steelwise

INTRODUCING THE V14.0 AISC DESIGN EXAMPLES

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This is the second installment of a three-part series on the new companion materials—all available free online—that have been prepared to complement the 14th Edition AISC *Steel Construction Manual*.

14th Ed. +

IF YOU HAVE EVER wondered how to apply any of the tables in the AISC *Manual* or a provision in the AISC *Specification*, the *Design Examples v14.0* may be just the help you need. This collection of more than 150 design examples is currently available in PDF format for free downloading on the AISC website at www.aisc.org/2010spec. It illustrates the use of the 2010 AISC *Specification* and the 14th Edition AISC *Manual* tables.

As an update of V13.1 of the AISC *Design Examples* that were keyed to the 13th Edition AISC *Manual*, the V14.0 AISC *Design Examples* continue to include solutions using both LRFD and ASD methods. Each example includes *Specification* and *Manual* section and equation references and illustrates a step-by-step approach. The update includes enhanced navigation features and a number of new and expanded examples. Also, the newly added Part IV contains additional design tables and design aids not included in the *Manual*.

The *Design Examples* are divided into three parts:

- Part I includes examples that illustrate the provisions of Chapters A through K of the AISC *Specification*. These examples follow the same organization as the *Specification*.
- Part II covers connection designs.
- Part III outlines the design of a four-story office building.

The intent of the Part I design examples is to demonstrate how to use various *Specification* provisions, and in some cases, compare alternative solutions. In addition to updates of the examples provided in previous versions, additional examples have been added. For instance, Chapter C includes new examples demonstrating how to design a moment frame using the direct analysis method, effective length method, and first-order analysis method. Also, there are additional new examples incorporated into Part I, such as the design of a double tee compression member in Chapter E, design of a single-angle flexural member subject to combined bending about both principal axes in Chapter F, and several new examples demonstrating use of the provisions in Chapter I on composite design.

Part II covers four sub-parts: simple shear connections, fully restrained moment connections, bracing and truss connections, and miscellaneous connections. Part II examples show how the *Manual* tables can be used to simplify design—from a simple shear connection, such as the all-bolted double-angle connection that can be selected from Table 10-1, to a complex bracing connection design that involves the use of several tables in the calculations. The miscellaneous connections that are included in Part II address topics such as prying action, beam bearing plates, and slip-critical connections with oversized holes.

Part III consists of an 87-page example that addresses aspects of design that are linked to the analysis, design and performance of a building as a whole. The example walks through the steps involved, including coverage of lateral stability and second-order analysis, and design of representative members for a four-story building that combines braced-frames and moment frames. This example delves into the major aspects of designing a typical building, including load determination using ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*, for both LRFD and ASD methods, as well as drift and deflection checks. Floor and roof framing plans, as well as details of connection designs and façade attachments, are also included.

The new Part IV, entitled *Additional Design Aids*, contains design tables for 65-ksi column and beam-column design, adding similar information to that provided in *Manual* Tables 4-1 and 6-1 for 50-ksi steel.

As mentioned previously, a number of new examples not included in previous versions of the AISC *Design Examples* address more complicated designs. One topic not previously included was the design of a single-angle flexural member, which is now addressed in Examples F.11A, F.11B and F.11C. The three different examples have various loadings and bracing configurations—vertical loading with bracing at the ends only, vertical loading with bracing at the ends and midpoint, and combined vertical and horizontal loading with bracing at the ends only.

Several new examples related to *Specification* Chapter I

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have been incorporated to cover topics not previously addressed and to demonstrate the use of new composite design provisions in the 2010 AISC . For example, the use of noncompact and slender elements in lled composite members was not previously permitted, but now is, and these cases are addressed. Design Example I.7 addresses the design of a concrete- lled box beam-column with noncompact/slender elements and illustrates the use of the new local buckling requirements in Tables I1.1A and I1.1B. The design also requires the use of the new provisions in Sections I2.2b and I3.4b for compression and exure in lled composite members with noncompact and slender elements. The rst step in determining the available exural strength of a noncompact section is to calculate the moment corresponding to the plastic stress distribution over the composite cross section. This concept is illustrated graphically in AISC Commentary Figure C-I3.7(a), and is carried out in this example. Other new composite design examples include: a composite girder design; lled composite member force allocation and load transfer; a lled composite member with loads combined with exure and shear; encased composite member force allocation and load transfer; and steel anchors in composite components.

The best way to get familiar with what is available in the updated AISC *D E* is to review the table of contents, and doing so will make one improvement immediately apparent: better navigation features. Navigating through 150 plus design examples is now less of a challenge because V14.0 of the AISC *D E* includes bookmarks for each chapter in an interactive table of contents. Within the table of contents, there are links to the beginning page of each design example listed. Once in the design examples, a link at the top of each page takes the user back to the table of contents for further searching. This is a time saver as it speeds scanning through the hundreds of pages of examples when searching for the pertinent one.

Whether you are an experienced engineer designing an encased composite member under combined loading, or an engineering student learning how to design a simple beam, the V14.0 AISC *D E* contain information you need. Go to a 14 and explore this free resource for yourself. MSC

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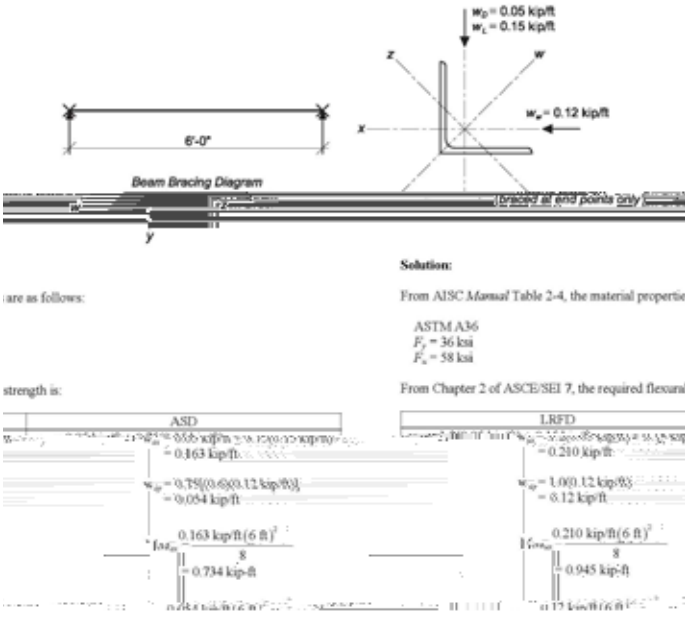
An Example from the *Design Examples*

For most of the AISC *De ign E ample* , the problem statement is given with an accompanying figure. In this case, Figure 1 shows the angle configuration and loading. After a statement of the problem and assumptions (for example, A36 steel), the solution begins with calculation of the required flexural strength using ASCE/SEI 7 load combinations and side-by-side calculations of both the LRFD and ASD methods. The solution continues on subsequent pages of the design example with step-by-step calculations of the required moments about the geometric axes, required moments about the principal axes, nominal flexural strength about the z-axis, nominal flexural strength about the w-axis, and application of the combined stress equation from AISC *Speci ca ion* Section H2,

$$\left| \frac{f_{rx}}{cx} \quad \frac{f_{rbw}}{cbw} \quad \frac{f_{rbz}}{cbz} \right|$$



▲ Fig. 1: Single angle flexural member example.

▼ Fig. 2: Single angle loading.