

LWC-PLUS

Learning Guide

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Langley, BC, Canada

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About the Learning Guide

This guide is designed to acquaint new and more experienced LWC-Plus users with some of the features of the software. Each lesson walks you through a sample project, giving you the skills needed to finish each project and create estimates for your own projects.

Information in this chapter includes:

- using this guide
- getting help with your projects
- getting product information
- an overview of the sample projects
- a table of keyboard shortcuts for entering coordinates

Using the Learning Guide

This guide presents information in a consistent way to help you quickly acquire skills. Concepts are explained and illustrated comprehensively. And tasks are laid out in straight forward procedures. To complete each project, simply follow the steps as they are set out for you.

Throughout the guide, you will notice **Tips!** in the left hand margin. These tips suggest shortcuts, and act as hints to help you use **LWC-Plus** efficiently.

Getting help

LWC-Plus is created by ASR Automated Systems Research Inc. We provide two ways for you to get help for your estimating projects:

- online help
- technical support

Online help

Our online help provides detailed information on LWC-Plus features and optional settings.

To view LWC-Plus online help

- Press F1 to view help for a particular menu option, toolbar button, or window
- On the **Help** menu, click **Table of Contents** to browse or search through the online help

Technical support

If you cannot find the technical help you need in this guide or in the online help, our Technical Support Representatives can help. Here is how to reach them:

ASR Automated Systems Research Inc

Toll free: 1-800-818-2051 Phone: 604-539-0122 Fax: 604-539-1334 Email: support@asrsoft.com Web: www.asrsoft.com

Getting product information

For information on this product, as well as our entire line of roofing estimating software products, please visit our website at www.asrsoft.com, or call us at the numbers listed above. One of our helpful company representatives will be happy to assist you.

About the sample projects

Each tutorial is designed to introduce new skills to help you use LWC-Plus effectively and efficiently. While the tutorials introduce basic as well as advanced features of the application, they are by no means indicative of the limits of the software.

For a more complete description of LWC-Plus' many advanced features, press F1 at anytime to view the online help.

Lesson 1 introduces you to the LWC-Plus interface. You learn about some of the basic settings, and then you start on your first project. You quickly go through an entire project from drawing the roof outline to creating a report.

Lesson 2 covers some of the drawing features of LWC-Plus. You start by drawing a roof outline with circular and angled line segments. Then you add voids and interior roof sections to the roof outline. You finish by adding small crickets to the project.

Lesson 3 covers letter schemes and the material database. This teaches you how to specify properties of the materials that you commonly use in the program.

Lesson 4 introduces help lines, a useful drawing tool in LWC-Plus. You use help lines to draw a roof oriented on an angle, without calculating the length of all sides on the roof. You also learn about low area orientation.

Lesson 5 teaches you to draw more complicated roofs. You learn to manipulate a layout, diverting water around corners on a roof. To accomplish this you learn how to move and delete roof points, move low areas, and change the starting thickness of roofs.

Lesson 6 teaches you to draw a roof with constant elevation at the perimeter. You learn to use more than one letter scheme on a roof, copy roof sections, extend low areas, and add full crickets.

Lesson 1 : Introduction

In this first lesson, you'll cover some of the basic features of LWC-Plus. You'll create a new project with one roof section, for which you'll generate a report and plot.

Included in this section:

- Default project templates
- Changing settings
- Opening a new project
- The quick menu
- Adding a roof
- Adding drains
- Adding low area on drains
- Changing drawing options
- Viewing estimates
- Generating reports
- Printing your roof plan

Default Project Templates

Before you start working on your first project, you should check your default project template. You choose a template whenever you create a new project. But you can change the properties of the project later, and you can even change the properties for each roof section in a project.

Project templates include the following properties:

- the LWC material and letter scheme
- EPS material and dimensions
- slurry thickness and dimensions
- the cricket material and letter scheme

We'll discuss materials and letter schemes some more in Lesson 3.

You can create any number of project templates. And you can specify one of the templates as the default template. This is the template that's selected by default if you don't specify a different template.

When you work with LWC-Plus, you should spend some time at first creating comprehensive templates. Creating templates will save time down the road and ensure that you create the most accurate estimates for your roofing projects. However, while working through these tutorials, you should use the default project template shown here to ensure that your projects match the ones illustrated in the tutorials.

Setting the Default Project Template

Now you'll check the project template named DEFAULT to make sure that it matches the one shown here.

To set the default project template

1. On the **Setup** menu, click **Default Project Templates**.

The **Setup Default Templates** dialog box opens.

2. In the **Default Template** area, check that **DEFAULT** is selected, as shown in Figure 1-1.

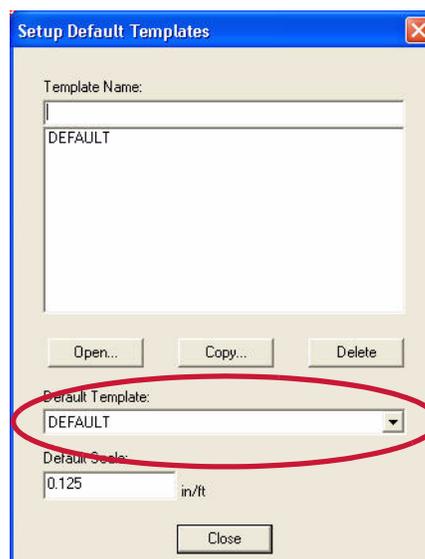


Figure 1-1 The Setup Default Templates dialog box

Tip

You can create any number of templates for your typical projects. Each must have a distinct name. To create a new template, type the name, and click Open.

- In the Template Name area, click DEFAULT, and click Open.

If DEFAULT is not listed, then type DEFAULT, and click Open to create a new template.

The Setup Defaults dialog box opens.

- Edit the options in the dialog box so that it matches Figure 1–2.

Figure 1–2 The Setup Defaults dialog box

For now, the most important properties are:

- **Minimum Thickness: 0**
- **Lettering Scheme: L2**

You should have the L2 letter scheme installed by default. If you don't you can use an equivalent letter scheme with 0.5 in/ft. slope and 2' x 2' rows.

- When finished, click OK.

The Setup Defaults dialog box closes, and you're returned to the Setup Default Template dialog box.

- Click Close.

Changing Settings

Before proceeding, you should also check some settings to make sure that they match the settings used in this tutorial. Right now, you'll check the Repeating Commands settings. However, you should look through all of the settings at some point.

In the Repeating Commands dialog box, you can choose which commands are repeatable. If you select the command once, you can continue to use the command repeatedly without having to select it again. In these tutorials, most procedures describe commands that are repeatable.

To change settings

- On the View menu, click Settings.
- In the Settings dialog box, click Repeating Commands.

3. In the **Repeatable Commands** dialog box, click **Mark All** to select all the commands listed.

Every command in the **Repeatable Commands** dialog box should be highlighted, as in Figure 1–3.

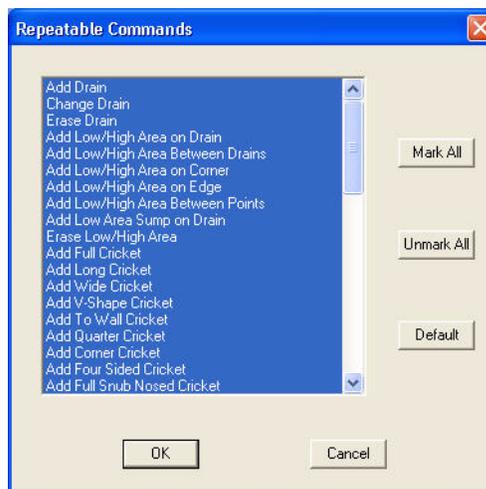


Figure 1–3 The **Repeatable Commands** dialog box.

4. Click **OK** to close the **Repeatable Commands** dialog box.
5. Click **OK** again to close the **Settings** dialog box.

Check out the LWC-Plus online help for details on all the settings.

Opening a New Project

You're now ready to open a new project using the default project template.

To open a new project

1. On the **File** menu, click **Open Project**.

The **Open Project** dialog box opens, as in Figure 1–4.

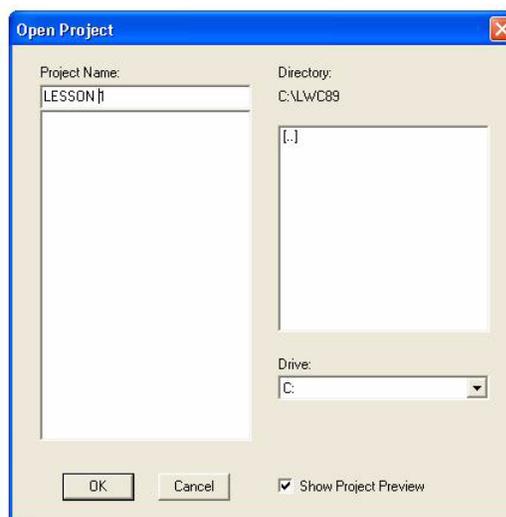


Figure 1–4 The **Open Project** dialog box

2. In the **Project Name** box, type the name of the project. Call this job **LESSON 1**.

3. Click OK.

The Project Title dialog box opens, as in Figure 1–5.

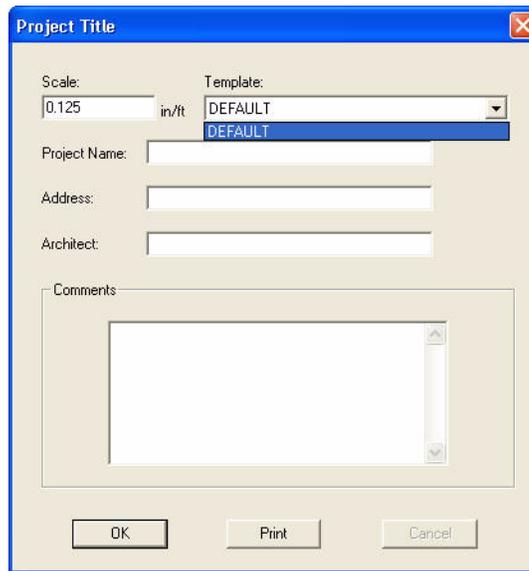


Figure 1–5 The Project Title window

4. From the Template drop down menu, select DEFAULT, and click OK.

The Quick Menu

You can right-click your mouse in the drawing area at any time to view a menu of common tasks. This menu is called the Quick Menu, as seen in Figure 1–6, and can be customized to display only the tasks you use most often. For information on customizing the Quick Menu, see the online help.

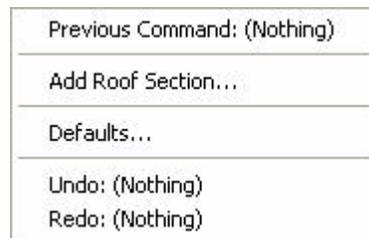


Figure 1–6 The Quick Menu

Adding a Roof

A roof section can be an entire roof or any part of a complete roof. In this project you will add the entire roof as one section.

You can name your roof sections, for example “garage roof,” as you add them to your projects. By default, roof sections are given letter names, such as A, B, and C.

To add a roof

1. On the Add menu, click Roof Section. Or on the main toolbar, click Add Roof



The Add Roof Section dialog box opens, as in Figure 1–7.



Figure 1–7 The Add Roof Section window

Notice that the roof section name defaults to A.

- To accept the default name, click OK.

The Add Roof Section dialog box closes, and a cross hair appears in the drawing window. The command line at the bottom left of the screen tells you what to do next. It looks like Figure 1–8.

ENTER SECTION START POINT A (Adjust)

Figure 1–8 The Add Roof message bar

- By default, the starting point is X:0.0000 and Y:0.0000. Press ENTER to accept the default starting point.

The command line now tells you which keyboard options are available to enter the next point.

ENTER NEXT POINT U D R L H V S C A B M or Q (Quit)

Figure 1–9 Command line

- Type U to go up, type 24 in the command line, as shown in Figure 1–10, and press ENTER.

UP: 24 ft

Figure 1–10 The Coordinate Entry box

- Type R to go right, type 10, and press ENTER.
- Type U to go up, type 8, and press ENTER.
- Type R to go right, type 32, and press ENTER.
- Move your mouse down and to the right, and type S to enter a slope.

You should move your mouse in the general direction of the point that you want to place. Doing so eliminates the need to enter negative coordinates.

- Type 6 in the horizontal text box, tab to the vertical text box, and type 5. Press ENTER.
- Type D to go down, type 27, and press ENTER.
- Type Q to close the roof outline.

Tip!
To choose a new position for your starting point, type A (adjust) and enter the new coordinates.

Tip!
If you make a mistake at any time, simply type B to back up a step or several steps.

Four options appear on the message bar at the bottom left of your screen, as in Figure 1-11.



Figure 1-11 The Close options

12. Type H, or tab to Horizontal and press ENTER to close your roof outline horizontally.

Your roof outline should look like Figure 1-12.

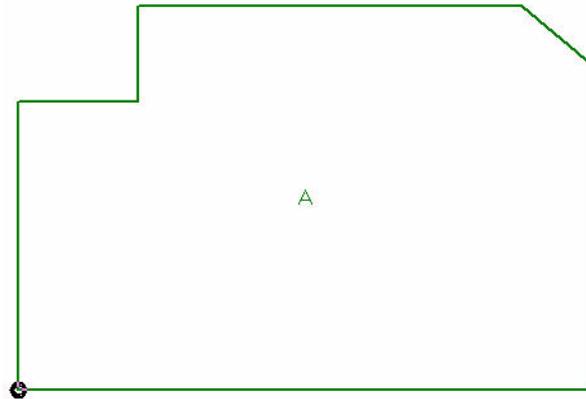


Figure 1-12 Outline of Roof Section A

Adding Drains

There are several ways to add drain locations. You can use your mouse or enter the coordinates using your keyboard. In this lesson, you will use the keyboard to add drains to Roof Section A. But first you need to zoom into the roof.

To add a drain

1. On the main toolbar, click Zoom Current  to zoom into your project.
2. On the main toolbar, click Add Drain .

Your cursor becomes a cross hair, and the command line tells you what to do next, as shown in Figure 1-13.



Figure 1-13 Positioning the drain

3. Move the mouse pointer up and to the right of the reference point, so that you can enter positive offsets from the reference point regardless of what direction the new point is in. Then type A to adjust the starting point. Note that the reference point is the point circled onscreen and is the starting point from which distance is measured. For more information on the reference point and how it can be used and changed check out the HELP file.
4. Type 16 for the Horizontal drain coordinate, tab to the Vertical drain coordinate box, and type 16. Press ENTER.
5. Move the mouse pointer to the right of the first drain, and type A to adjust the position of the second drain.

6. Type 32 in the Horizontal drain coordinate box, ensure that the Vertical drain coordinate is set to 16, and press ENTER.
7. Right-click, or press ESC to stop adding drains.

Your roof outline should look like Figure 1-14.

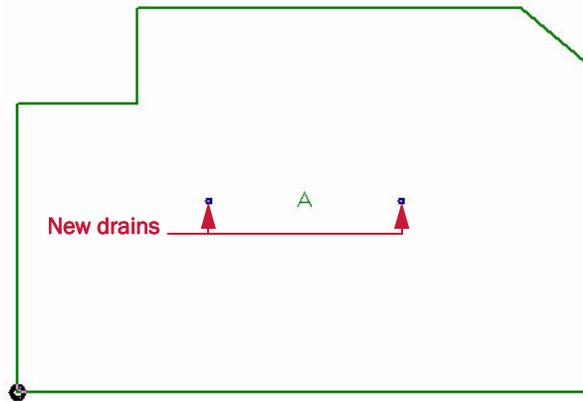


Figure 1-14 Roof outline with drains

Adding Low Areas on Drains

Now you need to show LWC-Plus where to slope the insulation by adding low areas to the roof. Low areas indicate the lowest points on a roof section. All insulation slopes towards these points. You can easily add low areas to drains on the roof.

To add a low area on drains

1. On the Add Low Area toolbar, click Add Low Area on Drain . Click on the left drain to select it.
2. Click on the right drain.
3. Right-click to stop adding low areas on drains.

The low areas are labeled 0 and 1. Your roof should look like Figure 1-15. Note that you made need to change the **Drawing options** - see next page

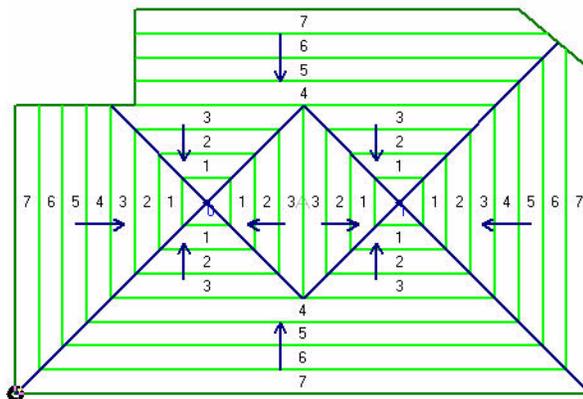


Figure 1-15 Your roof outline

Changing the Drawing Options

Once you add low areas to a roof, you can view the rows of insulation on your roof plan. You can also view the layout without the rows of panels. You can set your drawing options to display the roof planes and direction of slope.

To change drawing options

1. On the main toolbar, click Draw  or press <F5>.

The Drawing Options dialog box open, as in Figure 1–16.

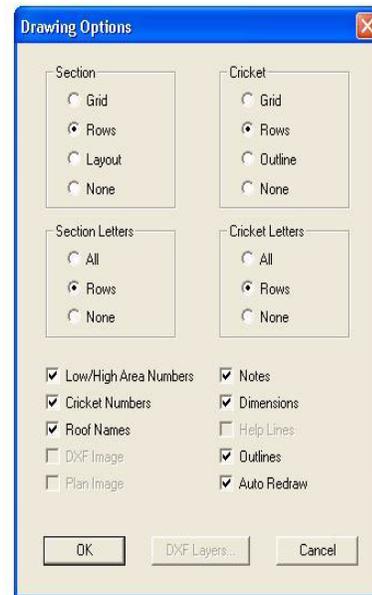


Figure 1–16 The Drawing Options dialog box

2. In the **Section** area, click **Layout**.
3. Leave all other settings as they appear, and click **OK**.

Feel free to change the drawing options at any time to get a different view of your roof.

Viewing Estimates

Another way to view the insulation is by viewing an estimate of the roof. The estimate shows each panel of insulation.

To view an estimate of your roof plan

- On the main toolbar, click Estimate .

The roof plan is redrawn. Notice that each panel is labeled. You should always estimate your project before you generate reports. If you have changed your project in anyway you must redo **Estimate** so that plots and reports are correct.

Generating reports

You can choose to create a number of reports. For this sample job, you will create a summary cut list report.

For more information on generating reports, click F1 to view our online help.

To generate a report

1. On the Output menu, click Reports.

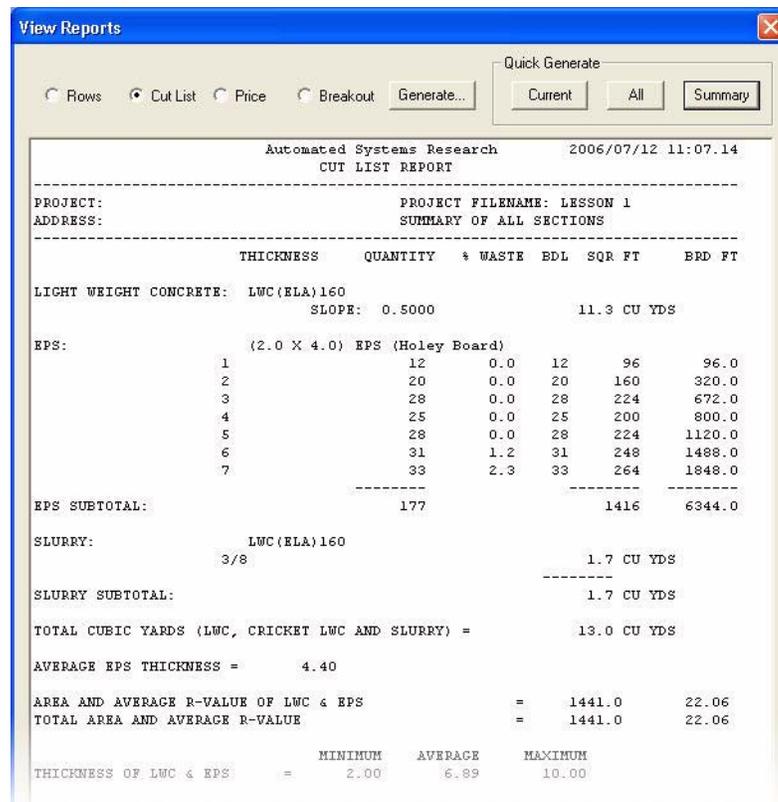
The View Reports dialog box opens, as in Figure 1–17.



Figure 1–17 The View Reports window

2. Click Cut List to select a cut list report.
3. In the Quick Generate area, click Summary.

The View Reports window changes, and quickly generates a summary report of the project, as in Figure 1–18.



THICKNESS	QUANTITY	% WASTE	BDL	SQR FT	BRD FT
LIGHT WEIGHT CONCRETE: LWC(ELA)160					
SLOPE: 0.5000					
11.3 CU YDS					
EPS: (2.0 X 4.0) EPS (Holey Board)					
1	12	0.0	12	96	96.0
2	20	0.0	20	160	320.0
3	28	0.0	28	224	672.0
4	25	0.0	25	200	800.0
5	28	0.0	28	224	1120.0
6	31	1.2	31	248	1488.0
7	33	2.3	33	264	1848.0
EPS SUBTOTAL:		177		1416	6344.0
SLURRY: LWC(ELA)160					
3/8					
1.7 CU YDS					
SLURRY SUBTOTAL:				1.7	CU YDS
TOTAL CUBIC YARDS (LWC, CRICKET LWC AND SLURRY) =					13.0 CU YDS
AVERAGE EPS THICKNESS =		4.40			
AREA AND AVERAGE R-VALUE OF LWC & EPS				=	1441.0 22.06
TOTAL AREA AND AVERAGE R-VALUE				=	1441.0 22.06
THICKNESS OF LWC & EPS		=	MINIMUM 2.00	AVERAGE 6.89	MAXIMUM 10.00

Figure 1–18 A summary report in the View Reports window

The cut list report provides a summary of the volume of LWC and number of EPS panels required for the project.

4. Click OK to close the View Reports window.

Printing your Roof Plan

When you have completed drawing your roof plan, you can generate a roof plan image to send directly to your printer.

Tip!

For information on saving images to be viewed and modified in other CAD programs (.dxf files) or popular graphic program (.tif files), please search our online help index for the type of file.

To print a roof plan

1. On the Output menu, click Plot.

The Plot Preview window opens with a copy of the project in the center of the page, as in Figure 1–19

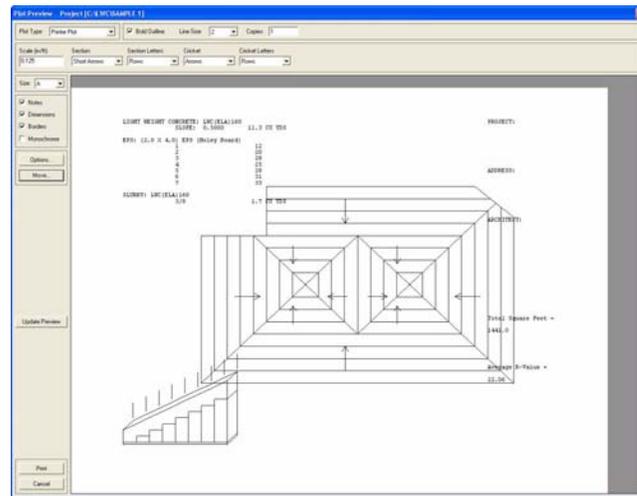


Figure 1–19 The Plot Preview window

Tip!

For information on using the Options and Move buttons to change your roof plan preview, see the online help.

2. In the Plot Type box, choose Printer Plot.
3. Select Bold Outline. NOTE: You can print in black and white by selecting Monochrome.
4. In the Section area, select Grid.
5. In the Size section, select A. (A is 8 1/2 by 11)
6. Click Update Preview.
7. Click Print.

A dialog box appears asking you if it is OK to print, as in Figure 1–20.



Figure 1–20 The Print dialog box

8. Click Print to print your roof plan, or click Print and Exit to close the dialog box and return to the preview pane without sending your roof plan to the printer.
9. Click Cancel to close the Plot Preview window and return to the roof plan view.

You have completed Tutorial 1. Tutorial 2 covers drawing in more depth.

Caution!

Clicking Cancel closes the Plot Preview window without saving any changes you made to your plot image. Note that changes to the project are not affected.

Lesson 2: Drawing in LWC-Plus

In this lesson, you'll learn to draw more complicated roof plans. The roof outline will contain circular and angled line segments. And the project will contain void and interior roof sections, as well as crickets.

Topics Included:

- Drawing circular and angled edges
- Adding voids
- Adding a roof in reference to an existing roof
- Copying roof sections
- Adding an interior roof
- Adding low areas on edges
- Adding long crickets

Drawing in LWC-Plus

As a first step in this project, you'll draw a new roof section. Here are a few tips to help you draw in LWC-Plus:

- You can enter roofs with the mouse or the keyboard.
- If you enter a point incorrectly, you can press B to go back to the previous point.
- At the last point of the roof section, you can press Q or right-click the mouse, and click **Sloped** to close the roof section.
- If your roof section contains only right angles, you can close the roof section one point earlier. Press Q or right-click the mouse, and click **Right Angle** to close the roof section.
- If you draw the roof with the keyboard, look at the command line to see which options are available, as shown in Figure 2-1.

ENTER NEXT POINT U D R L H V S C A B M or Q (Quit)

Figure 2-1 Entering new point command line

- When you type a key, continue to look at the command line to see what's required to complete the step, as shown in Figure 2-2 for the U key.

UP: U ft

Figure 2-2 Command line for U key.

- If you draw with the mouse, look at the coordinate boxes at the top-right and bottom-right corners of the drawing area, as shown in Figure 2-3. They list the horizontal and vertical placement of the mouse pointer from the reference point (top coordinate box) and from the previous point (bottom coordinate box).

X: 7.0000 Y: 26.0000

Figure 2-3 Coordinate boxes

- If you draw a roof section with only right angles, use ortho mode to only enter points at right angles. Click .

Table 2-1 lists the keys used to draw a roof section.

U = up	S = sloped
D = down	C = circular segment
R = right	A = angled
L = left	B = back up a step
H = horizontal	M = change coordinate display
V = vertical	Q = quit section (closes section)

Table 2-1 Direction shortcut keys

In Lesson 1, you used the U, D, R, L, S, and Q keys. In this tutorial, you'll also use the A and C keys.

Starting a New Project

Before drawing the roof, you need to open a new project. You can also start to add the roof without any further instruction. See Lesson 1 for help completing these steps.

To start the project

1. Open a new project named **TUTORIAL 2** using the DEFAULT template.
2. Click Add Roof  to add a new roof section.
3. Accept the default roof name and the default starting point for the roof section.

We'll now explain how to draw a more complicated roof outline.

Drawing Circular and Angled Edges

The outline of this roof section has circular and angled segments. It's shown in Figure 2-4.

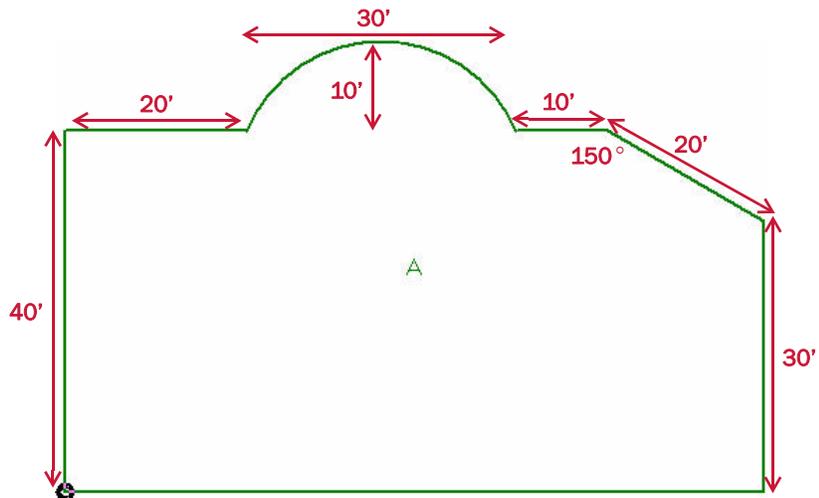


Figure 2-4 Roof section A

In Lesson 1, you drew a roof with a sloped line segment, where you knew the horizontal and vertical components of the line. This roof section contains a similar line segment, but this time we know the angle and the length of the line. To complete this roof you'll use the U, R, C, A, D, and Q keys.

To draw the roof section

1. Type U, type 40, and press ENTER.
2. Type R, type 20, and press ENTER.
Next, enter a circular line segment with the C key.
3. Move the mouse in the general direction of the arc coordinates. Type C, enter 30 as the horizontal coordinate and 0 as the vertical coordinate, and press ENTER.
The default height for the arc is half of the radius. We want to specify a smaller height.
4. Type A, type 10, and press ENTER to specify the height of the arc.
5. Type R, type 10, and press ENTER.
Next enter an angled line segment. Since we know the length and angle of the line segment, you'll use the A key.
6. Type A, enter a length of 20' and an angle of 330° (as measured from the horizontal line: $180^\circ + 150^\circ = 330^\circ$), and press ENTER.

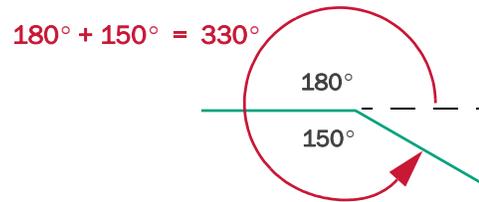


Figure 2-5 Calculating an angle

In LWC-Plus, an angle's coordinates are absolute:

- 0 degrees is always to the right
- 90 degrees is always straight up
- 180 degrees is always to the left
- 270 degrees is always straight down

7. Type D, type 30, and press ENTER.
8. Type Q, and click Horizontal to close the shape.
9. Click Zoom Current  to zoom into the roof section.

The roof should look like Figure 2-4.

If you accepted the default name, the roof should be named A. Throughout this lesson, this roof is referred to as roof A.

Adding Drains

You'll now add drains to the roof section. You can go ahead and add the drains on your own. Figure 2-6 shows the roof section with four drains.

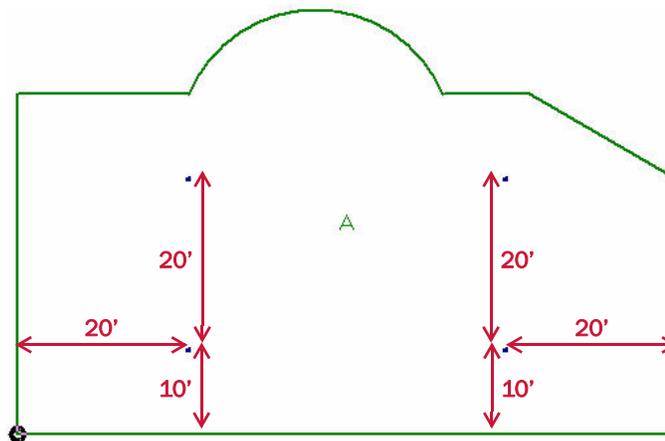


Figure 2-6 Roof B with drains

To add drains to the roof section

1. Click Add Drain .
2. Move the pointer up and to the right of the reference point.
The reference point should still be in the bottom-left corner of the roof. If it isn't, move it there by right clicking the reference point icon and left clicking on the desired point.
3. Type A, enter 20 in the Horizontal box and 10 in the Vertical box, and press ENTER.

4. Type A again, enter 20 in the **Horizontal** box and 30 in the **Vertical** box, and press ENTER to place the second drain above the first drain.
5. Click **Reference Point**  to change the reference point.
6. Click in the bottom-right corner of the roof and move the mouse towards the drain locations.
7. Add two more drains on this side of the roof, as indicated in Figure 2-6.
8. Right-click to stop adding drains.

Adding Low Areas on Drains

Once again, we want to add low areas to the four drains on the roof section. This time you'll use a command that adds low areas to all of the drains at the same time. You'll then change the drawing options to view the insulation layout. The roof section should still be selected from the last procedure.

To add low areas to all drains

1. On the **Add Low Area** toolbar, click **Low All Drains** .

Low areas are automatically added to all of the drains.
2. Click **Draw**  to redraw the roof showing the insulation layout.
3. In the **Section** area, click **Rows**. In the **Section Letters** area, click **Rows**.
4. Click OK to accept the drawing options. Then click **Zoom Current**.

Adding Voids

Voids represent areas on a roof where no insulation is applied. You can add voids in the same way that you add roof sections. Voids are referred to as void roof sections.

You'll add two identical voids to roof A. Both will be placed in the arc area of the roof. You'll add the first void in reference to a point on roof A.

Adding a Void in Reference to an Existing Roof

The first void on this roof will be placed in the arc, such that its bottom-left corner is 6 feet to the right of the left corner of the arc. To make adding the void easier, you can add it in reference to the first roof.

You can add the void in reference to any point on roof A. Since we know the distance from the left point of the arc, you'll choose that point (the third point on the roof) when you add the void.

To add a void in reference to an existing roof

1. Click **Add Section**  to add a new roof section.

The **Add Roof Section** dialog box opens.
2. In the **Roof Section Type** area, select **Void**. Select the **Use Reference From Another Roof** check box.

The **Add Roof Section** dialog box looks like Figure 2-7.

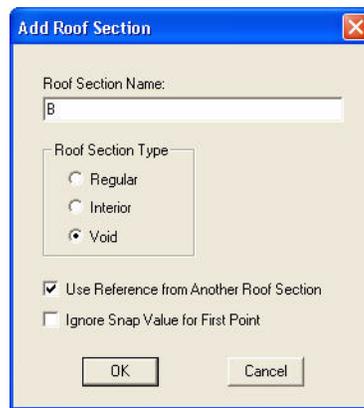
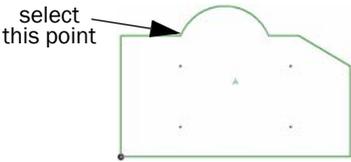


Figure 2-7 Add Roof Section dialog box

Click **OK**. The **Select Reference Section** dialog box opens, prompting you to choose a roof to reference from.

3. Make sure that A is highlighted, and click **OK**.

In the command line, you're prompted to select a corner on roof A.

4. Click on the left point of the arc on roof A, the third point in the drawing. 
5. Watching the top coordinate box, move the mouse pointer 6 feet to the right of the point, and click to place the first point.
6. Type U to go up, type 3 in the text entry box, and press ENTER.
7. Type R to go to the right, type 3 in the text entry box, and press ENTER.
8. Type Q and select **Right Angle** to close your roof section at a 90-degree right angle. **NOTE:** **Quit Right Angle** is only available when a right angle is possible.

The **Select Enclosing Section** dialog box opens, as in Figure 2-8. Make sure A is selected.

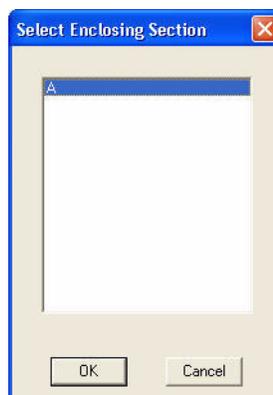


Figure 2-8 The Select Enclosing Section dialog box

9. Click **OK** to return to the drawing area.

Copying Roof Sections

The second void is identical to the first void. Instead of drawing every point on the void, you'll copy the first void that you added. You can copy any type of roof in the same way. We want to position the second void an equal distance from the right point of the arc.

To copy a void

1. Scroll down the **Section** box, and click **B** and press **ENTER** to select the first void section.

The **Section** box is located directly above the drawing area. You can use it to select roof sections and to see the currently selected roof section. It's shown in Figure 2-9.



Figure 2-9 Section box

Tip!

You can also select a roof section in two other ways: Double-click on the roof section. Or click the Section button and then click on the roof.

2. On the **Change Roof** toolbar, click **Copy Section** .

The **New Roof Section** dialog box opens, as in Figure 2-10.

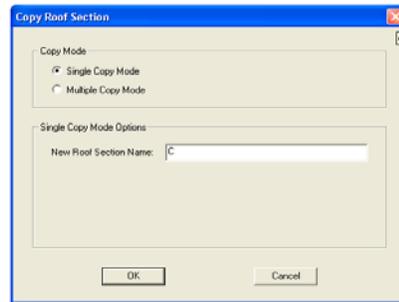


Figure 2-10 The New Roof Section dialog box

3. Click **OK** to accept the default name.

The **Select Enclosing Section** dialog box opens, as in Figure 2-11.

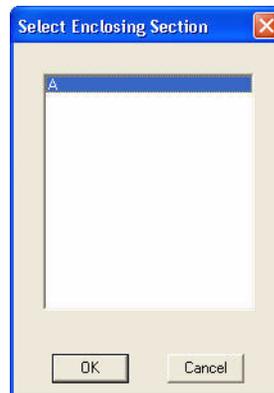


Figure 2-11 Select Enclosing Section dialog box

4. Make sure that **A** is selected, and click **OK**.

The command line prompts you to position the roof section, as shown in Figure 2-12.

POSITION ROOF SECTION A (Adjust) R (Reference) L (Locator Point)

Figure 2-12 Copy roof command line

We want to place the bottom right point of the roof in reference to the right point of the arc. So we need to specify a new reference point (the right point of the arc) and a new locator point (the bottom-right point of the void).

5. Type **R**, and click on the right point of the arc to specify the reference point.

6. Type L, and click on the bottom-right corner of the void to specify the locator point.
7. Move the mouse in the desired direction. Type A, to specify the distance between the reference point and the locator point.
8. Enter 6 as the horizontal distance and 0 as the vertical distance. And press ENTER.
9. Double-click on roof A to select it, and view the layout.

Your roof outline should look like Figure 2-13.

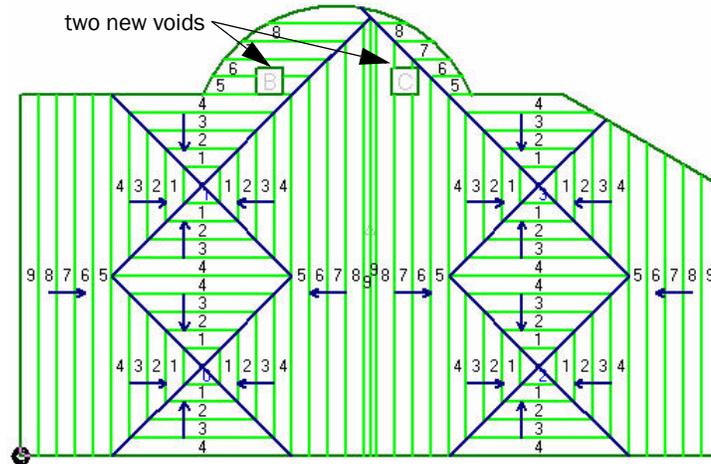


Figure 2-13 Your roof outline with two voids

Adding an Interior Roof

Interior roofs indicate areas on the roof that use a different layout. The interior roof is attached to the original roof, but low areas on the original roof don't affect the interior roof.

To add an interior section

1. Click Add Roof .

The Add Roof Section dialog box opens, as in Figure 2-14.

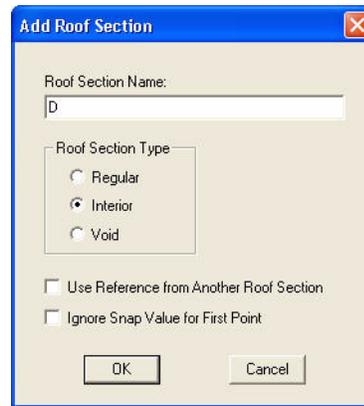


Figure 2-14 The Add Roof Section window

Note that the roof section name is D. This is because you added two voids (sections B and C).

2. In the Roof Section Type area, click Interior, then click OK.
3. With the reference point in the bottom-right corner of roof A, move the mouse pointer 35 feet to the right and 15 feet up, and click to place the first point.
4. Type U to go up, type 10, and press ENTER.
5. Type R to go right, type 10, and press ENTER.
6. Type Q to close the roof section, then click **Right Angle** to close the section at a right angle.

Tip!

You can also use decimals to enter feet and inches. For example, 14'6 can be entered as 14.5.

The Enclosing Roof Section dialog box opens, as in Figure 2-15.

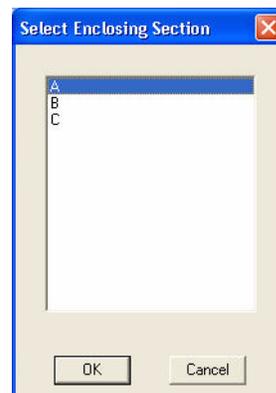


Figure 2-15 The Select Enclosing Section window

7. Select A, and click OK.

The interior roof is added. Your roof plan should look like Figure 2-16.

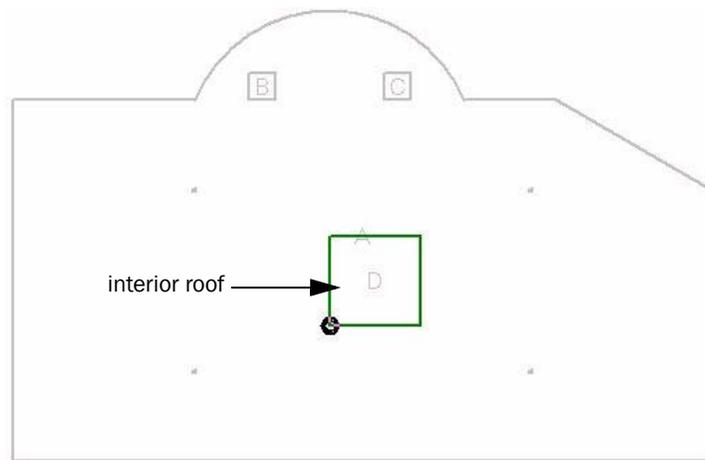


Figure 2-16 Your outline with an interior roof

Adding Low Areas on Edges

The interior roof does not have a drain, so you need to direct water off the interior roof and onto the main roof section. To do this, you'll add low areas on the left and right edges of the interior roof.

To add a low area on an edge

1. On the Add Low Area toolbar, click Add Low Area on Edge .
2. Click on the left edge of the interior roof to select it.
3. Click on the right edge of the interior roof to select it.
4. Right-click or press ESC to stop adding low areas to the roof.

The roof outline should look like Figure 2-17.

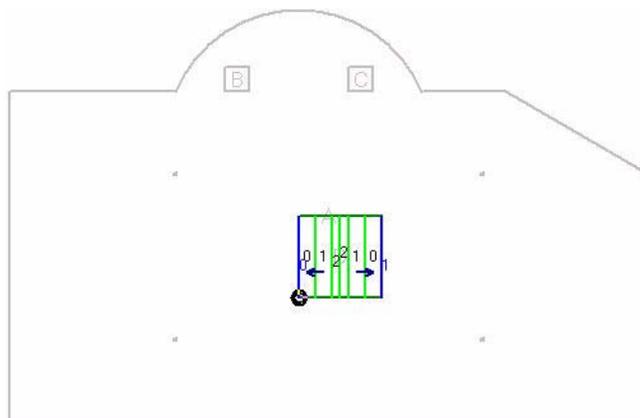


Figure 2-17 Roof outline with low areas on the interior roof

Adding Long Crickets

If you look at the sloped layout of the entire roof, you should notice two places where the layout doesn't quite work:

- In the area above the left void (B), water slopes onto the void.
- In the area to the left of the right void (C), water slopes onto the void.

This is illustrated in detail in Figure 2–18.

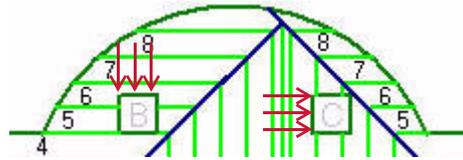


Figure 2–18 Detail of roof with voids

To fix this, you'll add two long crickets to the roof, one above the first void and one to the left of the second void. The crickets should direct the water onto the main roof section.

In LWC-Plus, cricket EPS is added separately and is laid out parallel to the cricket low edge. So the cricket EPS is not stacked with field EPS.

To add a long cricket

1. Select roof A.
2. On the Add Cricket toolbar, click Add Long Cricket .

Since you want to attach the cricket to existing points, you'll use Attach mode. Attach mode lets you attach a new point to an existing point without having to calculate the exact coordinates.

3. Click Attach  to turn on Attach mode.

The icon on the toolbar turns blue to indicate that it is on, and your cursor becomes a box.

4. Place the mouse pointer on the top left corner of the first void, and click, as shown in Figure 2–19.

Tip!

Attach mode is used when you want to attach a point to another point in your drawing. It only works when there is an existing point to attach to. Note that clicking the icon toggles Attach mode on and off

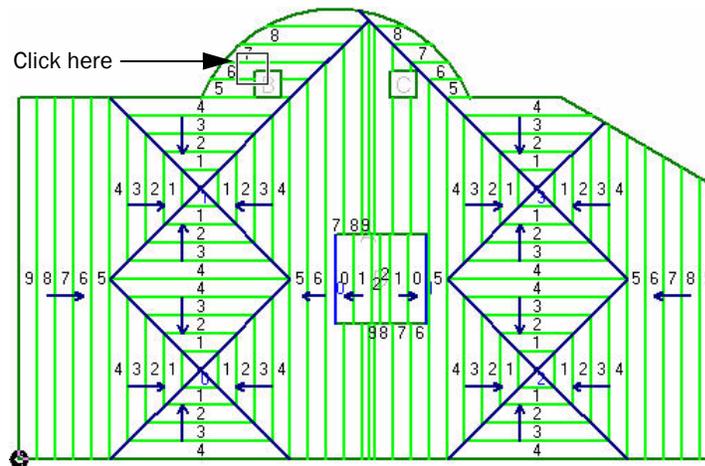


Figure 2–19 Selecting the first point of the long cricket

5. Place the pointer on the top-right corner of the first void (section B), and click.

The command line asks for the cricket tip point, as shown in Figure 2–20.

CRICKET TIP V (Value) A (Adjust) R (Reference)

Figure 2–20 The Cricket Tip message bar

6. Type V for value, type 1, and press ENTER.

Tip!

You can also type A to specify the point at the cricket tip.

7. If the command line asks *Is this the correct side?*, press ENTER for Yes.
8. Add another long cricket on the second void.

When you add the second cricket, place the first point on the bottom-left corner of the second void and place the second point on the top-left corner. You should specify the same width for the cricket.

9. When finished, right-click or press ESC to stop adding crickets.

Your roof outline is finished. It should look like Figure 2-21.

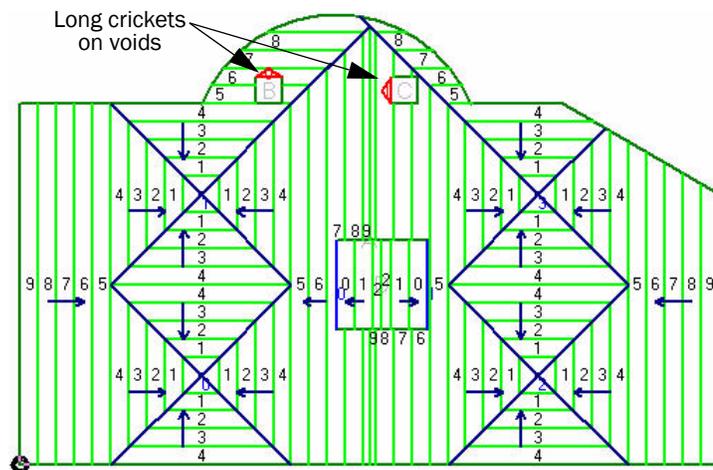


Figure 2-21 Your roof outline with long crickets on voids

You have reached the end of Lesson 2. Lesson 3 covers working with the Materials Database.

Lesson 3: Letter Schemes and Materials

The next lesson in this sample project introduces you to customizing Letter Schemes and the Materials Database.

Included in this section:

- Creating letter schemes
- Creating a flat letter scheme
- Accessing the materials database
- Specifying material data
- Adding a material
- Itemizing fill bundling

Creating Letter Schemes

In this lesson you'll set up a new letter scheme to use with crickets. The default letter schemes (L2 and L4) have a minimum LWC thickness of 2 inches. However, with crickets, the LWC is placed on top of the base letter scheme. In order for the crickets to slope up from the existing insulation, the LWC minimum thickness should be zero.

To create a letter scheme

1. On the **Setup** menu, select **Letter Schemes**.

The **Setup Letter Schemes** dialog box opens, as in Figure 3-1.

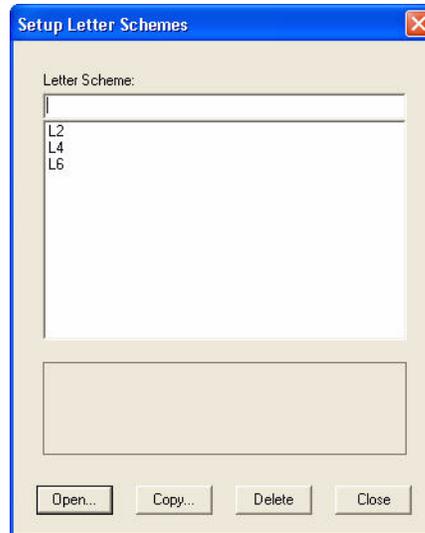


Figure 3-1 The Setup Letter Schemes dialog box

2. In the **Letter Scheme** box, type the name **L4 CRICKET**, and click **Open** to create a new letter scheme.

The **Setup Letter Scheme: L4 CRICKET** dialog box opens, as in Figure 3-2.

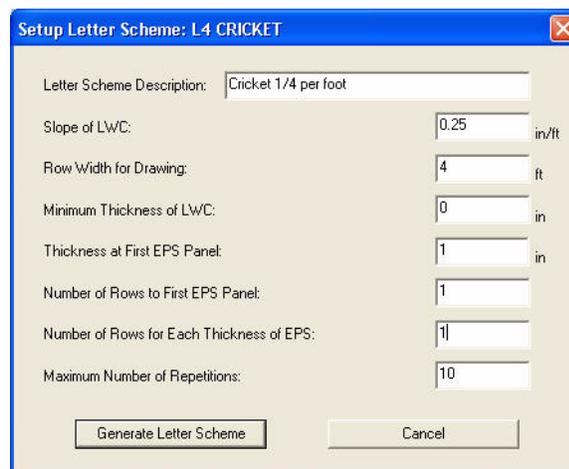


Figure 3-2 The Setup Letter Scheme: L4 CRICKET dialog box

3. In the **Letter Scheme Description** box, enter **Cricket 1/4 per foot** as a description of the letter scheme.
4. In the **Slope of LWC** box, enter **0.25 in/ft** as the slope of the letter scheme.

5. In the **Row Width for Drawing** box, enter 4 ft.
6. In the **Minimum Thickness of LWC** box, enter 0 in.
7. In the **Thickness at First EPS Panel** box, enter 1 in.
8. In the **Number of Rows to First EPS Panel** and the **Number of Rows for Each Thickness of EPS boxes**, enter 1.
9. In the **Maximum Number of Repetition** enter 10

The window should match the one shown in Figure 3–2.

10. Click **Generate Scheme** to create the letter scheme.

The new letter scheme should look like Figure 3–3. Click **OK** to save the letter scheme

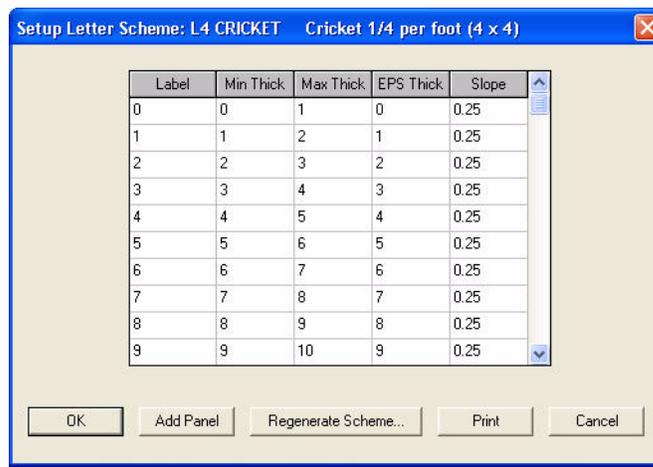


Figure 3–3 New single slope letter scheme

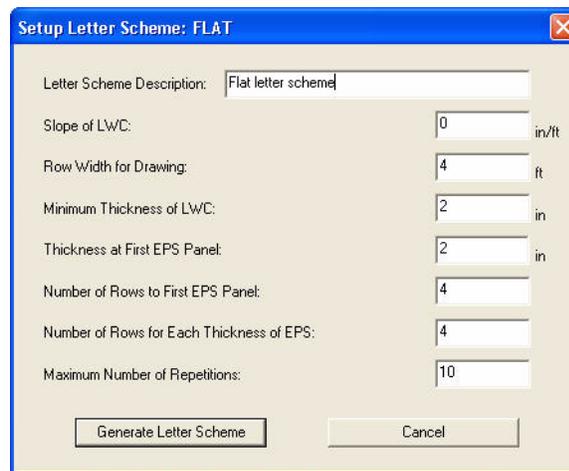
Creating a Flat Letter Scheme

Next you'll create a flat letter scheme to use on roofs that have a built-in sloped structure. The new letter scheme will have a LWC thickness of 2 inches and an EPS thickness of 1 inch.

To create a flat letter scheme

1. In the **Setup Letter Schemes** dialog box, type **FLAT** as the name of the new letter scheme, and click **Open**.
2. In the **Letter Scheme Description** box, type a description of the letter scheme.
3. In the **Slope** box, enter **0**.
4. In the **Minimum Thickness of LWC** box, enter **2**.

The **Setup Letter Scheme FLAT** dialog box should look similar to Figure 3–4.



Setup Letter Scheme: FLAT

Letter Scheme Description: Flat letter scheme

Slope of LWC: 0 in/ft

Row Width for Drawing: 4 ft

Minimum Thickness of LWC: 2 in

Thickness at First EPS Panel: 2 in

Number of Rows to First EPS Panel: 4

Number of Rows for Each Thickness of EPS: 4

Maximum Number of Repetitions: 10

Generate Letter Scheme Cancel

Figure 3-4 Setup Letter Scheme FLAT dialog box

5. Leave the other options as they appear, and click **Generate Letter Scheme**.
The Flat letter scheme opens. Each row in the letter scheme is identical with 2 inches of LWC and 0 inches of EPS.
Next, you need to edit the entire EPS Thick column to specify the same value for each row of the letter scheme.
6. Click on the heading of the EPS Thick column.
The Column Change dialog box opens, as in Figure 3-5.



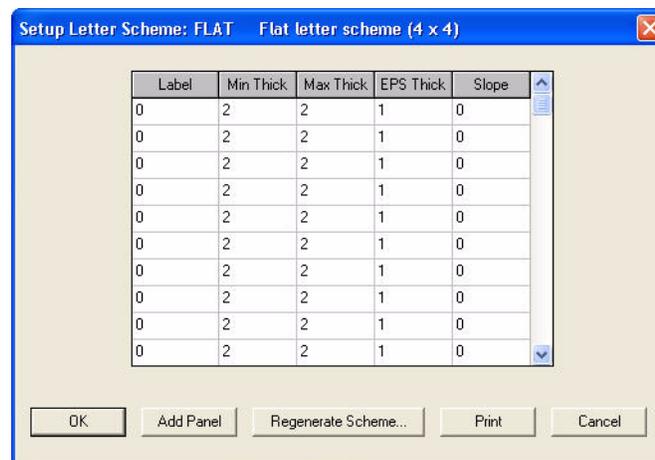
Column Change

EPS Thick: 1 in

OK Cancel

Figure 3-5 Column Change dialog box

7. Type **1** as the EPS thickness, and click **OK**.
Each value in the EPS Thick column changes. The letter scheme should have a number of identical rows, as shown in Figure 3-6



Setup Letter Scheme: FLAT Flat letter scheme (4 x 4)

Label	Min Thick	Max Thick	EPS Thick	Slope
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0
0	2	2	1	0

OK Add Panel Regenerate Scheme... Print Cancel

Figure 3-6 Flat letter scheme

8. Click **OK** to save and close the **Setup Letter Scheme: FLAT** dialog box.

Accessing the Materials Database

The LWC-Plus materials database is designed to provide total flexibility in specifying your roof system. Initially, you have some work to do to customize the database according to your requirements; however, doing so will save you time when you are estimating jobs and ordering materials.

To view the materials database

- On the **Setup** menu, click **Materials**.

The **Setup Materials** dialog box opens, as in Figure 3-7.

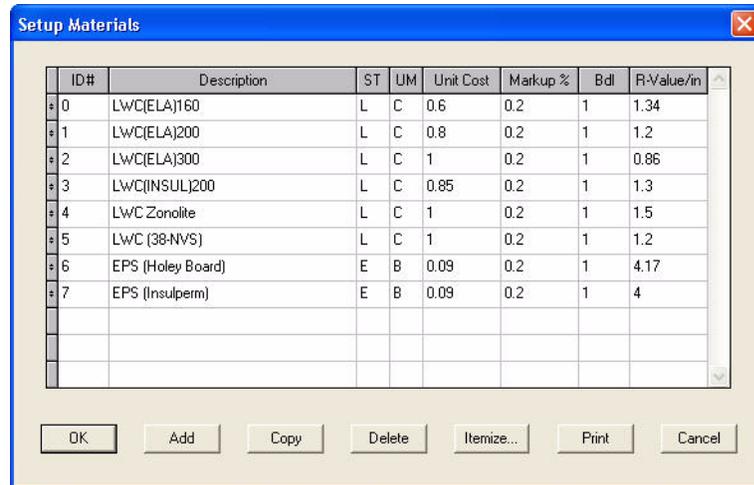


Figure 3-7 The Setup Materials dialog box

Specifying Material Data

You can specify the dimensions and costs of the materials you use in your projects.

The materials database has the following columns:

Material data columns

Column title	What is it?
ID#	the unique number given to the material
Description	the type of material
ST	the material sub-type, either L for LWC or E for EPS
UM	the unit of measurement (cubic yards, square feet, board feet, or item)
Unit Cost	the price of a material, per unit of measure
Markup %	the markup expressed as a decimal. For example 0.1 is a 10% markup
Bdl	the number of panels needed per bundle .
R-Value/Inch	the measure of thermal resistance per inch

Changing Material Data

When you start using LWC-Plus for your own projects, you will need to change material data from time to time. In the next step, you will change the price of LWC(ELA)160 to 0.9. If you don't have this material, you can change the price of any other material with the same steps.

To change material data

1. In the **Setup Materials** window, click **LWC(ELA)160**.
2. Tab over to the **Unit Cost** column and type **0.9** to specify **\$0.90/unit of measure**. You can specify the unit of measure by left clicking on the column title **UM**

If you were only making the one change, you would click **OK** now to close the dialog box and save the change. But you are going to add a material before closing the database.

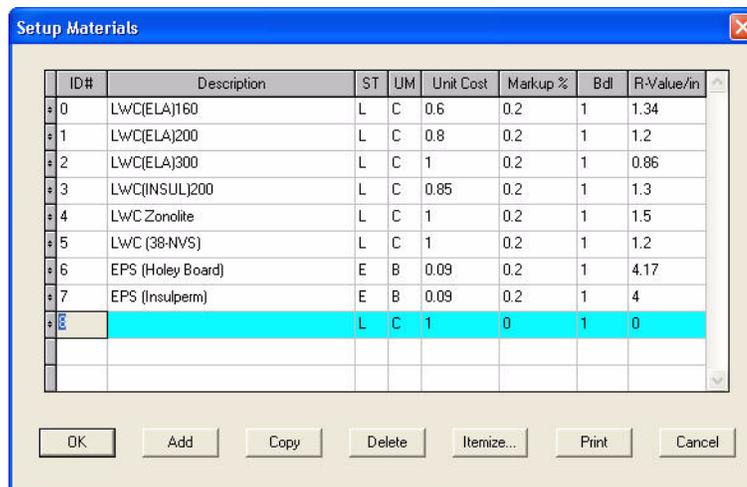
Adding a Material

Just as you sometimes need to modify information about materials in your database, occasionally you also need to add new materials. For example, in the next step you will add a regional-specific EPS panel called **EPS - West**.

To add a material to the database

1. Click the **Add** button to add a material.

A new row is added, and a unique ID number is generated for the new material, as in Figure 3–8.



ID#	Description	ST	UM	Unit Cost	Markup %	Bdl	R-Value/in
0	LWC(ELA)160	L	C	0.6	0.2	1	1.34
1	LWC(ELA)200	L	C	0.8	0.2	1	1.2
2	LWC(ELA)300	L	C	1	0.2	1	0.86
3	LWC(INSUL)200	L	C	0.85	0.2	1	1.3
4	LWC Zonolite	L	C	1	0.2	1	1.5
5	LWC (38-NVS)	L	C	1	0.2	1	1.2
6	EPS (Holey Board)	E	B	0.09	0.2	1	4.17
7	EPS (Insulperm)	E	B	0.09	0.2	1	4
8		L	C	1	0	1	0

Figure 3–8 The added row

2. Tab to the **Description** column and type **EPS - West**.
3. Tab to the **ST** column and type **E** for EPS.
4. Tab to the **UM** column and type **I** for item.

We'll leave the other values alone for now. The **Setup Materials** dialog box should look like Figure 3–9.

We want to add three thicknesses of EPS insulation. So you will add three rows of EPS panels.

3. Click Add three times.
4. In the Thickness column, specify thicknesses of 1, 2, and 3 inches.

The Thickness column should look like Figure 3-11.

Thickness
1
2
3

Figure 3-11 Thickness column in the Itemize EPS Material dialog box

5. In the Panel Cost column, specify costs of 0.88, 1.76, and 2.64 for the three panel thicknesses to specify the cost per panel

The Panel Cost column should look like Figure 3-12.

Panel Cost
0.88
1.76
2.64

Figure 3-12 Panel Cost column in the Itemize EPS Material dialog box

6. Click on the heading of the Markup % column, and enter a markup of 0.2 to specify 20% markup for each EPS thickness.

You edit values of the entire column in the Column Change dialog box, as shown in Figure 3-5 on page 32.

7. In the Bdl column, specify 36, 18, and 12 as the number of panels per bundle for each EPS thickness.
8. In the R-Value/in column, enter a R-Value of 4.2 for each EPS thickness.
9. In the Description column, enter appropriate descriptions for each panel.

The dialog box should look similar to Figure 3-13.

Thickness	Type	Panel Cost	Markup %	Bdl	R-Value/in	Description
1	N	0.88	0.2	36	4.2	1" thick eps
2	N	1.76	0.2	18	4.2	2" thick eps
3	N	2.64	0.2	12	4.2	3" thick eps

Figure 3-13 The Itemize EPS Material dialog box, finished

10. Click OK to close and save the Itemize EPS Material dialog box. And click OK again to close the Setup Materials dialog box and save all changes to the Materials Database .

You've reached the end of Lesson 3. In Lesson 4, you'll learn how to use help lines to draw irregular roof sections.

Lesson 4: Using Help Lines

In this lesson, you'll learn about help lines. You'll use several types of help lines to help draw a roof outline and add drains in the center of the roof.

Topics Included

- Angle help lines
- Bisecting help lines
- Parallel help lines
- Changing the roof outline
- Adding points to the roof outline
- Low area orientation
- Changing low area orientation

Drawing an Angled Roof

Until now, you've drawn roofs that are oriented horizontally and vertically on the roof plan. While some roof edges might have been sloped or curved, the general orientation of the roof was perpendicular. This simplifies drawing with the keyboard. And since the LWC-Plus coordinate system uses a perpendicular orientation, it makes it easier to add points in reference to existing points.

In this lesson, we'll deviate a little from these perpendicular roofs. You'll draw a simple roof with two wings. One wing is oriented at a right angle, while the other wing is oriented at a 45 degree angle. The roof is pictured in Figure 4-1.

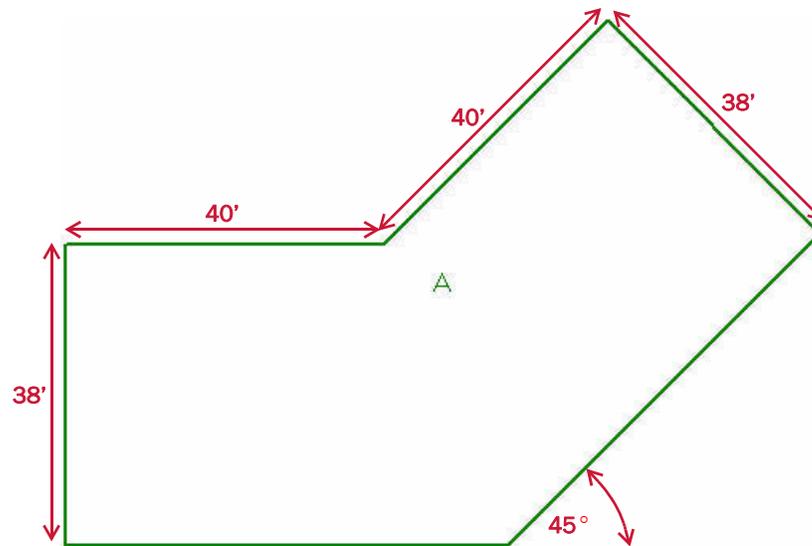


Figure 4-1 Roof outline

While you can easily enter perpendicular roof points with the standard keyboard commands, you'll see that it's also easy to draw roofs at different angles when you use help lines. You'll use help lines to place many of the points in this project.

Adding a New Roof Section

You'll first create a new project and draw a roof section. You won't complete the roof just yet. Later you'll add two help lines before adding the final point of the roof outline.

To draw the roof section

1. Create a new project named **TUTORIAL 4**, using the default template.
2. Click Add Section  and click OK to add a new roof section.
3. Press ENTER to accept the section start point, or click at some other point in the bottom left corner of the drawing area.
4. Type U, type 38, and press ENTER.
5. Type R, type 40, and press ENTER.
6. Type A, and enter a length of 40 feet and an angle of 45 degrees.
7. Type A, and enter a length of 38 feet and an angle of 315 degrees.
We'll stop here since we don't know the length of the next edge.
8. Type Q, and click Sloped to close the roof section.

The roof should look like Figure 4–2.

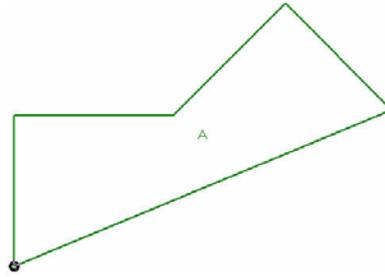


Figure 4–2 Unfinished roof.

Using Help Lines

Before adding the final point of the roof section, let's learn a bit about help lines.

Help lines are continuous lines that you can add anywhere in a LWC-Plus project. When you add a help line to a project, the intersecting points between the help line and other lines in the project are attachable. That means you can select these points when you turn on attach mode. This can make drawing and adjusting roofs much quicker and more precise.

You can add help lines in five ways:

- between two points: either attach to existing points or create new points
- parallel to an existing line
- perpendicular to an existing line
- at a specified angle
- bisecting two existing lines

Help lines can give a visual reference on the roof plan. But they're most useful in attach mode. You can attach to any point where a help line intersects with another line on the roof plan, including another help line.

To draw the roof in this project, you'll add angle, bisecting and parallel help lines.

Adding Angle Help Lines

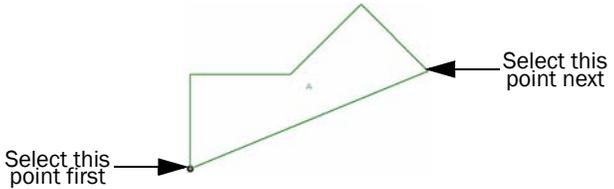
Compare the roof outline with Figure 4–1. Your roof section is still missing one point. You didn't add it earlier because you didn't know the length of the last edge. But if you look at Figure 4–1, you can see the angles of the edges:

- One edge is horizontal, at a 0° angle.
- One edge is at a 45° angle.

You can also find points on the current roof outline that each line passes through. So you can add two angle help lines to the roof to represent the desired roof outline. You can later attach the final point on the roof outline to the intersection of the two help lines.

To add angle help lines

1. Click Zoom Current  to zoom into the roof section.
2. On the Inspect & Help Lines toolbar, click Add Help Line .
3. Click Attach  to turn on attach mode.

4. Click on the bottom-left point of the roof to attach the first help line to the bottom-left corner.
5. Type A, type 0 as the angle, and press ENTER to add a horizontal help line.
6. Click on the last point of the roof section. 
7. Type A, type 225, and press ENTER to add a help line at 225° (180° + 45°).
8. Right-click to stop adding help lines.

The roof plan should look like Figure 4-3.

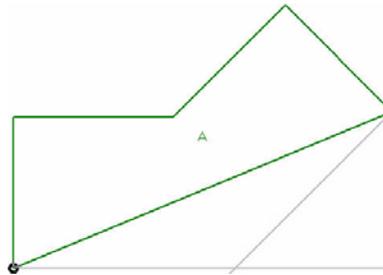


Figure 4-3 Roof A with two angle help lines

Changing the Roof Outline

Now you need to change the shape of the roof outline. On the **Change Roof** toolbar, there are several commands that you can use to explicitly change the shape of the roof outline. These are explained below. Note that these commands can be accessed from the **Change** menu as well as the **Change Roof** Toolbar described below

Adding Points to the Roof Outline

You added the angle help lines to indicate where to place the last point of the roof outline. Now, using attach mode, you'll add a final point to the outline, attaching to the intersection between the two help lines.

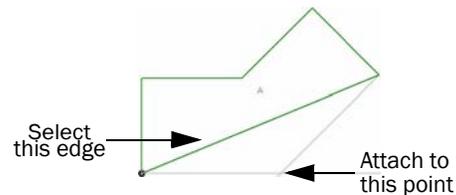
To add a point to the roof outline

1. Turn on Attach mode if it isn't already set. 
2. On the **Change Roof** toolbar, click **Add Point to Section**

3. Select the bottom edge of the roof.

The mouse pointer jumps to the last point of the roof section.

4. Click on the intersection of the two help lines to place the point.



5. Right-click to stop adding points.
6. On the **Inspect & Help Line** toolbar, click **Delete Help Line** .
7. Click on each help line to delete it.

- Right-click to stop deleting help lines.

The roof outline is complete. It should look like Figure 4–1 on page 38.

Adding Drains on an Angled Roof

Now, you need to add drains to the roof. Both drains should be along a line in the center of the roof, each 20 feet from the edge, as shown in Figure 4–4.

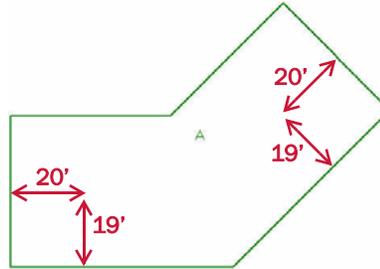


Figure 4–4 Placement of drains

You can easily add one of the drains in reference to the bottom-left point of the roof. However, you don't know the absolute position of the second drain in reference to any point. You only know the position of the drain relative to two angled lines.

Adding Bisecting Help Lines

We're designing the drainage of this roof along a line down the center of the roof. We want drains at points along this line. Since you're concerned with a line along the center axis of the roof, you can use bisecting help lines to help visualize this axis.

With bisecting help lines, you need to select two existing lines on the roof plan. Then, LWC-Plus automatically draws a help line, bisecting the two original lines. The angle of the help line is the average of the two angles, and the help line is placed at a distance directly between the two lines. If the lines are parallel, the help line is drawn at the same angle as the other lines and it's placed directly between them.

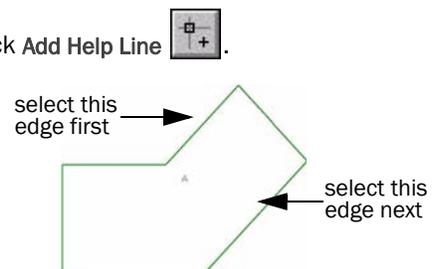
In the current project, you'll add a bisecting help line to determine the center axis of the right side of the roof.

To add a bisecting help line

- On the **Inspect & Help Lines** toolbar, click **Add Help Line** .
- Type **B** to add a bisecting help line.
- Click on the top-right edge. Note: click towards the middle of the edge not near the corners
- Click on the bottom-right edge.

The help line is automatically drawn bisecting the two roof edges.

- Right-click to stop adding help lines.

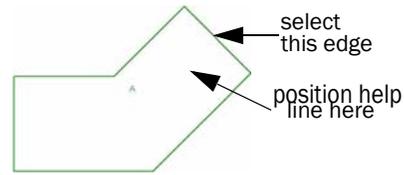


Adding Parallel Help Lines

Next you need to add a help line parallel to the far right edge of the roof section. You'll place this help line 20 feet in from the edge. This will determine where to place the right drain.

To add a parallel help line

1. On the **Inspect & Help Lines** toolbar, click **Add Help Line** .
2. Type P to add a parallel help line.
3. Click on the far-right edge to select it.
4. Move the cursor in towards the center of the roof section.
5. Type A, type 20, and press ENTER to place the help line 20 feet towards the center of the roof.
6. Right-click to stop adding help lines.



Your roof plan should look like Figure 4-5.

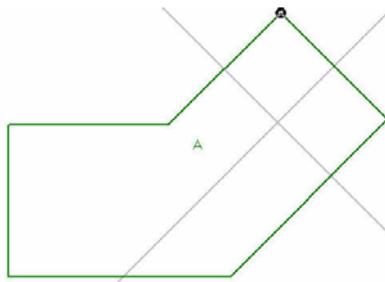


Figure 4-5 Roof with bisecting and parallel help lines.

Adding Drains

Now you'll add the two drains. Add the first drain in reference to the bottom-left corner of the roof. Then, add the second drain at the intersection of the two help lines.

To add two drains

1. Click **Reference Point**  to select a new reference point.
2. Click the bottom-left corner of the roof.
3. Click **Add Drain**  and move the mouse pointer up and to the right from the reference point.
4. Type A, enter a horizontal displacement of 20 feet and a vertical displacement of 19 feet.
5. Turn on attach mode if it isn't already set.
6. Click on the intersection of the two help lines to place the second drain.
7. Right-click to stop adding drains.

Your roof should have two drains in the places indicated in Figure 4-4.

Adding Low Areas on Drains

As in the previous lessons, you'll add low areas to the two drains on the roof and then change the drawing options to view the sloped layout.

To add low areas on drains

1. On the Add Low Area toolbar, click Low All Drains . Low areas are added to both drains on the roof.
2. Click Draw  to redraw the roof showing the insulation layout.
3. In the Section area, click Rows. In the Section Letters area, click Rows.
4. Click OK to accept the drawing options.

Your roof plan should look like Figure 4–6.

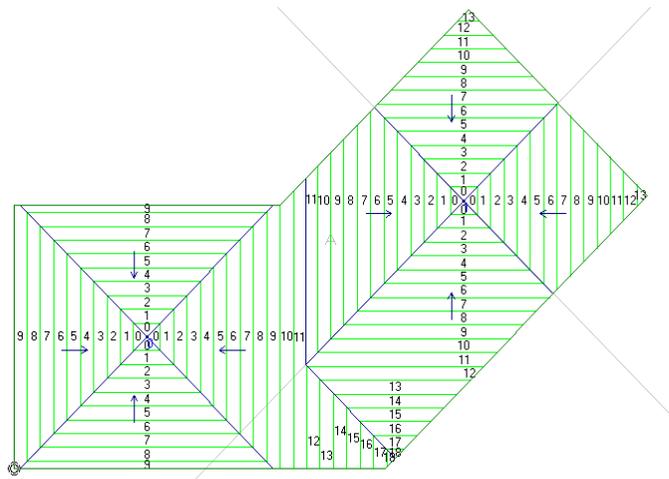


Figure 4–6 Roof with low areas showing insulation layout

Low Area Orientation

Low areas can consist of a point, a line, or a shape with multiple lines. When a low area is on a drain, it consists of a single point. When a low area is on an edge, like on the interior roof in Lesson 2, it consists of a line. We haven't yet seen any low areas consisting of multiple lines, but the result is similar to having separate low areas on each edge of the shape.

For line or shape low areas, the insulation slopes down at right angles towards the edges of the low areas. The angle of the line determines the angle at which the insulation slopes.

When the low area is a single point, like in this project, and there are two or more low areas then the insulation slopes towards the low area along the horizontal and vertical axis of the roof. This is illustrated in Figure 4–7. Note that if there is just one single point low area in a roof section, the insulation will align itself with the longest edge.

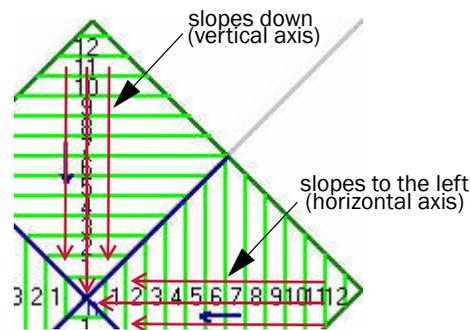


Figure 4-7 Detail around right low area

In the current project it would make more sense if the insulation sloped in angles that match the angle of the roof.

Changing Low Area Orientation

You can change the orientation of a single point low area so that it doesn't follow the horizontal or vertical axis. On the current roof section, you'll leave the orientation of the left low area, since that part of the roof has a perpendicular orientation. But you'll change the orientation of the right low area so that it matches the orientation of the roof.

To set the orientation of a low area

1. On the **Change Area** toolbar, click **Set Low/High Area Orientation** .
2. Click on the right drain to select that low area
3. Click on the the far right edge so that the grid will be parallel to that edge.

The command line asks if you want to set the orientation of all low areas, as shown in Figure 4-8.

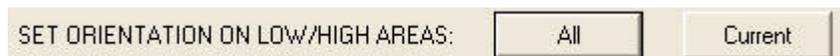


Figure 4-8 Command line

We only want to change the orientation of the low area on the right.

4. Click **Current**.

The low area orientation adjusts realigns to follow the selected edge. Now, let's delete the help lines to finish the project

5. On the **Inspect** toolbar, click **Delete Help Line** .
6. Click on each help line to delete it.
7. Right-click to stop selecting help lines

Your roof plan is complete. It should look like Figure 4-9.

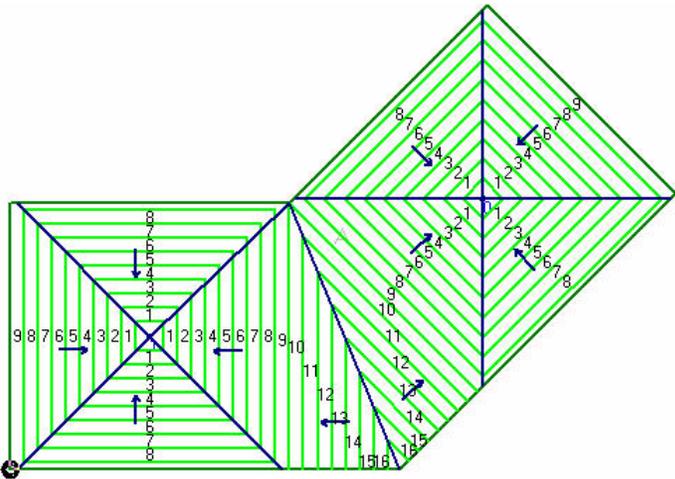


Figure 4-9 Completed roof plan

You have completed Lesson 4. In Lesson 5, you'll create a new project and learn to align insulation panels between different roof sections.

Lesson 5: Aligning Rows

In this lesson, you'll explore more ways to design complicated roof layouts. You'll learn to move valleys and align roof panels in order to achieve a correct drainage pattern.

Topics Included

- Diverting water around corners
- Splitting a roof
- Creating a one-way layout
- Adding a low area between points
- Aligning rows
- Measuring distances
- Moving low areas
- Matching row thicknesses
- Changing minimum thickness

Drawing a Roof

For this project, you'll continue to use the default template with the L2 letter scheme (see "Default Project Templates" on page 6). In this lesson, you'll match row thicknesses, so it's important that you use the same letter scheme as shown. If you don't have the L2 letter scheme, add it before proceeding. Otherwise, you can use another 0.5 in/ft slope letter scheme with 2 foot wide rows.

First, you need to open a new project and draw a roof section. The roof in this lesson is a simple rectangular roof with a protruding section at the top, as shown in Figure 5-1.

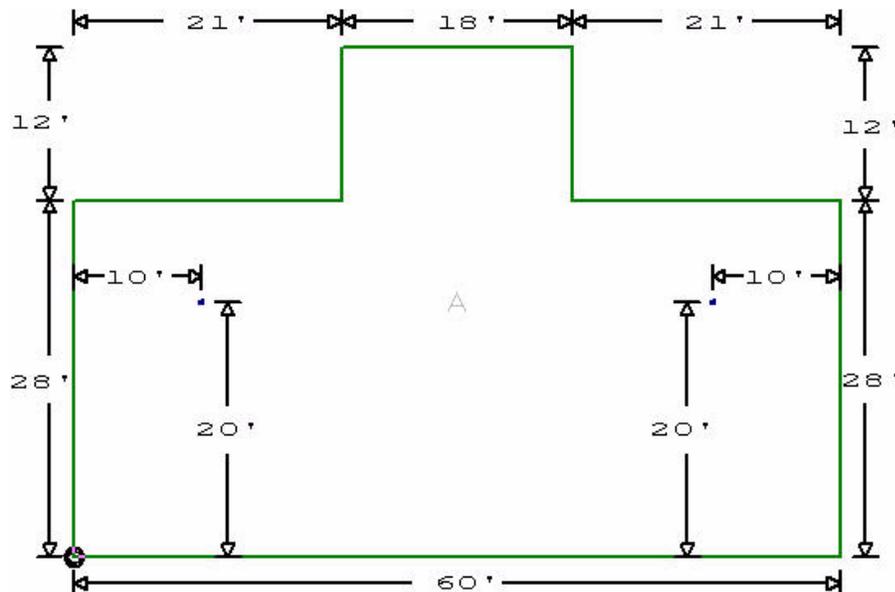


Figure 5-1 Roof Section A

To draw the roof section

1. Open a new project using the default template and name it **TUTORIAL 5**.
2. Add a roof section using the default name: A.
3. Draw the roof pictured in Figure 5-1, using the U, R, D, and Q keys.

You can stop drawing the roof in the upper right corner and use the Right Angle option to close the roof assuming you started the roof at the lower left corner and entered points clockwise.

4. Click Zoom Current  to zoom into the roof.
5. Add two drains to the roof, as shown in Figure 5-1.

Move the reference point to the bottom right corner to add the right drain.

6. On the Add Low Area toolbar, click Low All Drains .
7. Click Draw  to change the drawing options.
8. In the Section area, click Rows. And click OK.

The drawing area updates to show the direction of water flow. Your roof section should look similar to Figure 5-2.

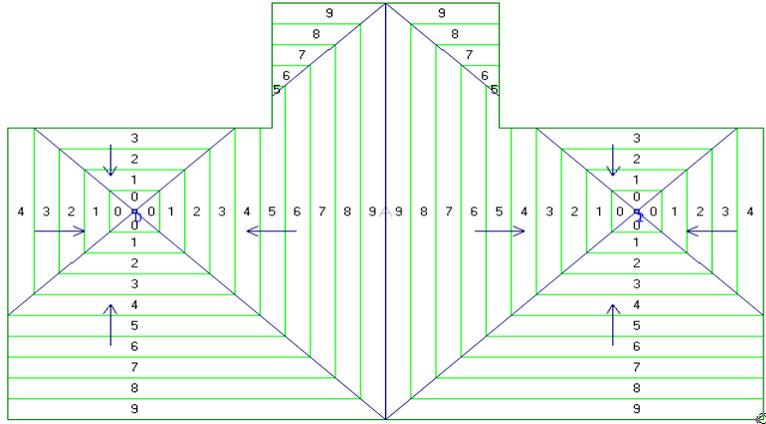


Figure 5-2 Roof A showing direction of water flow

As you can see there are a few problems with this layout.

Analyzing the Layout

When you look at the sloped layout of a roof section, you can see the direction that the insulation is sloped. In Figure 5-2, the arrows represent the direction of slope. In this project, water flows to two different drains. The water flows either directly towards a drain or to a valley that angles towards a drain. Figure 5-3 illustrates this in a close up of the area around the left drain.

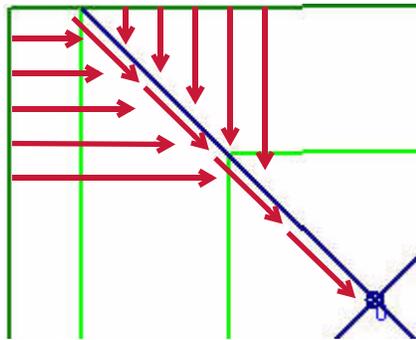


Figure 5-3 Direction of water flow around a valley

On the main part of the roof in Figure 5-2, all water that falls on the roof flows to a drain. However, on the protruding section at the top of the roof, the layout does not work. The valleys do not connect with the main part of the roof. So any water directed into the valleys flows towards the edge of the roof, as shown in Figure 5-4. At the point where the valley meets the edge, water will pool.

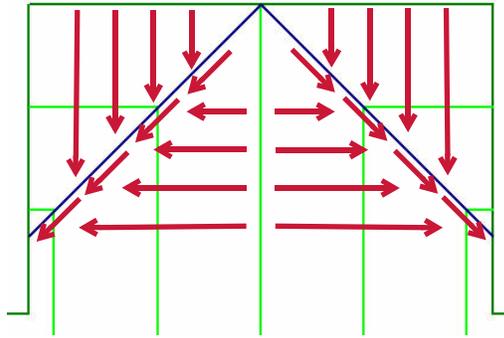


Figure 5-4 Direction of water flow on roof protrusion

Diverting Water Around Corners

To fix the water flow, we need to change the position of the valleys. Instead of leading to the edge of the roof, they should lead onto the main part of the roof. This would direct water around the corners of the roof and towards the drains.

For proper drainage, the valleys at the top of the roof should look like those pictured in Figure 5-5.

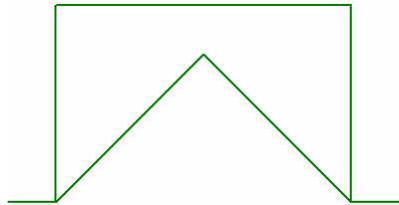


Figure 5-5 Roof protrusion with new valleys

Splitting a Roof

In order to change the layout, you need to split roof A into two separate roof sections. You create separate low areas for each roof section in a project. The low areas on one roof section don't affect the layout of another roof section. You can use these separate low areas to control the layout in different parts of the roof.

Adding a Second Roof

In this example, you'll create new valleys lines by adding a roof section along those lines. When finished, the original roof in your plan will consist of two separate roof sections. The second roof section is shown in Figure 5-6.

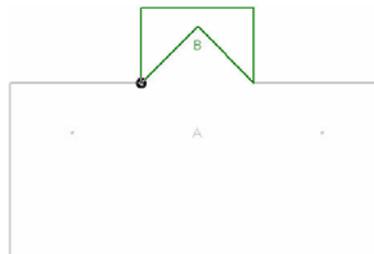
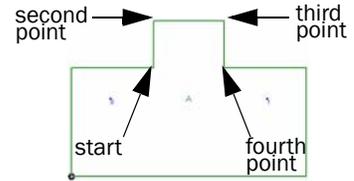


Figure 5-6 Roof A and roof B

To add a second roof section

1. Click Draw  to redraw the roof.
2. In the Section area, click None. And click OK.
3. Click Add Roof Section , and accept the default name: B.
4. Click Attach  to turn on attach mode.
5. Click on the bottom left point of the protrusion in roof A as the starting point.
6. Working clock-wise, click on the three other corners of the protrusion to attach the new roof to these points.
7. Click Attach  to turn off attach mode.
Watch the lower coordinate box to place the last point.
8. Move the pointer up 9 feet and to the left 9 feet, and click to place the last point. We know the valleys are at 45 degrees. Therefore the 2 valleys meet at this point
9. Right-click, and click Sloped to close the roof section.



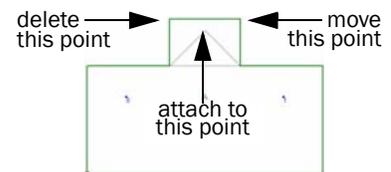
Your project should look like Figure 5–6.

Changing a Roof Outline

You now have two roof sections that overlap, so you need to change the outline of roof A so that it doesn't overlap with roof B. First, we will delete one of the corners of the protrusion. Then, we will move the other corner to align it with the inside tip of roof B.

To change the outline of roof A

1. Select roof A (by clicking on the Section button and clicking on A. (Alternatively use the drop down menu next to the button)
2. On the Change Roof toolbar, click Remove Point from Section .
3. Click on the top-left corner of the protrusion of roof A to delete it.
4. Right-click to stop deleting points.
5. On the Change Roof toolbar, click Point .
Adjust Section .
6. Click on the top-right corner of the protrusion of roof A to select it.
7. Click Attach  to turn on attach mode.
8. Click on the inside tip of roof B to place the corner of roof A.
9. Right-click to stop moving points.



Roof A should look like Figure 5–7.

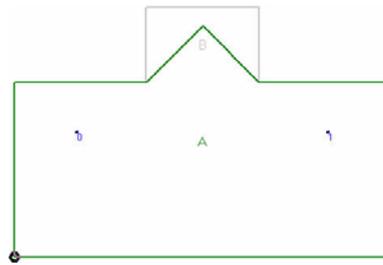


Figure 5-7 Roof A

Creating a One-Way Layout

You still need to design a tapered layout for the new roof section:

- The water flow on roof B should mimic the water flow on the protrusion of the original roof.
- The two bottom edges of roof B represent the two valleys in the protrusion of the original roof.

Look at Figure 5-4 on page 50 to see the sloped layout on the protrusion of the original roof. Notice that the area above the two valley lines slopes down towards the valleys. The four-way layout of the original roof section led to that design.

In order to mimic the slope of the original roof on the new roof section, you need to create a one-way sloped layout on roof B. Since all of roof B is above the valley lines (the bottom edges of roof B), we want all of roof B to slope straight down towards roof A. Figure 5-8 illustrates this layout.

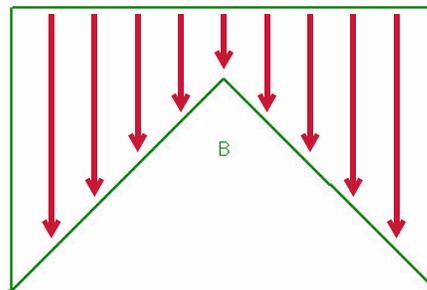


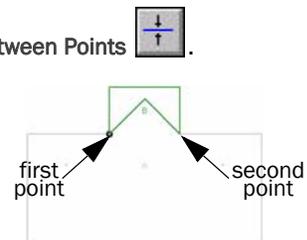
Figure 5-8 Sloped layout of roof B.

Adding a Low Area Between Points

In order to create a one-way sloped layout, you'll add a low area between the two bottom points of roof B.

To add a low area between points

1. Select roof B.
2. On the Add Low Area toolbar, click Add Low Area Between Points .
3. With attach mode turned on, click on the bottom-left point of roof B.
4. Click on the bottom-right point of roof B.
5. Right-click to stop adding low areas.
6. With the Section selection box, select PROJECT
Note: You can do this by double clicking on the screen outside the roof areas.



7. Click Draw  to change the drawing options.
8. In the Section area, click Rows. In the Section Letters area, click Rows. And click OK.

Your roof plan should look like Figure 5–9.

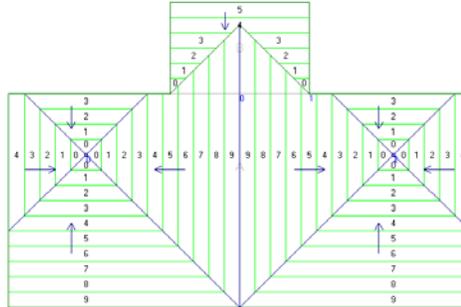


Figure 5–9 Layout of roofs

The valleys at the top of the roof section now lead to the corners of the roof. Water should now flow from the protrusion onto the main section of the roof and eventually into the two drains.

Aligning Rows

Look at your roof layout, and examine the border between the two roof sections. You should notice that the lines don't match along the border. Figure 5–10 shows this area in detail.

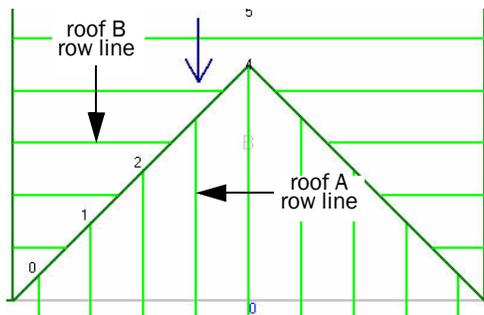


Figure 5–10 Detail of border between roof sections

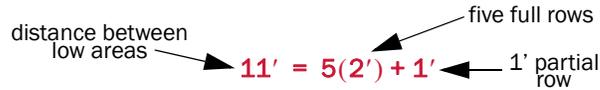
On the roof plan, a row line represents a specific thickness of insulation. If row lines are not aligned, then elevations are not equal. This means that there's a change in elevation from one roof section to the next. You need to fix this to create a proper layout.

LWC-Plus starts placing full rows at low/high areas. If the dimensions of the roof require partial rows, they're placed at the farthest distance from the low area. A roof with partial rows is shown in Figure 5–11.

If you choose to use high areas instead of low areas, the full row is placed at the highest area, and partial rows are placed at the furthest distance from the high area: the lowest points on the roof.

The horizontal distance from the drain to the corner of the roof is 11 feet as shown in Figure 5-13. And the rows in our letter scheme (L2) are two feet wide.

Let's analyze the horizontal distance from the low area of roof A to the low area of roof B.



So there is one foot left over on the sixth row on roof A. Note that this **is** the sixth row even though it is labelled 5 since the first row is labelled 0. This is illustrated in Figure 5-14.

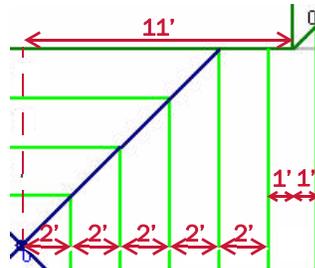


Figure 5-14 Length of panels on roof A.

In order for the rows on the two roof sections to align, you need the first row on roof B to have a width of only one foot.

Moving Low Areas

You've seen that complete rows are placed at low (or high) areas. So in order to realign rows, you must move the low area. LWC-Plus calculates where the first row begins, even if it doesn't begin on the roof section itself.

In this project, you want the first row on roof B to have a width of one foot. This means the second row on roof B will line up with a row on roof A. Since the rows in the letter scheme (L2) are two feet wide, you need to move the low area down by one foot. Then the first row would begin one foot below the beginning of the roof section and roof B would only use one foot of the row, as shown in Figure 5-15.

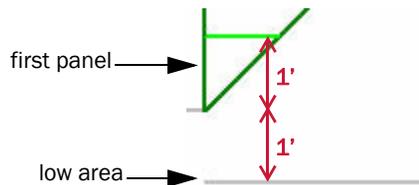


Figure 5-15 Detail of roof B and low area

To move the low area

1. Select roof B.
If attach mode is still set, click Attach  to turn it off.
2. On the Change Low/High Area toolbar, click Move Low/High Area .

Note that there is only one low area in roof B so it is automatically selected. You will need to watch the top coordinate box to position the low area.

3. Move the mouse pointer down one foot, and click to place the low area.

Make sure that you don't move the low area to the left or right while placing the low area.

4. With the Section selection box, select **PROJECT** once again to view the layout of both roof sections.

The rows on your roof plan should all align. The roof plan should look like Figure 5-16

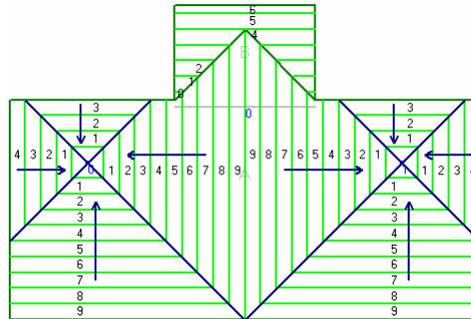


Figure 5-16 Rows aligned

Matching Row Thicknesses

The rows in the roof sections now appear to be aligned. Every line on roof A matches up with a line on roof B. However, on closer inspection, you can see that rows on roof A line up with different rows on roof B. A close up of the roof is shown in Figure 5-17.

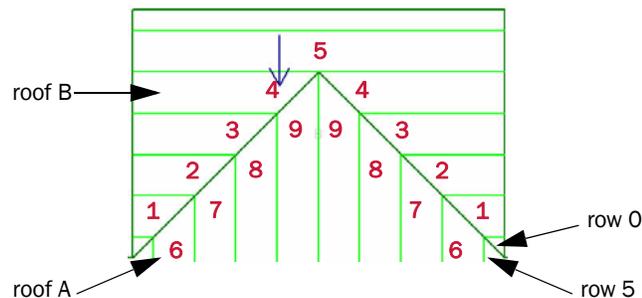


Figure 5-17 Close up of panels

The first row on roof B is row 0, the first row of the L2 letter scheme. However, it lines up with the sixth row on roof A, row 5. The rows on roof B represent different thicknesses than the rows on roof A.

In order to match the correct thickness you need to change the starting thickness of roof B.

Checking the Letter Scheme

The low area of roof B lines up with the row labelled 5 on roof A. Before changing the thickness of roof B, you'll check the L2 letter scheme to see the starting thickness of row 5.

To verify the L2 letter scheme

1. On the **Setup** menu, click **Letter Schemes**.
2. In the **Setup Letter Schemes** dialog box, click **L2**, and click **Open**.

The **Setup Letter Scheme: L2** dialog box opens as in Figure 5-18

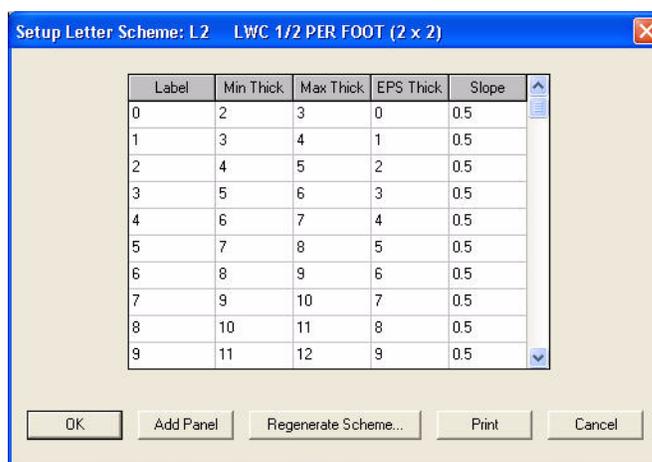


Figure 5-18 Setup Letter Scheme: L2 dialog box

- Note the minimum thickness of row 5.

Row 5 is in the sixth row (as shown in Figure 5-19), and the minimum thickness is listed in the second column.

5	7	8	5	0.5
---	---	---	---	-----

Figure 5-19 Row 5 of the L2 letter scheme

- Click **OK** to close the **Setup Letter Scheme L2** dialog box, and click **Close** to return to the drawing area.

Changing Minimum Thickness

We want the first row on roof B to be row 5. So, you'll change the minimum thickness of roof B to 7 inches, the minimum thickness of row 5.

To change the minimum thickness of a roof section

- With the **Section** selection box, select roof B.
- On the **Project** menu, click **Defaults**.

The **Defaults** dialog box opens at the **Section** tab.

- In the **Minimum Thickness** box, enter 7.

The **Minimum Thickness** box is in the **LWC** area of the **Project Defaults** dialog box. It's shown in Figure 5-20.

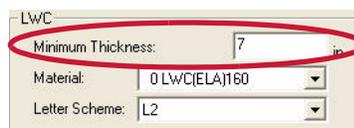


Figure 5-20 LWC area of the Project Defaults dialog box.

- Click **OK** to set the new defaults and close the dialog box.
- With the **Section** selection box, select **Project** to view the tapered layout of the entire roof plan.

Your roof plan is now complete. All water now flows to a drain, and all panels are aligned. It should look like Figure 5-21.

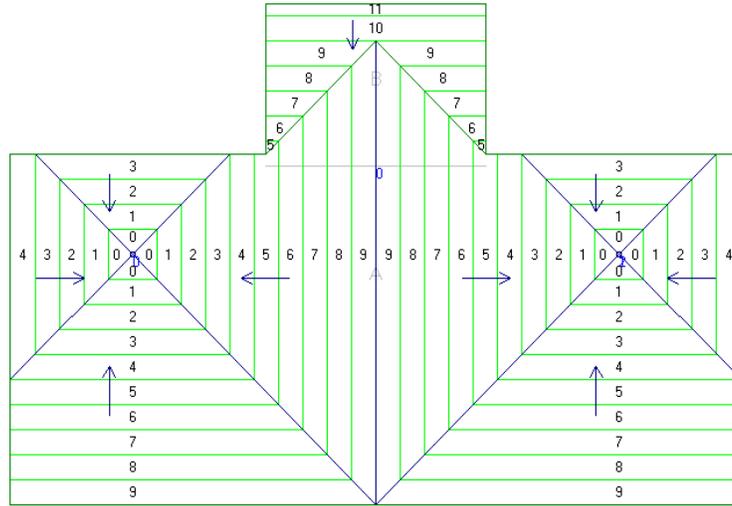


Figure 5-21 Completed roof plan

You have completed Lesson 5. In Lesson 6, you'll create a roof layout with a constant elevation at the perimeter.

Lesson 6: Constant Perimeter Roofs

In this lesson you'll design an insulation layout for a simple roof with a constant elevation at the perimeter.

Topics Included

- Designing a layout with a constant perimeter
- Using different letter schemes
- Interior roofs
- Mirroring roofs
- Specifying letter schemes
- Extending low areas
- Adding full crickets
- Adding crickets to interior roofs

Constant Perimeter Roofs

Conditions at the perimeter of roofs often affect insulation layouts. The thickness of flashing may limit the thickness of insulation at the roof edge. The height of adjacent walls and the location of openings in the walls can also affect the layout. As well, many designs require a uniform insulation thickness along roof edges to give a constant fascia profile along an edge or to provide room for other roof details.

When working with LWC-Plus, you normally worry about the insulation thickness at the drains, setting this as the lowest point and building up the insulation towards the perimeter. So conditions at the perimeter of the roof add a further complication to lightweight insulating concrete designs.

In this lesson, you'll create a sloped layout for a simple rectangular roof section with one major design criterion: the insulation must have a constant thickness at the perimeter of the roof.

Drawing a Roof

Before worrying about the insulation layout, you'll open a new project and draw the roof outline. This project contains a simple roof section with a single drain at the center and a low area on the drain. The roof will look like Figure 6-1.

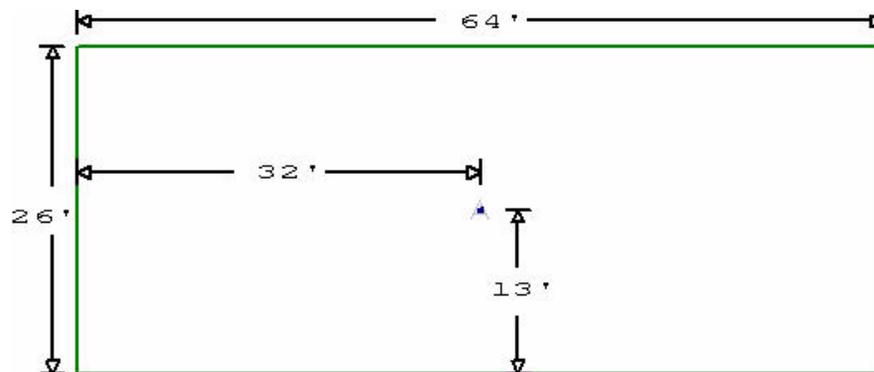


Figure 6-1 Roof outline with drain

To draw the roof outline

1. Open a new project.
2. Add a roof section with the dimensions of the roof in Figure 6-1.

You can draw the roof outline in three steps using the U, R, and Q: Right Angle commands.

3. Add a drain in the center of the roof, as indicated in Figure 6-1.
4. Add a low area on the drain.

5. Click Zoom Current  to zoom into the roof.

6. Click Draw  to change the drawing options.

7. In the Section Taper area, click Rows. In the Section Letters area, click Rows. And click OK.

The insulation layout should match Figure 6-2.

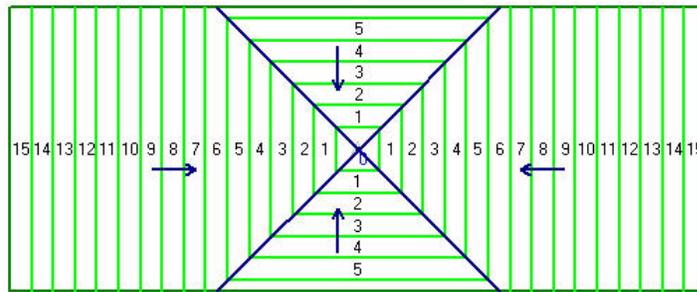


Figure 6-2 Roof outline showing eps layout

Analyzing the Layout

Look at the sloped layout of the roof section (Figure 6-2). The roof has a four-way layout, directing towards a single point at the center. Since the length of the roof is much larger than the width of the roof, there are more rows of insulation in the horizontal direction than in the vertical direction.

In the horizontal direction, the thickest row is row 15. In the vertical direction, the thickest row is row 6. So the insulation at the left and right walls is more than six inches thicker than at the top and bottom walls. As well, the insulation at the top and bottom walls slopes as it approaches the corners.

A diagram of the insulation at the top wall is shown in Figure 6-3.

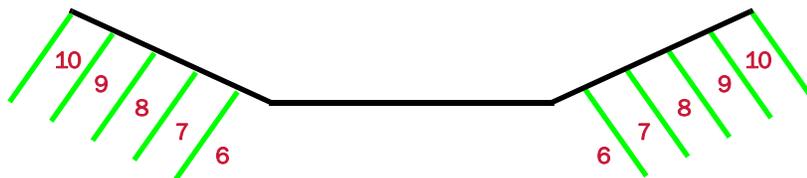


Figure 6-3 Insulation thickness at the top wall

This roof does not have a constant elevation at its perimeter.

Designing a Layout with Constant Perimeter

As you've seen in previous lessons, the thickness at any one point is determined by the letter scheme and the distance to the low area. In order to have a constant elevation at the roof perimeter, there must be equal distances between all walls on the perimeter and a low area.

Figure 6-4 shows two roofs with constant perimeter elevation. The first roof is a square with a single drain at its center. The second roof is a rectangle with two drains, each spaced at an equal distance from the side wall and from the top and bottom walls.

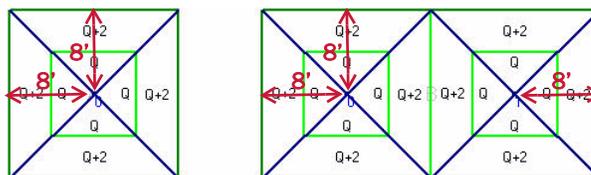


Figure 6-4 Two examples of roofs with constant perimeters

In order for the roofs in Figure 6–4 to have a constant elevation at the perimeter, each wall needs to be the same distance from the low area, in this case the drains. Since you can't change the dimensions of the roof, you'll need to change the dimensions of the low area.

Using Different Letter Schemes

Up until now we've designed tapered layouts using the L2 letter scheme. Now we'll try using two different letter schemes in the same roof plan. Since the roof is much longer from left to right than from top to bottom, we'll use a flatter letter scheme in the horizontal direction than in the vertical direction. This will help us get a constant elevation at the perimeter.

You should have two default letter schemes installed with LWC-Plus: L2 and L4. The L2 letter scheme has a 0.5 in/ft slope while the L4 letter scheme has a 0.25 in/ft slope. You'll use the L4 letter scheme on the sides of the roof plan and the L2 letter scheme at the top and bottom of the roof. The slope at the top and bottom will be twice as steep as the slope at the two sides.

If you don't have the L2 and L4 letter schemes or equivalent 0.25 in/ft and 0.5 in/ft sloped letter schemes, add these letter schemes before proceeding. See "Lesson 3: Letter Schemes and Materials" for instructions.

Designing a Layout

We've seen that each wall needs to be the same distance from the low area in order to create a constant elevation at the perimeter of the roof. However, now you'll use two different letter schemes to create the layout, and you need to determine the following:

- The distance from the wall to the low area for each letter scheme.
- The shape of the area occupied by each letter scheme.

Calculating the distance to the low area

Since the slope at the right and left sides of the roof will be different than at the top and bottom, the distance to the low area should also be different.

To get to an equal elevation, a letter scheme with half the slope needs twice the distance. This is illustrated in Figure 6–5.

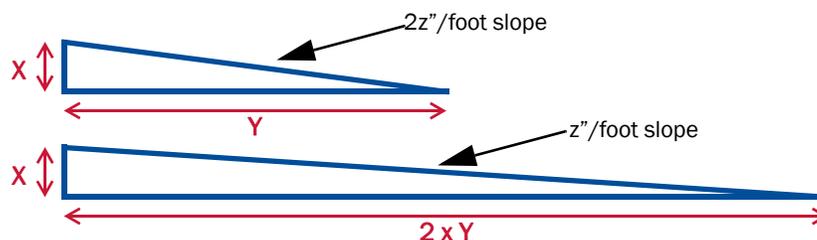
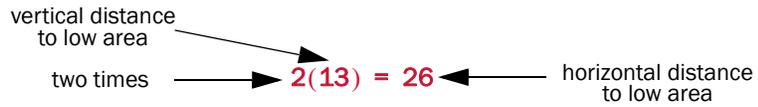


Figure 6–5 Relative distances and elevations of letter schemes

In this project, a 0.25 in/ft. letter scheme has half the slope as a 0.5 in/ft. letter scheme. To get to an equal elevation, the L4 letter scheme will need to cover twice the distance as the L2 letter scheme. Or, put another way, the distance to the low area will be twice as long.

You know that the distance from the top and bottom walls to the low area is 13 feet. Next, you need to calculate the distance from the right and left walls to the low area:



So the vertical distance is 13 feet, and the horizontal distance is 26 feet.

The Shape of Each Letter Scheme

We want to design a four-way layout for the roof. Figure 6-6 shows two perfect four-way layouts. The left roof is square and it uses only one letter scheme. The right roof is rectangular and it uses two letter schemes. The width of the rectangle is twice as long as the height. Both roofs have a constant elevation at the perimeter.

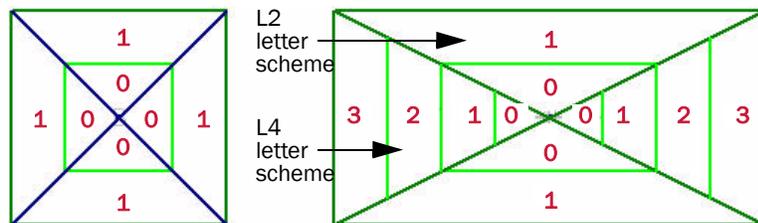


Figure 6-6 Example four-way layouts

Look at the roof on the right in Figure 6-6:

- The letter schemes change along valley lines.
- The area covered by each letter scheme is triangular.

To summarize, the layout in this project has the following properties:

- It uses the L2 letter scheme at the top and bottom of the roof and the L4 letter scheme at the left and right.
- The top and bottom walls are 13 feet from the low area.
- The left and right walls are 26 feet from the low area.
- The areas using each letter scheme are triangular, with its edges representing valleys.

Figure 6-7 shows the roof in this project outlining the areas occupied by each letter scheme.

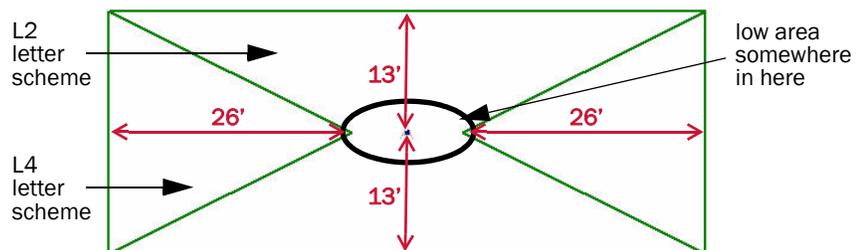


Figure 6-7 Outlines of areas with different letter schemes.

Interior Roofs

In LWC-Plus, you can only assign one letter scheme to a roof section. In order to define an area with a different letter scheme, you need to add a separate roof. In “Lesson 5: Aligning Rows,” you added a second roof section, and then you changed the outline of the original roof so that they didn’t overlap. You’ll complete a similar task now, except you’ll add an interior roof section instead of a regular roof section.

Interior roofs are attached to existing roofs. When you select the primary roof you also select all of its interior roofs. When you add an interior roof, the areas on the primary roof that it overlaps are erased from the section. This means that you don’t need to change the shape of the initial roof outline after adding interior roofs.

So when you add an interior roof section you complete two tasks:

- You add a new roof section to the project.
- You either change the roof outline of the primary roof or add a void to the primary roof where they overlap.

Adding Interior Roofs

You’ll now add two interior roof sections to the areas where we want to use the L4 letter scheme.

To add an interior roof section

1. Click Add Section  to add a new roof section.

The Add Roof Section dialog box opens.

2. In the Roof Section Type area, click Interior (as shown in Figure 6–8), and then click OK.

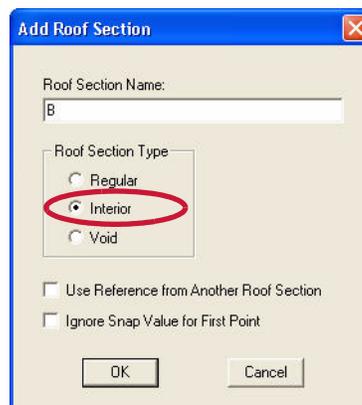
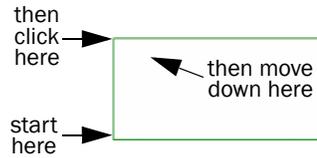


Figure 6–8 Add Roof Section dialog box

You can accept the default name, as shown here, or give the roof a more descriptive name.

3. Click Attach  to turn on attach mode.

4. Click on the bottom left corner of roof A to place the starting point.
5. Click on the top-left corner of roof A.
6. Move the pointer down and to the right, then press S to specify a sloped point.
7. Enter a horizontal displacement of 26 feet and a vertical displacement of 13 feet, and press ENTER.



Remember from before that these coordinates are the distances from the walls to the low area.

8. Type Q, and click Sloped to close the roof section.
The **Select Enclosing Roof Section** dialog box opens. This is where you select the roof section that contains the interior roof. Since there's only one roof section in our roof plan, it only lists roof A.
9. Click OK to select roof A and close the roof section.

Mirroring Roofs

We'll add the second interior roof in a mirror image to the first one. You can use the same procedure to mirror any other type of roof section.

To mirror a roof section

1. If roof B isn't selected, double-click on it to select it.

2. On the **Change Roof** toolbar, click **Mirror Section** .

The mouse pointer turns into a box, and you're prompted to select the edge that you want to mirror.

3. Click on the far left edge of the roof.

4. In the **New Roof Section** dialog box, click OK to accept the default name.



5. In the **Select Enclosing Section** dialog box, make sure that roof A is selected, and click OK.

You're prompted to position the new roof section.

6. Click **Attach**  to turn on attach mode.
7. Click on the bottom-right corner of roof A to place the corner of the new roof there.

If you accepted the default names, the roofs should be named B and C. In this lesson, the second roof is referred to as roof B, and the third roof is referred to as roof C.

Your roof plan should look like Figure 6–7 on page 63.

Specifying Letter Schemes

Next you need to specify a different letter scheme for the two interior roof sections. You'll use the L4 letter scheme that's included as one of the LWC-Plus default letter schemes.

To specify a letter scheme

1. Select roof B.
2. On the Project menu, click Defaults.

The Project Defaults dialog box opens.

3. Scroll down the Letter Scheme box, and click L4.

The Letter Scheme box is located in the LWC area of the dialog box, shown in Figure 6–9.

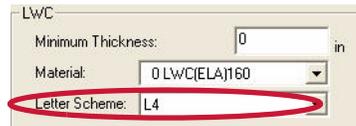


Figure 6–9 The LWC area of the Project Defaults dialog box

4. Click OK to save the settings.
5. Repeat with roof C.

Creating the Sloped Layout

Next we need to create the sloped layout for this project. In general we want to design a four-way layout. But since the project contains three roof sections, you need to create three layouts, one for each section.

The borders between the interior roofs and the main roof represent valley lines. So you have already created the valleys just by adding the interior roofs, and none of the roof sections will have its own four-way layout.

On the main roof section, we want to create a two-way layout directing water towards a horizontal line at the center of the roof. On the two interior roofs, we want to create one-way layouts directing water towards the tip of each roof section.

Unlike the roofs pictured in Figure 6–6 on page 63, this roof shape does not produce a perfect four-way layout. So you'll also need to add crickets to divert water to the drain in the middle of roof A.

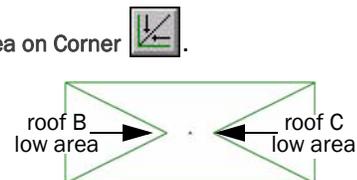
Adding Low Areas

You now need to add low areas to the roof plan. You'll start by adding simple low areas, which you'll later fix to get the correct layout.

Roof A already has a low area on the drain. So you'll add two low areas to the project, on the tips of each of the interior roofs.

To add low areas to the roof

1. Select roof B.
2. On the Add Low Area toolbar, click Add Low Area on Corner .
3. Click on the tip of roof B.
4. Right-click to stop adding low areas.
5. Select roof C, and add a low area on its tip.
6. Select roof A in order to view the insulation layout of all roof sections.



Remember, selecting roof A selects all interior roofs in roof A as well.

The sloped layout automatically updates. The roof plan should look like Figure 6–10. Notice that the rows on roof B and roof C are spaced differently than on than roof A. The width of each row is defined in the letter scheme.

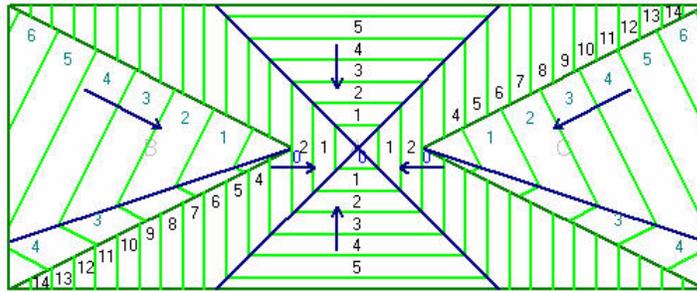


Figure 6–10 Roofs A, B, and C with low areas

Extending Low Areas

The layout that you created is obviously not complete. But you can easily fix the low areas to produce a correct layout in each section. You'll now use the Extend Low Area command, and LWC-Plus will automatically expand the low areas to create the proper layout.

To extend the low areas

1. Select roof B.
2. On the Change Low/High Area toolbar, click Extend Low/High Area .
3. Click Vertical to extend the low area up and down.
4. Select roof C.
5. On the Change Low/High Area toolbar, click Extend Low/High Area .
6. Click Vertical to extend the low area up and down.
7. Select roof A.
8. On the Change Low/High Area toolbar, click Extend Low/High Area .
9. Click Horizontal to extend the low area to the left and right.

Your roofs should now have the correct sloped layout, as shown in Figure 6–11.

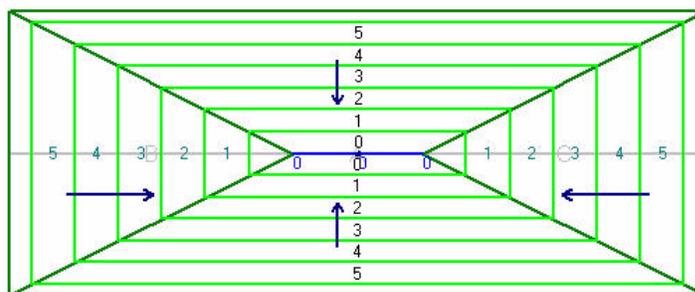


Figure 6–11 Roofs A, B, and C with correct layout

Directing Water Flow to a Drain

You've created a layout that directs water towards a valley at the center of the roof. You now need to direct the water to the drain in the middle of the valley. To

do this we will adjust the low area so that that the installers can create a slope to the drain using LWC.

To adjust the low area

1. Select roof A.
2. On the **Change Area** toolbar, click **Edge Adjust** .
3. Click on the center of the low area.
4. Then click on the upper roof edge to use it as a reference.
5. Enter 12 as the distance between edges.
6. Now do the same with the bottom edge.
7. Right click or hit **ESC** to quit adjusting edges.

Your roof plan should look like Figure 6–12.

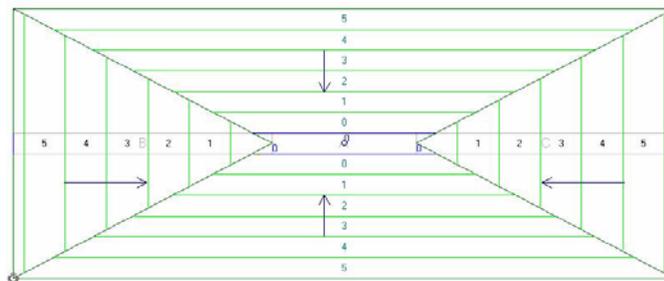


Figure 6–12 Roof A low area adjusted.

Adjusting the Interior Roofs

We now need to adjust roof B and roof C to align them with the low area in roof A .

To adjust the interior roof section

1. Select roof B.
2. First add vertical help lines 24 feet from the left and right roof edges
3. On the **Change Roof** toolbar, click **Add point to section** .
4. Select the top right sloped edge and place the new point at the intersection of the left help line and the top edge of the low area in section A. Turn on **Attach** if needed.
5. Right click or hit **ESC** to stop adding points.
6. Click on the **Point adjust** tool.
7. Select the right most tip of the roof and move the point to the intersection of the low area and the bottom edge of the low area in section A.
8. Stop adjusting points.
9. Go to the **Change area** toolbar and select **Move area**
10. Move the low area 3 feet to the right.
11. Make the same changes to section C.
12. Select roof A and go to the section defaults.
13. Change the minimum thickness to 3 inches.
14. On the **Erase** menu choose **Erase All** and check **Erase all help lines** in current project and click **OK**.

15. ISelect roof A to view the layout of all roof sections.

The project is complete. Your roof plan should look like Figure 6–13. The panels do not line up exactly because we have changed the angle of the valleys but that is not significant and will be covered with LWC.

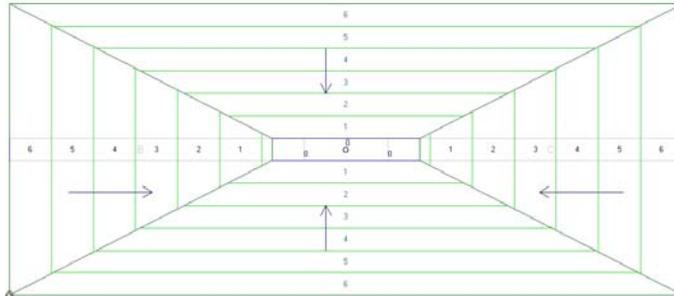


Figure 6–13 Finished roof plan

Congratulations, you've completed the LWC-Plus Learning Guide.

For more information on any of these topics, see the LWC-Plus online help.

