COMPARISON OF ANSI/AISC 360-16 TO ANSI/AISC 360-10
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This document summarizes the revisions contained in the 2016 AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360-16) compared to the 2010 AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360-10). Only Sections containing revisions are listed here.

CHAPTER A
GENERAL PROVISIONS

A1. **SCOPE**
Clarification on the interpretation of the language "is permitted" has been added.

A1.1. **Seismic Applications**
The statement on using Appendix 1 for seismic design has been removed. Additionally, the User Note on high-seismic and low-seismic buildings has been clarified and consolidated.

A2. **REFERENCED SPECIFICATIONS, CODES AND STANDARDS**
The reference dates of existing specifications, codes and standards have been updated. The following new referenced standards are listed:

ASTM A1065/A1065M—new HSS standard
ASTM A1066/A1066M—new plate standard
ASTM A1085/A1085M—new HSS standard
ASTM F3043—new 200 ksi twist off type tension control bolt/nut/washer assembly
ASTM F3111—new 200 ksi heavy hex structural bolt/nut/washer assembly
ASTM F3125—incorporates A325, A325M, A490, A490M, F1852 and F2280 as Grades
AWS A5.36/A5.36M—new welding electrode standard
ANSI/SDI QA/QC—quality control and assurance standard for steel decking

The following referenced standards have been deleted because they have been withdrawn by the standard developer:

ASTM A852

A3. **MATERIAL**

A3.1a. **ASTM Designations**
Metric standards for already approved materials have been incorporated. The "structural tubing" and "pipe" Sections have been combined and renamed "Hollow structural Sections (HSS)." For HSS, A1065/A1065M and A1085/A1085M have been added.

For plates, ASTM A852/A852M and A1011/A1011M have been removed and ASTM A1066/A1066M has been added.

A3.2. **Steel Castings and Forgings**
Specific references to ASTM A216/A216M for castings and ASTM A668/A668M for forgings have been removed. The 2016 *Specification* now states that "castings and forgings shall conform to an ASTM standard intended for structural applications and shall provide strength, ductility, weldability and toughness adequate for the purpose."

A3.3.   **Bolts, Washers and Nuts**
The following ASTM specifications have been added for bolts: ASTM F3043, ASTM F3111 and ASTM F3125/F3125M. The following ASTM standards have been removed for bolts, as they are included as grades in ASTM F3125/3125M: ASTM A325/A325M, ASTM A490/A490M, ASTM F1852 and ASTM F2280.

A3.5.   **Consumables for Welding**
AWS A5.36/A5.36M has been added to this Section.

A4.   STRUCTURAL DESIGN DRAWINGS AND SPECIFICATIONS
A User Note has been added to emphasize that there are terminology differences between this standard and the AISC *Code of Standard Practice*, but no conflict is intended.

CHAPTER B
DESIGN REQUIREMENTS

B1.   GENERAL PROVISIONS
A sentence regarding the provision of lateral load resistance and stability through any combination of members and connections has been removed.

B3.   DESIGN BASIS
This Section has been reorganized.

B3.1.   **Design for Strength Using Load and Resistance Factor Design (LRFD)** (was Section B3.3)

B3.2.   **Design for Strength Using Allowable Strength Design (ASD)** (was Section B3.4)

B3.3.   **Required Strength** (was Section B3.1)
The wording of this Section has been revised for clarity. A reference to Chapter C has been added for additional requirements. Section B3.7 in the 2010 *Specification*, *Moment Redistribution in Beams,* has been incorporated into this Section, and the wording for this paragraph has been revised to clarify that it is applicable only to indeterminate beams carrying gravity loads.

B3.4.   **Design of Connections** (was Section B3.6)
This Section has been edited for clarity.

B3.4a.   **Simple Connections** (was Section B3.6a)
No changes have been made to this Section.

B3.4b.   **Moment Connections** (was Section B3.6b)
For clarity, the word "initial" has been added to clarify the strength and stiffness requirements for an FR connection.

B3.5.   **Design of Diaphragms and Collectors** (was Section B3.8)
No changes have been made to this Section.

B3.6.   **Design of Anchorages to Concrete** (was Section B3.14)
The title of this Section has been changed from *Anchorage to Concrete.*

B3.7.   **Design for Stability** (was Section B3.5)
This Section has been edited for clarity.

B3.8.   **Design for Serviceability** (was Section B3.9)
This Section has been edited for clarity.

B3.9.   **Design for Structural Integrity** (new Section)
This Section addresses integrity requirements for column splices and end connections to be met when required by the building code.

B3.10.   **Design for Ponding**
This Section has been edited for clarity. The specific exclusion of roof surfaces with a slope of ¼ in. per ft. or greater has been removed.

B3.11.   **Design for Fatigue**
This Section has been edited for clarity.

B3.12.   **Design for Fire Conditions**
This Section has been edited for clarity.

B3.13.   **Design for Corrosion Effects**
No changes have been made to this Section.

B4. **MEMBER PROPERTIES**

B4.1.   **Classification of Sections for Local Buckling**
This Section has been edited for clarity.

B4.1a.   **Unstiffened Elements**
The definition of nominal dimension has been clarified.

B4.1b.   **Stiffened Elements**
In Section (a), the reference to "formed sections" has been removed and corner radius has been removed from the definition of *h*.
The prior Section B4.1b(e) was moved to Section B4.1b(f) and new content has been added in Section B4.1b(e) addressing flanges or webs of box sections and other stiffened elements.

TABLE B4.1a   Width-to-Thickness   Ratios: Compression   Elements Members Subject to Axial Compression

Case	Change in Description
1	*
2	*
3	*
4	*
5	Figures for built up I-shaped sections and channels have been added to this case to clarify that this case applies to these sections.
6	Boxes of uniform thickness have been removed from this case, they now default to Case 8.
7	*
8	*
9	*

* No changes have been made.

TABLE B4.1b   Width-to-Thickness   Ratios: Compression   Elements Members Subject to Flexure

Case	Change in Description
10	*
11	*
12	*
13	*
14	*
15	*
16	*
17	Boxes of uniform thickness removed from this case. Moved to Case 21.
18	*

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19	*
20	*
21	New case added for flanges of box sections. Previously in Case 17.

* No changes have been made.

B4.2.   **Design Wall Thickness for HSS**

References to ERW and SAW production of HSS in both this Section and the User Note within this Section have been removed. This Section has been updated to incorporate the new HSS standards, ASTM A1065/A1065M and ASTM A1085/A1085M.

B4.3.   **Gross and Net Area Determination**

B4.3a.   **Gross Area**

No changes have been made to this Section.

B4.3b.   **Net Area**

The User Note on splice plates has been removed because the requirement was removed from Chapter J.

B5.   **FABRICATION AND ERECTION**

No changes have been made to this Section.

B6.   **QUALITY CONTROL AND QUALITY ASSURANCE**

No changes have been made to this Section.

B7.   **EVALUATION OF EXISTING STRUCTURES**

No changes have been made to this Section.

CHAPTER C
DESIGN FOR STABILITY

The major changes to this chapter include:
- A User Note on alternative methods of analysis in Appendices 1 and 7 has been added.
- Clarification on what types of initial deformations to be considered has been added.

C1.   GENERAL STABILITY REQUIREMENTS
The phrase "all other deformations" has been clarified by appending the phrase "all other component and connection deformations." Consideration of stiffness reduction due to inelasticity has been expanded to include partial yielding due to residual stresses. Uncertainty in stiffness and strength has been expanded to include system, member, and connection strength and stiffness. The definition of design in a User Note has been removed because it was moved to the Glossary. A reference to inelastic analysis and the use of Appendix 1 has been moved to Section C1.1.

       C1.1.   **Direct Analysis Method of Design**
This Section has been reorganized and expanded to include both elastic and inelastic analysis. Clarification that Sections C2 and C3 are only applicable to elastic analysis has been added. In addition, references to pertinent Sections of Appendix 1 for inelastic analysis have been added.

       C1.2.   **Alternative Methods of Design**
This Section has been reworded to clarify that the methods in Appendix 7 are pertinent only to elastic analysis.

C2.   CALCULATION OF REQUIRED STRENGTHS
The word elastic has been added for clarity.

       C2.1.   **General Analysis Requirements**
A User Note on P-Δ only second-order analysis has been revised to clarify that the B_1 multiplier only applies to the required flexural strength of the member.

       C2.2.   **Consideration of Initial Imperfections**
The intended meaning of initial imperfections has been clarified.

A User Note has been reworded to clarify that this Section pertains to system imperfections only. A reference to *Code of Standard Practice* Appendix 1, Section 1.2, for analysis of member imperfections has been added.

       C2.2a.   **Direct Modeling of Imperfections**
No changes have been made to this Section.

       C2.2b.   **Use of Notional Loads to Represent Imperfections**
Language has been added to clarify that notional loads are applied to points of intersection of members to represent initial system imperfections only.

       C2.3.   **Adjustments to Stiffness**
Section C2.3(b) clarifies that the values for τ_b determined in this Section are for non-composite members only. A reference to Section I1.5 for calculation of τ_b for composite members has been added. In Equation C2-2b, P_y, axial yield stress, has been replaced by a new variable, P_{ns}, cross-section compressive strength. P_{ns} differentiates between nonslender and slender element sections, and references Section E7 for calculating slender-element section compressive strength.

C3.   CALCULATION OF AVAILABLE STRENGTHS

A statement on bracing requirements for individual members has been moved to a User Note. This statement has also been clarified to reflect that Appendix 6 is not applicable to bracing that is part of the overall lateral force-resisting system.

CHAPTER D
DESIGN OF MEMBERS FOR TENSION

D1.   **SLENDERNESS LIMITATIONS**

No changes have been made to this Section.

D2.   **TENSILE STRENGTH**

The reference to Section D3 for determining effective net area has been removed.

D3.   **EFFECTIVE NET AREA**

The User Note on bolted splice plates has been removed because the requirement was removed from Chapter J.

TABLE D3.1   **Shear Lag Factors for Connections to Tension Members**

This table remains the same with the following exceptions: Plate members and tension members that transmit tensile load through longitudinal welds only have been removed from Case 2. Case 4 has been expanded to include angles, channels with welds at the heels, tees and W-shapes with connected elements; the equation for calculating U and the example figure have been updated to address longitudinal welds of unequal length; a footnote [a], has been added on how to calculate l. Case 5 has been updated to clarify that the gusset plate is connected through slots in the HSS.

D4.   **BUILT-UP MEMBERS**

Usage of lacing has been added for clarity on the open-sides of built-up tension members.

CHAPTER E
DESIGN OF MEMBERS FOR COMPRESSION

E1. GENERAL PROVISIONS

TABLE USER NOTE E1.1 **Selection Table for the Application of Chapter E Sections**
No changes have been made to this table.

E2. EFFECTIVE LENGTH
Effective length is now defined as L_c. A User Note has been added to highlight that L_c can be determined by methods other than using the effective length factor, K.

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS
Uniform compression has been changed to axial compression. Unbraced length has been changed to effective length. The definitions of variables A_g, E, F_e, F_y and r now appear in this Section. The User Note has been edited for clarity.

E4. TORSIONAL AND FLEXURAL-TORSIONAL BUCKLING OF SINGLE ANGLES AND MEMBERS WITHOUT SLENDER ELEMENTS
The title of this Section has been changed from *Torsional and Flexural-Torsional Buckling of Members without Slender Elements*. This Section now clearly states that it applies to all doubly symmetric members without slender elements when the torsional unbraced length exceeds the lateral unbraced length and for single angles with $b/t > 0.71\sqrt{E/F_y}$. Definitions for b and t have also been added to this Section.

The special case in the former Section E4(a) has been removed and is now covered under the new Section E4(b). Section E4(b)(i) has been moved to Section E4(a), Section E4(b)(ii) has been moved to Section E4(b) and Section E4(b)(iii) has been moved to Section E4(c).

The descriptions above Equations E4-2, E4-3 and E4-4 have been clarified.

In Section E4(b), a User Note has been added clarifying the treatment of singly symmetric members with the *x*-axis as the axis of symmetry with regard to the use of this Section.

Section E4 Equations		
2010 *Spec*	2016 *Spec*	Changes in equation
E4-1	E4-1	*
E4-2	#	Case removed from *Specification*
E4-3	#	
E4-4	E4-2	*
E4-5	E4-3	*
E4-6	E4-4	*
E4-7	E4-5	*
E4-8	E4-6	*
E4-9	E4-7	*
E4-10	E4-8	Description of this equation added-"flexural constant".
E4-11	E4-9	*

\# No equivalent equation in 2016 *Specification*.
* No changes have been made.

A new Section E4(d) has been added clarifying that members with lateral bracing offset from the shear center must use analysis to determine F_e. A User Note has been added referencing a discussion of this subject in the Commentary.

E5. SINGLE ANGLE COMPRESSION MEMBERS
This Section has been reworded to clarify when flexural-torsional buckling needs to be considered. Two requirements for use of this Section have been moved to the main body from individual Sections E5(a) and E5(b): $L_c/r \leq 200$ and the ratio between the long leg and short leg dimensions must be less than 1.7. The variable r_x has been replaced by r_a to clarify that it is not the geometric x-axis but rather the axis parallel to the connection The definition of L_c has been added.

E6. BUILT-UP MEMBERS

E6.1. **Compressive Strength**
The User Note is revised to clarify that slip will reduce strength. Section E6.1(a) has been reworded for clarity. In Section E6.1(b), a requirement that the connecting elements must be Class A or B faying surfaces has been added for clarity.

E6.2. **Dimensional Requirements**
This Section has been reorganized from paragraphs into a list (a) through (e).

E7. MEMBERS WITH SLENDER ELEMENTS
This Section has been revised in its entirety to treat stiffened and unstiffened elements the same. Variables Q_s and Q_a are no longer used in the *Specification*. Equation E7-1 has been revised from $P_n=F_{cr}A_g$ to $P_n=F_{cr}A_e$ to reflect that an effective area is now used in place of a reduced stress as in 2010. A User Note on calculating A_e has been added.

E7.1. **Slender Element Members Excluding Round HSS**
The title of this Section has been changed from *Slender Unstiffened Elements, Q_s*, because stiffened and unstiffened elements are now treated the same. A new limiting criteria of $\lambda_r \sqrt{F_y/F_{cr}}$ has been introduced to determine how the user calculates b_e. Equation E7-3 introduces several new variables used in calculating b_e: c_1, c_2 and F_{el}. Table E7.1, *Effective Width Imperfection Adjustment Factor*, has been added to help determine c_1 and c_2 based on shape. Definitions of c_1, c_2, λ_r, λ and F_{el} have been added to this Section.

E7.2. **Round HSS**
Criteria in this Section determine how to calculate A_e for round HSS, which is used in the strength equation, Equation E7-1.

CHAPTER F
DESIGN OF MEMBERS FOR FLEXURE

TABLE USER NOTE F1.1   **Selection Table for the Application of Chapter F Sections**
For clarity, CFY (Compression Flange Yielding) has replaced Y in the limit states for Sections F4 and F5. LTB has been added as a limit state for Section F7. WLB has been added as a limit state for Section F9.

F1.   GENERAL PROVISIONS
The Section addressing the lateral-torsional buckling modification factor has been separated into a new subsection, Section F1(c). A requirement that warping be prevented at the support has been added to the statement that C_b is permitted to be taken as 1.0 for cantilevers. The User Note has been expanded to clarify that the commentary contains additional equations for calculating C_b.

F2.   DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS
The User Note on compactness has replaced 65 ksi with 70 ksi in the last statement on web compactness limits.

F4.   OTHER I-SHAPED MEMBERS WITH COMPACT OR NONCOMPACT WEBS BENT ABOUT THEIR MAJOR AXIS

F4.2.   Lateral-Torsional Buckling
The definitions for M_{yc} and F_{cr} have been added and the definition of F_L has been clarified. The definition of S_{xt} has been moved to Section F4.2(3). S_x has replaced S_{xc} in the equation for the value of M_p used in Equation F4-10. Equation F4-11 has been revised. The User Note has been removed, as the equation previously found in the User Note is now Equation F4-11.

F4.3.   Compression Flange Local Buckling
The referenced equations for calculating R_{pc} have been updated for clarity.

F4.4.   Tension Flange Yielding
The definition of M_{yt} has been added. I_{yc}/I_y has been added as a new criterion for determining R_{pt}, similar to the method used in determining R_{pc} in Section F4.2. Equation F4-17, for determining R_{pt} for certain cases, has been added. The definition of M_p has been added.

F5.   DOUBLY SYMMETRIC AND SINGLY SYMMETRIC I-SHAPED MEMBERS WITH SLENDER WEBS BENT ABOUT THEIR MAJOR AXIS

F5.2.   Lateral-Torsional Buckling
This Section has been edited for clarity.

F6.   I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MINOR AXIS

F6.2.   Flange Local Buckling
The definition of S_y has been added to this Section.

F7.   SQUARE AND RECTANGULAR HSS AND BOX SECTIONS
The title of this Section has been changed. It was previously called, *Square and Rectangular HSS and Box-Shaped Members.* Box-shaped member has been changed to box section throughout the *Specification*. The introduction to this Section has been modified to clarify that it also applies to members with slender webs. Section F7.4, *Lateral-Torsional Buckling* has been added. The User

Note on neglecting lateral-torsional buckling in rectangular HSS has been updated and moved to Section F7.4.

F7.1. **Yielding**
No changes have been made to this Section.

F7.2. **Flange Local Buckling**
Definitions of S and b have been added to Section F7.2(b). Equation F7-4 has been restricted to use with HSS only. Equation F7-5, used for calculating b_e of box sections, has been added.

F7.3. **Web Local Buckling**
S replaces S_x in Equation F7-6 for calculating nominal capacity. A new Section F7.3(c) has been added for the treatment of sections with slender webs. A User Note has been added to this Section noting that if F_{cr} is greater than F_y, Section F7.3 will not control member strength. A User Note has been added to this Section clarifying that there are currently no HSS with slender webs.

F7.4 **Lateral-Torsional Buckling** (new Section)
This Section provides a treatment of LTB for HSS and box sections, using a similar approach to that which is used for other sections. The User Note on lateral-torsional buckling in HSS has been updated to state that lateral-torsional buckling is usually only a consideration for sections with high depth-to-width ratios.

F9. **TEES AND DOUBLE ANGLES LOADED IN THE PLANE OF SYMMETRY**
Local buckling of double-angle web legs has been added to this Section.

F9.1. **Yielding**
The definition of M_y has been added to this Section. Section F9.1(a) has been updated to also apply to web legs in tension. Section F9.1(b) has been clarified to only apply to tee stems in compression. Section F9.1(c) has been added for calculating M_p for double angles with web legs in compression.

F9.2. **Lateral-Torsional Buckling**
This Section has been reorganized into separate subsections for tension cases and compression cases. Section F9.2(a) addresses members in tension, and has been divided into three cases, with L_b as the differentiating criterion. The strength equations are now presented in a format similar to that for other shapes. Section F9.2(b) has been added to address the calculation of moment capacity for stems and web legs in compression.

F9.3. **Flange Local Buckling of Tees and Double-Angle Legs**
The title of this Section has been changed from Flange Local Buckling of Tees to reflect an increased scope. The User Note on double angles with flange legs in compression has been removed. The prior content of this Section has been moved to Section F9.3(a). Section F9.3(b) has been added for the treatment of double-angle flange legs.

F9.4. **Local Buckling of Tee Stems and Double-Angle Leg Webs in Flexural Compression**
This Section was previously titled Local Buckling of Tee Stems in Flexural Compression and has been changed to reflect the additional content in this Section. The prior contents of this Section have been moved to Section F9.4(a) and Section F9.4(b) has been added for double-angle web legs. Within Section F9.4(a), the constants in Equation F9-18 (formerly F9-10) have changed, as have

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the criteria used to determine which equation in Section F9.4(a) is applicable. The User Note on double-angle web legs in compression has been removed.

F10.   SINGLE ANGLES
The word "principal" has been added to clarify the meaning of minor axis.

    F10.1.   **Yielding**
                The definition of M_y has been removed.

    F10.2.   **Lateral-Torsional Buckling**
                All equations have been rewritten to change the variable name from M_{cr} to M_e. Equation F10-5 for calculating critical moment of unequal leg angles has been removed. Equation F10-4 is applicable to unequal leg angles.

F11.   RECTANGULAR BARS AND ROUNDS

    F11.1.   **Yielding**
                $F_y S$ has replaced M_y at the end of Equation F11-1.

F12.   UNSYMMETRICAL SHAPES
A User Note on the use of Appendix 1.3 as an alternative to this Section has been added.

CHAPTER G
DESIGN OF MEMBERS FOR SHEAR

G1. GENERAL PROVISIONS

The first paragraph of this Section has been removed. A new statement on determining nominal shear strength has been added. Section G8, Beams and Girders with Web Openings, has been moved to Section G7.

G2. I-SHAPED MEMBERS AND CHANNELS

The title and scope of this Section have been changed. The former title was Members with Unstiffened or Stiffened Webs.

The entire approach for non-tension field action design has been revised, but the approach for design with tension field action has not changed. The determination of shear strength for built-up I-shapes has been completely revised.

G2.1.   **Shear Strength of Webs without Tension Field Action**
The title of this Section has been changed from Shear Strength and the statement on the applicability of this Section has been removed. The coefficient C_v used in this Section has been renamed C_{v1}. In Section G2.1(b), the h/t_w parameters and associated equations have been changed, and Equation G2-5 has been removed.

In Section G2.2(b)(2), the maximum value of k_v has been raised to 5.34 and the limit of h/t_w has been removed. The statement specifying k_v for stems of tee shapes has been moved to Section G3, which now applies to tee stems. Equation G2-5 (previously Equation G2-6) has been revised with the maximum value of 5.34 and the a/h limit removed.

G2.2   **Shear Strength of Interior Web Panels with a/h≤3 Considering Tension Field Action** (new Section)
Former Equations G3-1 and G3-2 have been moved into this Section as Equations G2-6 and G2-7. A new variable C_{v2} has been defined in this Section. Equations for determining C_{v2} are similar to Equations G2-3, G2-4 and G2-5 in the 2010 *Specification*. Definitions for A_{fc}, A_{ft}, b_{fc} and b_{ft} have been added to this Section. A statement indicating that nominal shear strength is permitted to be taken as the larger of the values from Sections G2.1 and G2.2 has been added. A User Note on when Section G2.1 may predict a higher strength has been added.

G2.3.   **Transverse Stiffeners** (was Section G2.2)
This Section has been organized into a list of requirements (a) through (e) and incorporates much of Section G3.3 from the 2010 *Specification*. The upper limit on k_v has been raised to 5.34. The termination distance for the transverse stiffener-to-web welds has been revised. The requirement for I_{st} has been modified. The equation for calculating I_{st} has been updated, and a new variable, ρ_w, has been introduced to represent the maximum shear ratio which was formerly directly in the equation for I_{st}. I_{st1} represents what was previously I_{st2}, and a new equation has been added to calculate I_{st2}. A new User Note on V_{c2} has been added. A new User Note indicating that I_{st} may conservatively be taken as I_{st1} has been added.

G3. SINGLE ANGLES AND TEES (was Section G4)

The title of this Section has been changed from Single Angles to reflect the increased scope of this Section. The applicable equation for the shapes governed by this Section has been added.

G4. **RECTANGULAR HSS, BOX SECTIONS AND OTHER SINGLY AND DOUBLY SYMMETRIC MEMBERS (was Section G5)**
The title of this Section has been changed from Rectangular HSS and Box-Shaped Members. The applicable equation for the shapes governed by this Section has been added. Definitions of A_w, C_{v2}, h and t have been revised and appear separately for HSS and box sections and other singly and double symmetric members.

G5. **ROUND HSS** (was Section G6)
The definition of t, design wall thickness, has been simplified. Specific references to ERW and SAW HSS have been removed.

G6. **WEAK-AXIS SHEAR IN DOUBLY SYMMETRIC AND SINGLY SYMMETRIC SHAPES** (was Section G7)
The applicable equation and definitions for all variables within have been added to this Section.

G7. **BEAMS AND GIRDERS WITH WEB OPENINGS** (was Section G8)
This Section has been edited for clarity.

CHAPTER H
DESIGN OF MEMBERS FOR COMBINED FORCES AND TORSION

H1.   DOUBLY AND SINGLY SYMMETRIC MEMBERS SUBJECT TO FLEXURE AND AXIAL FORCE

H1.1.   Doubly and Singly Symmetric Members Subject to Flexure and Compression
The definitions of P_r, P_c, M_r and M_c have been updated with references to the appropriate chapters used to calculate the respective quantities to emphasize that Chapter C must be followed when determining the required strength. The references to design with LRFD and ASD have been updated from Sections B3.3 and B3.4 to Sections B3.1 and B3.2, respectively.

H1.2.   Doubly and Singly Symmetric Members Subject to Flexure and Tension
The definitions of E, I_y and b have been added to this Section. The statement on more detailed analyses has been removed.

H1.3.   Doubly Symmetric Rolled Compact Members Subject to Single Axis Flexure and Compression
L_c has replaced KL for consistency. This Section has been edited for clarity.

H2.   UNSYMMETRIC AND OTHER MEMBERS SUBJECT TO FLEXURE AND AXIAL FORCE
References to appropriate chapters for computing P_r, P_c, M_r and M_c have been added to emphasize that Chapter C must be followed when determining the required strength. The references to design with LRFD and ASD have been updated from Sections B3.3 and B3.4 to Sections B3.1 and B3.2, respectively.

H3.   MEMBERS SUBJECT TO TORSION AND COMBINED TORSION, FLEXURE, SHEAR AND/OR AXIAL FORCE

H3.1.   Round and Rectangular HSS Subject to Torsion
The definition of t has been moved to Section H3.1(a).

H3.2.   HSS Subject to Combined Torsion, Shear, Flexure and Axial Force
References to appropriate chapters for computing P_r, P_c, M_r and M_c have been added to emphasize that Chapter C must be followed when determining the required strength. The references to design with LRFD and ASD have been updated from Sections B3.3 and B3.4 to Sections B3.1 and B3.2, respectively.

H3.3.   Non-HSS Members Subject to Torsion and Combined Stress
No changes have been made to this Section.

H4.   RUPTURE OF FLANGES WITH HOLES SUBJECT TO TENSION
References to appropriate chapters for computing P_r, P_c, M_r and M_c have been added to emphasize that Chapter C must be followed when determining the required strength. The references to design with LRFD and ASD have been updated from Sections B3.3 and B3.4 to Sections B3.1 and B3.2, respectively.

CHAPTER I
DESIGN OF COMPOSITE MEMBERS

I1.   **GENERAL PROVISIONS**

This Section has been edited for clarity.

    I1.1.   **Concrete and Steel Reinforcement**

The statement of ACI applicability was expanded to further clarify which documents collectively fall under the title of "ACI 318." Section I1.1(a) was revised to reflect a more general reference to ACI 318, therefore no longer limited to specific editions.

    I1.2.   **Nominal Strength of Composite Sections**

A statement was added to include the elastic stress distribution method and the effective stress-strain method as means to determine nominal strength of composite Sections.

    I1.2c.   **Elastic Stress Distribution Method** (new Section)

This new Section provides guidance on using the elastic stress distribution method to determine nominal strength of composite section.

    I1.2d.   **Effective Stress-Strain Method** (new Section)

This new Section provides guidance on using the effective stress-strain method to determine nominal strength of composite section.

    I1.3.   **Material Limitations**

Additionally, the requirement for minimum yield stress of structural steel and reinforcing bars (previously 75 ksi for both) was divided into two separate requirements; now 75 ksi for structural steel and 80 ksi for reinforcing bars. This Section has also been edited for clarity.

    I1.4.   **Classification of Filled Composite Sections for Local Buckling**

The User Note was updated to use ASTM A500 Grade C because it is the preferred material for HSS in the 15th Edition Manual.

    I1.5.   **Stiffness for Calculation of Required Strengths** (new Section)

This new Section provides a means to determine stiffnesses needed for direct analysis method calculation of required strengths.

I2.   **AXIAL FORCE**

    I2.1b.   **Compressive Strength**

The equation in which effective stiffness of composite sections is calculated (Equation I2-6) no longer includes a 0.5 factor.

    I2.1e.   **Detailing Requirements**

For composite cross sections built up from two or more encased steel shapes, batten plates were removed from the list of components that connect. This Section has also been edited for clarity.

    I2.2a.   **Limitations**

A statement has been added specifying that longitudinal reinforcement is not required. If longitudinal reinforcement is provided, internal transverse reinforcement is not required for strength.

    I2.2b.   **Compressive Strength**

The equation for calculating C_3 (Equation I2-13) has been revised to use A_{sr} and A_g in place of A_c.

I3.   FLEXURE

I3.1.   General

I3.1b.   Strength During Construction
This Section has been edited for clarity.

I3.2.   Composite Beams with Steel Headed Stud or Steel Channel Anchors

I3.2b.   Negative Flexural Strength
This Section has been edited for clarity.

I3.2c.   Composite Beams with Formed Steel Deck
Size requirements for steel headed stud anchors were removed and replaced with simply a requirement of the presence of such anchors. Size requirements have moved to Section I8.1.

I3.2d.   Load Transfer Between Steel Beam and Concrete Slab
This Section now specifies that the effect of ductility of the shear connection at the interface of the concrete slab and the steel beam shall be considered for load transfer for positive flexural strength

I5.   COMBINED FLEXURE AND AXIAL FORCE
Added to this Section are two new equations for determining the interaction between axial force and flexure. Table I5.1 has also been added to aid in using these new equations.

I6.   LOAD TRANSFER

I6.1.   General Requirements
A statement has been added to specify where the force transfer mechanisms should be located.

I6.2a.   External Force Applied to Steel Section
A User Note has been added to clarify the applicability of Equation I6-1.

I6.2b.   External Force Applied to Concrete
The method to calculate force required to be transferred to the steel has been divided into two separate equations depending on compactness/slenderness. F_{cr} has also been added to the variable list to account for this change.

I6.3b.   Shear Connection
This Section has been edited for clarity.

I6.3c.   Direct Bond Interaction
The values assigned to ϕ and Ω have changed to 0.50 and 3.00, respectively. The two equations used for calculating nominal bond strength, depending on section geometry, have been combined into one equation, and the variable list has been updated to reflect this.

I6.4.   Detailing Requirements

I6.4a.   Encased Composite Members
This Section has been edited for clarity.

I6.4b.   **Filled Composite Members**
A statement has been added to provide guidance for the specific case of load applied to the concrete of a filled composite member containing no internal reinforcement.

I8.   STEEL ANCHORS

I8.1.   **General**
Additional requirements regarding diameter of steel headed stud anchors have been added.

I8.2a.   **Strength of Steel Headed Stud Anchors**
The User Note has been edited for clarity.

I8.2d.   **Detailing Requirements**
This Section has been edited for clarity.

I8.3.   **Steel Anchors in Composite Components**
The references to ACI 318 have been updated to reflect the current provisions.

Within the User Note table, h/d has been revised to h/d_{sa}.

I8.3a.   **Shear Strength of Steel Headed Stud Anchors in Composite Components**
The references to ACI 318 have been updated to reflect the current provisions.

I8.3b.   **Tensile Strength of Steel Headed Stud Anchors in Composite Components**
The references to ACI 318 have been updated to reflect the current provisions and made more general.

I8.3c.   **Strength of Steel Headed Stud Anchors for Interaction of Shear and Tension in Composite Components**
The references to ACI 318 have been updated to reflect the current provisions and made more general.

I8.3e.   **Detailing Requirements in Composite Components**
Minimum concrete cover to steel anchors is no longer specified in this Section. This requirement shall be in accordance with ACI 318.

I9.   SPECIAL CASES
This Section has been removed.

CHAPTER J
DESIGN OF CONNECTIONS

J1. GENERAL PROVISIONS

J1.3. **Moment Connections**
A reference to an earlier Section has been updated.

J1.4. **Compression Members with Bearing Joints**
This Section has been edited for clarity.

J1.6. **Weld Access Holes**
Statements regarding inspection have been removed from this Section. A minimum weld access hole radius has been added. This Section has also been edited for clarity.

J1.8. **Bolts in Combination with Welds**
This Section has been completely rewritten and now provides information on resistance and safety factors, determining available joint strength, and criteria specific to pretensioned high-strength bolts.

J1.9. **Welded Alterations to Structures with Existing Rivets or Bolts** (new Section)
A statement has been added to specify that the weld available strength must provide the additional required strength, but not less than 25% of the required strength. Additionally, this Section has been edited for clarity.

A new User Note has been added to detail when this Section is most commonly used.

J1.10. **High-Strength Bolts in Combination with Rivets** (was Section J1.9)
This is a new Section and has replaced the previous Section J1.10, Limitations on Bolted and Welded Connections. The previous provisions for cranes and machinery (vibratory loads) covered under this Section have been moved to Section J3.1.

J2. WELDS
Many of the revisions to the weld requirements in this Section have been made to be consistent with the current AWS D1.1/D1.1M.

J2.1. **Groove Welds**

J2.1a. **Effective Area**
A statement regarding determination of effective weld throat for partial-joint-penetration welds using Table J2.1 and flare groove welds using Table J2.2 has been added. This statement replaced the previous paragraph specific to flare groove welds. Additionally, this Section has been edited for clarity.

J2.2. **Fillet Welds**

J2.2b. **Limitations**
The requirement for length of welds when longitudinal fillet welds are used alone in end connections of flat bar tension members has been removed. The specific situational limitations for fillet weld terminations, stopped short or extended, have been removed. This has been replaced with a more general limitation requiring that the termination not result in a base metal notch, subject

to applied tension loads, or a prevention of the deformation required to provide assumed design conditions. A statement detailing fillet welds in slots has also been added.

The previous User Note has been edited for clarity and now includes bullets detailing common situations where welds are terminated short of the end of the joint to permit relative deformation between the connected parts.

J2.3.   **Plug and Slot Welds**

J2.3a.   **Effective Area**
This Section has been edited for clarity.

J2.3b.   **Limitations**
This Section has been edited for clarity.

J2.4.   **Strength**
Equations to determine nominal strength and nominal moment capacity that are analyzed using instantaneous center of rotation method have been removed. This Section has also been edited for clarity.

A User Note stating that the instantaneous center method is a valid way to calculate strength of weld groups has been added.

TABLE J2.5 Available Strength of Welded Joints, ksi (MPa)
Text within this table has been edited for clarity.

J2.6.   **Filler Metal Requirements**
A913 Grade 70 has been added to the User Note table. The statement requiring filler metals to meet the requirements of AWS specifications has been removed from the User Note table. This Section has also been edited for clarity.

J3.   **BOLTS AND THREADED PARTS**
A statement specifying that ASTM A307 bolts are permitted except where pretensioning is specified has been added.

J3.1.   **High-Strength Bolts**
Group C bolts have been added, along with a statement and User Note specific to its application. All materials have been updated to current ASTM standards. Sections J3.1(b) and J3.1(c) have been added to detail the conditions in which bolts shall be designed as pretensioned or slip critical. The list of pretensioned and slip-critical bolt installation methods have been removed. This Section has also been edited for clarity.

J3.2.   **Size and Use of Holes**
All washer discussion has been removed and replaced with a statement summarizing that they are to be specified in accordance with the RCSC *Specification* and appropriate ASTM standards.

A washer-specific User Note has been added for the situation of Group C heavy hex fastener assemblies.

TABLE J3.1 and J3.1M Minimum Bolt Pretension
Group C bolts have been added. Group A values have been increased for bolt sizes over one inch.

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J3.3.　　　　　**Minimum Spacing**
A minimum for center-to-center distance has been added, and preferred center-to-center distance has been moved to a User Note. The User Note on anchor rods has been moved to Section J9.

TABLE J3.2　　Nominal Strength of Fasteners and Threaded Parts, ksi (MPa)
This table has been updated to include Group C bolts.

TABLE J3.3 and J3.3M Nominal Hole Dimensions
These tables have been moved here from Section J3.2. Dimensions have been increased for bolt diameters of 1 in. and greater.

J3.8.　　　　　**High-Strength Bolts in Slip-Critical Connections**
This Section has been edited for clarity.

J3.9.　　　　　**Combined Tension and Shear in Slip-Critical Connections**
This Section has been edited for clarity.

J3.10.　　　　**Bearing and Tearout Strength at Bolt Holes**
This Section has been renamed—previously called Bearing Strength at Bolt Holes. The two limit states of bearing and tearout are now given separately rather than in one equation. This Section has also been edited for clarity.

J3.12.　　　　**Wall Strength at Tension Fasteners**
This Section has been renamed—previously called Tension Fasteners. No other changes have been made to this Section.

J4.　　**AFFECTED ELEMENTS OF MEMBERS AND CONNECTING ELEMENTS**
No changes have been made to this Section

J4.3.　　　　　**Block Shear Strength**
This Section has been edited for clarity.

J4.4.　　　　　**Strength of Elements in Compression**
The effective length factor of KL has been replaced by L_c and is reflected with new variable definitions and a User Note.

J5.　　**FILLERS**

J5.1.　　　　　**Fillers in Welded Connections**

J5.1a.　　　　**Thin Fillers**
This Section has been edited for clarity.

J5.1b.　　　　**Thick Fillers**
This Section has been edited for clarity.

J5.2.　　　　　**Fillers in Bolted Bearing-Type Connections**
This Section has been renamed—previously called Fillers in Bolted Connections. The requirement in Section J5.2(d), that the joint be designed to prevent slip in accordance with Section J3.8, has been removed. This Section has also been edited for clarity.

J8. **COLUMN BASES AND BEARING ON CONCRETE**
This Section has been edited for clarity.

J9. **ANCHOR RODS AND EMBEDMENTS**
The User Note on column bases has been expanded and directs users to AISC Design Guide 1, *Base Plate and Anchor Rod Design.*

The User Note on permitted hole sizes, washer diameters, and nuts has been expanded to include specifications on body and nominal diameters for ASTM F1554 anchor rods.

This Section has also been edited for clarity.

J10. **FLANGES AND WEBS WITH CONCENTRATED FORCES**
A User Note directing users to the Commentary for design guidance on members other than wide-flange sections has been added.

J10.3. **Web Local Crippling**
A Q_f factor has been added to Equations J10-5a and J10-5b, used to calculate nominal strength, R_n, to accommodate HSS sections. When required, transverse stiffeners, pairs of transverse stiffeners, or doubler plates must now extend three-quarters of the depth of the web.

J10.4. **Web Sidesway Buckling**
No changes have been made to this Section.

J10.5. **Web Compression Buckling**
A Q_f factor has been added to Equation J10-8, used to calculate available strength, R_n, to accommodate HSS Sections.

J10.6. **Web Panel Zone Shear**
An α factor of 1.0 (LRFD) or 1.6 (ASD) has been added to the limits of applicability for use of Equations J10-9 to J10-12, to calculate nominal strength, R_n. The limits have been changed from a limit based on P_c to one based on P_y. This Section has also been edited for clarity.

J10.10. **Transverse Forces on Plate Elements** (new Section)
This Section has been added to direct users to appropriate limit states for plate elements when a force is applied transverse to the plane.

CHAPTER K
ADDITIONAL REQUIREMENTS FOR HSS AND BOX SECTION CONNECTIONS
Renamed—previously called Design of HSS and Box Member Connections

The chapter scope has been revised to address requirements specific to HSS and box-section members where seam welds are CJP groove welds. The chapter organization has been updated to match current format.

K1. **GENERAL PROVISIONS AND PARAMETERS FOR HSS CONNECTIONS** (new Section)
This Section provides clarification on the applicability of this chapter, in terms of member orientation, as well as collects common material from other Sections in Chapter K rather than repeating it in every Section. This Section was previously called Concentrated Forces on HSS, and that material has been moved to Section K2. Additionally, the importance of limits of applicability in tables has been further stressed. A statement has also been included for connections which do not comply with given limit states, specifying that they are not prohibited, but must be designed by rational analysis.

Two User Notes from the scope have been moved to this Section and were further expanded. They now provide information on connection deformations that may cause serviceability or stability concerns and limits on the angle between the chord and branches in connections.

K1.1. **Definitions of Parameters** (new Section)
Provides definitions of parameters used throughout Chapter K as well as collects terms that are repeated throughout the chapter.

K1.2. **Rectangular HSS** (new Section)

K1.2a. **Effective Width for Connections to Rectangular HSS** (new Section)
This Section provides details for how to calculate the effective width for certain connections to rectangular HSS members.

K2. **CONCENTRATED FORCES ON HSS** (moved from K1)

K2.1. **Definitions of Parameters** (moved from Section K1.1)
Symbols list is reduced to those not specified in Section K1.1.

K2.2. **Round HSS** (moved from Section K1.2)
Table references updated to reflect current organization.

TABLE K2.1 Available Strengths of Plate-to-Round HSS Connections
This was formerly Table K1.1. The scope of the table has been reduced and no longer includes cases specifically for longitudinal plate T-connections or cap plate connections.

TABLE K2.1A Limits of Applicability of Table K2.1
This was formerly Table K1.1A. Plate load angle has been removed and a limit for end distance has been added.

K2.3. **Rectangular HSS** (moved from Section K1.3)
Table references were removed and this Section now directs users to Chapter J for limit states.

K3. **HSS-TO-HSS TRUSS CONNECTIONS** (moved from Section K2)
Content specified in the new Section K1 has been removed to avoid duplication.

K3.1.   **Definitions of Parameters** (moved from Section K2.1)
Symbols list reduced to those not specified in current Section K1.1.

K3.2.   **Round HSS** (moved from Section K2.2)
Table references updated to reflect current organization. This Section has also been edited for clarity.

TABLE K3.1 Available Strengths of Round HSS-to-HSS Truss Connections
This was formerly Table K2.1. Equation references updated to reflect current organization.

TABLE K3.1A Limits of Applicability of Table K3.1
This was formerly Table K2.1A. Branch angle has been removed and a limit for end distance has been added.

K3.3.   **Rectangular HSS** (moved from K2.3)
Table references updated to reflect current organization. This Section has also been edited for clarity.

A User Note has been added to provide guidance to users when connections fall outside the limits of Table K3.2A.

TABLE K3.2 Available Strengths of Rectangular HSS-to-HSS Truss Connections
This was formerly Table K2.2. The scope of the table has been reduced and no longer includes T-, Y- and cross-connections. Equation references and notations have been updated to reflect current organization and parameters.

TABLE K3.2A Limits of Applicability of Table K3.2
This was formerly Table K2.2A. Branch angle has been removed and a limit for end distance has been added.

K4.   **HSS-TO-HSS MOMENT CONNECTIONS** (moved from Section K3)
Content specified in the new Section K1 has been removed to avoid duplication.

K4.1.   **Definitions of Parameters** (moved from Section K3.1)
Symbols list reduced to those not specified in current Section K1.1.

K4.2.   **Round HSS** (moved from Section K3.2)
Table references updated to reflect current organization.

TABLE K4.1 Available Strengths of Round HSS-to-HSS Moment Connections
This was formerly Table K3.1. Equation references and notations have been updated to reflect current organization and parameters.

TABLE K4.1A Limits of Applicability of Table K4.1
This was formerly Table K3.1A. Branch angle has been removed.

K4.3.   **Rectangular HSS** (moved from Sction K3.3)
Table references updated to reflect current organization.

TABLE K4.2 Available Strengths of Rectangular HSS-to-HSS Moment Connections
This was formerly Table K3.2. The scope of the table has been reduced and no longer includes branch(es) under in-plane bending T- and cross-connections.

The remaining case has been reduced to only one limit state. Equation references have been updated to reflect current organization.

TABLE K4.2A Limits of Applicability of Table K4.2
This was formerly Table K3.2A. No other changes have been made.

K5.   **WELDS OF PLATES AND BRANCHES TO RECTANGULAR HSS** (moved from K4)
Content specified in the new Section K1 has been removed to avoid duplication. Equation references have been updated to reflect current organization. This Section has also been edited for clarity.

TABLE K5.1 Effective Weld Properties for Connections to Rectangular HSS
This was formerly Table K4.1. Equation references and notations have been updated to reflect current organization and parameters.

CHAPTER L
DESIGN FOR SERVICEABILITY

The scope of this chapter has been edited for clarity.

L1.   GENERAL PROVISIONS
This Section has been edited for clarity.

L2.   DEFLECTIONS (moved from Section L3)
The User Note from this Section has been removed.

L3.   DRIFT (moved from Section L4)
This Section has been reduced to just state that drift should not impair serviceability of a structure.

L4.   VIBRATION (moved from Section L5)
This Section has been edited for clarity.

L6.   THERMAL EXPANSION AND CONTRACTION (moved from Section L7)
This Section has been renamed—previously called Expansion and Contraction. The statement on damage to building cladding has been removed.

L7.   CONNECTION SLIP (moved from Section L8)
This Section has been edited for clarity.

CHAPTER M
FABRICATION AND ERECTION

M2.   FABRICATION

M2.2.   **Thermal Cutting**
AWS references have been updated. The statement regarding the surface resulting from two straight torch cuts meeting at a point has been removed.

M2.4.   **Welded Construction**
This Section has been edited for clarity.

A User Note has been added to clarify the appropriateness of welder qualification tests.

M2.6.   **Compression Joints**
This Section has been edited for clarity.

M2.8.   **Finish of Column Bases**
This Section has been edited for clarity.

M2.10.   **Drain Holes**
This Section has been edited for clarity.

M2.11.   **Requirements for Galvanized Members**
ASTM references have been updated.

M3.   SHOP PAINTING

M3.5.   **Surfaces Adjacent to Field Welds**
This Section has been edited for clarity.

M4.   ERECTION

M4.3.   **Alignment**
This Section has been edited for clarity.

CHAPTER N
QUALITY CONTROL AND QUALITY ASSURANCE

N1.   GENERAL PROVISIONS
This Section was renamed—formerly called Scope. References have been updated and the Section has been edited for clarity.

N2.   FABRICATOR AND ERECTOR QUALITY CONTROL PROGRAM
This Section has been subdivided into three subsections and has been edited for clarity.

N2.1.   Material Identification (new Section)
Composed of content previously in Section N2; edited for clarity.

N2.2.   Fabricator Quality Control Procedures (new Section)
Composed of content previously in Section N2; edited for clarity.

N2.3.   Erector Quality Control Procedures (new Section)
Composed of content previously in Section N2; edited for clarity. Inspection of steel deck now refers to SDI *Standard for Quality Control and Quality Assurance for Installation of Steel Deck.*

N3.   FABRICATOR AND ERECTOR DOCUMENTS

N3.1.   Submittals for Steel Construction
This Section has been edited for clarity.

N3.2.   Available Documents for Steel Construction
The Section on documents for deck fasteners has been removed. A statement has been added requiring the presence of fabricator NDT personnel qualifications if NDT is performed by the fabricator. This Section has also been edited for clarity.

N5.   MINIMUM REQUIREMENTS FOR INSPECTION OF STRUCTURAL STEEL BUILDINGS

N5.2.   Quality Assurance
Requirements on the location of inspections have been removed.

N5.4.   Inspection of Welding
The requirement specifying that AWS D1.1/D1.1M should apply, has been removed. This Section has also been edited for clarity.

The User Note has been replaced with a new one directing users to Section M2.4 for additional information.

TABLE N5.4-1 Inspection Tasks Prior to Welding
Rows have been added for welder qualification records and continuity records and for fit-up of complete-penetration-groove welds.

TABLE N5.4-2 Inspection Tasks During Welding
A row has been added for placement and installation of steel headed stud anchors. The row for use of qualified welders has been removed.

TABLE N5.4-3 Inspection Tasks After Welding

Rows have been added for weld access holes in rolled and built-up heavy shapes and no prohibited welds without approval.

N5.5. **Nondestructive Testing of Welded Joints**

N5.5a. **Procedures**
The requirement specifying that AWS D1.1/D1.1M should apply, has been removed. This Section has also been edited for clarity.

The User Note has been replaced with a new one directing users to Section M2.4 for additional information.

N5.5b. **CJP Groove Weld NDT**
This Section has been edited for clarity.

N5.5c. **Welded Joints Subjected to Fatigue** (moved from Section N5.5d)
The provisions were replaced with the 2010 Section N5.5d provisions.

N5.5d. **Ultrasonic Testing Rejection Rate** (new Section)
This new Section is used to determine the rejection rate of ultrasonic testing. Some content is moved here from the 2010 Section N5.5e, Reduction of Ultrasonic Testing Rate.

N5.5e. **Reduction of Ultrasonic Testing Rate**
Renamed—formerly called Reduction of Rate of Ultrasonic Testing. A statement has been added specifying that for projects that contain 40 or fewer welds, there should be no reduction in the ultrasonic testing rate. All content on lengths of welds for evaluating the reject rate has been moved to Section N5.5d. This Section has also been edited for clarity.

N5.5f. **Increase Ultrasonic Testing Rate**
Renamed—formerly called Increase in Rate of Ultrasonic Testing. All content on lengths of welds for evaluating the reject rate has been moved to Section N5.5d. This Section has also been edited for clarity.

N5.6. **Inspection of High-Strength Bolting**
This Section has been edited for clarity.

TABLE N5.6-1 Inspection Tasks Prior to Bolting
This table has been edited for clarity.

TABLE N5.6-2 Inspection Tasks During Bolting
This table has been edited for clarity.

N5.7. **Inspection of Galvanized Structural Steel Main Members** (new Section)
This new Section identifies the need for inspection of galvanized structural steel main members.

N5.8. **Other Inspection Tasks** (moved from N5.7)
This Section has been rearranged and some content divided into User Notes. This Section has also been edited for clarity.

N6. **APPROVED FABRICATORS AND ERECTORS** (moved from N7)
This Section has been edited for clarity. The material in this Section was removed because it is now covered by SDI.

N7. **NONCOMFORMING MATERIAL AND WORKMANSHIP** (moved from N8)
No changes have been made to this Section.

APPENDIX 1
DESIGN BY ADVANCED ANALYSIS
Renamed—previously called Design by Inelastic Analysis

This appendix has been completely reorganized. The scope has been expanded as indicated by the change in the title from Design by Inelastic Analysis to Design by Advanced Analysis. The focus is to incorporate direct modeling of imperfections.

1.1   GENERAL REQUIREMENTS
This Section has been rewritten to focus on advanced analysis instead of inelastic analysis.

1.2   DESIGN BY ELASTIC ANALYSIS (new Section)

1.2.1.   General Stability Requirements (new Section)
This Section details the requirements and limitations of design by second-order elastic analysis that includes direct modeling of imperfections.

1.2.2.   Calculation of Required Strengths (new Section)
This Section directs users to Section C2 for methods of calculating required strengths for design using a second-order elastic analysis.

1.2.2a.   General Analysis Requirements (new Section)
This Section provides general requirements for elastic analysis.

1.2.2b.   Adjustments to Stiffness (new Section)
This Section discusses the requirement to use a reduced stiffness in the analysis of a structure.

1.2.3.   Calculation of Available Strengths (new Section)
This Section directs users to the appropriate Sections for methods of calculating available strengths for design using a second-order elastic analysis.

1.3   DESIGN BY INELASTIC ANALYSIS (new Section)
A User Note is included stating that design by the provisions of this Section is independent of Section 1.2.

1.3.1.   GENERAL REQUIREMENTS (moved from Section 1.1)
This Section has been edited for clarity.

1.3.2.   DUCTILITY REQUIREMENTS (moved from Section 1.2)
No changes have been made to this Section.

1.3.2a.   Material (moved from Section 1.2.1)
No changes have been made to this Section.

1.3.2b.   Cross Section (moved from Section 1.2.2)
No changes have been made to this Section.

1.3.2c.   Unbraced Length (moved from Sectoin 1.2.3)
This Section has been edited for clarity.

1.3.2d.   Axial Force (moved from Section 1.2.4)
This Section has been edited for clarity.

1.3.3.   ANALYSIS REQUIREMENTS (moved from Section 1.3)

Section references have been updated.

1.3.3a.   **Material Properties and Yield Criteria** (moved from Section 1.3.1)
This Section has been edited for clarity.

1.3.3b.   **Geometric Imperfections** (moved from Section 1.3.2)
This Section has been completely rewritten and includes all necessary information on geometric imperfections; no longer referencing users to other Sections.

1.3.3c.   **Residual Stress and Partial Yielding Effects** (moved from Section 1.3.3)
Section references have been updated.

APPENDIX 2
DESIGN FOR PONDING

The scope has been refined and now specifies what type of roofs this appendix applies to.

2.1.   SIMPLIFIED DESIGN FOR PONDING

This Section has been edited for clarity.

2.2.   IMPROVED DESIGN FOR PONDING

This Section has been edited for clarity. The definition of f_o was revised.

The User Note for this Section has been removed.

APPENDIX 3
FATIGUE
Renamed—previously called Design for Fatigue

3.1. **GENERAL PROVISIONS**

This Section has been edited for clarity.

3.3. **PLAIN MATERIAL AND WELDED JOINTS**

Equation A-3-3 and A-3-3M have been removed. All other equations have had their scalar factors adjusted to reflect new table values. This Section has also been edited for clarity.

A User Note has been added for stress categories C′ and C″ where the fatigue crack initiates in the root of the weld.

3.4. **BOLTS AND THREADED PARTS**

Equations calculating the allowable stress range, F_{sr}, have been removed. This Section has also been edited for clarity.

3.5. **FABRICATION AND ERECTION REQUIREMENTS FOR FATIGUE**

Requirements for end returns on certain fillet welds subject to cyclic service loading are now directly stated instead of referenced. The wording of this Section has also been extensively edited for clarity.

3.6. **NONDESTRUCTIVE EXAMINATION REQUIREMENTS FOR FATIGUE** (new Section)

This new Section specifies that in order for the ranges calculated by Equation A-3-1 to apply, the complete-joint-penetration groove welds must have been tested according to AWS requirements.

TABLE A-3.1   Fatigue Design Parameters

The magnitude of the C_f constants have been divided by a factor of 10^9, and the equations adjusted accordingly. Also the table text has been extensively edited for clarity. Additional changes include:

- Case 1.3, 1.4, 3.3, and 3.6 have been divided into multiple stress categories.
- Case 1.5, 3.7, and 5.5 have been added.
- For Case 2.3, the stress category and threshold have changed.

Figures have been updated to reflect these changes.

APPENDIX 4
STRUCTURAL DESIGN FOR FIRE CONDITIONS

4.1. **GENERAL PROVISIONS**
A User Note has been added to clarify the term "elevated temperatures."

4.1.1. **Performance Objective**
This Section has been edited for clarity.

4.1.2. **Design by Engineering Analysis**
Section references have been updated.

4.1.4. **Load Combinations and Required Strength**
The notation for nominal forces and deformations due to the design-basis fire has changed.

A User Note has been added to reference a load combination for extraordinary events in ASCE/SEI 7.

A User Note has been added to specify how to take into account the effect of initial imperfections.

4.2. **STRUCTURAL DESIGN FOR FIRE CONDITIONS BY ANALYSIS**

4.2.1. **Design-Basis Fire**
This Section has been edited for clarity.

4.2.1b. **Post-Flashover Compartment Fires**
This Section has been edited for clarity.

4.2.1c. **Exterior Fires**
This Section has been edited for clarity.

4.2.1d. **Active Fire Protection System**
This Section has been edited for clarity.

4.2.3a. **Thermal Elongation** (relabeled from Section 4.2.3.1)
No changes have been made to this Section.

4.2.3b. **Mechanical Properties at Elevated Temperatures** (relabeled from Section 4.2.3.2)

Specific mechanical properties for bolts are now specified in Table A-4.2.3. This Section has also been edited for clarity.

TABLE A-4.2.1 Properties of Steel at Elevated Temperatures
Values for k_y and k_u for lower steel temperatures are now to be found using ambient properties.

TABLE A-4.2.3 Properties of Group A and Group B High-Strength Bolts at Elevated Temperatures (new table)
This is a new table relating bolt temperature to $F_{nt}(T)/F_{nt}$ or $F_{nt}(T)/F_{nt}$.

4.2.4. **Structural Design Requirements**

4.2.4a. **General Structural Integrity** (relabeled from Section 4.2.4.1)

Users are now directed to Section C1for frame stability and required strength requirements. This Section has also been edited for clarity.

4.2.4b.   **Strength Requirements and Deformation Limits** (changed from Section 4.2.4.2)
A statement has been added to provisionally permit the inclusion of membrane action of composite floor slabs. This Section has also been edited for clarity.

4.2.4c.   **Design by Advanced Methods of Analysis** (changed from Section 4.2.4.3a)
Renamed—previously called Advanced Methods of Analysis. This Section has also been edited for clarity.

4.2.4d.   **Design by Simple Methods of Analysis** (changed from Section 4.2.4.3b)
Renamed—previously called Simple Methods of Analysis. An alternate method for calculating the nominal flexural strength of a composite beam using the bottom flange temperature has been provided. Subsections of Design for Shear and Design for Combined Forces and Torsion have been added. This Section has also been extensively rearranged and edited for clarity.

A User Note has been added to discuss uniform versus nonuniform heating.

TABLE A-4.2.4 Retention Factor for Composite Flexural Members (new table)
This is a new table providing retention factors to be used in the new alternate method for calculating nominal flexural strength of composite beams.

APPENDIX 5
EVALUATION OF EXISTING STRUCTURES

A statement has been added specifying that Section 5.4 is only applicable to static vertical gravity loads applied to existing roofs or floors.

5.1.   GENERAL PROVISIONS
This Section has been edited for clarity.

5.2.   MATERIAL PROPERTIES

5.2.2.   Tensile Properties
This Section has been edited for clarity.

5.2.6.   Bolts and Rivets
This Section has been edited for clarity.

5.3.   EVALUATION BY STRUCTURAL ANALYSIS

5.3.2.   Strength Evaluation
This Section has been edited for clarity.

5.4.   EVALUATION BY LOAD TESTS

5.4.1.   Determination of Load Rating by Testing
This Section has been edited for clarity.

5.4.2.   Serviceability Evaluation
This Section has been edited for clarity.

APPENDIX 6
MEMBER STABILITY BRACING
Renamed—previously called Stability Bracing for Columns and Beams

The User Note now directs users to the Commentary for guidance on applying these provisions to stabilize trusses. The User Note has also been edited for clarity.

6.1. GENERAL PROVISIONS
The terminology of relative brace has changed to panel brace and nodal brace has changed to point brace. The exception where nodal bracing systems with regular spacing could be modeled as continuous systems has been removed. An exception has been added where the required bracing stiffness can be obtained as $2/\phi$ (LRFD) or 2Ω (ASD) times the ideal bracing stiffness determined from a buckling analysis. This Section has also been edited for clarity and generalized.

A User Note has been added to clarify the basis for requirements in Sections 6.2, 6.3 and 6.4, and note the difference in using computational analysis methods.

6.2. COLUMN BRACING
This Section has been edited for clarity.

A User Note has been added to clarify the Section's applicability, assumptions of location, and provisions for exceptions.

6.2.1. Panel Bracing
Renamed—previously called Relative Bracing. The notations within the given equations have changed. The factor on Equation A-6-1, required shear strength, has changed from 0.004 to 0.005. This Section has also been edited for clarity.

A User Note has been added for the condition if the stiffness of the connection to the panel bracing system is comparable to the stiffness of the panel bracing system itself.

6.2.2. Point Bracing
Renamed—previously called Nodal Bracing. The notations within the given equations have changed. A statement has been added that when the unbraced lengths adjacent to a point brace have different P_r/L_{br} values, the larger value should be used to determine the required brace stiffness. This Section has also been edited for clarity.

The User Note stating that these equations correspond to the assumption that the nodal braces are equally spaced has been removed.

6.3. BEAM BRACING
This Section no longer applies to trusses. This Section has also been edited for clarity.

6.3.1. Lateral Bracing
A statement has been added permitting use of either panel or point bracing to provide lateral bracing for beams. This Section has also been edited for clarity.

6.3.1a. Panel Bracing
This Section has been renamed—previously called Relative Bracing. The notations within the given equations have changed. The factor on Equation A-6-5, required shear strength, has changed from 0.008 to 0.01. This Section has also been edited for clarity.

A User Note has been added stating that the stiffness contribution of the connection to the panel bracing system should be assessed as provided in the User Note to Section 6.2.1.

6.3.1b.   **Point Bracing**
Renamed—previously called Nodal Bracing. The notations within the given equations have changed. A statement has been added that when the unbraced lengths adjacent to a point brace have different M_r/L_{br} values, the larger value should be used to determine the required brace stiffness. This Section has also been edited for clarity.

6.3.2.   **Torsional Bracing**
This Section has been edited for clarity.

6.3.2a.   **Point Bracing**
Renamed—previously called Nodal Bracing. The notations within the given equations have changed. The symbols list has been updated to reflect this revision. The factor and variables used in Equation A-6-9, required flexural strength, have changed. This Section has also been edited for clarity.

The User Note has been expanded to include special considerations for β_{sec} and β_{br}. A User Note has been added to provide values specific to doubly symmetric members.

6.3.2b.   **Continuous Bracing**
This Section has been rearranged and edited for clarity.

6.4.   BEAM-COLUMN BRACING
A fourth subsection has been added for the condition when the combined stress effect from axial force and flexure results in compression to both flanges. This Section has also been edited for clarity.

A User Note has been added for this new subsection, directing users to the Commentary for more information.

APPENDIX 7
ALTERNATIVE METHODS OF DESIGN FOR STABILITY

7.2. **EFFECTIVE LENGTH METHOD**

7.2.1. **Limitations**
This Section has been edited for clarity.

7.2.2. **Required Strengths**
This Section has been edited for clarity.

7.2.3. **Available Strengths**
This Section has been edited for clarity.

7.3. **FIRST-ORDER ANALYSIS METHOD**

7.3.1. **Limitations**
Equation A-7-1 has been revised to accommodate members with slender elements. Notations within the given equation have changed. This Section has also been edited for clarity.

7.3.2. **Required Strengths**
This Section has been edited for clarity.

7.3.3. **Available Strengths**
This Section has been edited to reflect the change in how the effective length is determined.

APPENDIX 8
APPROXIMATE SECOND-ORDER ANALYSIS

8.2.   CALCULATION PROCEDURE
This Section has been edited for clarity.

8.2.1.   Multiplier B_1 for P-δ Effects
This Section has been edited for clarity.

8.2.2.   Multiplier B_2 for P-Δ Effects
This Section has been edited for clarity.

The User Note has been expanded to include the lower bound values for R_M.