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Are You Properly Specifying Materials?
January 14, 2020

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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Course Description

Are You Properly Specifying Materials?
January 14, 2020

When you specify materials by referencing ASTM specifications, are you sure that you're making the right choices? With the many ASTM specifications available in steel building construction, it can be a challenge to stay current with standard material production practices. This webinar will review which ASTM specifications are standard in steel building design and construction for structural shapes, plate products, fastening products, and other products. Specify steel materials with confidence on your next job, and reduce RFIs!

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Learning Objectives

- Describe the importance of not over-specifying or under-specifying steel material as related to cost and project success.
- List the preferred material specifications for structural shapes and plate products.
- Describe recent changes in how fasteners are standardized.
- Identify new materials used for HSS and how they differ from past preferred materials.

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Are You Properly Specifying Materials?

January 14, 2020

Lawrence F. Kruth, PE
Vice President of Engineering & Research
American Institute of Steel Construction
Chicago, IL

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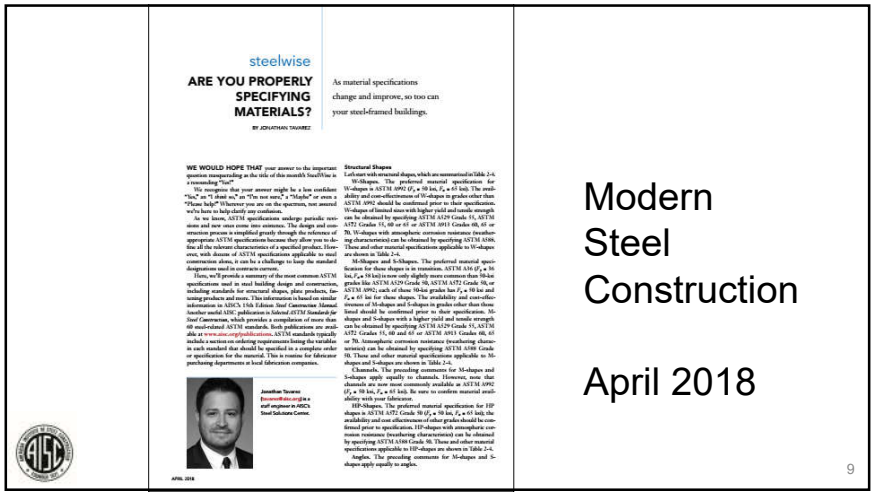

steelwise

ARE YOU PROPERLY SPECIFYING MATERIALS?

BY JONATHAN TAVAREZ

As material specifications change and improve, so too can your steel-framed buildings.

WE WOULD HOPE THAT your answer to the important question masquerading as the title of this month's SteelWise is a resounding "Yes!"

We recognize that your answer might be a less confident "less," an "I think so," an "I'm not sure," a "Maybe" or even a "Please help!" Wherever you are on the spectrum, rest assured we're here to help clarify any confusion.

As we know, ASTM specifications undergo periodic revisions and new ones come into existence. The design and construction process is simplified greatly through the reference of appropriate ASTM specifications because they allow you to define all the relevant characteristics of a specified product. However, with dozens of ASTM specifications applicable to steel construction alone, it can be a challenge to keep the standard designations used in contracts current.

Here, we'll provide a summary of the most common ASTM specifications used in steel building design and construction, including standards for structural shapes, plate products, fastening products and rivets. This information is based on similar information in AISC's 15th Edition *Steel Construction Manual*. Another useful AISC publication is *Selected ASTM Standards for Steel Construction*, which provides a compilation of more than 60 steel-related ASTM standards. Both publications are available at www.aisc.org/publications. ASTM standards typically include a section on ordering requirements listing the variables in each standard that should be specified in a complete order or specification for the material. This is routine for fabricator purchasing departments or local fabrication companies.

Jonathan Tavarez
Jtavarez@aisc.org is a staff engineer in AISC's Steel Solutions Center.

Structural Shapes

Left-over with structural shapes, which are summarized in Table 2-4.

W-Shapes. The preferred material specification for W-shapes is ASTM A992 (F_y = 50 ksi, F_u = 65 ksi). The availability and cost-effectiveness of W-shapes in grades other than ASTM A992 should be confirmed prior to their specification. W-shapes of limited sizes with higher yield and tensile strength can be obtained by specifying ASTM A529 Grade 55, ASTM A572 Grades 55, 60 or 65 or ASTM A913 Grades 60, 65 or 70. W-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588. These and other material specifications applicable to W-shapes are shown in Table 2-4.

M-Shapes and S-Shapes. The preferred material specification for these shapes is in transition. ASTM A36 (F_y = 36 ksi, F_u = 58 ksi) is now only slightly more common than 50-ksi grades like ASTM A529 Grade 50, ASTM A572 Grade 50, or ASTM A992; each of these 50-ksi grades has F_y = 50 ksi and F_u = 65 ksi for these shapes. The availability and cost-effectiveness of M-shapes and S-shapes in grades other than those listed should be confirmed prior to their specification. M-shapes and S-shapes with a higher yield and tensile strength can be obtained by specifying ASTM A529 Grade 55, ASTM A572 Grades 55, 60 and 65 or ASTM A913 Grades 60, 65 or 70. Atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50. These and other material specifications applicable to M-shapes and S-shapes are shown in Table 2-4.

Channels. The preceding comments for M-shapes and S-shapes apply equally to channels. However, note that channels are now most commonly available at ASTM A992 (F_y = 50 ksi, F_u = 65 ksi). Be sure to confirm material availability with your fabricator.

HP-Shapes. The preferred material specification for HP shapes is ASTM A572 Grade 50 (F_y = 50 ksi, F_u = 65 ksi); the availability and cost effectiveness of other grades should be confirmed prior to specification. HP-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50. These and other material specifications applicable to HP-shapes are shown in Table 2-4.

Angles. The preceding comments for M-shapes and S-shapes apply equally to angles.

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Modern Steel Construction

April 2018

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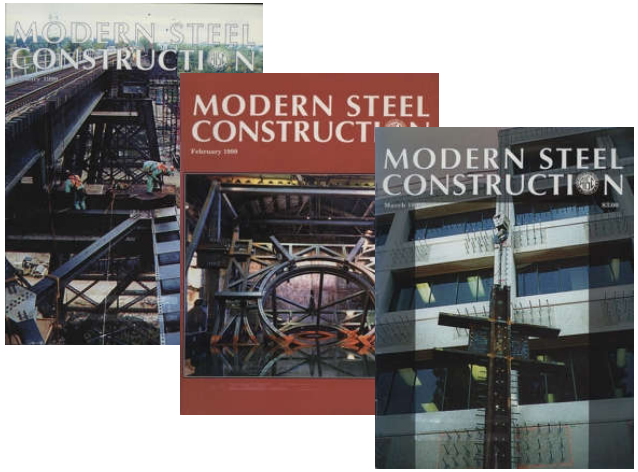

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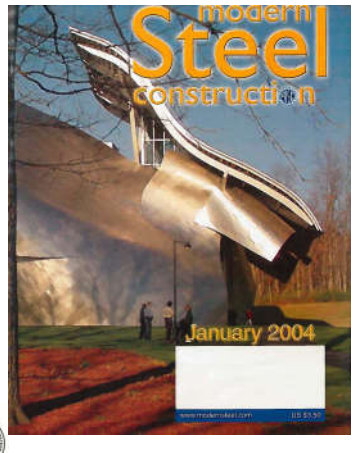

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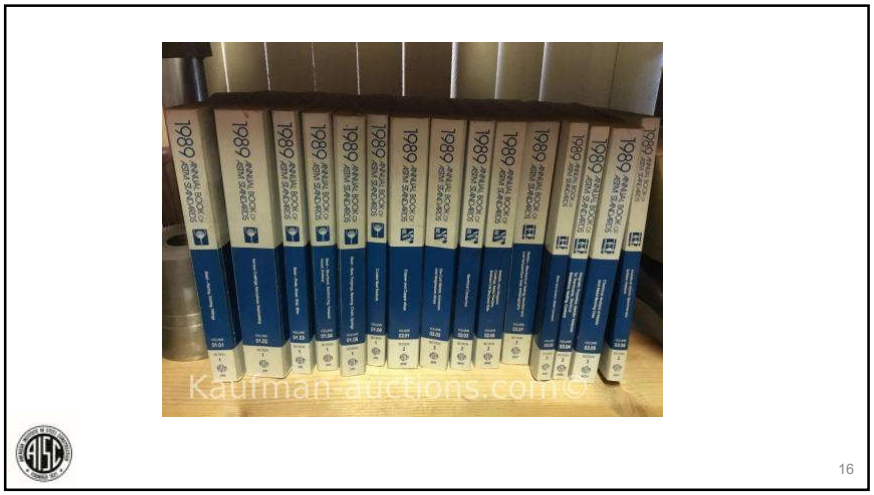

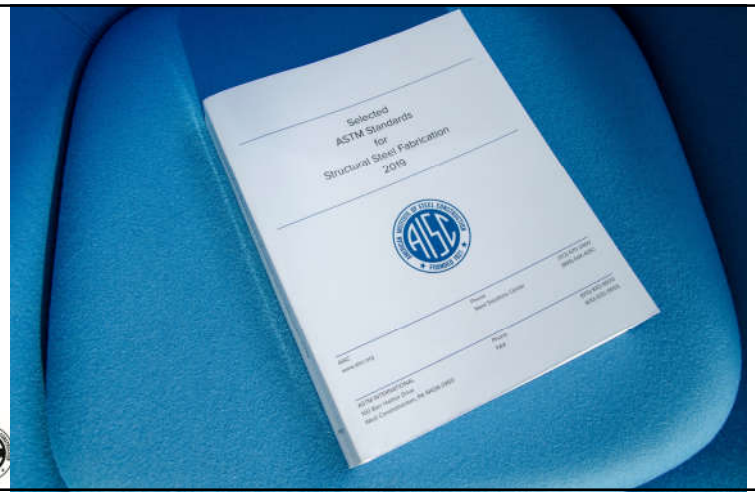

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ASTM Standards Get You:

- Ordering requirements
- Mechanical requirements (F_y, F_u, and elongation)
- Chemical composition requirements
- Process requirements
- Testing requirements
- Tolerances for cross-section, curvature, etc.
- Provisions for repair of defects
- Reporting requirements

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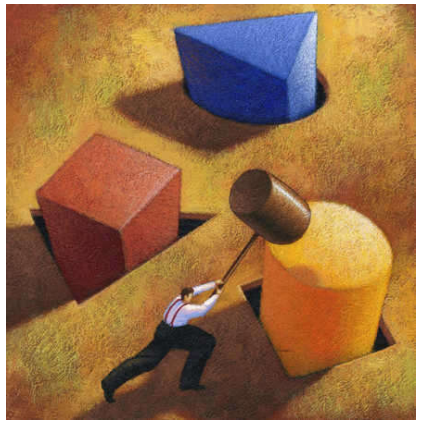

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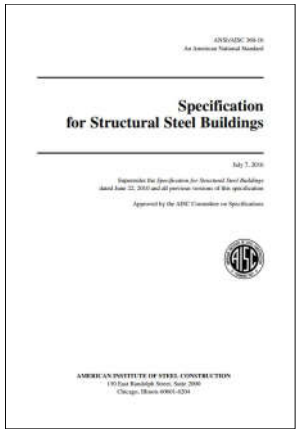


ANSI/AISC 360-16
An American National Standard

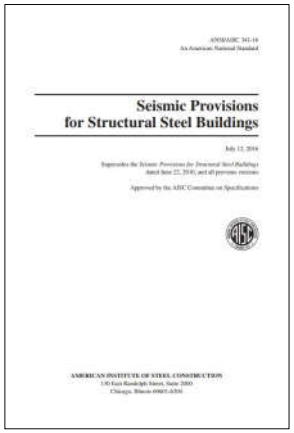
Specification for Structural Steel Buildings

July 7, 2016

Supersedes the *Specification for Structural Steel Buildings* dated June 22, 2010 and all previous versions of this specification

Approved by the AISC Committee on Specifications

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
130 East Randolph Street, Suite 2000
Chicago, Illinois 60601-6204



ANSI/AISC 341-16
An American National Standard

Seismic Provisions for Structural Steel Buildings

July 12, 2016

Supersedes the *Seismic Provisions for Structural Steel Buildings* dated June 22, 2010, and all previous versions

Approved by the AISC Committee on Specifications

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130 East Randolph Street, Suite 2000
Chicago, Illinois 60601-6204

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A3. MATERIAL

1. Structural Steel Materials

Material test reports or reports of tests made by the fabricator or a testing laboratory shall constitute sufficient evidence of conformity with one of the ASTM standards listed in Section A3.1a. For hot-rolled structural shapes, plates, and bars, such tests shall be made in accordance with ASTM A6/A6M; for sheets, such tests shall be made in accordance with ASTM A568/A568M; for tubing and pipe, such tests shall be made in accordance with the requirements of the applicable ASTM standards listed above for those product forms.

1a. ASTM Designations

Structural steel material conforming to one of the following ASTM specifications is approved for use under this Specification:

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(a) Hot-rolled structural shapes

ASTM A36/A36M	ASTM A709/A709M
ASTM A529/A529M	ASTM A913/A913M
ASTM A572/A572M	ASTM A992/ A992M
ASTM A588/A588M	ASTM A1043/A1043M

(b) Hollow structural sections (HSS)

ASTM A53/A53M Grade B	ASTM A847/A847M
ASTM A500/A500M	ASTM A1065/A1065M
ASTM A501/A501M	ASTM A1085/A1085M
ASTM A618/A618M	

(c) Plates

ASTM A36/A36M	ASTM A572/A572M
ASTM A242/A242M	ASTM A588/A588M
ASTM A283/A283M	ASTM A709/A709M
ASTM A514/A514M	ASTM A1043/A1043M
ASTM A529/A529M	ASTM A1066/A1066M

(d) Bars

ASTM A36/A36M	ASTM A572/A572M
ASTM A529/A529M	ASTM A709/A709M

(e) Sheets

ASTM A606/A606M
ASTM A1011/A1011M SS, HSLAS, AND HSLAS-F

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ANSI/AISC 303-16
An American National Standard

Code of Standard Practice for Steel Buildings and Bridges

June 15, 2016

Supersedes the *Code of Standard Practice for Steel Buildings and Bridges* dated April 14, 2010 and all previous versions

Approved by the Committee on the Code of Standard Practice

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
130 East Randolph Street, Suite 2000, Chicago, Illinois 60601
www.aisc.org

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Code of Standard Practice Section 6.1.1 Excerpt:
Unless an alternative system is established in the *fabricator's* written procedures, shop-standard material shall be as follows:

Material	Shop-standard material grade
W and WT	ASTM A992
M, S, MT and ST	ASTM A36
HP	ASTM A572 grade 50
L	ASTM A36
C and MC	ASTM A36
HSS	ASTM A500 grade C
Steel Pipe	ASTM A53 grade B
Plates and Bars	ASTM A36

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Material	Shop-standard material grade
W and WT	ASTM A992
M, S, MT and ST	ASTM A36
HP	ASTM A572 grade 50
L	ASTM A36
C and MC	ASTM A36
HSS	ASTM A500 grade C
Steel Pipe	ASTM A53 grade B
Plates and Bars	ASTM A36

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Material	Shop-standard material grade
W and WT	ASTM A992
M, S, MT and ST	ASTM A36
HP	ASTM A572 grade 50
L	ASTM A36
C and MC	ASTM A36
HSS	ASTM A500 grade C
Steel Pipe	ASTM A53 grade B
Plates and Bars	ASTM A36

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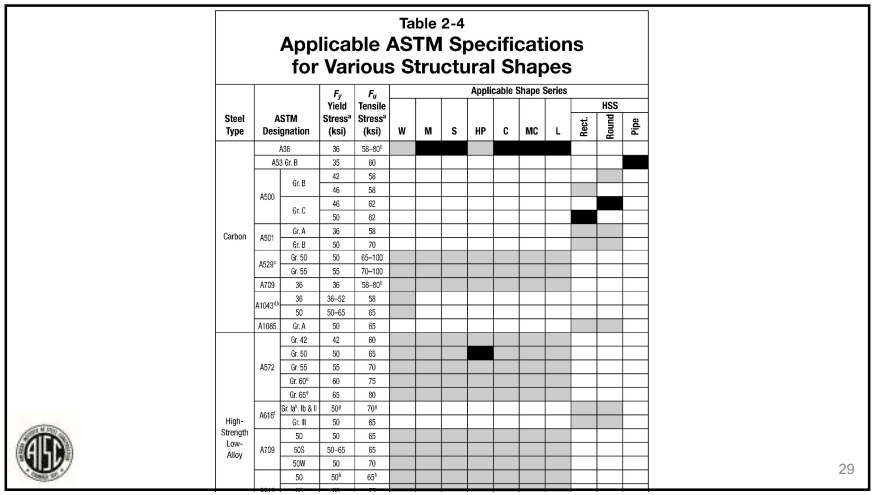

Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y Yield Stress[a] (ksi)	F_u Tensile Stress[a] (ksi)	Applicable Shape Series									
					W	M	S	HP	C	MC	L	HSS Rect.	HSS Round	HSS Pipe
Carbon	A36		36	58–80[b]	■	■	■	■	■	■	■			
	A53 Gr. B		35	60										■
	A500	Gr. B	42	58									■	
			46	58										
		Gr. C	46	62									■	
			50	62								■		
	A501	Gr. A	36	58									■	
		Gr. B	50	70										
	A529[c]	Gr. 50	50	65–100	■	■	■	■	■	■	■			
		Gr. 55	55	70–100	■	■	■	■	■	■	■			
	A709		36	58–80[b]	■	■	■	■	■	■	■			
	A1043[d,e]		36	36–52	■									
			50	50–65	■									
	A1085	Gr. A	50	65	■	■	■	■	■	■	■	■	■	
High-Strength Low-Alloy	A572	Gr. 42	42	60	■	■	■	■	■	■	■			
		Gr. 50	50	65	■	■	■		■	■	■			
		Gr. 55	55	70	■	■	■	■	■	■	■			
		Gr. 60[e]	60	75	■	■	■	■	■	■	■			
		Gr. 65[e]	65	80	■	■	■	■	■	■	■			
	A618[f]	Gr. Ia, Ib & II	50[g]	70[g]	■	■	■	■	■	■	■	■	■	
		Gr. III	50	65	■	■	■	■	■	■	■			
	A709	50	50	65	■	■	■	■	■	■	■			
		50S	50–65	65	■	■	■	■	■	■	■			
		50W	50	70	■	■	■	■	■	■	■			
		50	50[h]	65[i]	■	■	■	■	■	■	■			

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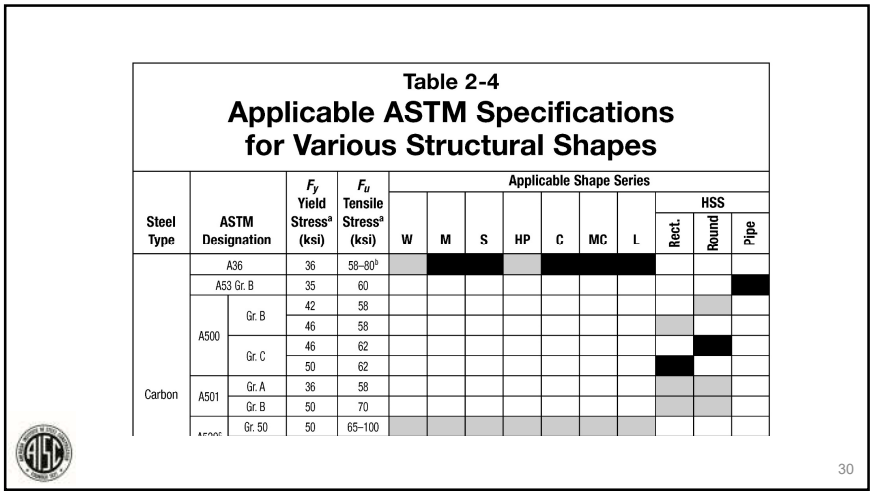

Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y Yield Stress[a] (ksi)	F_u Tensile Stress[a] (ksi)	Applicable Shape Series									
					W	M	S	HP	C	MC	L	HSS Rect.	HSS Round	HSS Pipe
Carbon	A36		36	58–80[b]	■	■	■	■	■	■	■			
	A53 Gr. B		35	60										■
	A500	Gr. B	42	58									■	
			46	58										
		Gr. C	46	62									■	
			50	62								■		
	A501	Gr. A	36	58									■	
		Gr. B	50	70										
	A529[c]	Gr. 50	50	65–100	■	■	■	■	■	■	■			

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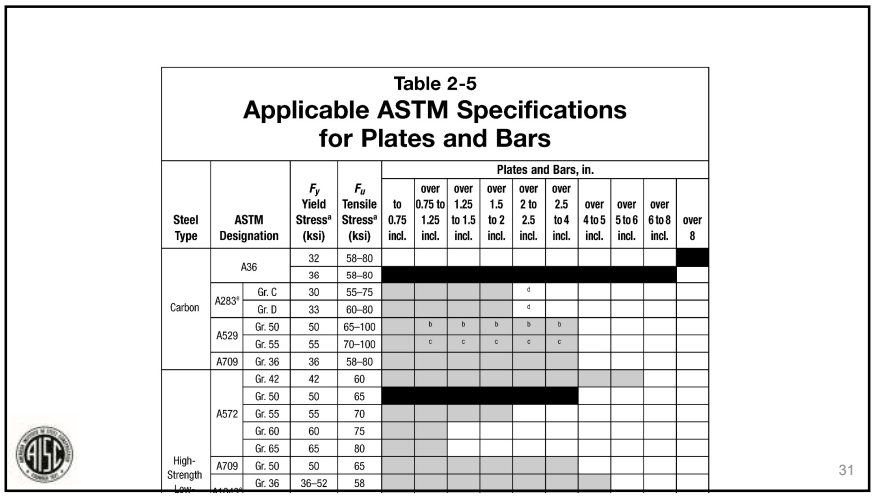

Table 2-5
Applicable ASTM Specifications for Plates and Bars

Steel Type	ASTM Designation		F_y Yield Stress[a] (ksi)	F_u Tensile Stress[a] (ksi)	Plates and Bars, in.									
					to 0.75 incl.	over 0.75 to 1.25 incl.	over 1.25 to 1.5 incl.	over 1.5 to 2 incl.	over 2 to 2.5 incl.	over 2.5 to 4 incl.	over 4 to 5 incl.	over 5 to 6 incl.	over 6 to 8 incl.	over 8
Carbon	A36		32	58–80										■
			36	58–80	■	■	■	■	■	■	■	■	■	
	A283[a]	Gr. C	30	55–75					[d]					
		Gr. D	33	60–80					[d]					
	A529	Gr. 50	50	65–100		[b]	[b]	[b]	[b]	[b]				
		Gr. 55	55	70–100		[c]	[c]	[c]	[c]	[c]				
	A709	Gr. 36	36	58–80										
High-Strength Low-	A572	Gr. 42	42	60										
		Gr. 50	50	65	■	■	■	■	■	■				
		Gr. 55	55	70										
		Gr. 60	60	75										
		Gr. 65	65	80										
	A709	Gr. 50	50	65										
		Gr. 36	36–52	58										

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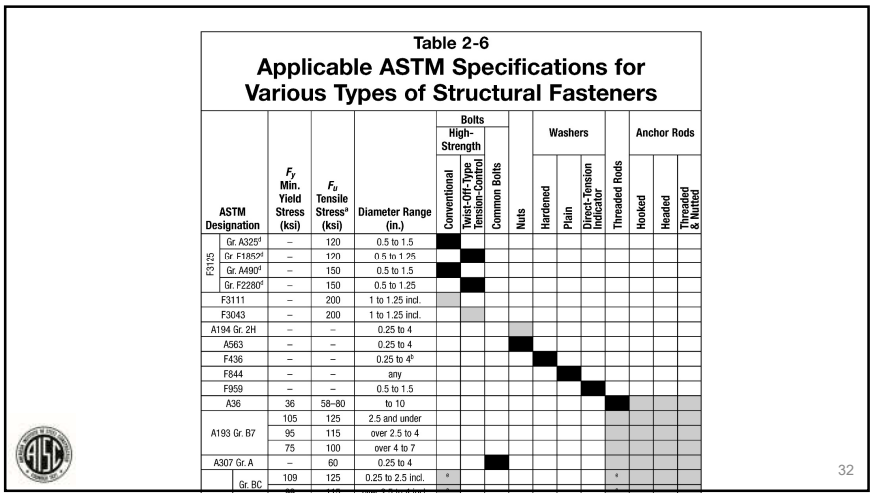

Table 2-6
Applicable ASTM Specifications for Various Types of Structural Fasteners

ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Diameter Range (in.)	Bolts: High-Strength: Conventional	Bolts: High-Strength: Twist-Off-Type Tension-Control	Bolts: Common Bolts	Nuts	Washers: Hardened	Washers: Plain	Washers: Direct-Tension Indicator	Threaded Rods	Anchor Rods: Hooked	Anchor Rods: Headed	Anchor Rods: Threaded & Nutted
F3125	Gr. A325[f]	–	120	0.5 to 1.5	■	■									
	Gr. F1852[f]	–	120	0.5 to 1.25		■									
	Gr. A490[f]	–	150	0.5 to 1.5	■										
	Gr. F2280[f]	–	150	0.5 to 1.25		■									
F3111		–	200	1 to 1.25 incl.											
F3043		–	200	1 to 1.25 incl.											
A194 Gr. 2H		–	–	0.25 to 4											
A563		–	–	0.25 to 4				■							
F436		–	–	0.25 to 4[b]					■						
F844		–	–	any						■					
F959		–	–	0.5 to 1.5							■				
A36		36	58–80	to 10								■			
A193 Gr. B7		105	125	2.5 and under											
		95	115	over 2.5 to 4											
		75	100	over 4 to 7											
A307 Gr. A		–	60	0.25 to 4			■								
	Gr. BC	109	125	0.25 to 2.5 incl.	[e]							[e]			

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ARE YOU PROPERLY SPECIFYING MATERIALS?

BY JONATHAN TAVAREZ

As material specifications change and improve, so too can your steel-framed buildings.

LIVE

WE WOULD HOPE THAT your answer to the important question masquerading as the title of this month's SteelWise is a resounding "Yes!"

We recognize that your answer might be a less confident "Yes," an "I think so," an "I'm not sure," a "Maybe" or even a "Please help!" Wherever you are on the spectrum, rest assured we're here to help clarify any confusion.

As we know, ASTM specifications undergo periodic revisions and new ones come into existence. The design and construction process is simplified greatly through the reference of appropriate ASTM specifications because they allow you to define all the relevant characteristics of a specified product. However, with dozens of ASTM specifications applicable to steel construction alone, it can be a challenge to keep the standard designations used in contracts current.

Here, we'll provide a summary of the most common ASTM specifications used in steel building design and construction, including standards for structural shapes, plate products, fastening products and more. This information is based on similar information in AISC's 15th Edition *Steel Construction Manual*. Another useful AISC publication is *Selected ASTM Standards for Steel Construction*, which provides a compilation of more than 60 steel-related ASTM standards. Both publications are available at www.aisc.org/publications. ASTM standards typically include a section on ordering requirements listing the variables in each standard that should be specified in a complete order or specification for the material. This is routine for fabricator purchasing departments at local fabrication companies.

Jonathan Tavarez (jtavarez@aisc.org) is a staff engineer in AISC's Steel Solutions Center.

APRIL 2018

Structural Shapes

Let's start with structural shapes, which are summarized in Table 2-1.

W-Shapes. The preferred material specification for W-shapes is ASTM A992 (F_y = 50 ksi, F_u = 65 ksi). The availability and cost-effectiveness of W-shapes in grades other than ASTM A992 should be confirmed prior to their specification. W-shapes of limited sizes with higher yield and tensile strength can be obtained by specifying ASTM A529 Grade 55, ASTM A572 Grades 55, 60 or 65 or ASTM A913 Grades 60, 65 or 70. W-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588. These and other material specifications applicable to W-shapes are shown in Table 2-4.

M-Shapes and S-Shapes. The preferred material specification for these shapes is in transition. ASTM A36 (F_y = 36 ksi, F_u = 58 ksi) is now only slightly more common than 50-ksi grades like ASTM A529 Grade 50, ASTM A572 Grade 50, or ASTM A992; each of these 50-ksi grades has F_y = 50 ksi and F_u = 65 ksi for these shapes. The availability and cost-effectiveness of M-shapes and S-shapes in grades other than those listed should be confirmed prior to their specification. M-shapes and S-shapes with a higher yield and tensile strength can be obtained by specifying ASTM A529 Grade 55, ASTM A572 Grades 55, 60 and 65 or ASTM A913 Grades 60, 65 or 70. Atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50. These and other material specifications applicable to M-shapes and S-shapes are shown in Table 2-4.

Channels. The preceding comments for M-shapes and S-shapes apply equally to channels. However, note that channels are now more commonly available as ASTM A992 (F_y = 50 ksi, F_u = 65 ksi). Be sure to confirm material availability with your fabricator.

HP-Shapes. The preferred material specification for HP shapes is ASTM A572 Grade 50 (F_y = 50 ksi, F_u = 65 ksi); the availability and cost-effectiveness of other grades should be confirmed prior to specification. HP-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50. These and other material specifications applicable to HP-shapes are shown in Table 2-4.

Angles. The preceding comments for M-shapes and S-shapes apply equally to angles.

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W-Shapes

ASTM A992

F_y = 50 ksi

F_u = 65 ksi

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W-Shapes

Atmospheric Corrosion Resistance

ASTM A588

F_y = 50 ksi

F_u = 70 ksi

36

W-Shapes
ASTM A913

37

W-Shapes
ASTM A913
Grade 50
Grade 65
Grade 70

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W-Shapes
ASTM A913

W44 x 230-335
W40 x 149-655
W36 x 135-925
W30 x 90-391
W27 x 84-539
W21 x 44-275
W18 x 35-311
W16 x 26-100
W14 x 22-873
W12 x 14-336
W10 x 12-112
W8 x 10-67

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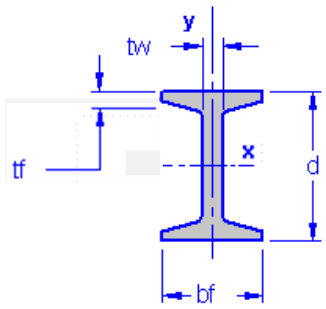

S-Shapes
ASTM A36
F_y = 36 ksi
F_u = 58 ksi
-or-
ASTM A***
F_y = 50 ksi
F_u = 65 ksi

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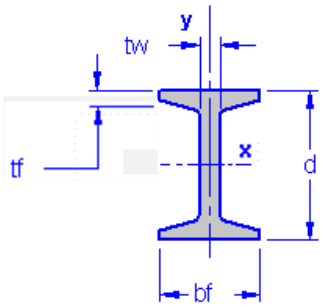
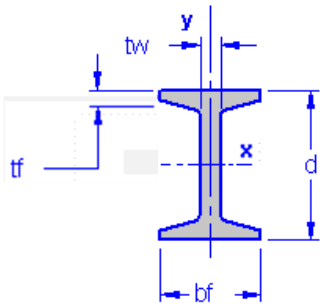


S-Shapes

ASTM A36
F_y = 36 ksi
F_u = 58 ksi
-or-
ASTM A***
A572 Grade 50
A529 Grade 50
or A992

41



S-Shapes

Atmospheric
Corrosion
Resistance

ASTM A588
F_y = 50 ksi
F_u = 70 ksi

42

Channels

C-Shapes and
MC-Shapes

43

Channels

Same as
S-Shapes

44

MC 12 x 14.3
Stringer Channel

45

Angles

Same as
S-Shapes

46

Photo courtesy of ArcelorMittal

Angles

Large Leg Angles

L12×12×1⅜
L12×12×1¼
L12×12×1⅛
L12×12×1

L10×10×1⅜
L10×10×1¼
L10×10×1⅛
L10×10×1
L10×10×⅞
L10×10×¾

47

Tees

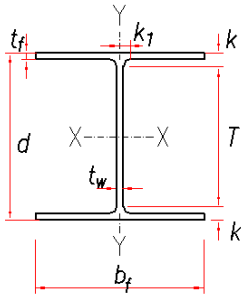
WT → W-Shapes

48

Tees

WT → W-Shapes
ST → S-Shapes

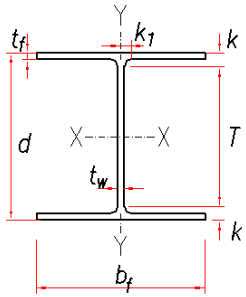
49



HP-Shapes

Bearing Piles

50



HP-Shapes

ASTM A572 Grade 50
F_y = 50 ksi
F_u = 65 ksi

51

HP-Shapes

ASTM A572 Grade 50
F_y = 50 ksi
F_u = 65 ksi

52

HSS

53

HSS (Rect.)

~~ASTM A500~~
~~Grade B~~
~~F_y = 46 ksi~~
~~F_u = 58 ksi~~

54

HSS (Rect.)

ASTM A500
Grade C
F_y = 50 ksi
F_u = 62 ksi

55

HSS (Round)

ASTM A500
Grade C
F_y = 46 ksi
F_u = 62 ksi

56

HSS

Atmospheric Corrosion Resistance
ASTM A847

57

HSS

ASTM A1085
F_y = 50 ksi
F_u = 65 ksi

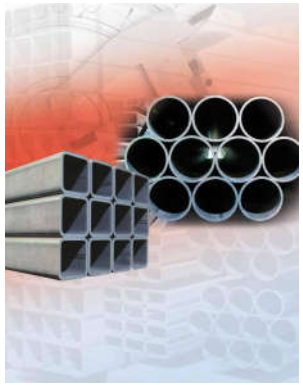
58

HSS

ASTM A1085

No more 0.93*t*

59



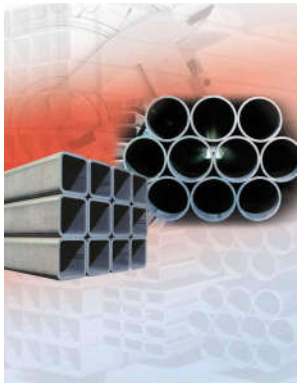
HSS

ASTM A1085

No more 0.93*t*

$F_{y\ max}$ = 70 ksi

60



HSS

ASTM A1085

No more 0.93*t*

$F_{y\,max}$ = 70 ksi

CVN 25 ft-lb @ 40°F

61

HSS

ASTM A1085

Ask your local Fabricator

62

HSS

ASTM A500 and ASTM A1085
Now available in larger sizes up to 88 inch periphery and 7/8 inch wall thickness.

63

Steel Pipe

ASTM A53 Grade B

F_y = 35 ksi
F_u = 60 ksi

64

Round HSS ≠ Steel Pipe

65

Round HSS ≠ Steel Pipe

A500 Grade C A53 Grade B

66

Round HSS ≠ Steel Pipe

A500 Grade C A53 Grade B

F_y = 46 ksi F_y = 35 ksi

67

Round HSS ≠ Steel Pipe

A500 Grade C A53 Grade B

F_y = 46 ksi F_y = 35 ksi

HSS6.625x0.280 Pipe 6 Std.

68

Round HSS ≠ **Steel Pipe**

A500 Grade C	A53 Grade B
F_y = 46 ksi	F_y = 35 ksi
HSS6.625x0.280	Pipe 6 Std.

But there are similarities …
The two designations shown have the same physical cross section.

69

Round HSS ≠ **Steel Pipe**

A500 Grade C	A53 Grade B
F_y = 46 ksi	F_y = 35 ksi
HSS6.625x0.280	Pipe 6 Std.

But there are similarities …
The two designations shown have the same physical cross section.

70

Round HSS ≠ **Steel Pipe**

A500 Grade C	A53 Grade B
F_y = 46 ksi	F_y = 35 ksi
HSS6.625x0.280	Pipe 6 Std.

Because A53 is Pipe,
Hydrostatic Testing is required
This is an added cost to A53

71

Plates

Bars

72

Plates & Bars

ASTM A36
F_y = 36 ksi
F_u = 58 ksi
-or-
ASTM A572 Grade 50
F_y = 50 ksi
F_u = 65 ksi

73

Plates & Bars

ASTM A36
F_y = 36 ksi *
F_u = 58 ksi
-or-
ASTM A572 Grade 50
F_y = 50 ksi **
F_u = 65 ksi

74

Plates & Bars

Atmospheric
Corrosion
Resistance

ASTM A588
F_y = 50 ksi
F_u = 70 ksi

75

Fasteners

76

Fasteners

Table 2-6
Applicable ASTM Specifications for Various Types of Structural Fasteners

	ASTM Designation	F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Diameter Range (in.)	Bolts: High-Strength: Conventional	Bolts: High-Strength: Twist-Off-Type Tension-Control	Bolts: Common Bolts	Nuts	Washers: Hardened	Washers: Plain	Washers: Direct-Tension Indicator	Threaded Rods	Anchor Rods: Hooked	Anchor Rods: Headed	Anchor Rods: Threaded & Nutted
F1125	Gr. A325[f]	--	120	0.5 to 1.5	■	■									
F1125	Gr. F1852[g]	--	120	0.5 to 1.25	■	■									
F1125	Gr. A490[f]	--	150	0.5 to 1.5	■	■									
F1125	Gr. F2280[g]	--	150	0.5 to 1.25	■	■									
	F3111	--	200	1 to 1.25 incl.											
	F3043	--	200	1 to 1.25 incl.											
	A194 Gr. 2H	--	--	0.25 to 4				■							
	A563	--	--	0.25 to 4					■						
	F436	--	--	0.25 to 4[h]						■					
	F844	--	--	any							■				
	F959	--	--	0.5 to 1.5								■			
	A36	36	58–80	to 10											
	A193 Gr. B7	105	125	2.5 and under											
		95	115	over 2.5 to 4											
		75	100	over 4 to 7											
	A307 Gr. A	--	60	0.25 to 4			■								

77

High Strength Bolts
Old

ASTM A325
ASTM A490

ASTM F1852
ASTM F2280

78

High Strength Bolts
New
ASTM F3125

Grade A325
Grade A490

Grade F1852
Grade F2280

79

High Strength Bolts

ASTM F3111

ASTM F3043

200 ksi Bolts

Not available in the US at this time

80

81

High Strength Bolts

ASTM F3148

TNA Bolt
Torque + Angle

82

High Strength Bolts

Grade A325 – 120ksi Grade A490 – 150 ksi

TNA Bolt
Torque + Angle

ASTM F3148 – 144KSI

83

High Strength Bolts

ASTM F3148

Installation Method

1. Snug Tighten
2. Set Degree of Rotation (90º or 120º)

84

Other Fastener Products

ASTM A563 NUTS

ASTM F436 WASHERS

ASTM A959 DTI WASHERS

85

Other Fastener Products

Anchor Rods

F1554 Grade 36

F1554 Grade 55

F1554 Grade 105

86

Other Fastener Products

Anchor Rod Washers

Table 14-2
Recommended Sizes for Washers and Anchor Rod Holes in Base Plates

Anchor Rod Diameter	Hole Diameter	Washer Size	Min. Washer Thickness	Anchor Rod Diameter	Hole Diameter	Washer Size	Min. Washer Thickness
in.	in.	in.	in.	in.	in.	in.	in.
3/4	1 5/16	2	1/4	1 1/2	2 3/8	4	1/2
7/8	1 9/16	2 1/2	5/16	1 3/4	2 7/8	4 1/2	5/8
1	1 7/8	3	3/8	2	3 1/4	5	3/4
1 1/4	2 1/8	3 1/2	1/2	2 1/2	3 3/4	5 1/2	7/8

Notes:
1. Hole sizes provided are based on anchor rod size and correlate with ACI 117 (ACI, 2010).
2. Circular or square washers meeting the washer size are acceptable.
3. Clearance must be considered when choosing an appropriate anchor rod hole location, noting effects such as the position of the rod in the hole with respect to the column, weld size, and other interferences.
4. ASTM F844 washers are permitted instead of plate washers when hole clearances are limited to 1/16 in. for rod diameters up to 1 in., 1/8 in. for rod diameters over 1 in. up to 2 in., and 1 in. for rod diameters over 2 in. This exception should not be used unless the general contractor has agreed to meet smaller tolerances for anchor rod placement than those permitted in ACI 117.

87

Welds

Filler Metals - F_{EXX} = 70 ksi

AWS A5.36
Supersedes A5.20 & A5.29

88

Other Things in the Article

- Raised Pattern Floor Plates – ASTM A786
- Crane Rails – ASTM A759
- Shear Studs – AWS D1.1 Clause 7.2.6 Type B
- Threaded Rods – A36, A193, A354, A449, A572
- Castings and Forgings – ASTM A27, A958, A668

89

Bridges

- ASTM A709
  - ASTM A36, A572, A992, A588 and three high-performance steel (HPS) grades
  - The HPS grades are available in plate form only.
  - Grades 50S and 50W are available in shapes. 50CR available in plates.
  - The other grades are available in plates form and as shapes.
- Toughness levels for three exposures and two uses.
- Acceptable for use where the corresponding parent standard is specified.

90

91

Steel Construction Manual Fifteenth Edition

Connection Material
36 ksi

92

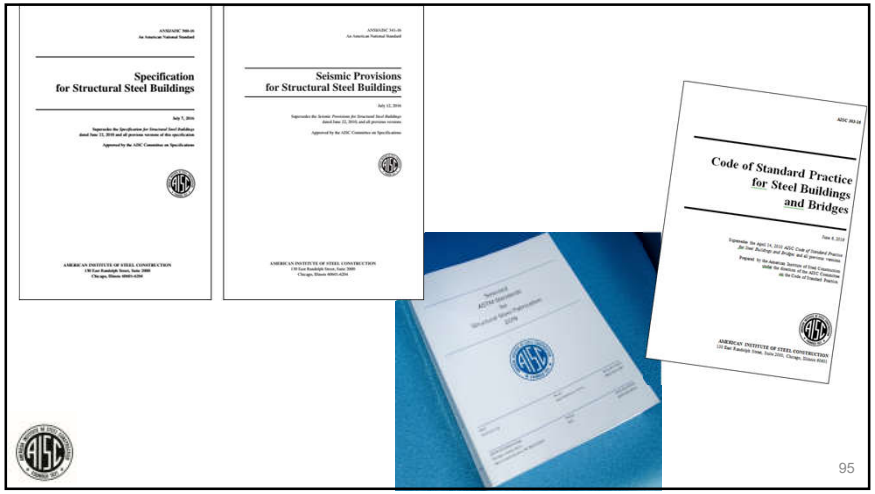
Steel Construction Manual
Sixteenth Edition

Connection Material
~~36 ksi~~

50 ksi

93

94



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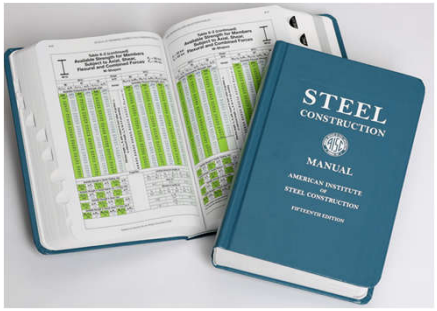


96

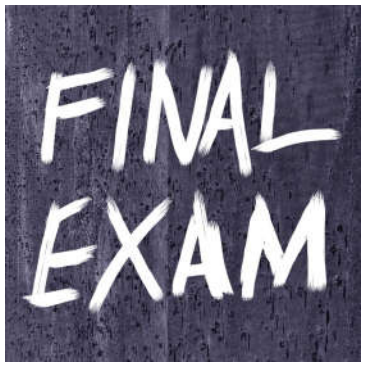
Right = Happy

97

Right = Happy

NO RFI's!!

98



Final Exam

Where can you find the preferred material for all structural steel material?

a. AISC Steel Construction Manual
b. ASTM Book of Standards
c. AISC Selected ASTM Standards for Steel Fabrication
d. Modern Steel Construction

AISC | Questions?

Smarter. Stronger. Steel.

CEU / PDH Certificates

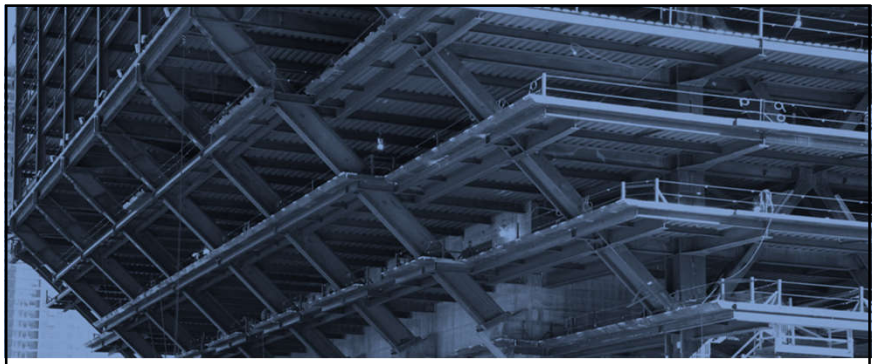
- You will receive an email on how to report attendance from: registration@aisc.org.
- Be on the lookout: Check your spam filter! Check your junk folder!
- Completely fill out online form. Don't forget to check the boxes next to each attendee's name!

Smarter. Stronger. Steel.

CEU / PDH Certificates

- Reporting site (URL will be provided in the forthcoming email).
- Username: Same as AISC website username.
- Password: Same as AISC website password.

Smarter. Stronger. Steel.



AISC | Thank you

Smarter. Stronger. Steel.