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Chapter 1  Thank you

Thank you for installing this copy of FASTRAK Composite Beam Design. You’re making a great choice by investing a small amount of time to become familiar with this product. We hope you like what you find and we welcome all feedback.

This Quick Start Guide will ease you into the use of this powerful product and ensure that you get maximum benefit in minimum time. You should be able to create, analyze and review the results for the beams in this Guide in just 15 to 20 minutes.

We look forward to answering any questions that you have and also addressing any suggestions that you have for future improvements.

So, thank you again for investing a small amount of time to get to know FASTRAK. We look forward to hearing from you.

Note  FASTRAK Composite Beam Design is part of FASTRAK Building Designer for the design of complete buildings. To find out more about FASTRAK Building Designer, please visit http://www.cscworld.com/fastrak/us/

The Fastrak team
Chapter 2

Introduction to the Quick Start Guide

This *Quick Start Guide* falls into 5 main sections. These are detailed below:

- introductory information,
- creating a simple example (ASD Girder) and reviewing its results,
- an extension to the first example which looks at some of *Composite Beam Design*’s features in slightly more depth,
- creating a second example (LRFD Beam),
- reviewing and documenting design details.

In the limited space available within this guide it is impossible to cover all the features of *Composite Beam Design*, and design questions that you may have. However this *Quick Start Guide* forms a small part of the complete *Composite Beam Design* documentation.

Once you have worked through this guide you may want to review this other information which is all included in *Composite Beam Design*’s help system, within which the *Engineer’s Handbook* section contains a wealth of useful information. Two sample beam files have also been included with the installation and are accessible through the *Welcome* page. Alternatively, you can open the examples by clicking *Start* on the Windows task bar then choose: *Programs>CSC>Fastrak>*. The beams in these files correspond to those used as examples in this document.

In addition to the documentation installed with *Composite Beam Design*, there is up-to-date information available on the *Fastrak Composite Beam On-line Support* web page at [www.CSCWorld.com/Fastrak/US/CompositeBeam](http://www.CSCWorld.com/Fastrak/US/CompositeBeam), this information includes:

- **Video tutorials:** Quickly learn to use the full capabilities of *Fastrak Composite Beam*, clearly demonstrated in narrated videos.
- **Design Examples:** Detailed calculations demonstrating the design process for LRFD and ASD methods. The calculations correspond to the examples presented in this document and the sample beams included with the installation.
- **Frequently Asked Questions:** A regularly updated list of questions and answers.
3.1 What is Composite Beam Design?

While the aim of this document is not to teach you how to design composite beams it is worth noting that an understanding of the design procedure is essential. There are many variables involved in the design of composite beams, and no one correct answer – different engineers might prefer different solutions. To appreciate this you should understand the sequence of design/checking for composite beams:

1. **Beam Selection**
   a) **Construction Stage Checks** – check that the bare beam is adequate to carry the construction stage loading.
   b) **Composite Design** – check that composite section is potentially adequate for Moment/Shear/Serviceability for the composite loading conditions.

2. **Optimization of Shear Connection** – Reduce number of studs as much as possible without causing any of the above to fail, subject to limits specified on the composite interaction.

Once the design has been performed you can review the design results in relation to the above sequence. The dialog below indicates the checks that are performed during the design process.

*Composite Beam Design* can either suggest possible design solutions for you (beam size, stud layout etc), or alternatively you can fully specify a beam configuration and *Composite Beam Design* will then check this out for you.

3.2 Install Composite Beam Design

If you have not yet installed *Composite Beam Design*, locate the file “setup_csc_free_us_composite” (located where you chose to save the file while downloading *Composite Beam Design*), double click on it and follow the on-screen installation instructions.
1) Click the Start button on the Windows task bar, then in turn click:
   • All Programs,
   • Fastrak,
   • Composite Beam Design

Composite Beam Design will start and initialize.

Footnotes
1. This style of paragraph numbering and this font indicate that this is a step for you to perform.
Chapter 4 Example 1: ASD Girder

4.1 Example Beam Details

For this example you will define and design a 30ft girder supporting 35ft span beams at third points.

The example beam uses an 18 gage Vulcraft 2VLI (24") deck with a 6 ½ in total depth slab. The decking and the beam span parallel to each other.

The floor loading is:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
<th>giving point loads at 10 ft and 20 ft of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab wet</td>
<td>71.4 psf</td>
<td>25.0 kips</td>
</tr>
<tr>
<td>Slab dry</td>
<td>69.1 psf</td>
<td>24.2 kips</td>
</tr>
<tr>
<td>Beam Dead</td>
<td>35 plf</td>
<td>1.3 kips</td>
</tr>
<tr>
<td>Superimposed Dead</td>
<td>15 psf</td>
<td>5.3 kips</td>
</tr>
<tr>
<td>Live load</td>
<td>100 psf</td>
<td>35.0 kips</td>
</tr>
<tr>
<td>Construction Live</td>
<td>20 psf</td>
<td>7.0 kips</td>
</tr>
</tbody>
</table>

The beam is designed for composite and construction stage loading.
4.2 Introduction

The aim of this document is to enable you to become productive with *Composite Beam Design* as quickly as possible.

After installation, and when you have a project open, the screen will appear as shown above. You can customize this at will, placing and docking windows and toolbars wherever you prefer.

You can access all *Composite Beam Design*’s commands either from the main menu pads, or by using the toolbar icons on the screen.

If you hover over an icon, then you will see a tool tip which indicates that icon’s operation.
4.3 Getting Started — Create a Project

New Project

In order to work on a beam you need to create a new project to contain it.

1. Pick File from the menu pads and New Project… from the menu that appears¹.  
   
   **Note** You can create a project this way, or you can click the New Project icon ( )  
   from the Standard toolbar. This icon is near the top left hand corner of the  
   screen.

You will see a dialog box² in which you define the appropriate project details. As you can  
see on your screen, the title Job No. is highlighted in red³ and OK is dimmed. Composite  
Beam Design requires that you define at least the Job No. before you can proceed.

Footnotes

¹. In future we shall shorten this to ‘pick File/New Project...’
2] Enter the project details as shown above.

3] Click OK. You will see the New Beam dialog.

Composite Beam Design assumes that the first thing you will want to do in your new project is to add its first beam, and pre-empts this by showing the dialog. For this example you want to create an internal beam, and so the default setting is appropriate. Change the reference as shown above.

Click OK. You will see that:

• an entry for the beam is added to the Workspace,
• the toolbar icons become active,
• Analysis Results and Beam Definition windows are created for the beam.

Footnotes

2. Shortened to dialog for the rest of this guide.
3. A general principle is that anything highlighted in red on the screen requires you to enter information or change an existing value.
4] You want to design your composite beam (as opposed to checking it), so click Design Beam from the Beam, Loading, Design toolbar.

Design Beam icon

4.4 Define the basic beam details

Now to define the basic details for the beam. You could click the appropriate button from the toolbar, however Composite Beam Design makes it even easier than this.

1] You will see a representation of the beam in the Beam Definition window. Left-click anywhere over this and you will see the Beam Properties dialog.

2] The red text shows exactly what you need to define – the beam Length. Enter a value of 30’

You are also now able to select whether the beam is considered continuously braced at the top flange by the metal deck during the construction stage. The deck will be parallel to the beam in this example and we will assume that the deck does not brace the top flange during the construction stage.

3] Remove the check next to Fully braced at construction stage.

Note that a new Braced page is added. You must define the lateral bracing that is provided.
4) Click the Braced tab.

5) Click Add twice to add two braces to the beam, and then click Eq. Spaced to set the distances to these to 10 and 20 ft respectively.

6) Click OK.

The Beam Definition window now shows the beam’s length and the brace positions. Now you need to define the details of the decking which acts with the beam.

7) Click Edit Floor Construction from the Beam, Loading, Design toolbar.

The Floor Construction dialog allows you to define these details.
Note that *Composite Beam Design* has automatically defined the maximum effective width of the concrete flange based on the beam length that you defined in accordance with AISC 360-05: Section I3.1a. No account is taken of adjacent beam proximity or of any significant slab openings (since no input is given regarding these). You can change the flange width to take account of such factors if you wish.

8) *Change the Overall Depth of the slab to 6 1/2 in, the other default details are OK for your example beam.*

9) *Click the Profiled Metal Decking tab.*

![Profiled Metal Decking tab](image)

10) *Change the Gage of the deck to 18.*

11) *The profile decking and the beam should span parallel to each other, so click the Parallel option for the Profile span direction relative to that of beam.*

   The rest of the default *Profile* details are OK for your beam.

12) *Click the Reinforcement tab.*

![Reinforcement tab](image)

13) *Ensure the Type of reinforcement is set to None.*
Note The slab reinforcement is included for information only and does not participate in any strength or serviceability calculations for the composite beam.

14] Click the Studs-Strength tab.

The default settings for stud strength are OK for this example.

15] Click the Connectors-Layout tab.

16] Ensure that Auto-layout is checked (which tells Composite Beam Design that it can determine the number of studs in each group and the spacing of the stud groups).

17] Ensure that Freeform is selected for the layout. This allows Composite Beam Design to vary the group size and spacing along the beam length in order to minimize the stud count.

Note A uniform layout of studs will ensure that the minimum spacing of studs required will be applied to the full beam length.
You have now defined all the floor construction details for your beam so click OK to close the Floor Construction dialog.

In this chapter you have only looked at the pages of this dialog which relate to the definition of the beam in hand. You may want to take time to review the other pages of the dialog. For further information on the options that are available please refer to the Engineer’s Handbook section of the Help System.

### 4.5 Define Loading

You have now defined the physical geometry of your beam and its floor construction details, you now need to define the load which it has to carry.

1] **Click Add/Edit Loadcases from the Beam, Loading, Design toolbar.**

You will see the Loadcases dialog.

This already contains 3 loadcases - for *Self weight*, *Slab wet* and *Slab dry* conditions. The titles of the latter 2 show in orange to indicate that there is an issue you might want to resolve – as yet these loadcases contain no loads.

2] **If the line for the Slab wet loadcase is not highlighted, click on it to highlight it and then click Edit...**

3] **Click the Load Type drop list and pick Point Load from the drop list that appears.**
4] Enter the value of the load (F) of 25 kips and the distance to the load (a) of 10′.
5] Repeat this process to define a load of the same value at 20′.
6] This completes the loading in this loadcase, so click OK.

Note: The title of the loadcase no longer shows in orange, since you have addressed the condition which caused the warning.

7] Highlight the line for the Slab dry loadcase, and enter its loads in a similar manner. For your information the remaining load details are tabulated below:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Point loads at 10 ft and 20 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab dry</td>
<td>24.2 kips</td>
</tr>
<tr>
<td>Beam Dead</td>
<td>1.3 kips</td>
</tr>
<tr>
<td>Superimposed Dead</td>
<td>5.3 kips</td>
</tr>
<tr>
<td>Live load</td>
<td>35.0 kips</td>
</tr>
<tr>
<td>Construction Live</td>
<td>7.0 kips</td>
</tr>
</tbody>
</table>

8] To define the other loads you first need to create the loadcases to contain them. In the Loadcases dialog click Add…

This time the dialog looks slightly different, you can define the Loadcase Title and specify the Loadcase Type as Dead, Live, Roof Live, Wind, Snow or Seismic as well as defining the loads that the loadcase contains.

9] Define the Loadcase Title as Beam Dead, with a Loadcase Type of Dead, and then define its loads in the same manner as previously. Define the Superimposed Dead loadcase similarly.
10] Define the **Live** and **Construction Live** loadcases similarly, not forgetting to set their Loadcase Type to Live. When you set the Loadcase type to Live or Roof Live a new column appears for each load, Lg term (%). This value sets the percentage of the load that is considered long-term for deflection calculations. Set the Live loadcase percentages to 33% and the Construction Live loadcase values to 0%.

![Loadcase Details](image)

11] Now that you have defined all the loadcases click OK to close the Loadcases dialog.

12] Click Add/Edit Combinations from the Beam, Loading, Design toolbar.

![Add/Edit combinations icon](image)

13] You will see the Combinations dialog.

![Combinations dialog](image)

This already contains a **Construction stage** combination.
14] Select the Construction Stage load combination if it is not already selected and click Edit... to look at the details for this combination.

![Combination Details Dialog](image)

**Note** These are ASD load combinations. LRFD design can be performed as well and changing the design method will be covered later in this tutorial.

15] Double-click the name of the Construction Live loadcase. It moves from the left-hand list of Available Loadcases to the right-hand list of Included Loadcases. Do the same for the Beam Dead loadcase. This combination is now complete so click OK to close the dialog.

16] Add... a new combination, giving it the Title **Dead + Live**, and ensuring that, as well as the self-weight the combination includes the Slab dry, Beam Dead, Superimposed Dead and Live load loadcases.

17] Click OK twice to close the Combination Details and Combinations dialog.

18] Click **Design Wizard** from the Beam, Loading, Design toolbar:

![Design Wizard Icon](image)

You will see the Design Wizard dialog.
The Size Constraints page allows you to ensure that the sections that Composite Beam Design proposes match any particular size constraints you may have. For instance for a composite beam you may want to ensure a minimum depth of 15 in. If so you would simply enter a value of 15 in as the Minimum depth, and Composite Beam Design would not consider sections less deep than this for the design of this beam.

19] Enter a minimum depth of 15in and a maximum depth of 31in. Also enter a maximum width of 12in.

20] Make sure the box next to Optimize shear connection is checked to ensure that Composite Beam Design will use partial composite action. Composite Beam Design will ensure that the composite action will be at least the percentage set as the absolute minimum, and will provide a warning if the advisory minimum is not met at the location of any point load or the location of the maximum moment. Set both the absolute and advisory minimums to 50% for this example.

21] Click on the Deflection tab

This page allows you to set the deflection limits Composite Beam Design will impose on the design process. The deflection at construction stage applies to the construction stage load combination. The remaining deflection limits apply to all other load combinations on the composite beam. (There is one composite load combination in this example.) Each of the limits applies to the appropriate loadcase types.

22] Apply relative deflection limits of span / 240 for construction stage, SLAB loads and total loads. Apply a relative deflection limit of span / 360 for live loads.

You have now defined and loaded your composite beam, and so you are ready to design it.
4.6 Design the beam and review the design

1) Click Perform Design from the Beam, Loading, Design toolbar.

   Perform design icon

   The design will proceed and you will see a progress dialog charting this.

2) When Composite Beam Design has checked all the sections selected for checking it shows the results in the Acceptable Sections dialog.

   Available files list shows the different section types which Composite Beam Design has checked, while the Section Designations list shows the files of the current type which pass all the design checks.

3) Click WMOrderAISCImp.USA from the Available files list. The lightest acceptable sections are shown at the top of the Section Designation list.

4) Click the W24X68 section, then click Preview to review its results. Composite Beam Design shows these in the Design Summary dialog.
5] Click the Connectors tab, and you will see that 52 shear connectors are required.

![Connectors Tab](image)

6] Click the Deflection tab, and you will see that the deflections and limits for the selected load combination. You can see that the total load deflection is very close to the specified limit.

![Deflection Tab](image)

7] Browse through the other results if you want.

8] Move the Design Summary dialog, so that you can access the Acceptable Sections one, and then click on other Section Designations. The Design Summary shows the results for each selected section, this means that you can compare the results for different sections immediately to help you select the section you want to use.

9] Click back on the W24X68 in the Acceptable Sections dialog. Click OK to assign this section to the beam and close the dialog, then click Close to close the Design Summary one.
10] To get a different view of the information for the designed beam click **Edit Floor Construction from the Beam, Loading, Design toolbar**.

11] Click the **Connectors-layout** tab and you will see that the beam has 24 shear studs in groups of two at 10 in centers in the first and last 10 ft segment of the girder. The center segment has single studs spaced at 30 in.

![Composite Beam Design Documentation page 24](image)

**Note**    
The stud distribution can also be seen graphically on the beam in the workbook.

12] Click **OK** to close the **Floor Construction** dialog.

Now that you have completed your first beam design you will take a look at some options you can use to refine the design process, and you will also take a closer look at the design that **Composite Beam Design** has performed.
Chapter 5 Taking the example further

5.1 Refine the design

If you watched the progress bar carefully, and you looked at the Acceptable Sections dialog you would have seen that Composite Beam Design checked a wide range of sections, and that the design process took a reasonable length of time. Since you are going to investigate some alternative designs, you will first look at ways of speeding up the design process and controlling the design more precisely.

1] Click Design Wizard from the Beam, Loading, Design toolbar.

You will see the Design Wizard dialog.

2] Click the Sections for Study tab.

This tab allows you to control the sections which Composite Beam Design will investigate during the design process. Simply remove the tick against all the Available files whose section types you don't want to investigate, and Composite Beam Design won't look at any of these sections during the design process.
3] Remove the tick against all the Available files other than WMOrderAISCImp.Usa, and then when you re-perform the design you will find a significant increase in speed as Composite Beam Design only investigates the wide flange beams.

Furthermore Composite Beam Design investigates the sections in the order that they appear in the Section Designation list. If you scroll down many of the lists, you will find that there is a point at which larger sections give way to smaller ones again.

We have ordered the Section Designation list based on our many years experience of the industry, the sections at the top of the list are the ones we know you prefer to use, whilst those at the bottom are those which you use less frequently if at all. By default most of the Section Designations are ticked, but you might want to remove the ticks against some or all of the non-preferred sections. Again this will speed the design process.

You may also have other requirements specific to your own company, for instance you may never want to use sections with flanges less than 6 in wide for erection purposes. If you remove the tick against these section sizes, then Composite Beam Design will never include them when it is performing a design, irrespective of the size constraint settings. Thus you are controlling the design, making Composite Beam Design look at just the section designations you are likely to accept, and in the process speeding up the design itself.

4] Remove the tick against all the non-preferred sections, (including all M sections), and all sections with flanges less than 6 in. When you perform a design, Composite Beam Design has to check far fewer sections so design is much faster.

Composite Beam Design maintains the Sections for Study settings that you make, until you choose to change them again. It is therefore worthwhile taking the time to tailor the list so that Composite Beam Design picks sections of which you are likely to approve during its designs. Removing the tick against all sections with flanges less than 6 in wide means that Composite Beam Design will never choose sections with flanges less than this width without you having to specify minimum width requirements on the Size Constraints tab.

5] Click OK to close the Design Wizard.

6] You will see a message box asking if you want to store the current settings for USA. This relates to the Sections for Study which you have tailored. Click Yes to save these settings.
Remember there are many things that have an impact on the initial sizes that Composite Beam Design finds adequate. For instance the width of the concrete flange, the concrete strength, the depth of concrete slab you specify... all have an effect on the design. Before you perform your design for the first time you should ensure that all these details are correct, otherwise when you change them later you may find that your design is no longer satisfactory, or that conversely if you had set these previously, then you could have achieved a better solution.

5.2 Design with Camber

Once Composite Beam Design has performed a design it automatically switches into check mode - the section you have selected is retained but you are able to adjust other parameters as required. However, if you need to re-design the beam - so that all the Sections for Study are once again reconsidered, you will first need to set Composite Beam Design back into design mode.

1] To put the beam back into design mode, click Design Beam from the Beam, Loading, Design toolbar.

2] Next click Edit Floor Construction from the Beam, Loading, Design toolbar.

3] To put the studs back into auto-layout, click the Connectors-layout tab and re-check the Auto-layout box (and keep the Freeform option).

You can now determine what effect (if any) applying camber will have on the section size.

4] To specify the camber criteria click Design Wizard from the Beam, Loading, Design toolbar.

You will see the Design Wizard dialog.

5] Click the Camber tab.
6] By default camber is not applied to the beam. To specify camber check the Apply box. The defaults as shown above for applying camber as a percentage of the dead load are OK for this example.

7] Click OK to close the dialog.

8] Click Perform Design from the Beam, Loading, Design toolbar.

Again you will see the Progress Bar run through the sections, this time far fewer of them because of the Sections for Study settings you made. This time the design lists several new beams that are now adequate, including a W16x77.

9] Select this section and click Preview to see the details for this section. On the Deflections tab you can see that 1 in of camber is applied. Select the W24X68 section selected previously and click Preview and click the Deflections tab. No camber is applied to this member, but it is still the logical choice as the beam design.

Which of the above is the better design is not really the concern of this example, they are simply different designs based on different engineering input.

5.3 Design as simple beam

You might decide to investigate the design of your beam as a non-composite, rather than a composite one. You can do so directly within Composite Beam Design.

1] Click Design Beam from the Beam, Loading, Design toolbar.

If you want to provide a non-composite solution, then the weight of the beam will rise from 68 to 99 lb/ft.
You therefore decide to adopt a composite beam design, and provide the required 52 studs.

Congratulations you have now finished Example 1 of this Quick Start Tutorial. We hope that you have found this introduction to Composite Beam Design helpful. Example 2 will skip the repetitive steps from this example and will deal with an infill beam designed using the LRFD method.
Chapter 6  
Example 2: LRFD Beam

6.1 Example Beam Details

For this example you will define and design a 35 ft span infill beam.

The example beam uses an 18 gage Vulcraft 2VLI (24") deck with a 6 ½ in total depth slab. The decking and the beam span perpendicular to each other.

The floor loading is:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
<th>giving line loads of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab wet</td>
<td>71.4 psf</td>
<td>714 plf</td>
</tr>
<tr>
<td>Slab dry</td>
<td>69.1 psf</td>
<td>691 plf</td>
</tr>
<tr>
<td>Superimposed Dead</td>
<td>15 psf</td>
<td>150 plf</td>
</tr>
<tr>
<td>Live load</td>
<td>100 psf</td>
<td>1000 plf</td>
</tr>
<tr>
<td>Construction Live</td>
<td>20 psf</td>
<td>200 plf</td>
</tr>
</tbody>
</table>

The beam is designed for composite and construction stage loading.
6.2 Getting Started - Add a beam to a project

New Project

In order to add a beam you need to open a project to contain it. This beam can be added to the project created in first example.

1] Pick Beam/New … from the menu.

Note You can create a new beam in this way, or you can right-click the project title in the workspace, in this example entitled 'ASD Beam and Girder'. You can also copy a beam that has already been created to take advantage of similar properties for the new beam. Right-click on the existing beam reference and select 'Copy'.

2] You will see the New Beam dialog.

For this example you want to create an internal beam, and so the default setting is appropriate. Change the reference as shown above.
Click OK. You will see that:

- an entry for the beam is added to the Workspace,
- the toolbar icons become active,
- *Analysis Results* and *Beam Definition* windows are created for the beam.

3] You want to design your composite beam, so click **Design Beam** from the **Beam, Loading, Design** toolbar.

6.3 Define the basic beam details

Now to define the basic details for the beam. You could click the appropriate button from the toolbar, however *Composite Beam Design* makes it even easier than this.
1] You will see a representation of the beam in the Beam Definition window. Left-click anywhere over this and you will see the Beam Properties dialog.

![Beam Properties - LRFD Beam](image)

2] Enter a value of 35' for the beam Length. You are also now able to select whether the beam is considered continuously braced at the top flange by the metal deck during the construction stage. The deck will be perpendicular to the beam in this example and we will assume that the deck braces the top flange during the construction stage. Click OK.

3] Now you need to define the details of the decking which acts with the beam. Click Edit Floor Construction from the Beam, Loading, Design toolbar.

![Edit floor construction icon](image)

The Floor Construction dialog allows you to define these details.
Note that *Composite Beam Design* has automatically defined the maximum effective width of the concrete flange based on the beam length that you defined in accordance with AISC 360-05: Section 13.1a. No account is taken of adjacent beam proximity or of any significant slab openings (since no input is given regarding these). You can change the flange width to take account of such factors if you wish.

4] *Change the Depth of Slab to 6 1/2 in, the other default details are OK for your example beam.*

5] *Click the Profiled Metal Decking tab.*

6] *Change the Gage of the deck to 18. The rest of the default Profile details are OK for your beam, note that the beam and profile decking for your beam span perpendicular to each other.*

7] *Click the Studs-Strength tab.*

8] *The default settings for stud strength are OK for this example.*
9] **Click the Connectors-Layout tab.**

![Connectors-Layout Tab](image)

**Floor Construction - LRFD Beam**

Auto-layout

- Unlabeled
- Freeform

Group spacing

- Consider as: Perpendicular
- Minimum group spacing: 1 x rib
- Maximum group spacing: 4 x rib

Adjust layout to ensure symmetrical about center line

10] **Ensure that Auto-layout is checked.**

11] **Ensure that Freeform is selected for the layout.**

12] **Change the maximum group spacing to 2 x rib**

13] **Ensure that Adjust layout to ensure symmetrical about center line is checked. If the beam requires an unsymmetrical stud layout checking this option will make sure the layout is symmetrical by applying the critical stud layout to both halves of the beam.**

14] **You have now defined all the floor construction details for your beam so click OK to close the Floor Construction dialog.**

### 6.4 Define Design Method

You have now defined the physical geometry of your beam and its floor construction details, you now need to define the design method for which to design the beam.

1] **Pick Design/Design Code... from the menu.**

![Design Code](image)

2] **Select AISC 360-05 LRFD from the drop-down list to design the beam by the LRFD method.**
6.5 Define Loading

You have now defined the physical geometry of your beam, its floor construction details, and the design method, you now need to define the load which it has to carry.

1] Click Add / Edit Loadcases from the Beam, Loading, Design toolbar.

You will see the Loadcases dialog.

This already contains 3 loadcases - for Self weight, Slab wet and Slab dry conditions. The titles of the latter 2 show in orange to indicate that there is an issue you might want to resolve - as yet these loadcases contain no loads.

2] If the line for the Slab wet loadcase is not highlighted, click on it to highlight it and then click Edit…

3] Click the Load Type drop list and pick Full UDL from the drop list that appears.

4] Enter the value of the load (g1) of 0.714 klf.

5] This completes the loading in this loadcase, so click OK.

Note The title of the loadcase no longer shows in orange, since you have addressed the condition which caused the warning.
6] Highlight the line for the Slab dry loadcase, and enter its loads in a similar manner. For your information the remaining load details are tabulated below:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Full UDL loads of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab dry</td>
<td>0.691 klf</td>
</tr>
<tr>
<td>Superimposed</td>
<td>0.150 klf</td>
</tr>
<tr>
<td>Dead</td>
<td></td>
</tr>
<tr>
<td>Live load</td>
<td>1.000 klf</td>
</tr>
<tr>
<td>Construction</td>
<td>0.200 klf</td>
</tr>
<tr>
<td>Live</td>
<td></td>
</tr>
</tbody>
</table>

7] To define the other loads you first need to create the loadcases to contain them. In the Loadcases dialog click Add…

This time the dialog looks slightly different, you can define the Loadcase Title and specify the Loadcase Type as Dead, Live, Roof Live, Wind, Snow, or Seismic as well as defining the loads that the loadcase contains.

8] Define the Loadcase Title as Superimposed Dead, with a Loadcase Type of Dead, and then define its loads in the same manner as previously.

9] Define the Live and Construction Live loadcases similarly, not forgetting to set their Loadcase Type to Live.

When you set the Loadcase type to Live or Roof Live a new column appears for each load, Lg term (%). This value sets the percentage of the load that is considered long-term for deflection calculations.
10] Set the Live loadcase percentages to 33% and the Construction Live loadcase values to 0%.

11] Now that you have defined all the loadcases click OK to close the Loadcases dialog.

12] Click Add / Edit Combinations from the Beam, Loading, Design toolbar.

You will see the Combinations dialog.

This already contains a Construction stage combination.
13] Select the Construction Stage load combination if it is not already selected and click Edit… to look at the details for this combination.

![Combination Details dialog]

**Note**
These are LRFD load combinations.

14] Double-click the name of the Construction Live loadcase. It moves from the left-hand list of Available Loadcases to the right-hand list of Included Loadcases. This combination is now complete so click OK to close the dialog.

16] Add… a new combination, giving it the title **Dead + Live**, and ensuring that, as well as the self-weight the combination includes the Slab dry, Superimposed Dead and Live load loadcases.

16] Click OK twice to close the Combination Details and Combinations dialogs.

17] Click Design Wizard from the Beam, Loading, Design toolbar.

![Design wizard icon]

You will see the Design Wizard dialog.

![Design Wizard dialog]

The **Size Constraints** page allows you to ensure that the sections that **Composite Beam Design** proposes match any particular size constraints you may have.
18] Enter the constraints as shown above and make sure the box next to Optimize shear connection is checked to ensure that Composite Beam Design will use partial composite action.

Limits on the amount of shear connection are also set on this page. Composite Beam Design will ensure that the composite action will be at least the percentage set as the absolute minimum, and will provide a warning if the advisory minimum is not met at the location of any point load or the location of the maximum moment. Leave the default settings for this example (as shown above).

19] Click on the Deflection tab.

This page allows you to set the deflection limits Composite Beam Design will impose on the design process. The deflection at construction stage applies to the construction stage load combination. The remaining deflection limits apply to all other load combinations on the composite beam.

20] Set the deflection limits as shown above.

21] Click on the Camber tab.

By default camber is not applied to the beam.

22] Check the box next to Apply to apply camber to the beam. The options for applying camber are then shown. The defaults (as shown above) for applying camber as a percentage of the dead load are OK for this example.

You have now defined and loaded your composite beam, and so you are ready to design it.
6.6 Design the beam and review the design

1) Click Design from the Beam, Loading, Design toolbar.

The design will proceed and you will see a progress dialog charting this.

When Composite Beam Design has checked all the sections selected for checking it shows the results in the Acceptable Sections dialog.

The Available files list shows the different section types which Composite Beam Design has checked, while the Section Designations list shows the files of the current type which pass all the design checks.

2) Click WMOrderAISCimp.Usa from the Available files and you will see the lightest acceptable sections shown at the top of the Section Designation list.

3) Click the W18X35 section, then click OK to select it and review the results. Composite Beam Design shows these in the Design Summary dialog.
4] Click the Connectors tab, and you will see that 20 shear connectors are required.

Note the text in orange. This indicates a warning in the design process. In this case there is a warning associated with the Degree of shear connection.

5] Click on the Degree of Shear Connection text, when you do so the light bulb (💡) icon in the upper right corner becomes active. Click on this button to see more information for the warning.

In this case there is a warning because the composite percentage is less than the advisory minimum set in the input.

6] Click the Deflection tab, and you will see that the deflections and limits for the selected load combination. You can see that the camber is 1.25 in.
7] You can see more detailed information for any result that has a plus next to it. Double-click on the Total load deflection.

Details of the calculation of the total deflection are shown including the location of the maximum deflection.

8] Browse through the other results if you want.

9] Click Close to close the Design Summary dialog.

10] To get a different view of the information for the designed beam click Edit Floor Construction from the Beam, Loading, Design toolbar.

Note You can also click anywhere on the slab in the workbook.

11] Click the Connectors-layout tab and you will see that the beam has 3 shear studs, one in each rib at each end and 14 studs spaced at 2 ribs in the center portion.

You can easily edit the stud layout in this dialog using the quick layout options or editing the layout table.
12] From the Quick Layout selection choose Total Number, set the number to 24, then click Generate. Composite Beam Design will automatically create a layout for the total number of studs indicated following the spacing rules you have already provided.

![Composite Beam Design Layout](image)

13] Click OK to close the Floor Construction dialog.

Note The stud distribution can also be seen graphically on the beam in the workbook.

![Stud Distribution](image)

14] Click Perform Design from the Beam, Loading, Design toolbar.

Composite Beam Design is set to Check Beam mode (after Designing a beam it is automatically set to Check Beam) but the stud layout is set to Auto-Layout. This means the beam size set earlier (W18X35) will be used but the stud layout will be determined from the new spacing limits. After clicking the Perform Design icon the design details
dialog is opened directly since the beam size is already known. (There is no point in showing the list of acceptable section designations.) The details reflect the new stud number and layout.

15] Browse the design results. The flexural strength and deflections are updated for the new stud layout.

16] Click Close to close the Design Summary dialog.

You have now completed the second beam design example.
Chapter 7  Another look at results

7.1 Design Report

A design report can be created for the project which contains a summary of all beams in the project and detailed calculations for each beam. The contents of these reports are customizable.

1] Click Report View from the Standard toolbar.

You will see the Report View window.

The first page contains a summary of the beams in the project. Subsequent pages show the detailed calculations for each beam in the project.
7.2 Customizing the Report

The design report contents, header, and footer can be customized to meet your needs.

2] Click Report Contents from the Standard toolbar:

You will see the Report Contents window. This allows you to select the report level for each beam in the project as well as allowing you to edit what specific information is included in each report level by clicking Edit Levels...

3] Click Edit Header or Edit Footer from the Report toolbar to edit the contents of the header and footer including the company logo displayed.

4] Click Export to RTF or Export to PDF from the Report toolbar to export the report contents to a file format that can be saved and shared.

The detailed calculation reports are an effective way to view, print, save, and share information about the designs in Composite Beam Design. In addition these reports are fully customizable to include company standards.

Congratulations you have now finished this Quick Start Guide. We hope that you have found this introduction to Composite Beam Design helpful.