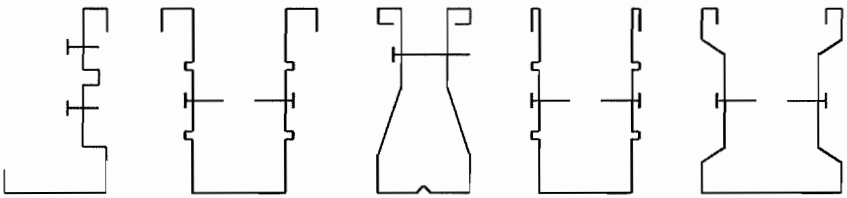

Figure 2: Truss Chord Shapes

In addition, to facilitate the needs of homebuilders, an industry consensus prescriptive method was needed which would allow builders to build with standard details and simply look-up member sizes in easy to use tables.

It seemed logical to extend AISI's standards development activity to support the growing needs of the cold-formed steel framing industry.

The Committee on Framing Standards

Rather than add to the complexity of the Specification, it was decided that a new family of standards should be developed. Specifically, there was a need to supplement the Specification

with a General Provisions standard, a family of application-oriented Design Standards, and a focussed Prescriptive Method for One and Two Family Dwellings.

It seemed logical to accommodate this activity under the existing AISI structure. However, it was decided that a new committee should be formed, called the Committee on Framing Standards. The Committee on Specifications would retain responsibility for the Specification, as well its test procedures, design manuals and design guides. The Committee on Framing Standards would take on the new standards needed for cold-formed steel framing.

AISI has long worked in partnership with other associations. Traditionally, these associations have included the Metal Building Manufacturers, Steel Deck Institute, Rack Manufacturers Institute, Metal Construction Association, Canadian Sheet Steel Building Institute and Center for Cold-Formed Steel Structures.

To pursue its new objectives in cold-formed steel framing, AISI also engaged the support of several new associations to help in the areas of identifying research and specification needs, funding research, and in facilitating technology transfer through the creation of design aids and implementation of seminars. These associations include the Steel Framing Alliance (formerly the North American Steel Framing Alliance), Light Gauge Steel Engineers Association, Steel Stud Manufacturers Association and National Association of Home Builders Research Center.

The Committee on Framing Standards operates under the same procedures as the Committee on Specifications. These procedures earned AISI the approval of ANSI as a recognized consensus standards organization. Specific requirements are met in order to accommodate balance between producer, user and general interest categories, voting, including the resolution of negatives, and public review, interpretations and appeals.

The formation of the Committee on Framing Standards was authorized by the AISI Construction Marketing Committee in the fall of 1997. It was launched in early 1998. Kevin Bielat was hired by AISI as a Program Manager to manage the day-to-day technical and administrative matters and to serve as Secretary to the committee. An Executive Subcommittee was formed and a strategic plan was developed.

Mission and Objectives

The Committee on Framing Standards established as its mission:

> *"To eliminate regulatory barriers and increase the reliability and cost competitiveness of cold-formed steel framing in residential and light commercial building construction through improved design and installation standards."*

The committee also established as its primary objective:

> *"To develop and maintain consensus standards for cold-formed steel framing, manufactured from carbon or low alloy flat rolled steel, that describe reliable and*

economical design and installation practices for compliance with building code requirements."

Organization

The committee established subcommittees, recruited 40 active members and began conducting business via face-to-face meetings and conference calls. The original organization included an Executive Subcommittee for administrative oversight, along with several technical subcommittees to work on the actual documents.

Over time, the committee has reorganized somewhat by adding a Steering Subcommittee for technical coordination, broadening the General Provisions subcommittee to include design methods, as well, and combining the Base, High Seismic and High Wind subcommittees into a single Prescriptive Methods subcommittee. Numerous task groups have been added under the various subcommittees. However, the main committee always maintains control of all decisions through the balloting process.

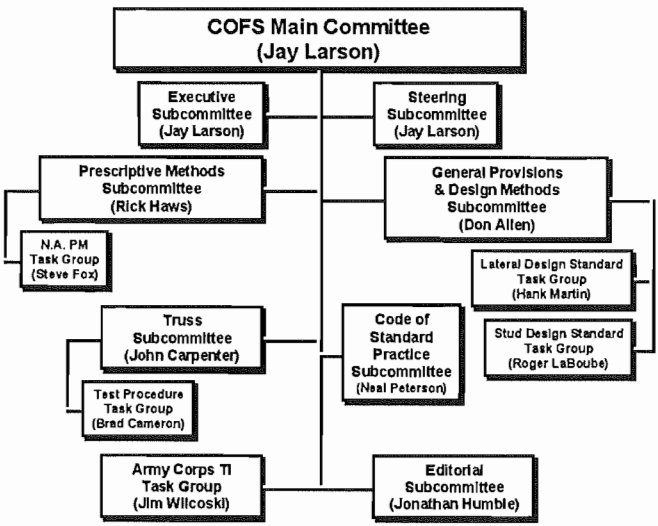

Figure 3: Committee Organization (April 2002)

Each subcommittee has a specific scope statement, as follows:

Executive Subcommittee - To provide administrative oversight of committee operations, including the tasks of accepting or rejecting membership applications, establishing or disbanding subcommittees, appointing or removing subcommittee chairmen, developing the committee budget, and authorizing and monitoring committee spending.

Steering Subcommittee - To provide technical coordination of committee activities, including the tasks of monitoring subcommittee and standards development activities for overlap and completeness, and reviewing and recommending action to the Executive Subcommittee on RFP's and proposals.

General Provisions and Design Methods - To develop and maintain a) general provisions for construction with cold-formed steel framing that are common to prescriptive and engineered designs and b) design methods for construction with cold-formed steel framing.

Prescriptive Methods Subcommittee - To develop and maintain prescriptive provisions for construction with cold-formed steel framing (excluding general provisions).

Truss Subcommittee - To develop and maintain provisions for truss construction (excluding general provisions).

Army Corps Technical Instructions Task Group - To maintain the U.S. Army Corps of Engineers' Technical Instructions for construction with cold-formed steel framing.

Editorial Subcommittee - To provide editorial review of committee documents prior to publication.

Accomplishments

By the first quarter of 2001, the COFS had completed first editions of three standards, namely the "Standard for Cold-Formed Steel Framing - General Provisions", "Standard for Cold-Formed Steel Framing - Truss Design", and "Standard for Cold-Formed Steel Framing - Header Design".

Later in 2001, the COFS completed second editions to these three standards (AISI, 2001a, AISI, 2001b and AISI, 2001c), as well finalizing a first edition of the "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings" (AISI, 2001d).

In 2002, commentaries and design examples were completed and a Steel Frame Construction Manual was developed. The Steel Frame Construction Manual incorporates the completed standards, commentaries and design examples into a single document. The manual also serves as a home for future standards that are to be developed.

General Provisions

The Standard for Cold-Formed Steel Framing - General Provisions (2nd edition) addresses all general provisions that are common to prescriptive and engineered design, and provides a link between all of the industry stakeholders and code enforcement agencies, ensuring everyone is "on the same page" with the basic requirements of cold-formed steel framing. The document contents range from member identification and labeling through basic tolerances such as in-line framing tolerances.

The scope of the General Provisions standard states "These General Provisions shall apply to the design, construction and installation of structural and non-structural cold-formed steel framing members where the specified minimum base metal thickness is between 18 mils (0.0179 inches) (0.457mm) to 118 mils (0.1180 inches) (3.00mm)." It was important that this scope statement differentiate the scope of this standard from that for other applications, such as metal buildings or structural steel buildings.

A review of the table of contents gives a good overview of the document. The General section provides the Scope and Definitions, as well as requirements for Material, Corrosion Protection and Products and the list of Referenced Documents. The section on Member Design provides requirements for Members and Member Condition. The section on Installation addresses In-Line Framing, Non-Structural Wall Framing and Installation Tolerances. The section on Connections considers Screw Connections, Welded Connections and Other Connections. The section on Miscellaneous covers Utilities and Insulation.

Truss Design

The Standard for Cold-Formed Steel Framing – Truss Design (2nd edition) provides technical information and specifications for cold-formed steel truss construction. This Standard applies to the design, quality assurance, installation and testing of cold-formed steel trusses used for load carrying purposes in buildings. Without such a document, our industry would be at a significant disadvantage with respect to competitive materials.

The scope of the Truss Design standard states "The design of cold-formed steel trusses for load carrying purposes in buildings shall be in accordance with the Specification for the Design of Cold -Formed Steel Structural Members and the Standard for Cold-Formed Steel Framing-General Provisions except as modified by the provisions of this standard. This standard shall also apply to manufacturing, quality criteria, installation and testing as they relate to the design of cold formed steel trusses."

As with the General Provisions standard, a review of the table of contents gives a good overview of the Truss Standard. In addition to Scope, Definitions and Referenced Documents, which are covered in the General section, the document covers Design Responsibilities of the Truss Designer and Building Designer, Loading, Truss Design, Quality Criteria, Installation and Bracing, and Test Methods. The requirements of this standard apply to both generic C-section trusses, as well as the various proprietary truss systems.

Header Design

The Standard for Cold-Formed Steel Framing – Header Design (2nd edition) is aimed at giving design professionals the tools they need to design efficient built-up headers and L-headers. The design methodologies are based on testing at the NAHB Research Center, the University of Missouri at Rolla and industry, and were developed under the guidance of Dr. Roger LaBoube of the University of Missouri at Rolla.

The scope of the Header Design standard states "The design and installation of cold-formed steel box and back-to-back headers, and double L-headers used in single-span conditions for load carrying purposes in buildings shall be in accordance with the Specification for the Design of Cold-Formed Steel Structural Members and the Standard for Cold-Formed Steel Framing-General Provisions except as modified by the provisions of this Header Standard."

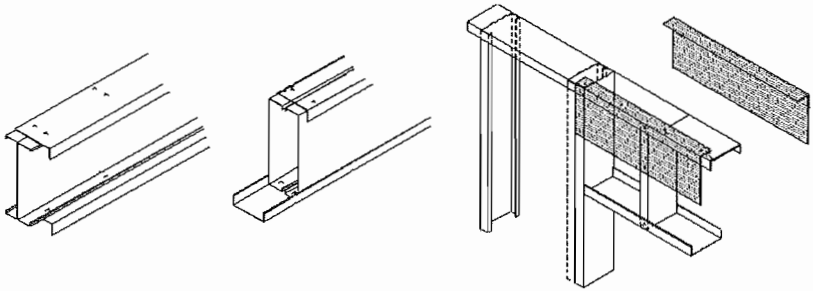

Figure 4 – Back-to-Back, Box and L-Header Assemblies

Prescriptive Method

The Standard for Cold-Formed Steel Framing - Prescriptive Method for One- and Two-Family Dwellings is essentially an updated version of previous CABO and IRC submittals. Additionally, the document has gone through the rigorous consensus process, earning it ANSI recognition, giving it instant credibility and making it easily accepted by the various building codes. The standard incorporates all of the latest cost saving develops of the Steel Framing Alliance, such as the L-header, coupled with the latest engineering and load combination developments, such as ASCE 7-98 and the LRFD provisions of the AISI Specification (1996 edition with 1999 Supplement).

The scope of the Prescriptive Method standard states "The provisions in this Standard for Cold-Formed Steel Framing-Prescriptive Method for One and Two Family Dwellings shall apply to the construction of detached one- or two-family dwellings, townhouses, and other attached single-family dwellings not more than two stories in height using repetitive in-line framing practices. Buildings complying with the limitations herein, shall be constructed in accordance with this Prescriptive Method and the Standard For Cold-Formed Steel Framing-General Provisions. Alternatively such dwellings are permitted to be designed by a Design Professional. Where there is a conflict between the Prescriptive Method and other reference documents the requirements of the Prescriptive Method shall govern."

This document provides span-load tables, connection requirements and details for framing a typical residential building, as shown, in steel.

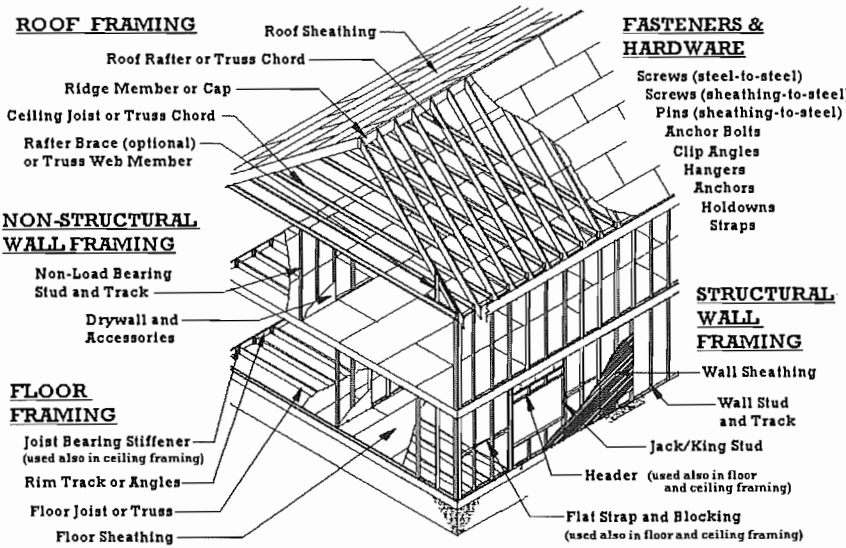

Figure 5: Typical Residential Building

Future Efforts

The COFS has by no means completed its mission. It is currently working on standards for wall stud and shear wall design. It has also assumed responsibility for maintaining the Army Corps Technical Instructions, is leading an effort to develop an industry Code of Standard Practice, is working towards a North American Prescriptive Method, and is assisting the Light Gauge Steel Engineers Association in the development of an inspection checklist for load bearing framing and guidelines on truss damage assessment and repair.

Conclusions

The American Iron & Steel Institute has effectively leveraged its experience and expertise in standards development to support the growing needs of the cold-formed steel framing industry.

Charged with a mission, to eliminate regulatory barriers and increase the reliability and cost competitiveness of cold-formed steel framing through improved design and installation standards, the Committee on Framing Standards has built on the internationally recognized AISI Specification and worked closely with the Steel Framing Alliance, Light Gauge Steel Engineers Association, Steel Stud Manufacturers Association and the Canadian Sheet Steel Building Institute. This relatively new organization has already developed and published four ANSI-accredited consensus standards. Topics include General Provisions, Truss Design and Header Design, as well as a comprehensive Prescriptive Method for One and Two Family Dwellings.

These ANSI-accredited documents are expected to have widespread application and building code acceptance in the very near future. They are readily available from the American Iron & Steel Institute (*www.steel.org*) and the Steel Framing Alliance (*www.steelframingalliance.com*).

The Committee on Framing Standards remains active, developing new standards and enabling the widespread and economic use of steel framing.

References

Yu, W.W., Wolford, D.S., Johnson, A.L. (1996), *Golden Anniversary of the AISI Specification*, Proceedings of the 13th International Specialty Conference on Cold-Formed Steel Structures, St. Louis, MO

Specification for the Design of Cold-Formed Steel Structural Members (1996), with 1999 Supplement, American Iron and Steel Institute, Washington, D.C.

Standard for Cold-Formed Steel Framing – General Provisions (2001a), American Iron and Steel Institute, Washington, D.C.

Standard for Cold-Formed Steel Framing – Truss Design (2001b), American Iron and Steel Institute, Washington, D.C.

Standard for Cold-Formed Steel Framing – Header Design (2001c), American Iron and Steel Institute, Washington, D.C.

Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings (2001d), American Iron and Steel Institute, Washington, D.C.