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SUMMARY OF MAJOR CHANGES IN THE 2007 EDITION OF THE NORTH AMERICAN SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS

The 2007 edition of the North American Specification for the Design of Cold-Formed Steel Structural Members will soon be issued by the American Iron and Steel Institute (AISI) and the Canadian Standards Association (CSA). This second edition of the North American Specification has been approved in the USA by ANSI as the American National Standard, in Canada by the Canadian Standards Association, and endorsed in Mexico by CANACERO. The document was prepared on the basis of the 2001 edition of the Specification, the Supplement 2004 to the 2001 Specification, and subsequent developments. The new and revised provisions provide the up-to-date information for the design of cold-formed steel structural members, connections, assemblies, and systems

The revisions of the 2001 North American Specification during the period from 2002 through 2004 were summarized in the CCFSS Technical Bulletin, Vol. 14, No.1, Spring 2005. This Technical Bulletin presents a brief summary of the major changes of the Specification made from March 2005 to August 2007. The reasoning behind and the justification for the additions and revisions are discussed in detail in the Commentary on the 2007 edition of the North American Specification.

In this edition, many editorial changes have been made for consistency. In each section, all the variables are defined below the equation where the variable appears for the first time. Appropriate languages are added to sections where available strengths are calculated in accordance with Sections A4.1.1 for ASD, A5.1.1 for LRFD and A6.1.1 for LSD. In addition, design provisions are re-arranged with provisions applicable to light steel frame construction in Section D4, diaphragm construction in Section D5, and metal roof and wall systems in Section D6.

A. GENERAL PROVISIONS

A1 Scope, Applicability, and Definitions

In the 2001 edition of the North American Specification, Section A1.1 covered both Scope and Limits of Applicability. The 2007 edition of the Specification separates Scope and Applicability into two subsections. The term "Definitions" is added to the section title.

A1.1 Scope

This Section deals only with the scope of the Specification.

A1.2 Applicability

This Section covers only the applicability of the Specification. Appendix A is now applicable to the United States and Mexico. Appendix B remains as the approved standard in Canada. Appendix C was deleted from the entire Specification. The new Appendix 2 was added in this Section for the use of second-order analysis.

A1.3 Definitions

This Section uses a new title, which includes General Terms, ASD and LRFD Terms (USA and Mexico) and LSD Terms (Canada). This Section replaced previous Section A1.2 by including numerous new and revised terms based on the 2007 edition of the AISC and AISI Standard Definitions for Use in the Design of Steel Structures.

A1.4 Units of Symbols and Terms

This Section is similar to Section A1.3 of the 2001 Specification with minor editorial revisions.

A2.1 Applicable Steels

This Section was revised by adding ASTM A1039 steel. All ASTM Standards were updated in this Section.

A2.3 Ductility

Minor editorial revisions were made in the introductory paragraph. In Item (1) of Subsection A2.3.2, Chapter E was added for using the reduced yield stress in the design of connections, as applicable. At the end of this Section, Exception 2 provides new design provisions for concentrically loaded compression members with a closed box section.

A7.1 Yield Stress

The term “yield point” was revised to “yield stress” through out the entire Specification.

A9 Referenced Documents

This Section was revised by adding five AISI North American Standards for Cold-Formed Steel Framing and three AISI standards for test procedures. The AISI test procedures were re-designated from “TSn-xx” to “S9n-xx”, where “n” is the sequence number and “xx” is the year developed or updated. The ASME and ASTM Standards were updated with an addition of ASTM A1039 steel.

B. ELEMENTS

B2.2 Uniformly Compressed Stiffened Elements with Circular or Non-Circular Holes

This Section was revised by combining the design provisions for circular and non-circular holes into the same section. The provisions for non-circular holes were moved to this Section from previous Section D4.1 of the 2001 edition of the Specification and the 2004 Supplement with editorial revisions.

B4 Effective Width of Uniformly Compressed Elements with a Single Lip Edge Stiffener

This Section was revised to cover only the effective width of uniformly compressed elements with a single lip edge stiffener. It was mainly based on Section B4.2 of the 2001 edition of the Specification with the deletion of the equations for other stiffener shapes. Section B4.1 of the previous Specification for uniformly compressed elements with one intermediate stiffener was deleted from this Section. The design of such elements should be based on the revised Section B5 of the 2007 Specification.

B5 Effective Widths of Stiffened Elements with Single or Multiple Intermediate Stiffeners or Edge Stiffened Elements with Intermediate Stiffener(s)

Section B5 and Subsection B5.1 were revised to allow the use of design provisions herein for stiffened elements with single and multiple intermediate stiffeners.

C. MEMBERS

C3.1 Bending

For determining the nominal flexural strength, this Section was revised by referring to two existing subsections (C3.1.1 and C3.1.2), two new subsections (C3.1.3, and C3.1.4), and three subsections moved from previous Section 3.1 to present Section D6 (D6.1.1, D6.1.2, and D6.2.1). For flexural members subjected to combined bending and torsion, reference is made to a new Section C3.6.

C3.1.2 Lateral-Torsional Buckling Strength [Resistance]

The safety factor and the resistance factors for determining the allowable strength or design strength of flexural members were moved from Section C3.1.2.1 of the 2001 edition to this Section.

C3.1.2.1 Lateral-Torsional Buckling Strength [Resistance] of Open Cross-Section Members

Minor editorial revisions were made in the first and second paragraphs.

C3.1.2.2 Lateral-Torsional Buckling Strength [Resistance] of Closed Box Members

Minor editorial revisions were made in this Section.

C3.1.3 Flexural Strength [Resistance] of Closed Cylindrical Tubular Members

This is a new subsection for determining the flexural strength of closed cylindrical tubular members. It was based on the design provisions previously included in Section C6.1 of the 2001 Specification.

C3.1.4 Distortional Buckling Strength [Resistance]

This is a new section to provide design provisions for computing the distortional buckling

strength of I-, Z-, C- and other open cross-section members using edge stiffeners for the compression flange.

C3.2.1 Shear Strength [Resistance] of Webs without Holes

Minor editorial revisions were made in this Section.

C3.4.1 Web Crippling Strength [Resistance] of Webs without Holes

Some tabulated values were revised in Tables C3.4.1-1, C3.4.1-3, and C3.4.1-4. New design provisions were added on the end-one-flange loading condition for C- or Z-sections with overhang on one side of the bearing plate.

C3.6 Combined Bending and Torsional Loading

This is a new section for determining the available flexural strength of laterally unrestrained members subjected to both bending and torsional loading.

C3.7 Stiffeners

In this Section, the section number was revised from “C3.6” to “C3.7. As a result, the sequence numbers of subsections and equations were changed accordingly.

C4 Concentrically Loaded Compression Members

This Section was revised by referring to all applicable subsections of Chapters C and D for computing the nominal axial strength of compression members.

C4.1 Nominal Strength for Yielding, Flexural, Flexural-Torsional and Torsional Buckling

The title of this Section was revised editorially. This Section was based on Section C4 of the 2001 Specification. Consequently, Sections C4.1 through C4.4 of the previous Specification were renumbered to Sections C4.1.1 through C4.1.4 in the 2007 Specification. The new Section C4.1.5 was added for closed cylindrical tubular sections. In the entire 2007 edition of the Specification, the term “torsional-flexural buckling” was revised to “flexural-torsional buckling” according to the AISC and AISI Standards on Definitions.

C4.1.5 Closed Cylindrical Tubular Sections

This new section was based on Section C6.2 of the 2001 Specification. It includes merely the design equations for determining the effective area of closed cylindrical tubular sections. The elastic flexural buckling stress is determined in accordance with Section C4.1.1.

C4.2 Distortional Buckling Strength [Resistance]

This is a new section for determining the nominal axial strength of I-, Z-, C-, hat and other open cross-section compression members governed by distortional buckling.

C5.1.1 ASD Method

The definition of the safety factor for bending was simplified.

C5.1.2 LRFD and LSD Methods

The definition of the resistance factor for bending was revised by adding the resistance factors

for closed cylindrical tubular members.

C5.2.1 ASD Method

In the first paragraph, Appendix 2 was added as an alternative method to check the required strengths P , M_x , and M_y by applying the given interaction equations with the values of K_x , K_y , α_x , α_y , C_{mx} , C_{my} specified in Appendix 2. In the second paragraph, the design requirements for singly-symmetric unstiffened angle sections were based on the definitions of M_x and M_y previously included in the 2001 Specification. The values of α_x and α_y were limited to be greater than zero. Section C6 was deleted from the definitions of P_n and P_{no} . The definition of the safety factor for bending was simplified.

C5.2.2 LRFD and LSD Methods

Similar revisions were made as for Section C5.2.1 except that the values of the resistance factor for bending were added for closed cylindrical tubular members.

D. STRUCTURAL ASSEMBLIES AND SYSTEMS

The title of Chapter D was revised to cover assemblies and systems.

D1.1 Flexural Members Composed of Two Back-to-Back C-Sections

The title of this Section was revised to cover only flexural members composed of two back-to-back C-sections. This Section was based on Item (b) of Section D1.1 of the 2001 Specification.

D1.2 Compression Members Composed of Two Sections in Contact

The title of this Section was revised. The content of this Section was based on Section C4.5 of the 2001 Specification.

D1.3 Spacing of Connections in Cover Plated Sections

The title of this section was revised by changing “Compression Elements” to “Cover Plated Sections.” This Section is the same as Section D1.2 of the 2001 Specification.

D3 Lateral and Stability Bracing

The title of this Section was revised by adding “and stability.” Additional requirements are provided in Appendix B.

D3.2 C-Section and Z-Section Beams

Editorial revisions were made in this Section.

D3.2.1 Neither Flange Connected to Sheathing that Contributes to the Strength and Stability of the C- or Z-Section

The title of this Section was revised by adding “that contributes to the strength and stability of the C- or Z-section.” This Section was based on Section D3.2.2 of the Supplement 2004 to the 2001 Specification.

D3.3 Bracing of Axially Loaded Compression Members

This is a new section for determining the required brace strength and stiffness to restrain lateral translation at brace point for an individual compression member.

D4 Cold-Formed Steel Light-Frame Construction

This is a new section on cold-formed steel light-frame construction, in which five North American Standards for Framing are included as design standards.

D4.1 All-Steel Design of Wall Stud Assemblies

The title of this Section was revised for All-Steel Design of Wall Stud Assemblies. The design provisions for compression members having non-circular web holes were moved to Section B2.2.

D5 Floor, Roof, or Wall Stud Diaphragm Construction

Minor editorial revisions were made in this Section.

D6 Metal Roof and Wall Systems

This is a new section on Metal Roof and Wall Systems.

D6.1 Purlins, Girts and Other Members

This is a new section dealing with purlins, girts, and other members having one flange through-fastened to deck, sheathing or standing seam roof system.

D6.1.1 Flexural Members Having One Flange Through-Fastened to Deck or Sheathing

This Section was based on Section C3.1.3 of the 2001 Specification with revisions. In Item (1), the member depth was revised to be less than or equal to 11.5 in. Item (8) of previous Section C3.1.3 for continuous span systems was deleted and the subsequent item numbers were revised. The minimum rib depth in Item (10) of the previous edition was reduced from 1-1/4 in. to 1-1/8 in. The equation numbers and table number were revised accordingly. The method for determining the R value for continuous purlin systems having span length variation more than 20 percent was added.

D6.1.3 Compression Members Having One Flange Through-Fastened to Deck or Sheathing

Section C4.6 of the 2001 Specification was moved to this Section. Several changes were made on the equation numbers.

D6.2 Standing Seam Roof Panel Systems

This is a new section on standing seam roof systems.

D6.2.1 Strength [Resistance] of Standing Seam Roof Panel Systems

Section C3.1.5 of the 2001 Specification with the 2004 Supplement were moved to this section with considerable revisions on the determination of nominal strength of standing seam roof panels under gravity and/or uplift loading. When the number of test assemblies is 3 or more, limitations were added on the safety factor and resistance factor.

D6.3 Roof System Bracing and Anchorage

This is a new section for Roof Systems and Anchorage.

D6.3.1 Anchorage of Bracing for Purlin Roof Systems Under Gravity Load with Top Flange Connected to Metal Sheathing

This is a new section to provide design requirements for lateral force to be resisted by the anchorage device and the minimum stiffness of the anchorage device. It replaced Section D3.2.1 of the 2001 Specification. These new design provisions were based on the recent research findings.

D6.3.2 Alternate Lateral and Stability Bracing for Purlin Roof Systems

This is a new section providing design requirements for torsional braces and limitations on lateral displacement for purlin roof systems.

E. CONNECTIONS AND JOINTS

In the following sections, editorial revisions were made for the design of connections and joints: E1, E2.1, E2.2, E2.2.1, E2.2.2, E2.3, E2.4, E2.5, E2.6, E2.7, E3.1, E3.2, E3.3, E3.3.1, E3.3.2, and E3.4.

E4 Screw Connections

Editorial revisions were made in the text of this Section. New definitions of d_h and d_w' were added and the definitions of d_w , t_1 , t_2 , F_{u1} , and F_{u2} were revised.

E4.3.1 Connection Shear Limited by Tilting and Bearing

Editorial revisions were made in this Section.

E4.3.2 Connection Shear Limited by End Distance

Editorial revisions were made in this Section

E4.4 Tension

A symbol for diameter " d_h " was added in the first sentence.

E4.4.2 Pull-Over

In Equation E4.4.2-1, diameter d_w was replaced by the effective pull-over diameter, d_w' . The methods for determining diameter d_w' and three new figures were added in this section.

E4.5.1 ASD Method

Definitions of symbols were rearranged and the definitions of t_1 and F_{u1} were deleted.

E4.5.2 LRFD and LSD Methods

Definitions of symbols were rearranged.

F. TESTS FOR SPECIAL CASES

F1.1 Load and Resistance Design and Limit States Design

In Item (c), the first and second sentences were added for the mechanical properties to be used for the evaluation of test results. The term “yield point” was changed to “yield stress.” In Table F1, the statistical data for the following eight new items were added: (1) tensile strength of welds, (2) shear strength of bolts, (3) tensile strength of bolts, (4) shear strength of screw, (5) tensile strength of screw, (6) pull-out, (7) pull-over, and (8) combined shear and pull-over.

APPENDIX 1: DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS USING THE DIRECT STRENGTH METHOD

1.1.1. Applicability

Editorial revisions were made in this Section.

1.1.1.1 Pre-qualified Columns

In Table 1.1.1-1, the geometric limits for complex lips were added for C-sections. In addition, the pre-qualified categories of lipped C-section and rack upright were merged.

1.1.1.2 Pre-qualified Beams

In Table 1.1.1-2, the geometric limits for complex lips were added for C- and Z-sections.

1.2 Members

Editorial revisions were made for the following subsections: 1.2.1, 1.2.1.2, 1.2.1.3, 1.2.2, 1.2.2.1, 1.2.2.2, and 1.2.2.3.

APPENDIX 2: SECOND-ORDER ANALYSIS

This is a new appendix dealing with the second-order analysis for structural systems composed of moment frames, braced frames, shear walls, or combinations thereof. It contains general requirements with design and analysis constraints.

APPENDIX A: PROVISIONS APPLICABLE TO THE UNITED STATES AND MEXICO

A1.1a Scope

The title was changed to “Scope.” The last two sentences in Section A1.1a of the 2001 Specification were deleted.

A2.2 Other Steels

In the last paragraph, the term “yield point” was changed to “yield stress.”

A2.3.1a Ductility

This is a new section to add a limitation for the use of curtain wall studs.

A3.1 Nominal Loads

Editorial revision was made for ASCE 7.

A4.1.2 Load Combination for ASD

Editorial revision was made for ASCE 7. The second and third paragraphs in Section A4.1.2, Appendix A, of the 2001 Specification were deleted.

A5.1.2 Load Factors and Load Combinations for LRFD

Editorial revision was made for ASCE 7.

A9a Reference Documents

This is a new section in Appendix A, which includes updated ANSI/AISC 360 and ASCE/SEI 7 together with two AISI standards and three AWS standards.

C2 Tension Members

Editorial revisions were made in this Section.

D4a Cold-Formed Steel Light-Frame Construction

This is a new section for the use of North American Standard for Cold-Formed Steel Framing – Lateral Design.

D6.1.2 Flexural Members Having One Flange Fastened to a Standing Seam**Roof System**

Section C3.1.4 in Appendix A of the 2001 Specification was moved to this Section with editorial revisions and the changes of section number and equation number.

D6.1.4 Compression of Z-Section Members Having One Flange Fastened to a Standing Seam Roof

Section C4.7 in Appendix A of the 2004 Supplement to the 2001 Specification was moved to this Section with editorial revisions and the changes of section number and equation numbers.

D6.2.1a Strength [Resistance] of Standing Seam Roof Panel Systems

This is a new section to provide additional provisions for determining nominal wind load.

E2a Welded Connections

Editorial revision was made for the AISC Specification.

E3a Bolted Connections

Editorial revision was made for the AISC Specification.

E3.1 Shear, Spacing and Edge Distance

Editorial revisions were made in this Section.

E3.2 Rupture in Net Section (Shear Lag)

Editorial revisions were made in this Section. The term “fracture” was changed to “rupture.”

E3.4 Shear and Tension in Bolts

Editorial revisions were made in this Section with the deletion of Tables E3.4-2, E3.4-3, E3.4-4 and E3.4-5. When bolts are subjected to a combination of shear and tension, the nominal tensile

stress F_{nt} is now determined by using the newly added Equations E3.4-2 or E3.4-3, whichever is applicable.

E4.3.2 Connection Shear Limited by End Distance

Editorial revisions were made in this Section.

E5.1 Shear Rupture

Editorial revisions were made in this Section.

E5.3 Block Shear Rupture

Editorial revisions were made in this Section.

APPENDIX B: PROVISIONS APPLICABLE TO CANADA

A1.3a Definitions

This is a new Section, which replaces the previous Section A1.2a, Terms. The definitions of *load factor* and *load combination factor* were deleted from this Section.

A2.1a Applicable Steels

In this Section, the CSA Standards G40.20/G40.21 were updated.

A2.3.1a Ductility

This is a new section, in which the low ductility steel is limited to *curtain wall stud* used in seismic areas as defined in the Specification.

A9a Reference Documents

In this Section, the CSA Standards G40.20/G40.21 were added and other standards were updated.

C2.2 Rupture of Net Section

Minor editorial revisions were made in this Section. Several equations were renumbered.

D3.1.1 Discrete Bracing for Beams

The title of this Section was changed by adding “for Beams.” The first sentence was revised to be applicable only for beams.

D3.1.2 Bracing by Deck, Slab, or Sheathing for Beams and Columns

The title of this Section was changed by adding “for Beams and Columns.”

D3.2.2 Discrete Bracing

The section number was changed from “D3.2.3” to “D3.2.2.” In the first paragraph, the section number of “Section C3.1.3” was changed to “Section D6.1.1.”

D3.2.3 One Flange Braced by Deck, Slab, or Sheathing

The section number was changed from “D3.2.4” to “D3.2.3.”

D3.2.4 Both Flanges Braced by Deck, Slab, or Sheathing

The section number was changed from “D3.2.5” to “D3.2.4.”

D6.1.2 Flexural Members Having One Flange Fastened to a Standing Seam**Roof System**

This is a new section on discrete bracing for flexural members having one flange fastened to a standing seam roof system.

E2.2a Arc Spot Welds

The first paragraph was added to this Section.

E3.4 Shear and Tension in Bolts

In this Section, the table number of “E3.4-5” was changed to “E3.4-2.”