SUMMARY OF MAJOR CHANGES AND IMPROVEMENTS 
IN THE 2001 NORTH AMERICAN SPECIFICATION 
FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS

The 2001 edition of the *North American Specification for the Design of Cold-Formed Steel Structural Members* will soon be issued in Canada, Mexico and the United States. This first edition of the North American Specification was developed on the basis of the 1996 AISI Specification with the 1999 Supplement, the 1994 Canadian Standards Association (CSA) Standard S136, and subsequent developments. It includes a main document applicable to all three countries with Appendix A for US, Appendix B for Canada and Appendix C for Mexico. A hand point symbol with appendix letters A, B and C is used in the main document to point out that additional provisions are provided in the corresponding applications.

Three design methods (ASD, LRFD, and LSD) were included in this new North American Specification. ASD and LRFD methods are used only in the US and Mexico, and LSD is used only in Canada. The equivalent terms for LSD were included in the brackets for the convenience of LSD users. The factors of safety and resistance factors were listed in the corresponding design provisions.

This Technical Bulletin presents a brief summary of major changes made in the North American Specification as compared with the 1996 AISI Specification with the 1999 Supplement. All section numbers shown below are those used in the North American Specification. The reasoning behind and the justification for the revisions and additions are discussed in the Commentary on the North American Specification.

A. General Provisions

A1.1 Scope and Limits of Applicability
This Section was completely revised except for the first paragraph. It specifies that the Allowable Strength Design (ASD) and Load and Resistance Factor Design (LRFD) methods are used in the United States and Mexico, while the Limit Sates Design (LSD) method is used in Canada according to Chapters A through G, and Appendices A through C for a specific country. For those special cases where the design strength and/or stiffness cannot be so determined, it can be established either by tests or by rational engineering analysis on the basis of the given factor of safety and resistance factor.

A1.2 Terms
This Section was revised to include General Terms, ASD and LRFD Terms (USA and Mexico), and LSD Terms (Canada).

A1.3 Units of Symbols and Terms
This Section was revised to use U.S. customary units, SI units, and MKS units.
(Section A2, Non-Conforming Shapes and Construction, of the 1996 AISI Specification was deleted in the North American Specification.)

A2.1 Applicable Steels
The Section number was changed from A3.1 to A2.1. The ASTM A1008 and A1011 Standards in the North American Specification replaced the ASTM A570, A607, A611, and A715 Standards in the 1996 AISI Specification and the 1999 Supplement. ASTM A1003 Standard was added to the list of Section A2.1.

A2.2 Other Steels
The Section number was changed from A3.2 to A2.2. Editorial changes were made in the text for section numbers. This section was moved to Appendix A for use in the United States.

A2.3 Ductility
The Section number was changed from A3.3 to A2.3. Editorial revisions were made for the use of the LSD method and the MKS unit. The ASTM Standards were updated according to the revisions of Section A2.1.

A2.4 Delivered Minimum Thickness
The Section number was changed from A3.4 to A2.4.

A3 Loads
The Section number was changed from A4 to A3. The design requirements for loads and load combinations are presented in Section A3 of Appendix A for use in the United States. The definitions of symbols were deleted. Section A4.2 of the 1996 AISI Specification for ponding was deleted.

A4 Allowable Strength Design
The Section number was changed from A5 to A4 with a title change from “Allowable Stress Design” to “Allowable Strength Design.”

A4.1 Design Basis
The Section number was changed from A5.1 to A4.1. The term “Allowable Stress Design” was changed to “Allowable Strength Design.” Other editorial revisions were also made in this Section.

A4.1.1 ASD Requirements
The Section number was changed from A5.1.1 to A4.1.1 with a title change from “ASD Strength Requirements” to “ASD Requirements.”

A4.1.2 Load Combinations for ASD
This Section was completely rewritten by deferring loads and load combinations to applicable building codes and ASCE 7. It replaces the design requirements previously covered in Sections A5.1.2, A5.1.3 and A5.1.4 of the 1996 AISI Specification. This newly revised Section A4.1.2 is included in Appendix A for use in the United States.
A5  **Load and Resistance Factor Design**  
The Section number was changed from A6 to A5.

A5.1  **Design Basis**  
The Section number was changed from A6.1 to A5.1. Editorial revisions were also made in this section.

A5.1.1  **LRFD Requirements**  
The Section number was changed from A6.1.1 to A5.1.1 with a title change from “LRFD Strength Requirements” to “LRFD Requirements.”

A5.1.2  **Load Factors and Load Combinations for LRFD**  
This Section was completely rewritten by deferring loads and load combinations to applicable codes and ASCE 7. It replaces the design requirements previously covered in Sections A6.1.2 and A6.1.3 of the 1996 AISI Specification. It is included in Appendix A for use in the United States.

A9  **Referenced Documents**  
The first paragraph was revised with a reference to Appendix A for documents applicable to the United States. ASCE 7, AISC ASD Specification, AISC LRFD Specification, AWS D1.3-98, AWS C1.1-66, and AWS C1.3-70 Standards were moved to Section A9a of Appendix A. ASME B46.1-85 was added. All ASTM standards were updated. ASTM A1008 and A1011 Standards replaced the ASTM A570, A607, A611, and A715 Standards. ASTM A1003 Standard was added to the list.

**B. ELEMENTS**

B1.1(a)  **Maximum Flat-Width-to-Thickness Ratios**  
In Item (1), definitions of $I_s$ and $I_a$ were added.

B1.1(b)  **Flange Curling**  
The footnote for flange curling was changed to a note in the text.

B2  **Effective Widths of Stiffened Elements**  
In this Section, the term “Load Capacity Determination” was changed to “Strength Determination,” and the term “Deflection Determination” was changed to “Serviceability Determination.”

B2.1  **Uniformly Compressed Stiffened Elements**  
Equation E2.1-4 for computing the slenderness factor $\lambda$ was changed with an addition of Equation E2.1-5 for $F_{cr}$. Minor editorial revision was made for the definition of “$f$.”

B2.3  **Webs and other Stiffened Elements under Stress Gradient**  
A list of symbols and definitions were added to the first paragraph of this Section. The design requirements were revised to adopt a two-part approach for the effective width of webs based on the ratio of overall web width to overall flange width. The stress ratio $\psi$ is defined as an
absolute value and some signs for $\psi$ were changed in several related equations.

**B2.4 C-Section Webs with Holes under Stress Gradient**
Condition “$d_o/h < 0.7$” was revised to “$d_o/h \leq 0.7$.”

**B3 Effective Widths of Unstiffened Elements**
In this Section, the term “Load Capacity Determination” was changed to “Strength Determination,” and the term “Deflection Determination” was changed to “Serviceability Determination.”

**B4 Effective Widths of Elements with One Intermediate Stiffener or an Edge Stiffener**
In this Section, the term “Deflection Determination” was changed to “Serviceability Determination.”

**B4.1 Uniformly Compressed Elements with One Intermediate Stiffener**
The design requirements for the case of $b_o/t > S$ were changed to eliminate the discontinuity. A new equation (Eq. B4.1-4) for determining “n” was added.

**B4.2 Uniformly Compressed Elements with an Edge Stiffener**
The limiting $w/t$ was changed from $S/3$ to 0.328S. Design equations were changed for the case of $w/t > 0.328S$ by adopting an equation for “n,” which eliminated a discontinuity that existed in the previous design expressions.

**B5 Effective Widths of Stiffened Elements with Multiple Intermediate Stiffeners or Edge Stiffened Elements with Intermediate Stiffeners**
This Section was completely revised to reflect recent research findings for flexural members with intermediate stiffeners in the compression flange. It includes two new subsections to cover sub-element local buckling and distortional buckling. Section B5.1 deals with the effective widths of uniformly compressed stiffened elements with multiple intermediate stiffeners, while Section B5.2 deals with edge stiffened elements with intermediate stiffeners.

(Section B6 – Stiffeners of the 1996 AISI Specification was changed to Section C3.6 of the North American Specification. See Chapter C on Members)

**C. MEMBERS**

**C2 Tension Members**
This Section was moved to Appendix A for use in the United States.

**C3.1 Bending**
The title of this Section was simplified. In the first paragraph, reference is made to Appendix A for use in the United States. The footnote for torsional effects was added as the second paragraph of this Section.

**C3.1.1 Nominal Section Strength [Resistance]**
In Subsection (b) for Procedure II, Condition (4) was revised to read “The shear force does
not exceed 0.35 \( F_y \) times the web area, \( ht \), for ASD, and 0.60 \( F_y \, ht \) for LRFD.”

C.3.2.1 Lateral-Torsional Buckling Strength [Resistance] of Open Cross Section Members
The footnote for the applicability of design provisions was added as the first paragraph of this Section.
In Subsection (a), \( C_b \) and \( C_{\text{tr}} \) are not required to be unity (1.0) for members subject to combined axial load and bending moment in the North American Specification.
In Subsection (b), Eq. C3.1.2.1-14 is now permitted for doubly-symmetric I-sections and singly-symmetric C-sections. The unbraced length “L” in Eqs. C3.1, 2.1-14 and C3.1.2-15 was clarified as “\( L' \).”

C.3.12.2 Lateral-Torsional Buckling Strength [Resistance] of Closed Box Members
The unbraced length “L” in Eq.C3.1.2.2-2 was clarified as “\( L' \).”

C.3.1.4 Beams Having One Flange Fastened to a Standing Seam Roof System
This Section was moved to Appendix A for use in the United States.

C.3.1.5 Strength [Resistance] of Standing Seam Roof Panel Systems
In the last line of this Section, the resistance factor was revised from “0.5” to “0.8” for the number of physical test assemblies less than 3.

C.3.2 Shear
The title of this Section was simplified.

C.3.2.1 Shear Strength [Resistance] of Webs without Holes
The format for the nominal shear strength was revised to be \( V_n = A_v F_v \). Equations are given for \( F_v \) governed by shear yielding, inelastic shear buckling and elastic shear buckling. The factor of safety for ASD was revised to 1.60 and the resistance factor for LRFD was changed to 0.95 for all cases.

C.3.2.2 Shear Strength [Resistance] of C-Section Webs with Holes
Condition “\( d_o/h < 0.7 \)” was revised to “\( d_o/h \leq 0.7 \)”

C.3.3.1 ASD Method
For beams with unreinforced webs, the design provisions were revised to specify that the required allowable flexural strength, \( M \), and the required allowable shear strength, \( V \), shall not exceed \( M_n/\Omega_b \) and \( V_n/\Omega_v \), respectively.

C.3.3.2 LRFD and LSD Methods
For beams with unreinforced webs, the design provisions were revised to specify that the required flexural strength [factored moment], \( M_u \), and the required shear strength [factored shear], \( V_u \), shall not exceed \( \phi_b M_n \) and \( \phi_v V_n \), respectively.

C.3.4 Web Crippling
The title of this Section was simplified. This Section was completely revised to use a unified web crippling strength equation with variable coefficients on the basis of the type of cross
section and the fastened condition at support. The web crippling coefficients, factors of safety for ASD, and resistance factors for LRFD are presented in five separate tables for built-up sections, single web channel and C-sections, single web Z-sections, single hat sections, and multi-web deck sections, either fastened or unfastened to support.

C3.5.1 ASD Method
In Subsection (c), the interaction equation for the support point of two nested Z-sections was modified according to the new web crippling equation. In addition, it is specified that the moment, \( M \), and the concentrated load or reaction, \( P \), shall not exceed \( M_{no}/\Omega_b \) and \( P_n/\Omega_w \), respectively.

C3.5.2 LRFD and LSD Methods
In subsection (c), the interaction equation for two nested Z-shapes was modified according to the new web crippling equation. In addition, it is specified that the moment, \( M_u \), and the concentrated load or reaction, \( P_u \), shall not exceed \( \phi b M_{no} \) and \( \phi w P_n \), respectively, for the LRFD method.

C3.6 stiffeners
This Section was previously included in Chapter B of the 1996 AISI Specification as Section B6. It was moved to Section C3.6 for the design of flexural members.

C3.6.3 Non-Conforming stiffeners
This Section was revised to permit the use of rational engineering analysis with some minor changes on section numbers.

C4.1 Sections Not Subject to Torsional or Torsional-Flexural Buckling
The footnote for the effective length factor was moved to the text as a new note.

C4.2 Doubly or Singly-Symmetric Sections Subject to Torsional or Torsional-Flexural Buckling
A new paragraph was added at the end of this Section for singly-symmetric unstiffened angle sections, for which the effective area (\( A_e \)) at stress \( F_y \) is equal to the full unreduced cross-sectional area (\( A \)).

C4.3 Point-Symmetric Sections
This is a new Section for the design of point-symmetric sections.

C4.4 Nonsymmetric Sections
This Section was renumbered from “C4.3” in the 1996 AISI Specification to “C4.4” in the North American Specification.

C4.5 Built-Up Members
This is a new Section for built-up members. It replaces Section D1.1(a) of the 1996 AISI Specification.
C4.6 Compression Members Having One Flange Through-Fastened to Deck or Sheathing
This Section was renumbered from “Section C4.4” of the 1996 AISI Specification to “Section C4.6” of the North American Specification. Minor revisions were made in conditions (5), (6), and (8). The footnote for Condition (8) in the 1996 AISI Specification was added to the text as a new Note.

C5.2.1 ASD Method
In the first paragraph, an additional requirement was added to specify that each individual ratio in Eqs. C5.2.1-1 and C5.2.1-3 shall not exceed unity.
For the definition of \( M_y \), the design requirements for singly-symmetric unstiffened angle sections were revised in the North American Specification.

C5.2.2 LRFD and LSD Methods
In the first paragraph, an additional requirement was added to specify that each individual ratio in Eqs. C5.2.2-1 and C5.2.2-3 shall not exceed unity.
For the definition of \( M_{uy} \), the design requirements for singly-symmetric unstiffened angle sections were revised in the North American Specification.

C6 Closed Cylindrical Tubular Members
The term “Cylindrical Tubular Members” was changed to “Closed Cylindrical Tubular Members” in the title and the text.

C6.1 Bending
Definitions of “D” and “t” were added.

C6.2 Compression
Equation C6.2-5 for determining \( A_e \) was simplified with the revision of Eq. C6.2-6 for determining “R.” Definitions of “D” and “t” were added.

D. Structural Assemblies

D1.1 I-Sections Composed of Two C-Sections
In Subsection (a), new requirements for built-up compression members composed of two C-sections are given in Section C4.5.
In Subsection (b), the equations for determining “m” (Eqs. D1.1-3 and D1.1-4 of the 1996 AISI Specification) and the definitions of \( w_f \), \( d \), \( D \), and \( I_x \) were moved to the Commentary.

D3.2 C-Section and Z-Section Beams
The footnote in the 1996 AISI Specification was added to the text as a new Note.

D3.2.2 Neither Flange Connected to Sheathing
The equation for determining \( K' \) for Z-sections (Eq. D3.2.2-2) was revised from “\( K' = I_{xy}/I_x \)” to “\( K' = I_{xy}/2I_x \)” The direction of the applied brace force for Z-sections is also specified in the new requirement.
Other editorial changes were also made in the text.
D4 Wall Studs and Wall Stud Assemblies
Minor editorial changes were made in the text. The limits for yield strength, section depth, section thickness, overall length, and stud spacing previously included in Subsection (b) were moved to Section D4.1.

D4.1 Compression
The title of this Section as simplified. Limits for using the equations provided in Conditions (a), (b), and (c) of this Section were added from Section D4. Editorial revisions were made for several symbols not previously defined in this Section.

D4.2 Bending
The title of this Section was simplified. The definitions of $M_{max}$ and $M_{max}$ were revised to directly refer to Section C3.1.1.

E. Connections and Joints

E2 Welded Connections
This Section was revised by moving some of the design provisions to Section E2a of Appendix A for use in the United States.

E2.1 Groove Welds in Butt Joints
For the ASD method, the factors of safety for tension, compression, and shear were reduced.

E2.2 Arc Spot Welds
All figures in the Specification use numbers at the end instead of letters

E2.2.1 Shear
Some factors of safety for ASD and resistance factors for LRFD were revised for Subsections (a) and (b).
The definition of “$d_a$” for multiple sheets not more than four lapped sheets over a supporting member was changed from $(d - 2t)$ to $(d - t)$.
For the ASD method, the factors of safety for Eq. E2.2.1-6a were revised.
Minor editorial revisions were also made.

E2.2.2 Tension
In the North American Specification, Eq. E2.2.2-2 was modified to replace Eqs. E2.2.2-2 and E2.2.2–3 of the 1996 AISI Specification. Different factors of safety and resistance factor are used for applications other than panels and decks. A new limitation for the value of $td_aF_u$ was added.

E2.3 Arc Seam Welds
For the ASD method, the factor of safety was increased slightly. The definition of “$d_a$” was revised for a double sheet in the North American Specification. All figures in the Specification use numbers at the end instead of letters.

E2.4 Fillet Welds
Several factors of safety and resistance factors were revised. This Section was revised to require a weld strength check when the plate thickness is greater than 0.10 in. i.e., the thickness limit of \( t > 0.15 \text{ in.} \) was changed to \( t > 0.10 \text{ in.} \). All figures in the Specification use numbers at the end instead of letters.

E2.5  **Flare Groove Welds**  
Several factors of safety and one resistance factor were revised. All figures in the Specification use numbers at the end instead of letters. Thickness limit for weld strength check was revised to \( t > 0.10 \text{ in.} \).

E2.6  **Resistance Welds**  
For the ASD method, the factor of safety was increased slightly. Equations E2.6-5 and E2.6-6 for the MKS unit were added.

E2.7  **Fracture in Net Section of Members Other Than Flat Sheets (Shear Lag)**  
The title of this Section was changed from “Shear Lag Effect in Welded Connections of Members Other Than Flat Sheets.”

E3  **Bolted Connections**  
The design provisions for the thickness of the thinnest connected part exceeding 3/16 in., the maximum size of holes and other requirements were moved to Section E3a of Appendix A for use in the United States.

E3.1  **Shear, Spacing and Edge Distance**  
This Section was moved to Appendix A for use in the United States. Minor editorial revisions were made for spacing and edge distance.

E3.2  **Fracture in Net Section (Shear Lag)**  
This Section was moved to Appendix A for use in the United States. The title of this Section was changed from “Shear Lag Effect in Bolted Connections.”  
In Subsection (1), the design provisions were revised to use the reduction equation of \( F_t \) only for a single bolt or a single row of bolts perpendicular to the force. For multiple bolts in the line parallel to the force, \( F_t = F_u \). The definition of \( "r" \) was deleted and the definition of \( "s" \) was revised.  
In Subsection (2), the design provisions were simplified.

E3.3  **Bearing**  
This Section was revised by including two subsections: E3.3.1 – Strength without Consideration of Bolt Hole Deformation and E3.3.2 – Strength with Consideration of Bolt Hole Deformation.  
In Section E3.3.1, the design format and tables for determining the bearing strength were revised on the basis of the bearing factor, modification factor, and the ratio of bolt diameter to member thickness, \( d/t \). The factor of safety and resistance factor were also revised accordingly. A variable \( \alpha \) was introduced in Eq. E3.3.2-1 to accommodate different units used.

E3.4  **Shear and Tension in Bolts**  
This Section was moved to Appendix A for use in the United States.
E4 Screw Connections
Editorial revisions were made in this Section. Definitions of new terms were added for $d_w$, $P_{xx}$, $P_{xx}$, and $t_c$.

E4.2 Minimum Edge and End Distances
The minimum distance from the center of a fastener to the edge of any part was revised from $3d$ to $1.5d$. The nominal shear strength per screw is specified for the end distance parallel to the force.

E4.3.1 Connection Shear Limited by Tilting and Bearing
The title of this Section was revised from “Connection Shear.”

E4.3.2 Connection Shear Limited by End Distance
This Section was completely revised. It was moved to Appendix A for use in the United States.

E4.4 Tension
The sentence “$\Omega$ and $\phi$ shall be determined according to Section F1” was deleted.

E4.4.1 Pull-Out
The definition of $t_c$ was deleted.

E4.4.2 Pull-Over
Editorial revision was made for the definition of $d_w$.

E4.4.3 Tension in Screws
This Section was revised by adding a new equation for calculating the nominal tensile strength for screws.

E5 Rupture
The entire section including Subsections E5.1, E5.2, and E5.3 were moved to Appendix A for use in the United States.

F1.1 Load and Resistance Factor Design and Limit States Design
Editorial revisions were made in the first paragraph with the update of several section numbers in the text.
The footnote in the 1996 AISI Specification was added to the text as a Note.

F3.1 Full Section
Item (d) of this Section was revised to require one full section test be made from each master coil for acceptance and control purposes.

F3.3 Virgin Steel
Minor editorial revisions were made in this Section.
F. Design of Cold-Formed Steel Structural Members and Connections for Cyclic Loading (Fatigue)
This is a new chapter for fatigue design. It was developed on the basis of the available research data on cold-formed steel members and the AISC provisions.

Appendix A: Provisions Applicable to the United States
This is a new Appendix. It contains Sections A1.1a, A2.2, A3.1, A4.1.2, A5.1.2, C2, C3.1.4, E2a, E3a, E3.1, E3.2, E3.4, E4.3.2, and E5, which are applicable only to the United States.