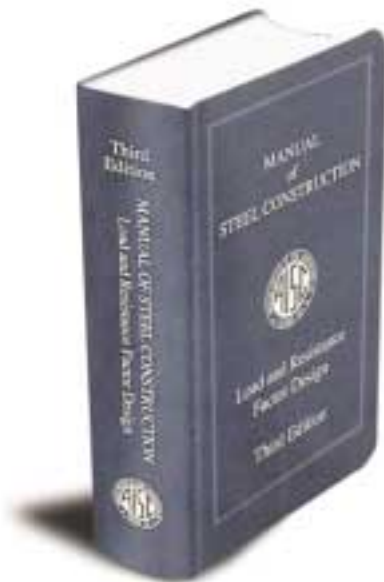


# Third Edition LRFD Manual

## A Return to Simplicity

Charles J. Carter, S.E., P.E.



The new 3<sup>rd</sup> Edition *LRFD Manual of Steel Construction* just published by AISC is a significant return to simplicity. With this revision, member and connection design information has been reunited in a single volume. Nearly all textbook tendencies shed in favor of roadmap-style guidance through the various requirements and recommendations for steel design and construction. Even the cover harkens back to an earlier time, its Penn State blue hue and layout resembling that of the 5<sup>th</sup> Edition *AISC Manual* of the late 50s. The familiar thumb-cuts ease access to the wealth of information it contains.

### SPECS & CODES INCLUDED

The following specifications, codes and standards are included in or with this Manual:

- 1999 LRFD Specification for Structural Steel Buildings
- 2000 LRFD Specification for Steel Hollow Structural Sections
- 2000 LRFD Specification for Single-Angle Members
- 2000 RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts
- 2000 Code of Standard Practice for Steel Buildings and Bridges

Each of these documents is also available for free download from the AISC or RCSC web sites, [www.aisc.org](http://www.aisc.org) and [www.boltcouncil.org](http://www.boltcouncil.org).

The AISC Shapes Database V3 CD is also included with every Manual purchased.

In recognition that the AISC Manual is primarily written for use in wind and low-seismic applications (i.e., when the seismic response modification factor  $R$  is taken as 3 or less), the AISC Seismic Provisions and related documents have not been included in this Manual. However, AISC is in the process of preparing a *Seismic Manual* to address high-seismic applications (when  $R$  is taken greater than 3 and a defined level of system ductility must be achieved). Note that the AISC Seismic Provisions and various other related documents are available for free download at [www.aisc.org/seismic.html](http://www.aisc.org/seismic.html).

### MAJOR IMPROVEMENTS

The following major improvements have been made in this revision:

**Workable gages for flange fasteners have been reintroduced.** For years, users of the *AISC Manual* have written in the flange gages from older editions. They're back, but with the clarification that other dimensions that satisfy edge distance, spacing and access requirements can also be used.

**The revised  $T$ ,  $k$  and  $k_1$  values for W-shapes and the 0.93 wall-thickness reduction factor for HSS have been considered.** The latest shape dimensions and properties are now available in one place.

**Guidance is provided on the new OSHA safety regulations, stability**

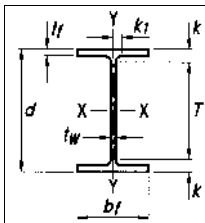
**bracing requirements and proper material specification.** While not a replacement for a review of the complete OSHA safety regulations, the essentials are highlighted. Visit [www.aisc.org/library.html](http://www.aisc.org/library.html) for more information.

**New information is provided on design drawing information requirements, criteria needed for connection design, mill, fabrication and erection tolerances, façade issues, temperature effects and fire protection requirements with summaries of common UL assemblies.** These are common topics that must be addressed on many projects. The new and updated guidance in the AISC Manual will get you to the answers you need faster.

**Shape information has been updated to the current series.** A few shapes added, a few deleted. The current series is reflected in the tables and on the AISC Shapes Database CD included with the Manual.

**Coverage of round HSS has been added.** There is a difference between steel pipe (ASTM A53,  $F_y = 35$  ksi) and round HSS (ASTM A500,  $F_y = 42$  ksi for grade B). Both products are covered throughout the 3<sup>rd</sup> Edition *LRFD Manual*.

**Dimensions and properties have been added for double channels back-to-back.** While some of the less-frequently-used built-up shapes have been removed from the Manual, coverage of double channels has been added in recognition of the common usage of this type of member.



**Table 1-1 (cont.).  
W-Shapes  
Dimensions**

Shape	Area, A	Depth, d	Web		Flange		Distance				Workable Gage†				
			Thickness, tw	tw 2	Width, bf	Thickness, tf	k		T						
			in.	in.	in.	in.	in.	in.	in.	in.					
W18×71	20.8	18.5	18 1/2	0.495	1/2	1/4	7.64	7 5/8	0.810	13/16	1.21	1 1/2	7/8	15 1/2	3 1/2
×65	19.1	18.4	18 3/8	0.450	7/16	1/4	7.59	7 5/8	0.750	3/4	1.15	1 7/16	7/8	↓	↓
×60	17.6	18.2	18 1/4	0.415	7/16	1/4	7.56	7 1/2	0.695	11/16	1.10	1 3/8	13/16	↓	↓
×55	16.2	18.1	18 1/8	0.390	3/8	3/16	7.53	7 1/2	0.630	5/8	1.03	1 5/16	13/16	↓	↓
×50	14.7	18.0	18	0.355	3/8	3/16	7.50	7 1/2	0.570	9/16	0.972	1 1/4	13/16	↓	↓
W18×46	13.5	18.1	18	0.360	3/8	3/16	6.06	6	0.605	5/8	1.01	1 1/4	13/16	15 1/2	3 1/2
×40	11.8	17.9	17 7/8	0.315	5/16	3/16	6.02	6	0.525	1/2	0.927	1 3/16	13/16	↓	↓

Workable gages have been re-introduced into the section property tables.

Tables of surface and box perimeter, weight/area-to-perimeter ratios and surface areas have been expanded to cover all common structural shapes. These tables will be useful for calculation of coating quantities and fire protection requirements.

A new section on properly specifying materials, including shapes, plates, fasteners and other products, has been added. Never call out the wrong ASTM specification again! From W-shapes to plates to angles to shear stud connectors to bolts, washers and nuts, this simple-to-follow and detailed summary will give you the guidance you need.

New information on corrosion protection and seismic design has been added. SSPC preparation summaries and painting guidance—including when painting is unnecessary!—are provided. Also, a discussion of seismic design is included to establish just what are the differences between wind, low-seismic and high-seismic design.

A new section has been added with design aids for tension members. This section includes explicit consideration of net section requirements to ensure connectable member selection. On the surface, it would seem that tables for tension members are almost unnecessary. However, selection of tension members based upon gross area and yielding only have often led to net section difficulties and design issues in the past. New tables have been included for many different cross-sections to facilitate direct consideration of net sec-

tion in the tension member selection process.

Beam selection tables are included for selection based upon  $I_x$ ,  $Z_x$ ,  $I_y$ , and  $Z_y$ . Keep in mind that deflection criteria most often control the selection of beams. Either way, these tables will facilitate proper member selection, in addition to weak-axis bending applications.

Beam charts ( $\phi M_n$  vs.  $L_b$ ) are plotted for both W-shapes and channels. When unbraced length is a design consideration for beams, the beam charts will help. Channels are now also included in the beam charts.

New floor plate deflection and bending design aids have been added. Selection tables have been added for floor plate based upon both strength and deflection criteria.

Additional beam diagrams and formulas have been added. I must admit, I did not think there were any other cases that needed to be tabulated. But Mike West of Computerized Structural Design in Milwaukee, WI, proved me wrong! A few new cases have been added to the beam diagrams and formulas.

A new section has been added with design aids for W-shape beam-columns. Based upon the work of Ammiansour, first at Penn State and subsequently at the University of Illinois, new tables have been added to facilitate the rapid selection of W-shape beam-columns. These tables make it easy to get a final member size, even when starting with a rough guess.

New bolt length selection tables have been added. Knowing the grip and number of washers under the nut, the appropriate bolt length is easily determined from these tables. The minimum ply thickness adjacent to the nut for excluding threads, when desired, is also tabulated.

Bolt entering and tightening clearances have been updated. Values for conventional and tension-control bolts have been updated for today's equipment and products.

Bolting information has been updated for consistency with the 2000 RCSC Specification. If you've not seen the 2000 RCSC Specification, visit [www.boltcouncil.org](http://www.boltcouncil.org) today. It is a vast improvement for simplicity, clarity and practicality in bolting.

Welding information, including the prequalified welded joint tables, has been updated to for consistency with AWS D1.1-2000.

Information on prying action, Whitmore section and strength of coped beams has been updated. In fact, the whole section on connection-element limit states has been updated and improved.

Selection tables for shear end-plate connections and single-plate connections have been improved and expanded. These tables now include single-plate connections with up to 12 rows of bolts and up to 1 1/8" diameter.

New information and examples for flexible moment connections has been added as an update of Disque's historic "type 2 with wind" moment connection design approach. This type of framing system has previously been heralded as a return to simplicity. And so often, what's old is new again.

Previous limitations on the use of moment end-plate connections have been relaxed. Although the historic procedure for the design of moment end plates is still limited to static loading, alternative procedures are now available to allow the use of moment end plates in high-seismic applications. The new information in the Manual has been updated to reflect this.

**Information on the design of anchor rods has been updated.** This information now includes a new table of minimum dimensions for washers used with anchor rods.

**Composite member tables have been updated to include coverage of both 4 ksi and 5 ksi concrete.**

**A cross-reference between U.S. customary and Metric shapes series has been included.**

In addition, many other improvements have been made throughout the 3rd Edition *LRFD Manual*.

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