Cold-Formed Steel Design Support

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Abstract

Cold-formed steel design is governed by the provisions of the AISI North American Specification for the Design of Cold-Formed Steel Structural Members (AISI, 2012) and the suite of AISI cold-formed steel framing standards. A series of Tech Notes has been developed by the Cold-Formed Steel Engineers Institute (CFSEI) to aid design engineers in the application of these documents. In addition to providing specification and design standards guidance, the Tech Note series also explores design issues and challenges that are unique to cold-formed steel structures.

Tech Note topics address a myriad of topics such as curtain wall design, floor joist design, nonstructural member design, diaphragm design, lateral systems design and corrosion protection and durability of cold-formed steel members and connectors.

This paper will summarize the CFSEI activities with a focus on the ongoing Tech Note development activity.

Introduction

The design of cold-formed steel is governed by the provisions of the American Iron and Steel Institute (AISI) North American Specification for the Design of Cold-Formed Steel Structural Members (AISI, 2012), also referred to as the cold-formed steel or AISI Specification, and the suite of AISI cold-formed steel framing standards. While the AISI Specification is applicable to all cold-formed steel structures, the cold-formed steel framing standards apply to wall studs, joists, trusses, and similar structural members and accessories for repetitive member applications.

To assist structural engineers in the application of the cold-formed steel specification and framing standards, AISI has developed a number of documents including AISI Cold-Formed Steel Design Manual (AISI, 2013), which is similar to the structural steel design manual published by AISC (AISC, 2011), and the AISI Cold-Formed Steel Framing Design Guide (AISI, 2007). Another organization recognized that more assistance was needed, especially in cold-formed steel framing. That organization, the Cold-Formed Steel Engineers Institute (CFSEI), has developed a series of Tech Notes to assist structural engineers designing cold-formed steel framed structures.

The mission of CFSEI, an organization composed of primarily structural engineers, is “To enable and encourage the efficient design of safe and cost effective cold-formed steel (CFS) framed structures.”

CFSEI began in the 1990s when some west coast steel manufacturers realized that many engineers did not understand the AISI Specification. To provide engineers design guidance and technical information that is easy to use, the Light Gauge Steel Engineers Association (LGSEA) was
formed in 1994. In ten years, the organization had grown from only fourteen members to over 800 members. In 2005, LGSEA became a part of the Steel Framing Alliance, and in October 2006, announced its new name: the Cold-Formed Steel Engineers Institute (CFSEI).

**Tech Note Functions**

The original mission of LGSEA, and continuing with CFSEI, is being partially accomplished through the development of Technical Notes on Cold-Formed Steel Construction, more commonly known as Tech Notes. See Figure 1 for an example of a Tech Note.

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**Figure 1: Example of CFSEI Tech Note**

Tech Notes address fundamental design issues as well as frequently asked questions pertaining to the design and construction of cold-formed steel structural members, assemblies, and connections. In addition to providing discussion of the design concepts and methods, Tech Notes typically illustrate the design with numerical example problems, and some include design aids. Listed below are specific functions of CFSEI Tech Notes, each with an example of a specific Tech Note that fulfills that function:

- **Explain existing building code provisions:** L001-10, *Design of Diagonal Strap Bracing Lateral Force Resisting Systems for the 2006 IBC*

- **Explain new building code provision and specifications:** L000-08, *Changes from the 1997 UBC to the 2006 IBC for Lateral Design with CFS Framing*

- **Provide information not covered by the building code or building code referenced documents:** L300-09, *Design of End Posts for Diaphragm Shear Walls: A Perspective*

- **Provide design examples:** W200-09, *Header Design*

- **Provide design aids:** G101-08, *Design Aids and Examples for Distortional Buckling*

- **Collect related technical information from a variety of sources:** F101-12, *Screws for Cold-Formed Steel-to-Wood and Wood-to-Cold-Formed Steel Attachments*

- **Provide inspection guidelines:** G500-11, *Guidelines for Inspecting Cold-Formed Steel Structural Framing in Low Rise Buildings*

- **Provide information on construction practices:** W500-12, *Construction Bracing for Walls*

**Tech Note Limitations**

CFSEI Tech Notes are not the building code. They are intended to be used by experienced engineers and other professionals to supplement the building code and other documents. One objective of the Tech Note is to have a succinct document that can be produced in a relative short amount of time. Following this philosophy, Tech Notes do not repeat information clearly covered in other documents such as the AISI Specification, AISI framing standards, and AISI and other industry design guides.

CFSEI Tech Notes are not the only way to design cold-formed steel framing. On the cover of each Tech Note is the following disclaimer. “Designs cited herein are not intended to preclude the use of other materials, assemblies, structures or designs when these other designs and materials demonstrate equivalent performance for the intended use; CFSEI documents are not intended to exclude the use and implementation of any other design or construction technique.”
Available CFSEI Tech Notes

Currently there are forty-seven Tech Notes available in eight categories, several of which are archived (Figure 2). The Tech Note identification system recognizes the main category by the first letter, with the next three numbers identifying the subcategory. The numbers after the dash is the two-digit revision year.

D000 Durability & Corrosion Protection
D001-07, Durability of Cold-Formed Steel Framing Members
D001-13, Durability of Cold-Formed Steel Framing Members
D100-08, Corrosion Protection of Screw Fasteners
D100-13, Corrosion Protection of Fasteners
D200-07, Corrosion Protection for Cold-Formed Steel Framing in Coastal Areas
D200-12, Corrosion Protection for Cold-Formed Steel Framing in Coastal Areas

F000 Fasteners and Connection Hardware
F100-09, Design of Clip Angle Bearing Stiffeners
F101-12, Screws for Cold-Formed Steel to Wood and Wood-to-Cold-Formed Steel Attachments
F102-11, Screw Fastener Selection for Cold-Formed Steel Frame Construction
F140-10, Welding Cold-Formed Steel
F300-09, Pneumatically Driven Pins for Wood Based Panel Attachment
F501-11, Cold-Formed Steel Truss to Bearing Connections
F701-12, Evaluation of Screw Strength
F562, Powder Actuated Fasteners in Cold-Formed Steel Construction (Oct-01)

C000 Component Assemblies (Trusses and Wall Panels)
551e, Design Guide: Permanent Bracing of Cold-Formed Steel Trusses (Feb-98)

G000 General Topics
G000-08, Cold-Formed Steel Design Software
G100-07, Using Chapter F of the North American Specification for the Design of CFS Structural Members
G101-08, Design Aids and Examples for Distortional Buckling
G102-09, Designing Cold-Formed Steel using the Direct Strength Method
G103-11a, Tabulated Local and Distortional Elastic Buckling Solutions for Standard Shapes
G104-14, Welded Box-Beam Flexure Design
G800-07a, ASTM Standards for Cold-Formed Steel
G800-12, ASTM Standards for Cold-Formed Steel
G801-13, ASTM A1063 - No Cause for Rejection
G500-11, Guidelines for Inspecting Cold-Formed Steel Structural Framing in Low Rise Buildings
G500-08, Design Methodology for Hole Reinforcement of Cold-Formed Steel Bending Members
G560, Acoustic Insulation and Sound Transmission in CFS Construction (Oct-99)
G559, Design Considerations for Flexural and Lateral-Torsional Bracing (Jun-01)

J000 Floor and Joist Systems
J100-11, CFS Floor Joists

W000 Wall Systems
W100-08a, Single Slip Track Design
W101-09, Common Design Issues for Deflection Track
W102-12, Introduction to Curtain Wall Design Using Cold-Formed Steel
W103-11, Design of By-Pass Slip Connectors in CFS Construction
W104-10, Top Track Load Distribution Members
W105-13, Design of Nonstructural Members
W200-09, Header Design
W500-12, Construction Bracing for Walls

T000 Thermal, Fire, and Acoustic
T001-09, Suggested Cost-Effective Cold-Formed Steel Fire and Acoustic-Rated Wall and Floor/Ceiling Assemblies for Multi-Unit Structures
T100-12, Fire Assemblies of Cold-Formed Steel Construction

L000 Lateral Systems
L000-08, Changes from the 1997 UBC to the 2006 IBC for Lateral Design with CFS Framing
L001-10, Design of Diagonal Strap Bracing Lateral Force Resisting Systems for the 2006 IBC
L001-09, Design of Diagonal Strap Bracing Lateral Force Resisting Systems for the 2006 IBC
L200-09, Roof Framing Anchorage Forces: MWFRS or C&C
L200-12, Diaphragm Design with Pneumatically Driven Pins
L300-09, Design of End Posts for Diaphragm Shear Walls: A Perspective
L558-1, Lateral Load Resisting Elements: Diaphragm Design Values (May-98) - Archived Nov. 2011

Several available Tech Notes are identified with a different system, the superseded LGSEA identification system. These Tech Notes are undergoing “CFSEI re-branding” and being archived. Twenty-two Tech Notes have been withdrawn or replaced.

Tech Notes can be found at the CFSEI website (www.cfsei.org) under Technical Publications. CFSEI members can download the documents for free. They are also available for purchase through the online store.

Tech Note Development

The technical topic for Tech Notes comes from a variety of sources. The CFSEI Technology Development Committee has surveyed the membership for topics. The last survey was performed in 2011. Suggestions come from members, some of whom volunteer to write the Tech Note. Other suggested topics come from discussions at committee meetings for the AISI Specification and AISI framing standards. Another major source of topics is from engineers with cold-formed steel design questions who contact CFSEI by calling 1.800.79.STEEL (1.800.797.8335) or emailing info@cfsei.org. Tech Notes are developed to address a current need in the cold-formed steel industry.

The topical suggestions for Tech Notes are assembled and added to the spreadsheet maintained by the Technology Development Committee (TDC). During their monthly meetings, the TDC evaluates the scope of the proposed Tech Note topics, such as is it too limited, too general, or has the idea already been covered by another document. The TDC ranks the topical suggestions and identifies potential authors and reviewers.

Tech Notes are written by structural engineers experienced in cold-formed steel design, and are thoroughly reviewed by members of the CFSEI Technical Review Committee. The authors and reviewers volunteer their time to fulfill the mission of CFSEI. Authors and reviewers for a particular Tech Note must have demonstrated an expertise in the subject.

The TDC provides assistance to Tech Note authors by providing a guide and template. A sample of the guidance provided follows:

The core of the document is the design example. This is where users typically get the most benefit, and see how the principles and concepts put forth in the previous sections apply directly to cold-formed steel design and construction. The design example should be:
• real-world, (something that could be expected to be encountered in a regular design practice),

• practical, (something that could and should be built, and is constructable by an experienced framing crew), and

• economical, (design examples should show solutions that are cost competitive).

All Tech Notes are reviewed by the CFSEI Technical Review Committee before they are published. One of the charges of this committee, according to the CFSEI website, is “to ensure that structural engineers receive information from the CFSEI that is of the highest caliber of technical content.” The reviews are performed by more than one person. Multiple reviews may be required to ensure appropriate technical differences of engineering judgment are represented.

The time frame for a Tech Note to go from an idea to publication is typically six months to a year. Another charge of the Technical Review Committee is “to perform their duties in a timely manner so that the structural engineering community may have the most up to date information available.”

Tech Notes cannot be developed without the assistance of engineers and other design professionals. CFSEI welcomes their input. As stated the Technology Development Committee (TDC) page of the CFSEI website, “The TDC is always receptive to new suggestions for projects and welcomes those who want to roll-up-their-sleeves and actively work on the development of Technical Notes and other technical publications and tools for CFS design engineers.” To make a suggestion for a new Tech Note, or volunteer to author or review a Tech Note, send an email to technology@cfsei.org.

Tech Note Maintenance

The CFSEI Technology Development Committee and Technical Review Committee reviews the Tech Notes on a regular basis. Their goal is to update, archive, or withdraw notes every five years to keep the technical content current. When a Tech Note is updated, the title typically remains the same and the alpha-numeric identifier remains the same except for the last two digits, which is the new two-digit revision year. Some Tech Notes are not updated, they are replaced or superseded by another document, such as a design guide. For example, Tech Note 556a-4, *Shear Transfer at Top Plate: Drag Strut Design*, was superseded by the AISI Shear Wall Design Guide (CFSEI, 2009). When a Tech Note is replaced or superseded, the CFSEI website lists the Tech Notes that have been replaced and superseded, preserving the history of these Tech Notes.

A Tech Note is archived when the provided information not current, but has technical merit and value. These archived Tech Notes remain available on the CFSEI website. For example, Tech Note 558b-1, *Lateral Load Resisting Elements: Diaphragm Design Values*, originally published in 1998, was archived in 2011.

A Tech Note is withdrawn when the information not current and has limited value. These Tech Notes are not available. An example of a withdrawn note is Tech Note 560c, *Clinch (Integral) Fastening of Cold-Formed Steel*, originally published in 1999 and withdrawn in 2011. However, the CFSEI website lists the Tech Notes that have been withdrawn, again preserving the history of these Tech Notes.

Tech Note Development & Maintenance Status

Suggestions for new Tech Notes are received on a regular basis. Currently there are over twenty suggestions on the list maintained by the CFSEI Technology Development Committee. The suggestions range from anti-terrorism requirements to sustainability. The Technology Development Committee ranked the following three suggestions with highest priority: anti-terrorism requirements for government projects, blast resistant design, and design and detailing exterior walls for story drift movement.

There are over twenty Tech Notes in production, which could be the initial draft to final formatting. Tech Notes in production include:

• Bridging and bridging anchorage

• Clip angles used in cold-formed steel construction

• Design of built-up compression members

• Fire stopping cold-formed steel head of wall joints

• Wall stud splicing

Finally, there are five Tech Notes, Tech Notes G000, G100, G101, G900, and W100, which were last revised in 2007 and 2008, that are in the process of being updated. In addition, Tech Note L000-08 will be archived. And there are currently four LGSEA Tech Notes that are undergoing the re-branding process.
Conclusion

CFSEI Tech Notes are developed to enable the efficient design of safe and economical cold-formed steel framed structures. If you have suggestions for future Tech Notes contact CFSEI at info@cfsei.org.

References


CFSEI, 2009, Design Guide: Cold-Formed Steel Framed Wood Panel or Steel Sheathed Shear Wall Assemblies (Shear Wall Design Guide), Cold-Formed Steel Engineers Institute, Washington, DC, 2009.