GRAPHISOFT®

ARCHICAD 8

User Guide

Volume 1

Graphisoft

Visit the Graphisoft website at http://www.graphisoft.com for local distributor and product availability information.

Graphisoft ArchiCAD User Guide

Copyright © 2002 by Graphisoft, all rights reserved. Reproduction, paraphrasing or translation without express prior written permission is strictly prohibited.

The Orchard Millenium Project, Borough of Basingstoke and Deane used for illustrating the book is copyrighted by and used with the permission of The Haddow Partnership Architects, Basingstoke, UK.
Second edition - first printing.

Trademarks

ArchiCAD and ArchiFM are registered trademarks and PlotMaker, Virtual Building, StairMaker and GDL are trademarks of Graphisoft. All other trademarks are the property of their respective holders.

Contents

Chapter 1: Learning about ArchiCAD 7

ArchiCAD User Guide and ArchiCAD Help 7

Structure of the User Guide 7

Additional Quick Help Features 8

Structure of the Help Menu 9

The Graphisoft Website 9

Further Reading 10

Chapter 2: The ArchiCAD User Interface 11

ArchiCAD Windows 12

Construction Windows 12

Floor Plan Window 12

The 3D Window 12

Additional Windows 13

Section/Elevation Windows 13

Detail Drawing Window 14

3D Picture Windows 14

Listing Windows 15

Auxiliary Windows 15

The Project Notes Window 16

The Project Preview Window 16

The Report Window 16

Displaying and Refreshing Views 16

Zooming 16

Fit in Window 17

Pan 17

Preset Zooms 17

Redrawing or Rebuilding a View 18

ArchiCAD Palettes 19

The Coordinate Box 19

The Control Box 19

The Toolbox 20

The Info Box 20

Tool Settings Dialog Boxes 21

Navigator and Navigator Preview 22

The 3D Navigation Palette 22

Additional Palettes 23

Pet Palettes 23

Menubar and Context Menus 23

Chapter 3: Project Organization and Navigation 25

Scale 25

Origins 27

The Coordinate System 28

The Grid System 29

Defining the Grids 29

Defining the Construction Grid 30

Defining a Skewed Grid 31

Defining the Background 31

Controlling the Grids 32

Displaying the Grids 32

Elevation 32

Gravity 33

Reference Levels 33

Elevation Control in 3D 34

Elevation and Stories in the 3D Window 34

Stories 34

Defining Stories 35

Defining a Ghost Story 36

Activating Stories . . . 37
Layers . . . 38
Layer Settings and States . . . 39
Layer Definition . . . 39
Setting Up Layer Combinations . . . 40
Using a Single Layer . . . 41
The Quick Layers Menu and Palette . . . 41
3D Image Setup . . . 41
Projections . . . 42
Perspectives . . . 42
Parallel Projections . . . 43
Sun Direction and Light Effects . . . 45
3D Window Contents . . . 46
3D Modes . . . 47
The 3D Navigation Palette . . . 48
Navigation Basics . . . 49
Navigation in Perspective . . . 49
Navigation in Parallel Views . . . 50
Animation Controls . . . 51
Navigator . . . 52
Navigator Mode . . . 53
View Editor Mode . . . 55
View Set Controls . . . 55
Saving Views . . . 56
Redefining Views . . . 57
Organizing the View Set . . . 57
Cloning Folders . . . 58
Redefining All Views in a Folder . . . 58
Navigator Preview Functions . . . 58

Chapter 4: Element Creation . . . 61
Introduction . . . 61
Using Construction Tools . . . 62
Walls . . . 65
Definition . . . 65
Wall Tool and Settings . . . 65
Drawing Walls . . . 68
Wall Intersections in 2D . . . 74
Modifying Wall Geometry . . . 76
Walls and Other Elements . . . 77
Columns . . . 77
Definition . . . 77
Column Tool and Settings . . . 78
Drawing Columns . . . 79
Columns and Other Elements . . . 80
Beams . . . 82
Definition . . . 82
Beam Tool and Settings . . . 82
Drawing Beams . . . 85
Defining Holes in Beams . . . 85
Joining Beams . . . 86
Beams and Other Elements . . . 87
Slabs . . . 87
Definition . . . 87
Slab Tool and Settings . . . 88
Drawing Slabs . . . 89
Slabs and Other Elements . . . 90
Roofs . . . 91
Definition . . . 91
Roof Tool and Settings . . . 91
Drawing Roofs . . . 93
Creating Roof Intersections . . . 98
Holes in Roofs . . . 99
Adding Roof Level Lines . . . 99
Roofs and Other Construction Elements . . . 99
Meshes . . . 102
Definition . . . 102
Mesh Tool and Settings . . . 102
Drawing Meshes . . . 104

Using the Magic Wand 106
How to Create an Element with the Magic Wand 106
Using the Magic Wand with the Pet Palette 107
Using the Magic Wand in 3D 107
Approximation of Curves 108
Creating Element Duplicates 109
Copy-Paste 109
Drag, Rotate, Mirror a Copy 109
Multiply 110
Parameter Transfer 112
Favorites 112
GDL Object Types 115
GDL Object Type Tool Settings 116
Windows and Doors 117
Definition 117
Window and Door Tool and Settings 117
Placing Windows or Doors 122
Placing Corner Windows 124
Skylights 125
Definition 125
Placing a Skylight 125
Objects and Lamps 126
Definition 126
Object Tool and Settings 126
Placing Objects and Lamps 128
Stairs 130
Definition 130
Geometry 130
Stair Tool and Settings 131
Placing Standard Stairs 132
Defining Slopes 143
Creating Custom Stairs from Drawing Elements 144
Adding Structural Elements and Finishes 146
Adding Structural Elements with RoofMaker 146
Placing the Objects 146
Adding Structural Elements with TrussMaker 154
Creating Trusses in the Floor Plan 154
Creating Trusses in Section/Elevation Windows 157
Editing Trusses 158
Adding Finishes 159
Accessories 159
Interior Wizard 162
Drawing Elements 164
Straight Lines and Curves 164
Definition 164
Line Tools and Settings 164
Drawing Lines 166
Fills 169
Definition 169
Fill Tool and Settings 170
Drawing Fills 171
Text Blocks 173
Definition 173
Text Tool and Settings 174
Placing Text Blocks 175
Figures 175
Definition 175
Figure Tool and Settings 175
Placing Figures 177
Hotspots 177
Definition 177
The Hotspot Tool and Settings 177
Placing Hotspots 177
Annotation Elements 179
Dimensioning 179
Definition 179

Dimensioning Units *181*
Dimensioning Tools and Settings *182*
Placing Dimensions *185*
Zones 195
Definition *195*
The Zone Tool and Settings *197*
Zone Categories *201*
Defining Zones *202*
Calculating Zone Space *203*
Updating Zones *204*
Labels 205
Definition *205*
Label Tool and Settings *206*
Label Settings 206
Placing Labels *209*

Presentation Elements **210**
Sections and Elevations 210
Definition *210*
Section/Elevation Windows *211*
Section/Elevation Tool and Settings *212*
Placing Section Lines *216*
Detail Drawings 217
Definition *217*
The Detail Drawing Window *217*
Detail Tool and Settings *217*
Creating Details *219*
Cameras 219
Definition *219*
The Camera/VR Tool and Settings *221*
Placing Cameras *224*

Index **231**

Chapter 1
Learning about ArchiCAD

This introductory chapter presents the ArchiCAD User Guide. It also explains the relationship between the printed documentation and the on-line Help available with the program and reviews additional information sources.

ArchiCAD User Guide and ArchiCAD Help

The printed **ArchiCAD User Guide** provides concise information about all ArchiCAD features and functions. It is made up of two volumes containing Chapters 1-4 and 5-13, respectively.

The **ArchiCAD Help,** from ArchiCAD's Help menu, contains the electronic version of the printed manual. In each chapter, the **More Information** item, not included in the printed manual, points the user to additional information aimed at users of very specific functions or expert tools. ArchiCAD Help also includes the entire **Graphisoft GDL Reference Manual,** which provides a comprehensive description, including extensive examples, of the programming language used to create library items.

> **Note**: Some of the expert programming materials are available only in English.

Structure of the User Guide

In both its printed and electronic formats, the ArchiCAD User Guide is divided into the following chapters:

Chapter 1: Learning about ArchiCAD is the section you are reading now and helps you locate the information you need.

Chapter 2: The ArchiCAD User Interface introduces the visible elements of the ArchiCAD working environment. It helps you find your way around the ArchiCAD workplace and understand the role each component plays in using ArchiCAD.

Chapter 3: Project Organization and Navigation presents the ways ArchiCAD simulates and improves on the traditional environment needed to develop an architectural project and produce presentation and construction documents. This chapter describes how to implement some basic architectural concepts using special automation tools to speed up daily work.

Chapter 4: Element Creation concentrates on the creation of ArchiCAD elements of different types. It also covers the tools and settings available for constructing Virtual Building elements. Special techniques for the duplication of existing elements and the creation of elements by using the contours of other elements are discussed, as are the semi-automatic tools that add structural elements and finishes, such as StairMaker, RoofMaker and Interior Wizard.

Chapter 5: Drafting and Editing Techniques concentrates how to fit elements to each other and to special points of the worksheet, and how to modify placed elements by moving or transforming them.

Chapter 6: Project and Program Customization tells you how, in your everyday use of ArchiCAD, you can tailor the program to your specific needs, define standard options for all projects in your office, or use special settings for different projects. ArchiCAD provides a large amount of freedom in customizing the program, the workplace, and your own personal preferences. This chapter presents those options that can be changed by the user, from custom symbol line types

and shortcut keys to library usage and the precision of decimal display.

Chapter 7: Library Management describes how to manage the Library folders that contain the external files used by ArchiCAD, and which are referred to by construction elements.

Chapter 8: Working with GDL Objects deals with the creation and editing of GDL Objects stored in outside files, including Doors, Windows, Lamps and general Objects, as well as calculation database components such as Zone Stamps and Property Objects.

Chapter 9: Collaboration and Connectivity includes the data exchange tools that you need in your architectural practice to collaborate with colleagues and other professionals. In addition, documents created with ArchiCAD can be reviewed in the special mark-up mode or even through the Internet.

Chapter 10: Project Data Calculation sums up the calculation process based on ArchiCAD's integrated database of construction elements, which can display in list format the number, quantities and components of elements in a project or the elements' spatial disposition (zones), using the features of the Calculate menu.

Chapter 11: Menu Command Reference reviews the commands available through the ArchiCAD menubar. It provides a short description of each command and refers you back to the sections that detail these functions. Features that are not presented in detail in any other chapter are discussed at more length here.

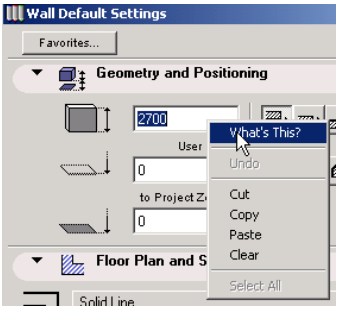
Chapter 12: Using PlotMaker discusses PlotMaker, a standalone layouting application that is part of the ArchiCAD package. PlotMaker is optimized for preparing an architectural documentation set based on the views, drawings and images created with ArchiCAD, with the possible addition of data from additional, external sources such as other CAD and image files, word-processing documents and spreadsheets.

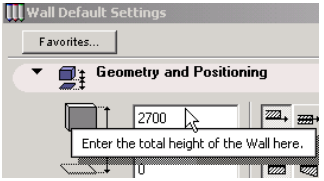
Chapter 13: Printing and Plotting reviews the possibilities offered by ArchiCAD and PlotMaker for printing and plotting the various aspects of the Virtual Building. It also sums up the output options available for different element types and points out further output possibilities.

Additional Quick Help Features

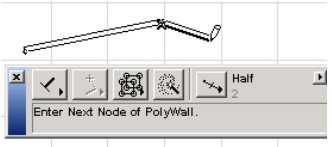
In addition to the ArchiCAD Help menu item, ArchiCAD offers a number of help features inside the program.

- If you enable **Tool Tips** (Windows) or **Help Tags** (MacOS), you will see short descriptions over interface elements. On Windows, you may need to right-click and choose the **What's This?** item in the appearing context menu.

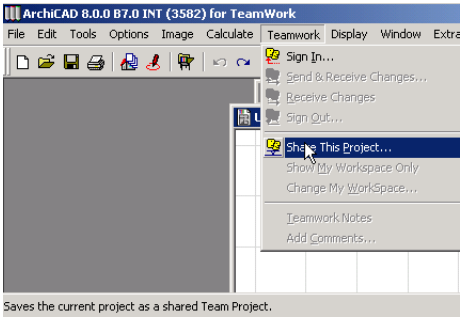




- In its expanded state, the Control Box (located by default at the bottom of the ArchiCAD screen) includes a **Prompt Box** that provides step-by-step instructions about the next editing operation expected from you.



- On Windows only, the **Status Bar** at the bottom of the main ArchiCAD window displays information on the selected menu command or the editing operation underway.



Structure of the Help Menu

In addition to the ArchiCAD Help item, the Help Menu of ArchiCAD includes program information **(About ArchiCAD)** and links to Graphisoft and ArchiCAD websites.

ArchiCAD Help contains the **Getting Started** manual (also available in printed format) with information on the ArchiCAD package, system requirements, components, installation and troubleshooting. The **ArchiCAD Shortcuts** item is a quick reference guide to frequently used keyboard combinations.

The Graphisoft Website

You can connect directly to the Graphisoft website from the ArchiCAD Help menu or type http://www.graphisoft.com into your browser . The Graphisoft website contains up-to-date information about product availability, support, user community news, events and the latest news about related products that allow you to take the Virtual Building concept further within the architectural and building profession and connect to other professional fields such as facility management and HVAC.

In different sections of the website, you can access information about:

- Products that allow you to connect to other professional fields, for example Graphisoft's ArchiFM product family including ArchiFM WebServer and ArchiFM Maintenance, or GDL Technology's intelligent object tools for the creation of manufacturer libraries that can be used in both ArchiCAD and other CAD programs.

- Utilities related to ArchiCAD with which you can design library items, add elements that correspond to a particular usage in a specific area or export data from the project for further processing.

- Special libraries that can be added to the default ArchiCAD Library.

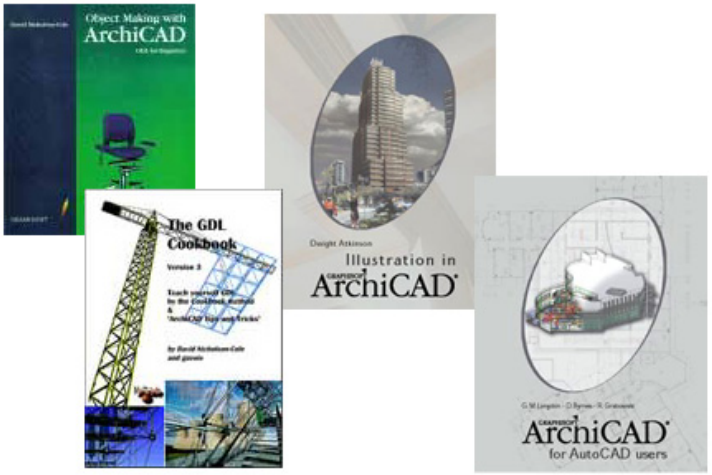
Contact your ArchiCAD dealer for more information about the availability and pricing of these products.

Further Reading

In addition to the printed ArchiCAD User Guide and the electronic ArchiCAD Help, the following books are recommended for mastering ArchiCAD or immersing yourself in specific fields:

- The **ArchiCAD Step by Step Tutorial** is a self-teaching book that allows you to learn the basics of ArchiCAD in a few short lessons, while the **ArchiCAD Training Guide**, also a general handbook, is more suited for classroom situations.
- **Project Framework** presents recommended implementations of ArchiCAD in your office.
- **ArchiCAD for AutoCAD Users** is recommended reading for those who need to use both programs in the same office.
- **Object Making in ArchiCAD** will teach you the basics of creating your own library parts without or with GDL scripting. The **GDL Cookbook** is a comprehensive book on GDL including guidelines and expert options.
- **Illustration with ArchiCAD** deals with basic, intermediate and expert visualization options both inside ArchiCAD and on exported files in software that further process images and animations for presentation purposes.

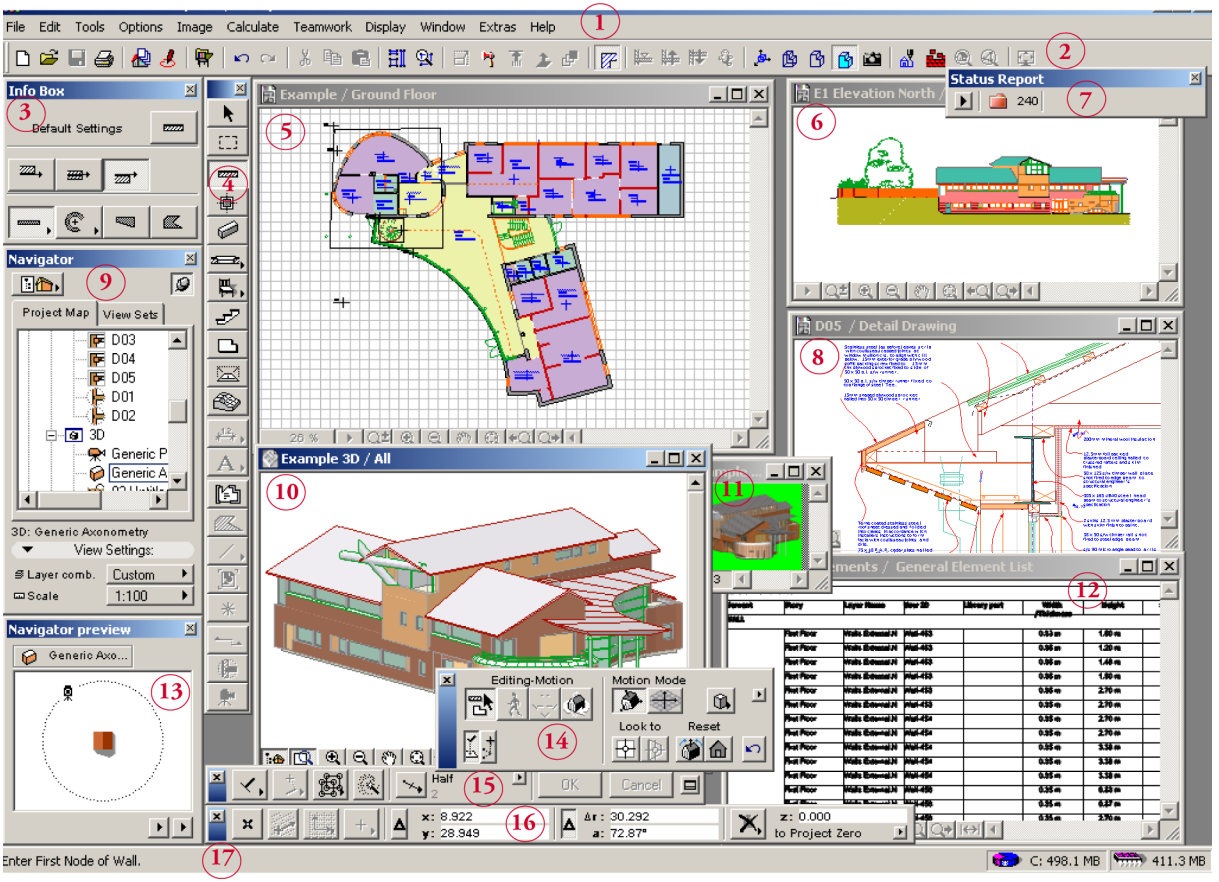
All these books are presented on the Graphisoft website. Consult your ArchiCAD dealer for more information about their availability. You can also purchase them directly from Amazon.com.



Note that the list of books is subject to change. Some of these books may not yet have been updated to the latest versions of ArchiCAD. Many ArchiCAD dealers also offer their own training courses and materials.

Chapter 2
The ArchiCAD User Interface

This chapter introduces the visible elements of the ArchiCAD working environment. It will help you find your way around the ArchiCAD workplace and understand the role each component plays in ArchiCAD.



1) Menubar
2) Toolbar
3) Info Box
4) Toolbox
5) Floor Plan worksheet
6) Section/Elevation window
7) Status Report window
8) Detail Drawing window
9) Navigator
10) 3D Window
11) Project Preview window
12) Listing Window
13) Navigator Preview
14) 3D Navigation Palette
15) Control Box
16) Coordinate Box
17) Status Bar

ArchiCAD Windows

There are three basic types of windows in ArchiCAD:

- **Construction windows**, in which you build your model. These are the **Floor Plan** window and the **3D** window. Both of these windows are available at any time you work in the project, although the 3D Window can be hidden by closing it without closing the project.
- **Additional windows** that show specific views of the model or allow you to elaborate on it. These windows are generated from elements of the Construction windows. They include any number of interactive **Section/ Elevation** windows and **Detail Drawing** windows as well as **3D Picture** windows showing PhotoRendered still images and **Listing** windows that display text data about the project.
- **Auxiliary windows** that display information about the project, such as the **Project Notes**, the **Project Preview** and the **Report** window.

All window types are resizable in all directions.

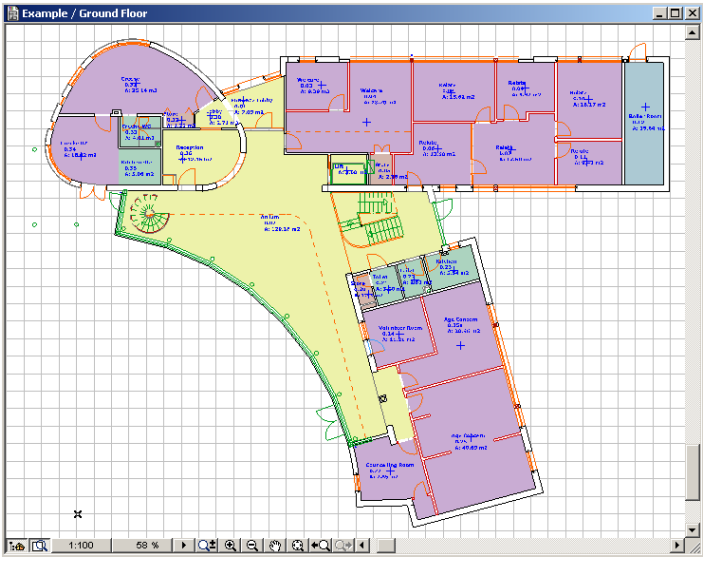
Most of the windows include a number of shortcut icons next to their bottom scrollbar. They represent shortcut commands as described later in this chapter.

> **Note**: GDL Objects (or Library parts) open for editing also have a number of windows. These are described in detail in *Chapter 8: Working with GDL Objects.*

Construction Windows

Floor Plan Window

The Floor Plan Window is the basic construction area where most editing operations take place. It shows a representation of the current Project as a traditional architectural drawing.



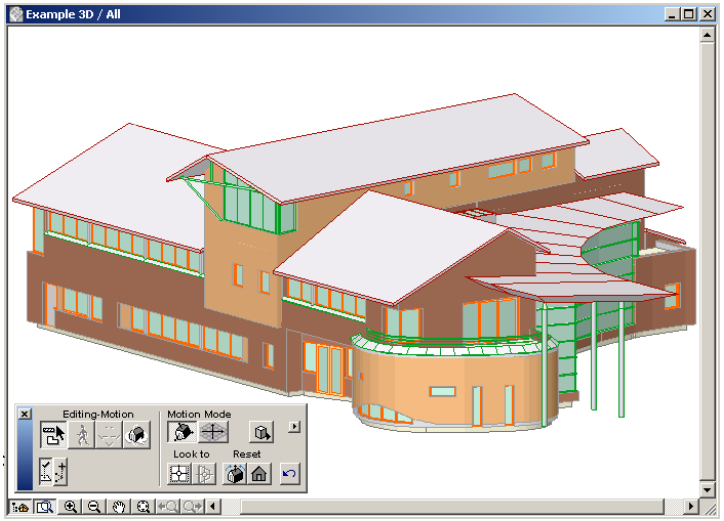
- The Floor Plan worksheet represents a window into an arbitrarily large drawing space.
- You can pan and zoom the window within the full drawing space to obtain the best view of the work you are currently doing by using the shortcut icons next to the bottom scrollbar or the commands of the **Display** and **Window** menus.
- It is a starting point for exporting drawings into various file formats.

When working in the **Floor Plan** window, you can use all or most of the functions offered by the floating palettes and other interface component.

The 3D Window

The **3D window** gives you instant feedback on the construction operations performed in other views and at the same time allows you to directly edit your model in either perspective or axonometric view. New elements can also be

created in this window. In the production phase of your project, you can also generate here accurate 3D images optimized for plotter output.



The 3D Window is directly linked to the **Floor Plan** and to the **Section/Elevation** windows: any changes made on the **Floor Plan** or in any of the **Section/Elevation** windows will be visible in the **3D** window and vice versa.

- Either the complete project or just the parts you select can be displayed in the 3D.
- **Block**, **Wireframe**, **Hidden Line** or **Shaded** views are available in all types of parallel and perspective projections.
- The 3D model can be post-processed by the **PhotoRendering** feature, or exported in a variety of 2D or 3D file formats for other applications.

Most construction aids are available in the **3D** window.

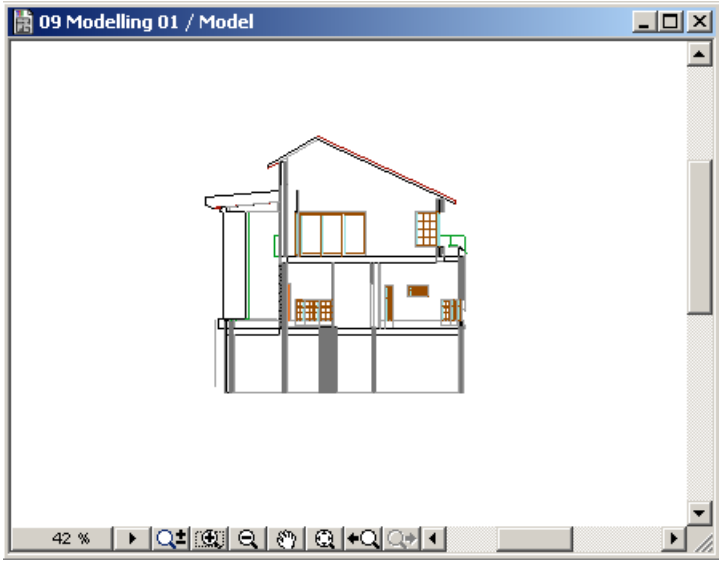
Additional Windows

Section/Elevation Windows

The **Section/Elevation** tool in the **Toolbox** allows you to generate any number of sections or elevations of your Project in separate **Section/Elevation** windows linked to named and numbered Section markers.

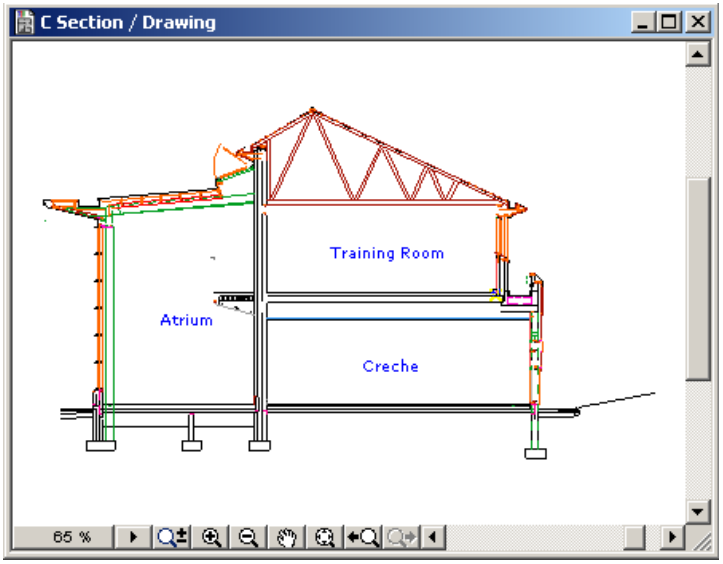
There are two modes for sections/elevations:

- In **Model** mode, the window consists of construction elements and any changes made in will automatically be updated in the Floor Plan window, as well as in the 3D window and other Section/Elevation windows when activated.



- In **Drawing** mode, construction elements are decomposed into 2D Fills, Arcs and Lines. Changes made in this type of window are not updated in other windows.

You can, however, update the Drawing to reflect recent changes made to the model.

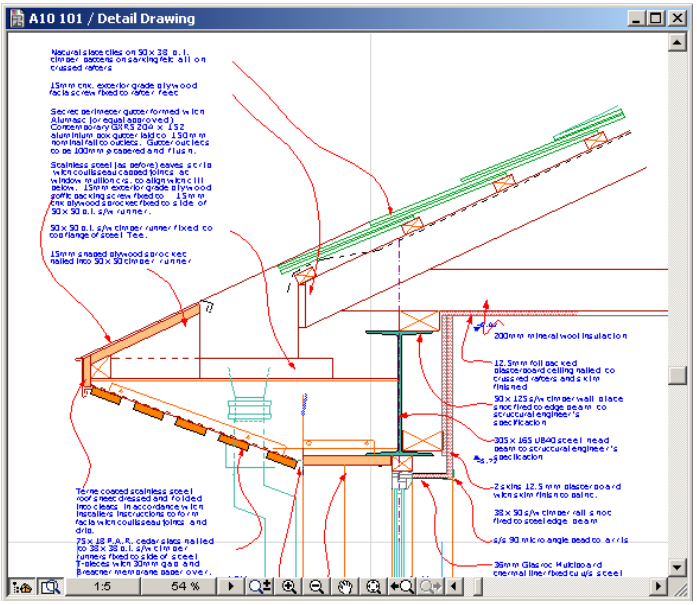


Drawings are obtained by choosing the **Unlink from Model** command from the **Display** menu's **Sections/Elevations** hierarchical menu. In the caption of the window, the word **Model** changes to **Drawing**. This command is NOT undoable.

In both modes, you can add 2D graphics, annotation and dimensioning. *See Sections in Chapter 4: Element Creation for details.*

Detail Drawing Window

The **Detail** tool in the **Toolbox** allows you to generate Detail Drawings from **Floor Plans**, **Sections/Elevations**, models or plan drawings, which can be opened in separate **Detail Drawing** windows.



Detail Drawing windows are linked to **Detail Markers** placed on **Floor Plans** or **Section/Elevations** by using the **Detail** tool. They are numbered and named according to the settings of the **Detail Marker** they are linked to.

See also Detail Drawings in Chapter 4: Element Creation.

3D Picture Windows

Any number of photorealistic images of the model in the **3D** window can be generated using the PhotoRendering feature as a snapshot of the current state of the Project. **3D Pictures** are not editable. You can save them as separate files, independent from the model.

- PhotoRendered images can be exported to image-processing applications for retouching.
- You can copy a part of the picture with the **Marquee** tool and paste it as a **Figure** into the **Floor Plan** or a **Section/Elevation** window.

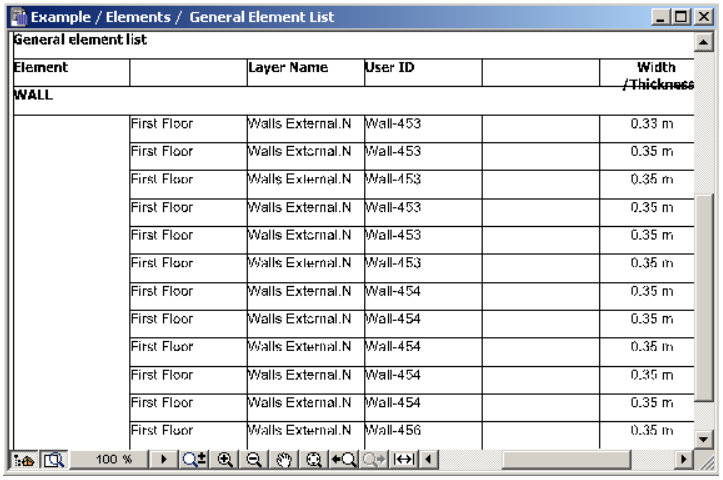
- **3D Pictures** are listed in a hierarchical menu of the **Window** menu, together with picture files opened with the **File/Open** command.

  Note: Neither **3D Pictures** generated by ArchiCAD nor external files opened with **File/Open** are kept as part of the project when saving it. You will have to save the individual windows as separate files if you wish to keep them.

See also the PhotoRendering feature in Chapter 11: Menu Commands.

Listing Windows

ArchiCAD provides different options for viewing on screen the quantity calculations for the whole Project, selected sets of elements or Zones.



Element and **Component List** windows will display a detailed list of quantities of either the whole project or any desired part or subset of it. ArchiCAD combines the building components of the Project with the Properties descriptions residing in the Object Library to provide a detailed list of the elements and their user-defined components.

Zone List windows display a detailed list of quantities of either all the zones of a Project or selected ones. Zones are floor plan spatial units including rooms, groups of rooms or even larger parts of the Project defined with the **Zone** tool.

The lists displayed in these windows can be exported into a variety of file formats for further processing.

See also Chapter 10: Project Data Calculation.

Auxiliary Windows

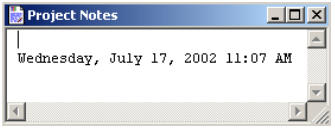
A number of secondary Windows are available at any time for displaying information about the current state of the Project. These include the **Project Notes**, the **Project Preview** and the imaging and listing **Report** windows.

The Project Notes Window

You can access this window by choosing the **Window/ Project Notes** command. Whenever you open it, the date and time will be updated and a blinking insertion point marker will appear next to the current date and time.

It works like a note pad, where you can:

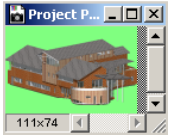
- enter written notes about the Project or comments for fellow designers,
- keep track of the time spent on a particular job.



Any text entered here is saved with your Project.

The Project Preview Window

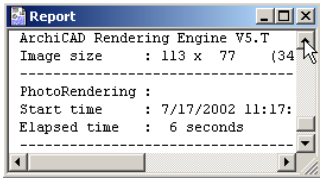
You can paste a PhotoRendered image of your Project into this window. This preview is shown in the **Open file** dialog box in order to make the identification of files easier.



The Report Window

The **Report** window displays information about the imaging and listing process, provided that you have checked the **Write Report** option in **Options/Preferences/Imaging & Calculation** menu command.

It also lists input/output operations, as well as the name and version number of the Add-Ons that have been loaded either at startup or by choosing the **Tools/Add-On Manager** command.



Displaying and Refreshing Views

ArchiCAD provides a number of options that affect the view of the current ArchiCAD window. These commands give you complete control over your views: you can enlarge and reduce them, move around freely in your windows or go to previous or predefined views and refresh and clean up the screen. These commands can be accessed from the **Display** and **Window** menus and most of them are available in the form of shortcuts from the **bottom scrollbar** of the windows. Special zooming commands can also be accessed by using a wheel-mouse.

Zooming

You can zoom in on details or use zoom out to encompass more elements by using a number of techniques.

In any view:

- Choose **Zoom In** or **Zoom Out** from the **Display** menu**.** Draw a rectangle around the detail you intend to enlarge with the **Zoom In** cursor. The area surrounded by the rectangle is enlarged to the size of the current window. With Zoom out, the entire current view is squeezed into the rectangle that you have defined. The operation is optimized, no distortion will result.
- Clicking the **Zoom In** or **Zoom Out** button on the **bottom scrollbar** of the active window activates the corresponding shortcut. The process is the same as above. You can also double-click the appropriate icon to double the current magnification or reduction level.

In any view:

- If you have a mouse with a scrolling wheel, you can use it for zooming in and out around the mouse pointer by scrolling the wheel ahead and back.

  Note: You can even use this feature in the **Navigator Preview** palette.

- Click the **Special Zoom** button on the **bottom scrollbar** to emulate the operation of a wheel-mouse controlled zoom: to zoom in, click the button and move the cursor upwards in the window. To zoom out, click the button and move the cursor downwards. The next click will activate the chosen zoom.
- Use the **numeric keypad** by pressing the **'+' key** for zooming in and the **'-' key** for zooming out.
- Use the **Navigator Preview** palette as detailed in that feature's description in *Chapter 3: Project Organization and Navigation*.

In addition, you can optimize the view to show the selected elements only by choosing the **Zoom to Selection** command in the **Display** menu.

Fit in Window

You can size your Project to accommodate all the currently visible construction elements. This provides a good way of checking to see if you have placed something in the far corners of your drawing by mistake during numeric input or a multiply operation.

Choose the **Fit in Window** command in the **Display** menu or click the corresponding shortcut button on the **bottom scrollbar** of the active window.

For **Listing** windows you have an additional shortcut in their **bottom scrollbar** allowing you to **Fit the Width** of the generated list to the current size of window.

Pan

You can also move in a worksheet to display design elements or details that do not fit in the current view. You have the following options:

- Choose the **Pan** command from the **Display** menu to pan the entire virtual worksheet by moving the **Hand** cursor over it with your mouse. The whole on–screen area will move, while the current zoom level is preserved.
- Click the **Pan** button on the **bottom scrollbar** of the active window as a shortcut to the previous option.
- If you have a three-button mouse, you can use it for panning by pressing down the middle button while moving the **Hand** cursor over the worksheet. This feature is not available in 3D views.
- If you have a mouse with a scrolling wheel, you can use it for panning by pressing the wheel continuously while moving the **Hand** cursor over the worksheet. This feature is not available in 3D views.
- You can use the **numeric keypad** by pressing the following keys: 4 (pan left), 2 (pan downwards), 6 (pan right), 8 (pan upwards).
- Use the **Navigator Preview** palette as detailed in that feature's description in *Chapter 3: Project Organization and Navigation*.

  Note: The **Pan** command can be used with the numeric input and Mouse Constraints to pan in specific directions relative to element or Project geometry.

Preset Zooms

You may need to get a zoom level where your drawing elements appear at the same size they would assume on paper if represented at the current scale (the one set in **Options/Floor Plan Scale...**), for example before pasting elements that should appear in real paper size on the worksheet, such as a scanned site plan.

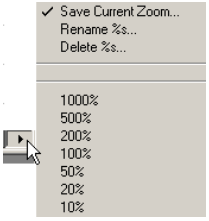
You can access this zoom level by either choosing the **Actual Size** command from the **Display** menu or clicking the **Zoom Level** button on the **bottom scrollbar** of the active window

(this button displays the current zoom level in percent of the Actual Size).

Note: Since scale does not affect 3D views, this option is not applicable in the 3D Window.

If you need to return frequently to a part of your project, you can define it as the Home Zoom by choosing the **Set Home Zoom** command in the **Display** menu. You can return easily to this view by choosing the **Home Zoom** command in the **Display** menu. This zoom is saved with the Project.

You can save different zooms for further use by clicking the **arrow pop-up** button in the **bottom scrollbar** of the active window. The pop-up menu commands allows you to access, rename and delete predefined zooms.



If you wish move one step back from your previous **Zoom In**, **Zoom Out**, **Pan**, **Home Zoom** or **Fit in Window** operations, you can either choose the **Previous Zoom** command in the **Display** menu or click its shortcut button in the **bottom scrollbar** of the active window. Up to 20 previous steps are stored. To return forward, use the **Next Zoom** command or shortcut button .

Redrawing or Rebuilding a View

Operations such as transformations and deletions may leave your screen strewn with unwanted artifacts. This is just a temporary screen display problem (your prints and plots will be fine) and can be corrected by choosing the **Redraw** command in the **Display** menu, which cleans up your screen.

If you need to get a more thorough refreshment of your windows, you can choose the **Rebuild** command, also in the **Display** menu.

- When you Rebuild the 3D Model, the program will replace your outdated 3D view with an updated one.

  Note: The 3D Window is automatically rebuilt every time you activate it. By default, rebuilding also occurs every time you change the 3D settings. You can disable this in the **Options/Preferences/Imaging and Calculation** dialog box.

- When working on a dynamic **Model** Section, the name of the **Rebuild** command changes to **Rebuild Model S/E**. If you modify elements in this window, some complex changes (e.g., modifying a Library Part) do not appear automatically in this Window and you have to use the **Rebuild Model** command to see them properly.

- When working on a static **Drawing** Section or a **Detail Drawing** window composed of 2D drawing elements only, the name of the **Rebuild** command changes to **Rebuild Drawing S/E** or **Rebuild Detail Drawing**. These commands refresh the view as a 2D drawing, fixing any potential temporary display errors.

- For a complete refreshing of static **Drawing** Section or **Detail Drawing** windows, choose **Section-Elevations/ Rebuild from Model** or **Detail Drawings/Rebuild from Source View**. This will refresh the contents of these windows to fully reflect the current state of the Virtual Building model. In the process, all 2D elements originating from the model will be removed and an up-to-date view will be generated. This means that any previous manual editing of this artwork will be lost. 2D artwork added to the the drawing manually will be kept intact.

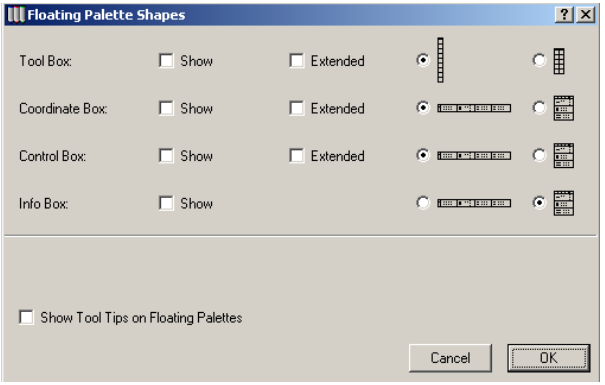
  Note: In both Section/Elevation modes, ArchiCAD recreates the view without removing the drawing elements that you added to it in.

Additional options are available for rebuilding Section/Elevation and Detail Drawing Windows from the appropriate hierarchical menus of the **Display** menu. You can rebuild all the windows at the same time or select some section markers or detail markers on the Floor Plan and then choose the **Rebuild Selected** command.

ArchiCAD Palettes

ArchiCAD's floating palettes help you construct, modify and locate elements. Each palette can be shown or hidden separately using the Floating Palettes hierarchical menu in the Window menu. The four main palettes (Toolbox, Info Box, Coordinate Box, Control Box) can be enabled or disabled together using the **Show Main Palettes Only** command.

The shapes of the main palettes can be customized with **Options/Customize**.



The Coordinate Box

The **Coordinate Box** is available when working in any construction window. By default, it appears in the bottom of the screen. The **Coordinate Box**:

- shows you the precise location of the ArchiCAD cursor within both the Cartesian and polar coordinate system for your drawing;
- enables you to enter numeric drawing coordinates for greater precision;
- houses the **Origin**, **Grid** and **Gravity** control icons.

See also Chapter 3: Project Organization and Navigation for the detailed description of these features.

The Control Box

The **Control Box** contains a number of drawing aids in the form of icons. The **Control Box** is only available when you are working in any of the **Construction Windows.** By default, it appears at the bottom of the screen, on the top of the Coordinate Box.

The palette's controls, from left to right:

- **Relative Construction Methods** constrain the cursor to a defined angle or distance during drafting or editing. They are linked to the Mouse Constraints feature which helps you place the endpoints of linear elements at predefined angles.
- **Cursor Snap Variants** control the way the current position of the cursor is projected.
- The **Suspend Groups** switch allows you to choose between editing grouped elements together or on their own.
- The **Magic Wand** traces the contours of existing elements in order to create new elements of other types.
- The **Special Snap Point** definition controls automatically generate temporary snap points on different parts of edges and help you position elements at exact points or distances along lines and edges.

- In the palette's maximized state (shown below), the **Prompt Box** provides point-by-point instructions during drafting or editing.

See also Chapter 5: Editing and Drafting Techniques for the detailed description of these features. The use of the Magic Wand is described in Chapter 4: Element Creation.

The Toolbox

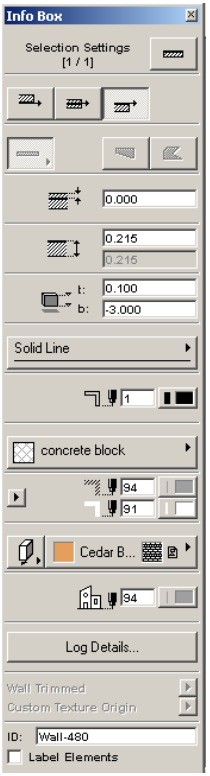
The **Toolbox** located by default on the left edge of the Floor Plan Window shows a variety of tools for selection, 3D construction, 2D drawing and visualization.

In its default shape, **Toolbox** does not display every single tool icon; some tools are grouped into pop-up menus that open from a related icon.

Note*:* Besides the standard set of tools, additional tools can appear in the **Toolbox** depending on the installation and the available Add-Ons. The location of these tools in the **Toolbox** cannot be set by the user.

The Info Box

The **Info Box** is located by default on the right edge of the screen and is only available when working in any of the **Construction Windows**.



- The **Info Box** displays either the default parameters of the active tool or those of the most recently selected element.

- The **Info Box** provides a condensed view of the corresponding tool's settings dialog box with direct access to the displayed attributes and parameters.
- Input or Geometry Methods specific to the tool are also shown in the **Info Box**. Most of these are not available in the corresponding tool's settings dialog box.
- Unlike the tool settings dialog boxes *(see below)*, the Info Box shows no panel titles and as little text as possible. Use the **Tool Tips** from the **Help** menu to learn about each of the controls.

You can customize the amount and order of the Info Box panels with the **Options/Customize** menu command. *See Chapter 6: Program and Project Customization for details.*

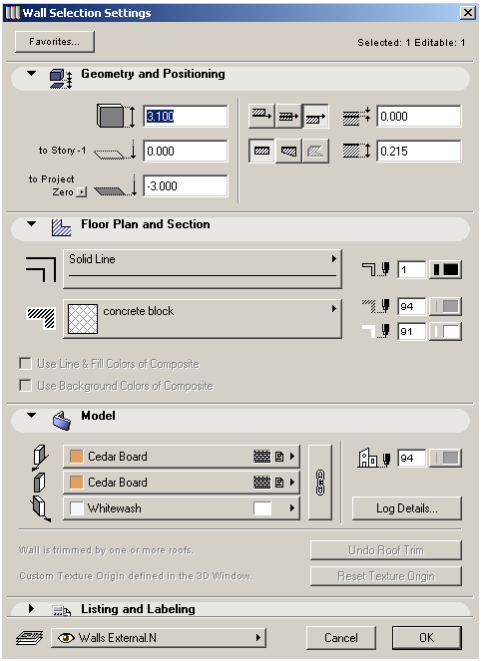
Note: When several elements are selected, the displayed information refers to the most recently selected element. If several elements overlap, successive clicking with the **Checkmark** cursor (in **Arrow** tool mode) will cycle through the selection markers of the available elements.

Tool Settings Dialog Boxes

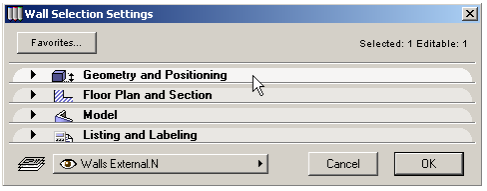
Tool settings dialog boxes are not palettes, but they can be accessed from either the **Toolbox** or the **Info Box** palette and are best discussed here. They contain the group of settings that define the appearance and parameters of the elements each tool draws.

There are several ways to open a tool's settings dialog box:

- Double-click the tool icon in the **Toolbox.**
- Click the tool icon in the **Info Box.**
- Press the **left arrow** key on the keyboard.
- Choose **Edit/(Tool) Settings**.
- Click an element with the right mouse button (Windows) or hold down the Control key (MacOS), and choose the **(Tool) Settings** command from the appearing **Context** menu.



The settings for each tool are organized into several panels that can be opened or closed individually by clicking the caption of the panel.



The title bar of the dialog box displays the type of the element and whether you are viewing Default settings or those of Selected elements.

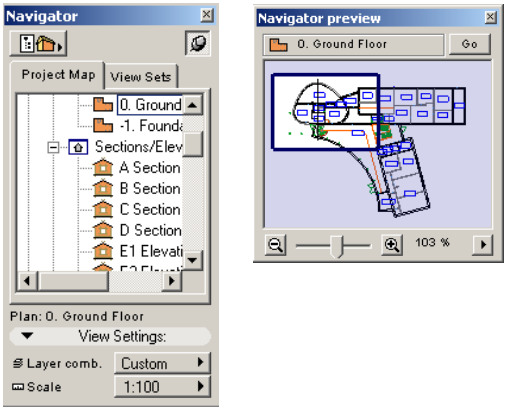
To prevent crowding of dialogs when opening new panels, use the checkboxes in **Options/Preferences/Dialog Boxes & Palettes** to have the program automatically close the

previously opened panels and/or move the dialog box upward on the screen.

You can customize the number and order of the tool settings box panels with the **Options/Customize** menu command. *See Chapter 6: Program and Project Customization for details.*

Navigator and Navigator Preview

The **Navigator** and **Navigator Preview** are two separate palettes that facilitate navigation inside the project. Both of them appear on the left side of the screen by ArchiCAD default.



The **Navigator** palette has three modes: Navigator, View Editor and Publisher. You can change modes by clicking the house icon in the top left corner of the palette.

- In **Navigator** mode, you get an overview of the project structure and can instantly access stories, sections, elevations, detail drawings, 3D views, lists and other text windows;
- In **View Editor** mode, you can manage view options for easy access to typical drawing types like architectural, HVAC, or office furniture setup and define a set of construction documents that can be exported to PlotMaker;
- In **Publisher** mode, you can publish view sets by saving, uploading, printing and plotting them.

The **Navigator Preview** palette:

- Shows a preview of the selected item in Navigator. If no item is selected, a small view of the front window is shown;
- Allows you to zoom to different parts of the contents of the front window;
- Sets up 3D projections.

The visibility of the **Navigator** and **Navigator Preview** palettes can also be controlled by clicking the corresponding buttons on the **bottom scrollbar** of the **Floor Plan, 3D** and **Listing** windows.

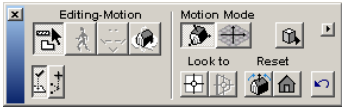
The **Navigator** disappears from the screen when you click on the work space. To keep it permanently visible on the screen during your work, you can fix it by clicking the **Pin** icon in the top right corner of it.

See Chapter 3: Project Organization and Navigation and the Publisher function in Chapter 9: Collaboration and Connectivity.

The 3D Navigation Palette

This palette is only available when working in the **3D** window. It lets you:

- navigate in 3D space in real time;
- switch among projection and navigation modes;
- place and edit Cameras and animation paths.



See also 3D Image Setup in Chapter 3: Project Organization and Navigation.

Additional Palettes

In addition to the main palettes presented above, there are a number of additional palettes used by specific ArchiCAD tools and functions. None of these palettes is displayed by default; they can be shown or hidden with the appropriate commands of the Window menu.

- The **Favorites** Palette contains the list of preset combinations of tools and their settings that can be recalled at any time. Favorites are presented in *Chapter 4: Element Creation*.
- The **Mark-Up** Palette contains the Entries that mark elements of your project with a color highlight for correcting mistakes or managing design suggestions. Project Mark-Up is presented *in Chapter 9: Collaboration and Connectivity*.
- The **Status Report** floating palette shows you the names of the Library Part files that present problems and the download status of web objects. The palette automatically appears when you open a project whose library set is not fully loaded. *See also Chapter 7: Library Management*.
- The **Selections** palette allows you to store and recall any selection, rename and delete a selection or sort added selections. *See Selection in Chapter 5: Drafting and Editing Techniques for details*.
- The **Quick Layers** palette houses controls for setting the states of layers without having to open the **Layer Settings** dialog box. *See Layers in Chapter 3: Project Organization and Navigation*.
- The **Element Information** palette displays information about the dimensions of element(s) selected on the **Floor Plan**. *See Chapter 10: Project Data Calculation*.

Pet Palettes

Pet Palettes are displayed automatically during drafting and editing operations. The palette can either continuously follow the cursor's movement, or always jump to the last used position (you can set this feature in the **Options/Preferences/Dialog Boxes & Palettes** dialog box). The palette is automatically closed when the operation is finished.

The actual contents of the pet palette depends on the type of the selected element, the current window, and whether you have clicked an edge or a node of the element.

For example, you can use the pet palette to:

- draft or edit polygonal element contours;
- drag entire elements or element nodes;
- stretch elements horizontally and vertically (in 3D only);
- rotate, mirror, elevate and multiply elements.

Clicking the last icon of the palette, representing a slab and an arrow, allows you to alternate between transformation and modification methods.

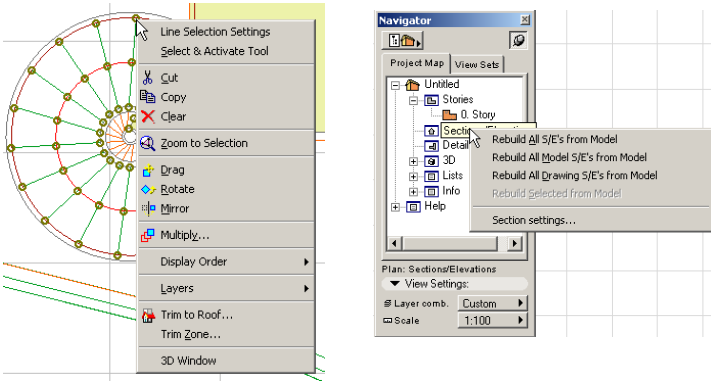
The operations that can be performed by using the pet palette are detailed in Chapter 4: Element Creation and Chapter 5: Drafting and Editing Techniques.

Menubar and Context Menus

The **Menubar** is displayed on top of the screen. All menus are visible at all times, but the contents of individual menus can change according to the currently viewed window and the availability of Add-Ons. Commands that are not available in certain situations are grayed out in the list.

Context menus can be displayed by clicking a selected element or in empty space in construction windows, Section/Elevation and Detail Drawing windows or a selected item in the Navigator palette with the right mouse button (Windows) or while holding down the Ctrl key (MacOS).

Context menus always contain commands that are relevant to the given element or situation.



In the Windows environment, a **Toolbar** can also be displayed under the **Menubar**, including a wide range of shortcuts for frequently used commands and actions.

Note: Both the shortcuts assigned to the menu commands and the **Toolbar** can be customized to your current needs as detailed in *Chapter 6: Program and Project Customization*.

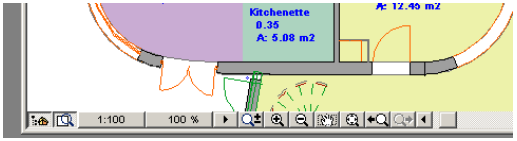
Chapter 3
Project Organization and Navigation

ArchiCAD is optimized to simulate and improve on the traditional environment needed for the development of an architectural project and the production of presentation and construction documents. This chapter describes the implementation of some basic architectural concepts and the special automation tools that speed up daily work.
The following concepts are covered here: ***Scale***, ***Origins***, ***Coordinates***, ***Construction Grids***, ***Elevation Values and Reference Levels***, ***Layers***, ***Stories***, ***3D Image Setup*** *and* ***Project Navigation***.

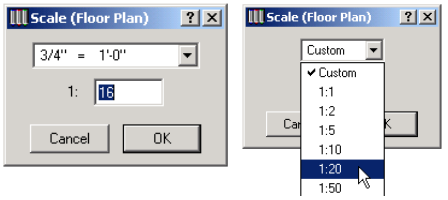
Scale

Traditional concepts of architectural scale (for example 1:1000, or 1/4" =1') do not apply to ArchiCAD, because you are building a real size digital building. If you rescale your document, only the relative size of fixed (or paper) size elements like text or vector hatch patterns changes, as compared to the construction elements, which have been defined in world coordinates. *See details later.*

After setting a scale, what you see will be a preview of the Project if printed or plotted at that scale. To see a REAL preview, not a zoomed one, choose **Display/Actual Size** after setting the scale. Alternatively, you can click the button displaying the current zoom level next to the one showing the current scale at bottom left of the worksheet. Actual Size is the equivalent of the 100% value.

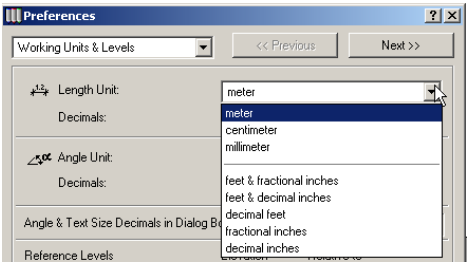


To set the scale factor for the Project, choose the **Floor Plan Scale** command (**Options** menu) or click the shortcut at bottom left of the worksheet.



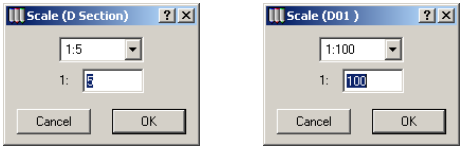
You can select either a standard scale from the pop–up menu or you can type a special, nonstandard scale into the text input field.

Standard scales are shown according to either metric or US standards, depending on the Length Unit setting made in the **Options/Preferences/Working Units & Levels** dialog box.



When choosing the menu item in a Section/Elevation or Drawing Detail window, its name changes to **Section Scale** or **Detail Scale**. You can change the scale separately for every

window. The name of the given window is displayed in the caption of the dialog box.

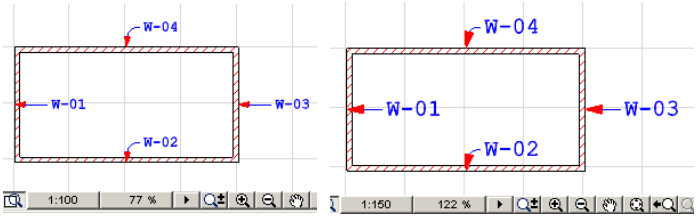


Note: If you change the drawing scale, the current view will change accordingly, and the current magnification will remain constant, i.e., fixed size elements will appear unchanged on screen. To return to the previous view of the window, choose **Display/Previous Zoom**.

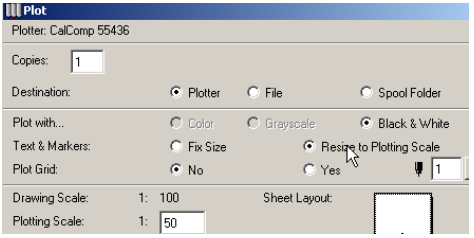
According to their behavior at different scales, there are two types of elements in ArchiCAD.

Scaled elements are rescaled according to their real size whenever you change the Project scale. Scaled elements include all construction elements such as walls, objects, slabs, etc.

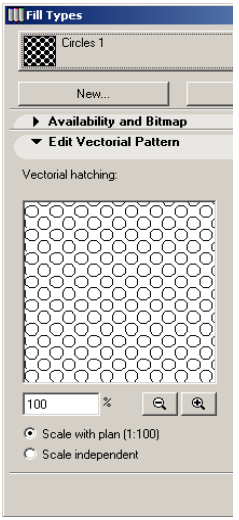
Fixed Size elements are printed or displayed on the screen at the size you specify regardless of the scale selected for the Project. For elements that do not have any real size such as text blocks, dimensions and arrowheads, you can specify a fixed size defined in either points or millimeters.

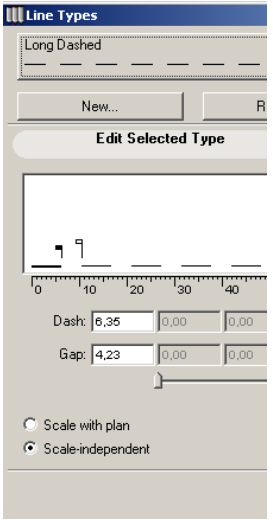


The ArchiCAD **Print** and **Plot** dialog boxes allow you to specify an output scale each time you print or plot your work. You can also choose whether or not you want the program to reduce or enlarge fixed size elements as the drawing is reduced or enlarged according to the ratio of drawing scale and printing scale. In most cases, scaling is the recommended choice. *See Chapter 13: Printing and Plotting.*



Dashed and symbol line types as well as vectorial and symbol fill types can be defined as either fixed or scaled. You can set this characteristic for each line type or fill pattern in the **Line Types** and **Fill Types** dialog boxes (**Options** menu). These settings are valid for the whole Project and cannot be changed for individual construction elements.





The 2D Symbol of GDL Objects can be sensitive to the current scale. *See in particular Windows, Doors and Stairs in Chapter 4: Element Creation.*

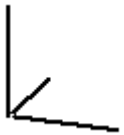
Origins

All ArchiCAD drawing is performed in an invisible two-dimensional coordinate system. Like in any coordinate system, all measurements are made in reference to an origin.

ArchiCAD defines three coordinate system origins:

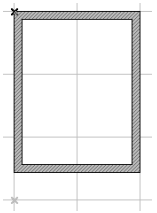
- The **Project Origin** is a constant location which remains fixed for the life of your Project.
- The **User Origin** is an aid to drafting and measurements. The User Origin can be moved to any location, allowing you to "reset the zero point" to any location. This is often helpful when you need to draw elements with respect to existing walls, slabs or other components.
- The **Edit Origin** appears only during drafting and editing operations and is used to display the distance and angle of a rubberband line from the starting point of a drawing operation.

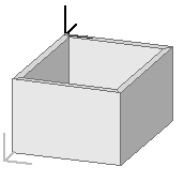
In Floor Plan and other 2D views, the origin is always marked by a bold **X** called the Origin Indicator, while in 3D, the User Origin and the X, Y and Z axes are displayed with bold black lines. The lines are 1 meter (approx. 3 ft.) long.



When you move the origin by specifying a User Origin or by drawing a new element, the Origin Indicator is relocated to show the new origin.

Note: When a User or Edit Origin appears, the Project Origin remains visible in the same color as the construction grid.

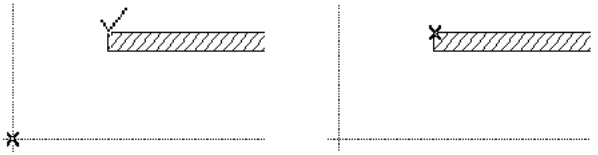




By default, the Project Origin of the coordinate system is close to the lower left corner of the startup screen.

There are two ways to create a User Origin:

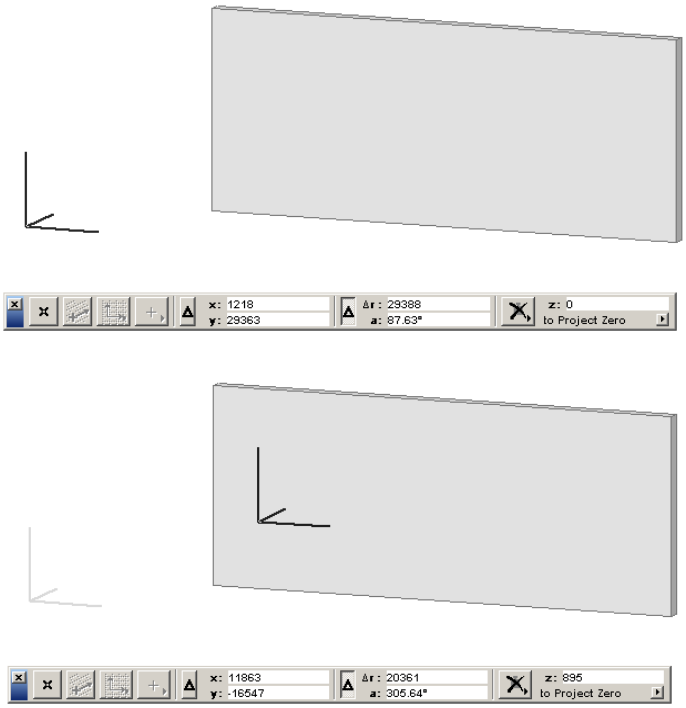
- At any construction node by using the keyboard. Hold down both the Alt and Shift keys while moving the cursor to the construction node where you want the origin located.



- At any location by using the **User Origin** button from the **Coordinate Box**. This method allows you to move the origin where nothing is currently drawn.

Click the **User Origin** button, then click at any point in the worksheet. The origin is instantly relocated there.

In 3D, you can place the User Origin at a different elevation by clicking on an element surface (this is only possible in Hidden Line or Shading mode). Clicking in blank space moves the Origin without changing its elevation.

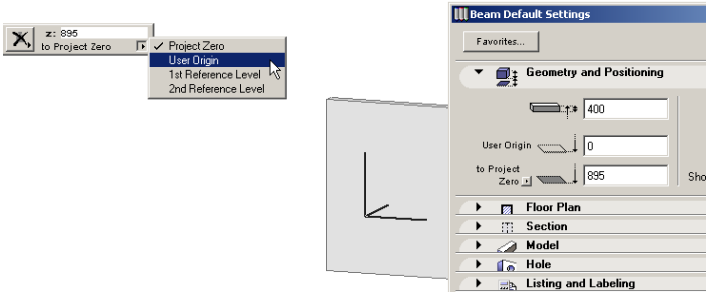


Note: The User Origin cannot be moved to preceding nodes of an element presently being constructed.

To return the origin to the Project Origin, double-click the **User Origin** button. Alternatively, in a 2D window, you can also select the current **User Origin** with the **Arrow** tool (or by shift-clicking it when any other tool is active) and press the Delete key.

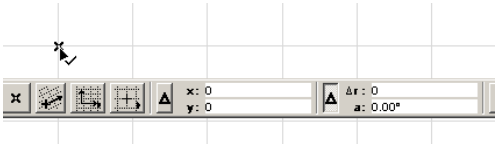
In 3D, the User Origin is more significant than on the Floor Plan:

- If Gravity is Off, its elevation determines the elevation of new elements.
- In the **Coordinate Box**, Z values can be measured from the User Origin.
- In the tool settings dialog boxes, elevation values refer to the User Origin rather than the current story.



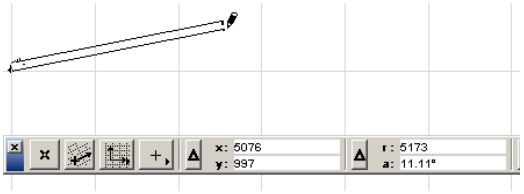
The Coordinate System

The ArchiCAD coordinate system is defined by the Origin (as seen in the previous section) and the coordinate values displayed in the Coordinate Box. The Origin is always interpreted as (0, 0).

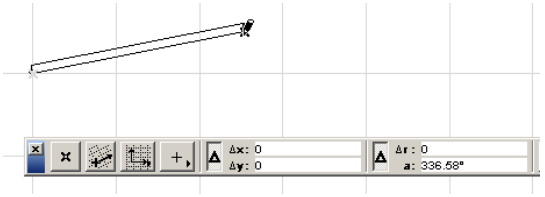


The **Coordinate Box** provides you with information about your location in the current worksheet window. It displays the Cartesian and Polar coordinates of the current cursor position. You can toggle between Absolute and Relative coordinate value display during drafting or editing by clicking its Delta (Δ) icons.

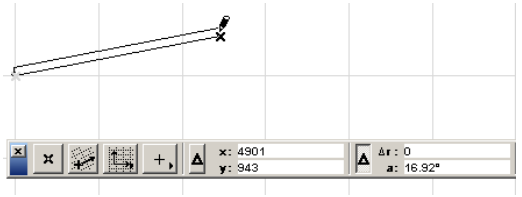
- **Absolute values** show the horizontal, vertical, radial and angular distance of the cursor from the Project Origin or a User Origin but never from an Edit Origin.



- **Relative values** show the horizontal, vertical, radial and angular position of the cursor relative either to the Project Origin, to a User Origin before any element is begun, or to an Edit Origin once a drafting or editing process is under way.



In general, viewing Absolute Cartesian and Relative Polar coordinates provides the most information, and is the most useful under normal circumstances.



With a well chosen User Origin, Absolute Cartesian displays your position relative to important locations in your Project, while Relative Polar values show the direction and length of elements as you draw them.

The Grid System

Two grid systems are provided to help you put ArchiCAD's accuracy to work: the **Construction Grid** and the **Snap Grid**.

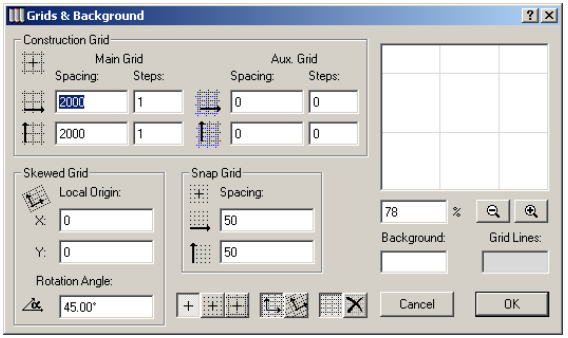
Like the printed grids on traditional graph paper, these ArchiCAD grids add a visual orientation and sense of scale to the Floor Plan worksheet and the Section/Elevation and Detail Drawing windows. Grids are not available in the 3D Window.

- The grids can be set up to reflect the layout and level of precision that is meaningful to your Project. You can also add a rotated or skewed grid for special alignments.
- The grids can be used for attracting the cursor (snapping). This allows you to create a precise graphic alignment of elements at consistent lengths and distances.
- The grids can easily be turned on and off as you draw, so you can use them as the situation requires.

Note: You can also create, place and use custom local structural grids of different sizes and shapes using the **Grid Tool** command from the **Tools** menu. These grids are not just drafting aids; they are an integral part of the documentation.

Defining the Grids

To define the Snap and Construction Grids, choose the **Grids & Background** command in the **Options** menu.



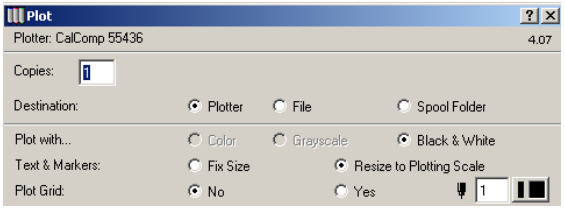
Note: All the values in this dialog box are based on the current measurement units defined in **Options/ Preferences/Working Units & Levels.**

The **Construction Grid** is used to reflect any characteristic spacing of your Project. The Construction Grid could also be used to define the foundation footings or the column grid of a building.

The Construction Grid can be enhanced with an **Auxiliary Grid**, which is also visible on the screen. The Auxiliary Grid is often used to indicate the thickness of concrete walls or foundation footings.

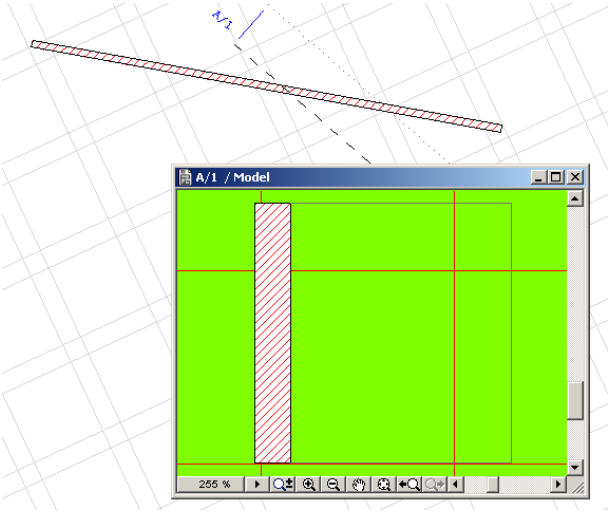
The Construction Grid is normally visible on the Floor Plan Worksheet, but you can turn it off with the **Grid Display** toggle command in the **Options** menu. Note that in this case, it will also disappear from the Grids & Background dialog box.

The Construction Grid can be printed or plotted with the Floor Plan (see Chapter 13: Printing and Plotting).



The **Snap Grid**, on the other hand, is an invisible grid that can be used to define the smallest unit of measurement relevant to your Project. You can set the horizontal and vertical Snap Grid increments independently, allowing you to reflect the unique geometry of your Project.

The Grids can be defined separately for the Floor Plan worksheet and any individual Section/Elevation or Detail Drawing window. Note that, in Floor Plan view, the same Grid settings will be used for all Stories.



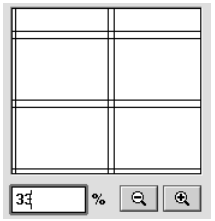
Defining the Construction Grid

Horizontal and vertical spacing can be independently defined for the construction grid in the **Spacing** and **Steps** edit boxes. The Construction parameters are used as follows:

- **Spacing** values determine the distance between grid lines.
- **Steps** indicates the number of repetitions for the spacing pattern. If you enter 0 in any of the Steps field, you disable the corresponding grid line.
- The **Main Grid** Step value is followed by the **Auxiliary Grid** Steps, then the pattern is repeated. The auxiliary grid spacing can be used to create periodic or stepped grids.

The sample window on the right displays a **preview** of the grid. Below this area, the percentage box and the Zoom In-Zoom Out icons work the same way as the zoom controls at the bottom of the worksheet. The only difference is that while you need to double-click the Zoom In/Out icons of the worksheet to get a double magnification/reduction, a single click will do the same here.

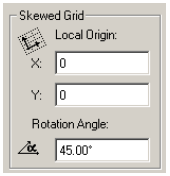
To define the grid, enter values for Main Grid and Auxiliary Grid Spacing and the number of Steps. Click the preview window to update the sample grid.



Defining a Skewed Grid

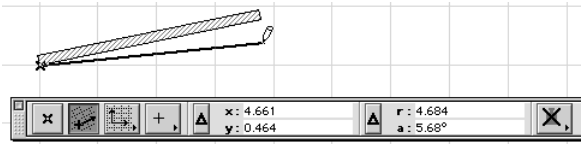
Two controls appear at the bottom of the dialog box to help you set up and use a **Rotated** or **Skewed Grid**. They also have their equivalents in the **Coordinate Box**.

To set up the Skewed Grid in the Grids & Background dialog box, use the controls in the bottom left area. You can specify here a Local Origin that is different from the Project Origin, as well as a Rotation Angle.

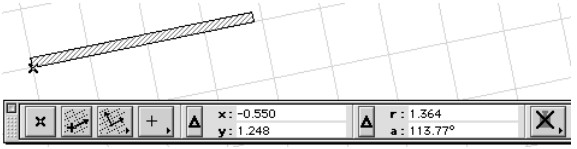


You can also define the Skewed Grid's angle graphically. Close the Grids & Background dialog box and activate the Coordinate Box. Click the second button from the left to enable the feature.

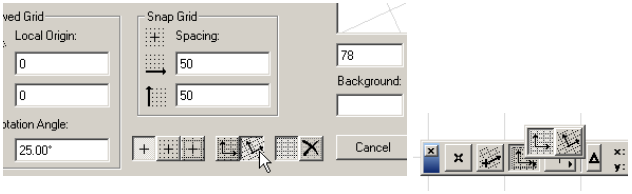
You can now draw a vector on the Floor Plan that will serve to define the angle of the **Skewed Grid** relative to the horizontal axis. You can use all construction aids to do this, including coordinate constraint, as below.



The Skewed Grid is defined and instantly displayed.



The control that actually enables the Skewed Grid is located below the Snap Grid area in the Grids & Background dialog box. Clicking the second button from the left activates it. The same control appears in the Coordinate Box.



Note: When using a transformed grid, Mouse Constraints and coordinate values are calculated according to this coordinate system. *See also Mouse Constraints in Chapter 5: Editing and Drafting Techniques.*

Defining the Background

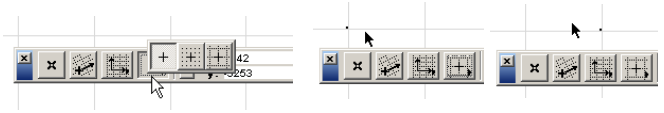
Below the preview area of the Grids & Background dialog box, the **Background** button controls the color of the worksheet. It shows a sample of the current color. Double–clicking the button will open the **Edit Color** dialog box in which you can select a color.

The **Grid Lines** button works the same. Note that the color you select here will also be used for the dimmed Project Origin when it is temporarily displaced.

Controlling the Grids

The **Grid Snap** function allows precise graphic alignment of elements at consistent lengths and distances. When the grids are active, the cursor can only draw from one grid intersection to another. This allows you to position the cursor accurately, even at low zoom levels.

To activate Grid Snap, you can choose the **Grid Snap** command from the Options menu or select the **Snap On** icon in the **Coordinate Box** or in the **Grids and Background** dialog box. When grid snap is active, it restricts the movement of the cursor to Construction or Snap Grid nodes. A small dot jumping from grid-point to grid-point indicates the current cursor position.



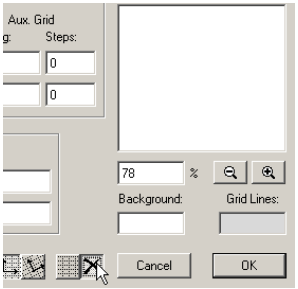
The **Grid Snap** command acts as a toggle between the last grid type used (Construction or Snap) and no grid snap. When the command is checked, Grid Snap is active. When the command is unchecked, Grid Snap is disabled.

You can suspend or activate the grid snap feature by pressing the **S** key.

When either Grid System is activated, the cursor moves from one grid intersection to another. Since there are times when you need to disable this feature (for example, to position a piece of furniture at a non-grid location), it is easily turned **On** or **Off**.

Displaying the Grids

You can show or hide the Construction Grid lines by clicking the X icon at the bottom of the Grids & Background dialog box. The grid instantly disappears from the preview and, when you click OK, from the active worksheet, too.



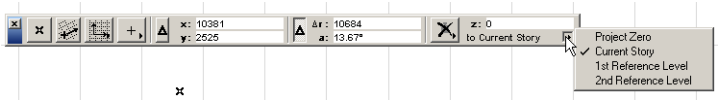
You can also achieve the same effect with the Grid Display toggle command in the Options menu.

Note: The grid is automatically hidden if it would be too dense on the screen, that is, if the smallest distance between two adjacent grid lines would be smaller than 3 pixels.

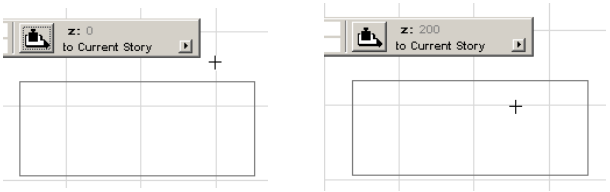
Elevation

ArchiCAD offers several ways to determine the elevation of elements and to set the height at which the new elements should be created.

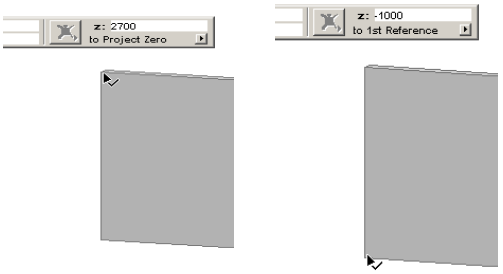
- In the **Coordinate Box**, you can choose whether to display elevation values from the Project Zero, the current Story (or in 3D, the User Origin) or one of the two optional Reference Levels defined in Options/Preferences/Working Units & Levels.



- While dragging the pointer over a slab, roof or mesh surface (provided that the corresponding **Gravity** icon is active, see below), you can monitor the changes in elevation (Z) values in the **Coordinate Box**. When several slabs, roofs or meshes overlap, the highest elevation value is displayed.



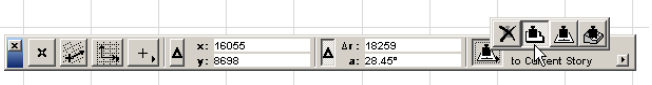
- In 3D, the Z field of the **Coordinate Box** also displays the elevation of any element hotspot the cursor currently touches.



- The elevation of the element to be placed is displayed in the **Info Box**. If you define an offset in the Info Box, the elevation is automatically calculated, and the element will be placed at the displayed elevation.

Gravity

Gravity helps you place Wall, Column, Beam and Object type elements relative to the elevation of a Slab, Roof or Mesh. The corresponding icons are located in the Coordinate Box.

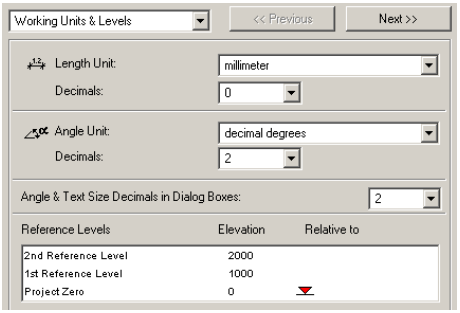


- With the first icon, newly created elements will be placed relative to the current **Story's 0** level (Floor Plan) or the current **User Origin** (3D Window).
- With the next icons, newly created elements will be placed relative to the **Slab**, **Roof** or **Mesh** beneath them.

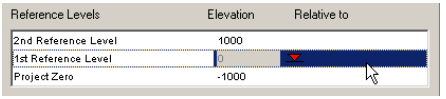
Notes: Gravity only affects newly created elements and cannot be used for editing existing ones. To measure elevation values, activate the Slab, Roof or Mesh tool and switch Gravity on.

Reference Levels

You can define two optional Reference Levels that will help you position elements. This is done in the bottom section of the Options/Preferences/Working Units & Levels dialog box.



Select a level's name and modify it as you like, then type the value you need in the **Elevation** field. The elevation marker symbol always shows the zero value inside this dialog box only. You may find it easier to calculate levels by switching the zero value to another level than Project Zero. You can do so by simply clicking in the **Relative to** field next to the level's name.



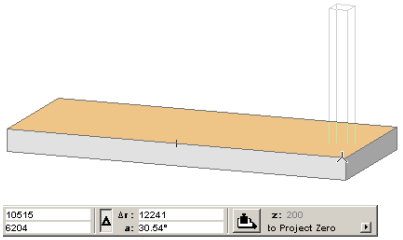
Note that Reference Levels are display and input aids only. Changing their value has no effect on placed elements, as their actual elevation is always calculated from Project Zero.

Elevation Control in 3D

Before you start drawing an element in 3D, set the controls and settings to make sure that the element will be inserted at the right elevation.

With **Gravity On**, Walls, Columns, Beams and Objects will be positioned on top of the Slab, Roof or Mesh surface you click. Elements of other types will have a “transparent” behavior, i.e., the click will poke through Walls or Objects and find the first Slab, Roof or Mesh surface.

The Z field in the Coordinate Box is locked to the elevation of the Slab, Roof or Mesh, and so is the bottom elevation value field in the Info Box.



With Gravity Off, the elevation of the User Origin is the principal factor. Move the User Origin at the desired height, and in the Settings dialog box of the Tools, set the elevation values as desired.

The ***Z*** field in the **Coordinate Box** will display the elevation of the User Origin, while the **Info Box** displays the top and bottom elevation values of the element you are about to create. You can specify an offset from the User Origin by defining the value for the Z coordinate.

> **Note:** The elevation of wall openings is strictly determined by the current values in the **Door** and **Window Settings** dialog boxes, and is always measured from the bottom of the clicked Wall.

Elevation and Stories in the 3D Window

The 3D Window always displays the range of Stories defined in Image/Elements to Show in 3D, and there is no visual clue as to which elements belong to which story.

New elements are always added to the story within the range that best matches their elevation. This means that:

- If the contents of the 3D Window was defined either by explicit selection (in most cases, the Arrow tool) or a single-story Marquee area, then all new elements will be added to the current story regardless of elevation.
- If multiple stories are displayed, then new elements within the range of a displayed story will be added to that story, while elements placed very high or very low will be added to the top or bottom story of the displayed range.

Note that this only applies to new elements. Existing elements will always keep their story, regardless of the vertical adjustments made in the 3D Window. To move them to another story, you need to activate the Floor Plan Window, cut them from one story and paste them to another.

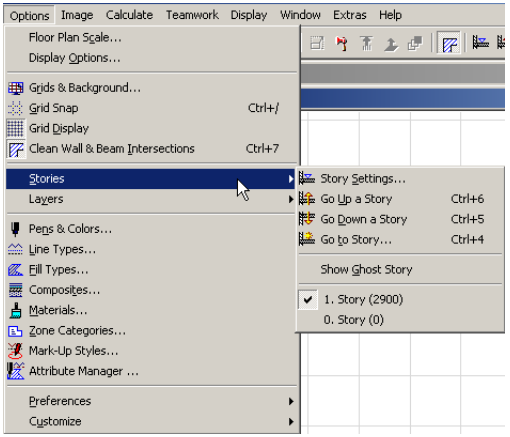
Stories

Stories provide a physical separation for elements according to the vertical level to which they belong. Each Story has its own Floor Plan in which you place elements.

Stories are typically used for drawing each Floor Plan of multistory structures separately. They can also be used for separating site plans, roof plans, etc., that have vertical 3D relationships.

- Only the current Story’s **Floor Plan** view is displayed for editing, printing or saving to an external file format.
- In **3D view**, all Stories are projected by default, but you can limit the projection with the Elements to Show in 3D command (Image menu).
- In **Section/Elevation views**, you can define a vertical range that can include entire Stories or only parts of them.

All Story functions are controlled through the **Stories** hierarchical menu in the Options menu. The currently defined Stories are displayed at the bottom of the submenu with their elevation value. The current Story is indicated by a checkmark in the list and its name appears in the title bar of the Floor Plan Window.

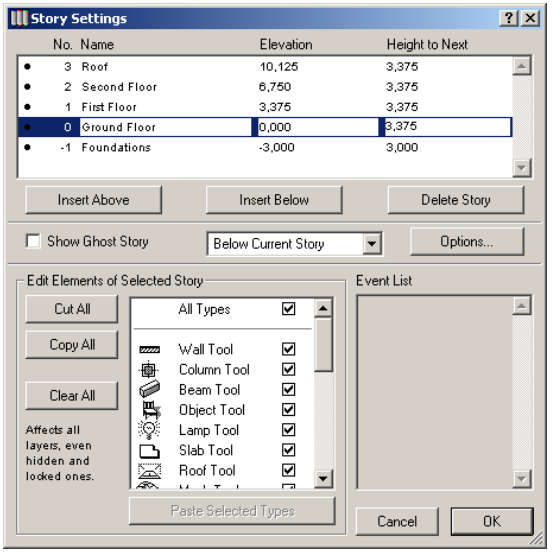


The commands of the **Stories** hierarchical menu allow you to:

- Define the Stories that make up the vertical structure of your design;
- Determine which Story is currently displayed in the Floor Plan worksheet;
- Display as a "Ghost Story" the elements of another Story in Floor Plan view.

Defining Stories

The **Story Settings...** command displays the **Stories** dialog box. This is where you will define the vertical structure of your Project.



The upper section of the dialog box offers a scrollable list of the current stories in your design. When starting a new project from scratch, you only have a single story, but if you are using a template, the file may already contain a predefined story structure.

- To add a new story, click the **Insert Above** or **Insert Below** button;
- To clear a story, clicking the **Delete Story** button.

  Warning: Deleting a Story also clears all the elements that are placed on it.

The new story appears above or below the selected story. The numbering is automatically updated. There is no limit to the number of stories.

Note: The ground floor is Story number 1 (US version) or 0 (International version).

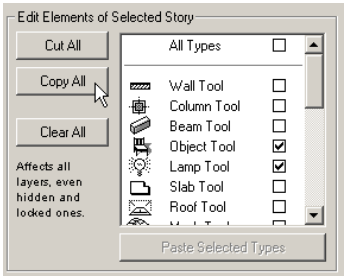
To activate a story, select it in the list and click OK. The Floor Plan sheet will show this selected story.

When the name of a Story is selected, you can edit its Name, Elevation (to Project Zero) and its Height to the Story above. The Number field is not editable manually.

Changes to story *height* and *elevation* are interpreted differently:

- If you modify the *height* of a story, this will affect the *elevation* of *all* stories above (if the story number is positive) or below (if the story number is negative). In practical terms, you stretch or shrink the whole building by making the height of a story larger or smaller. The height of all other stories remain as they were.
- If you modify the *elevation* of a story, this will affect the *heights* of the stories immediately above and below. In practical terms, you move the level of a single story while keeping the rest of the building static. The elevation of all other stories remain as they were.

When creating a new Story, you may wish to copy to it elements that already exist on another Story. In addition to the standard **Cut**, **Copy**, and **Paste** commands of the Edit menu, you can move all elements belonging to a given type in one step with a special function inside the Story Settings dialog box.



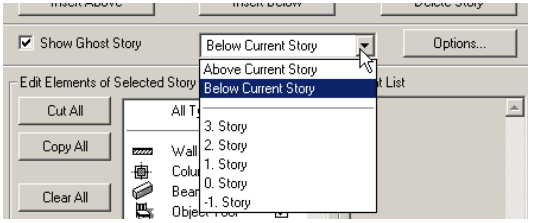
The elements or items to be pasted (placed) are selected by checking the box in front of the name of the tool that created this type of element. To select all elements, check the **All Types** box.

- Clicking the **Cut All** button removes all the selected elements from the story that is selected in the list.
- Clicking the **Copy All** button creates copies of the selected elements of the story that is selected in the list.
- Clicking the **Paste Selected Types** button pastes all the cut or copied elements on the story that is selected in the list (do not forget to switch stories before this operation).
- If there are already some elements on the target story and you wish to remove them first, select that story, check the appropriate element type box and click the **Clear All** button, then paste the new ones.

These operations are not actually performed until you confirm them and exit the dialog box. The Event List next to this area shows you the story editing steps you have taken. When you click **OK**, a final prompt will ask you to confirm that you want to proceed with the operation.

Defining a Ghost Story

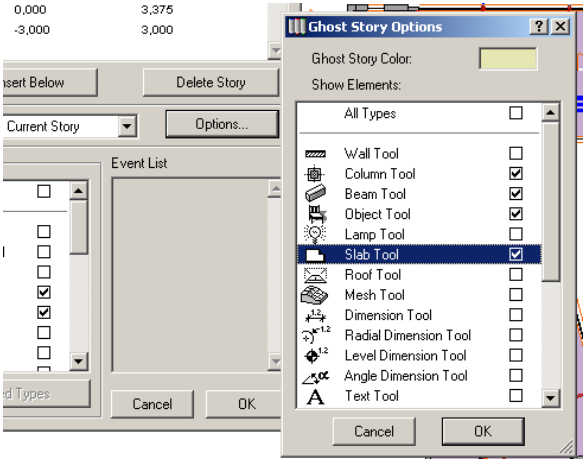
The Ghost Story option allows you to display the elements of another story on your Floor Plan Worksheet behind the story that you are currently working on. This function is accessible from the Story Settings dialog box.



You can only show one Ghost Story at a time. The pop-up menu lists all the stories available in your current Project. You can either choose a given story or the story right above or right below the current one.

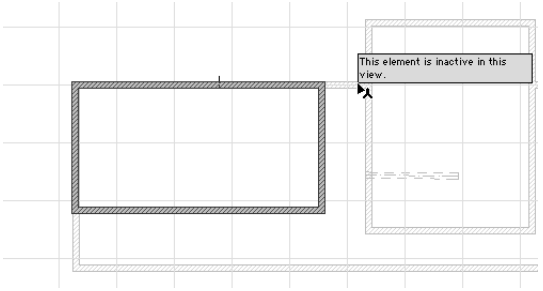
Clicking the **Options** button opens a subdialog box with the element types available to show or hide on the Ghost Story.

You can also choose here the uniform color that will be used to display all ghost elements.

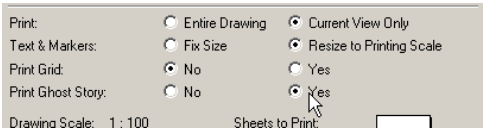


Once the Ghost Story has been defined, you can also switch its display on and off with a toggle command in the **Stories** hierarchical menu.

The elements of the Ghost Story can be seen and snapped to. If you click on such an element, a message will appear to inform you that this element is inactive in the current view.



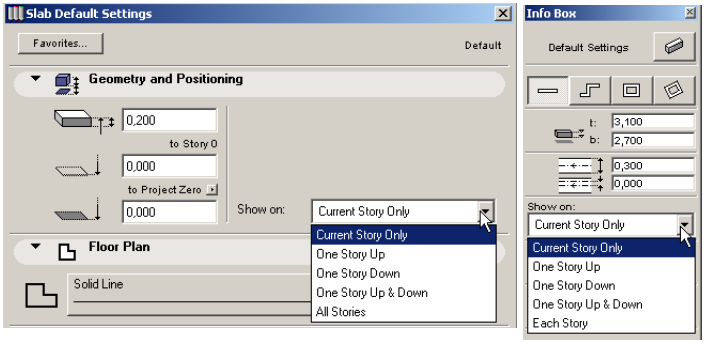
You can print the elements that are currently visible on the Ghost Story by checking the appropriate radio button in the **Print** dialog box.



Ghost Story elements cannot be:

- selected or edited
- plotted
- saved in any 2D format

Note: You can also show single elements of some types (Beams, Objects, Lamps, Stairs, Slabs, Roofs, Meshes) on more than one Story by activating the appropriate control in the given element's settings dialog box or the Info Box.



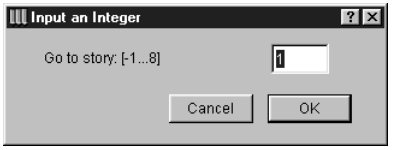
Activating Stories

In addition to selecting a Story from the Story Settings dialog box, you can use the Navigator palette (see later in this section) and commands from the Stories hierarchical menu.

The **Go Up a Story** command activates the next Story above the current one on the Floor Plan, while **Go Down a Story** takes you to the Story below the current one. If **Autosave** is **On** in the **Preferences**, this command triggers an **Autosave**.

If you attempt to go to a story that does not exist, an alert is displayed asking you whether you wish to create a new story.

The **Go To Story...** command opens a dialog box allowing you to jump directly to an existing Story and provides you with a range indicator of how many Stories currently exist. If you enter a Story number outside the existing range, the field will revert to the top or bottom Story of the valid range.



Each story defined in the **Stories** dialog box is displayed in the story list at the bottom of the hierarchical menu with its Name (or serial Number, if no Name has been defined for it), as well as its Elevation to Project Zero. From this list, choose a Story to display in the Floor Plan window.

Layers

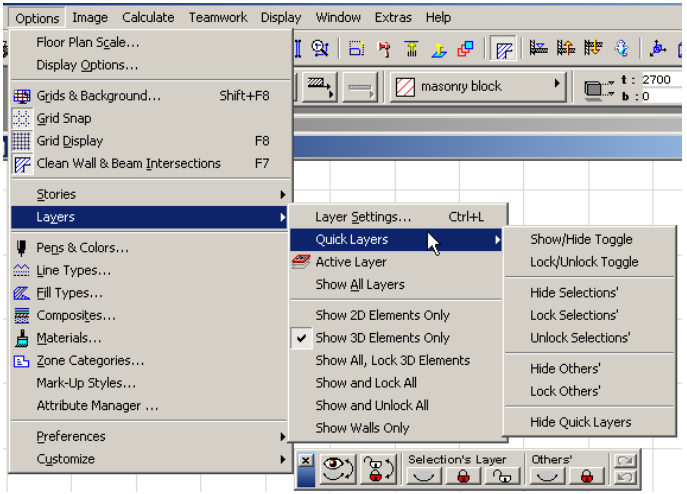
While plans are drawn on Stories, each element of the plan is placed in a particular **Layer**. Layers are global, which means that the same layers are available on all stories and in all worksheet windows.

Layers are analogous to pin-registered overlay drafting and provide a “logical” separation of elements. Related groups of elements, such as dimensions, furniture, electrical symbols and so on, are placed on common Layers. Since each tool has a default Layer assignment, elements are automatically placed on separate Layers when using the tool.

You can also show or hide each Layer depending on what you want displayed, saved to an external file format, printed or projected in 3D. In 3D only, elements on certain layers can appear in wireframe form. It is also possible to lock Layers in order to prevent certain elements from being selected or modified.

To automate the process of displaying and locking layers, you can store various setups in **Layer Combinations** and then choose any of these by name from the **Options/Layers** hierarchical menu.

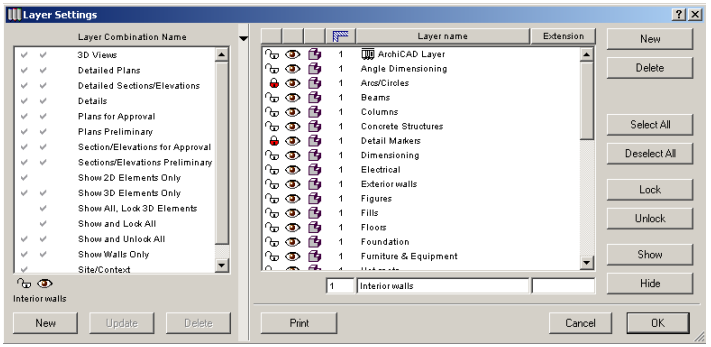
All Layer functions are controlled through the **Layers** hierarchical menu in the Options menu. The currently defined Layer Combinations are displayed at the bottom of the submenu. The current Layer Combinations is indicated by a checkmark in the list. Some of the commands are also accessible from a floating palette (QuickLayers) shown at the bottom of the illustration below.



Note: Layers and Layer Combinations are handled by ArchiCAD as attributes. *See Attribute Management in Chapter 6: Program and Project Customization for more details.*

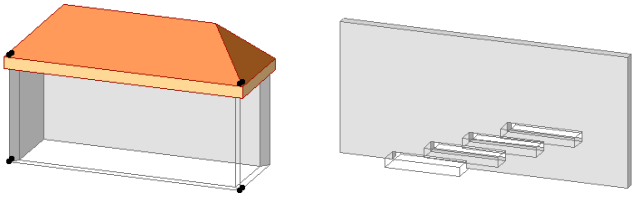
Layer Settings and States

Choosing the **Layer Settings...** command in the Layers hierarchical menu displays the **Layer Settings** dialog box which has two panels: Layer Combinations and Layers.



The dialog box uses a number of icons to indicate the different states of Layers.

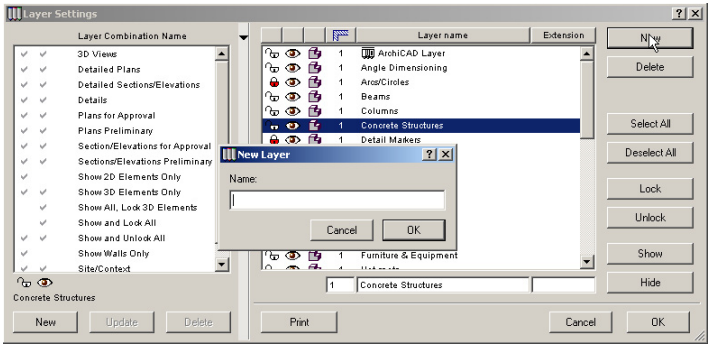
- The open or closed lock icons indicate that a Layer has been protected to prevent its contents from accidental modification. If a Layer is locked, the elements on it cannot be edited or deleted and no new elements can be placed on it.
- The open or closed eye icons indicate that a layer (and the elements assigned to it) are currently visible or invisible.
- The solid model or wireframe icons indicate that the elements placed on that layer are fully visible in 3D views or with their contours only, independently of the current 3D mode set in the Image menu. This can be useful, for example, for storing the operator elements of Solid Operations on wireframe layers and target elements on solid layers. *See Solid Operations in Chapter 5: Drafting and Editing Techniques.*



- The numbers under the intersection icon in the Layers panel indicate the number of the intersection group the elements on that layer belong to. Only elements on the same intersection level will cut or connect to each other in 3D view.

Layer Definition

Layers are created, edited and managed in the Layers panel. To create a Layer, click the New button on the right and give it a unique name.



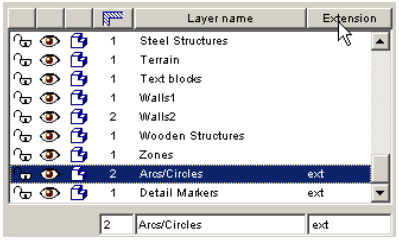
Note: Newly created Layers are not included in any Layer Combination.

The Layer that you select in the list appears in the edit boxes below the list field. You can:

- Modify a selected layer's name;
- Set an intersection group number in the first edit box;

- Add an extension to the layer's name. This can act as an additional sorting control if you have many layers.

You can sort Layers by Name and Extension by clicking the captions on top of the list field.



The first item on the list, the **ArchiCAD Layer**, cannot be deleted, hidden or locked. This layer collects all those elements that may have lost their layer definitions.

The icons inside the list field and the buttons on the right of the Layers panel help you manage layer states. With the **Select All** and **Deselect All** buttons you can select and deselect all layers, respectively. Multiple selection through keyboard shortcuts is also possible. All the management tools detailed below act on selected Layers.

- Clicking the lock, eye and model icons in the list field toggles the state of the corresponding Layer(s).
- The **Lock/Unlock** and **Show/Hide** buttons also change the state of selected Layers.

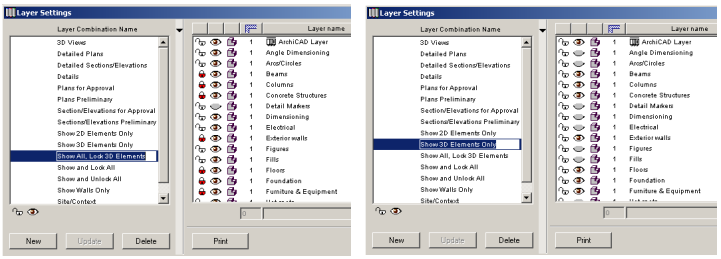
With the **Delete** button, you can remove selected layers. Deleting a layer clears all the elements on it and is not undoable. To help avoid clearing by mistake, ArchiCAD displays a warning prior to actually deleting the layers.

Setting Up Layer Combinations

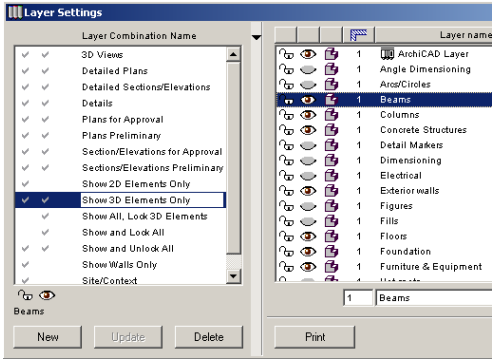
In the **Layer Combinations** panel of the Layer Settings dialog box you can define and save sets of layers.

A Layer Combination is a “snapshot” of the state of all Layers in the Project and can be recalled at any time by selecting its name from either this dialog box or the Layers hierarchical menu, where they are listed by name.

If you select a Layer Combination in the list and deploy the Layers panel, you will see that the layer state icons on the left change accordingly.

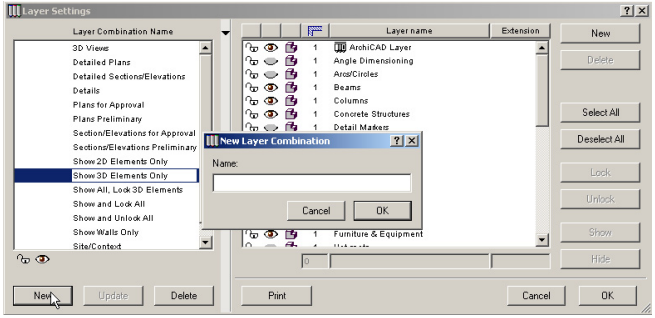


By selecting a name in the Layers list, you can check its state in the various defined Layer Combinations.



To define a new layer combination, your best choice is to start by setting the state (locked/unlocked, shown/hidden, solid/wireframe) of the individual layers. Use the sorting and selection controls to set several layer's state at the same time. You may want to first activate an existing combination that needs only minor refining.

When you are finished, click the **New** button in the Layer Combinations panel and give the new set a unique name in the appearing dialog box.



To modify an existing layer combination, for example by adding a newly created Layer or by changing the state of some of its Layers, select it, make the necessary adjustments and click the **Update** button.

The currently active Layer Combination is indicated by a checkmark in the Layers menu. If there is no checkmark, this means that the current layer state was achieved through manual changes and does not correspond to any of the predefined Layer Combinations. If you wish to save this state, go to Layer Settings and create a new Layer Combination without changing the current states of the Layers.

Using a Single Layer

You can choose to place all your elements on a single layer to simulate AutoCAD-like work. Instead of changing the default settings made for each tool individually, choose the **Active Layer** command from the Layers hierarchical menu. This will set the default layer of all element types to the same layer. All Tool Settings dialog boxes will use the same default Layer definition and successive elements will all be placed on that layer, regardless of type. You can, of course, override this setting manually for selected elements.

If you wish to return to the previous layer state, choose the **Individually Set Layers** option from the command's dialog box. The last set of manually defined layers will be used.

The Quick Layers Menu and Palette

The Quick Layers command accessible from the Layers hierarchical menu opens another submenu with a number of commands that help you quickly change the state of the Layers in your Project.

- The **Show/Hide Layers** Toggle inverts the visibility of all layers.
- The **Lock/Unlock Toggle** inverts the state of all protected and unprotected layers.
- The **Active Layer** command to switch to single-layer mode and back (see above).
- The **Hide/Lock/Unlock Selections' Layers** commands invert the state of the Layers belonging to the currently selected elements, while **Hide/Lock Others' Layers** does the same for the elements that are not selected. Both explicit selection and Marquee areas are taken into consideration.
- The **Show Quick Layers palette** command displays a palette housing all of the commands described above in the form of buttons.

3D Image Setup

In the 3D Window, you can view and edit the model under various angles and in various modes. You will change views and settings according to your current needs, by adding Cameras and using the commands of the Image menu.

This short introduction presents some of the basic concepts that are specific to the 3D Window only and do not apply by their nature to the Floor Plan worksheet or the other views of the Project.

Note that the 3D Window also acts as the source of the photorealistic still images and animations that you can create with ArchiCAD. Some of the features described below apply explicitly to PhotoRenderings.

Projections

ArchiCAD can display parallel (axonometric) projections and perspectives. By default, when first starting the program and activating the 3D Window, you get a Dimetric axonometry of the model.

Parallel projections automatically include the entire model, while perspectives are defined by a viewpoint and a specific target.

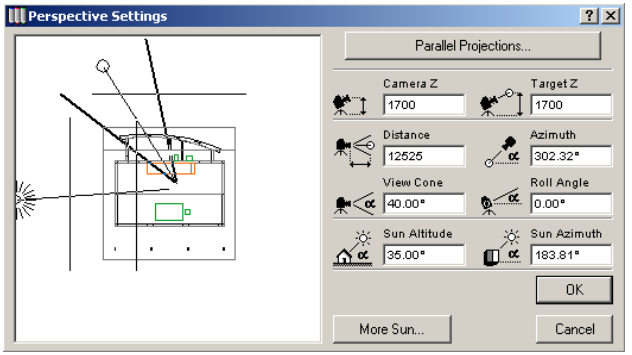
The 3D Projection Settings command from the Image menu opens a dialog box that contains all the controls you need to define the 3D view. The name and contents of the dialog box depend on the projection type: **Parallel Projection Settings** or **Perspective Settings**. You can easily switch from one to the other with the button at the top right corner.

The projections that you define in the 3D Projection Settings dialog box remain valid only until the next time you open the dialog box and modify them. To store projections that you set up in the 3D Window, you can:

- Save the Current View with the Navigator palette as described in the next section;
- Place a Camera on the Floor Plan if viewing a perspective (*see Animation Controls at the end of this section);*
- Add the current projection to the series of Pre-Set views if viewing a parallel projection.

Perspectives

In the Perspective Settings dialog box, you can easily set all the relevant parameters, such as viewpoint location and elevation, target location and elevation, width of the viewing cone, and sun position.



The preview area on the left side of the dialog box shows your Floor Plan as it currently appears in the worksheet. To see another part of the Project, leave the dialog box, choose another detail using the Navigator or zooming and panning operations, then open it again.

The solid line in the preview area represents the line of vision between the viewpoint and the target point. You can click and drag both the target point and the viewpoint independently of one another. Click anywhere in the preview area and the line of vision will be rotated around the target point to your click position.

The angle defining the **View Cone** is displayed in the preview area and provides reliable information if the line of vision is horizontal. If the line of vision is looking up or down, the angle can be used only for estimating the resulting view.

After zooms, pans, or numeric distance settings, the viewpoint and/or target point may occasionally disappear from the preview area. To retrieve them, simply Shift-click where you

want the viewpoint and Alt-click where you want the target point to be in the Window. They will immediately move to the points where you clicked.

You can also numerically specify the location of the viewpoint with respect to the target in the **Distance** and **Azimuth** edit boxes on the right side of the dialog box, and their effects will be displayed graphically in the preview area. (In this case, the position of the target will remain unchanged.) The elevation of the viewpoint and the target point, as well as the **View Cone** and **Roll Angle** of the Camera must be set numerically by using the remaining edit boxes.

1) For a one-point perspective, set the viewpoint and target point elevation to the same value. Set the viewpoint Azimuth parallel to the principal axis of the Project.
2) For a two-point perspective, set the viewpoint and target point elevation to the same value. The other settings can have any value.
3) For a three-point perspective, set the viewpoint and target point elevation to different values.
4) To get a top view in perspective, set the viewpoint elevation higher than that of the target point elevation, drag the target to the desired location on the plan, then set the distance to zero by dragging the viewpoint until the numeric field displays zero. (You cannot type zero in the **Distance** field.)
5) For a fast preview of projections, use the Block 3D modeling option described below. You can check the general look of the projections very quickly in the 3D Window this way.

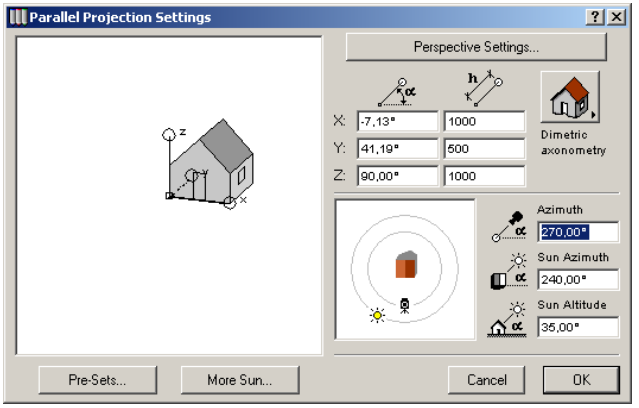
In the projection preview area, the dashed line from the center of the area with a sun icon at its end shows the direction of light for shaded and rendered representations. The sun icon can be dragged around the perimeter of the plan, but it cannot be positioned closer. Its distance is regarded as infinite. Both its Altitude and Azimuth can be set numerically in the edit boxes below the viewpoint and target settings. *See also Sun and Light Effects later.*

> **Note**: Cameras placed in the Floor Plan worksheet also define perspective views, but they are configured in the Camera Settings dialog box, not in this dialog box. You can copy a camera's settings here by selecting a single camera on the Floor Plan and choosing **3D Projection Settings**. *See also Cameras in Chapter 4: Element Creation.*

You can also use the **Navigator** and **Navigator Preview** palettes described in the next section to set up the 3D view.

Parallel Projections

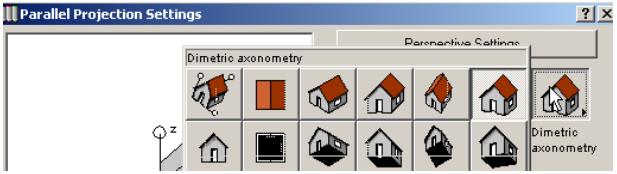
In the **Parallel Projection Settings** dialog box, the selections of the projection type pop-up palette offer a wealth of projection options, while the preview area and viewpoint control let you easily fine-tune a desired view.



You can choose from 12 Projection types to make a view of your Project, including predefined axonometrics, side, top and bottom views, and your own custom-defined axonometrics.

You can check the view given by the chosen projection type and any additional settings you have made by referring to the simple house in the Preview Window in the left part of the dialog box.

For each Projection type, the edit boxes at the top of the dialog box show the defining angles and scaling ratios of the x, y and z coordinate axes.



You can create your own customized axonometry, either by entering values for the angles and ratios of the three coordinate axes or by manipulating the house icon in the preview area:

- To rotate an axis about the origin, click on or near it and drag it to the desired orientation.
- To rescale and rotate an axis, click within the circle at its endpoint and drag it to the desired position. (If you only want to rescale, it is easier to enter a value in the edit box.)

The adjustments you make here are continuously reflected both by the values displayed in the edit boxes, and by the distortion of the house icon itself.

You can set the direction of your view and the position of the sun with the controls and edit boxes to the right of the preview area. Just as for perspective projections, the distance of the sun from the target is considered to be infinite, and for parallel projections the viewpoint distance is infinite as well.

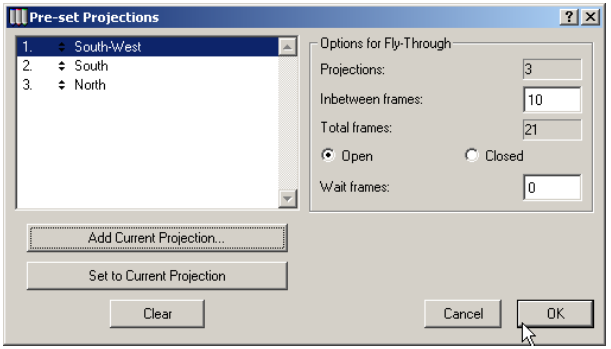
Simply click the **Sun** or **Camera** icon and drag it to the desired location. The effect of your changes is shown by the rotation of the house in the preview area and by the values in the edit boxes to the right of the control.

- To move the camera or the sun in 45° increments, click once near the desired direction on either of the gray circles.
- To move them in 5° increments, drag the camera or sun icon.
- To move to any in-between position, type the desired numeric value into the edit fields.

The **Azimuth** of the camera and the sun can be set either graphically or numerically, but the sun **Altitude** angle can only be set numerically.

Hint: Unless you are an experienced ArchiCAD user, it is generally best to begin with a predefined projection from the palette, then rotate the view with the camera angle control, and finally make minor adjustments with the rescaling features.

The **Pre-Sets** button opens a subdialog box where you can store and retrieve settings. You can also use this sequence of axonometric views for a future animation. Animations based on axonometric views are not fly-throughs in the same sense as perspectives, even though they are created with the same command. Using in-between frames, you will get an animated metamorphosis from one projection to the other.



- The **Add Current Projection** button places the current view on the list. The views on the list will be keyframes in the Fly-Through. You can also name each keyframe in the dialog box that appears after pushing this button.
- If no projection is selected, **New** will be added to the bottom of the list. If a projection is selected, the new projection will be inserted before the selected one.
- The **Set to Current Projection** button changes the highlighted keyframe in the list to the one you set prior to opening the **Pre-Sets** dialog box.

- The **Clear** button clears a keyframe from the list.

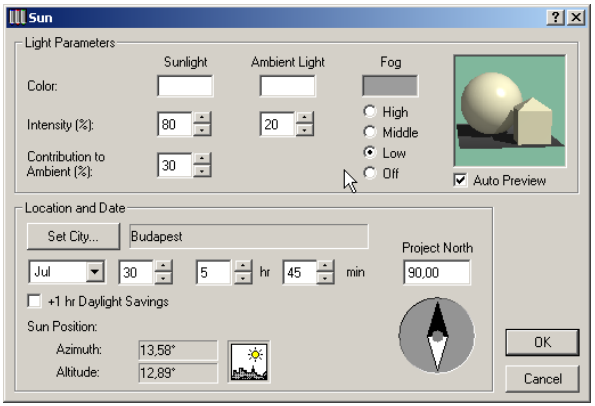
Under **Options for Fly-Through** in the right section of the dialog box you can also set the number of in-between frames that ArchiCAD will create by interpolating between every parameter (e.g., axis scaling ratio, camera angle, etc.) of consecutive keyframes.

- The **Open** and **Close** radio buttons control whether the animation will loop continuously from the last defined keyframe back to the first keyframe during the Fly-Through.
- **Wait frames** have the same effect as described for the **Camera Tool** in *Chapter 4*.

You can also use the **Navigator** and **Navigator Preview** palettes described in the next section to choose a parallel projection type and set up the 3D view.

Sun Direction and Light Effects

Clicking the **More Sun...** button in either the Perspective Settings or Parallel Projection Settings dialog box gives access to the **Sun** subdialog box for a series of more sophisticated sunlight settings, which can be used for PhotoRenderings.



Characteristics of light can be set in the upper part of the **Sun** dialog box.

Double-click the color box to go to the **Edit Color** subdialog box. The color of directional light (with a color intensity between 0 and 100%) can be set here.

- You can decide how much of the directional light is represented in nondirectional, ambient light.
- Both the color and intensity of directional light can affect the ambient light, according to the percentage specified in the Contribution to Ambient (%) field.

As opposed to directional light (e.g., the sun), ambient light is nondirectional and can stand as a substitute for the rich reflected and inter-reflected light experienced in a real environment. It can brighten otherwise overshadowed surfaces.

Ambient light may have its own color (in a pink room for instance) and its intensity may have to vary to obtain special effects in renderings.

- Its color is set through the **Edit Color** subdialog box. Double-click the sample color to open it.
- Its intensity can be set between 0 and 100%.

To further enhance the realism of your renderings, the atmospheric Fog effect alters light in proportion to the distance from your viewpoint. You can set the color of the fog by double-clicking its sample box to access the **Edit Color** dialog box. You can also set one of four levels of intensity for the effect with the radio buttons.

(To achieve a typical misting effect, set the color to white, and this will fade the more distant objects. To use light decay, set the fog color to black, and this will darken the more distant objects.)

Note: To apply this effect, make sure that Fog is activated in the **PhotoRendering Settings** dialog box.

Click the Apply button to test the sunlight, ambient light and fog settings you have made on a neutral white material.

Click the **Set City...** button to specify a geographical location by latitude and longitude, or by specifying a major city close to your site from the scrollable list.

- To add a new location, type into the appropriate edit boxes its name, the exact global coordinates and the time zone of the site, then click the **Add** button. The new location now appears in its alphabetical position in the list.
- To delete a location, select the city name by clicking on it, then click the **Clear** button to remove the city from the list.

In the **Sun** subdialog box, you can specify the date and time of day (just below the **Set City** button). The +1h correction (summer time) checkbox lets you adjust for Daylight Savings.

As a result of all these specifications, you can get the exact direction readings of the sun, with an icon indicating if it is day or night.

The orientation of your Floor Plan is defined by setting the North direction relative to the floor plan's orientation on screen. You can drag the compass needle or type in the angle numerically, relative to the X axis of your sheet.

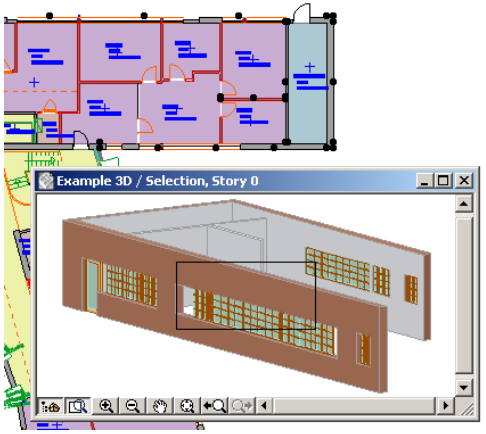
If you define the sun position by defining a location with date and time, its azimuth settings will be calculated with respect to this orientation (where East is at 0.00 degrees).

Note: When using surveyor's units (in **Preferences**/ **Working Units**), the North of the **Coordinate Box** will be the same as the one set here.

3D Window Contents

The actual contents of the 3D Window depend on a variety of settings and criteria.

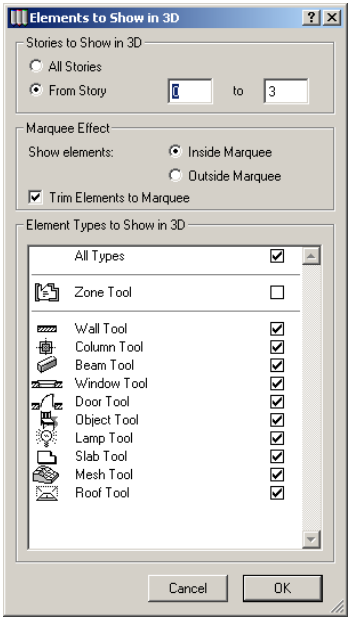
Explicit selection made on the Floor Plan (that is, with the Arrow tool or a selection command, but NOT the Marquee tool) is the first priority. If some elements are selected, only these will be displayed in the 3D Window and the caption of the window will include the "Selection" mention as well as the name of the active Story.



Note: If you create new elements in the 3D Window in a view based on explicit Floor Plan selection, these new elements will disappear from the current 3D view after you complete them.

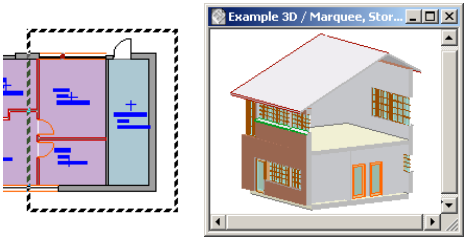
If there are no explicitly selected elements on the Floor Plan, the next priority is the state of the **Elements to Show in 3D** dialog box opened from the Image menu.

In this dialog box you can select which stories and element types should be included in the 3D Window.



- In the **Stories to Show in 3D** area, you can either choose **All Stories** or a continuous range of stories.
- The **Element Types to Show in 3D** checkboxes allow you to turn construction elements on and off. With Doors and Windows switched off, openings are interpreted as empty holes. It is possible to select all element types (with the exception of Zones) by checking a single box. Zones can also be selected separately to appear in the 3D Window.
- If you use the **Marquee tool** to create a selection rectangle prior to modeling, it can be used directly or inversely through a third set of options. With the inverse option, you can exclude internal elements of a house when you need only external views of the 3D model. The Marquee can affect multiple stories, not just the current story.
- If the **Trim Elements to Marquee** checkbox is checked, the model will be clipped at the Marquee's boundaries. Otherwise the model will not be clipped, but all those elements that have at least one hotspot inside the Marquee will be displayed.

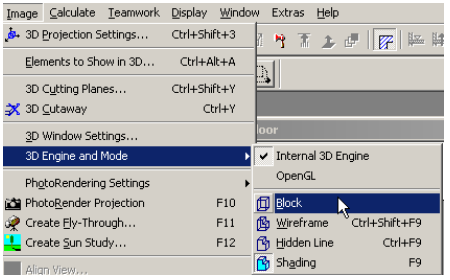
If there is a Marquee selection made in the Floor Plan, the settings of the Elements to Show in 3D dialog box are observed, but the caption of the 3D window includes the Marquee mention and the range of included stories.



See also the Marquee tool's description under Selection in Chapter 5: Drafting and Editing Techniques.

3D Modes

When using the ArchiCAD's internal rendering engine, four 3D viewing modes are offered. They can be chosen from the **3D Window Settings** dialog box in the Image menu or directly as the commands of the **3D Engine and Mode** hierarchical menu, also in the Image menu.



If you choose **Block** mode, the 3D Window will show only the blocked volume of each element without placing any holes into them. Block is the fastest 3D display format

available. It can only be used for information about the placement of the elements in the Project, but it gives you a quick way to check, for example, whether the angle of your view is appropriate.

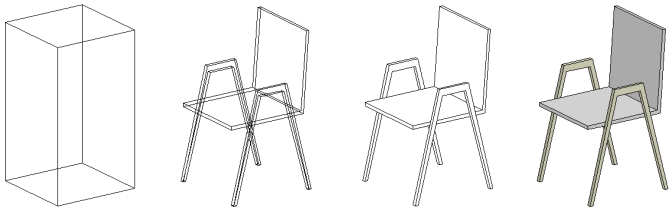
Choosing **Wireframe** mode creates a view showing all the edges and lines of your Project. This shows much more detail than the previous. Note that if you have many elements one behind the other, this type of view can be hard to interpret.

In **Hidden Line** mode, those lines which are blocked from view by solid objects are removed. This type of view is the best choice for easy interpretation, if you do not want a shaded view. It is also suitable for hard copy output on a printer. Hidden Lines can be saved in many file formats, either as 2D or 3D files.

Choosing the **Shading** method causes your 3D model to appear with all of its visible surfaces shaded according to the light direction set in the **3D Projection Settings** dialog box. The colors of the surfaces are determined by the material attributes of the construction elements (regardless of the color of light set in the **Sun** dialog box).

Shading is good for:

- Fast on-screen feedback,
- Easy checking of surface colors, and
- In any presentation for which photorealistic quality is not a requirement.



The same object in Block, Wireframe, Hidden Lines and Shading modes

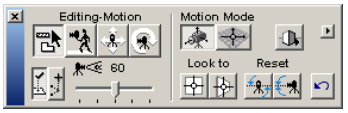
Note: When using the OpenGL engine, only the Wireframe and Shading modes are available.

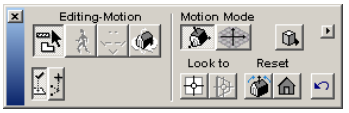
The 3D Navigation Palette

The 3D Navigation Palette is only available when the 3D Window is active. It has tools and controls to:

- change a 3D projection interactively;
- explore 3D spaces in real time (if model size and computer performance allow);
- edit the keyframes of animation paths.

Perspective and Parallel views have specific controls.





The **Projection Mode** switch in the top right part of the Palette toggles between view types, like the similar control button in the **3D Projection Settings** dialog box.

The Editing-Motion controls include:

The **Edit Mode** icon represented by an Arrow-Wall-Slab combination; with this mode on, 3D construction Tools can be used and the elements edited.

- The **Motion Tools** that allow you to move around in the 3D window by changing the 3D projection.

These Tools are different for perspective and axonometric views and are also modified by the Motion Mode chosen (Camera or Locked target). See details below.

The **Undo** button, bottom right, for undoing the last single view change.

Navigation Basics

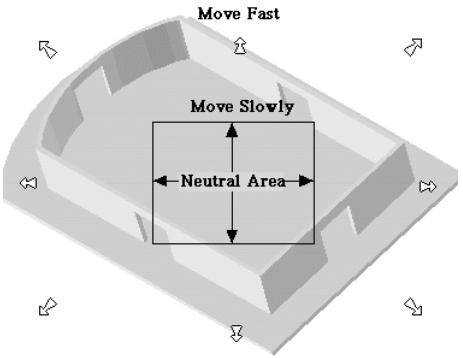
Navigation is controlled by **Motion Tools** and **Motion Modes**. There are different options for perspective and axonometric views. Each combination of Tools and Modes results in a different kind of movement.

Regardless of Tools and Modes, you need to click in the 3D Window to begin moving. Click first in the center of the image. A simplified image of the model will be displayed. ArchiCAD will ignore contours at first, then switch to rough Shading, Wireframe or Block modes. (Smaller models on fast computers produce the best results for movement.)

In the middle of the image, a rectangle will appear. This is the "neutral area".

If you click anywhere between the rectangle and the window border, you will begin moving. Click at the top or bottom for one kind of movement, to the left or right for another, and in the corner areas for a combination of the two.

Click close to the rectangle to move slowly, close to the window's border to move fast. To move at a constant speed, keep the mouse pressed. Drag the pointer around to increase or decrease speed and change directions. For extreme speed, drag the cursor out of the 3D Window as far as your screen size permits.



If there are individually selected elements in the 3D Window when you start navigating, only these elements will be displayed as you move. This feature can be extremely helpful with large projects. It also allows you to analyze one or several elements on their own, without their environment.

When you stop moving, the simplified image will be displayed until you click inside the rectangle (the neutral area) or use any of the **Look To**, **Reset**, **Undo** or **Edit Mode** buttons. Then it will rebuild the image with the current **3D Window Settings**. In Axonometric views, it will also fit the new view of the model to the Window.

With the **Motion Tools**, you can double-click the Zoom controls at the bottom of the 3D Window and use the **Fit in Window**, **Next** and **Previous View** buttons.

Clicking a Tool icon in the **Toolbox** while in **Navigation Mode** will automatically switch you back to **Editing Mode**.

Navigation in Perspective

Navigation in perspective view is defined by the combination of Motion Tools and Modes.

There are three Motion Tools in perspective views.

1) **Walk**
   - Top-Bottom: moves forward and backward horizontally.
   - Left-Right: turns around.
2) **Lateral Move**
   - Top-Bottom: moves up and down.
   - Left-Right: moves laterally to the left or right.
3) **Turn**
   - Top-Bottom: looks or turns up and down. Range is ±90 degrees; cannot turn upside down.
   - Left-Right: turns around.

The two perspective Motion Modes are as follows:

Camera: Keeps the physical distance between camera and target constant.

Target Lock: Keeps the current target at the center of the image. (See also the **Look to** buttons later.)

The following Motion Tool/Mode combinations exist in perspective views (note that the Tool icon changes in the Edit-Motion area according to the Mode chosen):

Walk - Camera: Walk within a building, look around in rooms.

Walk - Target Lock: Move around in external views, move closer and farther away.

Lateral Move - Camera: Go up, down and sideways but keep looking in the same direction (like an elevator or subway ride).

Lateral Move - Target Lock: Go up, down and sideways but keep looking at the same spot of the building.

Turn - Camera: Stand in one place and look in all directions as if in the centerpoint of a globe.

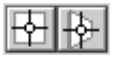
Turn - Target Lock: Move on the surface of a "glass dome" up, down and sideways but keep looking at the center.

Shortcuts and Tricks

With the **Walk** or **Lateral Move Tools**, press Shift to switch temporarily to the opposite Tool.

When using the **Turn Tool**, press Shift and click to the left or right to change the Roll Angle.

Click the **Look to** buttons, then click a surface in the 3D Window to interactively set the target point.



- With the left button, you will actually "face" the clicked surface as the axis of the camera will become perpendicular to it and point to the clicked location. The current distance between camera and target will remain constant.
- With the right button, the clicked point will become the target while your standpoint remains constant.

It is recommended that before using the Target Lock mode, you set a proper target using either these buttons or the **3D Projection Settings** dialog box for reliable movement.

Please note that you can only move the target point to visible surfaces in the 3D Window. To place the target in blank space or into a place hidden inside the building, use the graphic and numeric controls of the **3D Projection Settings** dialog box.

Click the **Reset** buttons to quickly normalize strange views if you get lost.

- The left button will reset the Roll Angle to zero, i.e., to make the horizon horizontal again.
- The right button will bring your viewpoint to the same elevation as that of the target point, i.e., to look in a horizontal direction again, returning to "2-point" or "architectural" perspective.

The **View Cone** sliding switch is the only view control that can also be used in 3D Editing Mode. Drag the sliding switch to change the view from wide-angle to telephoto.

Navigation in Parallel Views

In axonometric views, the number of options is somewhat smaller.

It is **Turn Tool** the only motion tool in Axonometric views. Clicking anywhere will commence rotation.

There are two Motion modes in axonometric views.

Model

- Rotates the model around the Project X, Y and Z axes.
- Top-Bottom: rotation around X.

- Left-Right: rotation around Z. This kind of motion keeps vertical edges vertical. Press Shift to rotate around Y.

Image

- Rotates the model around the Screen X, Y and Z axes.
- Top-Bottom: rotates the model around a horizontal axis. This kind of motion also keeps vertical edges vertical.
- Left-Right: rotates the model around a vertical axis. Press Shift to rotate around an axis which is perpendicular to the screen.

Click the left **Look to** button to "face" the clicked surface as the axis of the camera will become perpendicular to it. This affords undistorted views of roof planes or other skewed element surfaces.

Click one of the **Reset** buttons to quickly normalize strange views if you get lost.

- The left button will make vertical edges vertical again.
- The right button will generate a standard side view, keeping the current azimuth constant.

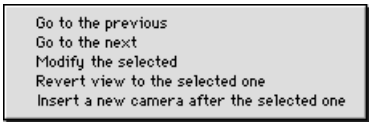
Animation Controls

To fine tune the keyframes of fly-through animations, use the small pop-up button at the top right of the palette.

With no or several cameras selected on the Floor Plan, you get the following menu:

Choosing this single command will place a camera on the Floor Plan that matches your current viewpoint in the 3D Window. If you have cameras on the Floor Plan already that define an animation path, the new camera will be added after the active camera, which is marked by its view cone on the Floor Plan.

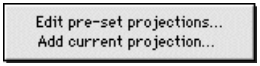
With a single camera selected, you get this menu:



- **Go to the previous:** steps one keyframe back on the animation path and selects the corresponding camera on the plan.
- **Go to the next:** steps one keyframe forward on the animation path and selects the corresponding camera on the plan.
- **Modify the selected:** updates selected camera to match the current projection. Use this when you have changed the view in the 3D Window.
- **Revert view to the selected one:** discards all changes you made manually and shows the 3D model as the selected camera sees it.
- **Insert a new camera after the selected one:** in addition to inserting the new camera, this will also select the new camera on the plan.

See also Cameras in Chapter 4: Element Creation.

In axonometric views, you get this menu:

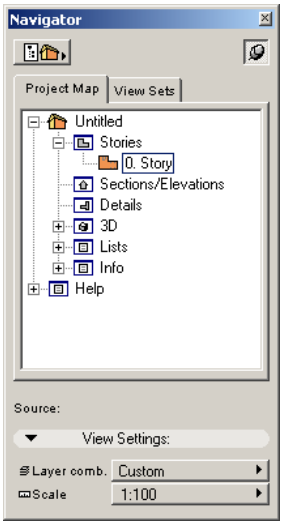


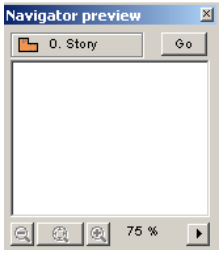
- **Edit pre-set projections**: opens the same dialog box as available from the **3D Projection Settings** dialog box.
- **Add current projection**: saves the current axonometric view in the list of pre-set projections.

Navigator

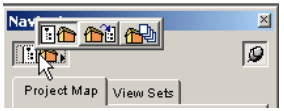
The Navigator feature helps you navigate in the ArchiCAD Project. It also integrates the Publisher function that allows you to create batch output from the project.

The feature includes two palettes: the Navigator palette itself and the Navigator Preview palette. By default, both of them appear on the left edge of the screen.

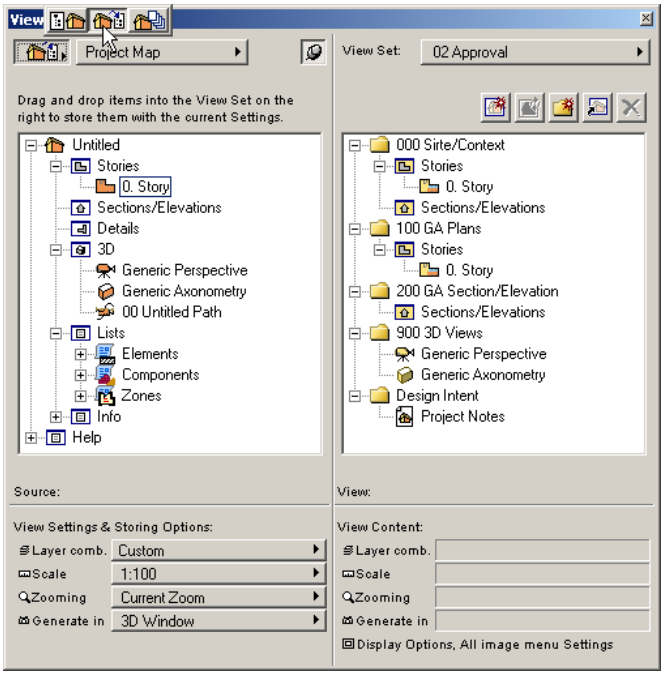




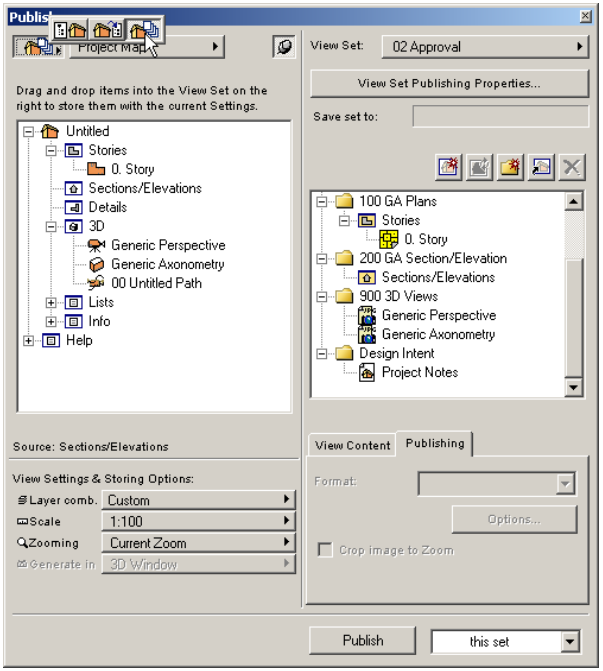
The Navigator palette displays in three possible modes the structure of your Virtual Building. You can change views with the button at top left of the palette.



- In **Navigator** mode, you can view the structure of the project according to a plain Project Map organized into the Stories, Sections/Elevations, Details, 3D views and Lists generated from the Virtual Building file or in a number of customizable View Sets defined for various purposes.
- In **View Editor** mode, you can build and customize View Sets based on the Project Map or another View Set. The View Sets are also the source used when adding ArchiCAD views to a PlotMaker Layout.



- In **Publisher** mode, you define sets of views to print, save or upload to the Internet as described in *Chapter 9: Collaboration and Connectivity*.



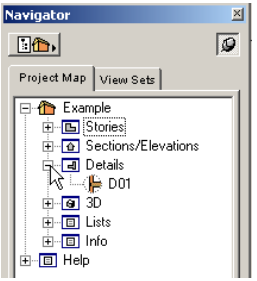
The shape and visibility controls of both palettes are presented in *Chapter 2: The ArchiCAD User Interface.*

Navigator Mode

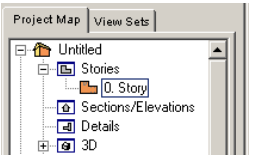
In Navigator mode, the Project Map is shown by default. The Project Map is automatically created in the course of your work. It displays the structure of the project in a hierarchy of folders.

On the top level, next to the house icon, you can see the name of the project. At the same level, a Help folder gives you quick access to the help system and to application and vendor information.

Below, the Stories, Sections/Elevations, Details, 3D, Lists and Info folders store the available views of the project. You can display the contents of each folder by clicking the plus sign in front of it or by double-clicking the item icon or name.



The **Stories** folder contains all the Stories defined for the project. When first starting a project from scratch, it contains a single item (0. Story or 1. Story, depending on the national version of ArchiCAD being used.)

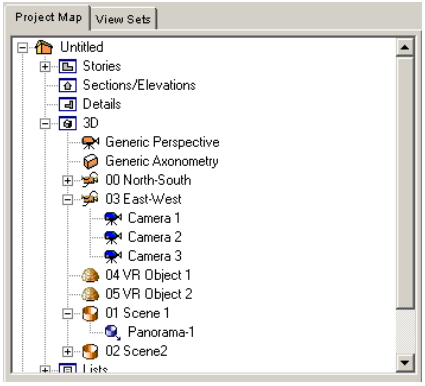


The **Sections/Elevations** and **Details** folders contain the list of corresponding windows. If there is no plus sign in front of either folder, this means that no such view has been defined yet for the project.

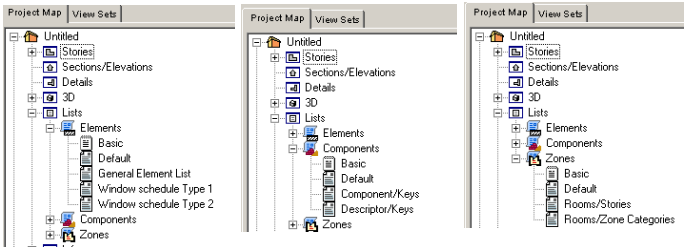
The **3D** folder contains five types of elements for the various projection and camera types. By default, three items are present on starting the project: Generic Perspective, Generic Axonometry and an Untitled Path for perspective type Cameras.

- When you place Cameras in the Project, their names appear under the Path. The Path can be renamed in the Camera Settings dialog box, and more Paths can be added. All these additions and changes are updated in the Project Map.

- Creating a VR Object-type Camera automatically adds its name to the Project Map. All the created VR Object type Cameras are listed one by one.
- Creating a new VR Scene automatically adds its name to the Project Map. Placed panoramic Cameras' names appear below the name of the VR Scene, and more Scenes can be added. All changes are updated in the Project Map.



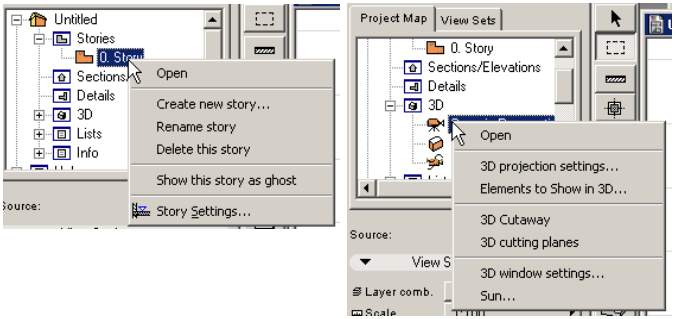
The Lists folder contains three items: Elements, Components and Zones. When opened, all three show the list of predefined list schemes available for the project. All these items also appear in the List Elements/Components/Zones hierarchical menus in the Calculate menu.



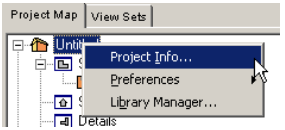
The Info folder contains two items: Project Notes and Report. They represent the corresponding windows also available from the Window menu.

Using the Project Map

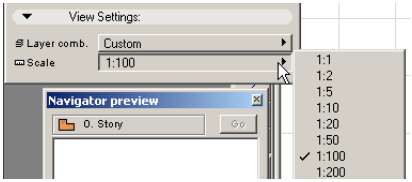
- When you **select** an item in the Project Map, you can see its preview in the **Navigator Preview** palette, if applicable.
- **Double-clicking** an item opens or brings to front the corresponding window.
- **Clicking** an item with the right mouse button (Windows) or with the Cmd key pressed (MacOS), opens a **context menu** with some basic commands that are relevant to the type of the item.



Note: For the house icon representing the Project, the context menu contains general project-related commands.

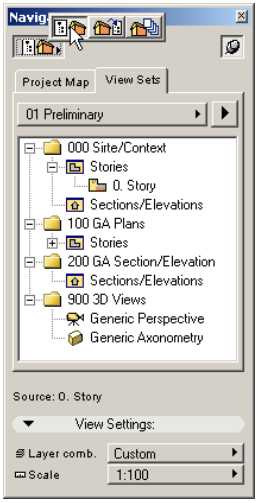


Below the Project Map, the View Settings controls show the current Layer combination and the Scale of the selected view. You can change both with the pop-up menus.



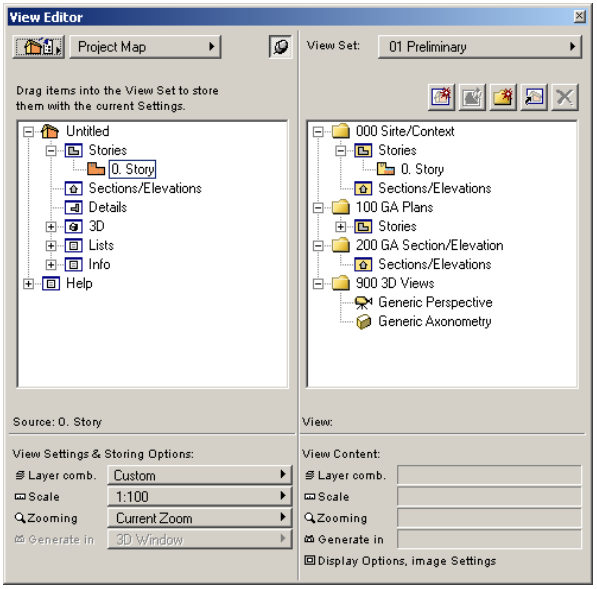
Using View Sets

Clicking the View Sets tab of the palette in Navigator mode gives access to predefined views defined by scale, layering, display options and view type. Accessing views is performed as from the Project Map. Custom views are defined in View Editor Mode detailed below.



View Editor Mode

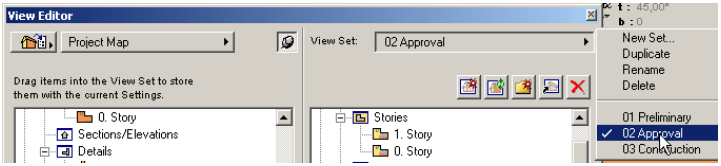
The second mode of the palette allows you to organize both the default views of the Project Map and additional, customized ones into any number of hierarchical groups. For example, all HVAC drawings including plans, sections and details can be arranged into one logical group.



View Set Controls

The View Set definition and management controls are in the top right corner of the View Editor.

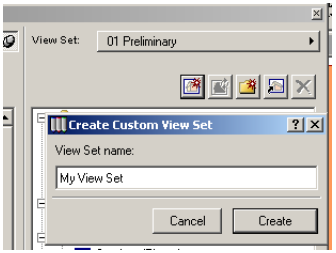
The View Set field shows the name of the active View Set. Clicking it opens a pop-up menu allowing you to manage and choose from currently defined View Sets.



Note: ArchiCAD includes by default three custom view sets (Preliminary, Approval and Construction). You can use these as the starting point for your own view sets, modify, rename or even delete them.

The **Duplicate**, **Rename** and **Delete** commands act on the selected View Set, that is, the one whose name is shown in the View Set field. These operations are not undoable, caution is recommended.

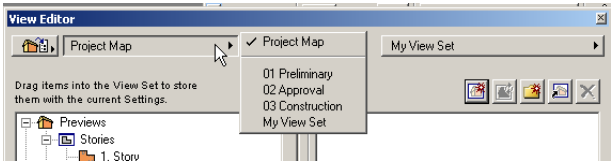
To create a new set from scratch, choose the **New Set** command in the pop-up menu. You will then be prompted to name it.



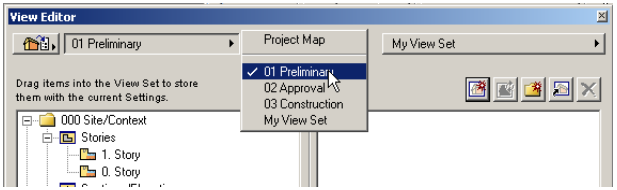
The new, empty Set immediately appears in the list and becomes active. You can then start building up the Set.

You have several options:

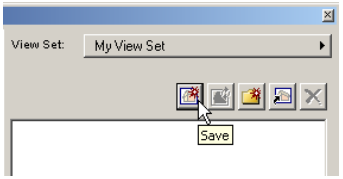
- Activate the Project Map in the pop-up menu on top of the left section of the View Editor and **drag and drop** items in the field on the right. Entire folders or single items can both be added.



- Activate another View Set in the same pop-up menu on the left and drag and drop items from there.



- Use the buttons below the View Set pop-up to build up from scratch a custom hierarchy and save custom views.



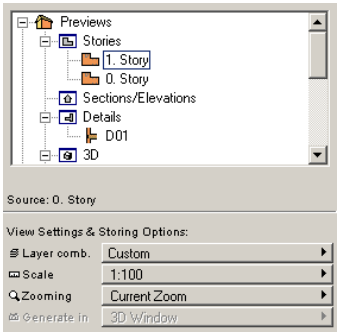
All these options can be combined to create the new set.

Saving Views

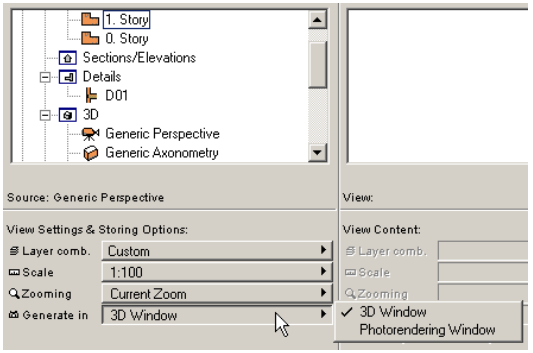
Before including a view in the set, you can set a number of options for it. This is true both for items dragged and dropped from the Project Map or another view set and for those saved directly from the active worksheet window.

If you choose to include in the set a view from the Project Map, select it and look at the bottom of the View Editor palette. Depending on the type of the view, some or all of the options in the View Settings and Storing Options area will become active.

- For Stories (Floor Plan) and other 2D views (Sections/ Elevations and Details), you can choose a Layer Combination and a Scale. You can also decide whether to include the current zoom rectangle in the view, or save it independently of the zooming.

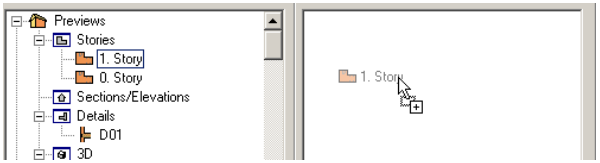


- For 3D views, you can decide whether the view should be generated in the 3D Window or the PhotoRendering window.

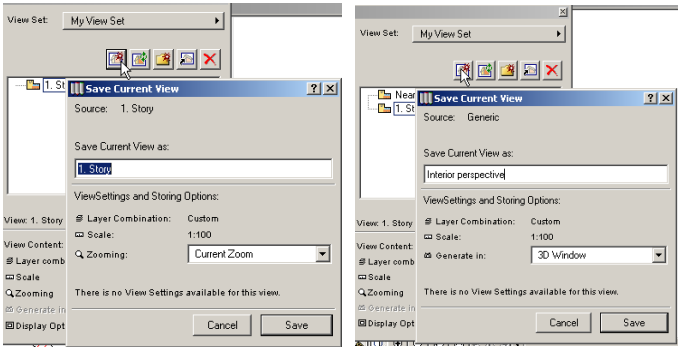


- For Lists, only the Layer Combination control will be applied.

When you have finished setting up the view, simply drag it to the right.



If you wish to save a view directly from the active worksheet window, you first need to set it up and make sure that it is the front window. Then click the Save Current view button below the View Set name. The Save Current View dialog box opens. You can name your new view here.



The Layer Combination and the Scale cannot be modified here, current values will be applied. You can choose to store the zoom level with the view and, for 3D views, the source of the view (3D Window or PhotoRendering).

The current Display Options are always saved with the view.

Redefining Views

At any moment, you can select a view in the list and click the **Redefine** button (second from the left) to change the definition of the selected item, using a dialog box whose content is identical to the Save Current View dialog box. You can also rename the view here.

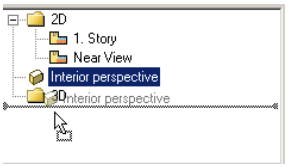
> **Note**: You can rename any of the items of the View Set by clicking in the name field and typing the new name.

Organizing the View Set

View Sets can be organized by folders. You can replicate the structure of the source set (Project Map or another View Set) by dragging entire folders into the editing area of the new View Set and then modifying their contents.

You can also add new folders by clicking the **New folder** button. The New folder immediately appears. Click its name to rename it.

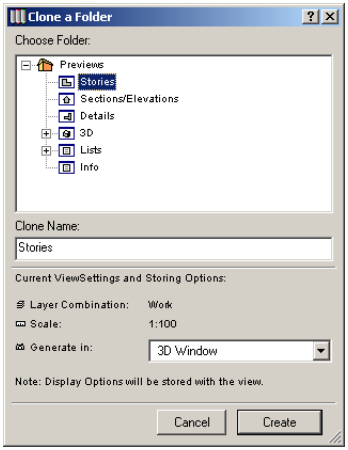
You can define the hierarchy of the new set manually by dragging items into folders, create subfolders and drag items from folder to folder, and so on. New folders are always created at your current location in the hierarchy.



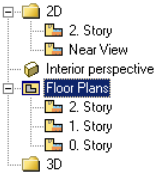
Cloning Folders

You can create an exact duplicate of a folder of the Project Map. This Clone Folder will be automatically updated when the original changes, which means that you will not have to edit its contents manually. A clone of the Stories folder, for example, will always show all Stories of the Project.

Click the **Clone a Folder** button . A dialog box appears, listing the possible folders.



Select a folder (the entire Project, Stories, Section/Elevations, Details, 3D, Lists, Info) and type in the Clone Name in the corresponding field, then click the Create button at bottom left. The new items will immediately appear in the View Set. The icon displayed on the new folder shows that it is a clone, as distinguished from other, manually created folders.



You can move the entire cloned folder inside the hierarchy of the View Set, but you cannot drag new items into it. If you wish to delete an item from a cloned folder, you will be warned that the entire link structure will be removed from the View Set.

You can delete any other view or manually created folder by clicking the last button (X) below the View Set pop-up.

Redefining All Views in a Folder

You can change all views in either a normal or a clone folder by selecting it and clicking the Redefine button to apply the current settings of the Source side. You can then select individual views and fine-tune them.

Note: In View Editor mode, both sides of the palette can be used for navigation to check the contents of the views you are editing.

Navigator Preview Functions

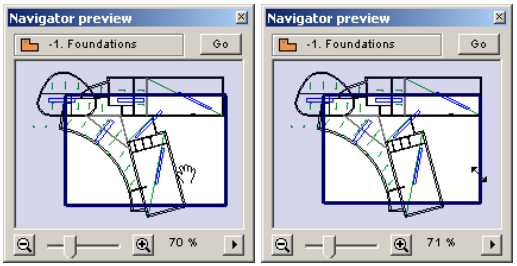
The Navigator Preview palette has three uses:

- It shows a small preview of the view selected in the Navigator palette.
- It can be updated to show the view currently defined in the active window.

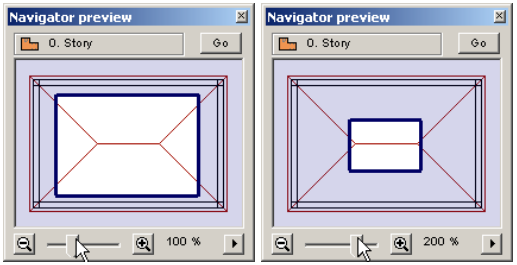
- With zoom and pan operations inside the palette, you can update the view displayed in the active worksheet window.

When previewing a 2D window, you have the following zooming and panning options in the 2D preview:

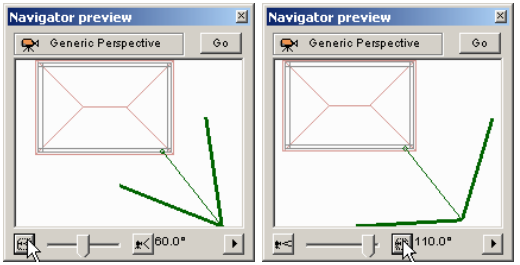
- To change the location of the frame, drag its enclosed area with the **Small Hand** Cursor.
- To change the size of the frame, drag its sides or corners.



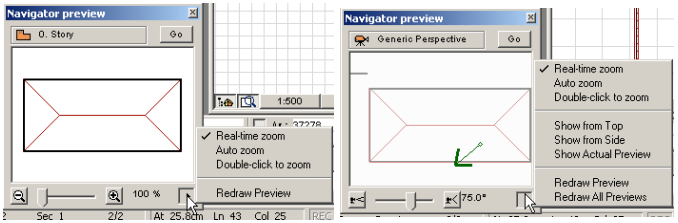
- At the bottom of the palette, the plus and minus buttons and a sliding switch allow you to zoom the current view in and out. Clicking the buttons increases or decreases the zoom level in about 10% increments.



For Perspective 3D views, you can change the view cone, using the sliding switch or the small icons, at its ends in 5 degree increments.



The Navigator Preview palette includes a small arrow icon in the bottom right corner. It opens a menu whose commands control the updating of the preview. Some of the options are available for both 2D and 3D views, but there are specific commands for 3D views only.

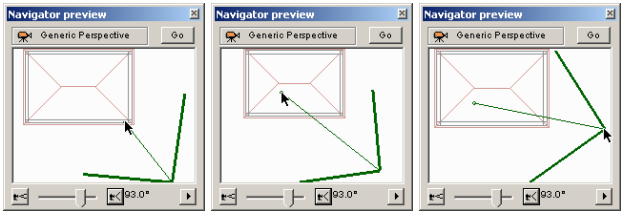


The common features are:

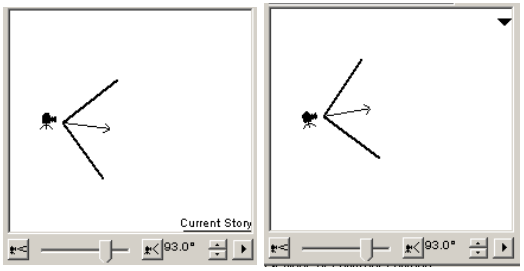
- **Real-time Zoom**: If you choose this option, the zooming and panning operations made in the preview are continuously shown in the worksheet.
- **Auto Zoom**: With this option, the zooming and panning operations made in the preview do not affect the worksheet until you release the mouse button.
- **Double-Click to Zoom**: With this option, the worksheet does not reflect the display changes made in the preview. To update it, you need to either double-click inside the preview or click the **Go** button in the top right corner of the palette.
- **Redraw Preview**: This command updates the preview window when you have edited the contents of the active worksheet.

The other options are only available for 3D views and are different for Perspectives and Parallel Projections (Axonometrics).

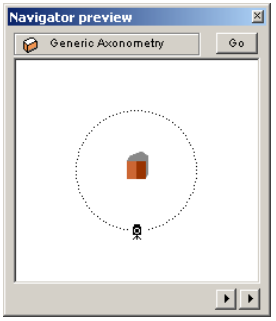
- Choosing **Show from Top** allows you to manipulate a **perspective** camera directly: move it around, fix the target point or the viewpoints.



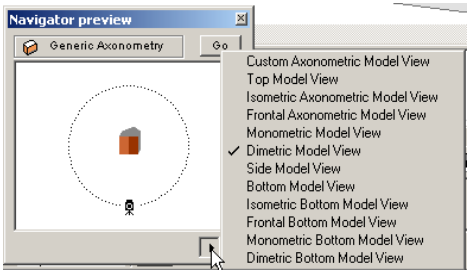
- Choosing **Show from Side** displays only the **perspective** camera and story elevation marks; you can control the vertical position and tilt of the camera by moving it upward. The story signs start to move in the opposite direction, simulating the effect of camera motion on the view. The arrows pointing downwards and upwards indicate the total height of the model.



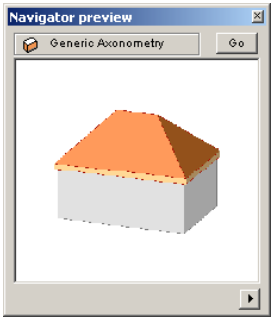
- For axonometric views, only the small house representing the model is displayed when showing the **Top** view. The controls resemble those of the Parallel Projection Settings dialog box.



An additional pop-up menu lists the same view type possibilities as those offered in Parallel Projection Settings.



- Choosing **Show Actual Preview** displays the current content of the 3D Window. In this case, all zooming controls are disabled. To refresh the preview, double-click it or choose **Redraw Preview**.



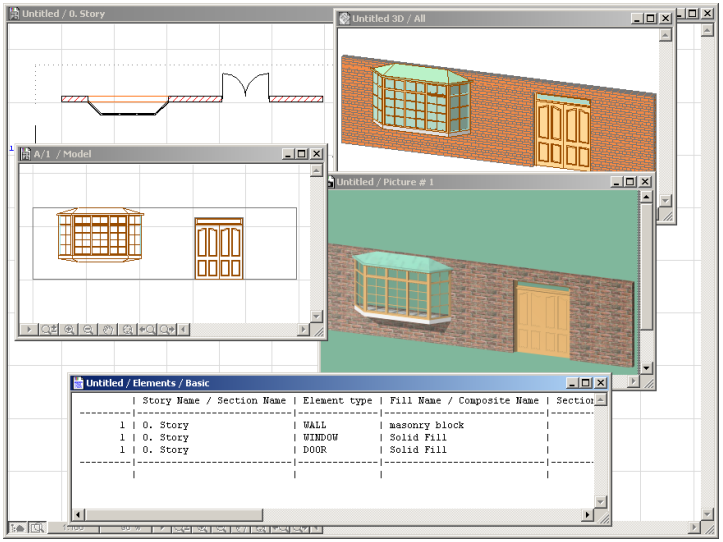
Chapter 4
Element Creation

This chapter concentrates on the creation of ArchiCAD elements of different types. It also covers the tools and settings available for constructing Virtual Building elements.

Introduction

ArchiCAD elements belong to four basic types: construction elements, drawing elements, annotation elements and visualization elements.

Construction elements are the virtual equivalents of actual three-dimensional building components such as Walls, Slabs, Roofs, Doors, Windows, Objects and so on.



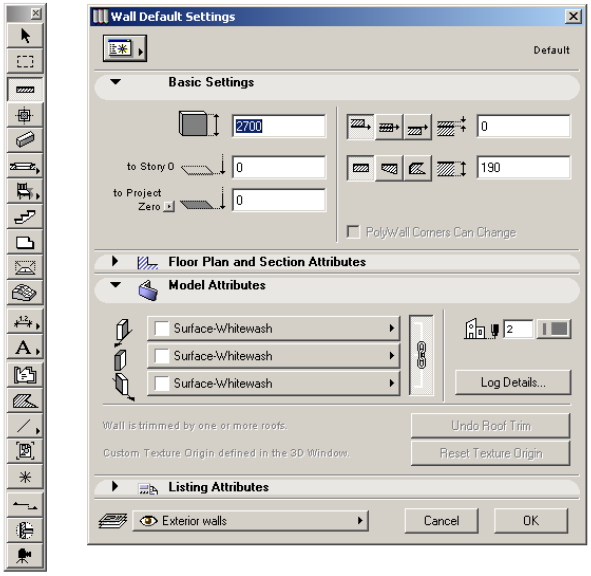
They are displayed as drawing symbols in the **Floor Plan**, as solid building components in the **3D Window** and their cut or elevated view can be projected in **Section/Elevations** windows. Their appearance can be enhanced to simulate realistic effects in **PhotoRendering,** and their properties including descriptions and components can be listed in text windows.

Drawing elements are strictly two-dimensional. They have many uses: they can serve as drawing aids that help you position construction elements, represent larger shapes in 2D views only, enhance details, and so on. With the exception of **Fills**, they do not appear in list views.

Annotation elements are associative Dimensions, Text blocks and smart Labels. Dimensions and Labels display numeric or textual data in 2D views either about the elements they refer to or as standalone informative elements. A special case is **Zones**, which also carry 3D information.

Visualization elements indicate the location and direction of special views of the project on the **Floor Plan.** They include **Section** and **Detail** markers as well as different **Camera** types and their paths.

The **Toolbox** plays the key role in the creation of all these types of elements. Its icons represent different element types; you can always create new elements belonging to the type represented by the active **Toolbox** icon. Double-clicking an icon opens a settings dialog box containing a large number of options for the given element type.



Using Construction Tools

You can create the following types of elements in both the **Floor Plan** worksheet and the **3D Window**: **Walls**, **Columns**, **Beams**, **Slabs**, **Roofs** and **Meshes**.

The creation, display and behavior of the elements obeys some common rules, but the specifics will be discussed in the sections dedicated to the different element types.

Creation Steps

The typical steps in creating construction element are the following:

1) Select the corresponding tool in the Toolbox and open its settings dialog box by double-clicking the tool's icon. (If the desired tool is active, you can also use the Info Box to reach its most important settings and open the settings dialog box by single-clicking the tool's icon.)
2) Adjust the settings offered by default to suit your particular situation or purpose, or click the Favorites button on top of the dialog box to select a predefined element configuration. Click OK to confirm the settings.
3) Choose a Geometry Method in the Info Box allowing you to create plain, curved, chained, rotated or polygonal variations of the elements, where applicable.
4) In the Floor Plan or 3D Window, define the location, the length or the shape of the construction element. In 3D, you can graphically override the height value typed in the settings dialog box.

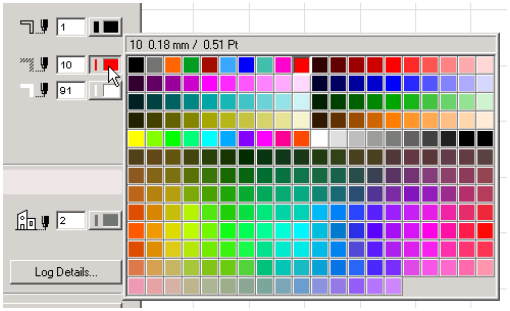
Element Display

The Floor Plan, Section/Elevation and 3D display of construction elements depends on the attribute choices made for them in their dialog boxes. Attribute sets are managed by a number of commands in the Options menu. For faster display or output, the 2D appearance of some of the attributes can be optionally modified in the Display Options dialog box opened from the Options menu.

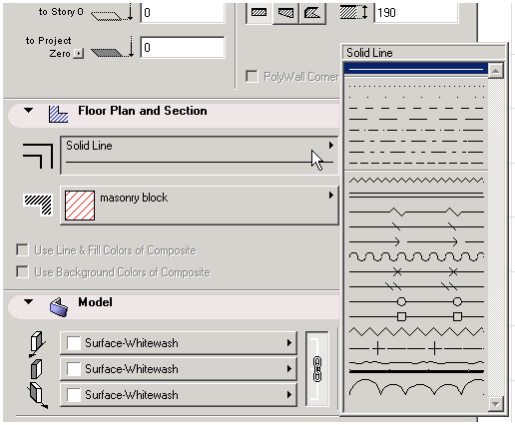
You can change the attribute settings of the elements by clicking the pop-up controls in the appropriate panels of the element settings boxes and dragging the cursor to your new choice.

Attributes include:

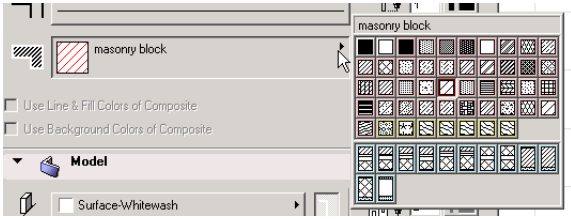
- **Pen Colors** for the color and line width of the elements' outlines and fill patterns.



- **Line Types** for the outline of the elements in the Floor Plan and the Section/Elevation windows. All Line types are available for any of the elements. Note that Line types can be scale-dependent, which means that their display may change according to the active window's scale factor.

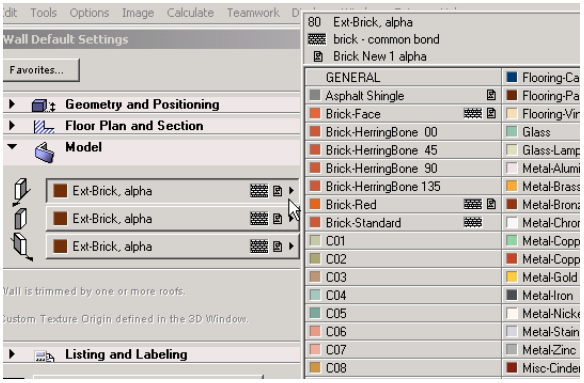


- **Fill Types** for the hatches of the Wall bodies and Columns in the Floor Plan and the cut surfaces of all construction element types in the Section/Elevation windows. The availability of fill patterns for construction elements is a general setting made in the Fill Types dialog box. Whether Construction Fills appear as bitmap patterns or vectorial hatches depends on the general setting made in Display Options. Note that vectorial Fill Types can be scale-dependent, which means that their display may change according to the active window's scale factor.



Fill Types can also be applied in the 3D Window as part of the Material definitions in the form of 3D Hatchings. This definition has no relation with the 2D Fill Type definition of the element, and all simple Fill Types are available.

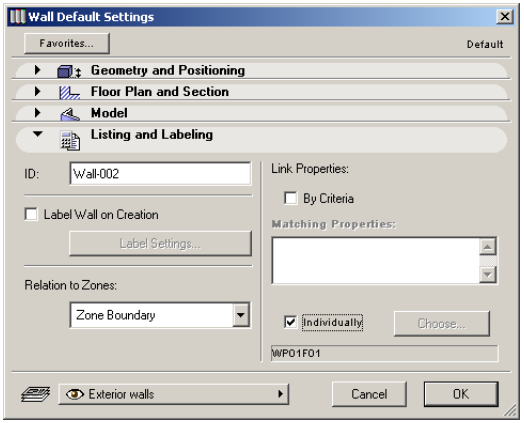
- **Composites** are complex structures including several predefined Fill Types. Only Walls, Slabs and Roofs can use Composites. The availability of each Composite is set individually for these three element types in the Composite Settings. Their display obeys the same rules as simple Fill Types.
- **Materials** provide the look and feel of construction element surfaces in both 3D and PhotoRendering. All Materials are available for any of the elements. Material definitions can be quite complex, including a Color, a bitmap Texture and a simple Fill Type in the form of a 3D Hatching, as well as Reflection, Transparency and Emission values.



Element Identification, Listing and Labeling

The last panel of the settings dialog box of all construction element-type tools is called **Listing and Labeling** and controls the handling of the elements in calculations.

> **Note**: The Fill and Zone tools also include this panel, as the elements they create can also be listed in calculations.



The **ID** field serves to identify and group elements in list views. The text string within this field cannot exceed 15 characters. Any character can be used.

If a number is included anywhere in the 15 characters, drawing successive elements will add one to this number for each new element, provided that the **Auto ID Increase** checkbox is enabled in the **Options/Preferences/ Miscellaneous** dialog box. Each new element will have a unique ID.

- If elements are duplicated or multiplied, the IDs of the replicas will remain the same as those of the originals.
- If you paste elements into a Project, you may have elements with conflicting IDs. ArchiCAD does not automatically exclude ID conflicts. It is up to the user to designate different IDs for elements that may be in conflict.
- IDs can be customized both before creating elements and after selecting a number of existing ones, by using the **Element ID Manager...** command in the **Calculate** menu. *See Chapter 10: Project Data Calculation.*

  Note: All construction elements also have a unique, automatically generated, internal ID which is conserved throughout the life of the Project. You can also use this identifier for labeling or in lists.

Checking the **Label Walls** (Columns, Beams, etc.) box allows you to automatically generate Labels next to the new elements. The **Label Settings...** button then becomes active and you can adjust them directly from here, without having to exit the settings dialog box. *See the Labels' description later for details about labeling.*

The **Link Properties** section allows you to link a Property Object to the element for calculations. *See Chapter 10: Project Data Calculation and the More Information section of Chapter 10: Project Data Calculation in ArchiCAD Help.*

Walls

Definition

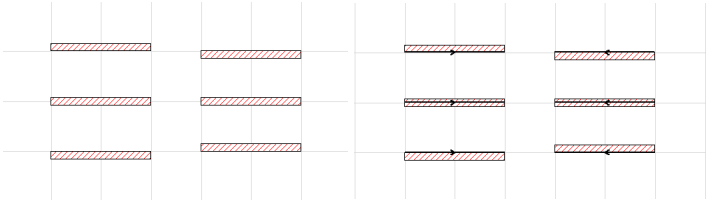
The **Wall** is a fundamental element in the practice of architecture. When you create a Wall in ArchiCAD, you create the outline and hatching of a Wall in 2D and a solid Wall body in 3D.

Walls can be straight, curved, trapezoidal and polygonal. The steps for creating each type are detailed later in this section.

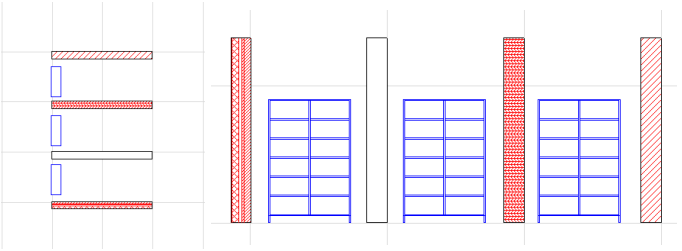
Each Wall possesses a reference line and a direction. It serves the precise connection of Walls for clean intersections. It also establishes hotspots and edges for selecting, moving and transforming Walls.

The reference line is a heavy black line that always appears when drawing the Wall. Depending on the chosen Construction Method, the wall body protrudes on either or both sides of the reference line. The direction of the wall is defined by the order in which you define the wall's endpoints.

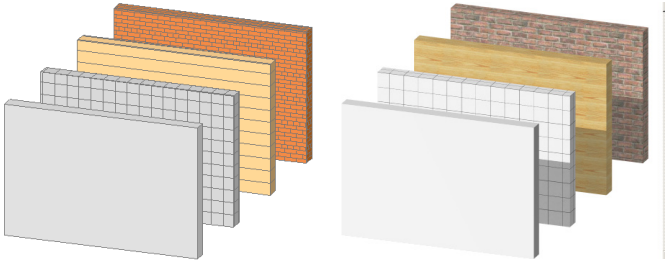
The reference line (including the arrow that shows the Wall's direction) is only visible on the **Floor Plan**, provided that the **Clean Wall & Beam Intersections** feature is switched off. Otherwise, all Walls look alike in this respect.



The hatching inside the Wall body shows the **Fill pattern** chosen to represent it in on the Floor Plan and in Sections. Multiple hatches represent **Composite Structures**.



In 3D views and PhotoRendering, the look of the wall's surfaces is provided by the **Materials** assigned to them.



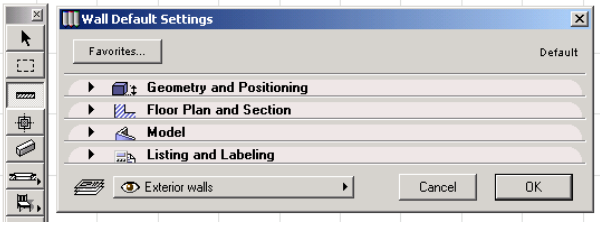
Note that the display of the Wall depends on the current settings in **Options/Display Options**.

- Clean Wall intersections can be set on and off.
- It is possible to show only the reference lines of walls without the contour lines.
- Fill patterns can be shown as uniform, bitmaps or vectorial lines.

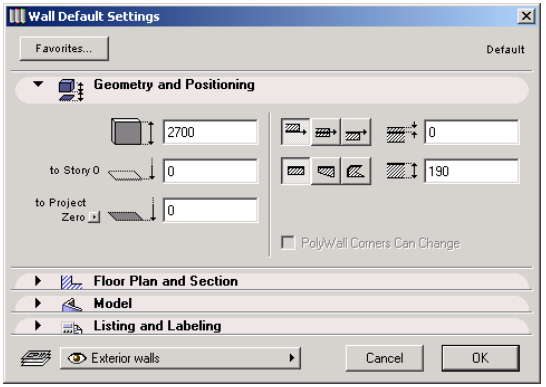
See also the interaction between Wall type elements and other elements at the end of this section.

Wall Tool and Settings

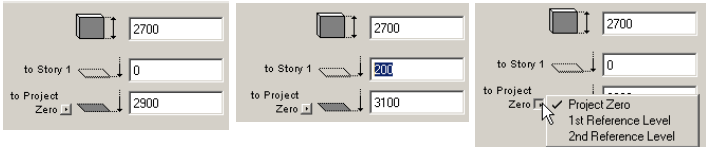
The **Wall** tool is located near the top of the Toolbox, preceded only by the two selection tools. Its settings dialog box contains four panels: **Geometry and Positioning**, **Floor Plan and Section**, **Model** and **Listing and Labeling**. At the bottom of the dialog box, as for all tools, the current layer choice is displayed in a pop-up menu.



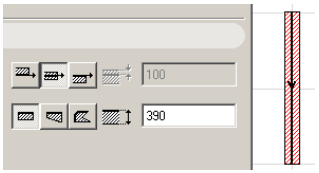
The **Geometry and Positioning** settings include the Wall's height and elevation, the position and offset of the Wall's reference line, the basic type of the Wall (simple, trapezoidal, polygonal), and the total thickness of the Wall.



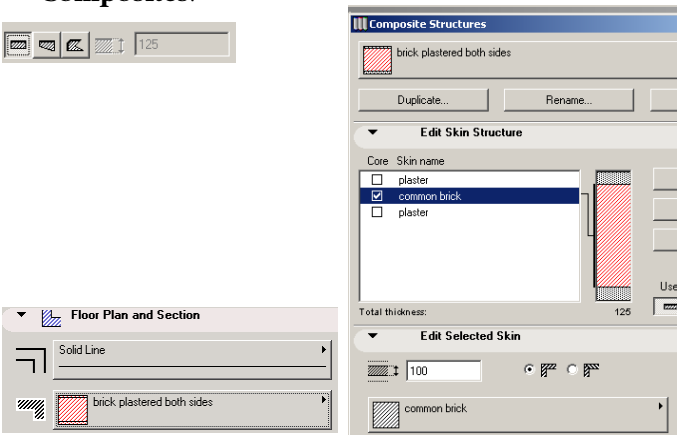
- The elevation values are interdependent. One value is measured from the level of the current story and the other from either the project's zero level or a special reference plane defined in **Options/Preferences**.



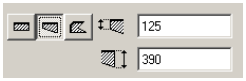
- Walls with an offset can be used to trace the outline of a Slab with one of the internal contours of composite Wall skins. An offset can also help keep the reference line at either the center or border of a wall structure skin.
- When drawing an axial wall, that is, when the reference line is right in the middle of the wall's body, the offset value is grayed out.



- Since the reference line is always parallel to one of the wall's edges, the axial wall method is not available for trapezoidal walls.
- If you have chosen a composite structure for the wall in the **Floor Plan and Section** settings, you cannot edit the thickness of plain walls, as the value is dependent on the added value of the individual skins as set in **Options/ Composites**.



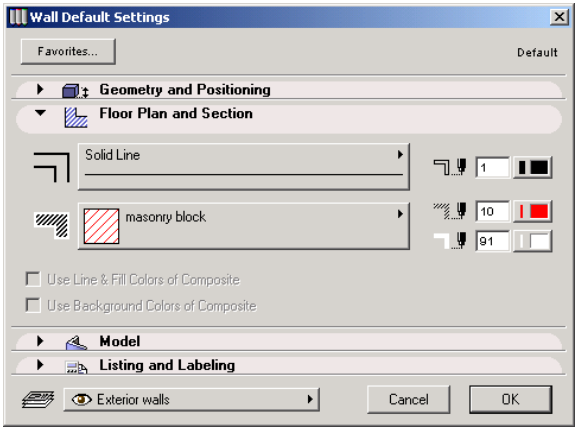
- The thickness of trapezoidal walls changes continuously along their length. You define here the thickness value of the two endpoints. When using a composite structure for a trapezoidal wall, neither of the two endpoint thickness values can be set to less than the default setting made in **Options/Composites**. The thickness variation will be applied to the innermost core skin of the composite.



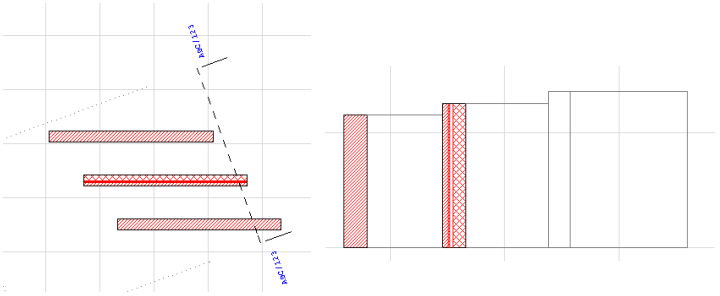
- Thickness does not apply to polygonal walls, the field cannot be edited.

- The **PolyWall Corners Can Change** checkbox is only active when drawing a Polygonal Wall. It controls the display of wall contours when connecting such a wall to other, plain walls. *See details later.*

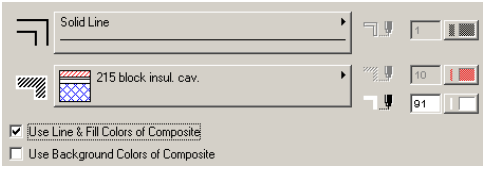
The second panel controls the **Floor Plan and Section** attributes of the Wall.



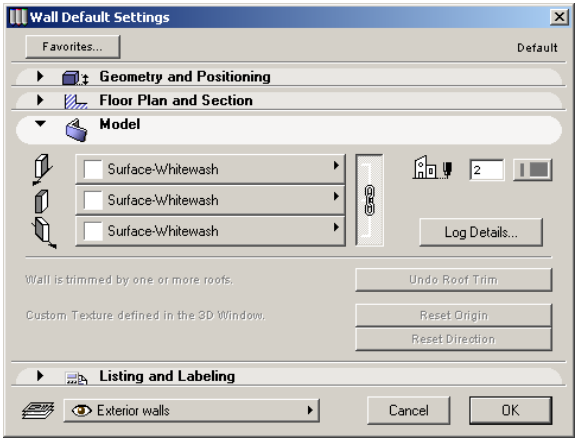
These settings affect the outlines and hatching of all Walls on the **Floor Plan** and of cut Walls in **Section/Elevation** windows. Uncut Wall edges do not display the hatching in Section/Elevation views, and their contour lines are displayed as set in the Model panel.



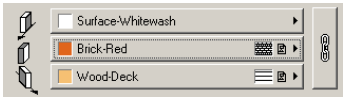
- Polygonal walls cannot have composite structures, only plain fill patterns.
- You can choose different colors for the wall body hatch and its background. In the case of composites, you can either use the composite structure's own line, fill color and background color definition or override it with manual choices. The corresponding controls are consequently disabled.

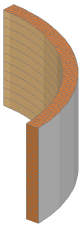


The third panel is called **Model** and controls the 3D display of the wall.



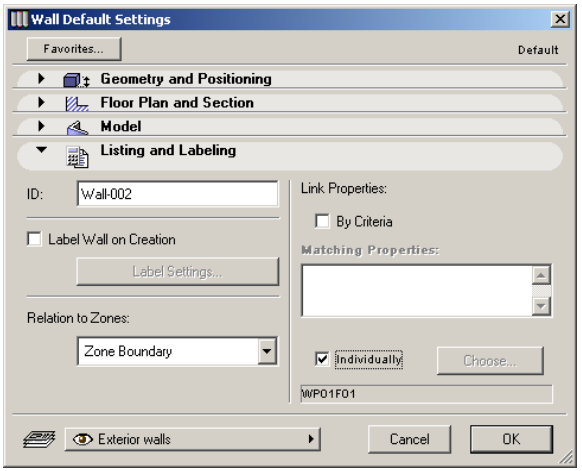
The most important control of this panel concerns the surfaces of the wall's two sides and all four edges. Clicking the chain icon will assign the last material chosen to all surfaces. Deselecting the chain icon will restore the materials that you originally set for each separate wall surface.





- The **Log Details...** button opens a dialog box for defining the display of walls constructed from logs. *See the Log Walls section for detailed explanation.*
- The **Undo Roof Trim...** button is never active when drawing new Walls. It serves to restore the original height of selected Walls trimmed to Roofs. *See the Roof section for details.*
- The **Reset Texture** buttons are never active when drawing new Walls. They serve to restore the origin and direction of the Texture if it was modified in the **3D Window**. *See Aligning Textures in 3D in Chapter 5: Drafting and Editing Techniques.*

The fourth panel is called **Listing and Labeling** and controls the handling of the Wall in calculations.



Most of the controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

The **Relation to Zones** pop-up defines whether the new Wall is a Zone delimiter, an element to subtract from the Zone's area or to be ignored when calculating Zones. *See the Zones' description for more details.*

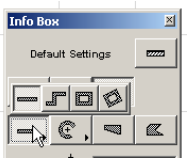
Drawing Walls

When you are satisfied with the choices you made in the **Wall Settings** dialog box, you can start drawing Walls. New Walls can be created in either the Floor Plan or the 3D Window.

Geometry

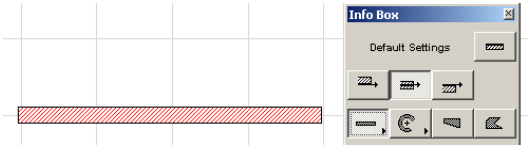
There are ten Geometry Methods available for drawing simple and special Wall configurations. They can be activated by

choosing the appropriate option in the **Info Box** before initiating the creation of the wall. You can also switch methods on the fly after you have already started drawing a Wall.



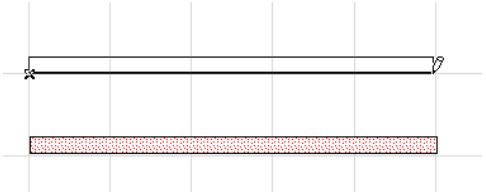
Drawing a Straight Wall Segment

The *Single Wall* method produces one straight wall element at a time.



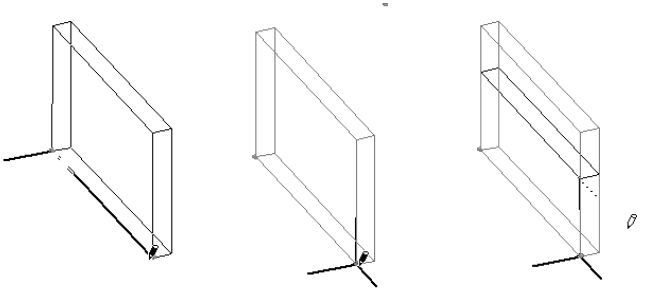
In the Floor Plan, you define the location of Wall segments, that is, their length, by clicking at their endpoints.

The moment you start drawing the Wall, a ghost contour appears and it follows the cursor until you click at the second endpoint.



In 3D view, in addition to defining the length of the wall, you can also graphically override the height value typed in the Wall Settings dialog box.

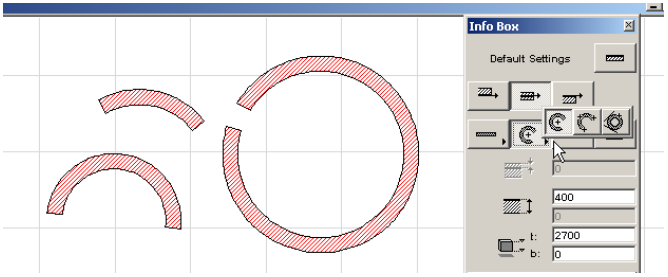
As on the Floor Plan, a ghost contour of the Wall follows the cursor showing the originally set height.



- To accept the original height of the Wall, double-click at the second endpoint.
- To override the height setting, move the Pencil cursor up or down along the vertical line projected from the second endpoint and click at the desired height.
- Hitting the Enter key validates the height of the Wall at the current location of the cursor.

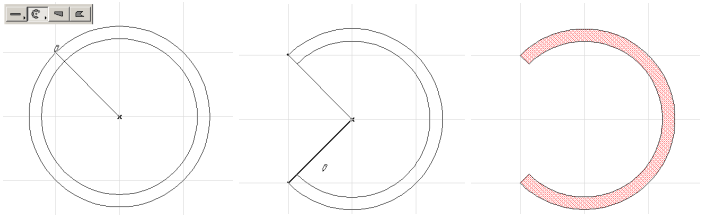
Drawing a Curved Wall

The Wall Geometry Methods available in the Info Box provide three different options for drawing *Curved Walls* in circular arc shapes. They differ in the basic points they define.

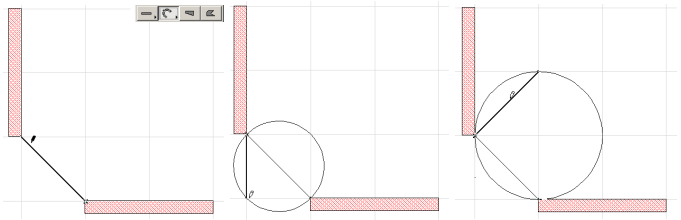


- The first option defines the curved wall by the arc's or circle's **centerpoint** and **radius**. Your first click defines the centerpoint. A ghost contour of the circular wall

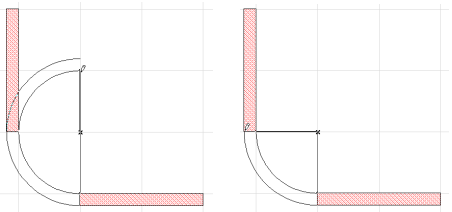
follows your cursor until you click a second to time to define the radius. After that, only a partial ghost curved segment is shown, until you click a third time to define the length of the arc wall's circumference. If you need a full circular wall, double-click when defining its radius. When all three points are defined, the ghost contour is replaced by the fully displayed wall contours and hatches.



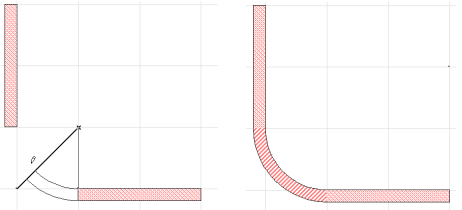
- The second option defines the curved wall by three points on the arc's **circumference**. The first two clicks define two points that you will probably locate on points connecting other elements, grid intersections or special snap points. After that, a ghost circle follows the cursor until you click a third time to define the third point.



A fourth click is needed to define the length of the arc segment. Double-click the third point to define a full circular wall. Note that the second and the third points do not need to be actually part of the arc wall.



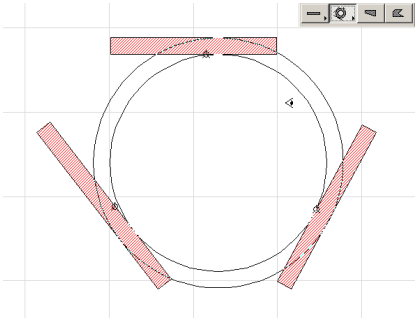
When the arc length is defined, the ghost arc is replaced by the fully displayed wall contours and hatches.



- The third option only defines full circular shapes based on three **tangential edges** or points. In this process, you select three initial points: these can be a tangent edge (indicated by the Mercedes cursor), a node (indicated by the Checkmark cursor), or a free-floating point (indicated by the Crosshair cursor.) An endpoint cannot qualify as a tangent edge when using this method, so a maximum of two endpoints are allowed. If more than two are selected, the process will revert to the first method described above. Only linear tangency is allowed: all tangent points must be on the straight edges of Slabs, Lines, Walls, etc. If you click a radial edge with the Mercedes cursor, the resulting Circle will pass through that point rather than being a tangent to the curve.

  The next step depends on the geometric situation.

- If there is only one solution, the circular Wall is automatically drawn.
- If there are two or four solutions, the Eyeball cursor appears and the ghost contour of the Wall flips from one position to the other as you move the cursor around. Click when it is at the right place to complete the circular wall.



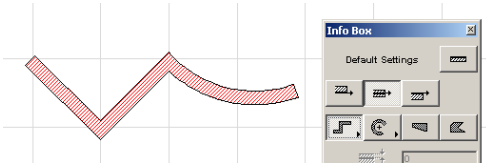
- If there is no solution, (for example, if you define three parallel edges for tangency), no circle will be made.

Notes: Since Walls need to have two endpoints, the fully closed circular Wall that you draw will in fact consist of two half-circles.
Walls in the forms of full ellipses, elliptic arcs or splines cannot be created directly, but you can trace the shapes of plain drawing elements with the Magic Wand. *See description later.*

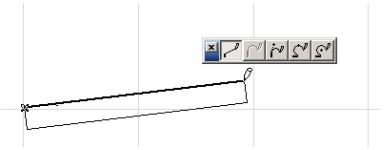
Drawing a Chain of Walls

The *PolyWall* method produces a sequence of connected straight or curved wall elements with automatically coincident reference line endpoints that will share the same characteristics.

In the Info Box, choose the Geometry Method that represents a chain of Walls.

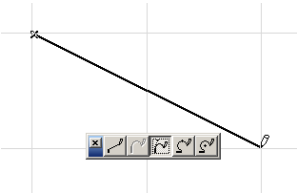


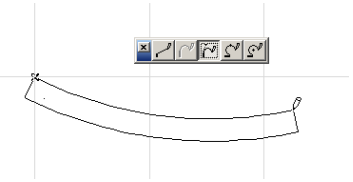
As soon as you start drawing the first Wall, a pet palette appears, offering you geometry options for drawing a straight or a curved segment.



The options are:

- A straight wall segment;
- A curved segment tangential to the previous one (cannot be used for the first wall segment);
- A curved segment tangential to a line you define before actually drawing the segment;





- A curved segment passing through two points;
- A curved segment defined by its centerpoint, radius and length.

Place the cursor on the option that suits you best and define the endpoint of the first segment using the methods described above for single Wall segments. This endpoint automatically becomes the starting point of the next Wall segment. When you want to finish drawing Wall chain segments, double-click the endpoint of the last segment.

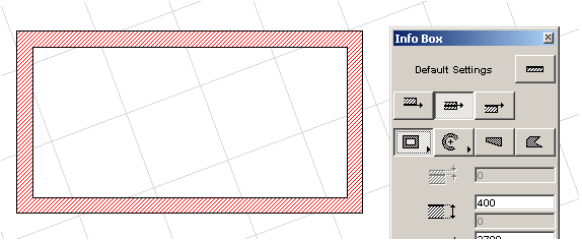
Throughout the process, a ghost contour of the Wall segments is shown. The full Walls are only displayed when you are finished.

- Clicking the Cancel button in the Control Box or hitting the Delete key at any time during drafting will abort the process, and no elements will be created.
- Choosing the Undo command in the Edit menu will remove the entire new chain of Walls, not just the last segment.

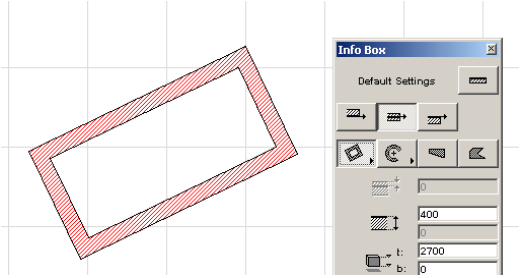
- Hitting the Backspace key allows you to undo the previous segment and continue the creation of the Wall chain.
- If you change the Wall's attributes in the Info Box during the creation process, all created Wall segments will have the modified attributes (reference line position, line type, fill color, material, etc.).
- If necessary, you can switch methods on the fly in the pet palette.
- If the Autogroup function (Tools menu) is switched on, the chained Wall segments will be created as part of a group.

Drawing a Rectangle of Walls

The *Rectangle Wall* method produces four Wall elements with coincident nodes by defining the diagonal line of a rectangle. Its four sides are always aligned orthogonally with the Normal Grid and are not affected by the use of a Skewed Grid.

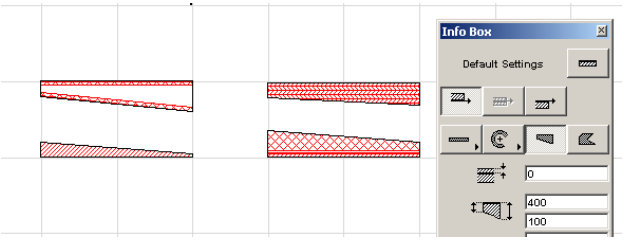


The *Rotated Rectangle Wall* method produces four wall elements as with the previous method, except that you first define a rotation vector for the rectangle's base reference line.



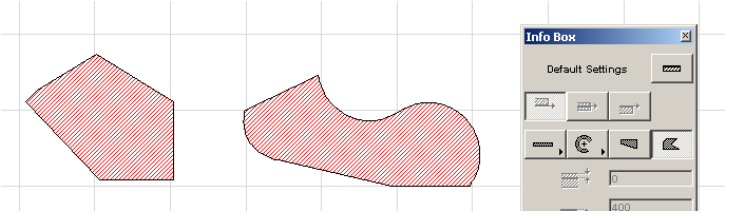
Drawing a Trapezoid Wall

The *Trapezoid* or Non-Parallel method allows you to draw straight Walls whose thickness is not constant. You draw this type of Wall as a straight Wall, except that you will first enter the thickness of the Wall at its two endpoints.

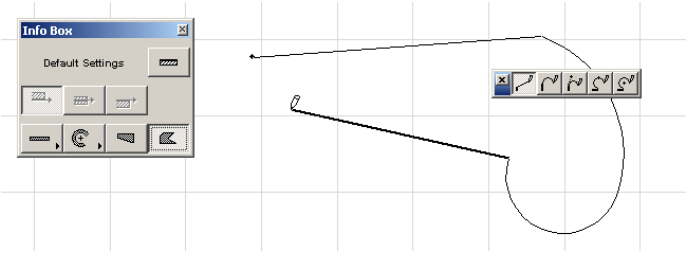


Drawing a Wall Polygon

To define a polygonal wall block of free shape, choose the *Wall Polygon* Geometry Method in the Info Box or the Wall Settings dialog box. Note that this type of Wall cannot contain Doors or Windows and that only simple fills are allowed for their structure. The definition of the contour of the Wall Polygon is quite similar to the PolyWall method. Both straight and curved edges are allowed.



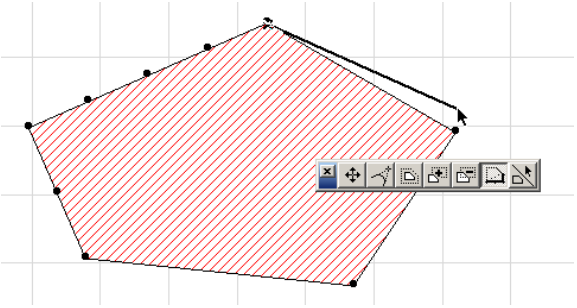
The edges of the polygon are defined the same way as for the chain of Walls described above. Wall Polygons must have at least four sides.



- If you define a polygon whose edges intersect themselves, ArchiCAD will warn you about this, but it will still be drawn.
- You cannot place any doors or windows into them;
- They cannot have composite structures.

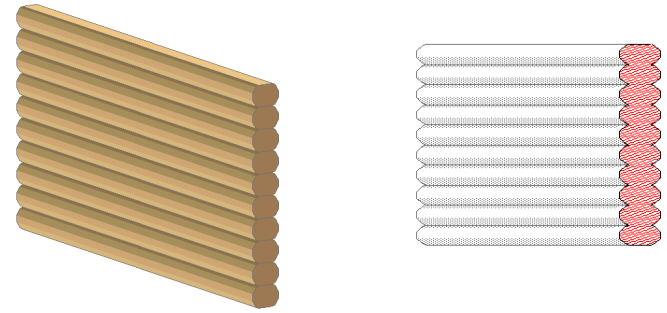
When completed, the polygon edges will be divided into groups of reference line edges and plain edges, separated by "real" edges. Materials will be assigned accordingly.

To edit polygonal Walls, click the nodes and edges or the selected Walls and use the pet palette. At the endpoints of the reference edge range, the pet palette will contain a special icon that lets you redefine this range by moving the range endpoints to other nodes of the Wall polygon.

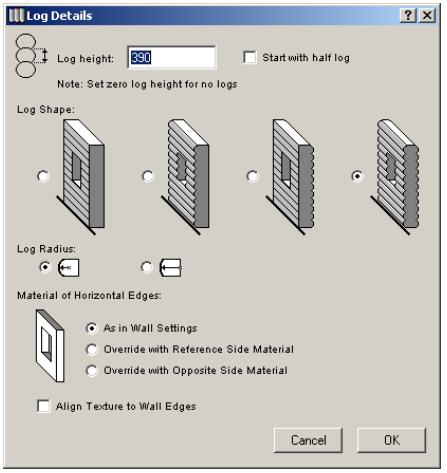


Drawing a Log Wall

You can create straight walls constructed from logs. Log details appear in both the 3D Window and Section/Elevation Windows.



Clicking the **Log Details...** button in the Model Attributes section of the **Wall Settings** dialog box opens a dialog box with a number of geometry and texture options.



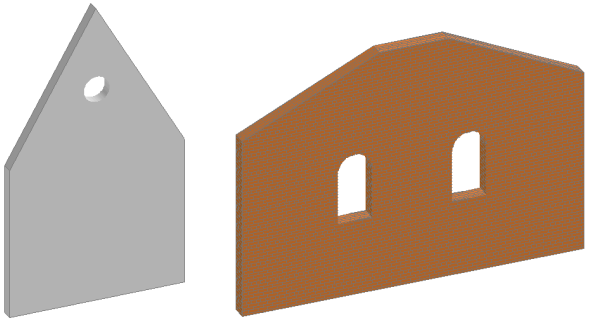
- **Log Height**: In this edit field, you can enter the height of a log. If the value is 0, no logs will be displayed.
- **Start with half log**: If this checkbox is active, the wall will start with a half-height log at the bottom.
- **Log Shape**: You can choose from four shapes by clicking the radio buttons.

- **Log Radius**: You can choose from two options by clicking the radio buttons - the wall can be built from round logs or from slightly chamfered square logs.
- **Material of Horizontal Edges**: You can choose from three options by clicking the radio buttons.
- **Align Texture to Wall Edges**: By enabling this checkbox, wall texture mapping will be aligned to the wall in order to avoid having a fragmented log texture.

  Notes: Log construction is only available for simple straight walls.
  When determining the log's height, remember that if you enter a value that is larger than the wall's width parameter, the logs will not rest on each other.

Drawing a Gable Wall

When you need walls to fit a Roof or you want Walls with cutoff corners, you can obtain them by cutting regular Rectangular Walls with appropriate roof pitches as shown below. *The full procedure is described under Roofs.*

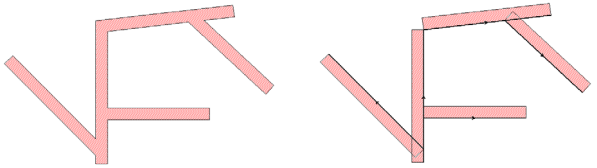


Wall Intersections in 2D

Clean Wall intersections can only be created between walls that are correctly joined. The reference line is the focal point when you join walls, and the reference lines of the walls to be joined must fit precisely. Simple **X** crossings of these lines are not enough: your lines should either join by their endpoints or create precise **T** or **L** junctions.

When drawing a new Wall or stretching an existing one by its endpoint, it is sufficient to click any edge or inside the hatching of the target Wall. The reference line of the new (or edited) Wall will be adjusted for proper connection. This construction aid is not effective with other editing operations.

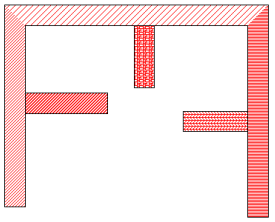
When you are faced with a complex joining situation, it may help to switch **Off Clean Wall & Beam Intersections** in the **Options** menu. With **Clean Wall Intersections Off**, the reference lines will be clearly visible, helping you to construct your walls precisely.



Note: Wall intersections are effective even if some of the intersecting elements are on currently hidden Layers.

Connection of Walls with Different Fill Patterns

If different walls are connected, in the case of L intersections, the wall patterns will be separated by the diagonal of the intersection *(see figure below)*. In the case of T intersections, the outline of the running wall will remain continuous.

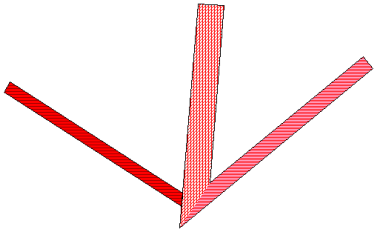


If you need a more elaborate drawing detail at wall intersections, you can create a patch or a detail drawing. You

can also retouch the drawing in PlotMaker before plotting or printing.

Priorities at Triple Wall Connections

Triple wall connections are based on priorities, and generated in two steps. First, the two thickest walls are connected. Second, the third wall will be fitted to the above two. If all walls are of identical thickness, Composite Walls will be prioritized over homogeneous ones.



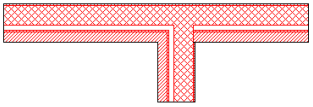
If a triple intersection does not look as you expect, move a wall endpoint by a very small distance away so that you get two double intersections instead of a triple.

Intersections of Walls with a Vertical Displacement

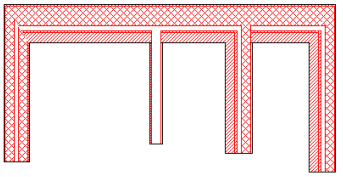
If two walls are connected by their horizontal position but do not connect vertically or just touch each other, they will not intersect in either the Floor Plan or in 3D.

Smart Connection of Composite Walls

Connecting walls are automatically matched and the fill compositions are analyzed. The connection is set up accordingly.



Corner (L) joints of Composite Walls with wall skins of identical Fill Patterns are automatically cleaned even if the layers of identical Fill Patterns have a different thickness value.

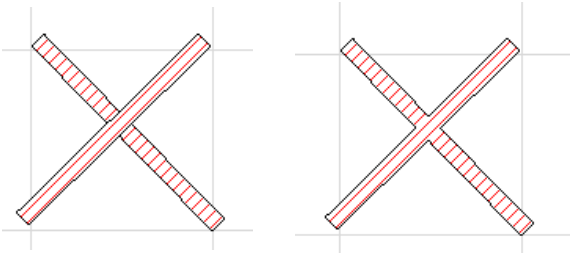


The core skins of Composite Walls are never cut through by other skins.

Creating Intersections from Wall Crossings

To transform a wall crossing into a proper intersection:

1) Draw two walls that cross each other.
2) Select one of the walls.
3) With the Wall tool active, Ctrl-click (Windows) or Cmd-click (MacOS) the reference line of the other wall. The selected wall will be split



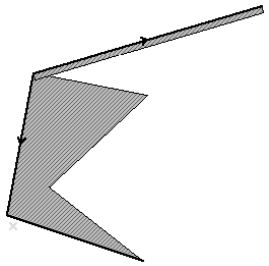
Notes: This technique also works on several walls selected at the same time. Alternatively, you can also use the Split command from the Edit menu.

PolyWall Corners

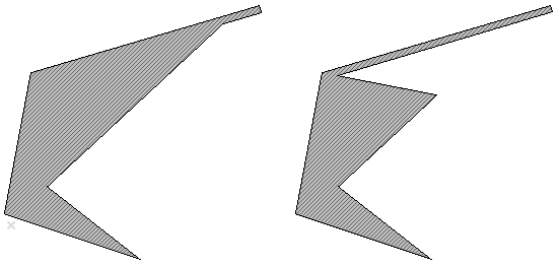
When connected to other, plain walls, wall polygons keep their original contour by default.

If you wish to override this setting, check the **PolyWall Corners Can Change** box in the General Settings section of the **Wall Settings** dialog box.

In the following example, a Single Wall is connected to a Wall Polygon. The first illustration shows you the situation with **Clean Intersections Off**.



Turning **Clean Intersections On** (**Options** menu) will give a different result with **PolyWall Corners Can Change** active (left) and inactive (right).



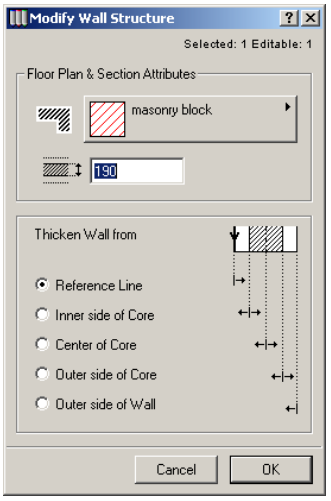
Modifying Wall Geometry

With the commands of the **Modify Wall** hierarchical menu of the Tools menu, you can modify the thickness, the Reference Line position and the direction of selected wall type elements.

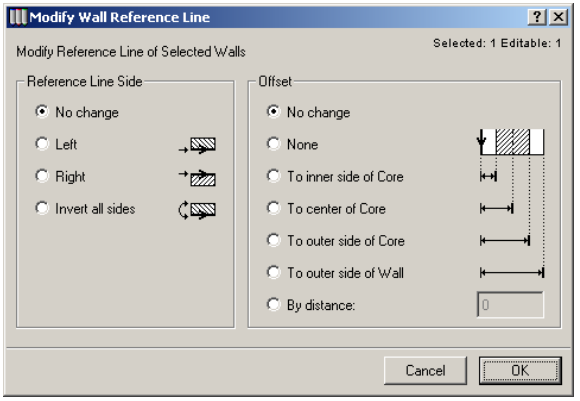
With the **Structure...** command, you can change the hatching of the selected Walls, and still keep the position of a desired part of the Wall.

At the top of the dialog box, you can set the fill. If the chosen fill is not a composite, you can set its thickness, otherwise the thickness of the core layer is displayed.

Click the radio button at the bottom to choose which part of the wall should keep its position after the modification. (If possible, this will be done by adding an offset to the reference line. If not, the reference line will be moved.)



With the **Reference Line** command, you can move the reference line of the selected walls without changing the walls' position on the Floor Plan.



On the left side of the dialog box, you can change the reference line side of walls. On the right you can add an offset to the reference line to position it to the desired part of the wall.

With the **Invert Direction** command, you can change the direction of the reference line. (This is visible when the **Clean Wall & Beam Intersections** toggle command is **Off**.)

Walls and Other Elements

- *Columns*: Automatic Wall-Column connections, optional Wall wrapping around columns. Walls and Columns must belong to Layers that have the same intersection group number. *See the Columns section for examples and details.*
- *Beams*: When a Beam crosses a Wall, the element of lower priority is cut in 3D. Wall priorities are defined globally in Options/Preferences/Construction Elements while Beam priorities are defined individually. Walls and Beams must belong to Layers that have the same intersection group number. *See the Beams section for examples and details.*
- *Doors and Windows*: A Wall is the only placeholder of these elements. They become part of the Wall. *See the Doors and Windows section for details.*
- *Slabs*: Overlapping Wall and Slab edges are eliminated in 3D: facades will be clean on elevations and other 3D views. *See the Slabs section for details.*
- *Roofs*: The top or the bottom surface of Walls can be trimmed to Roofs. *See the Roofs section for examples and details.*
- *Zones*: Walls are typically used to define the boundaries of Zones. *See the Zones section for details.*

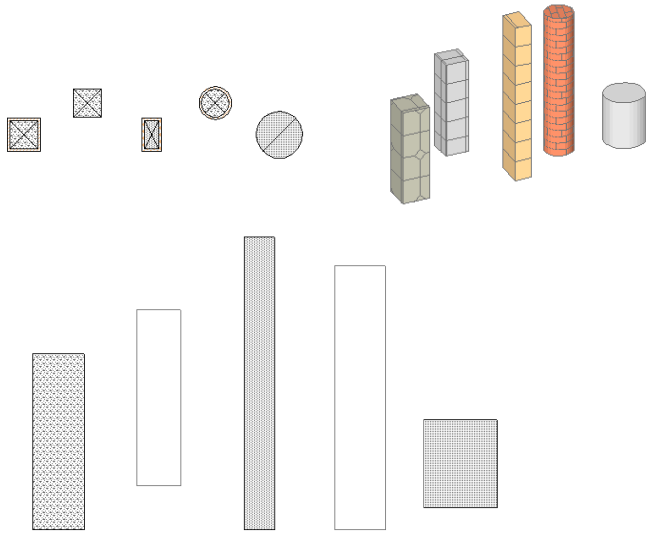
  Note: Solid Operations performed on Walls are always effective, regardless of any Layer settings.

Columns

Definition

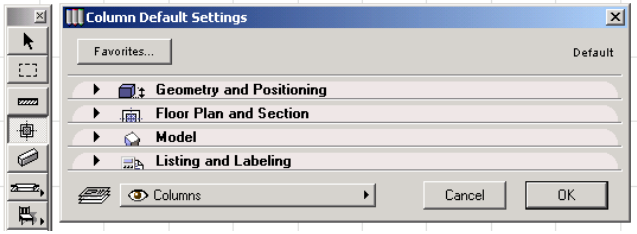
Columns in ArchiCAD are made up of two components: the load-bearing core and the optional veneer used to simulate fire proofing or any kind of sheathing around the core. The Column's base can be either rectangular or circular. Columns can stand free, or they can be smartly connected to walls.

In 2D, Columns are represented by their external and internal contour, an optional crossing symbol and two different fill patterns for the core and the veneer. In 3D, a single material is used to display all their surfaces. In Section view, the core fill pattern is shown, while in Elevations the Column is displayed with its contour only.

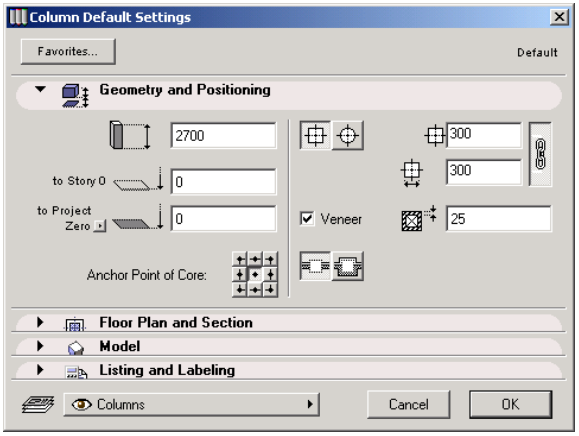


Column Tool and Settings

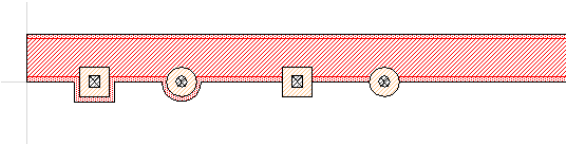
The **Column** tool is located below the Wall tool in Toolbox. Its settings dialog box contains four panels: **Geometry and Positioning**, **Floor Plan and Section**, **Model** and **Listing Attributes**. At the bottom of the dialog box, as for all tools, the current layer choice is displayed in a pop-up menu.



The **Geometry and Positioning** controls include the Column's height and elevation, the dimensions of the core and veneer and the location of the anchor point of the core.

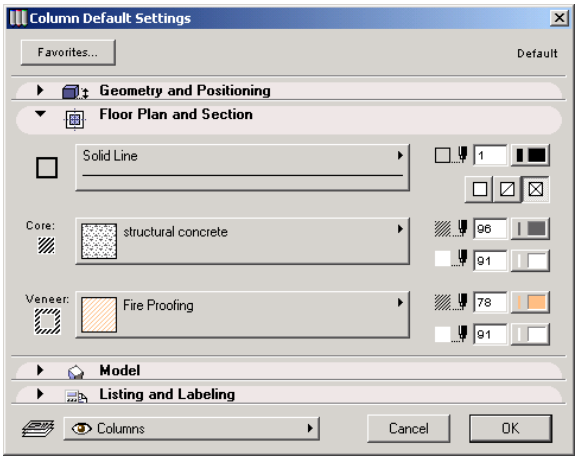


You can also choose between a circular and a rectangular Column and decide whether the Column should be freestanding or wrapped by Walls. *See the Columns and Other Elements section later.*



- The horizontal and vertical dimensions of rectangular Columns can be different. Use the chain icon next to them to constrain them to the same value.
- Veneer thickness is uniform around the core.

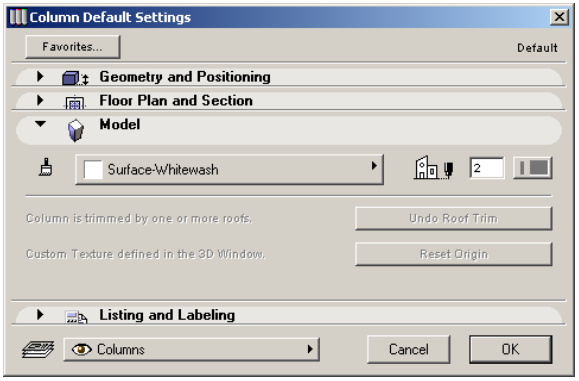
The second panel controls the **Floor Plan and Section** appearance of Columns.



These settings affect the Column's symbol (plain, slash or X), hatching and outlines of all columns on the **Floor Plan** and of cut columns in **Sections/Elevations**.

- The Line type choice affects both the Column's outline and the optional symbol.
- You can choose different colors for the Column's hatches and their backgrounds.
- Composites cannot be chosen as Column fills.

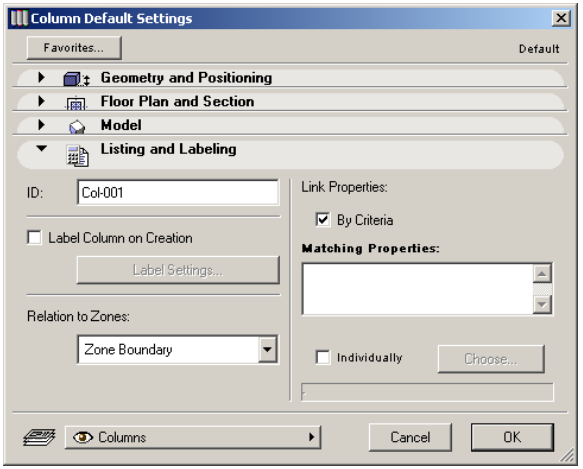
The third panel controls the **Model** attributes, that is, the display of the Column in the 3D Window, and of uncut Columns in Section/Elevation windows.



The most important control of this panel concerns the surface of the Column.

- For Columns placed with the Wrapped method, the Material choice you make here is overridden by the surface Materials of the Walls that they intersect.
- The **Undo Roof Trim...** button is never active when drawing new Columns. It serves to restore the original height of selected Columns trimmed to Roofs. *See the Roof section for details.*
- The **Reset Texture** button is never active when drawing new Columns. It serves to restore the origin of the Texture if it was modified in the **3D Window**. *See Aligning Textures in 3D in Chapter 5: Drafting and Editing Techniques.*

The fourth panel is called **Listing and Labeling** and controls the handling of the Column in calculations.



Most of the controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

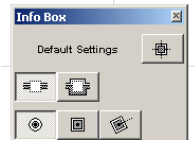
The **Relation to Zones** pop-up defines whether the new Column is a Zone delimiter, an element to subtract from the Zone's area or to be ignored when calculating Zones. *See the Zones' description for more details.*

Drawing Columns

When you are satisfied with the choices you made in the **Column Settings** dialog box, you can start drawing Columns. New Columns can be created in either the Floor Plan or the 3D Window.

Geometry

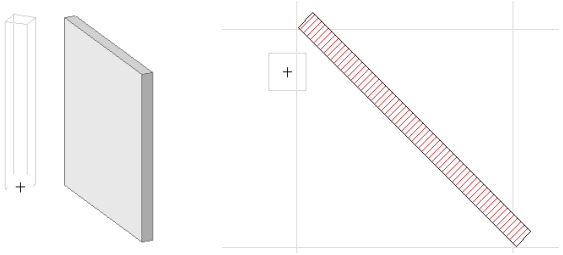
There are three Geometry Methods available for placing Columns. They can be activated by choosing the appropriate option in the **Info Box** before placing the Column.



- The **Circular** method allows you to place a Column with a circular base.
- The **Right-Angle** method produces a Column whose sides are aligned with the normal grid.
- The **Rotated** method produces a Column that can be freely rotated before placement.

Placing the Column

The ghost outline of the defined Column follows the cursor until you click to place it. If the dimensions of the Column are rather small, it is not visible at lower zoom levels on the Floor Plan.



Click to place the Column at the anchor point of its core defined in the Column Settings dialog box.

When placing a Column with the Rotated method, your first click defines the anchor point location. A ghost contour of the Column appears while you rotate it to find its final location. Click again to set the Column's angle and place it.

Columns and Other Elements

Similarly to Walls, Columns can be trimmed to the upper or lower surface of a Roof. *See Roofs section for details.*

When a Beam crosses a Column, the element of lower priority is cut in 3D. Column priorities are defined globally in Options/Preferences/Construction Elements while Beam priorities are defined individually. *See the Beams section for examples and details.*

Columns can be included in Solid Operations with all other types of construction elements.

Columns and Walls have a special relationship as detailed below.

Unwrapped Columns on the Floor Plan

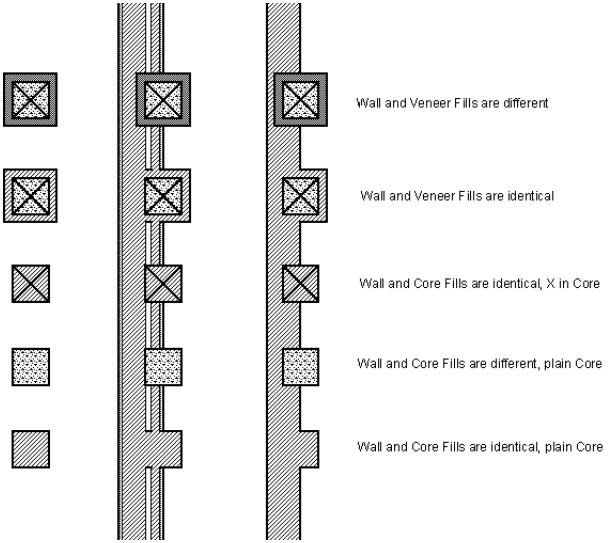
Unwrapped Columns do not modify the shape of the wall, just cut out a place for themselves, breaking through all wall skins. The connection line between wall skins and the Column are removed where their fill patterns match. The contour of Column cores with a slash or an X is always fully drawn, regardless of any other factors.

Below, the same Column variations are shown in three different situations:

1) The Column stands free of any walls.

2) The Column is placed in a composite Wall.

3) The Column is placed in a plain wall.



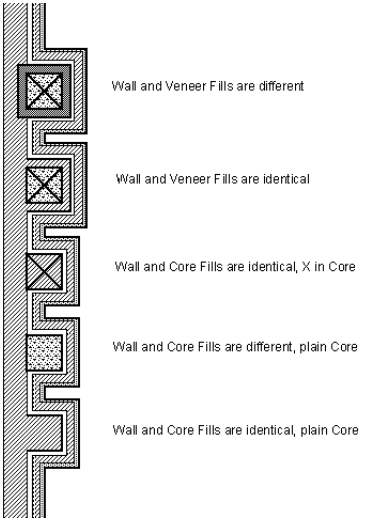
Wrapped Columns on the Floor Plan

Wrapped Columns can only break through the core skins of composite Walls. The other wall skins wrap around the column, retaining their thickness.

Wrapping will only occur if:

- the Column was placed using the Wrapped Method;
- it intersects a composite Wall;
- the composite Wall type has wrapping skins;
- the Column touches or intersects the core skin(s) of the composite Wall.

In the illustration below, you can see that the core of the wall works as with unwrapped Columns, and the intersection lines are cleaned as in the previous illustration. However, the other skins of the composite Wall go around the column.

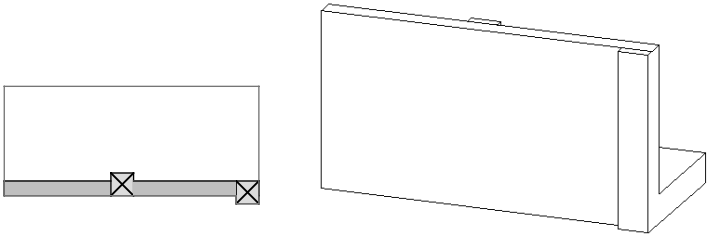


Note: Wrapping is not available for curved or polygonal Walls.

Columns in 3D Views

Columns placed with the Wrapped Construction Method will inherit the Surface Material of the connecting Walls, even if there are no wall skins configured to actually wrap around the Columns.

If Column surfaces are connected to wall or slab surfaces or other Column surfaces within the same 3D plane, the connection lines are eliminated in 3D view.

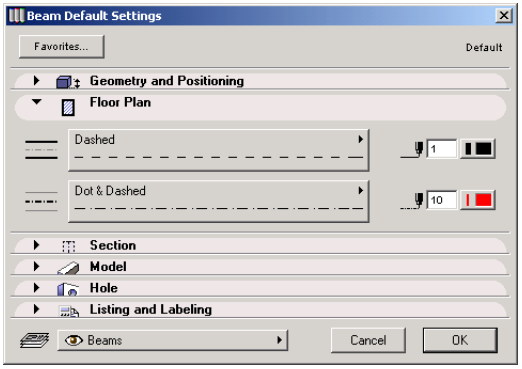


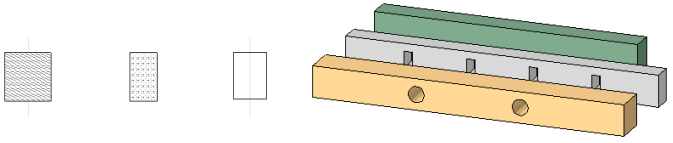
Beams

Definition

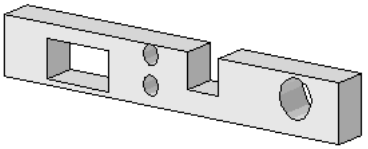
ArchiCAD Beams are straight horizontal construction elements with vertical end faces. They are best used when designing support building elements whose axis length is significantly larger than either their width or their height, for example rectangular concrete or timber beams.

When you create a beam, ArchiCAD generates the contour and the reference axis of the beam on the Floor Plan, a contour in Elevation with a section hatch when cut in Section, and a solid body in 3D.





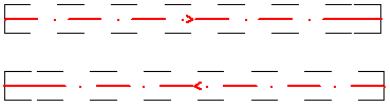
All types of Beams can include Holes. Holes are defined after the Beam has been placed. The geometry of the Holes is defined in the Model panel of the selected Beam's settings dialog box. Holes can be circular or rectangular, and Holes of different shape and size can appear in the same Beam.



Each Beam possesses a reference axis and a direction. The reference axis serves the precise connection of Beams for clean intersections and establishes hotspots and edges for selecting, moving and transforming Beams.

The reference axis is a heavy black line that always appears when drawing the Beam. The direction of the wall is defined by the order in which you define the wall's endpoints.

The reference axis (including the arrow that shows the Wall's direction) is only visible on the **Floor Plan**, provided that the **Clean Wall & Beam Intersections** feature is switched off. Otherwise, all Beams look alike in this respect.

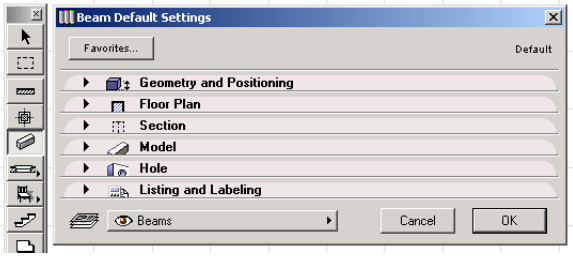


Note that the display of the Beam depends on the current settings made in **Options/Display Options**.

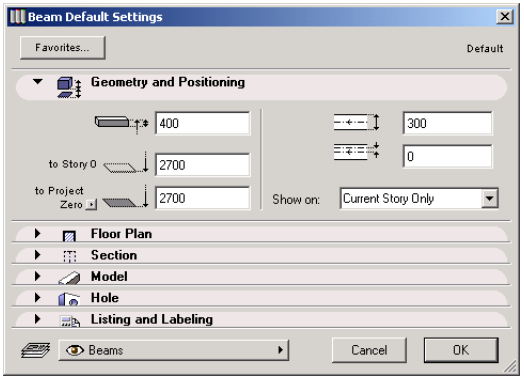
- Clean Wall & Beam intersections can be set on and off.
- It is possible to show only the reference lines or only the contour lines of the Beams.
- Fill patterns can be shown as uniform, bitmaps or vectorial lines.

Beam Tool and Settings

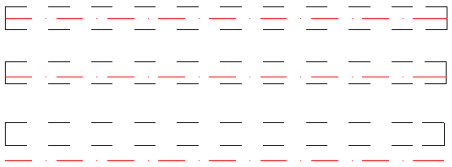
The **Beam** tool is located below the Column tool in Toolbox. Its settings dialog box contains six panels: **Geometry and Positioning**, **Floor Plan, Section**, **Model, Holes** and **Listing and Labeling**. At the bottom of the dialog box, as for all tools, the current layer choice is displayed in a pop-up menu.



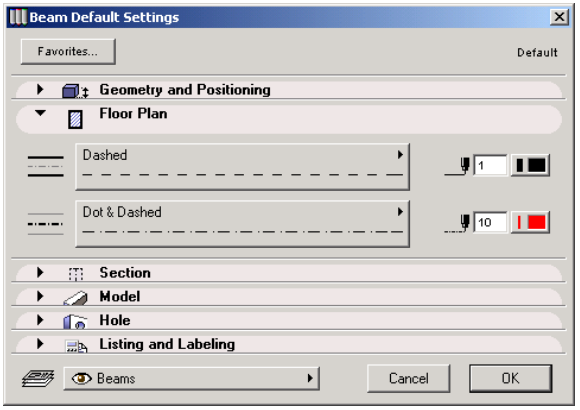
The **Geometry and Positioning** controls include the Beam's height and elevation, its thickness, an optional offset from the reference axis, and the option to show the Beam on its own story only, on all stories or on the stories right above and below.



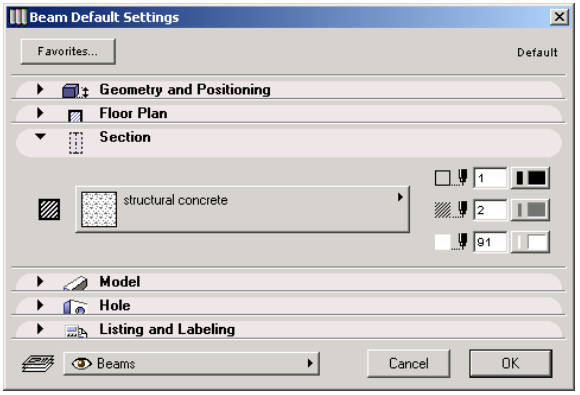
- By default, the reference axis runs in the middle of the Beam's upper face. However, you can define an offset for special purposes, and the reference axis can even be located outside the Beam's contour.



The second panel includes controls for the **Floor Plan** display. Different line types and pen colors can be chosen for the outline and the reference axis of the Beam. The same choices will be used to indicate the location and axis of the optional Holes.

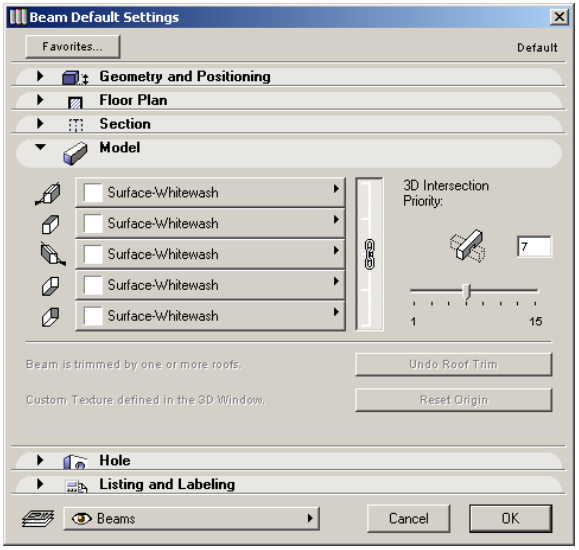


The third panel lists the possible attribute choices (fill patterns and pen colors) for the **Section** view. Different colors can be used for the outline, the cut Beam's internal hatch and the background of that hatch.



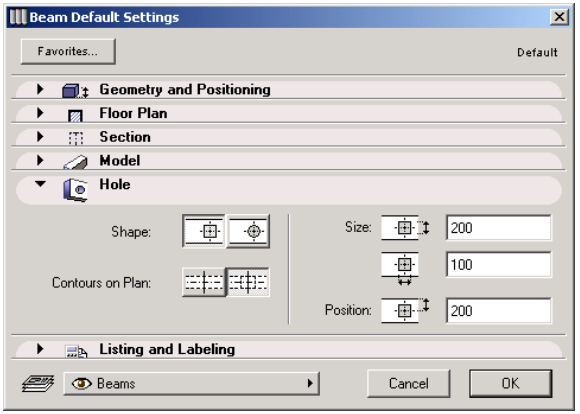
- Composites are not available for the Beam's hatch.
- Only exposed surfaces will use the fill pattern; in Elevation view, Beams appear with their outline only.

The **Model** attributes appear on the fourth panel. In addition to the Material choices available for all five surfaces of the Beam, this is also where you define the intersection priority of the Beam in 3D. Clicking the chain icon next to the Material names will assign the last material chosen to all surfaces of the Beam. Deselecting the chain icon will restore the materials that you originally set for each separate surface.



- 3D Intersection Priority is discussed below in the *Beam Connections* section.
- The **Undo Roof Trim...** button is never active when drawing new Beams. It serves to restore the original height of selected Beams trimmed to Roofs. *See the Roof section for details.*
- The **Reset Texture** button is never active when drawing new Beams. It serves to restore the origin of the Texture if it was modified in the **3D Window**. *See Aligning Textures in 3D in Chapter 5: Drafting and Editing Techniques.*

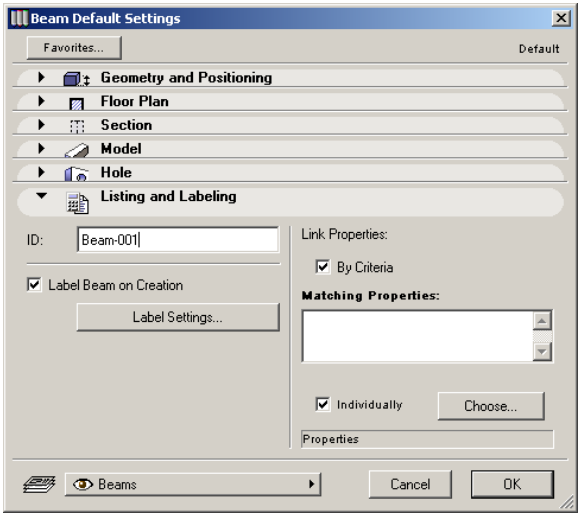
The fifth panel is used for the definition of **Holes**.



Rectangular and circular Hole shapes are allowed. The Position field sets the distance of the Hole from the top surface of the Beam. With the Contours on Plan control, you can decide to show the outline of the Hole inside the Beam or the axis only.

- You can modify the default settings made for Holes by selecting them inside the Beam. The same Beam can accommodate Holes of different shapes and sizes. *See the Defining Holes section below for more details.*

The sixth panel is called **Listing and Labeling** and controls the handling of the Beam in calculations.



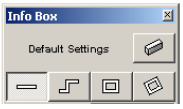
The controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

Drawing Beams

When you are satisfied with the choices you made in the **Beam Settings** dialog box, you can start drawing Beams. New Beams can be created in either the Floor Plan or the 3D Window.

Geometry

There are four Geometry Methods available for drawing Beams. They can be activated by choosing the appropriate option in the **Info Box** before initiating the creation of the beam.



- The ***Single Beam*** method produces a beam element by clicking twice in the worksheet at its axis' starting point and endpoint.
- The ***PolyBeam*** method creates a sequence of connected beam elements with automatically coincident axis endpoints. The process for drawing chained Beams is the same as for Walls *(see detailed description in the Drawing Walls section.)* Since, unlike for Walls, only straight segments can be drawn manually, the pet palette does not appear when you draw Beam chains. When you click to end the definition of the first Beam, you automatically start drawing the second one, and so on, until you double-click to finish drawing the chained Beams.
- The ***Rectangle Beam*** produces four beam elements with coincident nodes, the sides of the rectangle being parallel with the x and y directions, respectively. Define the rectangle by clicking the starting point and the endpoint of one of its diagonal lines.
- The ***Rotated Rectangle Beam*** method produces four beam elements with coincident nodes, the first side of the rectangle being defined by the first two mouse clicks at their endpoints and the perpendicular side defined by the third mouse click.

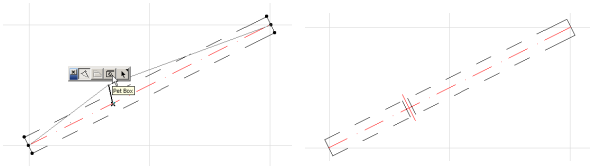
Note that although only straight Beams can be created directly, you can trace the contours of circular drawing or constructions elements with the Magic Wand to reproduce their shape by short straight Beam segments. *See description in the Using the Magic Wand section.*

Defining Holes in Beams

You can define Holes only after the Beam has been drawn. Select the desired Beam and make sure that the **Beam** icon is highlighted in the **Toolbox**.

On the Floor Plan, holes can be created by clicking on the Beam's reference axis. The pet palette appears with the possible editing choices. Click the Hole icon. The Hole will

immediately appear in the Beam with the options chosen in the Holes panel of the Beam Settings dialog box.



In the 3D Window, you can create holes by clicking the Mercedes cursor on either the Beam's reference axis or a top edge of the selected Beam element.

Selecting and Modifying Holes

If you need a number of Holes in the Beam whose settings are dissimilar, you may wish to first create the series of Holes by multiplying them and then fine-tune some of the Holes' shapes, sizes or positions.

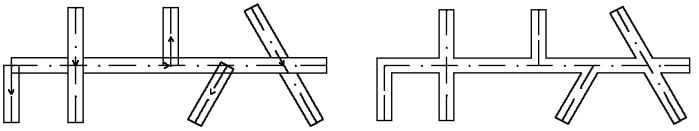
You can select a hole with the Beam tool active by Shift-clicking its center with the **Checkmark** cursor or by using the **Arrow** tool. Note that only one selected hole can be edited at a time, but if you select the Beam itself, you can modify the values of all holes simultaneously.

You can modify the Holes' shape and size in the Beam Settings dialog box or the Info Box. The position of the Hole can also be changed graphically. Selected Holes can be moved along the Beam in Floor Plan view. In 3D, the pet palette offers you the possibility of also moving the Holes up and down.

Joining Beams

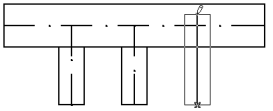
ArchiCAD automatically cleans crossings, **T** and **L** junctions of Beams if the **Clean Wall & Beam Intersections** feature is turned **On** in the **Options** menu.

When drawing Beam junctions with Clean Intersections **Off** and **On**, respectively, the results look like the figures below.

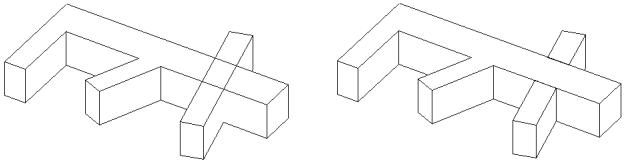


Note that unlike for walls, there is no need to split Beams for clean X crossings.

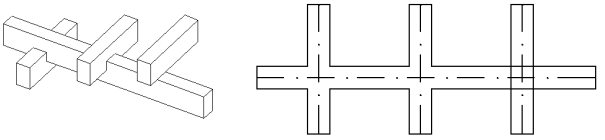
When joining Beams with **Clean Intersections** turned **On**, it's irrelevant whether the two reference axes meet or not. If one end of the joining Beam falls within the contour of the other Beam, the end of the joining Beam will automatically adjust to the reference axis. If the **Clean Intersections** option is **Off**, Beams end at the mouse clicks.



In 3D, intersections depend on the priority settings made for the individual Beams in the Model panel of the Beam Settings dialog box. For perfect X crossing in 3D, set different priorities.



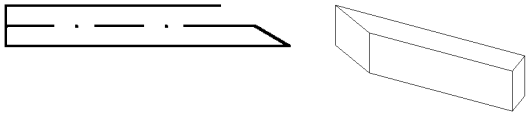
Beam junctions are also cleaned up if the crossing or joining Beams run at different elevations. If Beams pass each other in space, the junction is not cleaned up in the Floor Plan view.



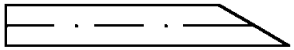
Beam end faces are always perpendicular to the sides of the Beam. For end faces at free angles, use the following trick:

1) Draw your Beam.
2) Set Beam thickness to zero in the **Beam Settings** dialog box in order to draw a second (virtual) Beam.
3) Draw the zero thickness Beam starting from the end of the reference axis of the first Beam at the desired angle as shown in the figure below. Use the horizontal snap variant in the **Control Box**.

4) **Rebuild** your view. You should see a similar configuration in your Floor Plan view and 3D view, respectively.



5) Touch up the floor plan symbol by adding a line segment to complete the gap.

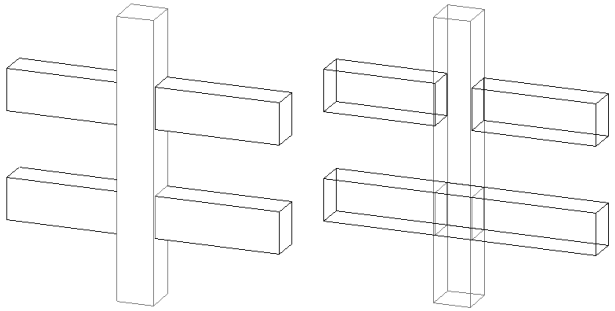


Beams and Other Elements

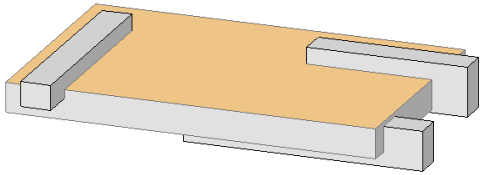
When Beams cross Walls or Columns, the element of lower priority will be cut in 3D, which means that the intersection part will be removed. The element of higher priority will remain intact. This applies to volume calculations as well.

- Wall and Column priority numbers are always even and can only be defined as a general setting in **Options/ Preferences/Construction Elements**.
- Beam priority numbers are always odd and can be defined individually for every Beam in the element's settings dialog box.

In the example below, the Column's priority number has been set to 8 in **Preferences**. The upper Beam's priority number is 3, and the lower Beam's priority number is 11. The Hidden Line and Wireframe views show you how the cut is effected.



Beams always cut Slabs when the two elements join in space (provided that their Layers belong to the same intersection priority group). This applies to both the 3D Window and volume calculations.



Beams can be trimmed to Roofs. *See the Roofs section later.*

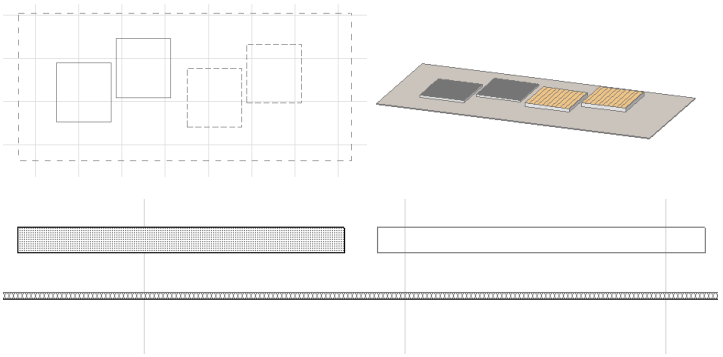
In addition, Beams can participate in all types of Solid Operations with other construction elements.

Slabs

Definition

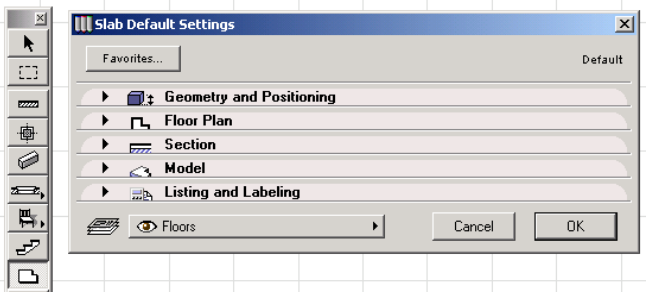
Slabs are the basic horizontal building blocks in ArchiCAD. They are typically used for modeling floors or split levels. Slabs can be drawn either on the Floor Plan or in the 3D Window.

On the Floor Plan, Slabs are represented by their outline. In 3D view, three different materials can be used to display their surfaces. In Section view, the cut Slab body's fill pattern is shown, while in Elevations the Slab is displayed with its contour only.

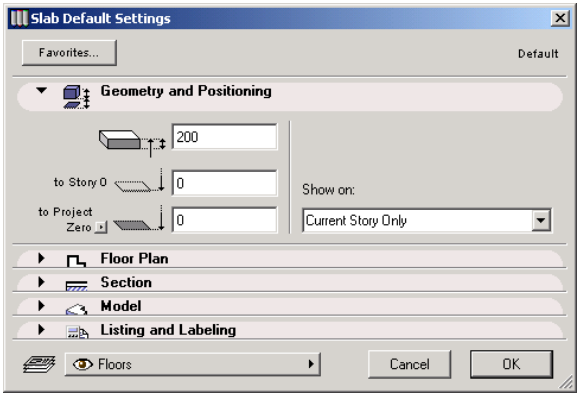


Slab Tool and Settings

The Slab tool is located in the lower part of the construction tools section of the Toolbox. Its settings dialog box contains five panels: **Geometry and Positioning**, **Floor Plan**, **Section**, **Model** and **Listing and Labeling**. At the bottom of the dialog box, as for all tools, the current layer choice is displayed in a pop-up menu.

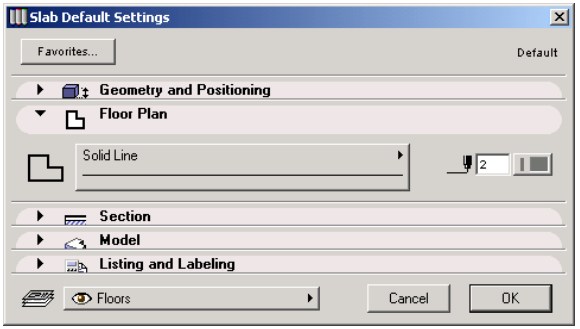


The **Geometry and Positioning** panel contains the Slab's thickness and elevation values as well as the option to show it on multiple stories.



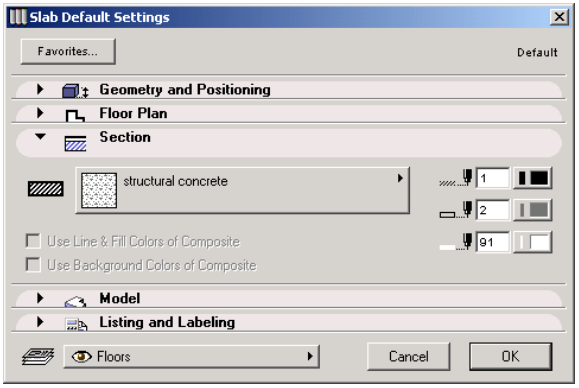
Note that by default, the Slab is set to coincide with the zero level of the story (or project), which means that the elevation of the bottom surface of the slab is obtained by subtracting the thickness from the value shown in the elevation field.

In the **Floor Plan** panel you can set the line type and pen color that will be used to represent the Slab's outline in the Floor Plan.



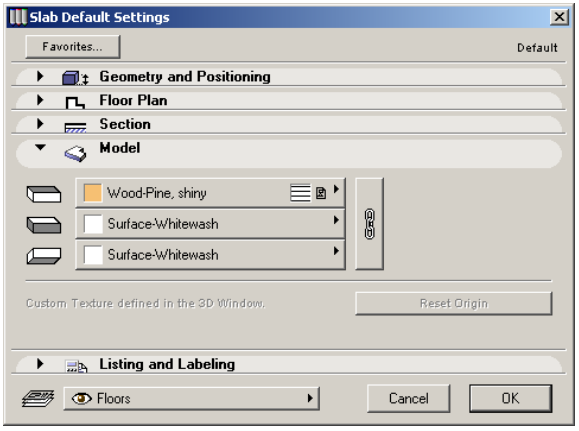
The **Section** panel defines the fill pattern used to represent cut Slab surfaces in Section/Elevation windows. Different pen

colors can be chosen for the Slab's outline, its body hatch and the background of the hatch.



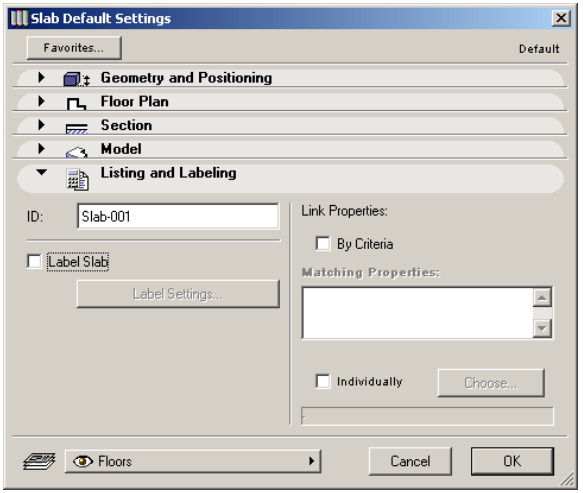
- Composites are available for Slabs. If you choose a composite structure as the Slab's body hatch, the two checkboxes below the pop-up control become active. You can use them to override the line type and color setting made here for the Section display and use the Composite's own attributes as defined in Options/Composites.

The **Model** panel's most important controls define the Materials used for displaying the different surfaces of the Slab in 3D view.



- You can use three different materials for the Slab's different surfaces or click the chain icon to use the last selected material for all surfaces. Deselecting the chain icon will restore the originally set materials to the slab's surfaces.
- The **Reset Texture** button is never active when drawing new Slabs. It serves to restore the origin of the Texture if it was modified in the **3D Window**. *See Aligning Textures in 3D in Chapter 5: Drafting and Editing Techniques.*

The fifth panel is called **Listing and Labeling** and controls the handling of the Slab in calculations.



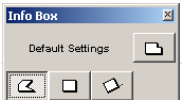
The controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

Drawing Slabs

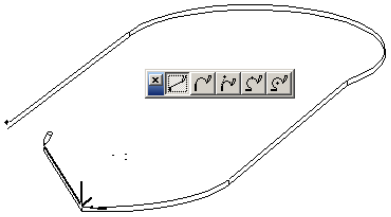
When you are satisfied with the choices you made in the **Slab Settings** dialog box, you can start drawing Slabs by applying one of the Geometry Methods in the Info Box. New Slabs can be created in either the Floor Plan or the 3D Window.

Geometry

There are three Geometry Methods available for Slabs from the Info Box.



- With the first icon on the left, you can create a Polygonal Slab. Just like for Walls, the pet palette appears and allows you to draw straight and curved segments for the Slab's outline. *See the Geometry section under Walls for details about the use of the different tools.*



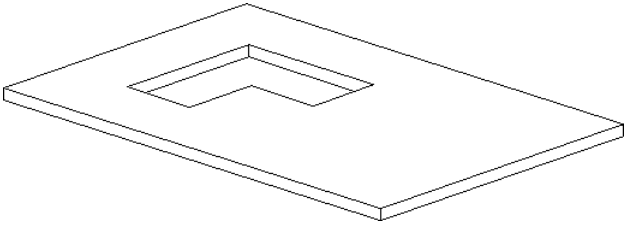
If the Slab's polygon intersects itself, a warning appears, but the Slab will still be drawn.

- The second and the third icon allow you to create a Rectangular or a Rotated Rectangular Slab. The rectangle is defined by placing two opposing corner nodes. A rectangle Slab is always aligned orthogonally with the grid. The Rotated Rectangular method requires that you first define a rotation vector.

Placing Holes in Slabs

You may need to make holes in Slabs to accommodate objects such as staircases, or for an open atrium space.

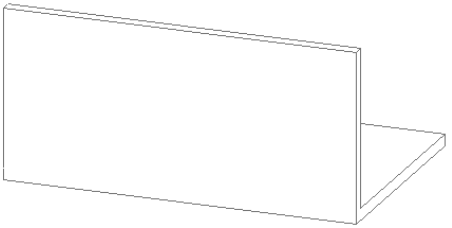
Select a Slab and activate the Slab tool, then draw a new contour within the Slab's boundaries. This new contour will be interpreted as a hole in the Slab.



- If you forgot to select a Slab before starting to create a hole in it, the new contour will be interpreted as a new Slab, even if it lies inside another Slab. To check for this, select the Slab in the Floor Plan view. If you have made a hole, selection dots will be displayed around both the external and internal contours of the Slab. You can then select and delete the accidentally created Slab.
- If you create a hole whose outline intersects the host Slab's contour or the outline of other holes in the same polygon, ArchiCAD will display a warning message, but the outline of the hole will still be created. A self-intersecting Slab polygon will be fixed automatically if you edit the polygon later using any of the pet palette's editing methods.

Slabs and Other Elements

If you build a Wall on top of a Slab and an edge of the Wall coincides with any part of the contour of the Slab, the coinciding line between them will be automatically omitted in 3D visualizations. This feature ensures correct hidden-line exterior views.



Slabs can participate in all types of Solid Element Operations.

Slabs, like other construction elements, can be trimmed to Roofs. There is, however, an important difference for Slabs: unlike for Walls, Columns and Beams, the trim is definitive and cannot be undone in the Slab Settings dialog box. *See Roofs later in this chapter for details.*

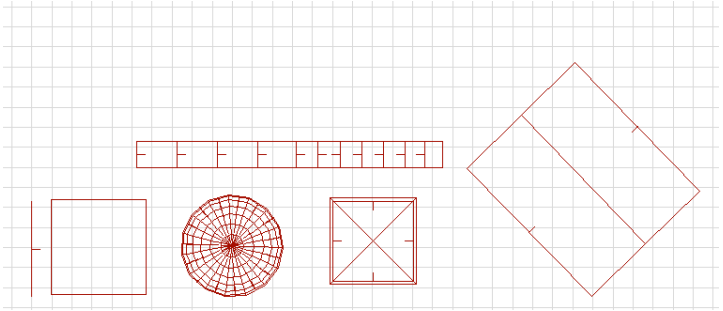
Roofs

Definition

ArchiCAD **Roofs** have very flexible characteristics. They can be used to create abstract 3D shapes meeting a wide variety of needs.

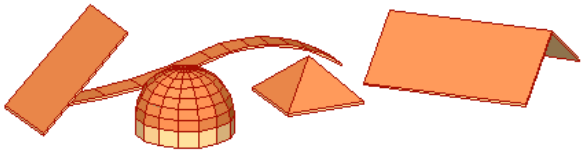
In Floor Plan view, the outline of the Roofs is shown together with their pivot lines. This horizontal non-printing element is part of the lower surface of the roof.

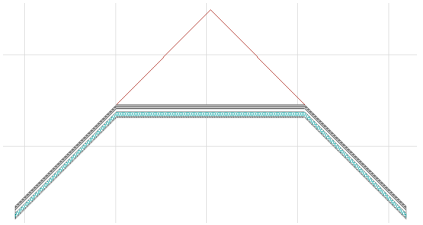
The roof pitch is interpreted as a pivoting angle around this line and the elevation of the roof's bottom edge is defined by the elevation of the pivot line.



Note: You can hide all pivot lines with the appropriate control in Options/Display Options.

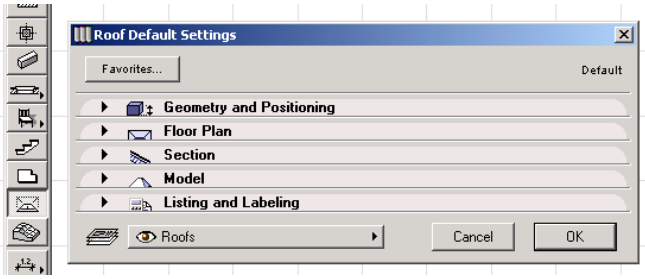
In 3D view, Roofs are displayed as solid bodies. In Section/Elevations, the exposed cut surfaces display the internal fill patterns. Roof panes that are not affected by the cut are displayed with their outlines only.



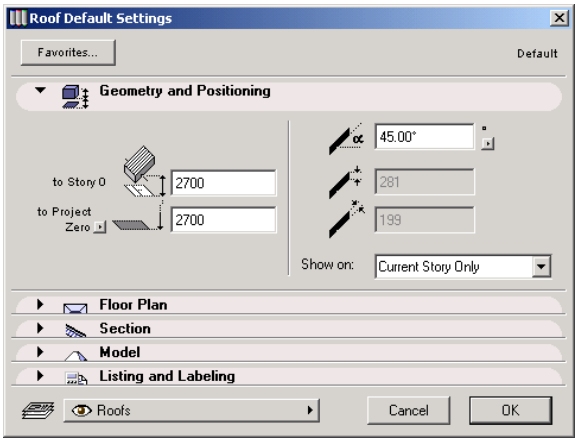


Roof Tool and Settings

The Roof tool is located in the lower part of the construction tools section of the Toolbox. Its settings dialog box contains five panels: **Geometry and Positioning**, **Floor Plan**, **Section**, **Model** and **Listing and Labeling**. At the bottom of the dialog box, as for all tools, the current layer choice is displayed in a pop-up menu.

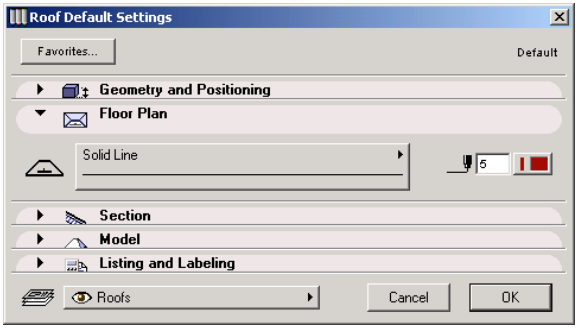


The **Geometry and Positioning** panel contains the Roof's thickness, the Roof pane's pitch and the pivot line's elevation values as well as the option to show the Roof on multiple stories.

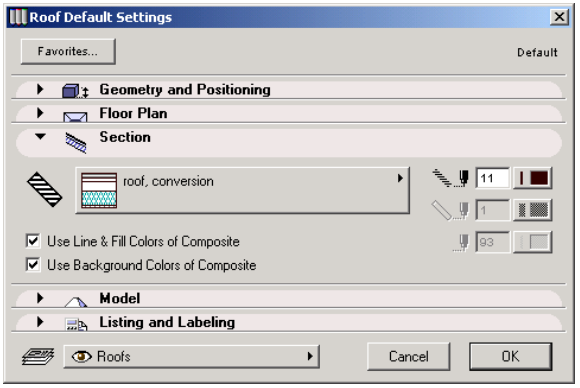


- The Roof pitch unit depends in the setting you choose in the pop-up menu near the Roof Pitch edit field. You can define the pitch in degrees, in percentages, or in the amount of roof rise per 12 feet or 12 inches of horizontal run. The roof pitch is typically positive, but it can also be a negative value, in which case the resulting roof is "reversed": the side defined with the **Eyeball** cursor going upward will instead go downward.
- The Roof pane's thickness can be set either vertically or perpendicularly. If a composite structure is used in the Section panel, these two fields cannot be modified, as the Roof's thickness is then determined by that of the Composite as defined in the Options menu.

In the **Floor Plan** panel, you can set the line type and pen color that will represent the Roof's outline in the Floor Plan and in Elevation and 3D views.

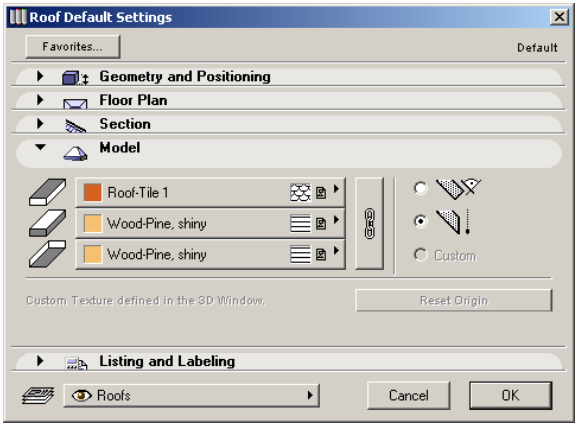


The **Section** panel defines the fill pattern used to represent cut Roof surfaces in Section/Elevation windows. Different pen colors can be chosen for the outline of the cut surface, the body hatch and the background of the hatch.

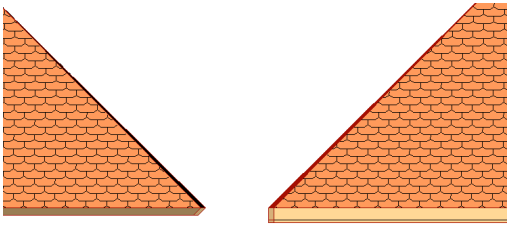


- Composites are available for Roofs. If you choose a composite structure as the Roof's body hatch, the two checkboxes below the pop-up control become active. You can use them to override the line type and color setting made here for the Section display and use the Composite's own attributes as defined in Options/Composites.

The **Model** panel's most important controls define the Materials used for displaying the different surfaces of the Roof in 3D view. You can also define here the Roof edges' angles.

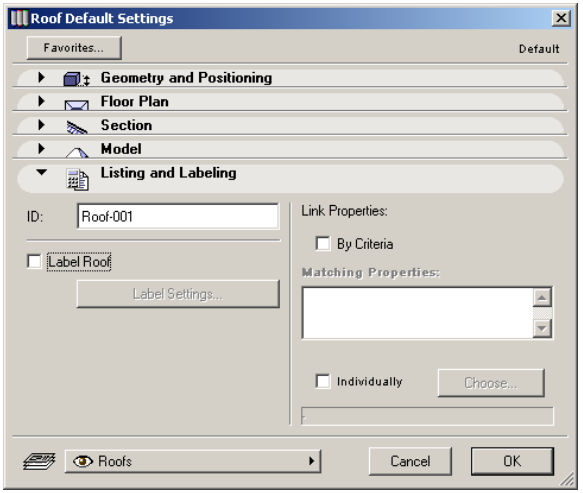


- You can use three different materials for the Roof's different surfaces or click the chain icon to use the last selected material for all surfaces. Deselecting the chain icon will restore the originally set materials to the roof's surfaces.
- The Roof Edge Angle setting defines the base and fascia boards of a roof. They can be set to be either vertical or perpendicular to the elevation of the roof plane. The **Custom** option is dimmed, unless the eave or the rake has been set to a custom angle *(see later)*. If the **Custom** radio button is selected, you have the option of changing this setting to vertical or perpendicular. Custom roof edges are not defined in this dialog box.



- The **Reset Texture** button is never active when drawing new Roofs. It serves to restore the origin of the Texture if it was modified in the **3D Window**. *See Aligning Textures in 3D in Chapter 5: Drafting and Editing Techniques.*

The fifth panel is called **Listing and Labeling** and controls the handling of the Roof in calculations.



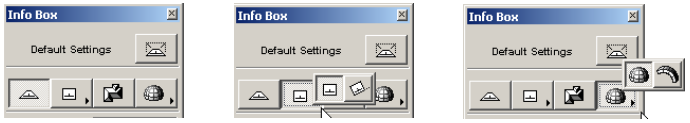
The controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

Drawing Roofs

When you are satisfied with the choices you made in the **Roof Settings** dialog box, you can start drawing Roofs. New Roofs can be created in either the Floor Plan or the 3D Window, although some options differ or are restricted.

Geometry

The **Roof** has six geometry methods in the Info Box, allowing you to create both simple and complex roof shapes. The options are: Polygon, Rectangle, Rotated rectangle, Polyroof, Dome and Barrel-vaulted. Note that only four options are visible a same time. The remaining options can be viewed by clicking the small arrow at the bottom of some of the icons.



Drawing a Simple Roof on the Floor Plan

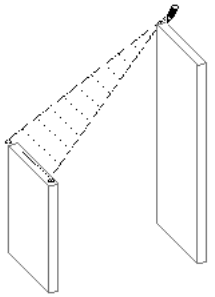
Choose one of the first three Geometry Methods in the **Info Box** (Polygon, Rectangle, Rotated Rectangle), then define with two clicks the position of the pivot line. With the Rectangle method, the roof will always be orthogonal.

In most cases, you will want the pivot line of the roof to coincide with a wall Reference Line or a slab edge. The change of the cursor form serves as a visual cue for accurate placement.

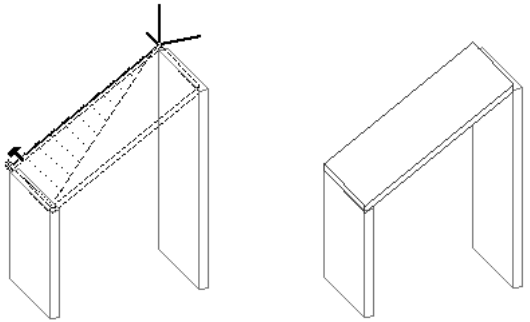
After defining the pivot line, a cursor in the form of an **Eyeball** will appear. Use this cursor to click on the side of the pivot line where you want the roof plane to rise. You can then draw the contour of the roof by clicking on each of the new roof's nodes.

Drawing a Simple Roof in 3D View

Choose one of the first three Geometry Methods in the **Info Box** (Polygon, Rectangle, Rotated Rectangle), then enter the roof plane by clicking any three points. ArchiCAD will generate the Pivot Line for you.



Draw the contour of the roof. The **Hammer** cursor appears when you return to the first node. Click to close the polygon. ArchiCAD will then generate the Roof.

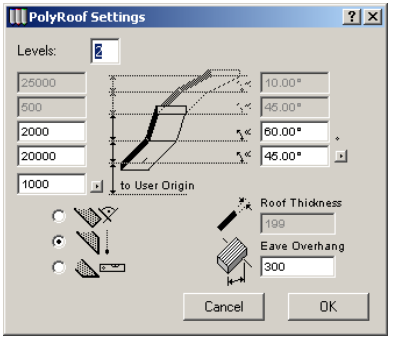


Drawing Complex Roofs

By choosing the Polyroof geometry method, you can create equally sloped roofs on any polygonal or curved base. The result will be a set of individual roof planes. With the Autogroup function active, they will be automatically grouped when created.

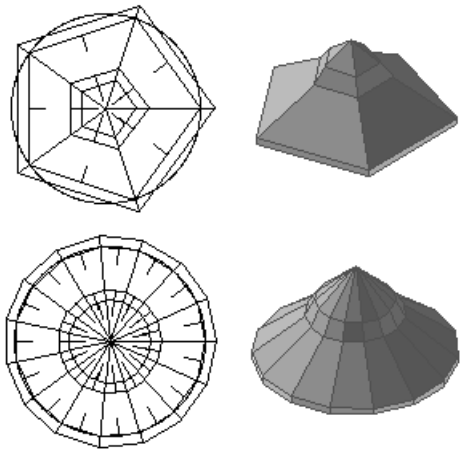
The process for drawing a Polyroof is the same on the Floor Plan and in the 3D Window.

First, you draw a polygon of straight segments only. This defines the pivot lines of the elements of the Polyroof. When you are finished, the **Polyroof Settings** dialog box appears.



The final outline will be defined by the Eave Overhang value which is added as an offset to the pivot line polygon.

Polyroofs can be made up of a maximum of four levels. The inclination and maximum height of each segment can be independently defined.



To create curved shapes with the Polyroof method, draw the shapes with the 2D drawing tools, then use the Magic Wand to define the pivot line polygon. Make sure that the Polyroof Geometry Method is active when you do so. *See also Using the Magic Wand later in this chapter.*

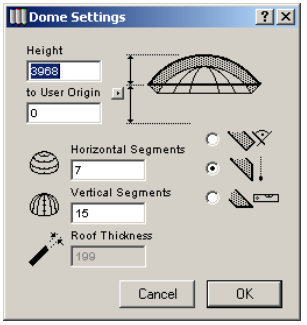
Note: ArchiCAD uses a crystal growth algorithm to calculate the best solution for any particular polygon base. The height defined in the settings dialog box is the maximum limit. If the roof meets another roof plane before it reaches that particular height, it will not go higher. If the roof has reached the maximum level allowed, and the roof planes have not met, a horizontal plane will be placed on top. Once the structure is completed, its parts are individually editable.

Drawing Dome-Shaped Roofs

To create a Dome-shaped roof, select the Dome geometry method in the **Info Box**. A Dome-Shaped Roof is a set of individual roof planes. With the Autogroup function active, they will be automatically grouped when created. The process for drawing a Dome-shaped roof is the same on the Floor Plan and in the 3D Window.

With the first click, you define the center of the arc; the second click marks the beginning and the third, the end of the outline. Double-clicking the beginning of the arc will create a full circular dome.

Once you have defined the outline, the **Dome Roof Settings** dialog box appears.



The edit field at top left in the dialog box contains the height of the Dome Roof as measured from its centerpoint. This value is set by default to the maximum allowed, i.e., the

height of a semi-sphere structure. By entering a smaller number, you can flatten your dome. The next edit field contains the elevation of the dome's base.

The number of strips and segments that make up the dome can also be defined in this dialog box: they are limited to 90 and 360 respectively.

The roof thickness measured perpendicular to the roof's elevation can also be set, while the roof edge's trimming is controlled by the radio buttons on the right. The three options available are perpendicular, vertical and horizontal trimming.

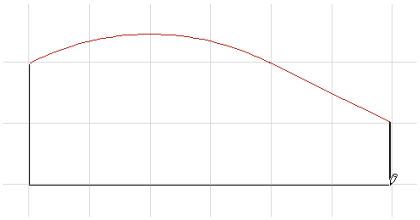
Once the dome is created, its parts can be edited as individual pitched roofs, but not as a whole.

Drawing Barrel-Vaulted Roofs

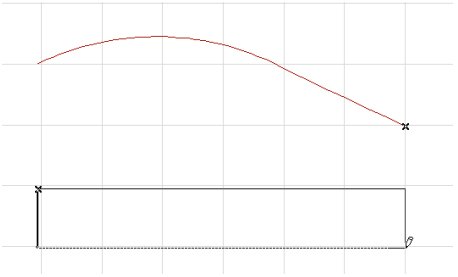
Barrel-vaulted Roofs can be constructed in either Floor Plan or 3D view, but it is done through different steps.

In 2D, a curve drawn on the Floor Plan is interpreted as the cross-section of the Roof. Draw a series of arcs (or trace a shape with the Magic Wand) and hit the **OK** or **Cancel** button when finished.

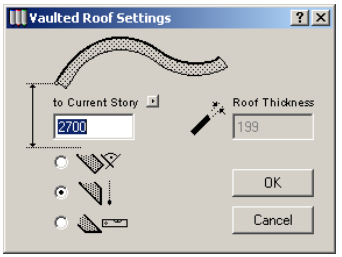
When you have defined the curve, you will see a rubberband boundary, whose ends are connected to those of the cross-section curve. One of the sides of this boundary is the imaginary "floor" and, at the same time, the side of the barrel roof.



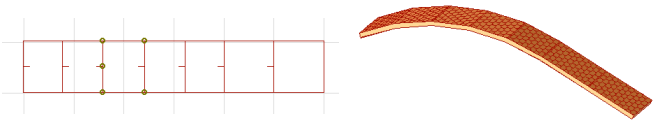
With a first click, you define the starting point and the shape, and with the second, the length of the barrel roof.



The Vaulted Roof Settings dialog box is displayed. You can set here the elevation of the base point of the roof, its edge angle and, if using a simple fill pattern, its thickness.



The resulting roof planes are individually editable. If Autogroup is on, they are generated as a group. The curve drawn in the Floor Plan is clearly visible in the 3D view of the roof.



Note: ArchiCAD only allows the construction of curved roofs that can be hit by vertical rainfall. This avoids the construction of self-intersecting or reclinate roofs. This also means that the same curve may be valid for the generation of a roof from one angle of the boundary box, and invalid from another angle. This is because the shape

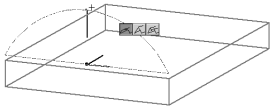
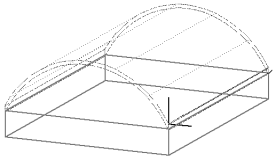
of the roof is determined not only by the curve that it is constructed from, but also by the angle of the boundary box that it is associated to. The start and end points of the roof must be defined in such a way that the heavy line side of the rubberband boundary does not intersect the original cross-section curve.

There are three possible methods available for drawing a Barrel-Vaulted Roof in 3D: rounded, symmetrical and irregular.

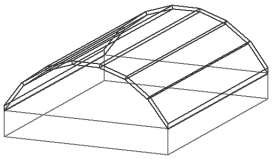
Draw the first side of the outline rectangle of the roof at the desired height. The pet palette appears. Defining the cross-section is different for the three methods.

To create a rounded roof:

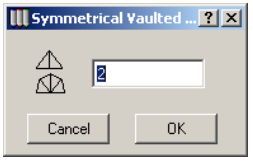
1) Click on the first icon.
2) Draw the geometry of the roof cross-section by defining its height and click.

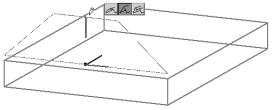
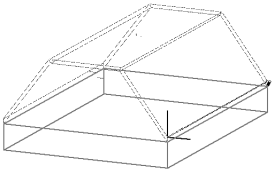
3) Extend the roof to the desired length and click to place the roof.



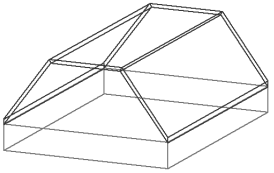
To create a symmetrical vaulted roof:



1) Click on the second icon. The **Symmetrical Vaulted Roof** dialog box appears. Enter the number of roof planes to create.
2) Draw the geometry of the roof by defining its height and click.

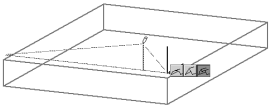
3) Extend the roof to the desired length and click to place the roof.



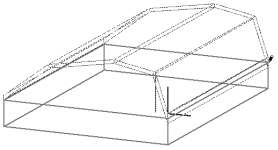
Note: This method creates roof planes of equal length in cross-section.

To create an irregular roof:

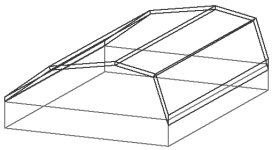
1) Choose the third method from the pet palette and click.



2) Define the shape of the roof by clicking as many times as you wish to create new planes. Double-click to finish creating roof planes.



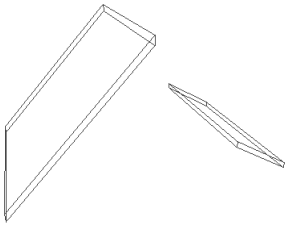
3) Extend the roof to the desired length and click to place the roof.



Creating Roof Intersections

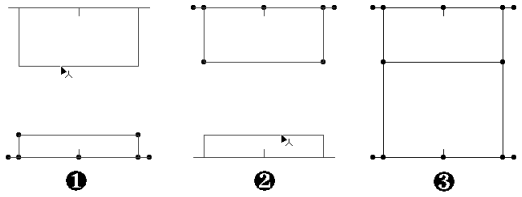
You may need to adjust simple roof panes to each other or to modify some of the panes of a complex roof, for example to accommodate a dormer.

Consider the two roof faces below:

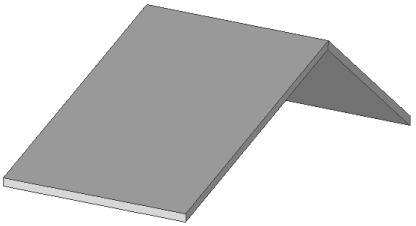


To have these two roof planes intersect:

1) Select the lower one on the Floor Plan, and Ctrl-click (Windows) or Cmd-click (Mac) the ridge line of the other.
2) Now select the other roof plane and Ctrl-click (Windows) or Cmd-click (Mac) the ridge line of the lower one.
3) The two faces have been adjusted to each other.

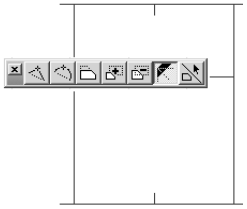


When the two ridge lines meet on the Floor Plan, this means that they are in fact intersected in 3D.

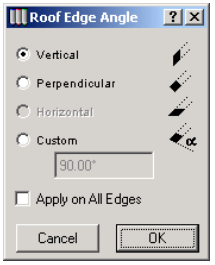


For more complex intersections, when more than two roof planes meet (e.g., when a barrel vaulted roof meets a simple pitched roof), additional nodes should be added to accommodate the shape. However, the intersection process itself is similar.

ArchiCAD allows fascia and barge boards to be at unique angles. For this reason, it is possible for two roofs to not be properly joined, even though they meet on the Floor Plan. You can create mortared joints at these intersections, or have the roof planes connect with vertical ridges.



This is done by selecting all roof planes that you would like to intersect, positioning the cursor at the common ridge and keeping the mouse button down. Select the **Roof Edge Angle** option in the pet palette that appears. This opens a dialog box.



The setting you make in this dialog box applies to all selected roof planes that meet the common ridge line on the Floor Plan.

Holes in Roofs

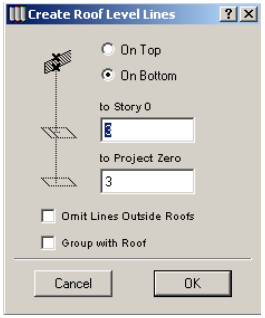
You may need to make holes in Roofs. Select a Roof pane and start drawing a new contour within its boundaries. The new contour will be interpreted as a hole in the Roof.

> **Note:** If you create a hole whose outline intersects the host Roof's contour or the outline of other holes in the same polygon, ArchiCAD will display a warning message, but the outline of the hole will still be created.

Adding Roof Level Lines

Choosing the **Create Roof Level Lines** command from the **Tools/Line Extras** hierarchical menu will place lines on selected roofs at the height values you specify in the appearing dialog box.

You can define whether the level lines should be placed on the top or bottom level(s) of the selected roof(s) by selecting the appropriate radio button in the top part of the dialog box.



In the fields in the middle, you can specify the height level where you want the level lines to be placed. The height can be relative to the Story's own level or to the Project Zero.

When the **Omit Lines Outside Roofs** checkbox is enabled, level lines that fall outside the floor plan polygon of the roof they belong to will not be drawn. If the checkbox is disabled, all resulting lines will be drawn. In this case, lines that fall outside the roof polygon will be drawn to be of equal length to the pivot line of the roof they belong to.

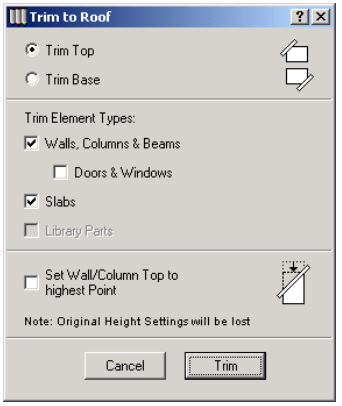
When the **Group with Roof** checkbox is activated, level lines will be grouped with the roofs they belong to.

> **Note:** This option is grayed if the **Suspend Groups** toggle is active.

Roofs and Other Construction Elements

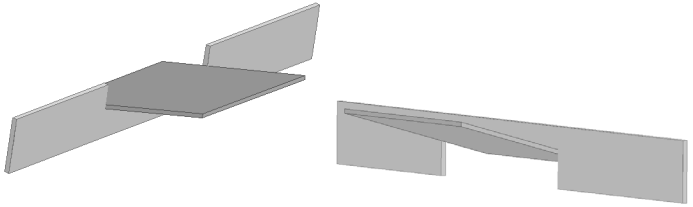
Roofs have the unique ability to trim either the top or the bottom of Walls, Beams, Columns, Slabs, Doors, Windows and Objects to fit the desired surface of Roofs. This trimming is not done automatically: use the **Trim to Roof** command in the **Edit** menu to determine which elements should be affected. For the command to be available, at least one roof or one element of the above types must be selected.

If walls, beams, columns, slabs and Library Parts are selected, they will be trimmed to those roofs that are crossing them. If one or more roofs are also selected together with these objects, the elements will be cut only to those roofs that are selected together with the objects. The objects are cut only if they are partly or wholly under the roof. You must always define which elements should be cut in the appearing dialog box.

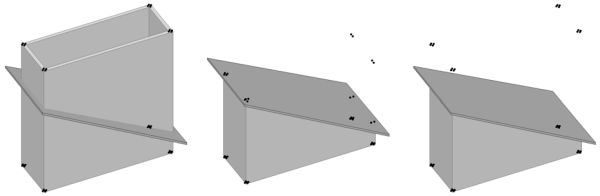


If only roofs are selected, you will have to define what elements you want to be cut by the roof by checking the types in the dialog box. You then need to decide whether you want to trim the top or the bottom of the elements and click the **Trim** button.

Only intersecting elements can be trimmed to a roof. The roof will only cut elements that are placed under or above its polygon shape.

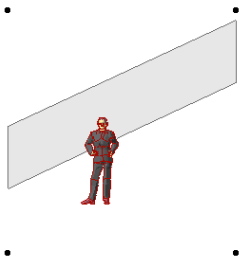


Trimming an element can either be temporary, for visual display only, or definitive. A checkbox in the bottom part of the **Trim to Roof** dialog box allows you to modify the height or base elevation of the affected element. In the example below, the **Set Wall/Column Top to highest Point** box was first unchecked, then checked. The selection dots show that, in the second case, the wall's actual height has changed to the highest point of the trimmed element.



Note that if you click **Trim Base**, the **Set Wall/Column Top to highest Point** box changes to **Set Wall/Column Base to lowest Point**. In this case, it's the base elevation of the element that changes.

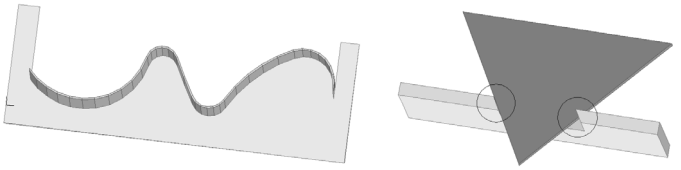
The trim remains in effect even if you hide the Roof or the trimmed elements, move them away from each other or even delete the trimming Roof. This allows you to create special gable shapes from those construction element types. In the example below, the sloped wall was created by trimming both its bottom and its top by two Roofs that had then been removed. The selection dots in this front view show the original elevation of the wall.



You can restore elements after a temporary trimming. If an element has been trimmed to a roof, an additional button appears at the bottom of that element's Settings dialog box (Model section) allowing you to undo the trimming. The only exception is Slabs: their trimming can only be undone through the **Edit/Undo** menu item just after the trimming has been done.

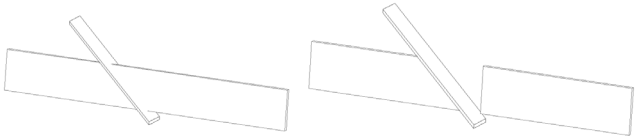
Trimming Walls, Beams, Columns and Library Parts

You can cut quite complex shapes into walls, beams and columns by trimming them to Roofs. The wall will always follow the shape of the roof(s) above them, no matter how many roof segments you have. However, you have to remember that any roof can only make parallel cuts into the walls *(see example on the right)*.



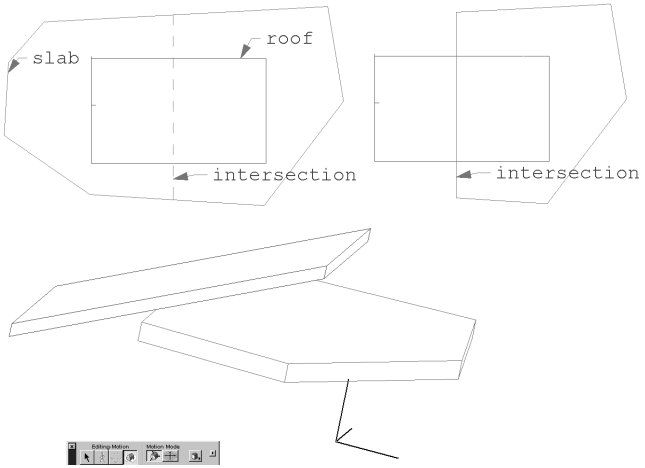
If you trim a wall with a roof that crosses the wall entirely, the wall will be cut into two parts: one with a cutting at the end, while the other will be a separate wall without any cut. This second wall will start from the point where the roof ends.

There is one exception from this. If you have an opening that would have points in both parts of the wall after the trim, the wall will remain one piece.



Trimming Slabs

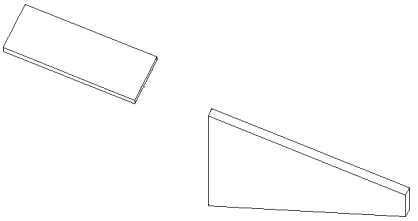
Slabs can also be trimmed by the lower or upper slope of roofs with the help of this command. However, there is a big difference between trimming slabs and trimming walls, columns or Library Parts. While other elements can be partly trimmed, slabs are always cut along the whole section line of the roof and the slab, effectively removing the cut part of the slab.



Trimming with a Remote Roof

You can also use remote roofs and even roofs on other stories whose outline is shown on the given story for trimming elements to the plane of that particular roof.

Just select the elements you intend to cut, then Ctrl-click (Windows) or Cmd-click (Mac) an edge or a node of the roof you want to cut them with. The reverse procedure will also work: select the roof you want to cut with and Ctrl-click (Windows) or Cmd-click (Mac) the individual elements you want to be cut.



Note: The wall/beam/column is cut whether it is under a roof or not. Be sure to set a sufficient height for the original rectangular walls/beams/columns so that they are cut correctly.

Meshes

Definition

Meshes are surfaces of any form created by defining the elevation of their characteristic points and interpolating between them.

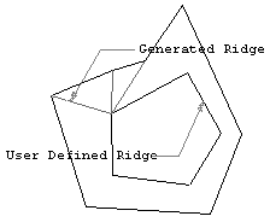
In the Floor Plan, only the outline and the ridges of the Mesh are shown.

In 3D, depending on the construction method chosen in the **Info Box** and the **Mesh Settings** dialog box, you will obtain meshes created as superficies, meshes created with vertical sides (skirt) and meshes created as solid bodies.

A mesh is created on the foundation of the basis Plane and the ridges of the Mesh.

You draw the main contours of the mesh projected to the basis plane. You can then raise the characteristic points of the mesh's superficies out of this plane.

There are two types of ridges in a mesh: user-defined and generated ridges.



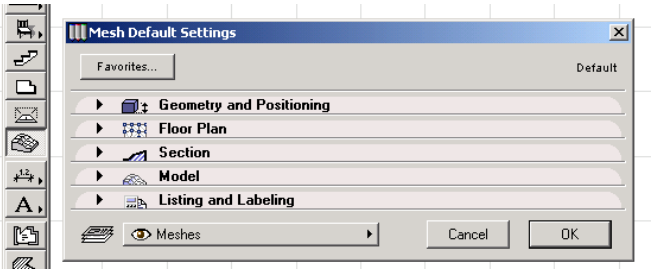
User-defined ridges are always visible as they are part of the outline of the mesh.

If the polygons or nodes are at different elevations and the **Show All Ridges** option is selected, ArchiCAD will show the ridges generated through the connecting the mesh nodes.

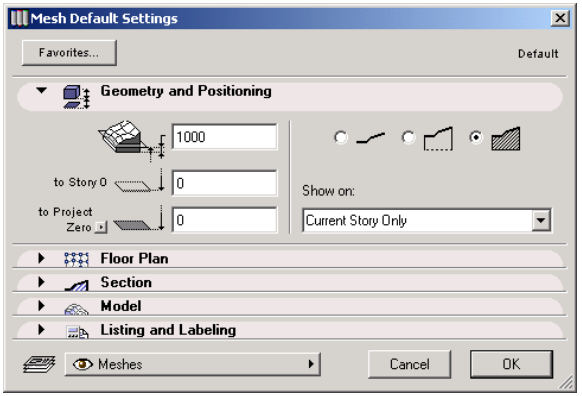
Each of the ridges generated by ArchiCAD connect two nodes at different heights that are not already connected by a user-defined ridge. Therefore, they are not shown if nodes do not differ in elevation.

Mesh Tool and Settings

The Mesh tool is located in the lower part of the construction tools section of the Toolbox. Its settings dialog box contains five panels: **Geometry and Positioning**, **Floor Plan**, **Section**, **Model** and **Listing and Labeling**. At the bottom of the dialog box, as for all tools, the current layer choice is displayed in a pop-up menu.



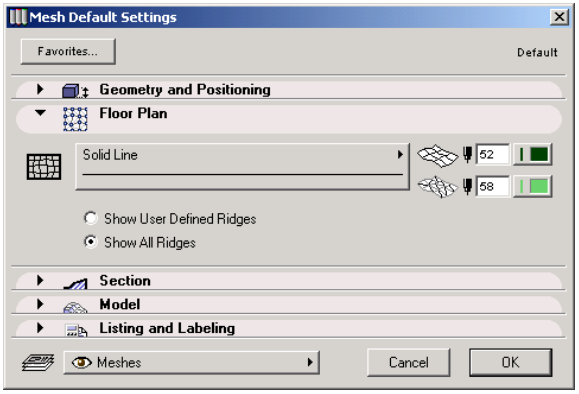
The **Geometry and Positioning** panel contains the elevation of the Mesh's basis plane, the depth of the mesh body or sides below the basis plane, and the option to show the Roof on multiple stories. You can also decide whether you will construct a simple surface, a skirted surface or a solid body.



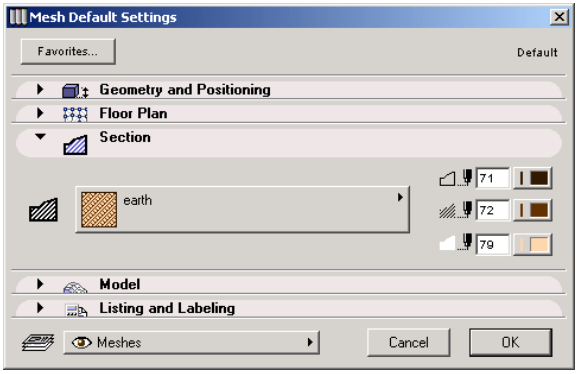
In the **Floor Plan** panel, you can set the line type and pen colors that will be used to represent the Mesh's outline in the

Floor Plan and its contours in 3D and Elevation views. ArchiCAD uses the same line type for user defined and generated ridges. You can make a distinction between the two kinds of ridges by setting their color in the Pen Color pop-up palette.

With the two Show Ridges radio buttons you can set whether to show all ridges or only those that you have defined when drawing the mesh.

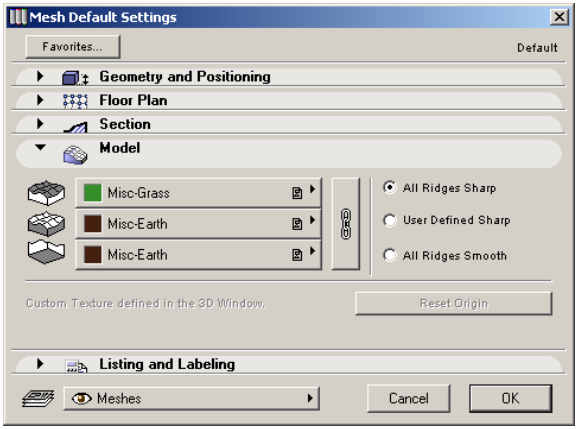


The **Section** panel defines the fill pattern used to represent cut Mesh surfaces in Section/Elevation windows. Different pen colors can be chosen for the outline of the cut surface, the body hatch and the background of the hatch. These settings only apply to solid bodies, not to simple or skirted superficies.



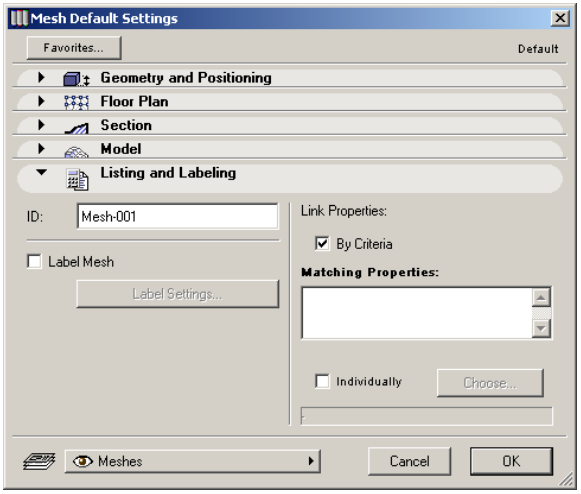
In the **Model** panel, you can assign materials to different sides of the mesh block. Depending on the construction method (simple surface, skirted surface, solid body), only some or all controls will be available. You can use different materials for the Mesh's different surfaces or click the chain icon to use the last selected material for all surfaces. Deselecting the chain icon will restore the originally set materials to the mesh surfaces.

You can also control the appearance of the generated ridges in the 3D model. If you choose **All Ridges Smooth**, only user-defined ridges will appear in 3D view.



The fifth panel is called **Listing and Labeling** and controls the handling of the Mesh in calculations.

The controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

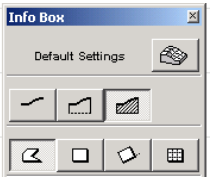


Drawing Meshes

When you are satisfied with the choices you made in the **Mesh Settings** dialog box, you can start drawing Meshes. New Meshes can be created in either the Floor Plan or the 3D Window.

Geometry

The Mesh has four geometry methods in the Info Box. You can create Polygonal, Rectangular and Rotated Rectangular shapes or a Regular Sloped Mesh.



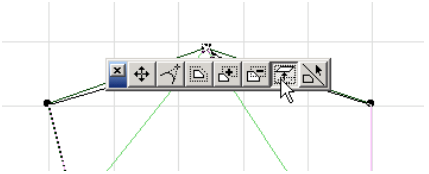
The first three methods work the same as for other construction tools, for example Walls or Slabs. *See the corresponding sections for details.* Note that these geometry methods only determine the outline of the mesh. The elevation of the mesh points has to be determined manually.

Drawing a Polygonal or Rectangular Mesh

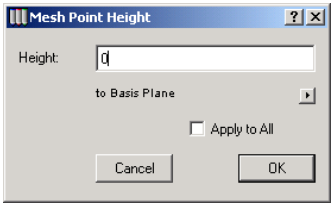
With the Polygon, Rectangle or Rotated Rectangle geometry method, there are two phases in the drawing of a mesh.

First, draw a polygon at the elevation of the basis plane that you defined previously in the Settings dialog box.

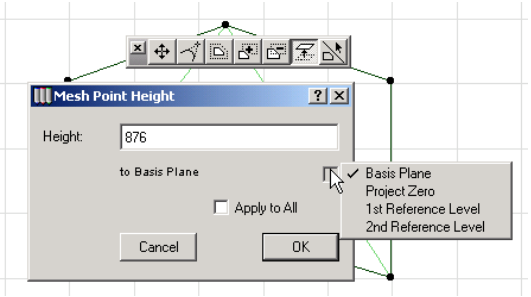
You can then edit the polygon after selecting it. Clicking the borderline of the polygon with the Mesh tool active will open the pet palette. By clicking one of its nodes, you can edit the elevation of nodes if you choose the corresponding icon of the pet palette.



This action opens the **Mesh Point Height** dialog box. You can enter a new height value in the text field.

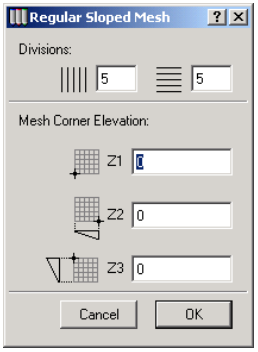


- Checking the **Apply to All** box will set all Mesh points to this new height.
- Changing the elevation of a single point will not affect the elevation of the neighboring points.
- The arrow below the text field opens a pop-up menu in which you can choose a reference level for the modified height.



Drawing a Regular Sloped Mesh

The Regular Sloped Mesh method (the fourth in the Info Box) helps you quickly create regular meshes with plane surfaces. After defining the rectangle contour of the mesh, the **Regular Sloped Mesh** dialog box opens automatically.



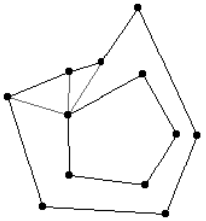
In the first part of the dialog box, you can set the number of divisions in either coordinate direction. You must then set the elevation of three mesh corners; the fourth one is generated automatically.

On confirming the settings, ArchiCAD will draw the mesh.

Adding New Points or Holes to the Mesh

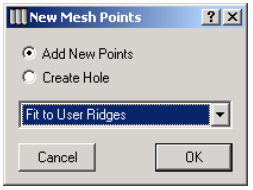
With the Mesh tool active, select the Mesh that you wish to add points to. Draw an open line or a closed polygon by clicking twice at the last node or clicking the **OK** button in the **Control Box**. The **New Mesh Points** dialog box then opens. You can define here the new nodes as the points of a hole or as an addition to the superficies.

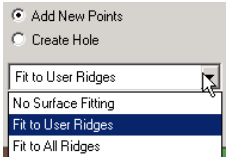
If you draw outside of the contour of the first polygon, only nodes within the contour will constitute the mesh.



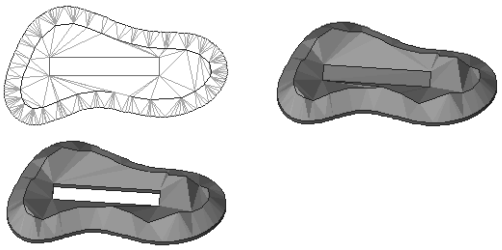
You may continue developing your mesh later by adding new nodes, polygons and editing elevations later as well. When you add new points or create a hole in a mesh, ArchiCAD offers several ways to define the relationship between the newly created points and existing ones.

When you add points to the selected mesh, in the **New Mesh Points** dialog box you can choose between adding new points and creating a hole. Located below the two radio buttons, the pop-up menu contains three choices that produce different results.

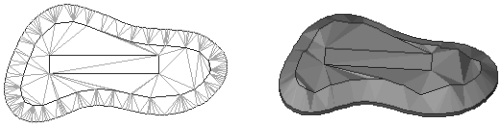




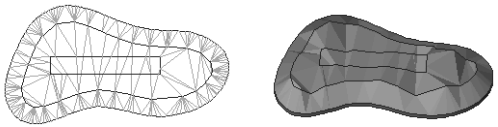
- If you choose **No Surface Fitting**, the new points will be added with the height value currently set in the **Mesh Settings** dialog box. Intersected user-defined ridges will keep their height. If you're creating a hole, the slopes of the mesh will be connected to the bottom elevation of the mesh.



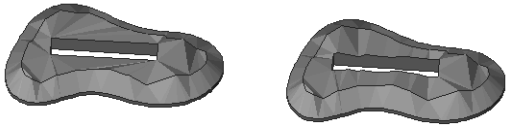
- If you choose **Fit to User Ridges**, the new points will be placed on the current surface of the Mesh, and only user-defined ridges will keep their height. This method is recommended for renderings.



- If you choose **Fit to All Ridges**, the new points will be placed on the current surface of the Mesh, and all ridges will keep their height. This method is the most precise one, but it may generate a rather large number of ridges.



In the latter two cases, if you wish to create a hole (for instance, for accommodating a house plot), no slopes connected to the bottom of the mesh will be created, allowing you to place your building exactly into the excavated site.



Using the Magic Wand

The Magic Wand saves you work by finding and tracing a polygon shape from among existing elements, and then generating a new element based on the polygon. The Magic Wand lets you create special shapes that are not available for that particular tool type or would be tedious to construct segment by segment. Using the Magic Wand is a *universal* method for defining polygonal shapes using all tools and methods that allow you to do so. Since it creates polygonal shapes by nature, the Magic Wand will ignore geometry method settings (such as Skewed Rectangle) for the current tool.

The Magic Wand works in both the Floor Plan and 3D Window and recognizes the following element types: Wall, Beam, Slab, Roof, Fill, Mesh, Line, Arc, Polyline, and Spline. Magic Wand recognizes elements that are locked, displayed from remote or Ghost stories, reserved by others or outside your workspace.

How to Create an Element with the Magic Wand

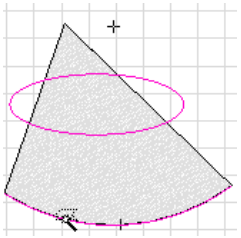
1) Select Desired Element Type. From the Toolbox, select the new type of element you want to create.

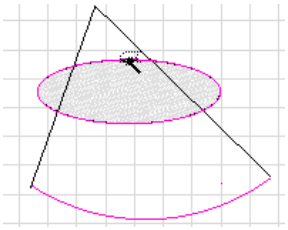
2) Activate the Magic Wand. Click the Magic Wand icon in the Control box (or, as a shortcut, press the Spacebar) to make it appear.

- The Magic Wand has three different shapes for identifying edges , nodes and empty space (including surfaces).

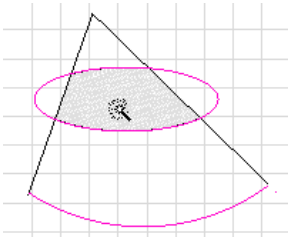
3) Click the Magic Wand to find and trace a polygon shape.

- If you click on an edge or node, the Magic Wand creates a polygon by tracing that element and/or finding an element chain: it runs along that edge and traces the element chains whose endpoints fall within that edge.

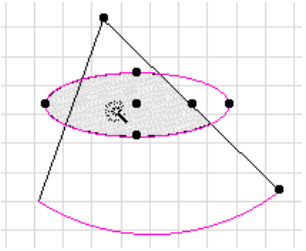




- If you click in empty space or on a surface, the Magic Wand searches for and traces the closed geometric area formed by the nearest elements (whether chained together or merely intersecting), and generates the resulting polygon.



- You can refine the Magic Wand function by selecting one or more elements. In this case, the Magic Wand will only take the selected elements into account when searching for chained elements or a bounded area.



4) The new elements are generated.

- The new elements are not linked to the originals and can be manipulated independently.
- If the original shapes are superfluous, you can delete them.
- If Offset or Multi-Offset has been activated, you can complete the offset function after the Magic Wand has created the new polygon.
- If you are creating a single Roof, you must draw a pivot line and define the slope in addition to creating the polygon with the Magic Wand.

All of the characteristics of the new elements are determined by the current default settings of the corresponding tool. You should always check that these are correct either before or after using the Magic Wand, especially if the elements are intended to have a specific relationship to each other, such as a roof resting on a Wall.

Using the Magic Wand with the Pet Palette

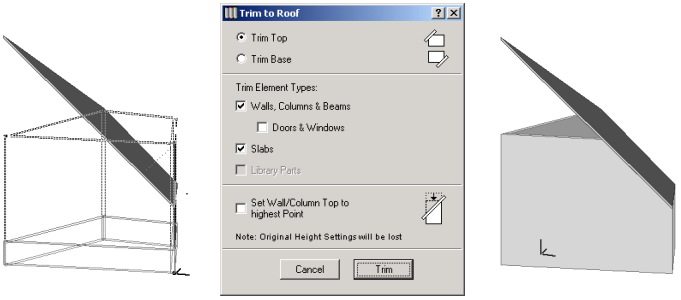
You can trace shapes for making holes in any polygonal element and add or subtract shapes to a polygon by combining the features of the Magic Wand with the pet palette. *See Modifying Element Sizes in Chapter 5: Drafting and Editing Techniques.*

Using the Magic Wand in 3D

In 3D, the Magic Wand feature works as in the Floor Plan, but instead of using only the top view of the elements, each element is considered the way it lies in space. When searching for the contours of the new element, ArchiCAD will only look at the elements that are actually intersected by the clicked plane. The clicked plane is always the horizontal plane through the clicked surface point or through the User

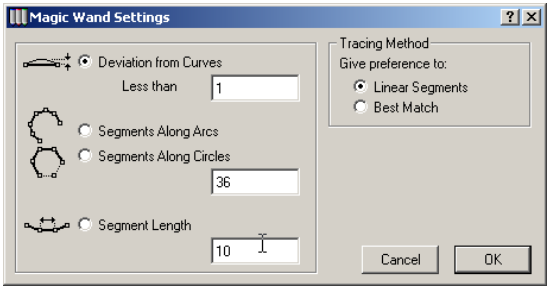
Origin (e.g., when clicking inside polygon walls/beams into space).

Note: If you create Walls by tracing the contour of a Roof and define a height above the plane of the Roof, you will be automatically prompted to trim the Walls to the Roof.



Approximation of Curves

When creating curved Walls and polygon-type elements based on Arcs, Circles and Splines, the approximation is based on the state of the **Magic Wand Settings** dialog box accessed from the Tools menu.



With the two radio buttons on the right, you can choose between two tracing methods.

- With Best Match, curved segments will follow as best as possible the natural form of Circles, Arcs and Splines.
- With Prefer Linear Segments, only linear segments are used.

The four radio buttons on the left allow you to choose from a set of options to approximate curves with linear segments.

- The first option allows you to define the maximum deviation of the polygon from the original curved element.
- The two buttons in the middle allow you to define the number of segments along an Arc or an entire Circle. In the second case, arcs will be transformed into a number of segments corresponding to the part of the circle they represent.
- The fourth button allows you to make the transformation with segments of uniform length.

  Note: if you choose the Best Match method and real curves cannot be created, ArchiCAD will try to approximate curves in the hierarchical order represented in this dialog box.

Creating Element Duplicates

You will often need to create exact duplicates of a particular element. ArchiCAD offers a large number of features that will help you recover the settings of previously placed or defined elements. While some of these features only work inside the same project, you can also store and retrieve element settings across projects.

Copy-Paste

The simplest way to create exact duplicates of elements is by selecting, copying and pasting them. Construction elements can only be copied and pasted on Floor Plans, while drawing elements can be copied in the Floor Plan, Section/Elevation and Detail Drawing windows. When copying construction elements in the Section/Elevation window, you can only paste the decomposed 2D elements of their current representation. Copy-Paste works across stories and even projects.

The selection can be made with either the Arrow or the Marquee tool.

When pasting Floor Plan elements, the elements keep their original x-y position. Before choosing the final position of the pasted elements, you can drag, rotate or mirror them.

- If the pasted elements cannot appear in the Window at the current zoom level, a dialog box opens where you can choose whether to paste the elements to the original location or to the current view, and whether to zoom to the pasted elements.
- When you are pasting with a multiple story marquee, an alert appears asking you to identify the copied story to merge to the current one.

  Note: If you **Cut**/**Copy** and then **Paste** a selection between stories at the same zoom level with no Panning operations in between, the contents of the Clipboard are pasted into the same position they were originally cut or copied from. You can change stories in ArchiCAD between **Copy** and **Paste** operations. This feature is very useful when copying a selection from one story to another.

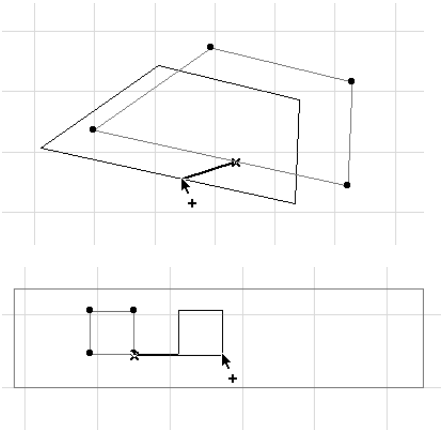
When pasting elements in another project, remember that element attributes are identified by name.

- If the pasted elements refer to attributes that do not exist in the target Project, the necessary attributes will be appended.
- If the elements refer to attributes that do exist in the target project but are different from those of the original project, they will take on the attributes of the target project.

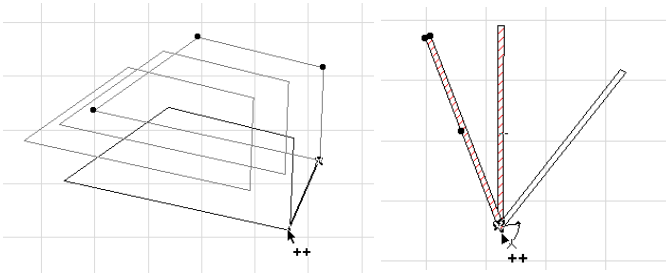
Drag, Rotate, Mirror a Copy

You can also create exact duplicates of an element inside the same project by dragging one or several copies of the selected element. The selection can be made with either the Arrow tool or the Marquee tool.

- If you choose the **Drag**, **Rotate** or **Mirror** command in the Edit menu and then start moving the selected element while holding down the Ctrl (Windows) or Cmd (MacOS) key, a copy of the selected element will be moved. Click to place the copy.



- If you choose the **Drag** or **Rotate** command in the Edit menu while moving the selected elements, hold down both the Ctrl (Cmd) and Alt keys to move several copies of the selected element. Click to place single copies and double-click the place the last copy. This function is not available for Mirroring.



This feature works in both the Floor Plan and the 3D Window. Note that, in the 3D Window, you can redefine the height of the copies before placing them. In the Section/Elevation window, the feature works on both additional drawing elements and Doors and Windows (dragging only). In Detail Drawings, you can use it on any drawing elements.

Hint: If you use this feature often, you can make the **Drag a Copy**, **Rotate a Copy** and **Mirror a Copy** commands appear in the Edit menu by checking the **Show Element Copy Transformation Commands in Edit Menu** box in Options/Preferences/Miscellaneous.

All the created elements will have exactly the same dimensions and attributes.

Note: With the Arrow tool only, you can also use the pet palette to create the transformed copies. Select the elements, start moving them with the pet palette and press the Ctrl or Cmd keys to place single copies and the Ctrl/Alt or Cmd/Alt keys to place multiple copies.

Multiply

If you need to create a number of identical elements inside the same project following a definite pattern, for example at equal distances from each other, use the Multiply function in the Edit menu.

This feature works in both the Floor Plan and the 3D Window. Note that, in the 3D Window, you can redefine the height of the copies before placing them. In the Section/Elevation window, the feature works on both additional drawing elements and Doors and Windows. In Detail Drawings, you can use it on any drawing elements.

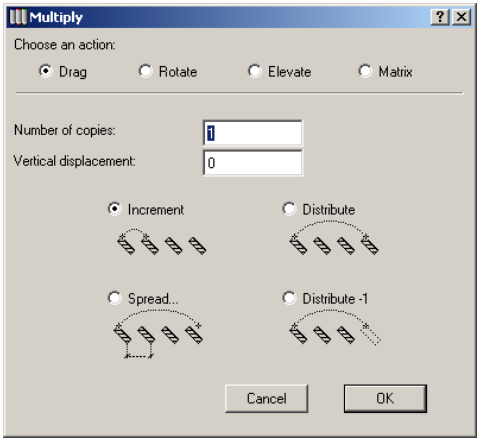
Multiply creates any number of exact copies of selected elements on the current story using the following methods and options:

- Drag the copies along a straight path with a reference line.
- Rotate the copies using an angle defined by a reference arc.
- Elevate (stack) the copies with a vertical displacement.
- Create a matrix of copies along two reference lines defined by strokes.
- Elevate and drag or rotate (stagger-stack) the copies, using both a reference line (or arc) and a vertical displacement. This is useful for conditions such as linear or circular stair risers or a sloping landscape's contours (stagger-stacked slabs).

  Note: Rotated text blocks, labels, dimensions and fill polygon area labels are always readable from the bottom and the right side of the drawing.

To use the **Multiply…** command, set up the parameters in the **Multiply** dialog box and apply them by setting a reference line or arc. The specific steps are as follows:

A set of radio buttons specifies the type of Multiply operation to perform.



- **Drag** multiplies the copies along a straight path defined by the reference line.
- **Rotate** multiplies the copies along an arc, using the angle specified in the reference arc.
- **Elevate** stacks the copies with a vertical displacement. Note that this option is grayed when working in a Section/Elevation or Detail Drawing window.
- **Matrix** will place the copies of the selected element(s) to a matrix defined by two perpendicular reference lines. When choosing the **Matrix** option, you need to define the number of copies for both the first and the second stroke of the matrix. It also needs two parameters for the vertical displacement.

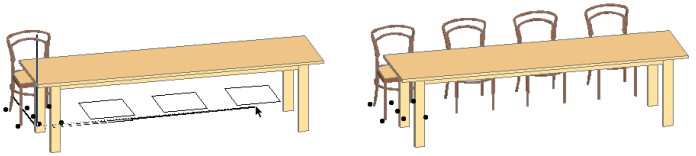
In the lower half of the dialog box, the distribution options determine how the start and endpoint of the reference line will be interpreted.

- **Increment** spaces the copies by an incremental distance equal to the length of the reference line or reference arc.
- **Distribute** spaces the copies evenly between the start and endpoints of the reference line or reference arc.
- **Distribute-1** will also space the copies evenly between the starting point and the endpoint of the reference line or arc, but the distance is divided by the Number of copies + 1 and no copy will be placed at the endpoint.
- **Spread** will place the copies of the multiplied element to equal distance from each other along the reference line or arc all the way until the reference is drawn. In this case, instead of defining the number of copies, you set the spacing in length or in degrees between two neighboring copies.

Vertical displacement will define the value that is added to the elevation of each subsequent copy of the multiplied object, even during dragging, rotating or arraying the copies.

When multiplying the element(s) in the 3D window, the vertical displacement must be defined with a reference vector, not by a value in the dialog box. In this case, simply push a radio button in the dialog box indicating whether you need vertical displacement.

When you have defined your choices, click OK in the **Multiply** dialog box and perform the operation by dragging the cursor to the desired location according to the chosen option.



Note: When multiplying Windows or Doors, do not forget that ArchiCAD will place the copies of the openings into the parent wall on the current story and not to the story above or below it, even if you have defined an elevation value that extends beyond that of the current story.

Parameter Transfer

ArchiCAD allows you to pick the settings of one construction element and pass them to another with two simple keyboard shortcuts. This facilitates the modification of either the default values in a settings dialog box, or the settings of existing elements, without having to select Tools and open dialog boxes. The feature is available:

- Both on the Floor Plan and the 3D Window for most element types;
- In Section/Elevation and Detail Drawing windows for drawing elements only.

When you press the Alt (Option) key, the cursor takes on the **Eyedropper** shape.

The **Eyedropper** is:

Full, when snapping to a Reference Line or axis node;

Half full, when snapping to Hotspots and general nodes;

Part full, part striped when snapping to a reference line or axis;

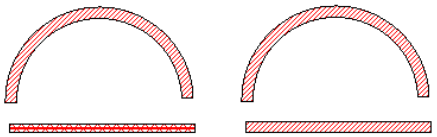
Striped, on top of an edge;

Empty, when the cursor is in an empty workspace area (visual feedback only).

Clicking with a full or striped **Eyedropper** will load the settings of the given element into the corresponding tool type's settings dialog box and make them the new default settings for that tool. The given tool becomes active, and, with the next click, you can start drawing a clone of a clicked element.

To transfer a dialog box's settings to an element, press the Alt and Cmd keys (MacOS) or the Alt and Ctrl keys (Windows) simultaneously while clicking on an element. The cursor changes into a **Syringe**. The same rules (empty, striped, full, etc.) apply as for the Eyedropper. Clicking an element will apply the default values and attributes (Line Type, Pen Color, Material, etc.) to that element.

In the example below, the settings of the Wall on top have been transferred to the Wall on bottom.



Notes: In the case of overlapping elements of different type, check in the **Info Box** to see which element has been selected. The attributes of the element will also be loaded into the **Find & Select** dialog box's corresponding fields, provided that the dialog box is currently open and the appropriate button is active. The transferred attributes will also be pre-selected when opening any of the corresponding dialog boxes (Line Types, Pens & Colors, Fill Types, Materials, Composites, Zone Categories).

Favorites

The **Favorites** feature allows you to save and easily recall default tool settings. If you choose a stored Favorite, you can create an element that has the same parameters and attributes as the Favorite.

Favorites are saved with your Project file. You can also save a separate **Favorites file** for reuse in other projects.

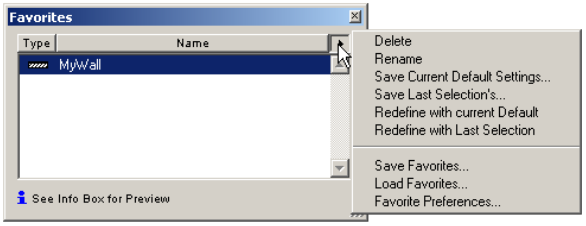
- If you close the current Project and create a new one, stored favorites will remain at your disposal just like materials, pen colors or line types.
- If you choose **New and Reset, Favorites** will be cleared.
- You can restore saved favorites by choosing the **Load Favorites** command from the Favorite palette's pop-up menu.

  Note: When importing Favorites from another Project, remember that element attributes are identified by name.

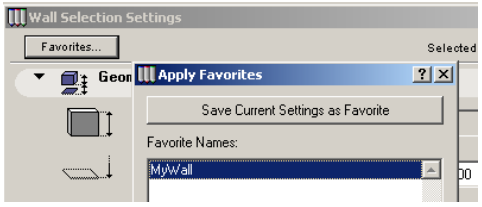
- If the Favorites refer to attributes that do not exist in the target Project, the necessary attributes will be missing.
- If the Favorites refer to attributes that do exist in the target project but are different from those of the original project, they will take on the attributes of the target project.

Favorites can be accessed from two locations:

- The Favorites floating palette that stores all saved favorite settings regardless of the tool that created them. The palette is hidden by default; choose **Window/Floating Palettes/Show Favorite Palette** to display it. It remains visible on top of the other Windows.



- The Favorites button in the top left corner of all **Tool Settings** dialog boxes (except Camera). The dialog box that opens will only list the favorite settings saved for that tool.

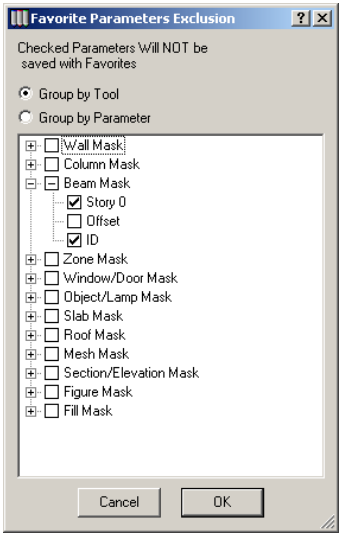


The stored settings include:

- The element's attributes, including the line type, fill pattern and pen color, as well as surface material choices;
- In the case of Library Parts, the name of the Library Part;
- All of the element's dimensions that can be entered in the settings dialog boxes for the element, e.g., wall thickness and height (but not length).

You can also customize the storing of Favorites for each tool or parameter type by choosing **Favorite Preferences** from the Favorite palette's pop-up menu.

In the Favorite Parameter Exclusion dialog box that appears, check the names of the parameters that you DO NOT want to store with Favorites.



Functions of the Favorites Palette

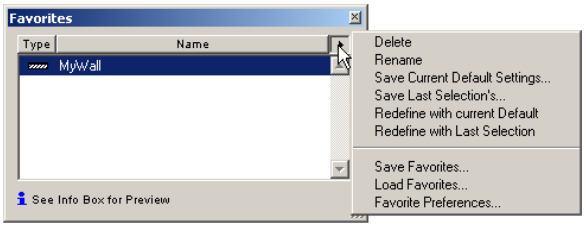
The Favorites palette lists the Names and Types of all stored default settings. You can verify the actual settings in the Info Box.

If no element is selected, clicking a name in the Favorites palette will show the settings of the Favorite in the Info Box. Double-clicking the name will also switch to the corresponding tool in the Toolbox.

If eligible elements (that is, ones that correspond to the type of the Favorite) are included in the current selection, double-clicking the name of the Favorite will apply its settings on the selected elements.

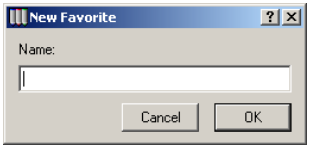
You can sort Favorites by Name or Type: just click the corresponding caption.

The arrow in the top right corner opens a pop-up menu with a number of commands that allow you to work on Favorites.



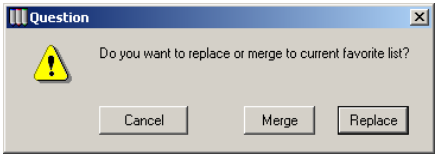
You can:

- **Delete** the selected Favorite (one at a time),
- **Rename** the selected Favorite (enter a new name in the appearing **Rename Favorite** dialog box),
- If any tool is active in the Toolbox, choose **Save Current Default Settings** to store these settings as a Favorite and enter a name in the **New Favorite** dialog box that appears. This item is inactive if the Arrow, Marquee or Camera tool is selected in the Toolbox.

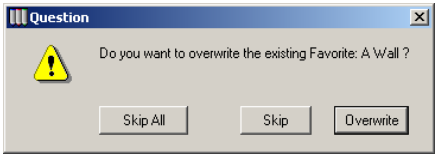


- If any element is selected, choose **Save Last Selection** to store that element's current settings as a Favorite. If nothing is selected, this command is inactive.
- If any tool is active in the Toolbox, choose **Redefine with Current Default** to change the selected Favorite's definition to the current default settings of that tool. This item is inactive if the Arrow, Marquee or Camera tool is selected in the Toolbox.
- If any element is selected, chose **Redefine with Last Selection** to change the selected Favorite's definition to the settings of that element.
- Export the whole set of Favorites in a separate file by choosing **Save Favorites**. The file will be saved with the .prf extension.
- Restore saved Favorites by choosing **Load Favorites**.

  Note: When you have located the file to restore and clicked OK in the directory dialog box, ArchiCAD will ask you whether you wish to replace the current list of Favorites with the one you are restoring or merge the two sets of Favorites.



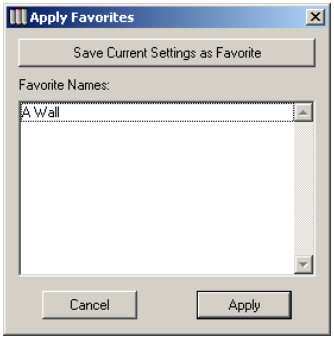
When merging the two sets, if any Favorites have identical names, you will be prompted to skip or overwrite the original definition.



- Define the exclusion of parameters by choosing Favorites Preferences as seen in the introduction of this section.

Storing and Applying Favorites in Tool Settings

If you click the Favorites button on top of any tool's settings dialog box, a dialog box appears listing only the Favorites defined for that given tool.



You can either:

- Select a stored Favorite in this list and click the Apply button to load that Favorite's settings in the tool's dialog box, or
- Click the **Save Current Settings as Favorite** button on top and create a new Favorite by naming it in the appearing dialog box.

  Note: Favorites are identified by their names. If you attempt to use the name of an existing Favorite when creating a new favorite (even if it belongs to another tool), ArchiCAD will warn you about this.

Parametric Objects

Some types of construction elements are placed in ArchiCAD as the instances of predefined elements residing in external files named GDL Objects or Library Parts. GDL Objects are stored in libraries of objects that can be used in many Projects.

GDL Objects comprise a 2D Symbol and a 3D description in GDL (Geometric Description Language), as well as some optional information such as an additional 2D description, a user interface script or a component definition. To learn more about Library Parts, see *Chapter 7: Library Management, Chapter 8: Working with GDL Objects* and the *Graphisoft GDL Reference Manual*.

When you insert a GDL Object, you are actually placing an instance of the external file. You can freely configure the placed instance within the parametric restrictions of the Library Part without actually modifying the external file itself.

GDL Object Types

GDL Objects are directly placed using ArchiCAD tools. Depending on their subtype, the tool that recognizes and places them can be either the Object tool or a dedicated tool, for example the Door, Window, Corner Window, Lamp, Stair or Skylight tool.

Typically, you will follow these steps when placing a GDL Object:

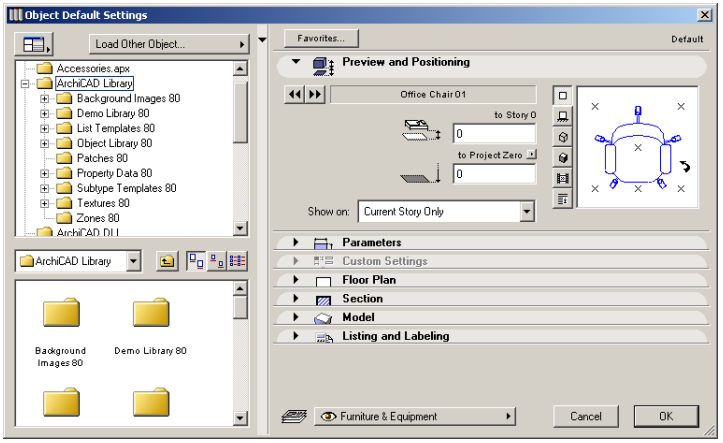
1) Select the corresponding tool in the Toolbox and open its settings dialog box by double-clicking the tool's icon.
2) Browse for the appropriate element in the available library folders.
3) Adjust the default settings default to suit your particular situation or purpose and click OK to confirm.
4) Click at the desired location and place the customized instance of the Library Part.

Note that there are special constraints and considerations for different types and subtypes of GDL Objects. *See the detailed descriptions of the different elements.*

Warning: If you open a Project and the **Status Report** palette informs you that library items are missing from the Active Library, those items cannot be displayed on the Worksheet, in the 3D Window or in the Bill of Materials. *See details in Chapter 7.*

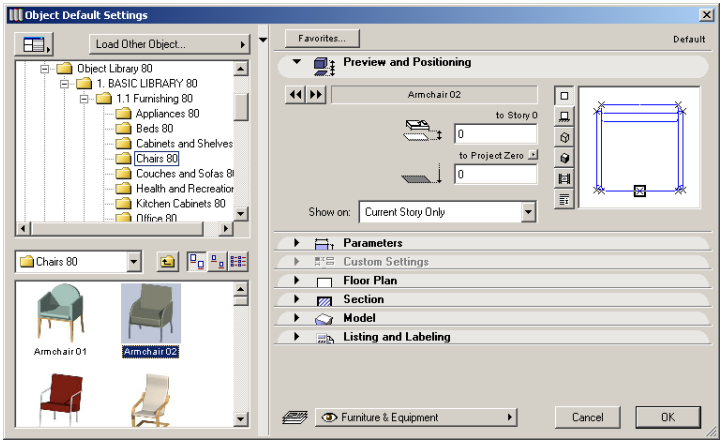
GDL Object Type Tool Settings

The settings dialog boxes of Library Part type elements are more complex than those of the basic construction elements presented in the previous section. They consist of two parts: On the left, the browser area allows you to locate single library parts corresponding to the active tool in the loaded libraries. The right-hand side of the dialog box contains a large number of unfoldable panels, similar to the ones described for construction elements.

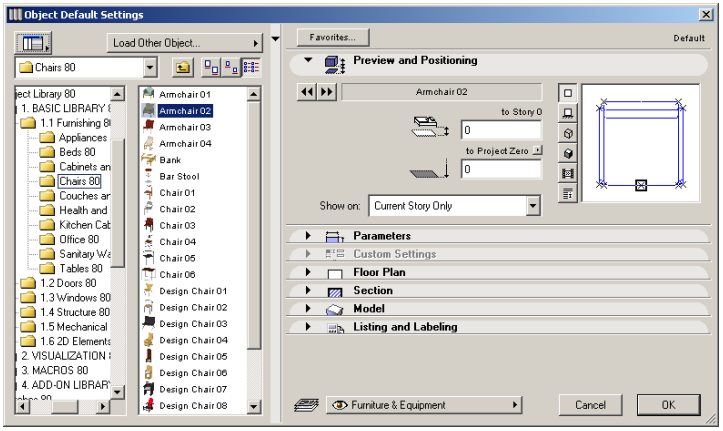


The browser area includes the libraries loaded with ArchiCAD. The set of library folders cannot be modified here. *See details in Chapter 7.*

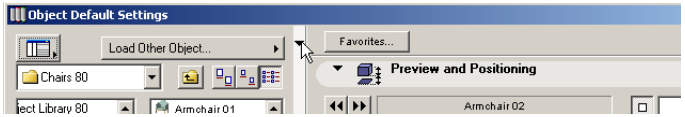
You can unfold library folders by clicking the plus sign (or, in MacOS, the purple arrow) next to their names in the panel on the left. The panel on the right always shows the content of the folder selected on the left. If you select an element (not a folder) in the panel on the right, its settings appear in the unfoldable panels on the right-hand side of the dialog box.



- A pop-up control in the top left corner of the settings dialog box allows you to arrange the browser area panels vertically or horizontally.
- With the **Load Other...** button, you can load a library part that is not located in an active library.
- Next to the navigation controls, three buttons representing different icon sizes allow you to display the contents of the browsed folder as large icons, as small icons or as a plain alphabetical list that always shows the full names of the elements.



By clicking the down-arrow in the center column of the settings dialog box, you can hide the browser area. This way, the dialog box takes up less space.



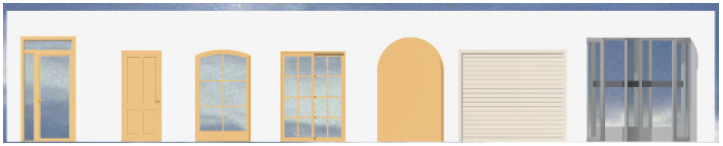
The panels of the individual library part types are presented in detail in the corresponding sections below.

Windows and Doors

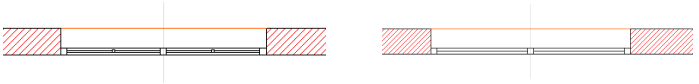
The handling and behavior of Windows and Doors is quite similar, therefore they will be described together.

Definition

In ArchiCAD, Windows and Doors simulate the look and behavior of real-life Windows and Doors. Doors and Windows cut real, see-through openings into the wall, so that 3D visualizations are more accurate ad lifelike. However, glass panes are represented as solid shapes, allowing opaque openings for standard elevations. The glass material lets light in and you can look through the Windows and glass Doors in PhotoRendered views.



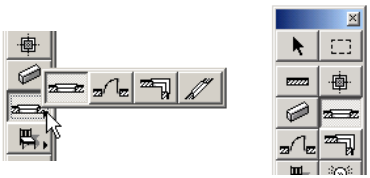
On the Floor Plan, Windows and Doors are represented by standard symbols. Depending on the scripting of the Library Part, various amounts of details can be available at different Floor Plan scales.



In addition, a setting in **Display Options** (**Options** menu) allows you to show Doors and Windows on the Floor Plan in full or in outline only, to show or hide their dimensions, or, by choosing the Reflected Ceiling option, to show the edge of the door lintel in the same way as the sill of a window.

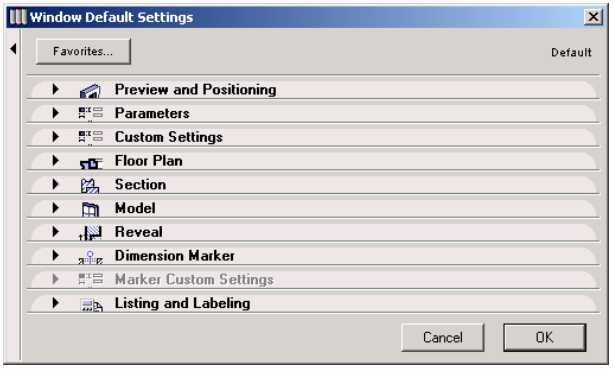
Window and Door Tool and Settings

The **Window** and **Door** tools are represented by a single icon in the default shape of the **Toolbox**, together with the Corner Window and Skylight tools. If you choose **Options/ Customize/Palette Shapes** and check the **Extended** checkbox for the **Toolbox**, you can see all tools at the same time.



Note: Additional icons represent special openings. In the example above, the Corner Window tool also appears. *See the Placing a Corner Window section later.*

The Window and Door Settings dialog boxes are alike. As seen in the section above, they comprise a browser area and a number of unfoldable panels. This section deals only with the unfoldable panels. (To see the browser area too, click the arrow at the edge of the dialog box.)

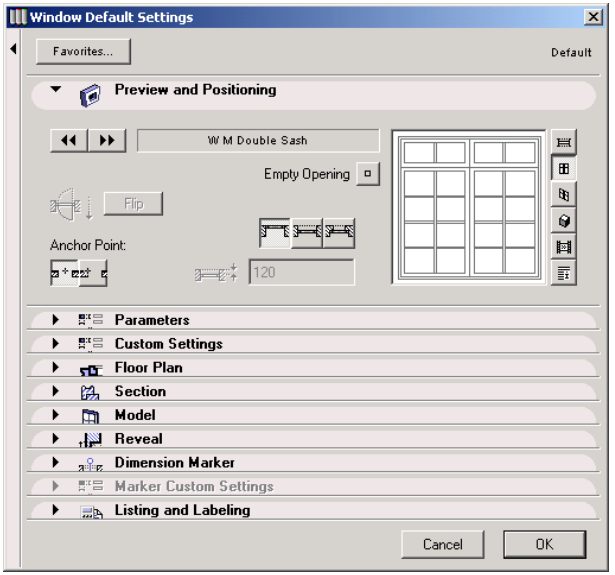


There are ten panels in the Window and Door Settings dialog box: Preview and Positioning, Parameters, Custom Settings, Floor Plan, Section, Model, Reveal, Dimension Marker, Marker Custom Settings and Listing and Labeling.

The **Preview and Positioning** panel includes, in addition to the preview of the Window or Door that you will be placing, simple navigation controls allowing you to go the previous and next element in the active library set without having to use the browser area and the controls needed to place the Window or Door in its host Wall.

On the right-hand side of the panel, the **Preview Area** displays the 2D symbol, the hidden line front view, the hidden line axonometry, the 3D shaded axonometry, the predefined preview picture or the optional information notes of the selected Window or Door. Use the buttons next to the **Preview Area** to choose a view.

Move the cursor inside the **Preview Area** and the cursor will change to an arrow, allowing you to turn to the 2D Symbol or 3D View of your Library Part.



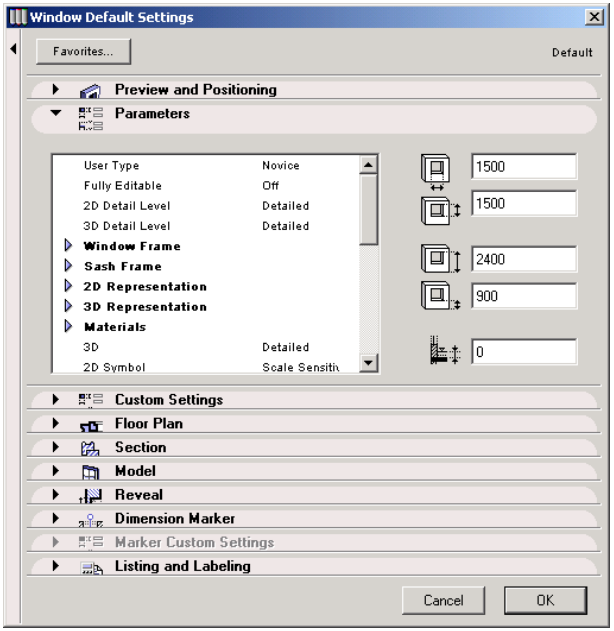
By clicking the **Empty Opening** icon, you can clear the current Library Part choice and create a simple hole-like opening in the Wall. *See Creating an Empty Opening later.*

Both the **Anchor Point** choices and the Construction Methods play a role in placing Library Part type Windows and Doors. The Anchor Point setting decides whether you will place the Window or Door by its centerpoint or one of its corners, while the Construction Methods define the sill depth and shape. *The use of these options is illustrated in the Placing a Window or a Door section.*

The **Sill Width** field specifies an offset for the opening away from the face of the wall in the direction you define by clicking with the **Eyeball** cursor. (It has no effect if you choose the edge positioning Construction Method.)

The **Flip** checkbox is only active when modifying the opening side of a placed Door or Window while keeping the frame in place.

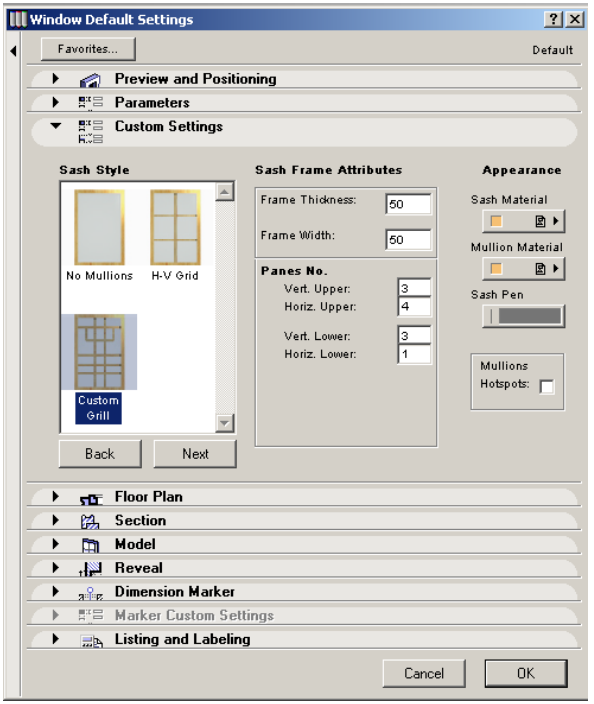
The second panel is called **Parameters**. It contains the nominal dimensions of the opening as well as the set of parameters defined in the Library Part.



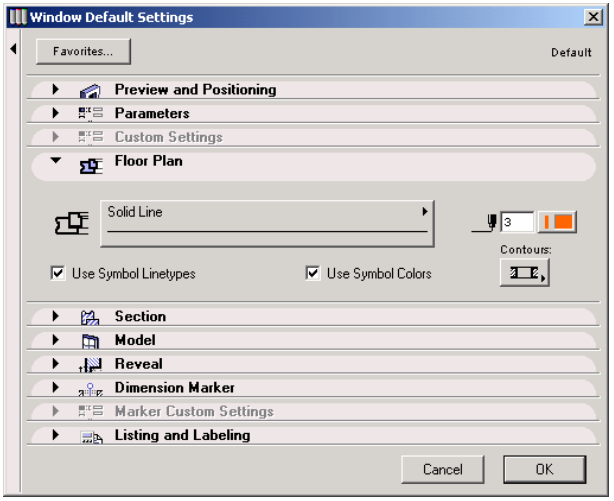
The dimensions of the opening are defined in the four editable fields on the right. The first two define the height and the width of the opening, while the ones below define the height of the header and the sill. These two values are linked: if you change one, the other will be updated. If you change the height of the opening, either the header or the sill will be revised automatically, depending on how you set this option in the **Options/Preferences/Construction Elements** dialog box. The last field allows you to adjust the nominal sill height to the desired level of the Slab connected to the host Wall.

Note that the physical size of Wall holes can be larger than their nominal size, depending on local standards. *See Dislocated Openings later.*

The parameter set listed on the left affects both the Floor Plan and 3D representation of the Library Part. Different Windows and Doors may have different sets of parameters. *See Chapter 8: Working with GDL Objects and the Graphisoft GDL Reference Guide for more details.*



The **Floor Plan** panel contains choices for the outline of the Window or Door. The Pen Color set here will be used in Elevation and 3D views as well for the lines of the element.

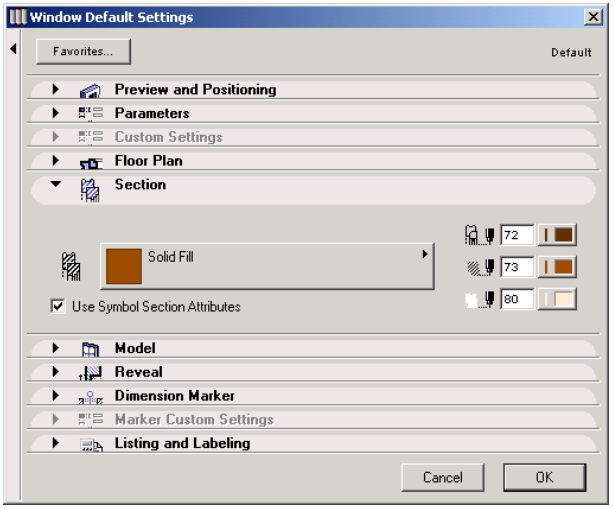


The **Use Symbol Colors** and **Use Symbol Line Types** options allow you, when checked, to use the same pens and line types for the opening that were used when its 2D symbol was created. When they are unchecked, you can use any single pen and line type for the 2D symbol of your item.

With automatic 2D wall framing, ArchiCAD will provide default door and window framing details when you add openings to your Project. You can switch automatic 2D wall framing on or off around an opening on a Floor Plan by using the **Contours** pop-up control. If you turn off automatic wall framing, you can manually add any kind of reveal or inner or outer sills to the 2D representation of your doors and windows.

Note: To see these 2D manipulations reflected in the 3D model, you must add true 3D elements to the incomplete hole, or modify the GDL macro of the door or window in question.

The **Section** panel contains choices for the contours and the fill of the cut surfaces of the Window or Door.

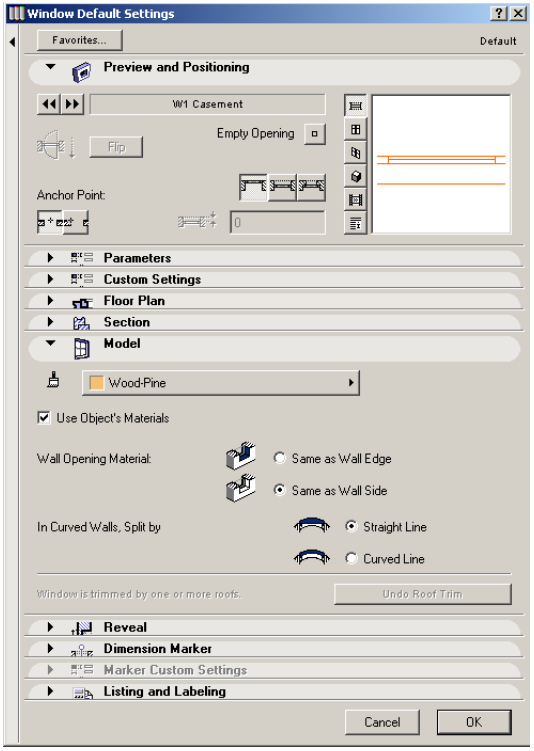


The **Use Symbol Attributes** option allows you to use the same pens and fill pattern for the opening that were used when its 2D symbol was created.

In the **Model** panel, you define the Material choices for the Window or Door.

In addition to the Surface Material options for the door or window defined in the pop-up menu, several different materials for individual parts of the door or window can be specified in the GDL description using the additional parameters of the opening. Checking the **Use Object's Materials** checkbox will ignore the set material and will apply the same material that was used when creating the Library Part.

See also Chapter 8: Working with GDL Objects for more information about the GDL description.

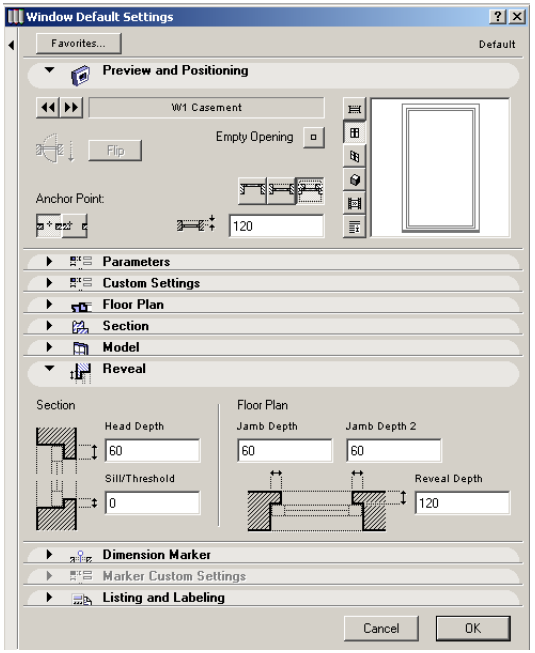


The surface materials of the host Wall can be applied to the opening in two ways.

- If you choose the **Same as Wall Edge** option, ArchiCAD will apply the material of the wall's edge to the opening's edges.
- If you choose the **Same as Wall Side** option, the external and internal wall surface materials will be applied to the opening's edges, with the reveal depth as the division line between them.

For curved walls, the materials can change either along a straight line or a curve.

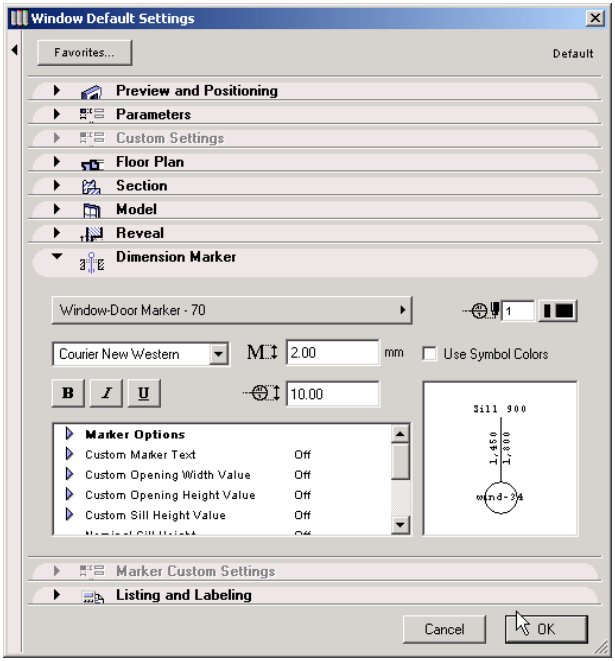
The **Reveal** panel's controls are only active if you have chosen the Reveal construction method in the Preview and Positioning panel.



You can customize here the various elements of the reveal, such as the Head Depth, Sill/Threshold Depth, left and right Jamb Depth and Reveal Depth.

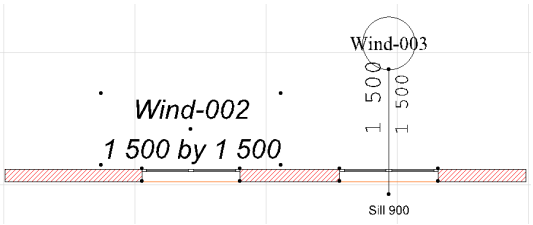
Note: For composite walls, ArchiCAD does not turn the skin opposite the reveal inside the opening, if the reveal depth is less than the remainder of the wall's thickness.

The **Dimension Marker** panel features the customizable Dimensioning options of the Window and Door tools. Note that the display of the dimensions and the marker is set universally for the entire project in Options/Display Options. If the marker display is inactive there, you will not see the preview of the dimension marker in this window either.



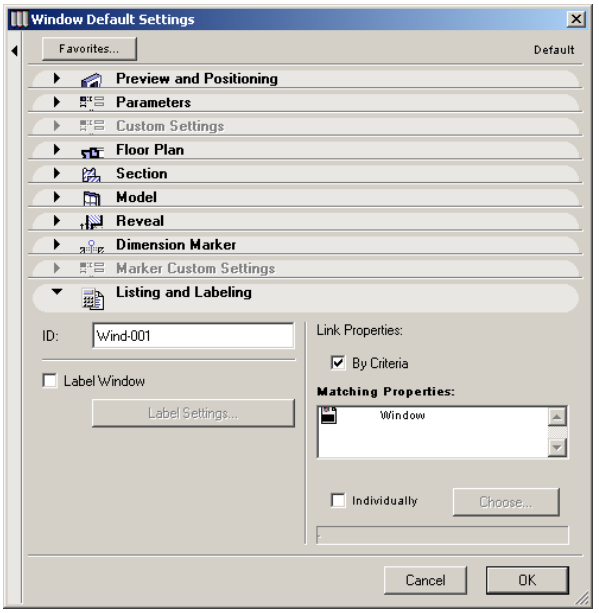
Dimension Markers are essentially parametric GDL Objects permanently linked to the opening.

The illustration below shows the Basic marker and the ArchiCAD 8.0 style marker.



The **Marker Custom Settings** panel contains options for the Library Part type dimension marker. The panel is active only if an eligible Marker has been selected in the Dimension Marker panel.

The last panel is called **Listing and Labeling** and controls the handling of Windows and Doors in calculations.



The controls of this panel are described in the Element Identification, Listing and Labeling section earlier in this chapter.

Placing Windows or Doors

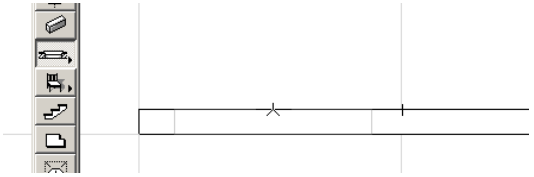
When you are satisfied with the choices made in the Window or Door Settings dialog box, you can start placing openings. Windows and Doors can only be inserted into Walls; they cannot be placed independently in the project.

In the Floor Plan, you can place a Window or Door opening at any **Checkmark** or **Mercedes** cursor position on a wall's outline. By turning **On** the **Clean Wall & Beam**

Intersections mode from the **Options** menu, any point where two or more Wall outlines meet becomes available as a placement position for openings.

In 3D, you can place a Window or Door anywhere along the length of the Wall. In Section/Elevation windows, you can create new Windows or Doors only by duplicating existing ones using the Multiply or Drag a Copy functions.

When the Door or Window tool is active and you place your cursor on top of an eligible location in the Wall, the ghost contour of the opening is shown and it follows the movements of the cursor. You can switch this feature off in Options/Preferences/Miscellaneous.



If you attempt to place a Window or Door near the end or top of a Wall, where there is not enough room to accommodate it, a dialog box will be displayed to warn you and give you the option of discarding the opening. You can still opt to place the Window or Door, but in this case you will obtain a dislocated opening.

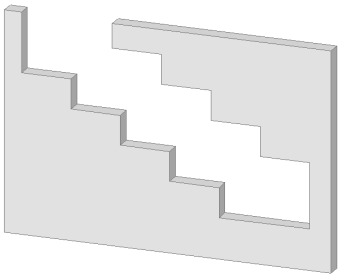
Geometry

The geometry of the Window or the Door is defined by the information included in the Library Part. While some generic elements allow a large amount of freedom in modifying the size and shape of the Window or Door before or after placing it in the project, more specific designs corresponding to real-life manufacturer catalog items can only be placed as defined, with restricted variation possibilities.

Creating a Simple Opening

To create a simple opening without placing a library part type Door or Window, click the Empty Opening button in the Preview and Positioning panel of the Door or Window Settings dialog box, then go to the Parameters panel and enter the height and width of the hole. Click along either side of an existing wall.

You can obtain special 3D wall shapes by adding several empty openings to it.

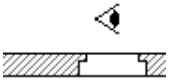


Placing a Window or a Door

If you wish to place a real Window or Door type object in a Wall and have made your choices in the settings dialog box, you need to decide on the construction and geometry method (anchor point) used to place the opening. You can use the choice made in the Window or Door Settings dialog box or choose another method in the Info Box.

A single click is required to place and orient the opening:

- Windows: the click defines the external side of the Window. Sill depth is always measured from this side.

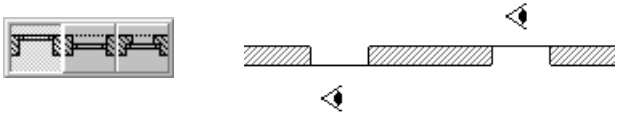


- Doors: the click defines the swing direction of the door. For doors without a German type reveal, sill depth will be measured from this side. For doors with a German reveal, sill depth will be measured from the opposite side.

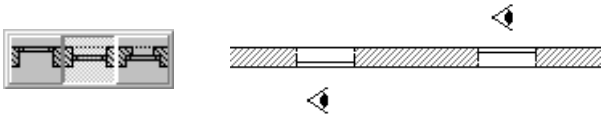
By selecting any of the three Door or Window Construction Methods you can define how the default or selected Door/ Window will be positioned in the opening.

- The **Edge** method will place the Window or Door at either edge of the opening in the wall. Clicking with the **Eyeball** cursor decides which edge is chosen.

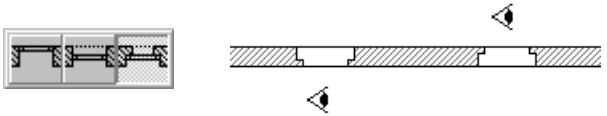
If this method is selected, the sill depth is automatically set to zero.



- The **Sill** method will place the Window or Door within the opening with a sill of the depth currently defined in the **Window/Door Settings** dialog box at the selected side of the opening. The **Eyeball** cursor will prompt you to choose a side.

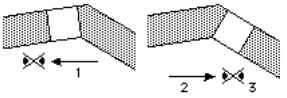


- The **Reveal** method creates a revealed opening according to the values currently defined in the **Window/Door Settings** dialog box. Use the **Eyeball** cursor to select the side of the wall on which you want the reveal to be placed.



Doors and Windows can be placed by their Anchor Points, that is, either by their centers or their corners.

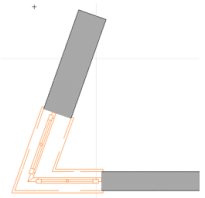
When placing a door or a window by its corner, the special **Double Eyeball** cursor appears and, as you move the mouse, it will flip the outline of the opening from one side (1) to the other (2), prompting you to click (3) when you are satisfied with the opening's position. This works the same way at wall corners.



Placing Corner Windows

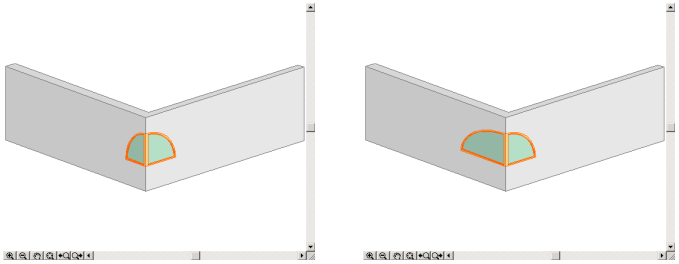
Corner Windows can be placed at straight wall corners. Most of the Windows of the standard ArchiCAD Library can be placed at corners. The Corner Window Settings dialog box is similar to the Door and Window Settings dialog boxes.

When you wish to place a Corner Window at a wall corner, you can click anywhere on the wall: ArchiCAD will automatically snap the window to the nearest corner of the wall and create a mirrored copy of it on the adjoining wall.



The second window's parameters and properties are identical to the first's. Their angle and position are automatically adjusted.

- You can only place one pair of corner windows at any given corner.
- The angle between the two walls cannot be equal to either 0 or 180 degrees.
- The placed windows can be stretched manually and individually without breaking the link between the two windows.



Corner Windows turn into simple Windows if:

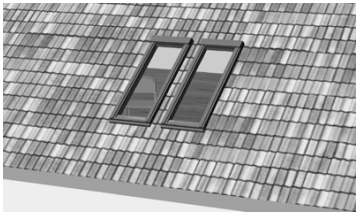
- You drag away, mirror or rotate any of the two placed Windows.
- The angle between the two Walls is changed to 0 or 180 degrees.
- One of the Walls is elevated (since Windows are part of the host Walls, the two Windows' elevations become different).
- One of the connecting Walls is deleted or dragged away.

Skylights

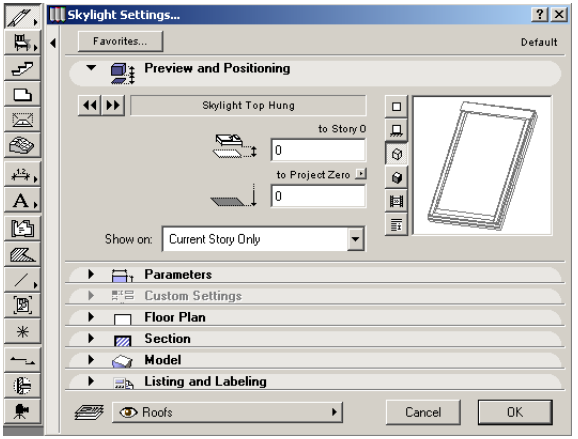
Definition

Skylights are smart GDL Object type elements that can be intelligently placed in Roof type elements. The Skylight Object placed on top of a roof will be automatically inserted in the roof and adjusted to the correct roof slope angle, at the appropriate elevation, rotated to the correct angle (parallel with the roof's reference line). A hole will be cut in the roof.

Note: The skylight must fit into a single roof plane.



Skylight Objects are stored in the "Dormers and Skylights" folder of the standard ArchiCAD library and can be activated with the Skylight tool.



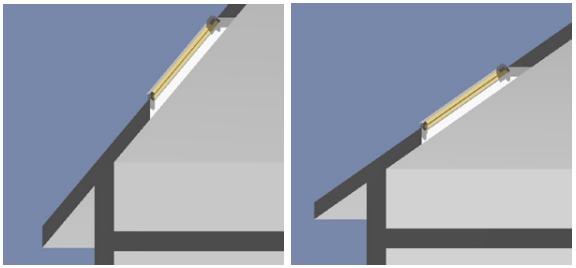
The panels available in the Skylight Settings dialog box are similar to those of the Window, Door, Object and Lamp tools.

Placing a Skylight

Skylights can be inserted into Roofs in either the Floor Plan or in 3D view.

- In Floor Plan view, you place the skylight inside the outline of the roof.
- In 3D view, click on the roof plane - ArchiCAD will detect the location of the mouse-click and place the skylight on the roof plane.

Skylights placed in Roofs behave quite similarly to windows placed in walls. For instance, when moving the skylight, its movements are restricted to the roof plane. If you modify the roof plane, for example by changing its pitch, the skylight object will follow suit.



Objects and Lamps

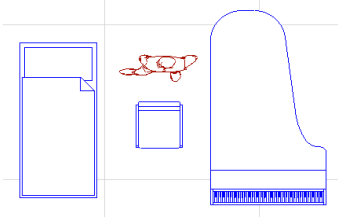
Definition

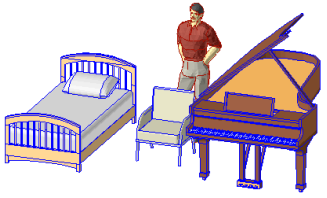
Objects are predefined complex parametric elements that can be freely placed in the project. Lamps are special Objects that are used as light sources in the project.

The ArchiCAD Library includes a large number of predefined Objects ranging from simple geometric shapes to complex pieces of furniture. Manufacturer libraries representing real-life products are also available from various sources including CD-ROMs and the Internet.

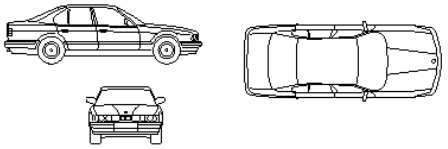
See also the concepts underlying GDL Objects presented in detail in Chapter 8: Working with GDL Objects. The creation of GDL Objects is fully explained in the Graphisoft GDL Reference Guide.

On the Floor Plan, Objects and Lamps are represented by a 2D Symbol while their 3D view is generated from the 3D script that takes into account the parameter choices made by the user.





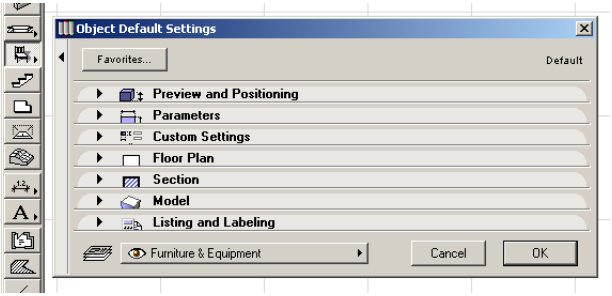
Some 2D-only objects have special 2D Symbols especially designed for use in the Section/Elevation window.



Object Tool and Settings

Similarly to the Door and Window tools, the **Object** and **Lamp** tools are represented by a single icon in the **Toolbox** default shape. The icon always shows the currently active one. Use the small arrow at the bottom to flush out the other tool.

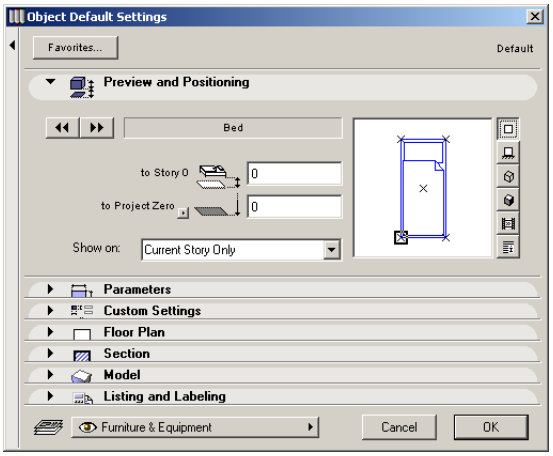
The Object and Lamp Settings dialog boxes are alike. As seen in the Library Part Tool Settings section above, they comprise a browser area and a number of unfoldable panels. The controls of the browser area have been presented there. This section only deals with the unfoldable panels. (To see the browser area too, click the arrow at the edge of the dialog box.)



There are seven panels in the Object and Lamp Settings dialog box: Preview and Positioning, Parameters, Custom Settings, Floor Plan, Section, Model and Listing and Labeling.

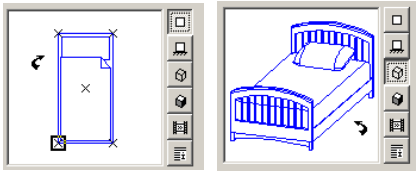
The **Preview and Positioning** panel includes, in addition to the preview of the Object or Lamp that you will be placing, simple navigation controls allowing you to go the previous

and next element in the active library set without having to use the browser area. You can also set the elevation of the Object or Lamp as for the other construction elements and decide whether to display it on other stories too.



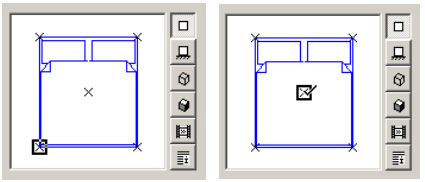
On the right-hand side of the panel, the **Preview Area** displays the 2D symbol, the hidden line front view, the hidden line axonometry, the 3D shaded axonometry, the predefined preview picture or the optional information notes of the selected Object or Lamp. Use the buttons next to the **Preview Area** to choose a view.

Move the cursor inside the **Preview Area** and the cursor will change to an arrow, allowing you to turn the 2D Symbol or 3D View of your Library Part.

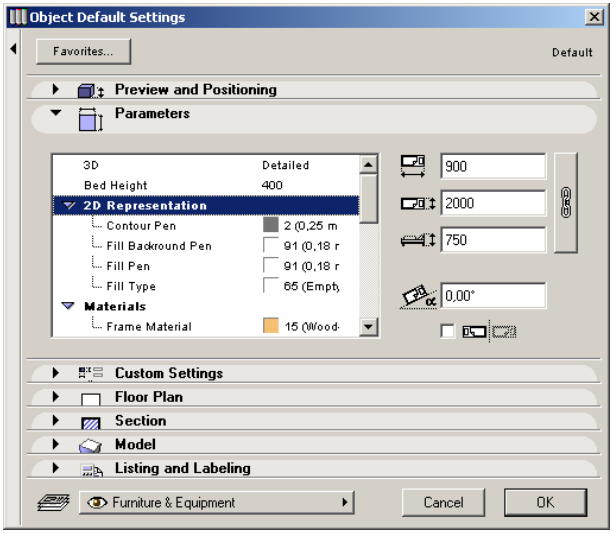


Objects can be positioned by their hotspots, defined in the 2D symbol of the Library Part. One Hotspot is initially defined as the primary hotspot. This hotspot is marked with a highlighted rectangle. It will act as the default positioning handle and anchor point for the Object.

The other hotspots are displayed as an X. Click any of them to use as a positioning handle. This allows you to choose the most appropriate handle for your purpose and facilitates swift and accurate object positioning.



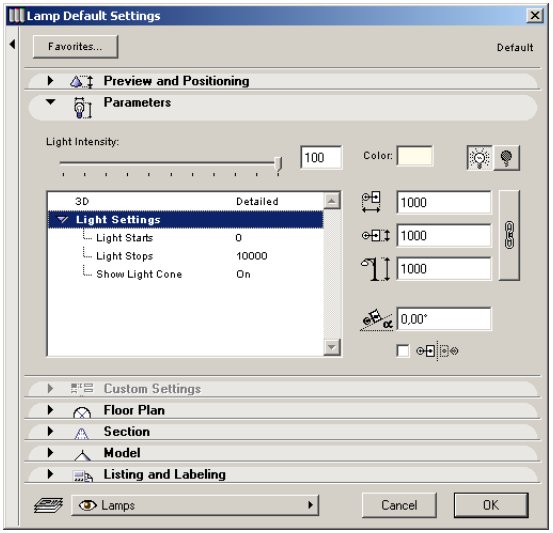
The second panel is called **Parameters**. It contains the dimensions of the Object as well as the set of parameters defined in the Library Part.



Activating the **Chain** icon to the right of the length and width edit fields allows you to link the horizontal and vertical parameters of your Objects and keep their original proportions.

You can also set a horizontal rotation angle. Below this field, a checkbox can be used to place mirrored Library Parts or to mirror them after placement. This option reflects the entire 3D description of the Library Part across the Y-axis defined by the Object Hotspot you entered in the **Object Settings** dialog box.

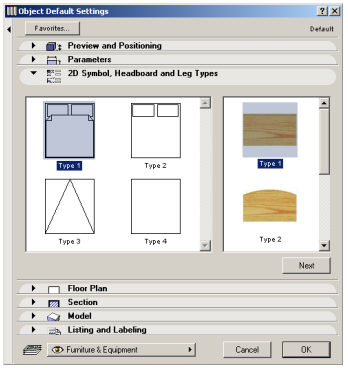
Some parameters related to Lamp type Library Parts are unique.

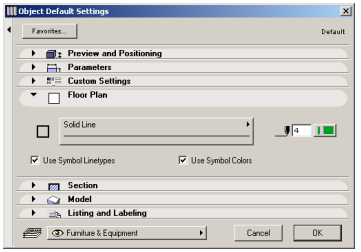


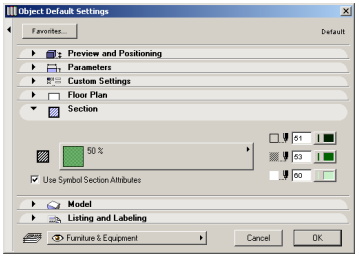
- You can set the light source's color by double-clicking the Color box, and choosing color in the standard Windows or MacOS color editing dialog box.
- The brightness of the light can be set with the sliding switch. Maximum brightness is at the right end.
- The switch next to the color box allows you to turn the lamp on and off in PhotoRendering.

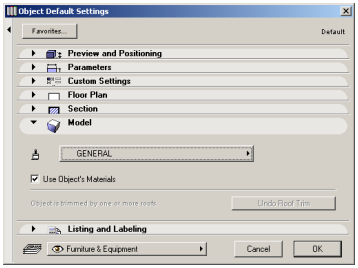
  Note: Whether Lamps will be actually used in PhotoRendering depends on the general setting made in Options/PhotoRendering Settings/Effects.

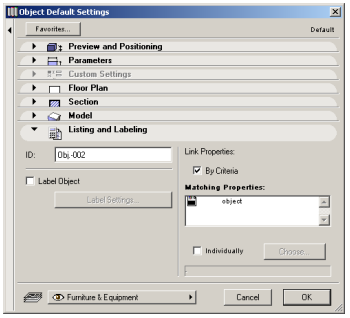
The Custom Settings, Floor Plan, Section, Model and Listing and Labeling panels of Objects and Lamps are quite similar to those presented for the Window and Door type elements. *See their description there.*











Placing Objects and Lamps

When you have selected an Object or Lamp and adjusted its settings in the Object Settings dialog box, you are ready to

place it. You can place Objects in both the Floor Plan and the 3D Window.

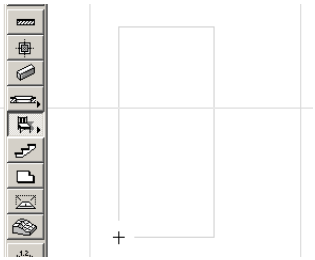
It is also possible to place the 2D Symbol of Objects in a Section/Elevation or a Detail Drawing window. Note that many 2D only elements have specific 2D Symbols for use in Floor Plan and Elevation view. Choose the appropriate view in the Preview and Positioning panel before placing the Object.

When positioning the Object or Lamp, you can use numerical input, gravitation, mouse constraints or the grids. This allows you to fit fixtures or furniture to corners, specific positions, or to each other with great accuracy.

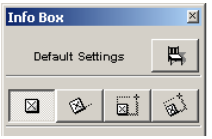
Geometry

Unlike walls or other elements constructed on the fly, object symbols have a predefined geometry and the cursor can only snap to predefined Hotspots of the symbol. The cursor is not sensitive to edges within symbols. Objects can be placed, selected, and fitted to other elements by these hotspots. The primary hotspot can be defined on the Preview and Positioning panel of the Object Settings dialog box. Before placing the Object or Lamp, make sure that you have selected the appropriate hotspot.

When the Object or Lamp tool is active and you place your cursor inside a construction window, the ghost bounding box of the element is shown and it follows the movements of the cursor. This also allows you to check the active hotspot used for positioning the Object or Lamp. You can switch this feature off in Options/Preferences/Miscellaneous.



Four geometry methods are available in the **Info Box** for placing Object and Lamp type Library Parts.



- The ***Orthogonal*** method automatically places Library Parts in alignment with the normal grid lines unless you specify a rotation angle in the Settings dialog box before placement.
- To place a ***Rotated*** Library Part, first define a reference point by clicking any point. Use the resulting rubberband line to place the rotation vector. This rubberband line can be constrained using any of the drafting modifiers or enabled Mouse Constraint angles.
- The ***Diagonal*** input method works like the rectangle geometry method used for polygonal elements.
- The ***Rotated diagonal*** input method works like the rotated rectangle method used for walls, slabs, etc.

The last two methods let you define the A and B parameters of the Object or Lamp graphically. Note that they are only available if the GDL Object can be freely stretched; some Objects may have fixed or proportionally set dimension parameters.

The result of this technique also depends on the active hotspot. As a rule of thumb, if a hotspot at the corner of the object is selected, you can define both the A and B parameters graphically. If the hotspot is along a side of the object, you can only define one of the parameters graphically and the other parameter will be taken from the Settings dialog box. When choosing a hotspot within the bounding box of the symbol, none of the parameters can be set graphically and the element will be placed as if using the simple orthogonal or rotated methods.

Objects and Other Elements

Like other construction elements, Objects can be trimmed to Roofs. *See the Roofs section for details.*

Stairs

Definition

Stairs are a special subtype of Objects. ArchiCAD stairs are created by StairMaker, an Add-On application smoothly integrated with ArchiCAD. It lets you easily design and construct all kinds of stairs required for ArchiCAD projects by selecting from a set of predefined geometry types, or by drawing the main geometry of the stair and editing parameters.

Note: To use StairMaker, it must be placed in ArchiCAD's Add-Ons folder that is located either in the same folder as ArchiCAD, or in the System Folder (MacOS) or at the location defined in the Windows Registry (Windows).

In most ways, Stairs behave similarly to Objects but they can only be created and modified with the Stair tool.

On the Floor Plan, Stairs are displayed as 2D symbols using standard architectural conventions. The way stairs are typically displayed allows you to see both the bottom part of the stairs going up and the top part of the stairs going down. Stairs can be visible across multiple stories and the amount of detail shown in the 2D symbol is scale-dependent. The controls that handle the display of the 2D Symbol are in the Preview and Positioning panel of the Stair Settings dialog box. *See their description in the next section.*

Note: Slopes (or ramps) can also be created in ArchiCAD. They too belong to the Stair subtype of Objects and share most of the options available for Stairs.

You can create stairs in two ways:

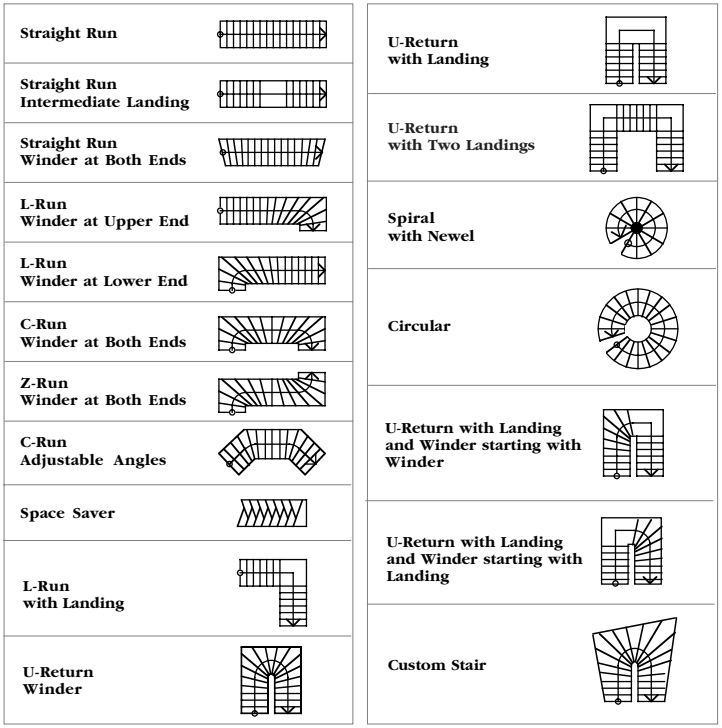
- Standard types can be created by selecting a predefined template and customizing it.
- Custom stairs can be created from a stair contour and a line of travel designed with ArchiCAD's 2D drawing tools.

Note: In addition to the stairs created with StairMaker, the Library may contain Stair objects for shapes and geometries not available in StairMaker.

Geometry

The various stairs you can create are categorized into 18 stair types.

Every time you create a new stair, a dialog box appears, containing the 17 standard stair types you can create with StairMaker. The last button represents the custom stair designed with ArchiCAD's drawing tools. The available stair type previews correspond to the basic schemes in the following illustration.

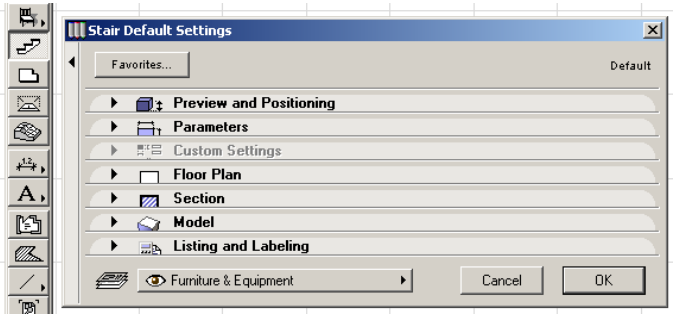


You need to save different Stair Object files for Stairs of different geometry. Since Stairs are typically specific to a Project, it is recommended not to save them in a common

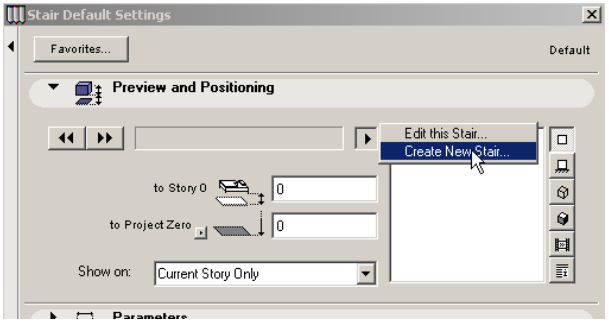
library folder, but rather set up a folder for Project-specific items and save your Stairs there.

Stair Tool and Settings

The Stair tool is located below the Object tool in the Toolbox. Its settings dialog box includes the same panels as that of the Object and Lamp tools: Preview and Positioning, Parameters, Custom Settings, Floor Plan, Section, Model and Listing and Labeling. *See the Objects section above for details.*



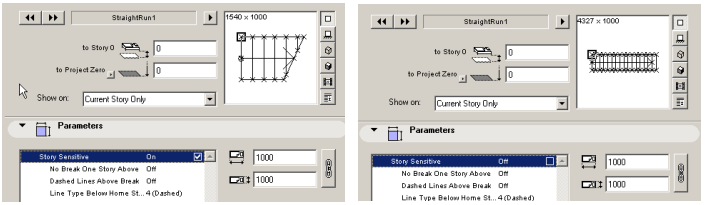
The only difference is a small arrow located next to the Preview area in the **Preview and Positioning** panel. It opens a pop-up menu with two commands allowing you to edit selected stairs and to create new ones.



Stairs have two types of parameters:

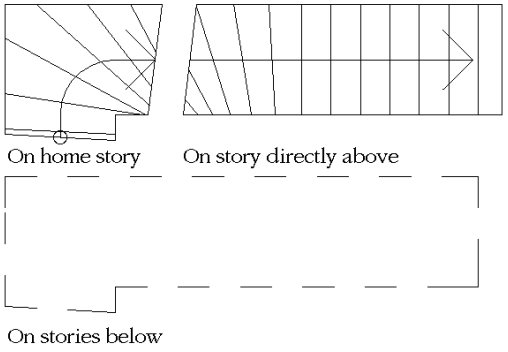
- In StairMaker, you set the stair type, shape, structure, railing and other parameters, as described later in this section.
- In ArchiCAD, you set display parameters for the stair symbol.

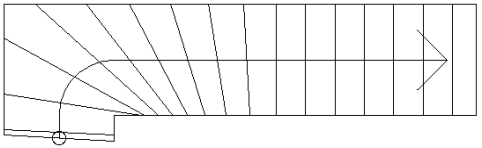
If you choose the 2D symbol in the Preview area, the Stair will be displayed according to the state of the Story Sensitive parameter.



If the Story Sensitive parameter is active, the stair will be displayed as follows:

- Home story of the stair: lower part of the stair is displayed.
- First story above the home story: the upper part of the stair or the whole stair is displayed.
- Stories below the home story: the contour line of the entire flight with dashed lines is displayed.
- Any other story above: the entire flight of stairs is displayed.





On further stories above

On the stair's home story, you can also choose to show the contour of the upper part of the stair by using the **Dashed Lines above Break** parameter. On the first story above the home story, you can show the entire flight of stairs by using the **No Break One Story Above** parameter.

If the **Story Sensitive** master switch is OFF, the entire flight of stairs will be displayed on all stories it is visible on, without a break line.

The amount of detail displayed with the Stair depends on the state of the parameters in the Scale Neutral Symbol group.

If the **Scale Neutral Symbol** master switch is ON, you can use the four parameters below to set up the details as desired.

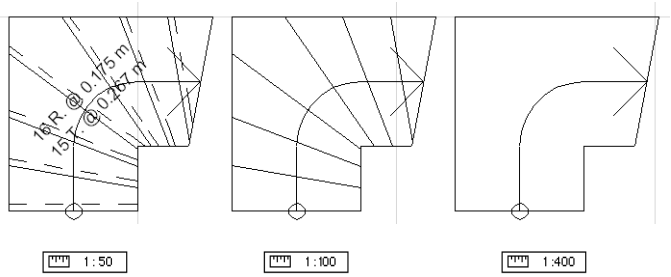
The Arrow UP/DOWN parameter is always effective if the line of travel arrowhead is present.

- OFF: all arrows are directed upwards.
- ON: all arrows are directed away from the current story - UP or DN will be added for better understanding.

The other three parameters are only effective if the master switch is OFF, and turn on and off details of the symbol.

If the **Scale Neutral Symbol** master switch is OFF, the stair will check the project scale.

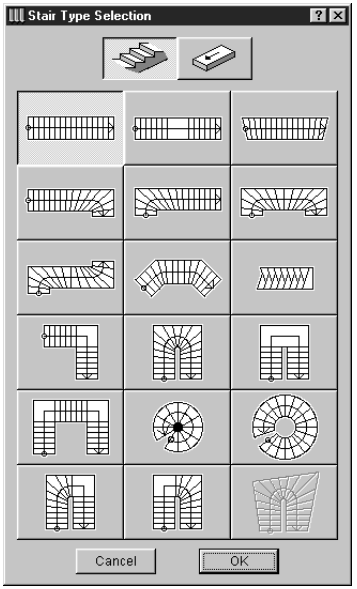
- Scales from 1:50 or 1/4"=1'-0" and up: includes tread/riser data, dashed lines for the nosing added
- Scales 1:200 and 1:100 or 1/16"=1'-0" and 1/8"=1'-0": includes tread edges.
- Scales smaller than 1:200 or 1/16"=1'-0": outline of the stair's line of travel displayed with an arrowhead.



The text size for the tread/riser data is always 2 mm, which is acceptable for these scales.

Placing Standard Stairs

To design a new stair based on a standard type, activate the **Stair** tool icon and choose the **Create New Stair** command popped up with the arrow next to the preview area or choose the **File/GDL Objects/New With/StairMaker** command.



Choose whether to build a stair or a slope using the stair or slope buttons. When you press the slope button the symbols of those stair types whose geometry can be transformed into slope will automatically turn into symbols of slope; all the other buttons become gray.

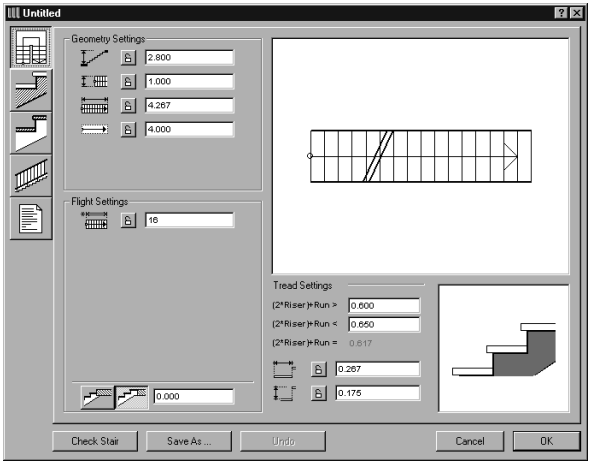
Choose the required stair/slope type from the dialog box, and click OK. A stair editing window appears on the screen for the chosen stair type. The window's tab pages can be used to select and set up the stair components, similarly to a setup wizard.

The editing windows of the various stair types are somewhat different, but work similarly. The large buttons on the left represent five tab pages allowing you to edit the stair document. They give access, respectively, to the Geometry, Structure, Tread, Railing and Listing settings. Any modification you make on any of the tab pages also affects the other four.

When finished, save the new stair into an appropriate folder by clicking the **OK** or the **Save As...** button.

Stair Geometry Parameters

The first tab page of the editing window contains preset values for the available parameters and the floor plan symbol of the preview area on the right.



The parameters are separated in three sections: Geometry Settings, Flight Settings and Tread Settings.

In the upper left part of the tab page, you will find editable text fields for the **Geometry Settings** parameters.

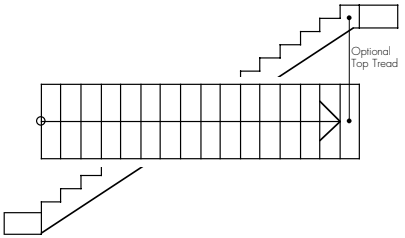
This is the place where you can set up the main geometric parameters of the stair: the story height, the horizontal bounding parameters, the flight width, the length and the location of the line of travel.

In the **Flight Settings** fields you can change the parameters that define the flight: the number of risers, the form and the number of the treads in the winder range (in the case of certain stair types), the dimensions of the landings, the value of the arrival offset, the closing angle of the flights, etc.

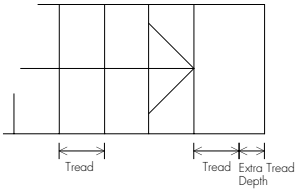
The geometry and the flight values affect the way the floor plan symbol of the Stair is displayed in the preview area on the right.

In the lower part of the Flight Setting section StairMaker allows you to add an optional top tread to the stair. It may either have the same depth as the stair's other treads, or you can customize an extra tread depth.

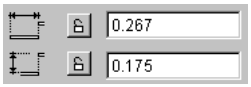
Click the button on the right to add a top tread to the floor level. A top tread is added to the stair at top floor level as shown below.

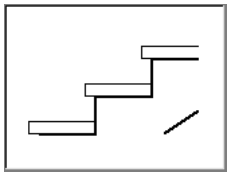


If you leave the extra tread depth field's value at zero, the top tread at floor level will have the same depth as the other treads. To change the top tread's depth, enter a positive value.

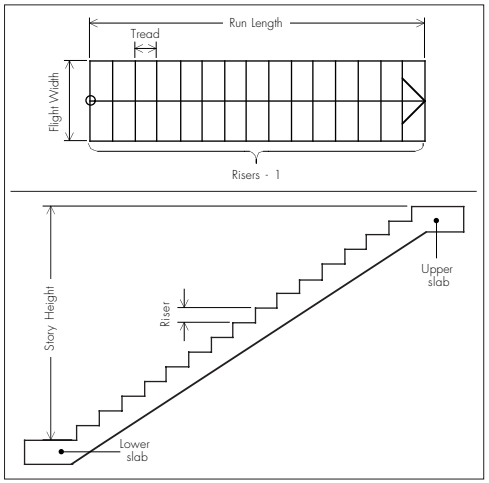


Bottom right in the dialog box, **Tread Settings** are shown. By setting these parameters, you can define the geometry of the Treads or the angle of the Slope, based on the same geometry. To the right of these fields, the longitudinal section of the stair is shown, giving you instant feedback on your changes.

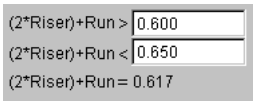




All these parameters together define the design of the stair as shown in the illustration below.



It is easier and more comfortable to climb the stairs if the sum of twice the riser and the run (2*Riser + Run parameter) is within the range of 60 to 63 cm, or 24 to 25 inches. To ensure this condition, you can define a range of values for the (2*Riser) + Run parameter in the Tread Settings section.

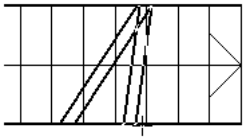


The last parameter is not editable. It only shows the current value of the (2*Riser) + Run parameter.

Note: The Geometry parameters are defined in a very strict hierarchy, which makes stair editing easy and intuitive. Stair geometry definition is based on the (2*Riser) + Run rule. Every time you modify a parameter, StairMaker checks that the (2*Riser) + Run parameter is still in the appropriate range. In addition to this hierarchy, you may lock one or more parameters by clicking on the lock button. Locked parameters will not be modified. If parameters need changing, StairMaker will skip locked parameters and look for the next value in the hierarchy. If editing is not possible without changing a locked parameter or if too many parameters are locked, an alert will appear.

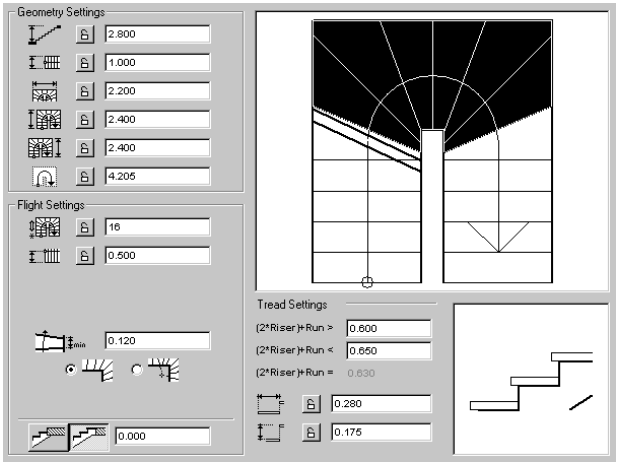
Usually, only the lower part of a stair should be displayed on the floor plan on its home story. The upper part of the stair should be displayed one story above. There is a double break line on the 2D Symbol of the stair showing where the stair is cut.

All four endpoints of the two break lines can be dragged along the stair outline while the lines remain parallel.



If the whole stair should be displayed on the floor plan, changing the break line will have no effect.

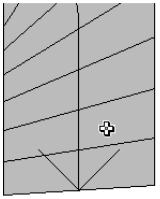
Some of the available stair types have one or two winders. In the following example using the stair type called “U-Return Winder”, we will see how winders are handled.



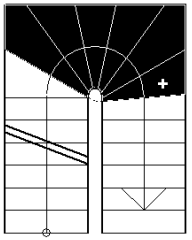
As you can see, a part of the stair is highlighted and all treads in the highlighted area are skewed. The highlighted section is the winder range for the stair. If the entire run is highlighted, then all treads are skewed with respect to the line of travel.

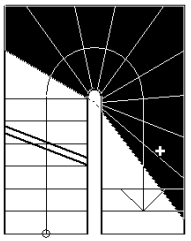
Tread edges outside the winder range are perpendicular to the line of travel. (For a comfortable stair, the winder range usually includes at least the entire curved portion of the line of travel, so that non-skewed treads are all in the straight run section.)

You can change the extent of the winder section with the mouse. First move the pointer onto the stair (the pointer takes a form that may remind you of a spreadsheet editor).

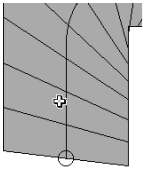


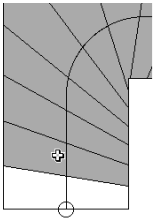
Press and hold the mouse button while moving it along the stair. Some treads turn white as you make the winder section shorter at the end. Release the mouse button, and StairMaker will show the new outline of the stair. Make sure that you define a winder section without overly skewed treads.





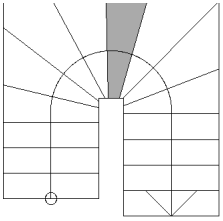
You can see that the treads shown in white are no longer skewed. You can also change the skewed state of a single tread by clicking. For example, to make the nose of the bottom tread straight, simply click on the second tread. The first tread turns white.



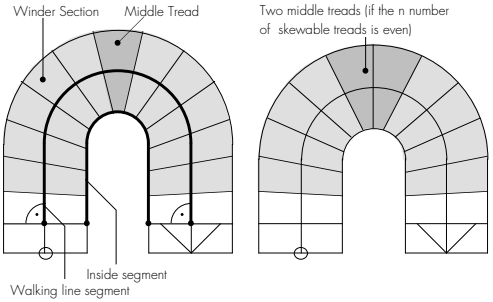


The winder section is “fixed” on the middle tread of the curve, i.e., you cannot shorten either end of the winder range beyond this tread.

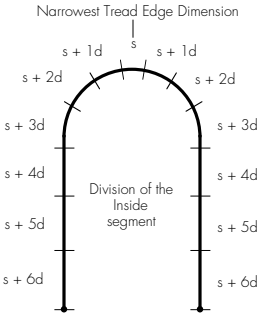
If you shorten both ends of the winder range until the middle tread, you will see something like the illustration below.



In StairMaker, the tread edges before the beginning and after the end of the winder range are perpendicular to the line of travel. These two edges define a line of travel segment and an inside segment.



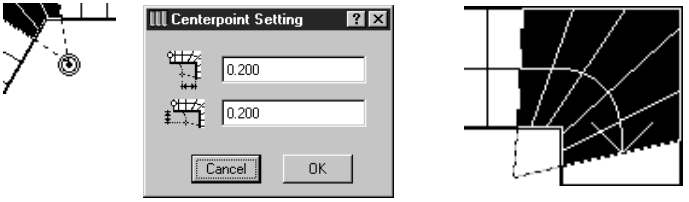
The inside segment is divided into treads as shown below:



Enter the dimensions in the editable parameter text field in the middle of the Flight Settings section. This value will be assigned to the middle tread of the stair run (or to the two middle treads, if the number of treads in the winder range is even).

As an alternative to the standard winder, you can create a radial winder. When using this method, the edges of the treads in the winder range meet in a single point. You can select this method by clicking the **Radial Winder** button.

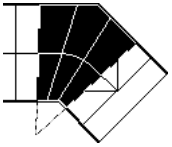
You can change the location of the centerpoint by clicking on it. A dialog box will then prompt you to enter numeric values for the offset.



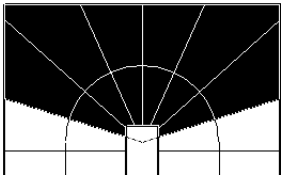
The location and the offset are displayed with dashed lines.

If the corner is chamfered or filleted, the offset is still measured from the imaginary corner.

The offset at custom angled stairs looks like this:



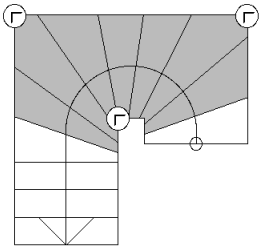
If you choose a U-Return Winder stair, StairMaker will automatically set the radial winder midpoint to the midpoint of the arced line of travel.



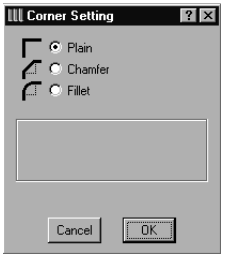
If you choose a "Straight Run with winder at both ends," you can define the upper and lower extra length along the side of the stair. The angles of the first and the last edge of the stair depend on this offset.

Note: You cannot define radial winders for this stair type.

Stair types with winders let you chamfer or fillet the corners of the run. To do this, move the pointer to a corner until it takes the form of a perpendicular sign.

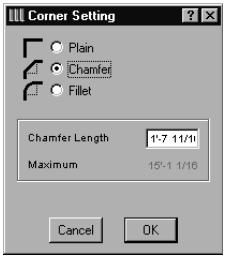


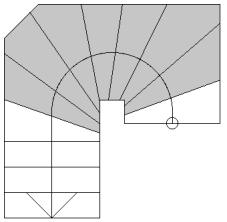
Click on one of the stair's corner points to open a dialog box offering the three corner shapes available.



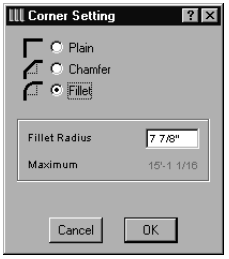
The **Plain** corner is the "normal" corner shape. When you start editing a new stair, all corners are plain.

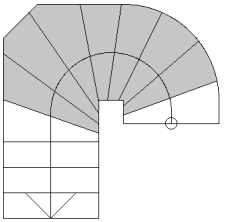
Choose the **Chamfer** radio button from the dialog box. Editable text fields appear where you can edit the chamfer length. Enter a value and click OK.



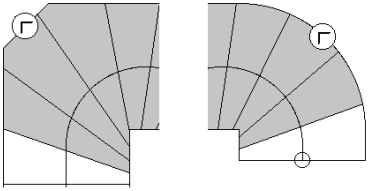


Now **fillet** the other corner.



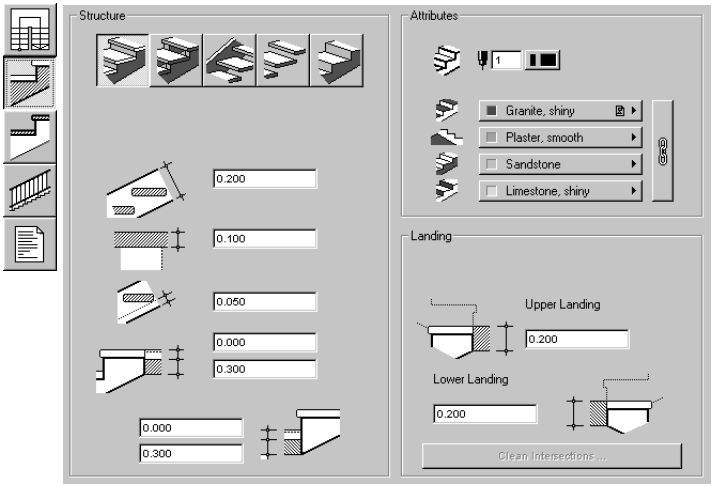


You can change the corner shape at any time. If you move the pointer to a chamfered or filleted corner it will again show the perpendicular sign.



Stair Structure Parameters

Click the second button on the left of the stair editing window to work on the **Structure Settings** tab page of the Stair.



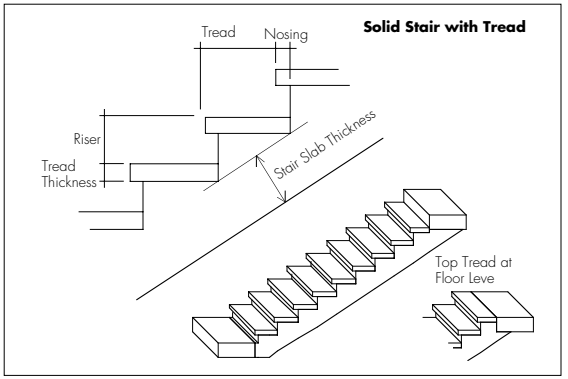
The content of this tab page changes according to the construction type of the stair.

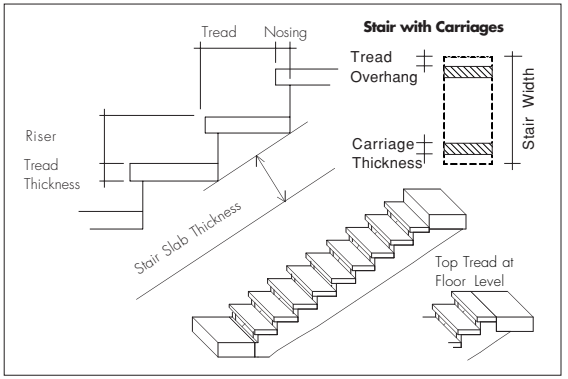
In the **Structure** section, you can choose among five ways to model the stair in 3D and edit the related parameters.

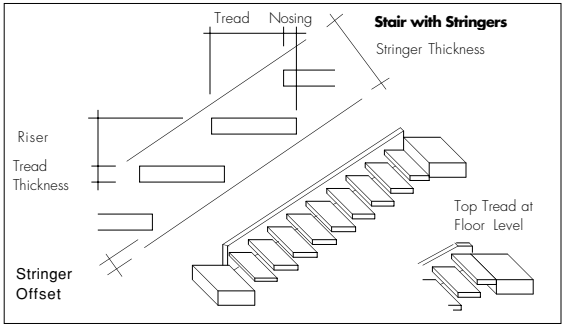
The following 3D alternatives are offered:

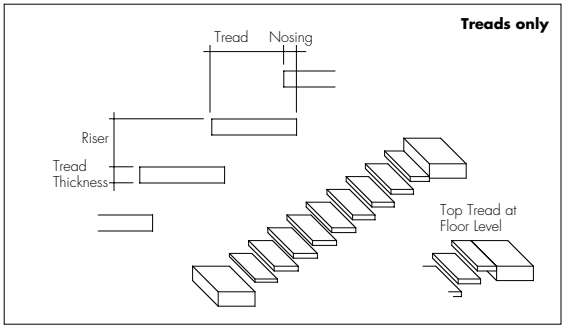
- Solid Stair with Treads;
- Stair with Carriages;
- Stair with Stringers;
- Treads only;
- Solid Stair.

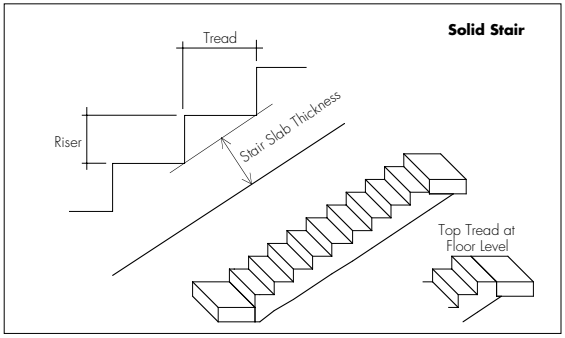
The following illustrations provide the explanation for the various types.



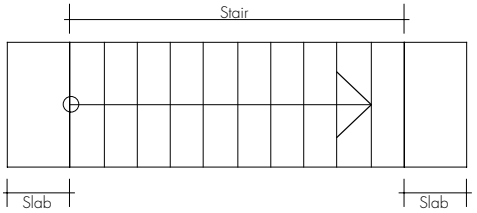








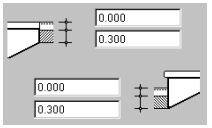
The upper and lower slabs should be set to exactly join the Floor Plan Symbol within ArchiCAD, no matter which 3D alternative is selected in StairMaker, and even if a top tread at floor level is added to the stair.

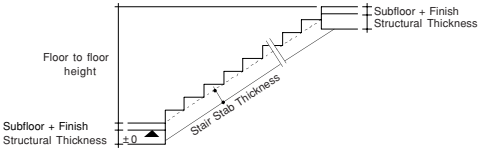


Note: When the stair construction is changed, the fields for treads and nosing may change as well, according to the current construction options.

The parameters of the stair's structure change according to the selected type. These changes will also appear in the stair geometry tab page and in the parameters of the stair.

In the bottom left section of the window, you can customize both the upper and lower structural and subfloor + finish thicknesses.





StairMaker automatically adjusts the stair parameters to these slab specifications. In the example below, the stair connects to the top floor slab as shown on the left and to the lower floor slab as shown on the right.

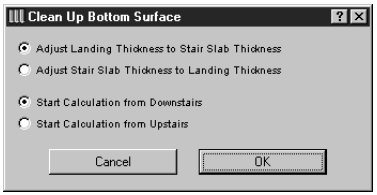
StairMaker automatically adjusts the stair height by referring to the top elevation of the connecting bottom floor slab as zero. If you use a separate slab for modeling the subfloor + finish in ArchiCAD, you only need to enter the thickness of this slab in the corresponding fields. When you place the stair in ArchiCAD, the positioning height in the Object Settings dialog box can be set to zero.

If you do not use any separate slab for subfloor + finish in your design, set the subfloor + finish thickness to zero.

You can set up the landing thickness of those stairs that have one or more landings in the editable text fields in the **Landing** section of the Structure tab page.

The location of the intersection lines at the bottom of the stairs depends on the thickness of the landings and the runs, as well as on the geometry of the landing.

StairMaker makes clean intersections at the bottom of the stair between the runs and landings if you click the **Clean Intersections** button at the bottom of the Landing section. The following dialog box will appear:



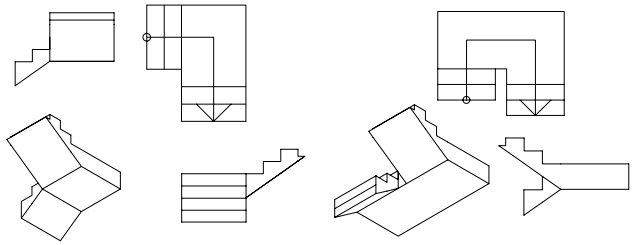
StairMaker cleans up these intersections by changing the thickness values of either the landing or the run. You can select the desired option in the dialog box.

Using the other set of radio buttons, you can choose whether the length of the landing is modified along the upper or the lower run.

StairMaker recalculates the parameters with the new values, and the 2D symbol of the stair will be updated.

One of the stair types has two landings. With this stair type, your options affect the lower landing and StairMaker will apply them automatically on the upper one.

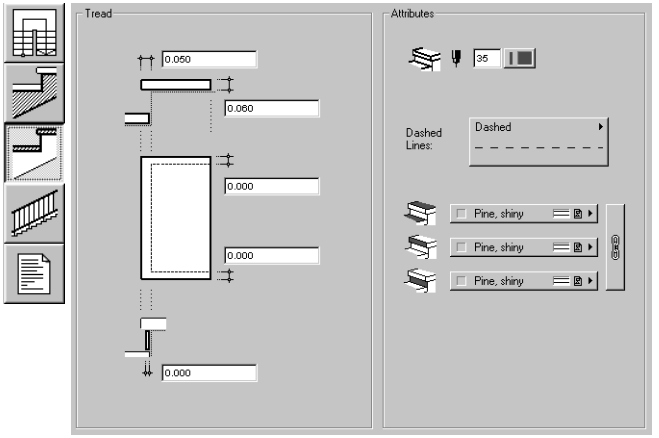
On the left, the result in 3D. On the right, the clean intersections of a U-Return stair with landing.



In the **Attributes** section of the Structure tab page, you can define the Pen Color used for the Stair's contour and the Materials of each of the Stair's sides in the 3D Window and PhotoRendering.

Tread Parameters

Click the third button from the top on the left of the stair editing window to open the Tread Settings tab page of the Stair.



Notes: This option is not available when the stair structure is set to Solid Stair or Solid Slope. The content of this tab page changes according to the current stair Structure settings.

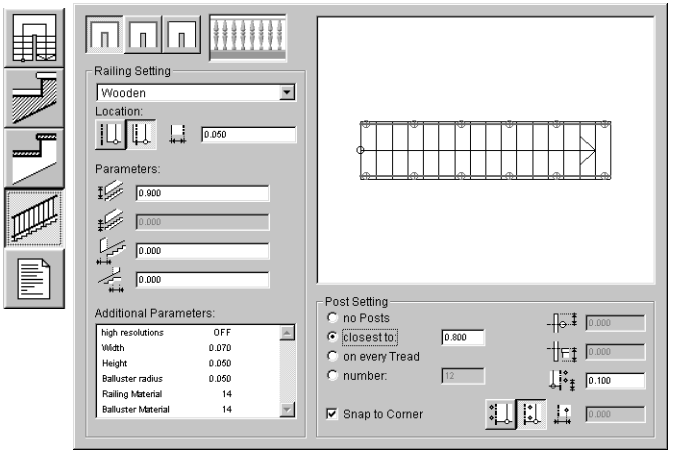
In the **Tread** section of the tab page you can set up the exact parameters of the stair's tread:

- define the thickness of the tread;
- define the nosing on the front and on the sides;
- define the thickness of the front of the risers.

In this Attributes section of the tab page, the Pen Color, Line type and Material pop-ups allow you to define the 3D appearance of the treads. You can assign different materials for each side of the treads.

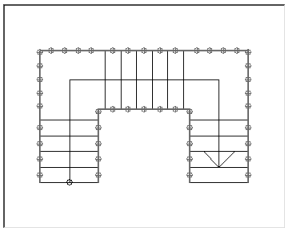
Railings

To set up the railings of the stair or the slope, click the fourth button from the top on the left of the stair editing window. The **Railing Settings** tab page will appear.



Using the three buttons on the top of the tab page you can define whether the railing settings should affect both sides of the entire stair (All Stair-Rail mode), one side of the entire stair (One Side mode), or a selected segment (One Segment mode). Selection of the segments is indicated by a red line in the preview area. The mode chosen here is also in effect when setting the post *(see below)*.

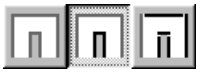
Clicking the first icon selects all the segments in the preview of the stair. Parameter settings will affect the whole of the stairs. A single railing type will be used for the whole stair with the same offset and parameter value for each segment. With regard to the offset value, the program automatically ensures the integrity of the railing, which means that the segments will intersect accordingly.

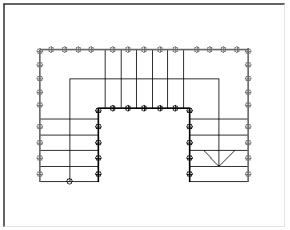


When switching to this mode from either of the other two (One Side mode or One Segment mode) each flight inherits the stair-rail and post settings of the lower starting flight's first left-hand segment.

After clicking the second icon, the left and right stair-rails can be set independently. The left stair-rail is selected by default as displayed in the preview of the stairs. To switch to the right stair-rail, move the cursor to the other side of the stairs until it takes the form of a stair-rail, then click it.

The settings displayed on the screen are always those relevant to the selected railing and any changes in the values of the parameters will only affect the selected railing. In this mode, the program uses single railing types for both sides of the stairs.

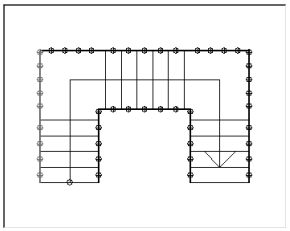




When switching to this mode from All Stair-Rail mode, both sides inherit the settings chosen in the previous mode. When switching to this mode from One Segment mode, the whole flight inherits the settings of the lower starting segment.

Clicking the third icon allows you to define a railing for each flight (segment) independently. By default, the first segment of the left railing is selected, as shown in the preview of the stairs. To select another segment, simply click it.

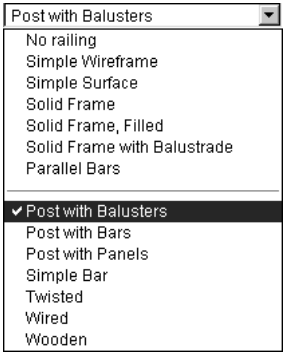
Different offset values can be used for each segment. In this case, the elements of the stair-rail belonging to different segments will not fit each other automatically. Positive or negative upper and lower overhang can be defined manually for each railing segment.



When switching to this mode from either of the other two (All Stair-Rail mode or One Side mode), all stair-rails inherit the previous settings. The overhang values of the stair-rails will be identical to those calculated automatically in the previous mode.

In the preview area that displays the floor plan of the stairs, each segment of the railing is represented by a line that shows where the centerline of the railing lies. To switch off a railing, first select it, then choose the **No Railing** option from the Railing type pop-up. A thin line will indicate the place of the stair-rail.

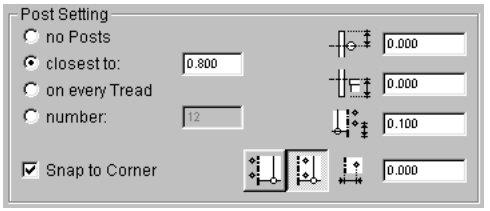
The types and parameters of the selected railing are set in the **Railing Setting** section. The available railing types are listed in the pop-up menu placed at the top of the dialog box. The content of the pop-up window depends on the available definitions. In the railing preview area (above the stair-rail type pop-up) you can see the small image of the selected railing type.



The editable parameters under the pop-up window are generally valid regardless of the railing type. They define the position of the railing as related to the sideline of the stairs, the height of the posts and the baluster as related to the stairs, and the overhang values. In One Segment mode, the lower and upper overhang relates to the current segment, while in the other two modes they concern the lower overhang of the bottom segment and the upper overhang of the top segment.

The parameters of the railing types are displayed in the list of additional parameters.

The settings and placement of the posts of the railing are defined in the **Post Setting** section. If the selected type does not contain posts, this section will be dimmed.



The position of the posts relative to the centerline of the stair-rail can be defined with the radio buttons and the parameter field. The rule according to which the posts are to be placed along the selected segments of the railings is defined with the radio buttons.

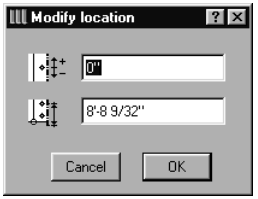
The placement of the posts can be defined by:

- setting up an approximate distance between the neighboring posts (the posts are placed alongside the flight or the segment at a given distance from one another),
- placing a post on every tread (on landings, an approximate distance will be used), or
- setting the number of the posts.

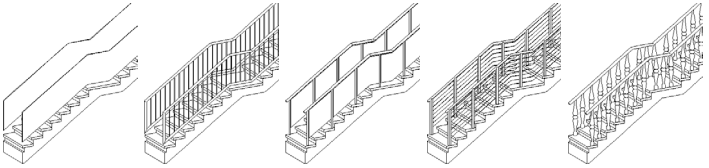
Using the **Snap to Corner** checkbox, the program automatically places posts to the segment ends and places

additional posts on the segments according to the rule defined above.

The position of the posts placed automatically by the program can be modified one by one by double clicking on the post on the selected stair-rail segment. A dialog box appears, where the position of the post can be set up numerically.

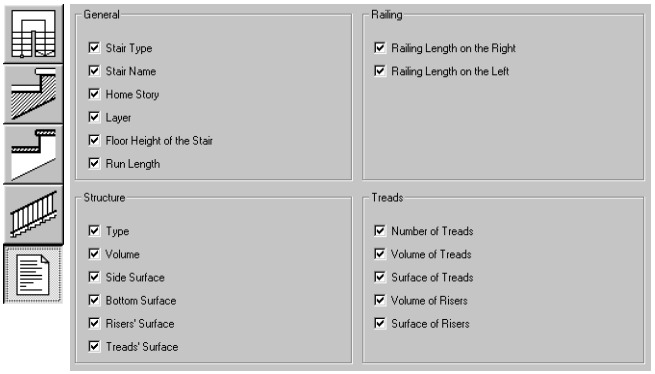


Some of the available railing types are illustrated below.



Listing Parameters

Click the fifth button on the left of the window to work on the Listing Settings tab page of the Stair.

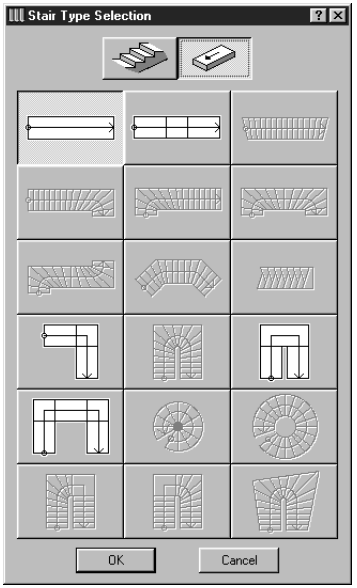


Each of the elements and properties (general, structure, railing and treads) of the stair can be listed with the Calculate menu commands. Stairs will be listed as library parts. The list can be set up individually in ArchiCAD; however, if you wish to list a part of the stair, be sure that the box beside it is checked.

For more information about listing features, refer to the ArchiCAD reference guides.

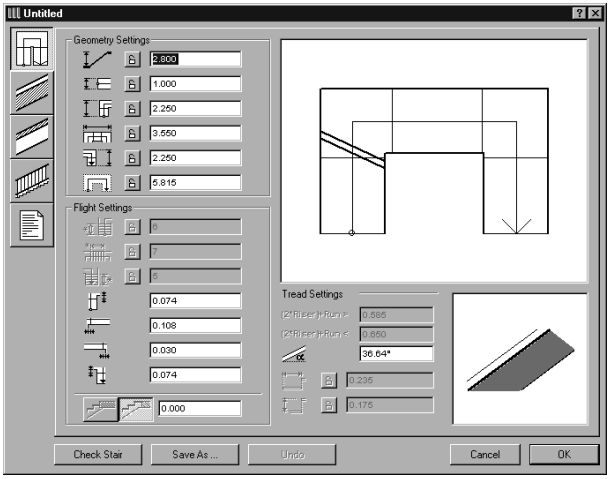
Defining Slopes

Instead of creating a Stair, you can define a Slope just by clicking the Slope button when the Stair Type Selection dialog box appears. Only plain slopes are available, all the choices with curved lines of travel are dimmed. A custom geometry can be used for creating a slope only when the starting and finishing edges of all flights are parallel with each other.



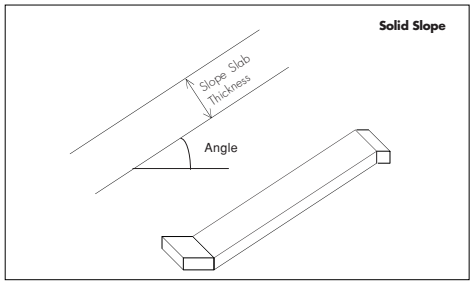
When you have made your choice, click OK. The appearing Slope editing window is quite similar to the Stair editing

window, but irrelevant symbols and parameter fields are dimmed and the others are transformed into slope setting functions.



In the Tread Settings section, a new element is the field where the angle of the slope can be set.

In the Structure tab page, the available structure types for the slopes correspond to the structure types for stairs.

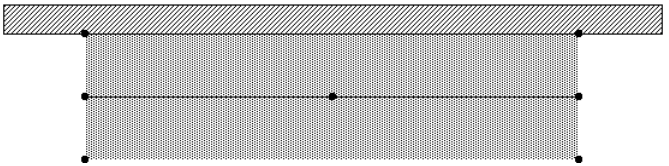


Creating Custom Stairs from Drawing Elements

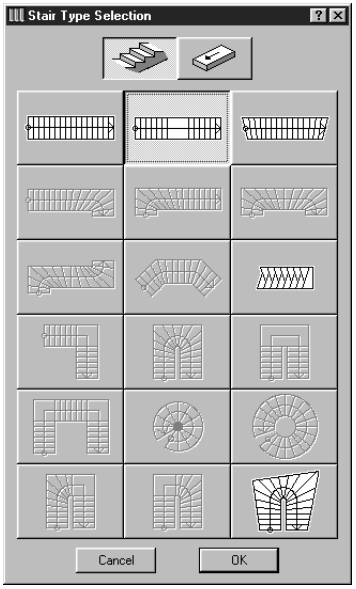
Standard Stair types work with fixed geometrical data. If you cannot find the stair type you want among the predefined templates that cover most of the common stair forms, you can define the geometry of your Stair within your ArchiCAD project.

1) Draw the exact contour of the stair with the **Fill** tool. The fill that defines the stair cannot contain any holes.
2) Define the line of travel by using connected **Lines** and **Arcs** inside the fill polygon. The segments of the line of travel need to be connected properly, i.e., they cannot cross each other or the sides of the fill. It has to be a continuous chain of lines. Begin drawing the arcs and lines from the starting edge of the stair to define the appropriate direction of the line of travel.

   Notes: The endpoints of the line of travel must snap exactly to the sides of the fill polygon but cannot connect adjacent edges or nodes of the fill polygon. Corners within the line of travel define landings. If the connection of two segments of the line of travel is not tangential, it will define a landing.
3) Select the fill polygon and all segments of the line of travel and choose the **Create Stair Using Selection** command in the Tools menu in order to transform these floor plan symbols into a stair object.



The Stair Type dialog box appears. StairMaker automatically finds possible stair types for your draft. If none of the predefined Stair Types match the sketch, you can only define a Custom Stair.



Note: If the defined geometry cannot be interpreted by StairMaker, you will receive a warning message describing the problem. Make the necessary changes according to the rules of the stair definition, and try again.

4) Select the required Stair type and click the OK button. StairMaker then displays the stair editing window. The following setting options are available for custom stair geometry:

   - story height;
   - stair shape parameters;
   - number of treads;
   - inclination angle (parameters of the riser and the run).

Clicking the **Check Stair** button will detect any conflicts that would prevent StairMaker from generating the stair.

When finished, click the **OK** button to automatically create the stair at the location defined in ArchiCAD. You will also be prompted at the same time to save your stair under the name of your choice in the appearing Save as dialog.

Use the **Cancel** button to abort Stair definition. Even then, you can name and save the Stair document without placing it in ArchiCAD. In this case, the sketched fill, lines and arcs remain selected, so if required they can be deleted.

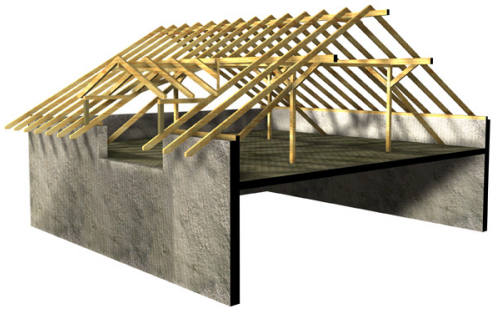
Adding Structural Elements and Finishes

The next sections deal with special tools and features that allow you to add GDL Object-based elements to specific parts of your design in order to enhance them in 3D views and Section/Elevation windows.

Adding Structural Elements with RoofMaker

ArchiCAD includes an automated tool allowing you to add structural elements to roofs. This tool is called RoofMaker and can be accessed from the Extras menu. Technically, RoofMaker is an ArchiCAD Add-On and is loaded with ArchiCAD on startup.

RoofMaker adds parametric GDL Objects to selected roofs. After placement, roof construction elements behave like ordinary Objects and can be modified.



To place **rafters**, **ridges** or **purlins** (beams), a single roof surface has to be selected. If multiple roof surfaces are grouped, you must first ungroup them using the Ungroup command in the Tools menu. You will then be able to select roof surfaces individually.

Although the placement of roof construction elements using RoofMaker works using other methods, we strongly recommend setting the reference line of the roof to the upper exterior edge of the wall beneath (as handled by ArchiCAD's Complex Roof Placement Method). The definition of elements, with or without overhang, uses this reference line as a basis.

We recommend setting the roof thickness equal to the general cross-section height of the rafters. This way, you can use the roof to cut elements that are standing upon the rafters (e.g., Posts).

To place a **trimmer** (blocking), a **collar beam** or a **tie beam**, two corresponding rafters must be selected (opposite rafters for a collar beam or a tie beam, and rafters in the same roof surface for a trimmer).

After choosing the command for the placement of an object, a dialog box opens in which certain parameters concerning the object itself can be set. Surface materials and a layer can be assigned to all elements. The current Pen Color set for the Object is used by default. If you change the current Pen Color, all the subsequently placed elements will have the new color.

The object is then placed with one or more clicks, or is placed automatically, depending on the object type. *See details below.*

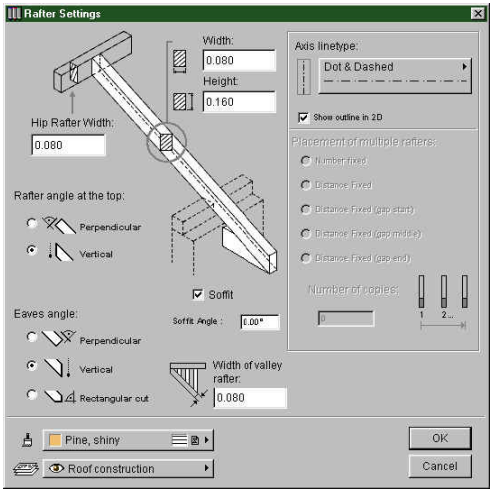
Placing the Objects

Create a Rafter

When creating rafters, the bottom plane of the roof serves as a reference plane. Rafters will be automatically placed on top of it.

Select a reference roof surface on the floor plan. Choose **Create a Rafter** from the Extras/RoofMaker menu.

A dialog box appears in which rafter parameters can be set.



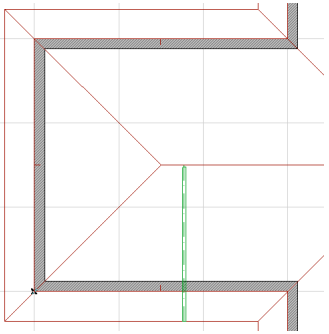
In addition to setting the height and width of the rafter's cross section and the type of eaves (vertical, perpendicular or rectangular cut), you must define the width and the position of a possible connecting element at the top (purlin, trimmer or hip rafter); and the bottom (valley rafter or trimmer).

You can add a soffit to the lower end of the rafter and set its angle. Zero angle means the soffit is horizontal. The soffit will have the same cross section as the rafter.

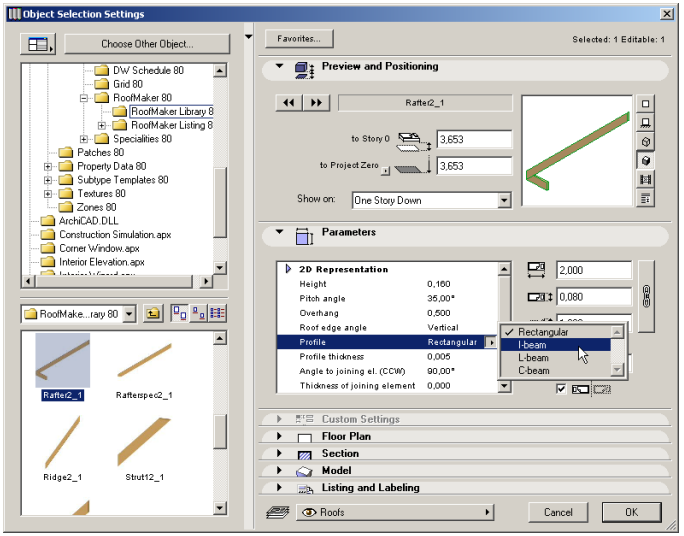
You can choose to view the outline of the rafter and the line type for the axis in the Floor Plan. Normally, a roof plan only shows the axis of any inclined element (rafters, hip rafters, valley rafters); however, it is best to temporarily view 2D outlines of the rafters for better control of the connections between elements.

Clicking OK returns you to the floor plan with the reference roof surface still selected. Click inside the selected roof surface. (If you click outside, an error message appears.)

A rafter is placed with its axis going through the specified point. By definition, rafters are perpendicular to the reference line of the roof.

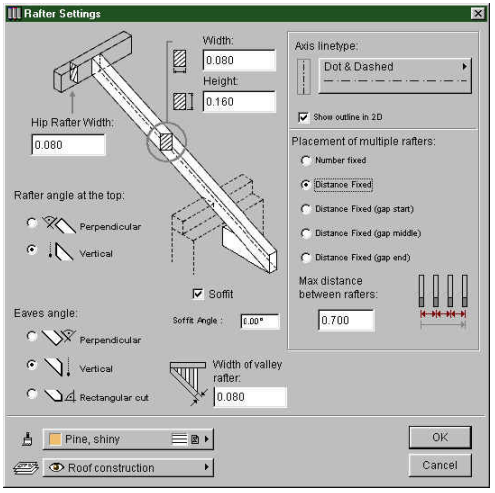


A profile parameter and a profile thickness parameter of the rafter can be set after placement. The rafter may have a rectangular (default) profile as well as I-beam, L-beam or C-beam profiles.



Create Multiple Rafters

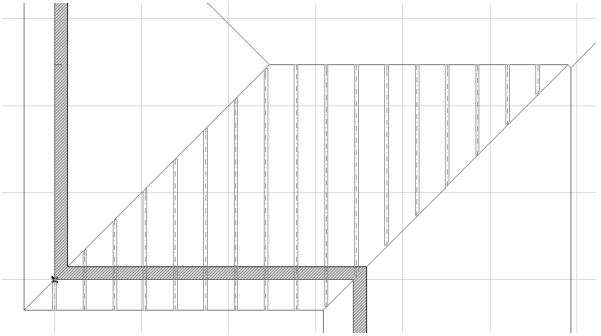
Select a reference roof surface on the floor plan. Choose **Create Multiple Rafters** from the Extras/RoofMaker menu. A dialog box appears in which rafter parameters can be set.



This dialog box is almost identical to the one used for creating a single rafter. The placement method is defined by either a maximal distance between the axes of the rafters (this is the most common method), or the number of rafters to be placed at an equal distance.

If you choose to define the placement giving a maximal distance, the user-defined range might not allow the regular placement of the objects. Therefore, there are further controls that allow you to set where the necessary gap will be introduced, either at the start, the middle or the end.

Clicking OK returns you to the floor plan with the reference roof surface still selected. Click twice inside the selected roof surface to define a placement line. (If you click outside, an error message appears.)

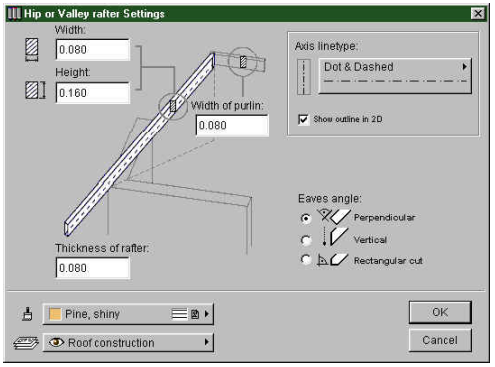


Several rafters are placed along the placement line, with the axis of the first rafter going through the point defined with the first click, and the axis of the last rafter going through the point defined with the second click. By definition, rafters are perpendicular to the reference line of the roof.

Create a Hip or Valley Rafter

The hip rafter usually lies between two neighboring roof polygons. Select the roof surface where the hip rafter connects to a purlin instead of another hip rafter; other methods may cause errors.

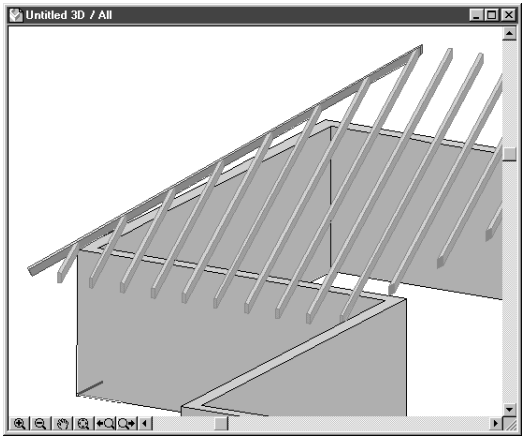
Choose **Create a Hip Rafter or Valley Rafter** from the Extras/RoofMaker menu. A dialog box appears in which hip rafter parameters can be set.



In addition to setting the height and width of the cross section of the rafter, and the type of eaves (vertical, perpendicular or rectangular cut), you must also define the width of a possible connecting element at the top. You can choose to view the outline of the rafter in 2D as well as the line type for the axis.

Clicking OK returns you to the floor plan with the reference roof surface still selected. Click along one of the edges of the selected roof that is NOT parallel or perpendicular to the reference line. (If you click elsewhere, an error message will appear.)

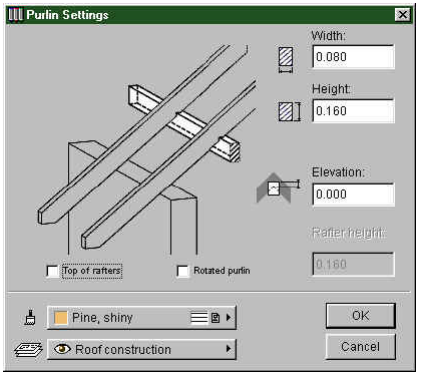
A Hip or a Valley Rafter (or a Valley Rafter without Overhang) is placed along the specified edge of the roof, depending on the position of the edge to the roof's reference line.



Hip and Valley Rafters can also be placed with two roof surfaces selected previously. It is then not necessary to click afterwards to specify an edge; the object will be placed along the common edge of the two surfaces. The difference between the two methods lies in the shape of the resulting objects; the top cut in the latter method makes the object suitable for steeple type roofs.

Create a Purlin (or Beam)

Select a reference roof surface on the floor plan and choose **Create a Purlin** from the Extras/RoofMaker menu. A dialog box appears in which purlin parameters can be set.



By default, the purlin is placed under the reference plane defined by the roof, since a purlin generally supports the rafters from below. However, an elevation value can be set for the purlin so that it can be higher or lower than the reference plane. You can also set the values for the width and the height of the cross-section.

The purlin can also be perpendicular to the rafters and be on the top of them as well. If the purlin is placed on top, the cross section height of the rafters has to be set.

Clicking OK returns you to the floor plan with the reference roof surface still selected. Click either an edge of the selected roof, or inside the roof polygon. (Clicking outside the polygon produces an error message.)

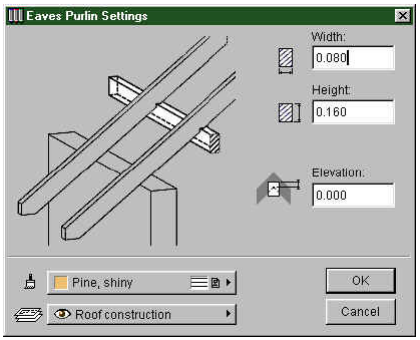
If you click on an edge, a purlin is placed with its axis along the edge. If the edge is not parallel to the reference line of the roof, the endpoints of the axis of the purlin will be at different heights - as indicated in the "Height difference" parameter of the library part - and the purlin will be inclined.

Clicking inside the roof polygon determines the position of only one side of the purlin; an additional click is needed to define the direction where the purlin extends. (For example if you want to place a rafter in line with the interior side of a wall, first you click to the interior side and then toward the exterior.)

If you click inside the polygon, the axis of the beam will pass through the clicked point parallel to the reference line of the roof.

Create an Eaves Purlin (or Plate Beam)

Select a reference roof surface on the floor plan and choose **Create an Eaves Purlin** from the Extras/RoofMaker menu. A dialog box appears in which eaves purlin parameters can be set.



This type of purlin is placed under the reference plane defined by the roof, supporting the rafters from below. However, an elevation value can be set for the eaves purlin so that it can be higher or lower than the reference plane. You can also set the values for the width and the height of the cross section.

Clicking OK returns you to the floor plan, with the reference roof surface still selected. You need to click either one of the edges of the selected roof, or inside the roof polygon. (If you click outside the polygon, an error message appears.)

If you click on an edge, the purlin is placed inside the polygon, with its side along the edge. If the edge is not parallel to the reference line of the roof, the two endpoints of the axis of the purlin will be at different heights, as indicated in the “Height difference” parameter of the library part, and the purlin will be inclined.

If you click inside the polygon, the axis of the purlin will pass through the clicked point, parallel to the reference line of the roof surface. An additional click is then needed to define the direction where the plate beam extends. (For example, if you want to place a rafter in line with the interior side of a wall, first click on the interior edge of the wall and then toward the exterior.)

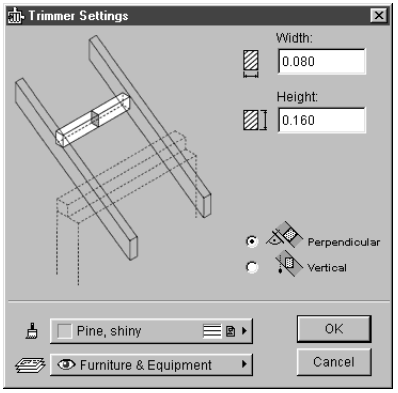
There is an empty fill included in the 2D symbol of purlins because purlins usually have to cover posts placed underneath. These posts are generally displayed as a larger circle to indicate that there is some kind of supporting structure. You can use the Bring to Front and Send to Back commands from the Tools menu to ensure the accurate positioning of elements.

We recommend that you begin modelling the roof construction with the purlins and continue with the hip rafters/valley rafters before placing the rafters. This way you can easily keep track of all the connecting elements. (When placing ridges, you already know the thickness of the purlin; when placing rafters you already know the thickness of purlins, hip and valley rafters, etc.)

Create a Trimmer (or Blocking)

In order to place a trimmer, you must first select the two rafters the trimmer is going to be placed between. The two rafters have to be within the same roof polygon. (This also means that they have the same pitch angle and they are both perpendicular to the reference line of the roof.)

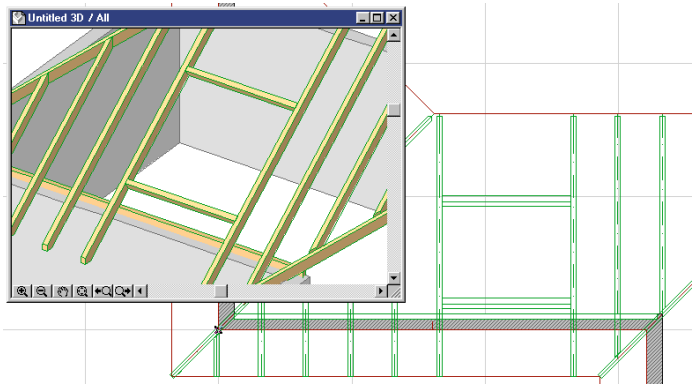
Choose **Create a Trimmer** from the Extras/RoofMaker menu. A dialog box appears in which trimmer parameters can be set.



A trimmer is placed at the same height as the rafters. It can be vertical or rotated to a position perpendicular to the pitch angle of the roof. The 2D symbol also shows the current position.

Clicking OK, you return to the floor plan with the two rafters still selected. Click between the rafters. (If you click outside them, an error message will appear.)

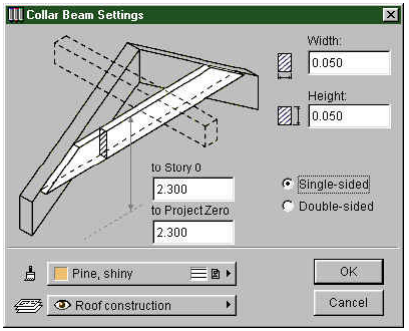
A trimmer is placed between the two rafters, the axis going through the specified point. Trimmers are always parallel to the reference line of the roof and thus perpendicular to the rafters.



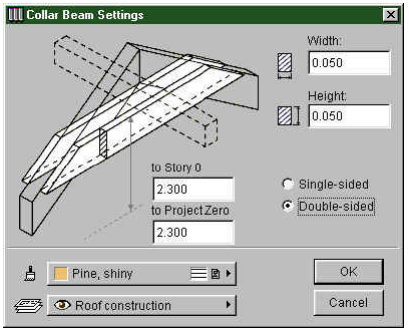
Create a Collar Beam

In order to place a collar beam you must first select two rafters to place it between. The axes of the two rafters must be along the same line and meet at the top, otherwise you will get an error message.

Choose **Create a Collar Beam** from the Extras/RoofMaker menu. A dialog box appears in which different parameters of the collar beam can be set.



A collar beam can be double- or single-sided. In addition to the dimensions of the cross-section, an elevation value must be set, calculated from the height of the insertion point of the rafters (which is usually also the height of the reference line of the roof). If the two rafters are not inserted at the same height, the collar beam is placed relative to the higher one.

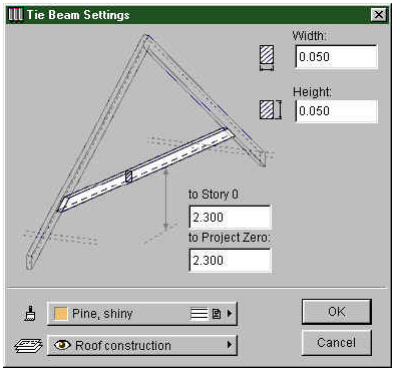


Clicking OK returns you to the floor plan with the two rafters still selected. If a double-sided collar beam has been selected, it is placed automatically in the appropriate position. If a single-sided collar beam is selected, click once more to determine on which side of the rafters the collar beam will be placed.

Create a Tie Beam

In order to place a tie beam, you must first select two rafters to place it between. The axes of the two rafters must be along the same line and meet at the top, otherwise you will get an error message.

Choose **Create a Tie Beam** from the Extras/RoofMaker menu. A dialog box appears in which different parameters of the tie beam can be set.



In addition to the dimensions of the cross section, an elevation value must be set, calculated either from Project Zero or the current story elevation.

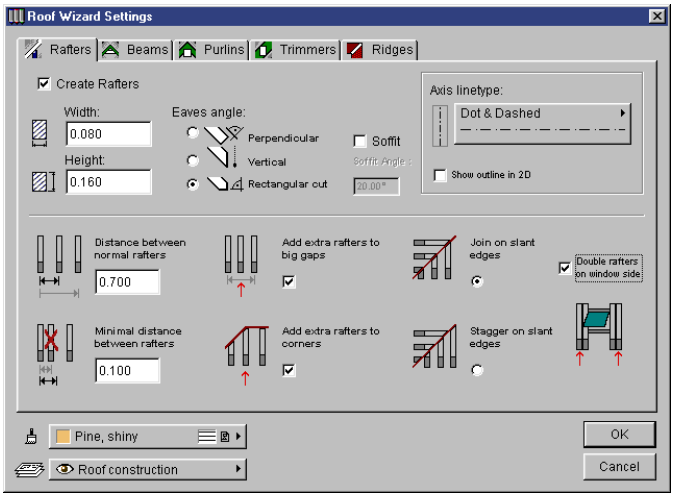
Clicking OK returns you to the floor plan with the two rafters still selected. The tie beam is placed automatically in the appropriate position.

Using the Roof Wizard

The Roof Wizard allows you to create entire roof constructions quickly and easily. You can place rafters, purlins, trimmers, collar or tie beams in one step.

To begin, select all the roof surfaces in the project that you wish to add structural elements to. Choose the **Roof Wizard** command from the **Extras/RoofMaker** menu. The Roof Wizard dialog box appears.

On the first tab page you can determine what the rafters should look like.

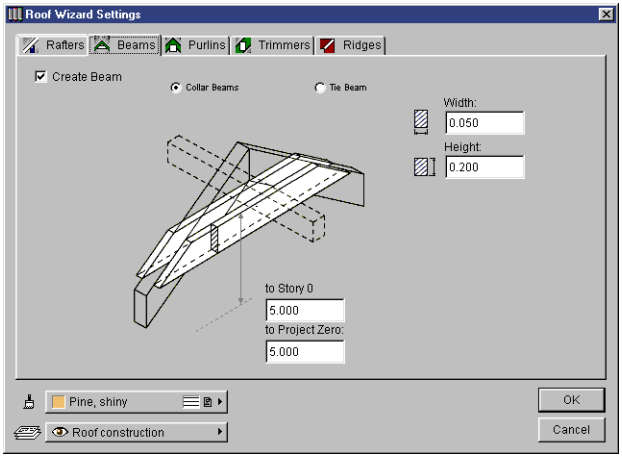


Apart from setting the general parameters of the rafters, such as cross section parameters, the eaves type or the Floor Plan visibility, you can also determine the placement of the rafters.

A standard and a minimal distance between rafters can be set. Extra rafters can be added to the intersection of hip rafters or to skylights.

A checkbox in the top left corner of all pages determines whether this type of object should be created or be omitted from this step.

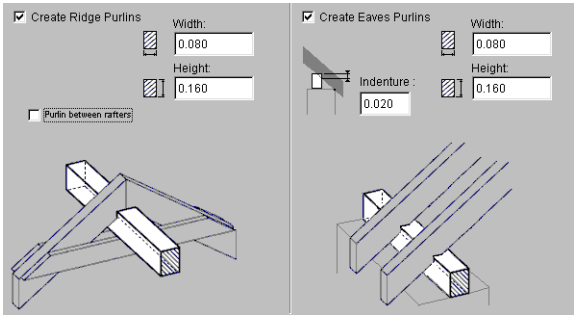
On the second tab page you can determine whether you want to place collar beams or tie beams.



In addition to setting the general parameters of the beams, such as cross section parameters, you can also set the elevation of the beams. For collar beams, set the elevation of the top; for tie beams, set the elevation of the bottom.

Note: With the Roof Wizard, only double collar beams can be created.

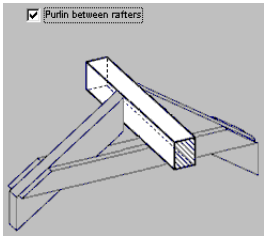
On the third tab page you can determine whether you want to place hip rafter purlins or eaves purlins.



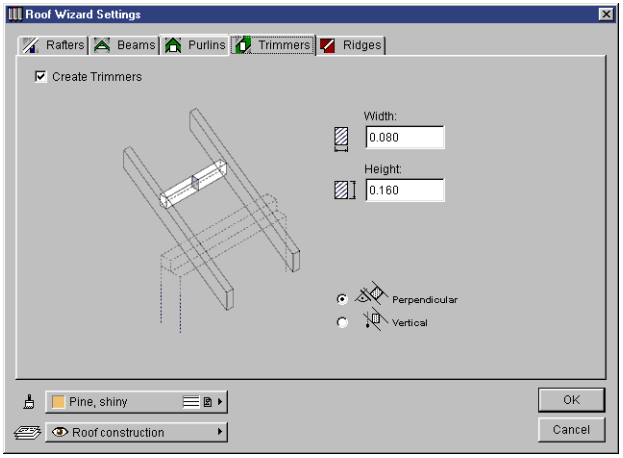
In addition to setting the general parameters of the purlins, such as cross section parameters, you can also affect the placement of the purlins.

You can also set the depth at which the eaves purlin cuts into the rafter it supports. The eaves purlin is always placed on the same level as the reference line of the corresponding roof surface.

An eaves purlin is placed either below the opposing rafters (supporting them), or between the rafters (supported by them).



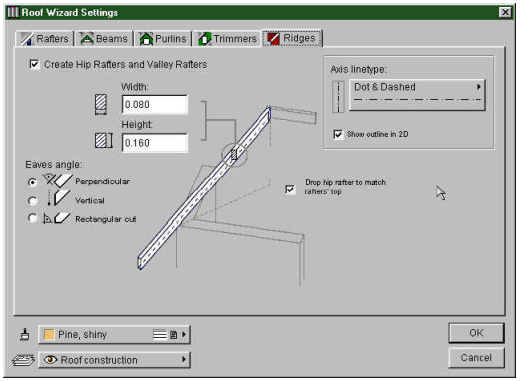
On the fourth tab page you can determine whether you want to place trimmers.



Apart from setting the general parameters of the trimmer, such as cross section parameters, you can also affect its placement.

The trimmers can be either vertical or perpendicular to the roof pitch angle.

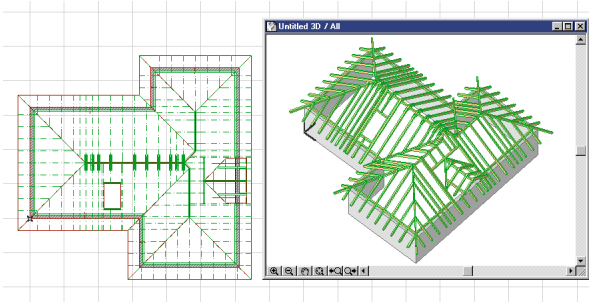
On the fifth tab page you can determine what the hip and valley rafters should be like.



Apart from setting the general parameters of the rafters - like cross section parameters, the eaves type or the Floor Plan visibility - you can also affect the placement of the rafters.

Because of the different pitch angle of standard and hip or valley rafters, the latter have to be lowered in order to get the top of all rafters to the same elevation.

Clicking OK returns you to the floor plan. The roof construction elements you have specified are placed automatically in the appropriate position.



The placement of the rafters is optimized to meet the specified requirements. The objects now behave as ordinary Objects and can be modified as such.

The RoofMaker Toolbox

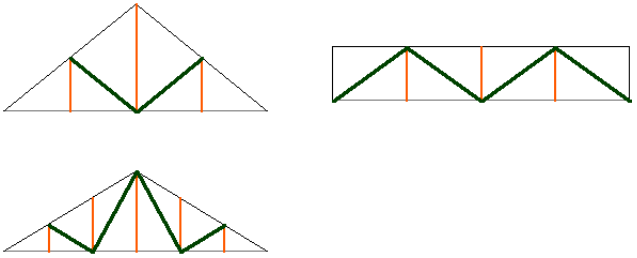
Choosing the last menu item of the RoofMaker hierarchical menu will display the RoofMaker Toolbox. The Toolbox contains shortcuts to all of the RoofMaker menu commands.

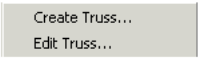
Adding Structural Elements with TrussMaker

TrussMaker is a built-in tool allowing you to create girder and truss objects for visualization purposes. It is accessed from the Extras menu. Technically, TrussMaker is an ArchiCAD Add-On and is loaded with ArchiCAD on startup.

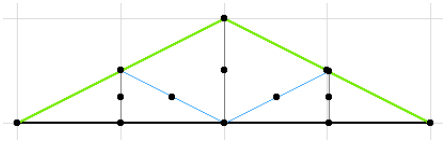
Creating Trusses in the Floor Plan

Start by drawing the framework of the truss in the Floor Plan window with the **Line** and **Arc/Circle** tools. Use different pen colors for the different parts of the truss, as seen below. Pen thicknesses have been exaggerated for clarity.

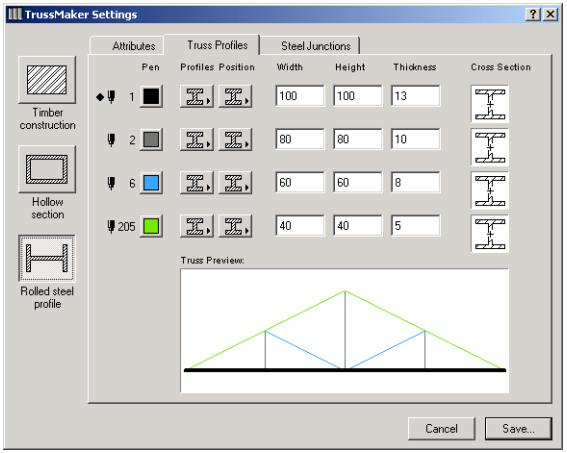




When you are satisfied with your design, select the lines making up the truss and choose the **Create Truss...** command from the **TrussMaker** hierarchical menu.

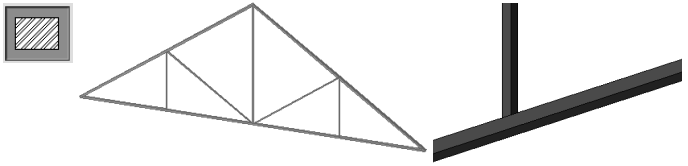


The **TrussMaker Settings** dialog box appears, allowing you to choose a shape and define options for creating the truss.

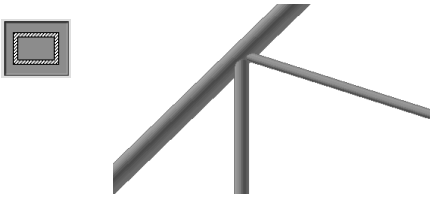


The three large buttons on the left of the screen allow you to choose a construction type:

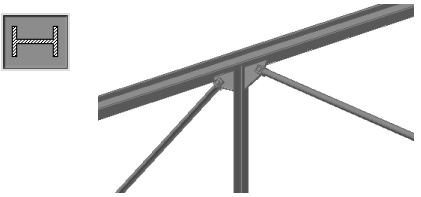
- **Timber Construction**: click this button to construct wooden trusses.



- **Hollow Section**: click this button to construct rectangular or circular hollow trusses.

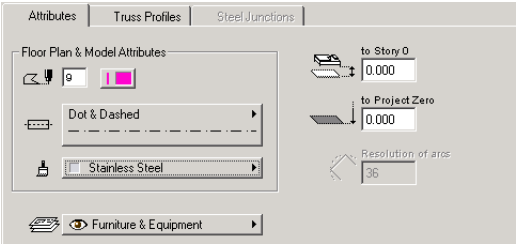


- **Rolled Steel Profile**: click this button to construct steel trusses using a variety of profile options.



The three tab pages contain a number of options for the different types.

The first tab page, Attributes, defines the appearance of the truss in floor plan, section and 3D views. This tab page is identical for all three construction types.



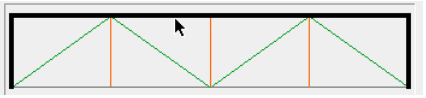
You can choose a pen color, a line type, a material and a layer assignment for your truss. It is also possible to define a vertical offset from the story or project zero level, and to set the segmentation of any curves that you used to define the outline of the truss.

Note: The value you enter in the Resolution of arcs field is relative to the complete circle, not the arc segment.

The Truss Profiles tab page has different choices according to the construction type.

Because the different pen colors used to define the different parts of the truss are interpreted separately, in this tab page you can assign distinct parameters (e.g., thickness, diameter or profile) to each part.

A black diamond next to the pen color icon indicates which part of the truss you are defining options for. You can check this in the preview area, where the given part appears thicker.

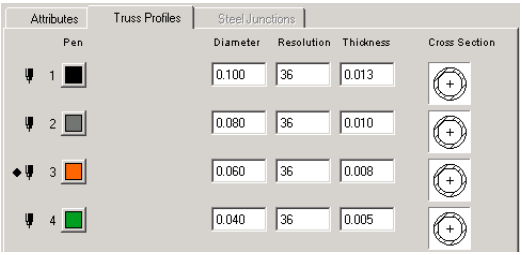


To select a part to work on, either click its pen color icon or its outline in the **Truss Preview**.

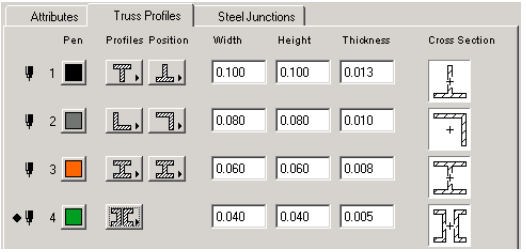
For the **Timber Construction** type, you can set the width and the height of the elements. The right side of the dialog box displays a preview of the cross section.

In addition to the above, the **Hollow Section** type of truss has a number of additional settings.

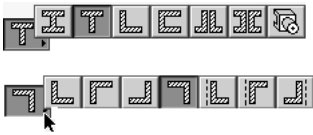
- You can choose between rectangular and circular elements (but you cannot combine the two).
- Instead of width and height values, circular truss elements are defined by their diameter and resolution.
- It is possible to customize the thickness of the different parts of the truss.



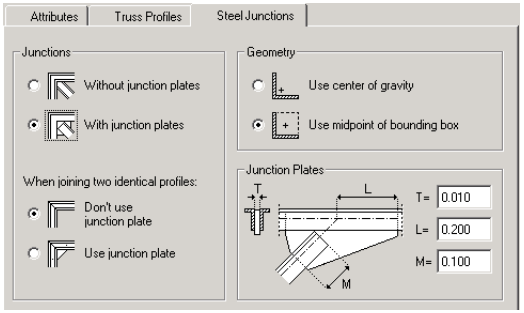
For the **Rolled Steel Profile** construction type, an even wider range of options is available:



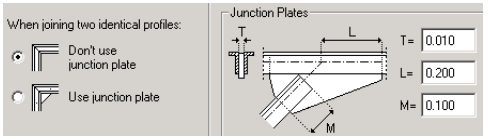
The two pop-ups next to the pen color icon allow you to choose among profiles and ways of positioning them.



The third tab page of the TrussMaker Settings dialog box is only available for the **Rolled Steel Profile** construction type.



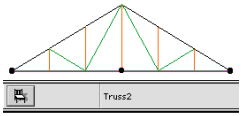
The options offered in this dialog box allow you to use customizable junction plates at the points where the truss elements meet. If you choose not to use junction plates, the corresponding options are grayed in the dialog box.

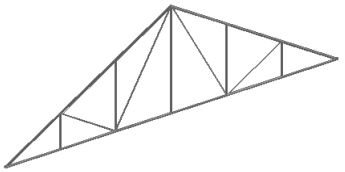


In the Junction Plates section, T stands for the cross-section value, L for the length of the junction plate from the intersection point of the profile axis and M for the minimal overlapping length of the profile and the junction plate. Depending on the geometry (the angle between the profiles), either L or M will be used to determine the actual junction plate length - whichever results in a longer junction plate.

When you have finished customizing your truss, click the **Save...** button at the bottom right of the dialog box. You will then be prompted to name the new truss object and place it in your active library.

The new truss appears on the Floor Plan on the baseline of the contour. Go to the 3D Window to visualize it, and then drag it into its final location.

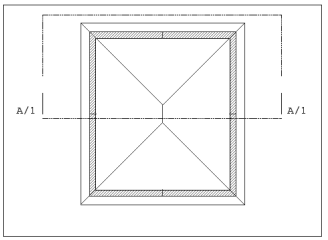




Creating Trusses in Section/Elevation Windows

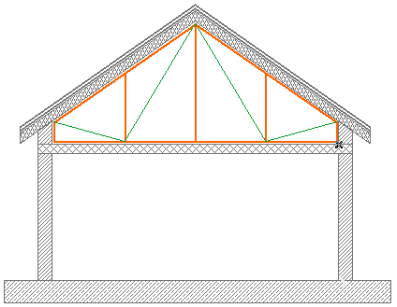
You can also create a truss in a Section/Elevation window:

1) Draw a Roof on the Floor Plan and add a Section Line.



2) Open the Section/Elevation window corresponding to the section line.

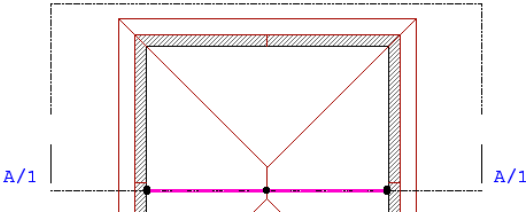
3) Fit the framework of the truss to the roof. Draw the outline with lines as you would on the Floor Plan *(see above)*.



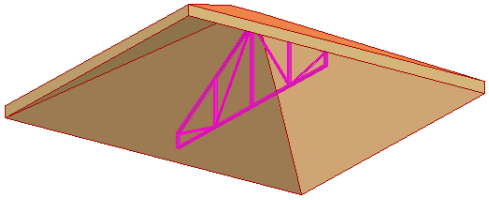
4) Select the framework's elements and choose **Create Truss...** from the **TrussMaker** hierarchical menu.

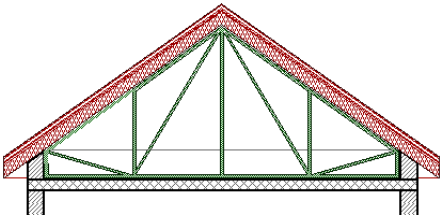
5) Make the appropriate settings in the **TrussMaker Settings** dialog box and save the object.

An alert will be displayed, informing you that the new truss object has been created on the Floor Plan. The truss is placed on the same line as the section line and will therefore appear in the Section/Elevation window as an element that was cut on its edge.



6) Display the new truss with the roof in 3D or in another Section window.





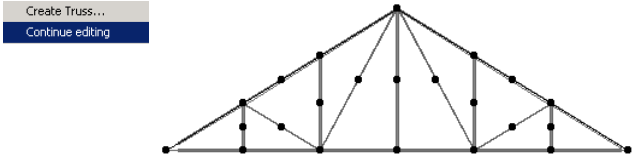
Editing Trusses

The framework drawn on the Floor Plan is not associated to the truss after it has been created and placed (and can only be used to create new trusses). Modifying this outline has no effect on placed trusses.

TrussMaker offers you an additional method for editing placed trusses.

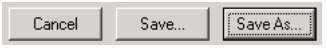
Select a truss and choose the **Edit Truss...** command from the **TrussMaker** menu or the **TrussMaker** palette.

An alert will appear, prompting you to create a new Section window. Draw a simple section line with the **Section/Elevation** tool, open the new **Section/Elevation** window and then choose **Continue Editing** from the **TrussMaker** menu or palette. The original framework will appear in the window and you will be able to edit it.



When you have finished making your changes, choose the **Create Truss...** command again.

The TrussMaker Settings dialog box will appear, with the same options as seen above. The only difference is that in addition to the **Save...** button, a **Save as...** button appears.



- If you click **Save...**, TrussMaker will display a warning telling you that you are about to save a library part under an existing name. Clicking **Overwrite** will replace the previous truss, while clicking **Cancel** will abort the whole process.

- If you click **Save as...**, a new truss object will be created. TrussMaker will prompt you to name this object and find a place for it in the library.

Adding Finishes

ArchiCAD includes built-in tools that allow you to enhance exterior and interior views in the 3D Window and in Section/Elevation views by adding parametric Objects based on the original geometry of selected Wall, Roof, Slab and Zone type elements. The objects recognize openings of any shape and are updated if the geometry of the base element changes.

The corresponding commands, Accessories and Interior Wizard, can be accessed from the Extras menu. Both commands are based on Add-Ons that are loaded by default on startup.

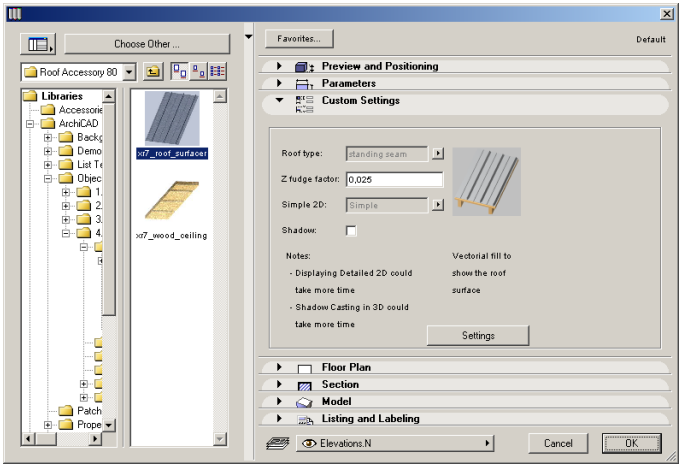
Accessories

Accessories enhance the modeling of Walls, Roofs and Slabs in 3D and Section views. Each Accessory comprises two elements: a command and the corresponding integrated parametric objects. Each object has a number of required parameters that are set by the command.

Using Roof/Slab/Wall Accessories

First, select an existing building element (wall, roof or slab) on the Floor Plan, and then choose the appropriate command from the **Extras**/**Accessories** hierarchical menu.

The **Object Settings** dialog box will then appear, prompting you to select one of the Accessory objects. Set the object's properties and parameters on the Parameters and Custom Settings panel (the latter may provide additional information that makes it easier to understand the parameters). Other parameters will be set automatically when placing the object, according to the related building elements.



Click **OK** in the **Object Settings** dialog box to place the Accessory Object. After placing it, you can select it and modify its parameters at any time.

You can also place an Accessory Object without selecting a corresponding building element.

- Select an Accessory Object and set its parameters in the **Object Settings** dialog box.
- Draw a polyline on the Floor Plan. The selected Accessory Object will be placed with the polyline geometry method.

  Note: Accessory Objects placed on their own are not associated to any element.

The **Accessories** commands update all parameter values of the placed objects appropriately:

- When you delete an element, associated Accessory Objects will also be deleted.
- When you modify an element, all parameter values will be updated on the fly (wall geometry may change when stretching connecting walls).

To simplify the procedure, you can save variations of the Accessory Objects, using different names for customized

default values. You can also create customized variations by opening an object and saving a copy with a different name (but keeping the first three characters and the underline character), and then modifying the custom parameters and/or scripts.

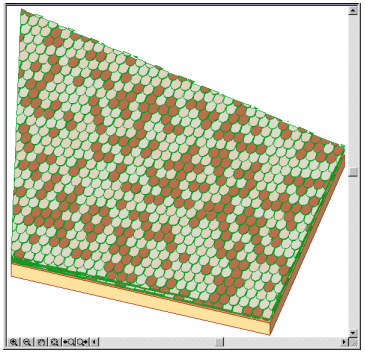
Roof Accessories

The **Roof Accessories...** command allows you to place the **Roof Surfacer** object. It can model a roof surface with metal sheets or with tiling. The metal sheets have two variations, and there are four available types of tile.

Note: The surfacing is done tile by tile, and can add considerable geometric detail (and, consequently, rendering time) to each roof plane. Curved surfaces are more demanding on the computer's resources than planar surfaces.

To simplify the operation, there are some restrictions on roof geometry:

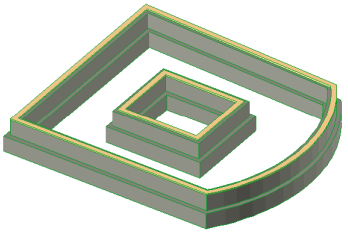
- The polygons (and subpolygons for the skylight holes) cannot contain curved segments.
- The subpolygons cannot contain concave segments.
- The concave segments of the polygon must be separated by at least one convex polygon segment.



Slab Accessories

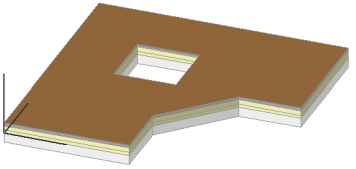
When choosing the **Slab Accessories...** command, you can choose between two objects.

The **Footing with Stem Wall** object can model a concrete footing with stem wall and sill plate.

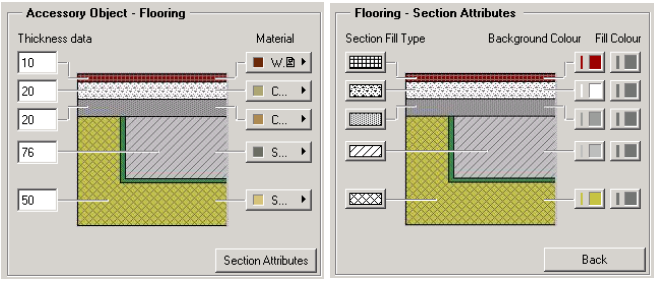


Note: To simplify the operation, there are some restrictions on the slab geometry. The slab perimeter polygon cannot contain curved segments. If present, these segments will be approximated with their chord.

The **Floor Construction** object can model layered floors.



The Custom Settings panel of this object allows you to make settings for the 3D model and the Section representation.



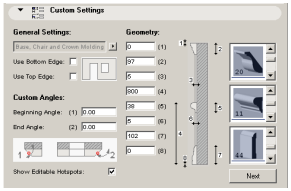
Wall Accessories

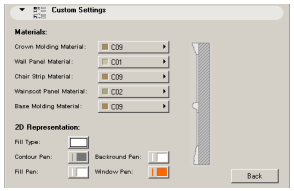
With the **Wall Accessories...** command, you can place a variety of objects adding details to your walls. The specific objects are detailed in the following paragraphs, together with their parameters.

The **Molding and Paneling** object can model interior details on walls consisting of up to three selectable molding profiles, and optional paneling (wainscot and wall panels) between these moldings.

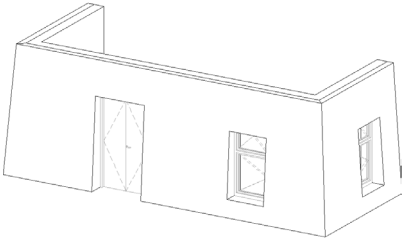
The object's custom parameters can be set in the **Object Settings** dialog box, on either the Custom Settings or the Parameters panel. Parameters are grouped according to different criteria on the two panels.

The Custom Settings panel has two pages, one for the General Settings, Geometry and Custom Angles and one for the Materials and 2D Representation.

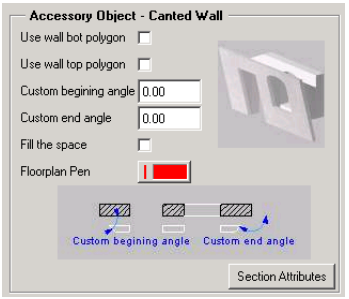




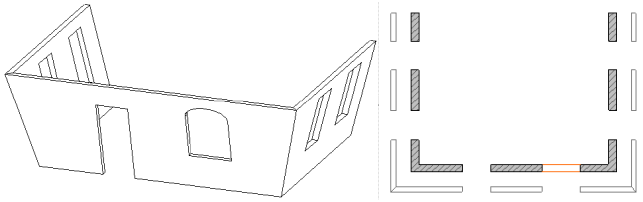
The **Battered Wall Modeling** object can model battered stone veneers and similar elements applied to the outside of a wall, and can have a different thickness at the bottom and the top. The object can extend beyond or end short of the bottom and the top of the wall by a specified distance.



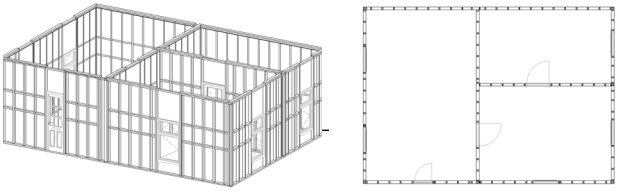
The **Canted Wall Modeling** object is an exact replication of the Wall it is derived from, except that it has a parametric tilting angle.



On the Floor Plan, it also shows the outside boundaries of the object, as well as the cross section at a given elevation (4 ft. by default).



The **Stud Wall Framing** object can be used to represent stud framing within walls. It handles the properly added studs at right angle corners and incoming wall joints. At the windows and doors it adds double studs, cripples and jack studs as well as parametric headers. The top header plate is broken or extended to provide overlap at the joining walls.



These objects have their property script set up to provide LUMBER PACK calculation where the individual pieces are listed with their nominal cross section sizes and their length is rounded up - if necessary - to the next inch. The list also gives an estimate on the overall board feet quantity.

Restrictions: Openings for Doors and Windows will have horizontal edges perpendicular to the original wall plane.

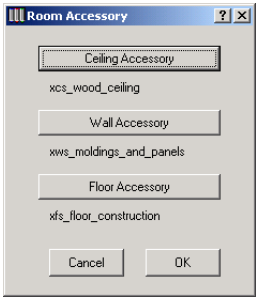
Interior Wizard

The **Interior Wizard** command enhances the modeling of 3D Zones. It creates interior finish elements on the surface of the 3D Zones defined by the user. You can edit the shape and the material parameters of these elements using standard ArchiCAD tools as well as parametric functionality. The Interior Wizard recognizes wall openings and is updated if the zone that it is connected to is updated or changed. The Interior Wizard also relies on the objects stored in the Accessories Library.

The Interior Wizard applies Accessory Objects to walls, ceilings and floors of the selected room. First select the 3D Zone on the Floor Plan. Then choose the **Create Room Accessories** command from the **Interior Wizard** hierarchical menu. A dialog box will then appear, prompting you to select from the different types of Accessory objects.

After pressing any of the three buttons (**Ceiling Accessory**, **Wall Accessory**, **Floor Accessory**), the **Object Settings** dialog box will appear, allowing you to choose an object and make the appropriate settings. The principle is the same as for the Accessories commands.

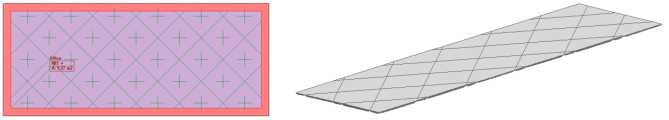
When you have selected an object for all three types, the **Interior Wizard** dialog box changes accordingly.



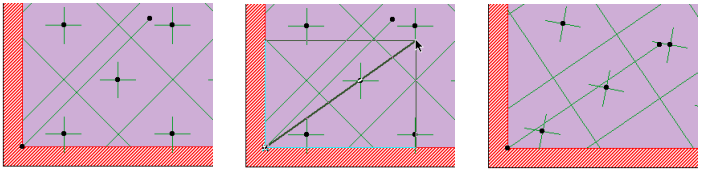
When pressing **OK**, Interior Wizard places the Accessory Objects on the surface of the 3D Zones. If the given room's Zone is changed or updated, use the **Update Room Accessories** command from the **Interior Wizard** menu to update the placed Accessory Objects.

To use the Gypsum Ceiling Object, construct a room, select it and choose **Extras/Interior Wizard**. Click the **Ceiling Accessory** button. In the **Object Settings** dialog box select the Gypsum Ceiling object. Click **OK** to place the object.

View the created ceiling in 2D and 3D.



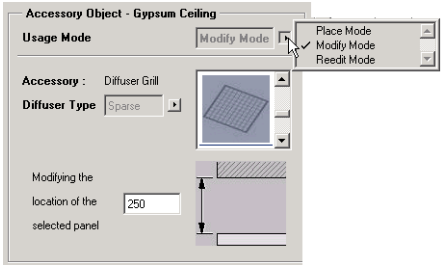
You can change the direction of the pattern by selecting a special hotspot of the ceiling object in the Floor Plan view and then moving it. Choose **Display/Rebuild** to update the view.



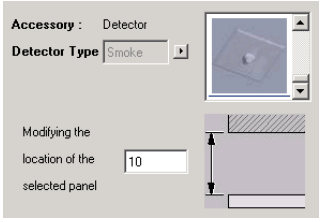
You can also add a number of details to the placed ceiling, including smoke detectors, lamps or diffuser grills, and modify or delete single panels.

Make sure that the placed ceiling object is NOT selected. Double-click the Object tool and select the Gypsum Ceiling object again.

On the dialog box's User Interface tab page, change the **Usage Mode** pop-up menu from Place Mode to Modify Mode.

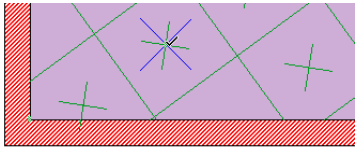


In the Accessory area, use the scrollbar to locate the item type that you wish to insert. Select, for example, a smoke detector.



You can enter a value to offset the accessory from the ceiling panel.

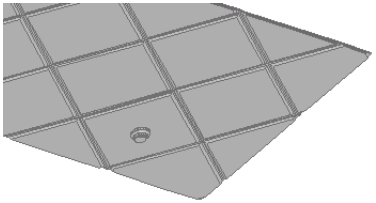
Click **OK**. Then, in Floor Plan view, click the location on the ceiling where you wish to place the smoke detector.



Select the ceiling object, open the **Object Settings** dialog box and change the **Usage Mode** to **Reedit Mode**. Click **OK**.

With the Alt key (Windows) or Options key (Mac) pressed, choose **Rebuild and Regenerate** from the **Display** menu.

Go to the 3D Window to see that the smoke detector has now been placed and integrated with the ceiling.



Drawing Elements

Drawing elements are 2D only. They have various uses:

- Details that you did not wish to model fully with construction tools.
- Positioning and drawing aids for the placement of construction elements.
- Their outlines can be used to generate complex 3D shapes using the Magic Wand tool.
- Decoration purposes or elaborating on details, especially in the Section/Elevation windows or Detail Drawings.

The following types of 2D elements are available: **Lines**, **Polylines**, **Arcs**, **Circles**, **Ellipses**, **Splines**, **Fills**, **Text**, **Figures** and **Hotspots**.

The creation, display and behavior of the elements obeys some common rules, but the specifics will be discussed in the sections dedicated to the different element types.

Creation Steps

The typical steps in creating a drawing element are the following:

1) Select the corresponding tool in the Toolbox and open its settings dialog box by double-clicking the tool's icon.
2) Adjust the settings offered by default to suit your particular situation or purpose, or click the Favorites button on top of the palette to select a predefined element configuration. Click OK to confirm the settings.
3) Choose a Geometry Method in the Info Box allowing you to create plain, curved, chained, rotated or polygonal variations of the elements, where applicable.
4) In the Floor Plan define the location or the length of the drawing elements.

Element Display

The Floor Plan and Section/Elevation display of drawing elements depends on the attribute choices made for them in their dialog boxes. Attribute sets are managed by a number of commands in the Options menu. For faster display or output, the 2D appearance of some of the attributes can be modified by the Display Options command, also located on the Options menu.

You can change the attribute settings of the elements by clicking the pop-up controls in the appropriate panels of the element settings boxes and dragging the cursor to your new choice. Attributes include Pen Colors and Line Types for most element types and Fill Types for Fills only. *See the Construction Elements section for illustrations.*

Straight Lines and Curves

Definition

Lines are one of the simplest drafting elements in ArchiCAD. You can use them to create any 2D shape without utilizing constraints.

The following straight and curved line elements can be created in ArchiCAD.

- Single straight line segments using the **Line** tool.
- Circular arcs and full circles using the **Arc/Circle** tool.
- Elliptical arcs and full ellipses using the **Arc/Circle** tool.
- Natural splines and Bézier curves using the **Spline** tool.
- Freehand curves using the **Spline** tool.
- Series of chained straight and curved line segments using the **Line** tool or the **PolyLine** tool.

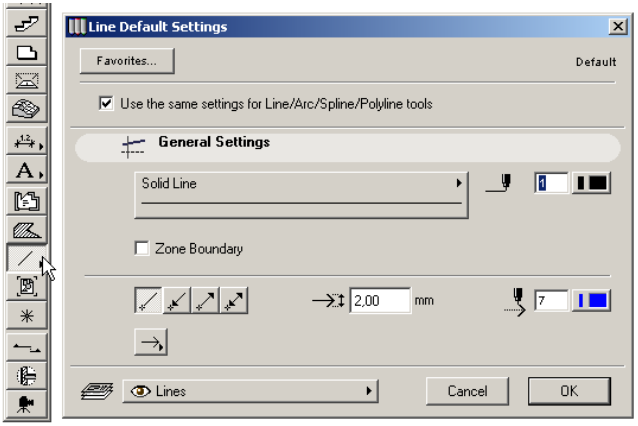
The Drawing Lines and Curves section will show the particulars of each technique.

Line Tools and Settings

In the **Toolbox** default shape, the **Line**, **Arc/Circle**, **Polyline** and **Spline** tools are represented by a single icon. Choose **Options/Customize/Palette Shapes** and check the

Extended option for the **Toolbox** to show them all at the same time.

Double-clicking any of the line type tools will open a dialog box in which you can adjust the settings of the given tool. This is a single panel dialog box with the Favorites button on top and the Layer assignment pop-up at the bottom.

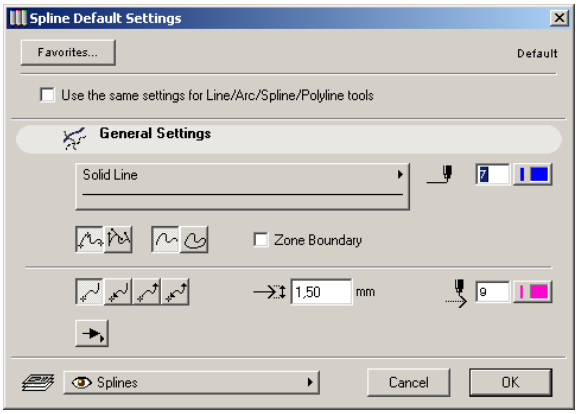


The available controls are identical for each of the line type tools, with a few exceptions. Near the top of the dialog box, a checkbox allows you to apply the settings made in the dialog box of one line type tool to all others.

The top part of the General Settings defines the Line type and the Pen Color of the line.

Below, activating the Zone Boundary checkbox allows lines to delimit Zones when using the Automatic Recognition method. *See the description of Zones later.*

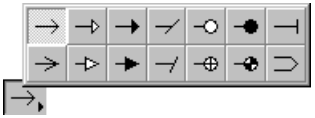
For Splines only, there are two additional controls in this section. This is where you can decide on drawing a natural Spline or a Bézier curve and to create an open-ended or a closed one.



In the bottom part of the settings dialog box you can choose whether to display Arrowheads on line segments that do not define a closed shape. These Construction Methods are also available in the Info Box. You can also set here the size and a distinct Pen Color for the Arrowheads.

- The **No Arrows** method produces a simple line segment with no arrowheads.
- The **Start Arrow** method produces a line with the current arrowhead style at the starting point of the line.
- The **End Arrow** method produces a line with the current arrowhead style at the endpoint of the line.
- The **Double Arrow** method produces a line with the current arrowhead style at both ends of the line.

Below the Construction Methods, a pop-up control contains the Arrowhead styles that are available for the different line tools.



The last arrowhead type is special, as it doubles the line with arrows at both ends. Using a line like this, the cursor will snap to the invisible axis line between the two visible lines. This arrowhead is not available for Arcs and Splines.

Note that only Arcs and open Splines may retain arrowheads: Circles, Ellipses and closed Splines are closed elements with no starting point or endpoint to receive an Arrowhead, and therefore do not support them.

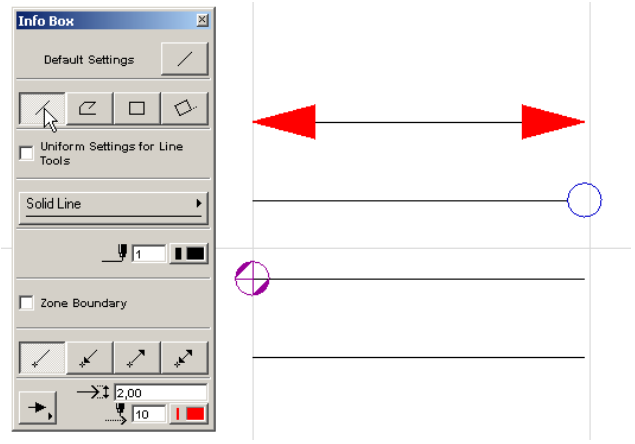
- If you begin to draft an open element with Arrowheads and decide to close it either while drafting or later, the Arrowheads will simply disappear.
- If you later convert a closed element to an open one, for example a Circle to an Arc, you can select it, open the settings dialog box and add Arrowheads to it.

Drawing Lines

The four line type tools can produce single elements and chains of elements in any combination of straight and curved segments. The following sections give a short description of all the possibilities.

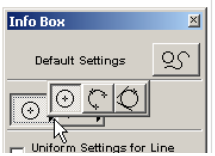
Drawing a Single Straight Line Segment

To draw a single straight Line segment, choose the **Line** tool in the Toolbox and the **Single Line** geometry method in the Info Box. The Line segment is defined by its two endpoints. If you have chosen to add Arrowheads to it, they will be placed according to the Construction Method chosen in either the Line Settings dialog box or the Info Box.



Drawing Circular Arcs and Full Circles

To draw a circular arc or a full circle, choose the **Arc/Circle** tool in the Toolbox and one of the Geometry Methods offered by the first icon in the Info Box (Centerpoint, Three Points or Tangent Point).

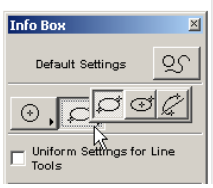


The three methods are identical to those presented in the Drawing Curved Walls section. *See the Wall tool description earlier.*

> **Note:** Unlike circular Walls, Circles can be fully closed. You will obtain one element, not two half-circles.

Drawing Elliptical Arcs and Full Ellipses

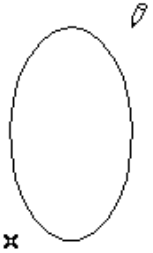
To draw an elliptical arc or a full ellipse, choose the **Arc/Circle** tool in the Toolbox and one of the Geometry Methods offered by the second icon in the Info Box (Diagonal Ellipse, Semi-Diagonal Ellipse, Ellipse Radii).



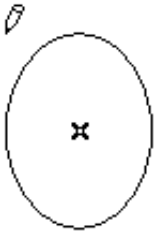
The **Diagonal Ellipse** method creates an Ellipse constrained into a rectangle.

The method stretches the ellipse of an invisible rectangle held by the two points of its diagonal.

1) Click the starting point of the imaginary rectangle.
2) By stretching the imaginary diagonal, you get ellipses of different sizes drawn into the invisible rectangle.
3) With the second click you choose the ellipse of the appropriate size.

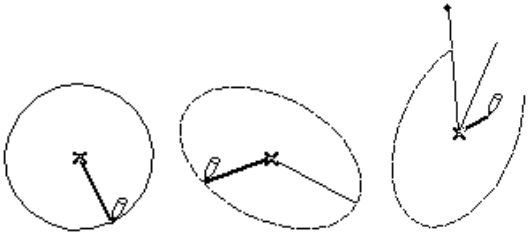


The **Semi-Diagonal Ellipse** method works in the same way as the Diagonal method but here you define the imaginary rectangle by its centerpoint and the endpoint of its semi-diagonal.



The **Ellipse Radii** method defines an elliptical arc by the major and another radius of an ellipse and the angle of the arc.

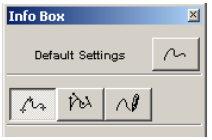
1) Click the centerpoint of the ellipse.
2) Choose the orientation of the major radius, by clicking again.
3) You get the rubberband line of the second radius, which you can stretch to different sizes and angles. Notice the accompanying ellipse that fits the length of the two radii. If you stretch the minor radius too far away or right in line with the major radius, you cannot draw the ellipse.



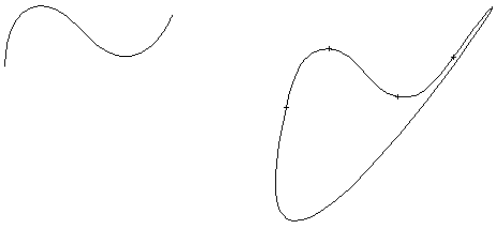
4) In the final phase ArchiCAD holds the ellipse while you define the side angle of the arc. First, you use a rubberband line to define the side where the angle starts from. Then you define a different side that closes the angle, while ArchiCAD follows the angle with the Elliptical Arc. Neither side of the angle remains visible when the final arc is drawn.

Drawing Splines

To draw a natural Spline or a Bézier curve, choose the **Spline** tool in the Toolbox and the first or the second Geometry Method icon in the Info Box.



Natural splines can be defined by placing nodes, which the program automatically connects, thereby generating a smooth custom curve. The angle of the tangent and the shape of the spline generated with it is affected by each subsequent node defined. You can conclude this operation either by double-clicking on the last node, or by clicking the **OK** button in the **Control Box**. Clicking **OK** always results in a closed spline.



Bézier splines are somewhat more complex in nature, but they allow more accurate reproduction of specific custom shapes. Bézier splines are defined by nodes, just like natural splines, but they also have editable tangent handles on each side of these points. The shape of the Bézier spline is affected by the direction of the tangent and the length of each tangent handle.

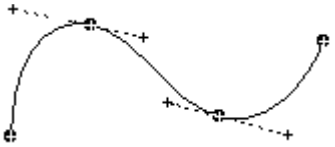
When defining Bézier splines, click once to place a node, and keep the mouse button depressed. By moving away from the node in any direction, you are in effect defining the initial tangent, and the length of the handle that defines the curvature. If you release the mouse button, ArchiCAD will assume that you wish to jump to the definition of the next node with your next click. Keep the mouse button depressed, and then define the next tangent and node as above. You can conclude this operation either by double-clicking the last node, by hitting the Enter key twice or by clicking the **OK** button in the **Control Box**.

Simple clicking a handle without dragging the mouse will define a sharp node within the Bézier spline.

You can edit Bézier splines by varying the length of each handle separately. Note that there is only one angle associated with both handles of a node, but the length of each handle may be different. The longer the editing handle, the smoother the curve will be at the control point.

You can pull out the handles from sharp nodes to turn them into curved ones.

Note: A Bézier spline's editing handles are visible on the Floor Plan if it is selected. If several Bézier splines are selected at the same time, only the editing handles of the spline last selected will be visible.



Editing Splines

When the **Spline** tool is selected in the **Toolbox**, you can freely edit selected splines in the following ways:

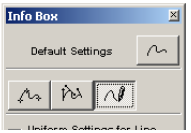
- Click a spline with the Mercedes cursor to insert a node.
- Drag a node onto its neighbor to delete it.
- Drag a node to move it without changing its handles.

Notes: To reposition several nodes at the same time, use the **Marquee** tool.

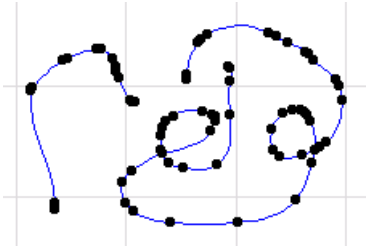
Drawing Freehand Curves

To draw a freehand curve, choose the **Spline** tool in the Toolbox and the third Geometry Method icon in the Info Box.

This method is particularly useful to mark up documents. When you start marking-up, ArchiCAD automatically activates the **Spline** tool with the Freehand geometry method.



The Freehand method always creates natural Splines.

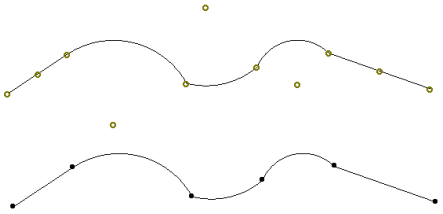


Drawing a Series of Chained Segments

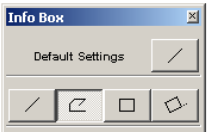
By combining the capabilities of the various line type tools, you can create series of chained straight and curved line segments using the PolyLine tool or the Chained geometry method of the Line tool.

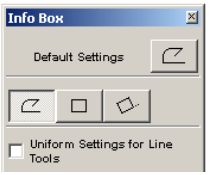
The difference between the two options is the result they produce.

- If you draw the series of elements with the Line tool, each segment remains an individual element, although they may be grouped on creation.
- If you draw the series of elements with the PolyLine tool, you obtain a single element.



Otherwise, the creation process is the same. Activate the Line tool or the PolyLine tool in the Toolbox. In addition to the Single Line method available for the Line tool only (*see Drawing a Single Straight Line Segment above*), there are three identical methods.





The **Chained** method produces a series of straight or curved line segments joined at their endpoints. As you click to complete one segment, you simultaneously begin the next one. Click the **Cancel** button in the **Control Box** or double-click the last endpoint to stop drawing. *For an illustration of the process, see the Drawing a Chain of Walls section earlier in this chapter.*

The **Rectangle** method produces four individual Line segments (Line tool) or a single Rectangle (PolyLine tool), defined by placing two opposing corner modes. With the **Rotated Rectangle** method, you first define a rotation vector for the rectangle's reference line. The rotation vector also defines the length of the two segments parallel to it. By hitting the Shift key once, you can unlock the length component constraint and use only the rotation angle component of the rotation vector.

- If you wish to decompose a PolyLine, select it and choose the Explode command in the Tools menu. You will then obtain a series of Lines and Arcs.
- Connected Lines and Arcs can be transformed into a PolyLine if you select all connecting elements and choose the Tools/Line Extras/Unify command.

Fills

Definition

You can mark different surfaces shown on your Floor Plans and 2D representations with a wide range of ready-made or customized fill patterns. 2D fills are especially useful in section drawings or in detail drawing. Marking floor tiling or

carpeting on Floor Plans and adding a graphic touch to elevations are examples of utilizing the 2D **Fill** tool.

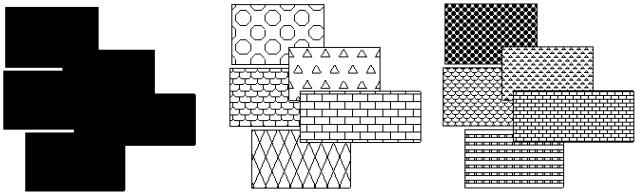
Fills can also serve to measure the area of polygons in your Floor Plans. This feature produces a text element that is fully associative and follows any changes in the associated fill polygon. *See the Adding Area Text section under Drawing Fills.*

Similarly to 3D construction elements, Fills can appear in calculations with associated properties, descriptions and components. The area of Fills can be subtracted from Zones.

Three types of fill representations are available in ArchiCAD under **Polygon Fills** in the **Display Options** in the **Options** menu.

- Solid Fill will display all Fills without any hatching lines or motifs.
- Vector fills are composed of simple lines or line segments, so they can be used for plotter output.
- Bitmap fills can be more intricate than vector fills, because they are composed of pixels.

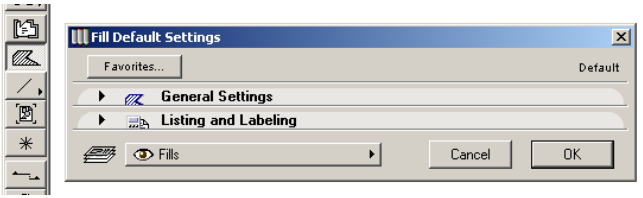
The two types of fills are associated with each other, so that each bitmap fill pattern has a vector fill counterpart.



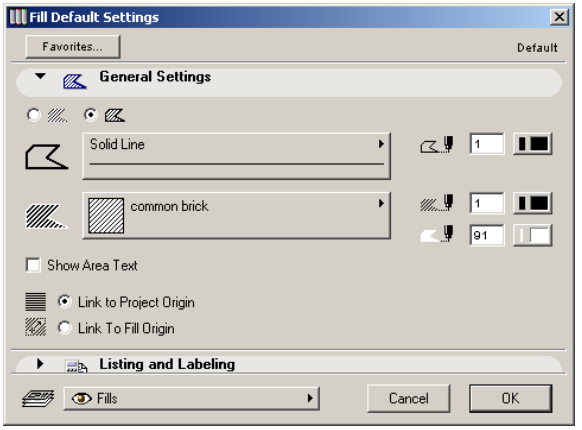
The orientation of the vectorized form of the fill pattern can be defined as either linked to the Project Origin or to the Fill's own origin. The setting can be made in the Fill Settings dialog box. *See the Vectorized Fill Orientation section under Drawing Fills.*

Fill Tool and Settings

The Fill tool is located in the bottom section of the Toolbox. Double-clicking it opens the Fill Settings dialog box, which has two panels: Floor Plan and Listing and Labeling.



The first panel controls the appearance of the Fill in the **Floor Plan**. Note that these same options are applied when adding a Fill in a Section/Elevation window or a Detail Drawing window.

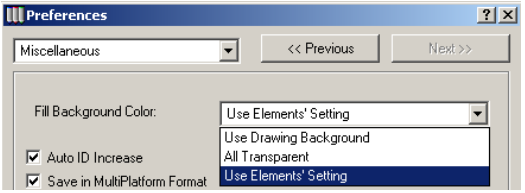


The first setting concerns the frame of the Fill. Choose the first radio button to draw a Fill without an outline. If you wish to have a framing line around the Fill's border, choose the second radio button and then choose a Line Type in the pop-up menu. In this case, the Pen Color control is also active and you can choose a color for the outline.

Below, you choose the fill pattern that will be used to display the Fill. Only simple Fill types are available, Composite structures do not appear in the pop-up control. The availability of a pattern for the Fill tool is set in Options/Fill Types. Note that you can choose a different color for the fill pattern and its background, and both can differ from the color of the outline.

For the fill background, you can also choose the transparent option represented by a crossed circle at the end of the Pen Color palette.

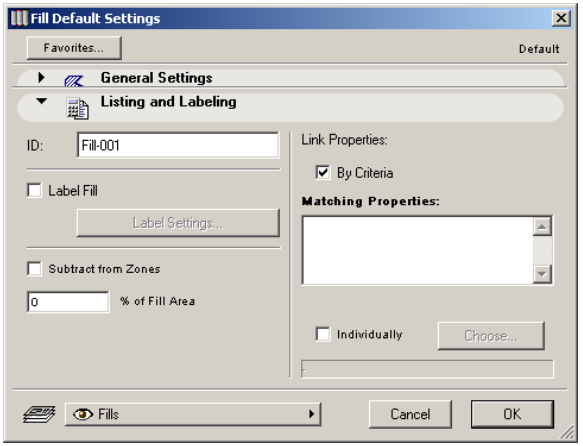
> **Note:** You can choose a global color option for Fill backgrounds in the whole project in **Options/ Preferences/Miscellaneous** to always use the given window's background color, to show all Fills as transparent or to use the settings made in this dialog box.



A checkbox allows you to show an associative area text with the Fill. *See the Adding Area Text section under Drawing Fills.*

With the two radio buttons, you can link the vectorized pattern of the chosen hatching to either the Project Origin or the Fill's own origin, as discussed above in the Definition section.

The second panel is called **Listing and Labeling** and controls the handling of the Fill in calculations.



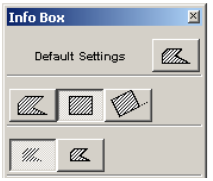
Most of the controls of this panel are described in the *Element Identification, Listing and Labeling section earlier in this chapter.*

If you check the **Subtract from Zones** box, you can subtract the area of the Fill from the Zone it is in. Set the percentage of the area to subtract from the measured zone area by typing the desired value in the text field. *See Zones later.*

Drawing Fills

Geometry

Activate the **Fill** tool in the Toolbox and choose one of the three Geometry Methods available for it in the Info Box.

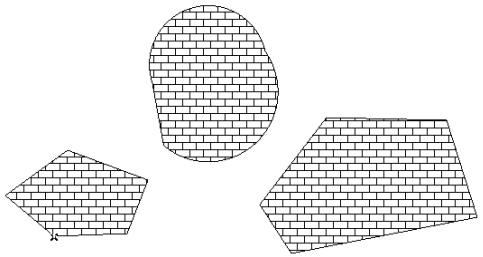


Drawing Fills with either the Polygon, the Rectangle or the Rotated Rectangle method is similar to the process discussed in the Drawing Walls section. *See details there.*

Vectorized Fill Orientation

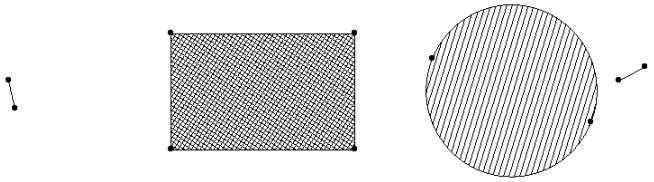
Before you actually start drawing the Fill, decide whether to link the vectorized fill pattern to the Project Origin or the Fill's own origin. You need to make this setting in the Fill Settings dialog box.

If you choose to link the fill pattern to the Project Origin, the pattern will start at the Origin and the part of the pattern that falls within the Fill's boundary will be displayed.

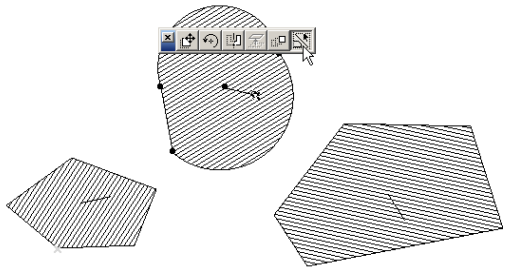


If you choose to link the fill pattern to the element's own origin, you first need to define this origin before actually starting to draw the Fill. Your first click will determine the Fill's origin and the second one the endpoint of the orientation vector.

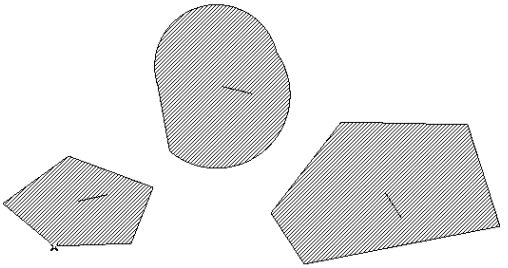
This orientation vector can be displayed as a handle with the vectorized Fill provided that you make this setting active in Options/Display Options/Fill Handles. The handle does not necessarily have to be located inside the Fill and can be used, if shown, to select the entire Fill.



The fill pattern starts at the origin of the Fill element. By selecting the Fill with the Fill tool active, you can modify the orientation vector. Click the endpoint of the orientation vector of the selected Fill and rotate it. If the Arrow tool is active, you need to click the last icon on the appearing pet palette to achieve the same result.



Note: Even in bitmap view, the handle remains visible, but the bitmap pattern does not reflect in any other way the rotated vectorized pattern.

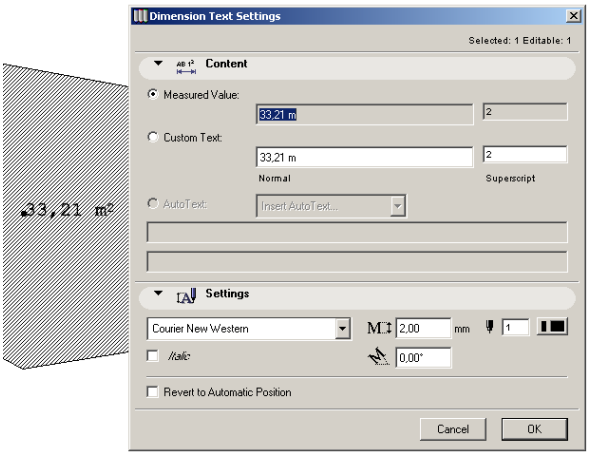


After setting the optional rotation vector for the fill pattern linked to the Fill's own origin, you can proceed.

Adding Area Text

If the **Show Text Area** checkbox has been marked in the **Fill Settings** dialog box (described below), the **Hammer** cursor will appear when you finish drawing the Fill with any of the Geometry Methods, prompting you to position the text with a click. The text block is created by calculating the area of the

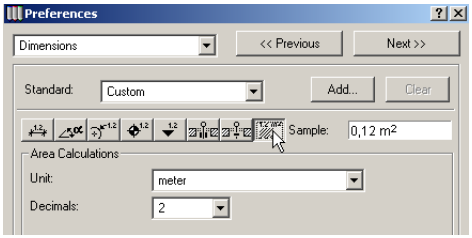
Fill. The text setting will be the same as the default values of Dimension texts.



To modify the font settings or even the content of the area text, select the text only (not the Fill itself) and choose the last command of the Edit menu which changes in this case to Dimension Text Settings.

See the description of the dialog box this command opens in the Dimensions section later.

The measurement unit and accuracy of the actual figure (number of decimals) is defined in Options/Preferences/ Dimensions by clicking the Fill icon and choosing from the pop-up menus.



Area value labels are always readable from the bottom or from the right after a rotation or a mirroring.

Note: The visibility of the text block depends on the current Text setting in Options/Display Options.

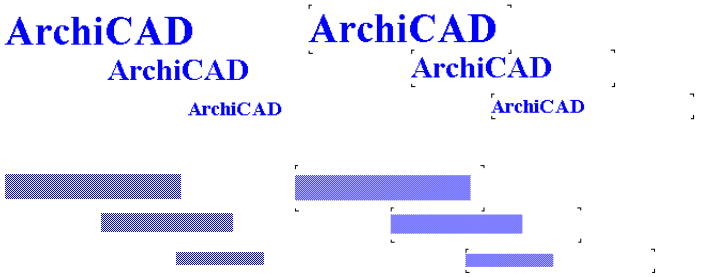
Text Blocks

Definition

With the dedicated Text tool, you can create multiline texts with full scale font options, multiple styles and justification in any direction. Text blocks can be created in the Floor Plan, in Section/Elevations and in Detail Drawing windows.

Other tools can also create text as part of the element they define, for example the area text of Fills, the internal dimensions of Windows and Doors, Zone stamps, the text part of Labels, the numbers and text in all types of Dimensions. The options for all these texts are the same as those of the Text tool detailed below. *See also Dimensioning, Zones and Labeling.*

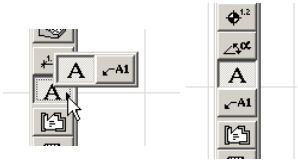
According to the choice made in Options/Display Options, all text blocks can be framed with brackets at each corner handle. This makes the text blocks easy to locate and edit, while keeping the text readable. Another option (Greek) is available for displaying a text block with the text illegible but with uniform gray patterns substituted for the actual text. Greek text can also be displayed with handles.



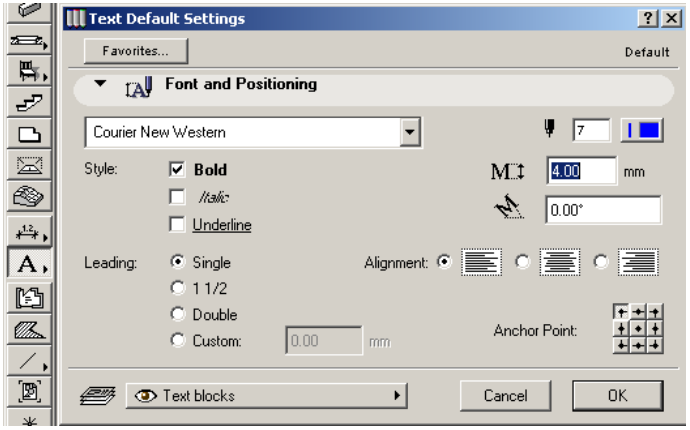
Notes: Text below 5 pt. (current screen size) will always be Greek. Greek text above 48 pt. will be displayed as normal. When editing text blocks, all Greek texts are temporarily enlarged. The framing options only apply to text blocks created with the Text and Label tools.

Text Tool and Settings

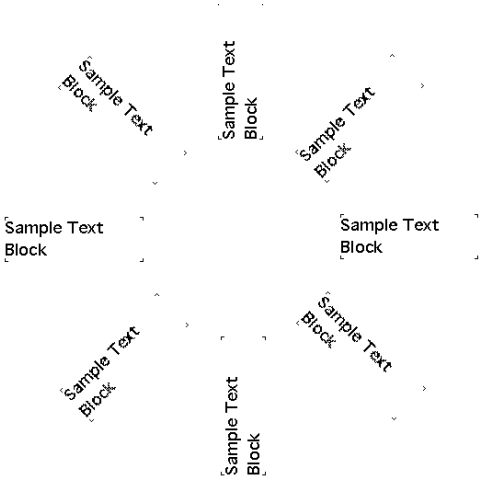
In the default shape of the dialog box, the **Text** tool and the **Label** tool have been grouped in a single icon. Choose **Options/Customize/Palette Shapes** and select the **Extended** version of the **Toolbox** to see both tools at the same time.



Double-click the **Text** tool to open its settings dialog box. This is a single panel dialog box with the Favorites and Layer selection controls at the top and the bottom of the window respectively. The controls in the **Font and Positioning** area give you complete control over the orientation and typography of your text elements.



- Text size is defined in absolute values, so its on-screen size will vary when you shift between different scales by choosing **Options/Floor Plan Scale**.
- Italics used for TrueType fonts translates to a 75° slant if the font is changed to a vector font.
- Leading can be set either relative to character size or in absolute values.
- The Justification & Anchor Point settings will help you place your text blocks in the most pleasing or practical arrangement. The Anchor Point is especially useful when you are editing text elements, since it will always remain fixed even if you change font sizes or other text characteristics.
- Some of the controls only appear if the plotter font has been selected in the font selection pop-up menu.
- Text blocks are always readable from the bottom or from the right even after a rotation or a mirroring.

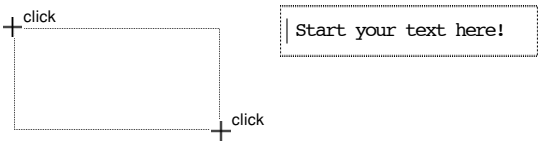


Placing Text Blocks

There are two types of text blocks in ArchiCAD: breaking and non-breaking ones.

Creating a Breaking Text Block

To start a line of text, simply draw a rubberband rectangle by clicking twice to define its corners with the **Text** tool on the Worksheet. A one-line block with the defined width remains on the screen, including a flashing text cursor indicating your position in the text block.



New lines of text will be automatically started as soon as you reach the predefined width of your text block. You can start a new line at any time by hitting the Return key on your keyboard. Click **OK** or hit the Enter key when you are finished, or alternatively, click **Cancel** if you want to start all over again.

Creating a Non-Breaking Text Block

Non-breaking text blocks are especially useful if you are not sure in advance how long your text block's lines will be.

To create a non-breaking text block, double-click on the Worksheet with the **Text** tool active. You can immediately start typing your text. You can type as many characters in the same line as you wish.

Hitting Return will automatically start a new line. The width of the text block will be determined by the width of the longest line of the block.

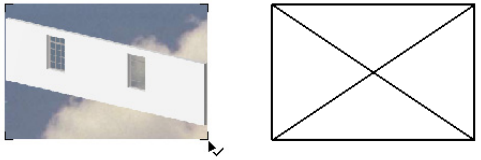
> **Note**: Stretching the Text block rectangle will cause it to break up. You cannot turn a breaking Text block into a non-breaking one. *See also Stretching in Chapter 5: Drafting and Editing Techniques.*

Figures

Definition

Figures are image files embedded in the ArchiCAD project file. They can be inserted in any of the 2D windows (Floor Plan, Section/Elevation window, Detail Drawing). Figures are placed and manipulated by the dedicated Figure tool.

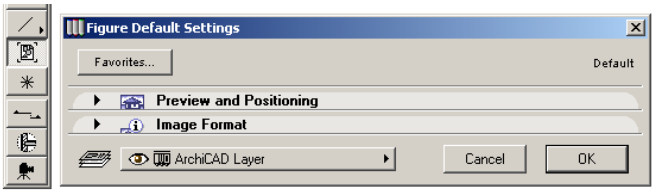
Figures can be displayed either with or without handles or as simple placeholders. This setting is global, that is, it affects all placed Figures. The choice can be made in **Options/Display Options/Figures**.



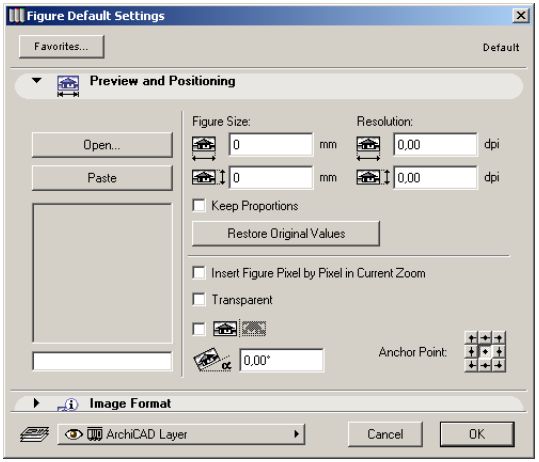
> **Note**: Regardless of the import method, the images of Figure type elements are embedded in the Project and can make the file quite large. Use sizes and resolutions only as needed to prevent overloading the Project.

Figure Tool and Settings

The Figure tool is located in the bottom section of the Toolbox. Double-click it to open its settings dialog box. The dialog box has two panels: Preview and Positioning and Image Format.



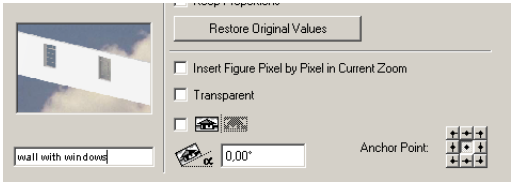
In the Preview and Positioning panel you can choose the image file or the pasted image to insert as a Figure, define its dimensions and the way it will be placed.



You have two options for getting image files:

- Click the **Open** button to browse the directory system for image files.
- Click the **Paste** button to use the contents of the Clipboard. (If the Clipboard contains image information, it will be used directly. If the contents is text, it will be first converted to bitmap.)

Either way, the image will be displayed in the preview area and all values will be relative to that opened or pasted image. Below, the **Name** field displays by default the imported file's name or "Pasted Image no. x" if the Clipboard's contents has been used. You can rename the image as you wish; this has no effect on the file's real name.



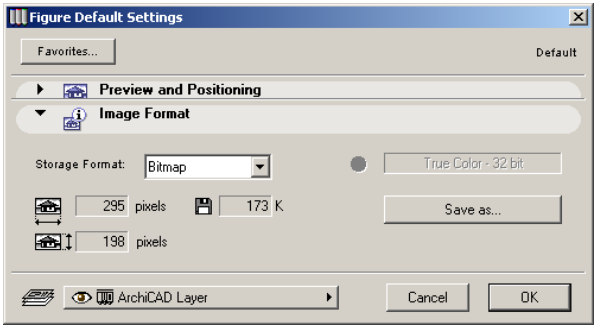
In the right-hand side of the panel you can adjust the Figure Placement parameters.

- Adjust inserted image size by typing new values in the **Figure Size** fields. Use these fields to give accurate dimensions to scanned site plans or measured layouts. The **Keep Proportions** checkbox below allows you to fix image proportions if appropriate.

  Hint: Dimensions are often distorted when drawings or images are scanned. Uncheck the **Keep Proportions** box to unlink the dimensions and adjust figure width and height independently if you want to make sure that dimensions are correct. This is especially important when inserting existing site plans, survey plans or layouts into ArchiCAD Projects.
- If you wish to control the resolution of the inserted figure rather than the image size, e.g., for specific print output quality, use the **Resolution** fields.
- Use the **Restore Original Values** button to reset the Placement Parameters to image default.

  Note: Figure size and image resolution are interdependent. By increasing image size, you decrease resolution and vice versa.
- Check the **Insert Figure Pixel by Pixel in Current Zoom** box to adapt the image to the current level of magnification in the target window.
- The **Transparent** checkbox allows you to hide or show elements below white pixels of the Figure according to the current display order.
- Use the **Mirror Figure** checkbox to insert the figure flipped horizontally.
- To automatically rotate the figure when inserting it into the Project, type the desired **angle** in the field at the bottom right of the panel.
- Position figures using the nine **Anchor Point** buttons.

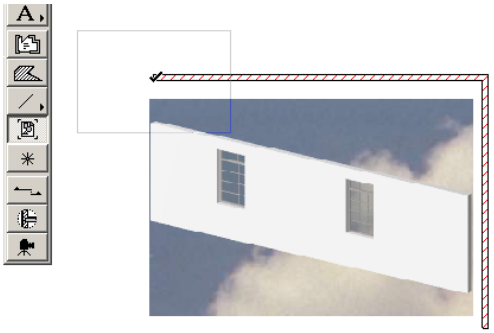
In the **Image Format** panel, you define the storage format of the image inside the project. In addition to the controls displaying the file size and color depth of the image, you can also save it in another format as an external file.



Placing Figures

When you have made your choices in the **Figure Settings** dialog box, just click with the cursor to place the Figure. If the result does not satisfy you (for example, the image is too small or too large), choose the Undo command, open the Figure Settings dialog box again, and adjust the size, resolution or other settings before placing the Figure again. You can also stretch the placed Figure, use the Shift key to constrain the diagonal and keep the image's proportions.

Before you place the Figure, its ghost contour follows the movements of your cursor showing its proportional size. The ghost contour's anchor point is sensitive to element nodes and edges. To make this option inactive, go to **Options/ Preferences/Miscellaneous**.



You can also place Figures in ArchiCAD directly, without using the Figure tool, by pasting bitmaps originating either from another ArchiCAD window (for example a PhotoRendered Model picture) or another image-processing software. The pasted element will be handled as a Figure by ArchiCAD.

Note: Images imported by this method are always pasted pixel by pixel in the current zoom.

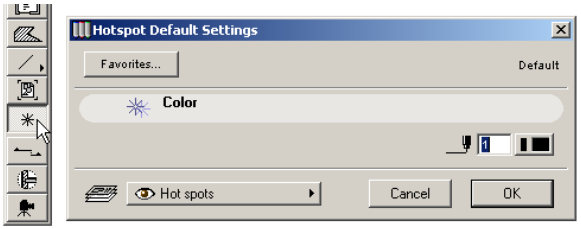
Hotspots

Definition

Hotspots are simple points indicated by a small cross. Their main role is to help position elements in 2D views. Hotspots do not appear on printed and plotted outputs and can be deleted when they are not needed any more.

The Hotspot Tool and Settings

The Hotspot tool is located in the bottom section of the Toolbox. Double-clicking the icon opens a simple settings dialog box in which you can set the Pen Color and the Layer assignment of the Hotspot.



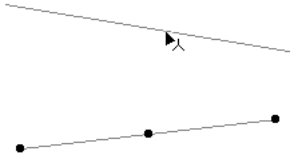
Placing Hotspots

When you have made your Pen Color and Layer choice in the settings dialog box, you are ready to place Hotspots. Just click at the desired location.

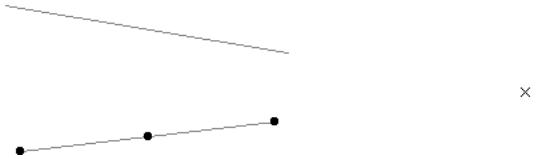
There is a number of situations when you may need to continue construction starting exactly on a given point of an element at a location where it has no hotspot or special point. The solution is to generate hotspots that will allow you to snap to this point.

There is no direct way to snap to remote intersection points of elements. You can automatically generate Hotspots at intersection points on the imaginary extensions of elements.

1) Select a line, edge or arc and place the cursor on top of another (it becomes an **Arrow** with a **Mercedes** if the **Arrow** tool is active, a simple **Mercedes** if another Tool is active).



2) Command-click (Macintosh) or control-click (Windows) to generate a section point.



Note: Cmd/Ctrl-clicking the edge of a Roof while another one is selected will fit the clicked edge to the common ridge (if any) of the two roof planes. With the Wall or Line tool active, selected Walls or Lines will be extended to meet the intersection point with the clicked edge.

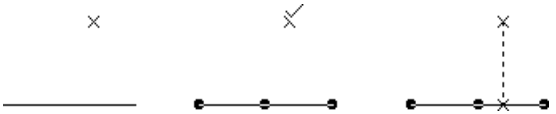
To place a Hotspot at a remote Tangential point, select the arc(s) and command-click (Macintosh) or control-click (Windows) with the **Checkmark** cursor on any element (hotspot or node).

Tangential hotspots will be generated on the imaginary extensions of arcs or curved edges.

It is also possible to add Hotspots with a Cmd-click (Macintosh)/Ctrl-click (Windows) to:

- A parallel projection of a wall, a line or the edge of a roof, a fill or a slab from a selected hotspot.

- A perpendicular projection from any element hotspot (**Checkmark** cursor location) or any empty space (**Crosshair** cursor location) to a selected wall, slab, roof, fill edge or line.



Annotation Elements

In addition to the 3D construction elements that represent the physical structure of the Virtual Building and the 2D drawing elements used as positioning aids, details and decoration, ArchiCAD offers different types of elements for labeling, organizing and listing the components of the building.

- A large variety of associative **Dimensions** can be added to construction elements and drawing elements in both the Floor Plan and the Section/Elevation windows.
- Another associative feature is **Labeling**, allowing you to link text information or a symbol to construction elements and 2D Fills. Freestanding Labels are also available.
- **Zones** can be used to define three-dimensional units inside the project, typically rooms or offices.

Dimensioning

Definition

ArchiCAD offers a large variety of dimensioning tools and options for various uses and situations. Dimensions are fully associative and can use various measurement units and standards. Linear dimensions are accurately tagged to the nodes and edges of project elements.

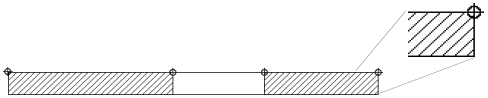
Dimensions can be placed in the Floor Plan, the Section/Elevation and the Detail Drawing windows.

Dimensions are placed individually or in series on eligible elements. You can also add automatic exterior or interior linear dimensions to selected elements.

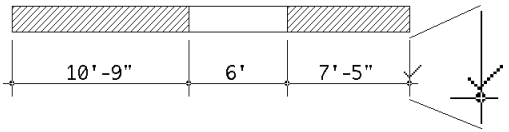
The various dimensioning types are Linear Dimensions, Elevation Dimensions, Level Dimensions, Angle Dimensions and Radial Dimensions.

Linear Dimensions are customized dimension lines. The following terms are used to describe dimensioning operations:

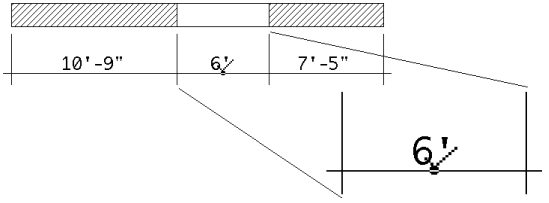
- **Reference points** are nodes on ArchiCAD elements that you have selected to be dimensioned.



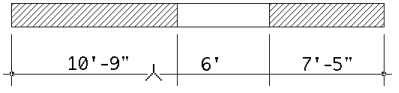
- **Dimension points** occur at the intersection of the dimension line and the witness line according to the previously defined reference points. They can be selected as shown below.



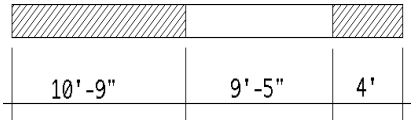
- **Dimension units** are the basic components of the dimension chain. A dimension unit connects two adjacent dimension points and includes the written value of its length. To select it you have to click the midpoint of the line with the **Checkmark** cursor.



- **Dimension values** are the text blocks containing the length of the dimension unit. To select a dimension value by itself, click on the lower left corner of the text.
- **Dimension chains** are the sum total of the connected dimension units. You can select a dimension chain by clicking at a “free spot” on the dimension line with the **Mercedes** cursor.



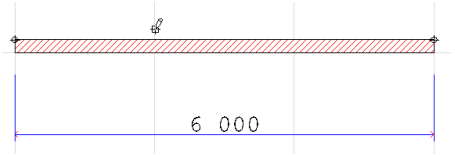
- **Associativity** means that any dimension point you create will adhere to its reference point until you delete one or the other. For example, stretching the window in the wall of the previous example causes the entire dimension chain to be automatically updated as shown below.

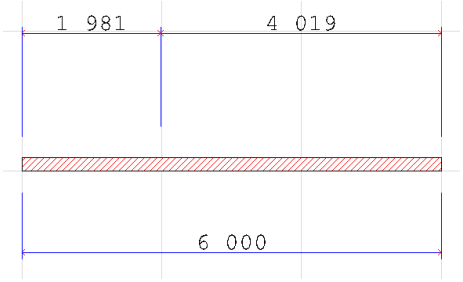


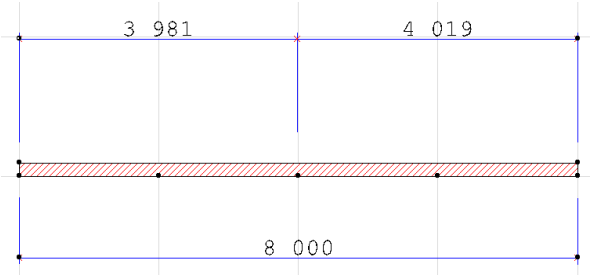
The following elements can be dimensioned by placing reference points on them:

- Construction elements: Walls, Columns, Beams, Windows and Doors (opening edges and midpoint only), Objects, Lamps, Slabs, Roofs and Meshes.
- Drawing elements: Fills, all line type elements, Hotspots.

Note: If you place a reference point at an ineligible location (or in empty space), the cursor shows a rectangular reference point instead of the regular circular one. This means that the reference point will be a static one and will not follow suit when the dimensioned elements are stretched or dragged.



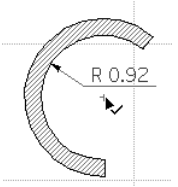




The appearance of the linear Dimensions depends on the Type or Construction Method and the Geometry Method chosen in either the Info Box or the Dimension Settings dialog box. *Details follow in the Placing Linear Dimensions section later.*

A special case of the linear Dimension's type is **Elevation Dimensioning**. It allows you to place height markers in Section/Elevation Windows. It can also be used on the Floor Plan, but it only measures the distance along the Floor Plan's Y-axis from the current Project/User Origin. This is not the same as the element's vertical height along the Z-axis, which the **Level Dimension** tool measures on the Floor Plan.

Radial Dimensions display the value of the radius of a curved element.

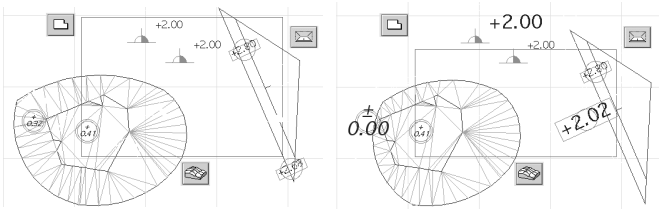


Level Dimensions are point-level elevation markers common to architecture and site planning.

Associated Level Dimensions remain linked to the elements they were placed on top of, even if they are no longer inside the contour of these elements.

If a Level Dimension falls outside the contour of the element it is associated to, its value changes according to the following rules:

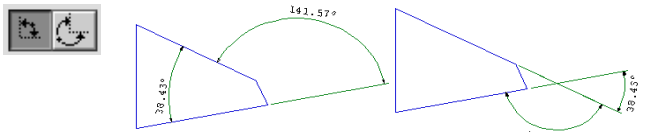
- With Slabs, there is no change: the value is the same as if the Level Dimension were still inside the Slab's contour.
- With Roofs, the value displayed is calculated by a projected extension of the roof (that is, what the value would be).
- With Meshes, it is the Story's height that will be displayed (but the Level Dimension remains associated to the Mesh).



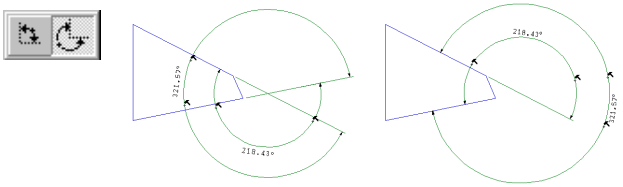
Angle Dimensions display angle values between line and/or linear element edge pairs as well as bent polygon edges. You can choose between two Geometry Methods-acute and obtuse angles-from either the **Angular Dimension Settings** dialog box or the **Info Box**.

When you place angle dimensions using the **Acute** method, only the quadrant of the space in which you click with the **Hammer** cursor will be dimensioned.

The following examples, wherein we dimensioned the same two edges of a general shape quadrangle, show the different variations.



When you place angle dimensions in the **Obtuse** method, ArchiCAD will calculate the angle of the specified quadrant together with the other two quadrants adjacent to the one that was clicked. The **Hammers** on the arcs indicate points that, when clicked, would give you the same result



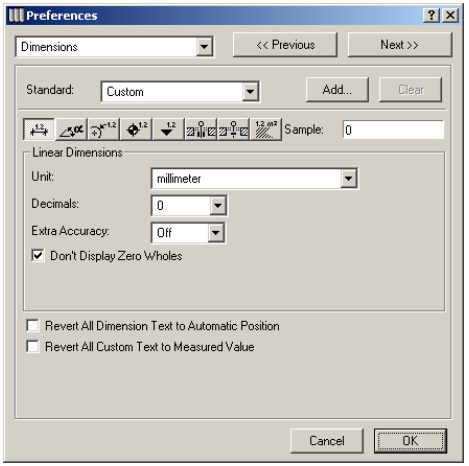
Note: You cannot dimension 180 degrees. If you want to mark it, use the **Arc Tool** with the Double Arrow method and place the value as text on top of the half-circle.

Dimensioning Units

ArchiCAD supports the use of different **Dimensioning Standards**. You can customize their use for the current project in Options/Preferences/Dimensions.

This is particularly useful when working on several Projects with differing levels of accuracy (construction details versus site plans) or Projects being built in countries other than those in which they are designed.

You can modify the accuracy of the different Dimensioning tools, apply predefined standards such as US Builder or DIN, or define your own customized settings.



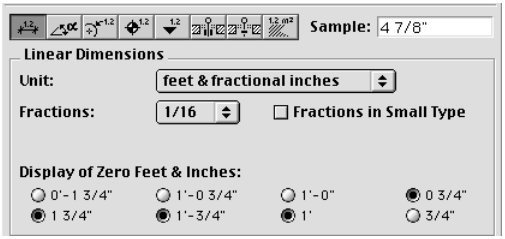
You can independently define the units for the different dimensioning Tools in this dialog box: Linear, Angular, Radial, Level and Elevation Dimensions, Window/Door Dimensions, Sill height values and Fill Areas, and a sample gives you feedback about the number format for the defined settings.

You can even independently define the number of decimals you want to display for each Tool.

When using metric units, the **Dimensions** dialog box also provides an option for suppressing zero values: 0.25 meters is displayed as 25 and 1.25 meters is displayed as 1.25.

Imperial Unit Display

If you define feet and fractional inches for the unit of any length type dimension, you have eight radio buttons to define how you want dimensions to appear when either whole feet or inches is zero.

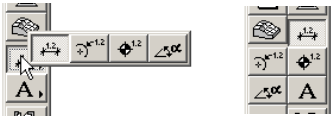


In each of the four pairs of radio buttons, click the option that fits your dimension display standards.

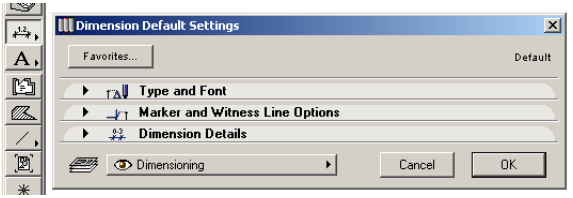
> **Note**: You cannot mix units for the same dimension type in a Project. However, you can display two types with the Secondary Dimensions command. *See details later.*

Dimensioning Tools and Settings

The Dimensioning tools are located around the middle of the Toolbox. In **Toolbox**'s default appearance, ArchiCAD's various Dimensioning tools are merged into one pop-up icon in the **Toolbox**. In order to see all Dimensioning tools at the same time, choose **Window/Floating Palettes/Palette Shapes** and choose the **Extended** option.

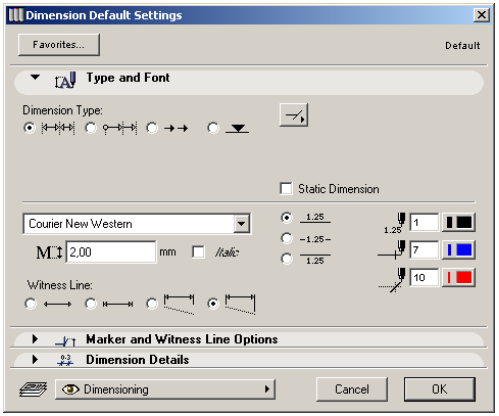


Double-click a Dimensioning tool and open its settings dialog box. The various Dimensioning tools share many of their options. The explanations below refer primarily to the linear Dimension tool; controls specific to the other tools will be presented additionally in detail.



The Dimension tool's setting dialog box includes three panels: Type and Font, Marker and Witness Line Options and Dimension Details. Note that some of the other dimensioning tools have single-panel dialog boxes.

In the upper part of the **Type and Font** panel, you can choose the Type or Construction Method of the various Dimension tools as well as the style of the pointers or arrowheads.



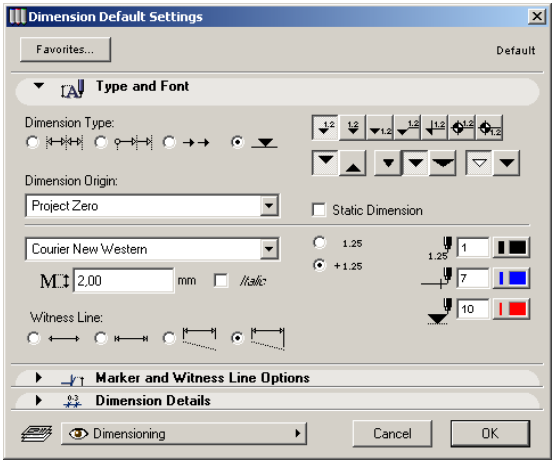
Using a pop-up menu, you can set the desired marker form. The last marker type is special, as it results in a double Dimension Line enclosing the values. With this marker, value position settings are not effective.

By clicking the **Static Dimension** checkbox you can create static dimensions that are not associated with any of the elements in the Project.

Once a dimension has been made static, it cannot be made associative again. If none of a dimension chain's markers are attached to construction nodes, the dimension chain will become static. Static dimensions behave like other dimensions in two ways:

1) If rotated or mirrored, the value is always turned so that you can read it from the bottom.
2) If the Dimension Unit is modified in **Preferences**, all values will be updated.

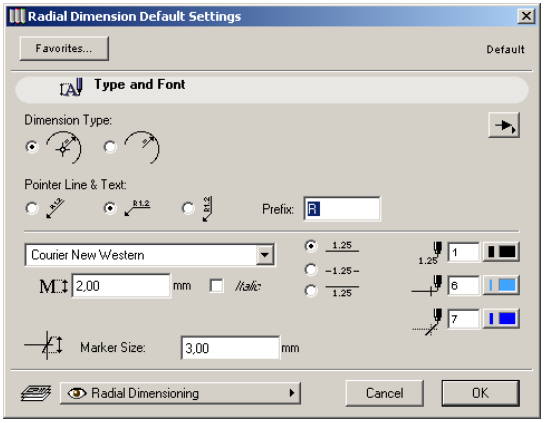
If the Construction Method you have chosen is Elevation Dimensioning, the panel changes accordingly to display the options available for **Elevation Dimensions**.



A marker series of Elevation Dimensions behaves as an associative dimension chain. You can select and edit the whole series by clicking on the invisible axis of the chain with the **Mercedes** cursor while holding down the Shift key or using the **Arrow** tool. Markers can be added or deleted from the chain as in other types of linear dimension chains. Individual markers in the chain cannot be edited.

For Elevation Dimensions only, you can choose the Reference Levels defined in **Options/Preferences/Working Units** for the placement of the dimensions.

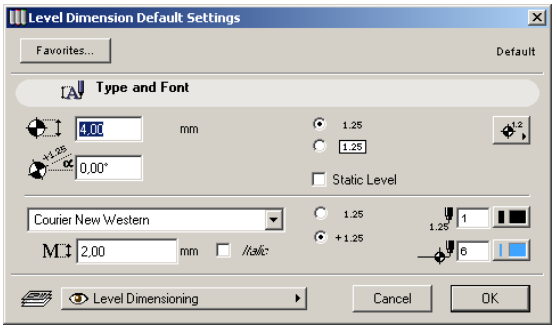
For **Radial Dimensions**, three radio buttons allow you to choose the label orientation. It can be either continuous with the dimension line, always horizontal or always vertical. An additional field allows you to define an optional prefix that will appear before the value of the radius.



Two Construction Methods, or types, are available:

- **With centerpoint:** When you select this type, and place a radial dimension on the plan, the centerpoint of the arc will automatically be marked by a crosshair.
- **Without centerpoint:** In this case, no centerpoint mark will be placed at the centerpoint of the curve.

For **Level Dimensions**, you can rotate the marker symbol by entering a value in the rotation edit box. When you rotate a marker symbol, the text will rotate with it, maintaining the original relationship.

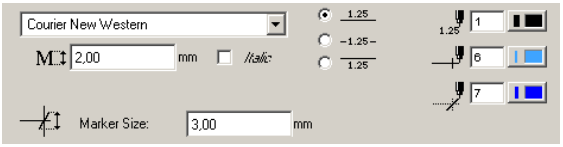


The **Level Dimension Text Frame** option places a box frame around the Level text for emphasis. The frame is automatically sized to fit the text and cannot be independently edited.

The Plus Sign Option places a plus or minus sign in front of each level dimension text to indicate its position relative to the zero level of the project.

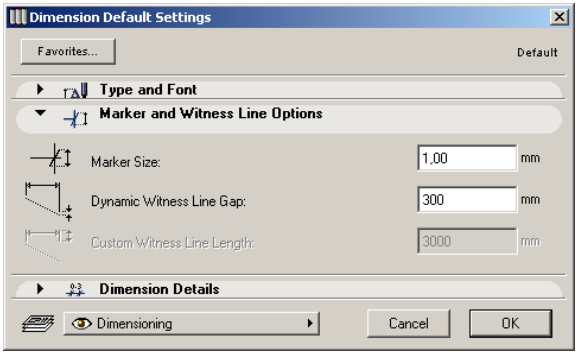
In the **Angle Dimension Settings** dialog box, with the first Numbering Orientation radio button active, the dimensioning value will always be horizontal. With the second button active, the dimensioning value is always in radial direction, while the third one will be parallel to the tangent of the curve next to it.

In the lower part of the Type and Font panel, you can choose the type and size of the font to use for the dimensions as well as the Pen Colors used for the different parts of the dimensions (values, lines and markers). You can set different types, sizes and Pen Colors for the different dimensioning tools or even for selected individual dimension units of a dimension chain.



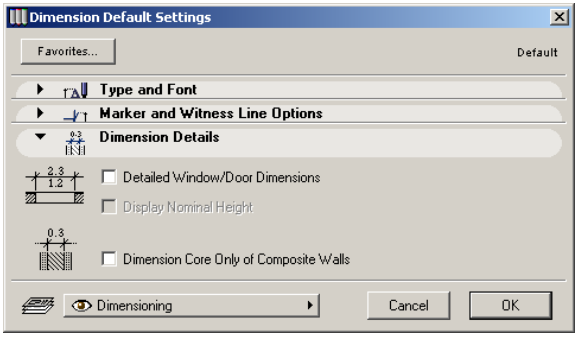
The Italic option appears in the dialog box if you use bitmap/TrueType fonts. If you select vector fonts, the slant option appears instead, allowing you to set the angle of the slant. Italic used for bitmap/TrueType fonts translates to a 75° slant if the font is changed to vector fonts.

On the **Marker and Witness Line Options** panel, you set the size of the dimension marker and the format of the witness lines.



Witness lines can be applied to the entire dimension chain, to selected dimension units or to individual dimension points. You can also create dimensions without any witness lines or with predetermined, short witness lines by clicking on the appropriate radio buttons. Using the short witness line option, the witness line length will automatically be fitted to the marker (and thus implicitly to the appropriate text size). The availability of the options depends on the Witness Line type chosen in the Type and Font panel.

The **Dimension Details** panel contains options for the dimensioning of Windows and Doors and composite Walls.



The Detailed Window/Doors Dimensions option adds the opening's height below the Dimension Line on any dimension chain with reference points at both corners of an opening. When this checkbox is checked, the second checkbox below constrains dimensions to Nominal Height.

> **Note**: This feature is in addition to the options available through the **Dimension Marker** panel of the **Door/ Window Settings** dialog boxes and works for both smaller and larger sizes for German type reveals.

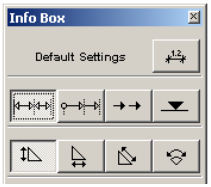
Dimension Text Settings

The **Dimension Text Settings** is available when only the value of a dimension element is selected. The name of the last command of the **Edit** menu then changes to **Dimension Text Settings**. You can also access the dialog box when clicking the tool's icon in the **Info Box**. When one or more dimension chains are selected, double-clicking the **Text** tool's icon in the **Toolbox** also opens this dialog box. *See the Manual Changes to Dimension Text section later.*

Placing Dimensions

Linear Dimension Geometry

There are four Construction Methods, or types, available for the Linear Dimension tool. These are available as icons in both the **Info Box** and the **Dimension Settings** dialog box.



- With the **Linear** method, distances between two adjacent Reference Points are measured and displayed.
- With the **Cumulative** method, the first Reference Point is considered the zero point of the dimension chain. All dimension values of the chain will give you the distance between any Reference Point and the zero point.
- With the **Base-line** method, measuring the dimensioning distances is the same as with the Cumulative method, but only pointers are shown on the screen instead of whole lines and the zero point is not marked.

- With the fourth icon, you create Elevation Dimensions. *See details below.*

Below the Construction Methods, the Geometry Methods available for linear Dimensions are shown.

- The **Vertical** method creates dimension chains that are always vertical, regardless of the angle of the nodes or element being dimensioned.

- The **Horizontal** method creates dimension chains that are always horizontal, regardless of the angle of the nodes or element being dimensioned.

- The **Skew** method creates dimension chains parallel to the first two Dimension Location Markers placed, regardless of the angle of any element(s) being dimensioned.

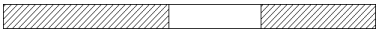
- The fourth geometry method, **Arc Length**, allows you to dimension curved elements.

Dimension Geometry settings refer to the entire dimension chain, and cannot be set unit by unit. Once you complete the chain, its geometry cannot be modified.

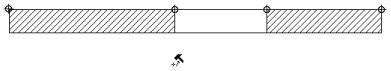
Placing Linear Dimensions

We will illustrate the placement of linear Dimensions with a simple example.

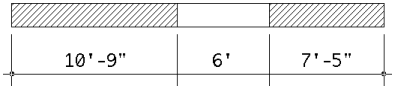
1) Construct a wall with an empty hole (window) in it.



2) Select the **Dimension** tool. Mark the first Reference Point. The **Cancel** button in the **Control Box** will then become active.
3) Click on each endnode of the wall and window, then double-click to close the dimension chain. Hitting the Delete key once, or pressing the **OK** button in the **Control Box**, will also display the **Hammer** cursor.
4) When the **Hammer** cursor appears, click at the location you want the dimension chain to be positioned.



5) The dimension chain will automatically be calculated and displayed.



- Once you mark the first Reference Point, the **Cancel** button in the **Control Box** will become active, offering an alternate way to cancel the dimensioning process.
- After you have marked your second Reference Point, the **OK** key in the **Control Box** will also be activated, indicating that you can create a valid dimension chain from now on.
- You can revoke any marked Reference Point by clicking it again.

The associativity of dimensioning requires a refined marking procedure for the overlapping points of different elements.

To determine which overlapping node the Reference Point will be assigned to, follow these steps.

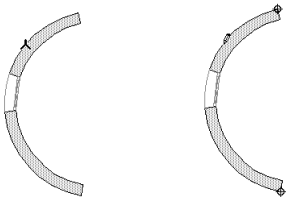
1) It will be evident that you have arrived at an overlapping element if the dimension markers are accompanied by selection dots on one of the overlapping structural elements.
2) If the selected element is correct, simply click on the next node. Clicking the **OK** button will confirm the element without activating the **Hammer** cursor.
3) If you want the dimension point to refer to another overlapping element, successive clicks at the same node will cycle the selection dots across them.

   Note: In everyday use, just place the markers, regardless of the selection dots. In most cases, you will not know which of the overlapping elements will be modified later.
4) To accept this second structure, click on the next point or complete the dimension. If you need yet another element, click on the point again. Repeat these steps if you cannot decide which element you want in the first cycle.

   Note: You can check this later if you select a dimension point. As long as you keep the mouse button pressed, selection dots will be shown on the associated element.

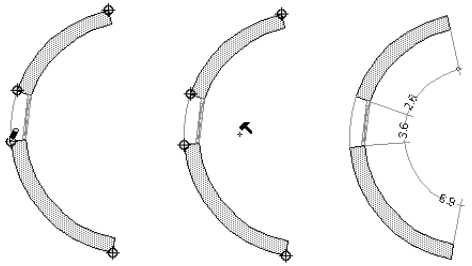
Dimensioning Curved Elements

Click on a circular arc or a curved edge of a construction element while the Arc Length Geometry Method is active in the **Info Box**. ArchiCAD marks the end points of the arc or the edge, respectively. This is the edge that arc length will be measured on.



You may click any other points you want to add to the dimension chain.

Double-click anywhere in the workspace with the **Empty Pencil** cursor or click the **OK** button in the **Control Box** to finish selecting arc points for dimensioning. The **Hammer** cursor appears, prompting you to place the dimension chain. Click to place the dimension chain.

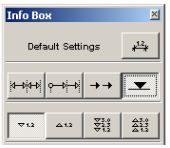


Editing methods of arc length dimension chains are similar to those of linear dimension chains, as is the process of adding or deleting dimension points.

> **Note:** The Arc Length geometry method cannot be used for elliptical arcs and splines.
>
> **Hint:** For approximate dimensioning, turn elliptical arcs and splines into a series of arcs using the **Magic Wand** tool.

Placing Elevation Dimensions

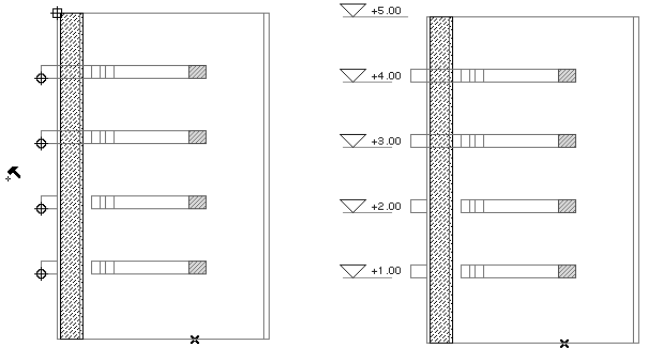
When you choose the Elevation Dimensions method for the linear Dimension tool, the placement options change accordingly.



Before placing an Elevation Dimension marker series, choose **Project Zero** or **Current User Origin** in the **Dimension Settings** dialog box or the Info to start your dimensioning from the project zero or from the User Origin, respectively. Alternatively, you can use one of the Reference Levels defined in Options/Preferences/Working Units.

The **Stored Origin** option only appears for selected Elevation Dimension chains and indicates that the User Origin has been changed since the dimension chain was placed and the dimension chain has not been updated.

Place individual markers by clicking the point you want to dimension, then click **OK** in the **Control Box**. Use the **Hammer** cursor to position the marker. Click multiple points before clicking **OK** and using the **Hammer** cursor to place a marker chain.



Note: Hotlinked Modules placed in the Project may contain Elevation Dimensions that refer to a User Origin. In this case, the dimension values will be the same as in

the source Project. Different rules apply if you move the Elevation Dimensions in the host Project:

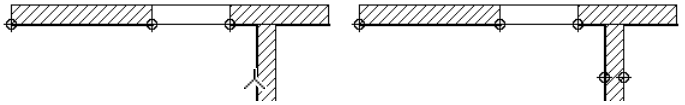
- If you select and move all elements related to an Elevation Dimension without selecting the dimension chain itself, the dimension chain will move with them. The origin of the dimension values will keep its position, which means that the numbers will change.
- If you select and move elements together with the Elevation Dimension they relate to, and the dimension chain has a custom origin, the origin will move with the dimensions, which means that the numbers will keep their values.

Dimensioning Wall Thickness

If you click on the Reference Line of a Wall perpendicular to the direction of the dimension chain, both of its sides will be marked.

When you complete the dimension chain, only those markers which have been placed on walls perpendicular to the dimension chain will be displayed.

If you start dimensioning with the Skew Geometry Method by placing double markers on both sides of a wall, these markers will define the chain angle to be perpendicular to this wall.



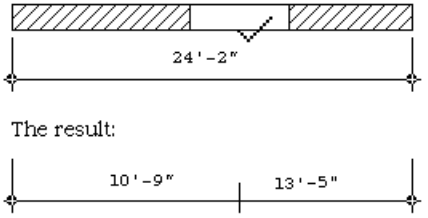
Editing a Dimension Chain

Dimensions can be dragged, rotated and mirrored, like any other ArchiCAD element.

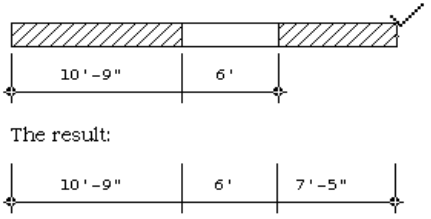
- If you edit all of the elements a dimension chain refers to, the chain will be transformed along with the elements.
- If only some of the elements are edited, the Dimension Line will keep its place and angle, and only the markers, witness lines and values involved will change.
- If dimensioned elements are multiplied, you need to also select the dimensions. The copies of the dimensions will be associative to the copies of the elements.

  Note: Units or points cannot be dragged, rotated or mirrored away from the parent dimension chain.

You can insert any number of new dimension points into the chain by selecting the chain and Command-clicking (Macintosh) or Control-clicking (Windows) on the desired new Reference Point. The new point can be located between existing chain points or anywhere outside the dimension chain.



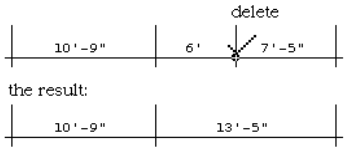
The existing dimension units will be divided into the necessary number of units.



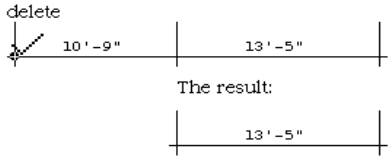
The dimension chain becomes longer as needed. You cannot insert points by selecting the dimension units directly. You must select the chain.

Note: You can insert one node at a time into a single dimension chain. When you insert a node, you have no control over overlapping elements.

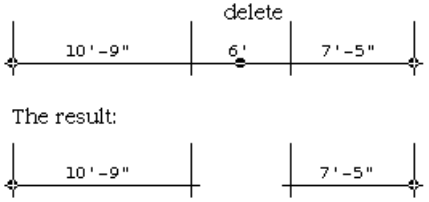
If you select and delete a dimension point in the middle of a chain, the adjoining two dimension units are merged.



If the deleted point was at the end of the chain, the last unit disappears and the chain becomes shorter.

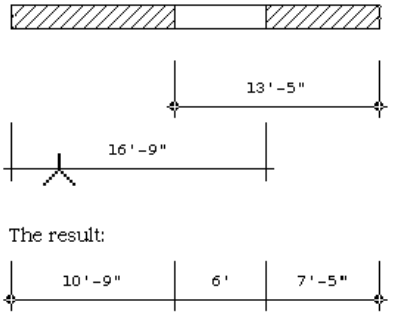


If you select and delete a dimension unit in the middle of a dimension chain, the chain will be broken into two separate parts.



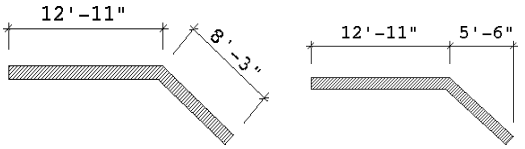
Finally, you can eliminate a complex dimension chain by selecting and deleting it.

Separate dimension chains can be merged by selecting one of the chains and Cmd-clicking (Macintosh) or Ctrl-clicking (Windows) on the other one.



The second chain will be deleted and its Reference Points added to, and dimensioned by, the first (selected) chain.

You can use this technique even with dimension chains that are not parallel with one another and/or have no overlapping parts at all.



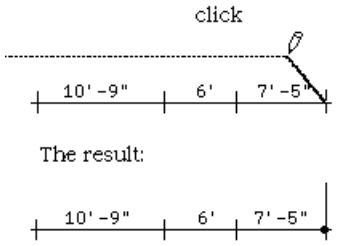
Setting the Witness Line Length Manually

The length of custom and dynamic witness lines can manually be set:

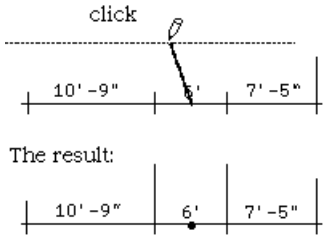
- for a single witness line;
- for both witness lines of a dimension unit;
- for all the witness lines in the chain.

To manually set the witness lines, select a dimension point, Unit, or Chain while the **Dimension** tool is active. Grab the hotspot or Reference Line of the selected part and drag the gray distance indicator away from the dimension line.

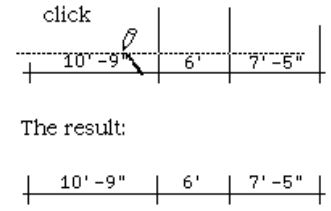
Point:



Unit:



Chain:



Clicking at the desired length will cut (or stretch) the witness lines involved.

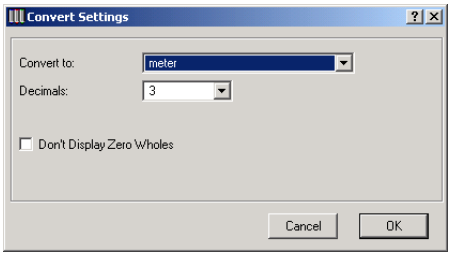
Dynamic witness lines will never extend beyond the reference node of the dimensioned element.

To manually set the nonexistent or short witness lines you must first change them into one of the long types by resetting them in the **Dimension Settings** dialog box.

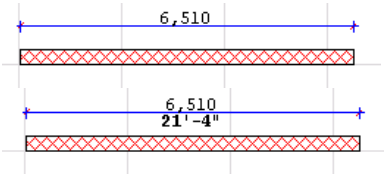
Secondary Dimensions

The **Secondary Dimensions** hierarchical menu from the Tools menu allows you to add metric unit equivalents to dimension values displayed in feet and inches, and vice versa.

Choosing **Convert Dimensions...** will open a dialog box where you can set the unit and the number of decimals of the converted dimension value.

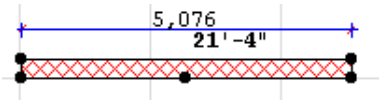


Click **OK** and the additional values will appear in brackets, always on the opposite side of the dimension line. The new value will be placed as a text block, and can be edited as any other text block.

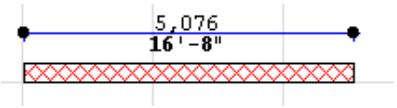


- If nothing is selected on the Floor Plan, all placed dimensions will be converted.
- If there are selected dimensions, only their values will be converted.

Changes made to dimensioned elements do not automatically update the converted dimensions.



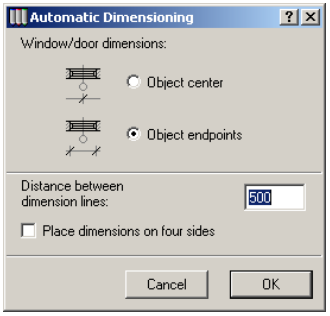
Choose the **Refresh converted dimensions** command from the hierarchical menu to update both the value and the location of the dimension. Again, this command will work on either all dimensions (if nothing is selected) or selected ones.



If you do not need equivalents any more, simply choose **Remove converted dimensions** from the hierarchical menu.

Automatic Exterior Dimensioning

You can add automatic associative linear Dimensions to selected elements with the Automatic Dimensioning command in the Tools menu. First, select a part of the elements on the Floor Plan (or even the entire Floor Plan). Choose the **Exterior Dimensioning** command. A dialog box appears.



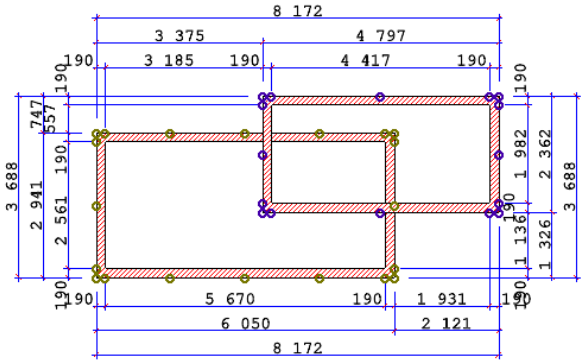
In the first section you can set the way you wish to dimension openings. Different architectural standards are possible. Either the axis or the side edges of the opening are going to be dimensioned.

In the next section, you can determine the placement of the dimension lines. The distance between the dimension lines is defined using the working units currently set in ArchiCAD.

You have the option to automatically place dimension lines on all four sides of the bounding box of the selected elements.

After clicking **OK**, it is necessary to define the direction of the dimension lines. You can do this either by clicking the side edge of any element, or, if the first click is made in an empty area, by defining the direction with a second click.

When you have defined the direction of the dimension lines, an additional click is needed to place the first dimension line (the one nearest to the selected elements). If you choose to place dimensions on all four sides, this distance also marks the overall distance between the nearest dimension lines and the bounding box of the selected elements.

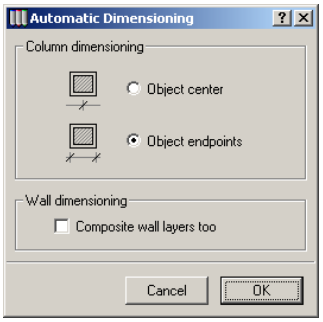


Exterior Dimensioning takes into consideration walls and openings. Up to four dimension lines are placed automatically: the opening dimensions, the dimensioning of the interior walls, the facade dimensions and the overall dimension. If any of these dimension lines are unnecessary (e.g., there are no openings, or the facade is straight), the corresponding dimension line is discarded.

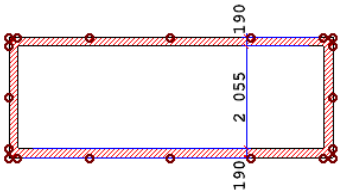
Automatic Interior Dimensioning

The second command of the Automatic Dimensioning hierarchical menu in the Tools menu allows you to add associative interior dimensions to selected elements.

If you choose the **Interior Dimensioning** command, a dialog box appears. It contains options for dimensioning Columns and composite Walls.



You then have to draw a line across the selected elements. Walls, Columns, Beams, and Slab, Roof and Mesh edges perpendicular to or crossing the drawn line will be dimensioned. The line can consist of several segments. Double-click to finish drawing the line. An additional click is needed to determine the place of the dimension line. After placing the dimensions, the crossing line disappears.



Drawing Radial Dimensions

Radial dimensions have two main parts: the Dimension Line and the Label.

The Dimension Line is always placed in a radial direction and the mark at its start always points toward the curved part. By clicking on a point of the curved element you can start drawing the Dimension Line either toward the centerpoint of the curve or in the opposite direction. You cannot place a radial dimension anywhere on the plan, as it always has to originate from a curved element.

The Label is connected to the end of the Dimension Line. It shows the value of the radius of the dimensioned curve. Its orientation can be selected in the **Radial Dimensioning** dialog box.

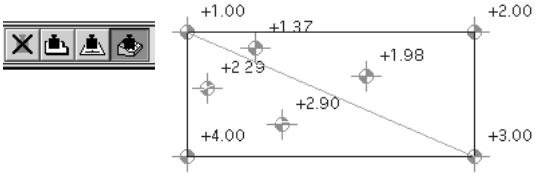
> **Note:** Deleting the dimensioned element will also delete any Radial Dimensions associated with it.

Drawing Level Dimensions

To place a level dimension in your Project, select the **Level Dimension** tool from the **Toolbox**, then click anywhere on the Worksheet. The elevation of the active story is immediately displayed along with a standard elevation marker as shown below.

You can place Level Dimensions on top of Slabs, Roofs or Meshes, provided that the corresponding **Gravity** icon is active in the **Coordinate Box**.

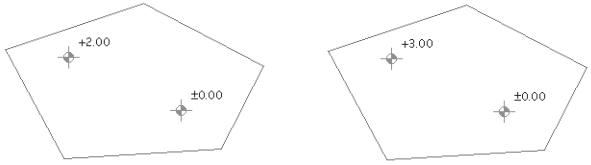
The following example shows Level Dimensions placed on a rectangular Mesh's four nodes and several randomly chosen points.



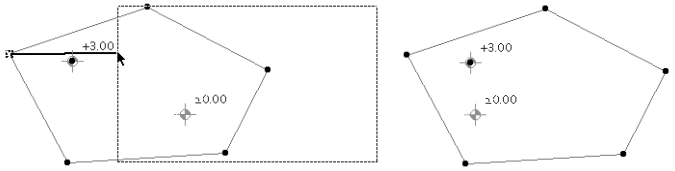
Level Dimensions placed with **Gravity On** on top of Slabs, Roofs or Meshes remain associated to them.

Both illustrations below contain two Level Dimensions placed on the same Slab: one placed with Gravity On, the other with

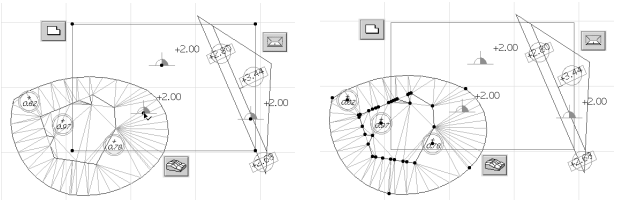
Gravity Off. When the Slab was elevated, the first Level Dimension's value changed.



Moving the Slab also moves the associated Level Dimension. The Level Dimension that was placed with **Gravity Off** remains in its place.



When selecting an associative Level Dimension, keep the mouse button depressed to temporarily display selection dots on the element the Level Dimension is linked to.



When you release the mouse button, these selection dots will disappear and only the Level Dimension will remain selected.

You can edit the elevation text separately as well as drag, rotate, and otherwise modify the text independently of the marker. The Level Dimension markers are individual elements, and each one can be individually edited. They can be dragged, rotated and mirrored, with or without copies, as any other element.

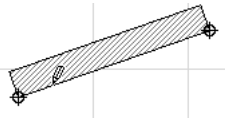
If multiplied together with the reference slab, the copies of the markers will be associated with the copies of the slabs. If multiplied alone, the copies will be associative with the same slab (or the story) as the original.

Drawing Angle Dimensions

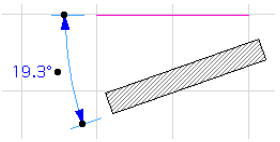
You need to define exactly four reference points in order to show angle values on the Floor Plan.

You can define these points in the following ways:

- Click any existing line or edge (wall, slab, roof, mesh, fill). This will immediately place two reference points on the clicked line/edge.



- Click the hotspots of existing elements.
- Click anywhere on the plan (in this case, the angular dimensions will not be associative).



- Click an existing edge. This will immediately result in four hotspots.

The four points you defined will determine two infinite lines that ArchiCAD will use in the calculation of the angle. Depending on which geometry method is selected in the **Info Box** or in the Settings dialog box, and on where you click

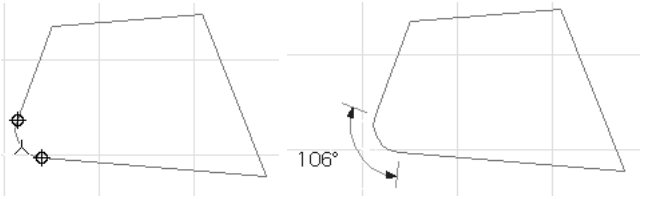
after the **Hammer** cursor appears, angle values are measured differently and can be placed in different locations.

The two infinite lines divide the space into four quarters. ArchiCAD will place the angle dimension in the quarter you click after the **Hammer** cursor appears. The arc of the angle dimension will pass through the point you click.

The angle dimension value, however, will automatically be placed next to the middle of the dimensioning curve. It can then be dragged to another location by the hotspot of the dimension value.

Placing Angle Dimensions on Curves

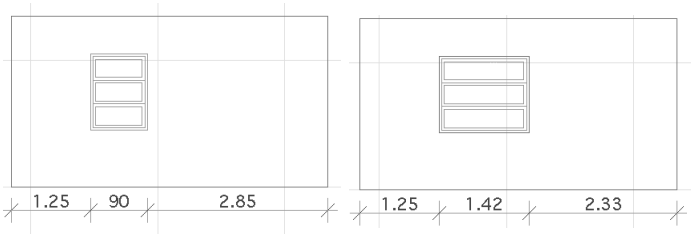
Select the **Angle Dimensioning** tool in the **Toolbox**, then click the bent polygon edge or circular you wish to dimension. The two endpoints of the arc will be automatically marked. Finally, place the dimension line with the **Hammer** cursor



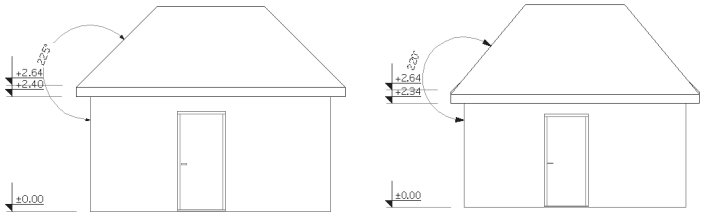
Note: It is always the arc side of the angle that will be dimensioned, regardless of the geometry method you choose, or which side you click to.

Associative Dimensions in Sections/Elevations

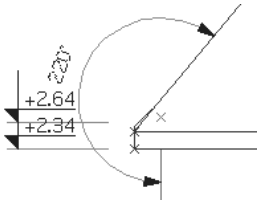
Dimensions in the Section/Elevation Window are associative, meaning that every dimension point you create adheres to its reference point. For instance, when you stretch the Window in the wall it will cause the entire dimension chain to be automatically updated.



Elevation Dimensions and Angle Dimensions are also associative.



- When the Model type Section is unlinked (and turned into a Drawing type Section), hotspots are generated on the elements to mark the associated dimension points.

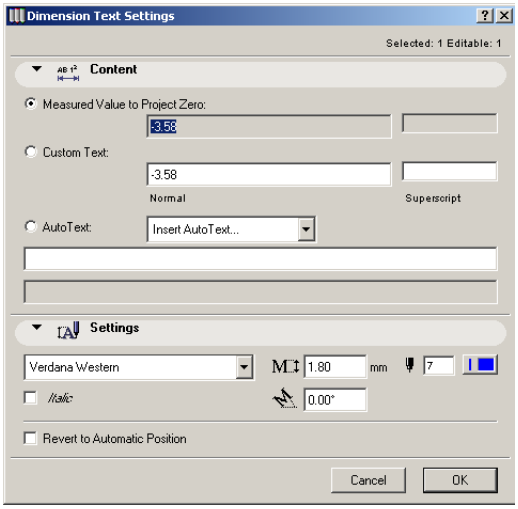


- When the Drawing type Section is updated from the model, the dimensions associated to the hotspots will be regenerated to reflect the changes to the model.

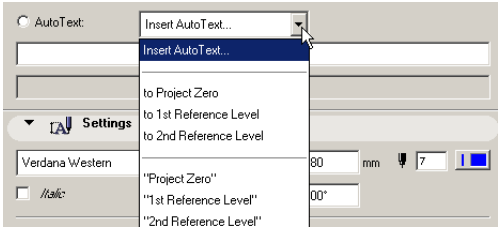
Manual Changes to Dimension Text

Dimension Text items are individually editable. Select a text item by clicking on its node. You can change the position and/or orientation of the text item using **Edit** commands (e.g.,

Drag, **Rotate**). Click the **Text** icon in the **Info Box** to open the **Dimension Text Settings** dialog box.



Type custom text, maximum 25 characters, into the corresponding field and add optional superscript, maximum seven characters, if appropriate, or add an AutoText by choosing from the pop-up menu.



You can reset the position of a selected custom text item by checking the **Revert to Automatic Position** box at the bottom of the dialog box. You can revert to the current value of the text item by clicking the **Measured Value** radio button.

To undo changes of all modified dimension text items, open the **Dimensions...** dialog box under **Preferences** in the **Options** menu. Two checkboxes allow you to undo changes.

- Checking the first box will return any manually displaced dimension text blocks to their original locations.
- Checking the second box will revoke any manual modifications to dimensioning texts by replacing them with their current values.

Zones

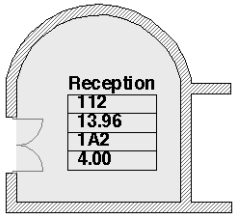
Definition

Zones are spatial units in your Project. Zones can be made up of rooms, groups of rooms or even larger parts of a Project.

Zone Polygon and Stamp

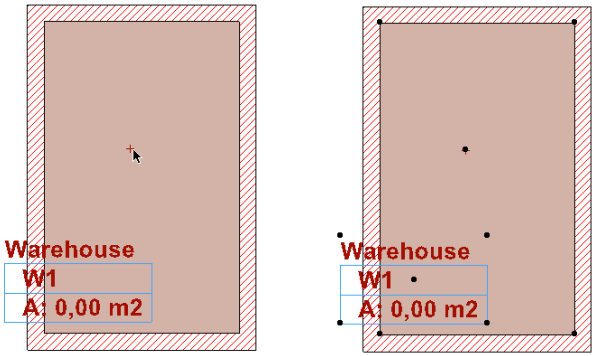
Zones appear on the Floor Plan as fills and zone stamps linked to the zone fills. The **zone fill** designates the zone space in the Project, while the **zone stamp** contains textual information about the zone, including its name, number, area, and other optional parameters such as the material of the subfloor, materials of the walls and surface of the walls (with or without their openings), etc.

Zone stamps are intelligent parametric GDL Objects whose look, contents and behavior can be fitted to local architectural practice. They reside in the ArchiCAD Library.



If you place the Zone Stamp with one of the automatic recognition methods, you will see a cross appear inside the

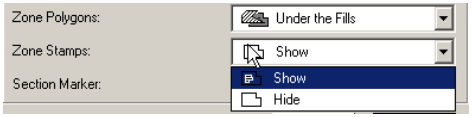
Zone at the location that you first clicked to define the Zone's area. This cross indicates the reference point of the Zone. The cursor is sensitive to this point which is used as the starting point of boundary recognition for subsequent updating actions.



In ArchiCAD, zones are grouped into categories. Zone categories are defined according to similar usage or purpose, e.g., public areas, laboratories and office space. Categories are marked with different colors and zone stamp GDL Objects.

Some Zone categories are predefined in ArchiCAD and you can define your own categories at will by using the **Zone Categories** command in the **Options** menu.

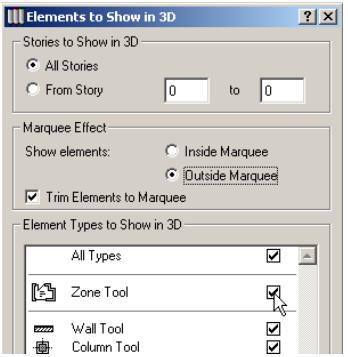
Three options are available for displaying Zone polygons in the Floor Plan in Options/Display Options: you can hide Zone colors or display them on top or below the Fills. Note that if the polygon that represents the Zone color is hidden, you cannot edit its shape. Also in Options/Display Options, you can choose to show or hide the Zone Stamps. Both of these settings are global, you cannot choose them for single Zones only.



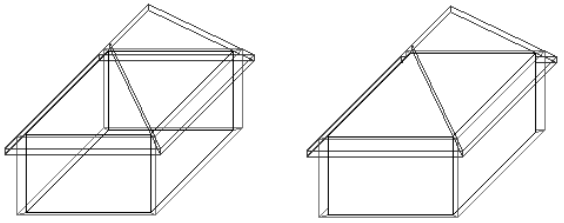
3D Zone Shape

In 3D, Zones appear as 3D spaces. The availability of **zone spaces** makes the accurate analysis of both the geometric and quantitative attributes of Zones possible. When the surrounding and trimming elements define a complex geometric shape, the corresponding zone space form that matches its boundaries can be equally complex.

To view zone spaces in 3D, go to the **Image** menu, choose **Elements to Show in 3D** and make sure the Zone icon is selected in the dialog box.

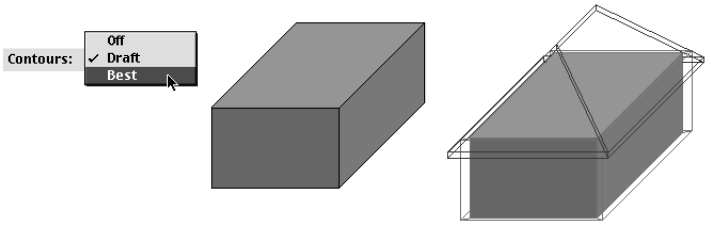


When Zone spaces are displayed in 3D, all construction elements appear in Wireframe mode, regardless of the currently active display mode. The same model in **Wireframe** and **Hidden Line** view appears below.

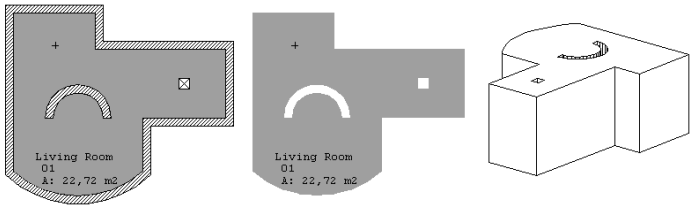


When viewing the **Shaded** model, go to the **3D Window Settings** dialog box in the **Image** menu, and choose the **Contours: Draft** option to view only the 3D Zones, without

any of the construction elements. If you choose **Contours: Best**, you will see the shaded Zone surrounded by the construction elements in wireframe. Elements hidden by the zone shape are not displayed at all.



Zones spaces have a complex geometry depending on the surrounding construction elements. The boundaries of zone spaces can be walls, columns, slabs, beams, roofs, lines, arcs and splines. Walls and columns, including freestanding ones, are automatically identified.



Zone spaces can be trimmed to roofs, slabs and beams with the Trim Zone… command in the Edit menu. 3D zone spaces allow you to create complex solids for all sorts of generic modelling purposes and massing studies. *See Trimming the Zone shape under Defining Zones below.*

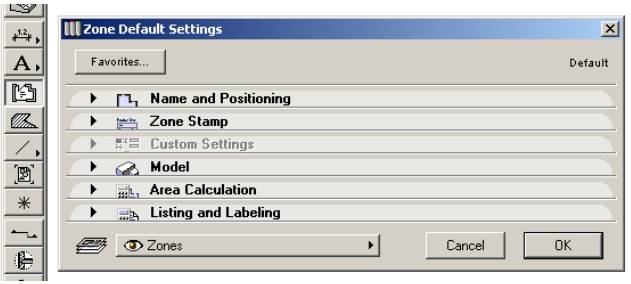
Zone Calculation

ArchiCAD Projects can be evaluated according to the information stored in the zones by creating a **Zone List** using the commands of the **Calculate/List Zones** hierarchical menu.

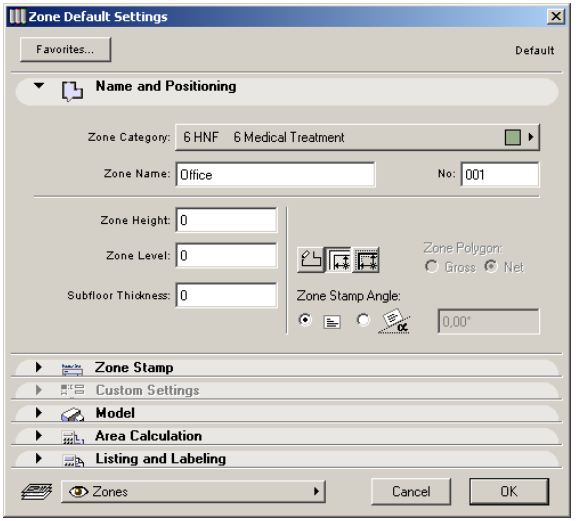
See also the Area Calculation panel under Zone Settings, the Calculating Zone Space section later and Chapter 10: Project Data Calculation.

The Zone Tool and Settings

The Zone tool is located in the bottom section of the Toolbox. Double-click it to open the Zone Settings dialog box. This window has six panels: Name and Positioning, Zone Stamp, Custom Settings, Model, Area Calculation and Listing and Labeling.



The **Name and Positioning** panel contains the basic information about the Zone, including its Category, Name and Number, with several options for defining and positioning the Zone polygon and stamp.



A scrollable list allows you to choose a zone category. Zone categories are defined by name, code, color and zone stamp, together with a set of parameters. *See the Zone Categories section later.*

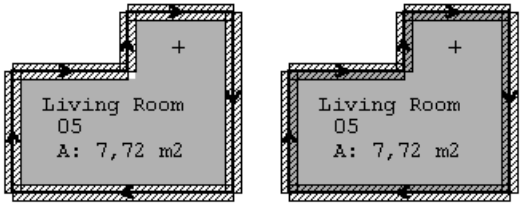
The Zone Name and Number edit fields have to be individually defined for every Zone and serve to identify the Zone Stamp on the Floor Plan. When a Zone is defined and the zone stamp is placed on the Floor Plan, several pieces of additional geometric information (zone area, zone outline, outline of holes, outline with walls, surrounding wall area, etc.) are automatically calculated. These parameters can be included in the Zone Stamp on the corresponding panel.

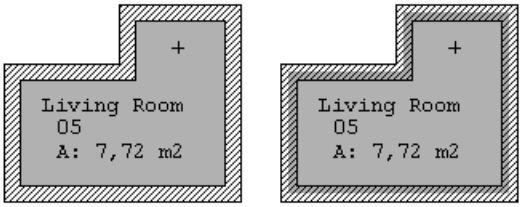
- The Zone Height is the height of the Zone body measured from the Zone's bottom elevation.
- The Zone Level is the reference level of the Zone, measured from the Story's elevation.
- The Subfloor Thickness is the elevation of the bottom of the Zone body measured from the Zone Level.

You can choose between the display of gross or net polygon shapes. These two radio buttons are only active if the zone is defined by the reference line construction method (third icon in the Info Box).

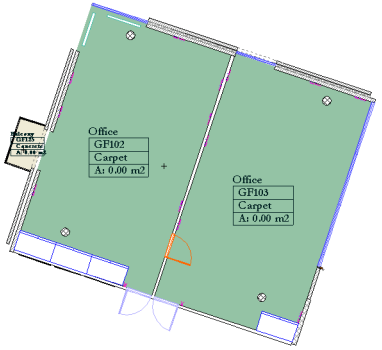
- If you choose the **Net** option, the zone polygon will not be displayed beyond the inner edge of the boundary walls.
- Select the **Gross** radio button if you want the full zone polygon displayed.

See the following figures for the difference both when the **Clean Wall & Beam Intersections** (**Options** menu) is turned on and off.

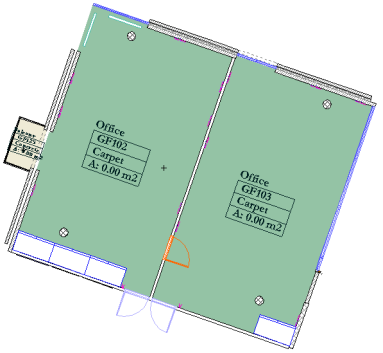




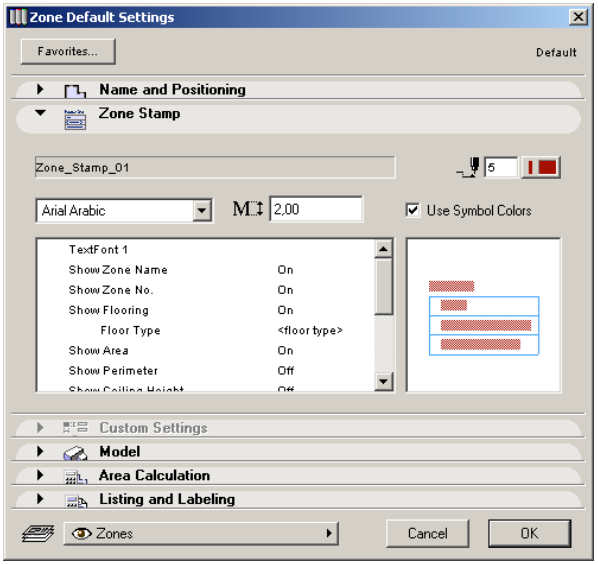
A pair of radio buttons control the rotation value of the Zone Stamp. By default, the **Horizontal** button is active. Zone Stamps are placed horizontally and keep their position even after rotation of the Zone. The angle text field is grayed.



If you click the **Rotated** button, and then rotate the Zone, you will see that the Zone Stamp's angle follows suit.



The **Zone Stamp** panel includes a preview of the Zone Stamp.



Zone stamps are assigned to zone categories, which means that by changing categories in the Name and Positioning panel, the displayed preview may be replaced by a new one.

You can set the desired color for your zone in the pen number edit box or you can use predefined stamp frame colors by checking the **Use Symbol Colors** box.

You can set here the font type, size and color for the text part of the Zone Stamp. Note that the preview shows the Stamp as it will appear in the Floor Plan. If, for example the Greek option has been enabled for all Text type elements in Display Options, both the preview and the actual placed stamp will display the text as gray, unreadable fields.

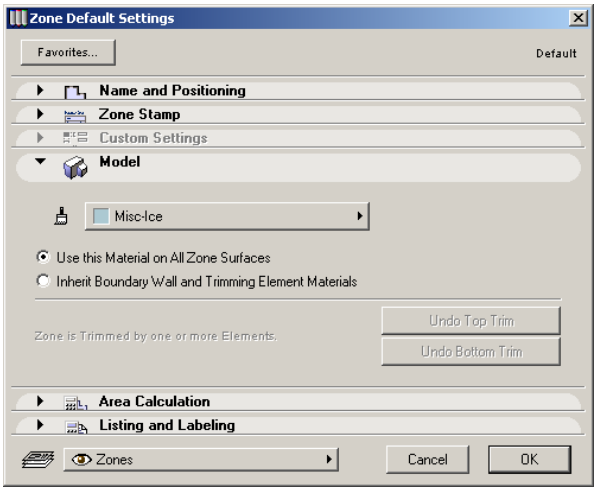
An unlimited variety of Zone Stamps can be scripted in GDL and the contents of the parameter list may vary accordingly.

These parameters have an effect both on the appearance and the contents of the zone stamp. The parameter list allows you to switch on and off the display of parameters in the Zone Stamp, as reflected in the preview.

Similarly to Windows, Doors and Objects, the **Custom Settings** panel can contain additional graphic choices linked to the active Zone Stamp. *See examples in the Windows and Doors section.*

> **Note**: Customization of the Zone Stamp parameters will be lost if you change the Category of the Zone. In this case, the parameters of the stamp will revert to the values stored with the Zone Category attributes.

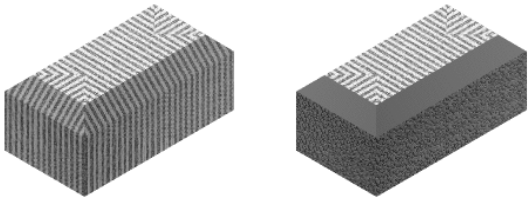
The **Model** panel controls the 3D appearance of Zones, including Material choices and trimming options.



You can choose a material for displaying the Zone in shaded and PhotoRendered 3D views.

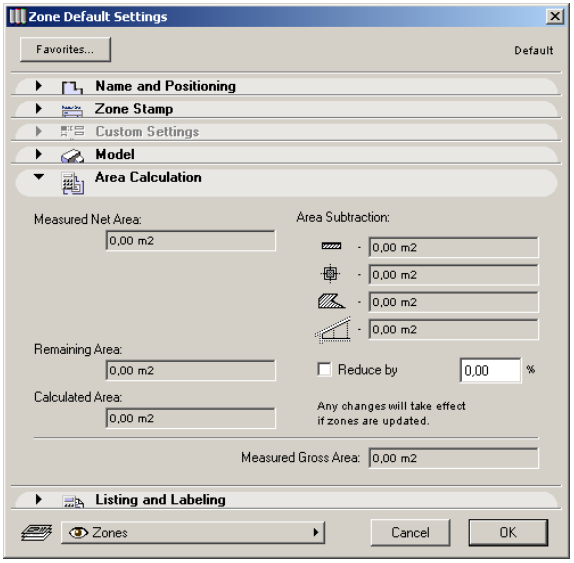
- By clicking the **Use this Material...** radio button, you choose to display the 3D zone shape in the single material you selected with the pop-up above.

- If you click the **Inherit Boundary Wall...** radio button, individual surface polygons will inherit the materials of the corresponding surfaces of boundary walls and any elements that you trimmed the Zone with.



Zone space trims can be undone by selecting the trimmed zone space and pressing the **Undo Top Trim** or **Undo Bottom Trim** button. *See the Trimming Zones section below.*

The **Area Calculation** panel allows you to check the measured area of the Zone and refine the calculated values.



The upper field, **Measured Net Area**, shows the net zone area. This is the zone area within the boundary walls with automatically recognized zones and the zone area within the zone perimeter with manually drawn zones.

The right-hand section of the panel shows how low ceiling areas, the areas occupied by Fills, freestanding Walls and Columns within the zone area affect the calculation of the total zone area.

- The space occupied by Walls and Columns that are not set to act as zone boundaries in their own settings dialog boxes can be partly or entirely subtracted from the zone area.
- You can subtract from the total zone area a part of the surface occupied by Fills as set in the Fill's own settings dialog box.
- It is also possible to take into account only a part of attic or other areas with ceiling heights below a certain value. *See Calculating Zone Space later.*

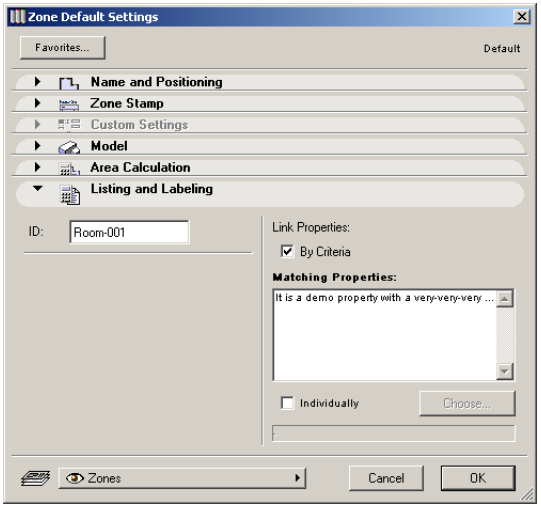
The **Remaining Area** field displays the value obtained by subtracting the Wall/Column, Fill and Low Ceiling reduction values from the Measured Value.

The checkbox and percentage field next to this field allow you to manually refine the calculated value. The last field near the bottom of the panel displays the value you will see in calculations.

Note: In order to activate the reduction defined in the selected **Zone's Settings** dialog box, you have to choose **Tools/Update Zones** and refresh it.

The last panel is called **Listing and Labeling** and controls the handling of the Zone in calculations.

The controls are the same as those used for construction elements as discussed earlier in this chapter.



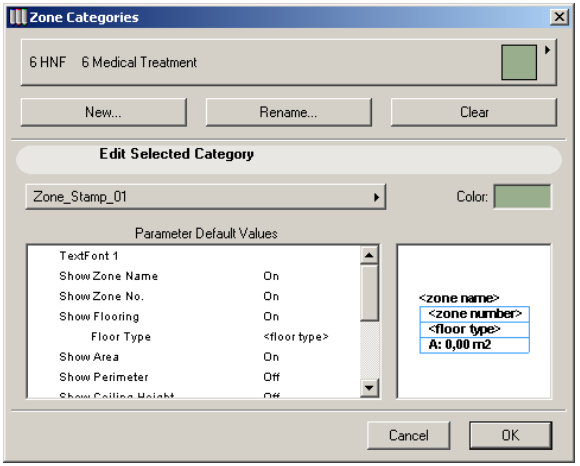
Zone Categories

Zones sharing the same function or purpose can be grouped in categories. Zone Categories are defined by the command of the same name in the Options menu and are handled as ArchiCAD attributes.

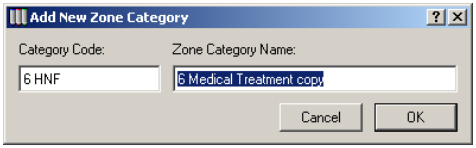
Zone Categories are defined by the following elements:

- **Category Code** aids in the fast identification of the categories, and in some countries this number can be set according to the local standard. It can also appear in the zone stamp.
- **Zone Category Name** describes the purpose or functionality of the category. Note that each Zone can have its own name and that it can be different from any of the category names.
- **Color** helps to identify the zones belonging to the same category on the Floor Plan.
- A **Zone Stamp** can be assigned to each zone category. You can set default values for the parameters of each category.

When you choose the **Zone Categories** command, a dialog box is displayed, allowing you to create, modify or delete zone categories.



Predefined Zone Categories are displayed in the pop-up on top of the dialog box. If you want to add a new category, click on the **New** button and fill in the Name field.



By double-clicking the Color box, you can assign any color to the specified category. Select a zone stamp for the new category by selecting a new GDL Object from the pop-up menu.

You can delete or rename a zone category by selecting the category in the category list and clicking the **Clear** or **Rename** button respectively.

The default parameters of the zone stamp can be adjusted in the parameter list of the stamp assigned to the current

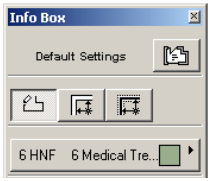
category. Some of these parameters (Zone Name, Zone Number, Zone Level, Zone Height) are used in special fields of the **Zone Settings** dialog box. The default values you enter here will appear in the **Zone Settings** dialog box when you select the given zone category.

See also the Graphisoft GDL Reference Guide for more information about the creation and scripting of Zone Stamps.

Defining Zones

Geometry

There are two basic Zone definition methods represented by three icons in the Info Box. You can either manually draw the contour of a zone, or let ArchiCAD automatically recognize a zone surrounded by bordering elements such as Walls, Lines, Arcs, Splines and Columns.

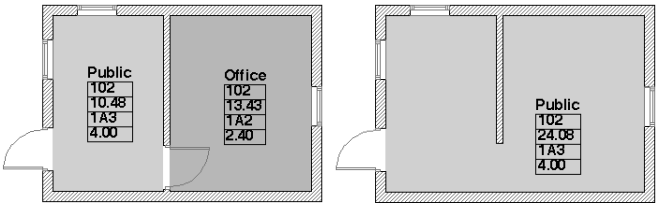


The **Polygonal** method is your best choice when your Zone's boundary is not clearly surrounded by elements. With this method, you simply draw a polyline (as you would for any other polygon) by clicking at every corner of the zone. Zones created with this method cannot change their shape when using the Update Zone command on them, and their area is not modified by related constructions (enclosed elements). *See the Drawing Walls section above for illustration and details.*

Both automatic recognition methods, **Inner Edge** and **Reference Line**, are based on the fact that most Zones are surrounded by Walls and the only openings in them are Doors and Windows. You can also activate the automatic recognition by other element types such as Lines, Arcs and Splines with the **Zone Boundary** checkbox in their settings dialog boxes (Listing and Labeling panel). For Walls and Columns, the **Relation to Zones** pop-up menu in the same panel lets you set whether to use the element as a Zone Boundary or to subtract its area from Zones.

- If you choose the **Inner Edge** method (second icon in the Info Box), ArchiCAD will always define the zone area by the inner edges of walls.
- If you choose the **Reference Line** method (third icon in the Info Box), ArchiCAD considers the reference lines of the walls as the boundaries of the zone. Note that even if you constructed Walls with the reference line placed on the internal edge, the Zone fill does not overlap the wall symbol until you choose **Bring to Front** from the **Tools** menu.

If the Zone has openings that are not Doors or Windows, ArchiCAD will continue searching for boundaries outside the spatial unit that you wished to identify as a Zone. In this case, the result may not be what you expect (figure on right below).

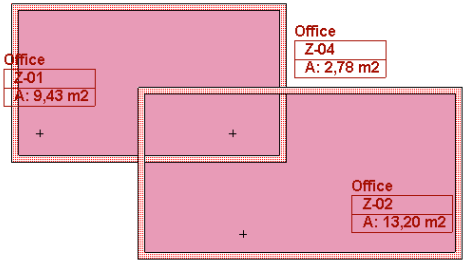


In this case, you can:

- draw a line as a Zone Boundary, or
- use the Polygon method.

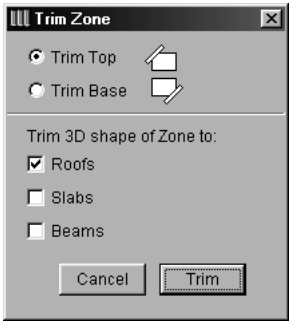
With standalone Zones, i.e., Zones that are not connected to any other, automatic recognition may produce the desired result even if the Zone is open. ArchiCAD will search around the walls surrounding the Zone and when it fails to find one, it automatically closes the Zone.

Whichever Geometry Method you choose, the Hammer cursor appears when you have finished defining the outline of the Zone. Click with it to define the location of the Zone Stamp. The Zone Stamp does not necessarily have to be placed inside the Zone polygon.

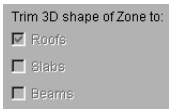


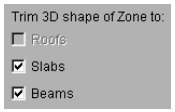
Trimming the Zone Shape

You can either select Roofs, Slabs and Beams and trim to them the Zone they protrude into, or select a Zone and then choose which element types to trim it to.

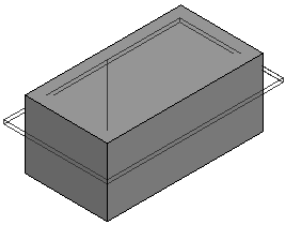


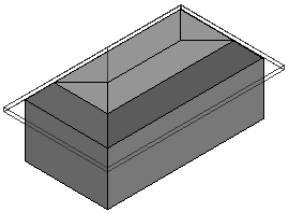
You can choose between trimming the base or the top of zone spaces. Check the corresponding boxes to define whether you wish to trim the zone space(s) to roofs, slabs or beams. If you select only one type of trimming element, e.g., roof, in the Project, all the checkboxes are grayed. If two types are selected, only the checkbox of the type not selected will be grayed, and you can still choose between the selected types if you wish.





The trim will be executed by clicking the **Trim** button in the dialog box.





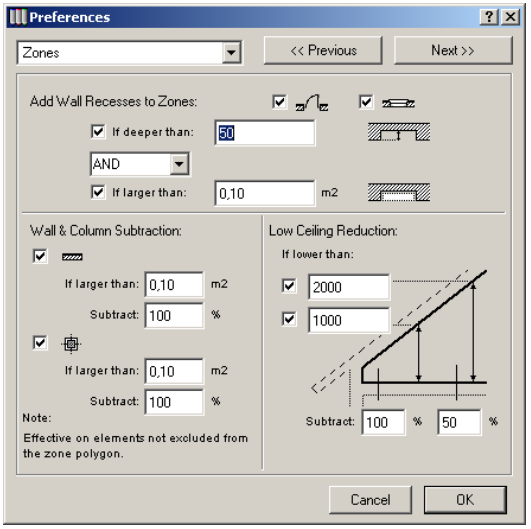
Zone space trims can be undone by selecting the trimmed zone space and pressing the **Undo Top Trim** or **Undo Bottom Trim** button in the Model panel of the **Zone Settings** dialog box.

> **Note:** You can also opt to undo the Trim when updating modified Zones. *See the Updating Zones section below.*

Calculating Zone Space

In addition to the settings made in the Area Calculation panel of the Zone Settings dialog box and the options chosen for the construction elements included in the Zone's area, the **Zones** screen in Options/Preferences contains controls for defining the behavior of **Related Constructions** when creating Zone Lists.

The top part of the dialog box concerns recesses cut in Walls by Door and Window openings. When calculating Zone sizes, it is possible to include or exclude recesses that are below a certain depth and/or whose surfaces are smaller than a certain value.



Check the boxes next to the Door and Window icons to add recesses to zones.

> **Note:** Wall recesses can only be added to the zone if the Door/Window elements in the active Libraries include a proper Parapet Wall Inset definition.

In the **Wall & Column Subtraction** area at bottom left, Walls and Columns (or part of the surface they occupy) can be included or excluded from the Zone's size.

Remember that the relationship of Walls and Columns to Zones can be defined in their own Settings dialog boxes; any settings made in **Preferences** can only act on elements that are not enabled for Zone Boundary recognition but are enabled for reducing the Zone's area.

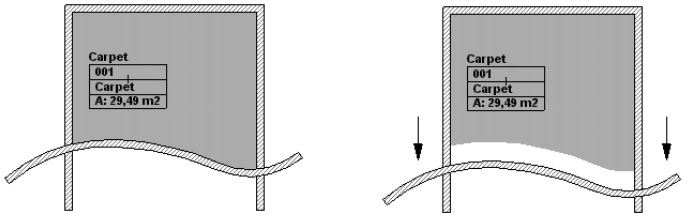
Use the checkboxes next to the Wall and Column icons to activate area reduction. Type the minimum value to be considered for the area occupied by an element in the **If larger than** text field. Then, in the **Subtract** text field, define the percentage of the occupied area to be subtracted from the measured area.

Located in the bottom right corner, the **Low Ceiling Reduction** controls allow you to specify to what degree reduced height spaces will be taken into account when calculating Zone sizes.

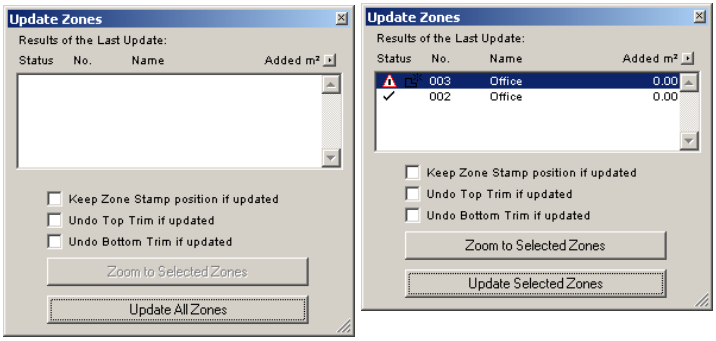
Checking both boxes enables the customization of two different height limits with different ratios. This allows you, for example, to differentiate between limited usage areas and unusable areas.

Updating Zones

When you modify your design, associative zones do not automatically adjust themselves to the changes.



Using the **Update Zones...** command in the Tools menu will adjust the Zones to your updated design and alert you about any problematic Zones that might have been created. The dialog box that appears also provides you with feedback on how each Zone has changed.



The dialog box contains the following columns:

- **Status:** This is where ArchiCAD tells you if the Zone could be updated, and if not, what the nature of the problem is. The icons appearing in this field represent the following:

  ✓: All is well, ArchiCAD has successfully updated your Zone.

  : The Zone was created manually and cannot be automatically adjusted.

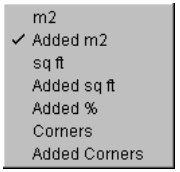
  : The layer on which the Zone resides is locked. Unlock the layer in the **Layer Settings** dialog box and repeat the update process.

  : The Zone is self-intersecting. Just as in the case of polygons, you may have to adjust the Zone to have valid geometry, or split it into two Zones. You can examine the Zone by selecting it in the list, and pressing the **Zoom to Selected Zones** button. Repeat the update process.

  : The reference point of the Zone is outside of its boundary. Each automatic Zone has a reference point that must lie inside the Zone. If you get this error message, move the reference point inside the Zone and repeat the update process.

  : The Zone you are trying to update is not in your workspace. This error can only occur if you are working in a shared Project in Teamwork mode, and the Zone is assigned to another team member. Ask the team member to make the Zone available to you.

  : The Zone you are trying to update cannot be properly adjusted, because it has difficulty in finding all of its edges. Use the **Zoom to Selected Zones** button to find the Zone and repeat the update process.
- **No.**: This column contains the number that has been assigned to the particular Zone.
- **Name**: This column contains the name of the Zone.
- **Added m2:** This column contains information on how the Zone has changed. To change the display from the relative change in square meters, choose a different unit from the pop-up menu in the upper right portion of the dialog box.



- You can keep the original position of zone stamps when updating zones if you check the **Keep Zone Stamp** position box.
- You can remove the 3D zone space trim by checking the **Undo Top Trim** and/or **Undo Bottom Trim** boxes.

  Note: If you leave the **Undo Top** and **Bottom Trim** boxes unchecked, conflicts may arise in certain geometric configurations.

Labels

Definition

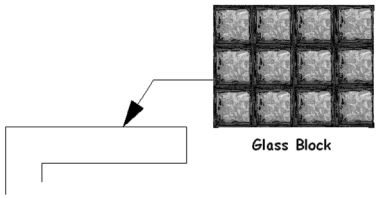
Labels are text blocks or symbols optionally linked to construction elements and 2D fills allowing you to identify or comment elements or parts of your design.

Labels can be framed or unframed, with leader and arrowhead. They can contain either custom text specification, the element's ID or unique Internal ID or a symbol.

You can use Labels in two ways:

- **Independent** labels are manually placed in the Floor Plan or in a Section/Elevation window.
- **Associative** labels can be assigned automatically before the creation of an element or added to them later.

Label Symbols are special GDL Objects. They can be scripted and/or graphically defined and can even include bitmaps. They can display all kinds of element information on the drawing, for example the skins of a composite Wall.



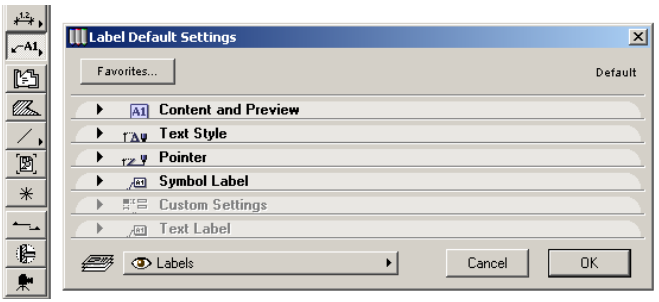
You can create your own Label Symbols as you would any other GDL Object by choosing the File/GDL Objects/New Object… command. *See Chapter 8: Working with GDL Objects for details.*

Note: Text Labels and Symbol Labels containing text are affected by the choice made for Text in Options/Display Options. If you have selected the Greek option there, all Labels with text in them will appear as gray, illegible blocks.

Label Tool and Settings

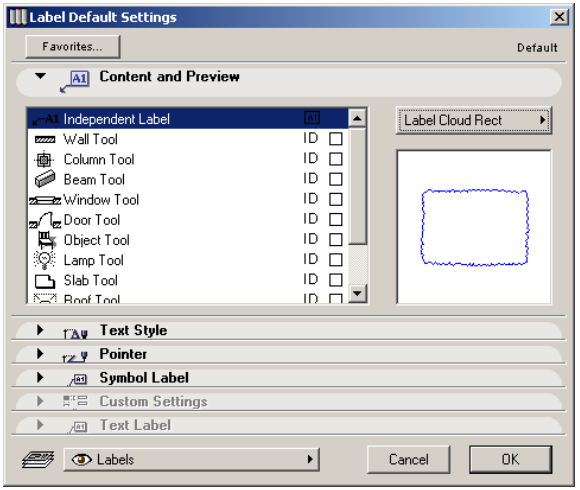
In the default shape of the dialog box, the **Text** and the **Label** tools are grouped in a single icon. Flush out the Label tool, or choose **Options/Customize/Palette Shapes** and select the **Extended** version of the **Toolbox** to see both tools at the same time.

Double-clicking the Label tool opens the Label Settings dialog box which has six panels: Content and Preview, Text Style, Pointer, Symbol Label, Custom Settings and Text Label. Depending on the currently chosen Label type, some of these panels will be inactive.



Label Settings

The **Content and Preview** panel defines the labeling options for element classes and displays a preview of the selected symbol label.



On the left, the element types eligible for labeling are listed. You can set default labeling options for each element type. If the **Label (element type) on Creation** box is checked in the given tool's settings dialog box, these are the options that will be offered by default.

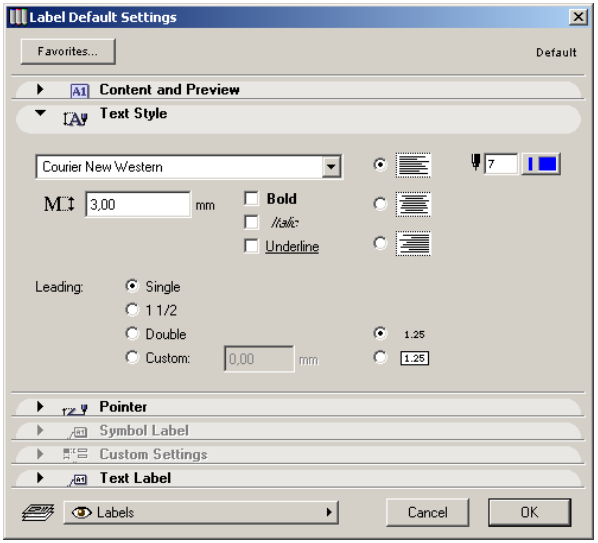
You can choose the type of Label to use from a pop-up menu on the right. The options are:

- **Text**. If you choose this option, ArchiCAD will place the Default Text defined in the Text Label panel. If there is none, you will be prompted to write the text of the Label when placing it.
- **ID**. If you choose this option, the Label will contain the ID of the associated element. Changing the ID field of the selected element will update the Label, too.

- **Internal ID**. Each ArchiCAD element has an internal identifier that the user has no access to. If you choose this option, the Label will contain this internal ID.
- **Choose Other Label...** followed by the names of the available **Label Symbols** in the current Library. With the Choose Other Label… command, you can use Labels that are not currently loaded.

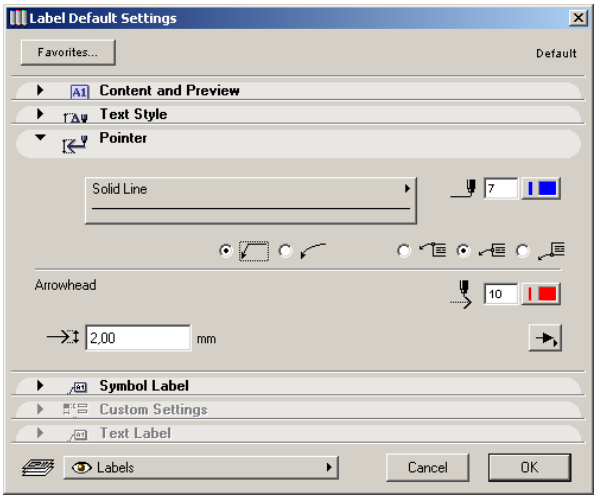
Below the pop-up, the preview area shows the Symbol Label you have chosen from the Library. It does not contain any associative elements.

The second panel is called Text Style. Depending on whether you have selected a Text or Symbol type Label to place, its controls are fully visible or dimmed.



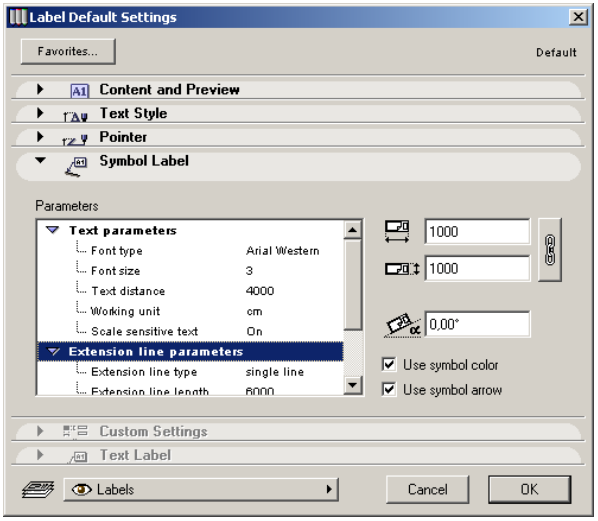
- If a Text type Label has been selected in the first panel, you can fully configure its font type, size, alignment and leading attributes and decide whether to draw a frame with the Label.
- If a Symbol type Label has been selected in the first panel, you can only choose a font type and size as well as the color of the text.

The third panel concerns the **Pointer** of the Label.



You can define a straight or a curved pointer line, and choose from three different pointer position options. The Arrowhead's size can be set in points (imperial units) or mm (metric units). Note that Symbol Labels can override the color and Arrowhead settings made here, as shown on the next panel.

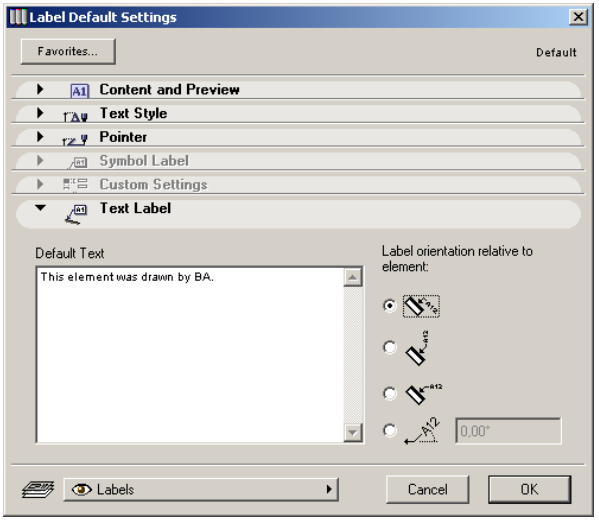
The **Symbol Label** panel is only active if you have selected a Symbol Label on the Content and Preview panel. It shows options for the Symbol Label's size and other parameters.



Symbol Labels can have any number of parameters listed on the left. On the right, you can set the size of the Label and its placement angle. You can also choose to display the Symbol Label with its own internal color and arrowhead or to use the options chosen in the Pointer panel.

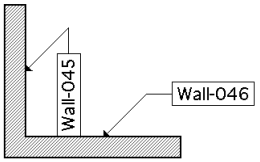
As for all other GDL Object type element, the **Custom Settings** panel contains special options defined in the Symbol Label's User Interface script. It is only active if you have selected an appropriate Symbol Label in the Content and Preview panel. *See Windows and Doors for illustration and details.*

In the **Text Label** panel, you can enter a default text and define the Label's orientation relative to the associated element. This panel is only active if you have chosen a Text type Label on the Content and Preview panel.

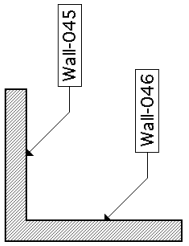


Four orientation options are available for Text Labels:

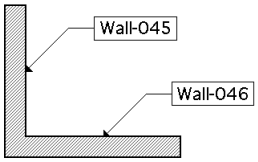
- The **Parallel** method always places the Labels parallel to the labeled elements.



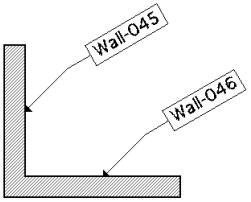
- The **Vertical** method always places the Labels vertically. The text can be read from bottom to top.



- The **Horizontal** method always places the Labels horizontally.



- The **Custom** method places the Labels at the angle you define in the edit field next to it.

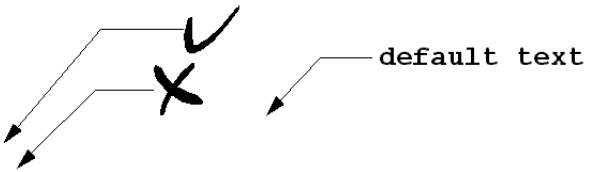


Placing Labels

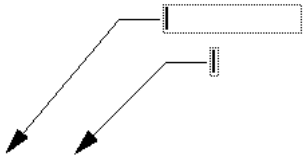
Placing Independent Labels

Independent Labels can only be placed manually. Click anywhere in the workspace with the **Crosshair** cursor to start drawing an independent label. Two additional mouse clicks define the pointer.

- If the label content is ID, Internal ID, Symbol or Default Text, the label is completed after the third mouse-click.



- If the label content is Text, draw a rubberband box after the third mouse-click to define the width of the label text column. If you do not want to predefine the text column width, simply click again at the end of the pointer with the **Checkmark** cursor. Type any length of text in the text box and click **OK** in the **Control Box** to complete the label.



Placing Associative Labels

Associative Labels can be placed automatically on creation or added to selected elements at a later stage.

- Associative labels will be placed automatically with every newly created element, if the **Label (element type) on creation** box is checked in the given tool's settings dialog box's **Listing and Labeling** panel. Click the **Label Settings** button to choose options for the Label you wish to place with the element to create.
- To add an Associative label to an element, select it and open its settings dialog box. Go to the **Listing and Labeling** panel, activate the **Label (element type)** checkbox and click the **Label Settings** button to choose options for the Label you wish to add to the selected element. You can also click the element with the Label tool active to place the associative Label set by default for that element type.

Presentation Elements

Presentation elements are special element types. They define the location of associated windows and views generated from the Virtual Building model.

- **Section** and **Detail** Markers are placed to define the location of associated Section/Elevation windows and Detail Drawings.
- **Cameras** are used for setting up the 3D projection of the model in perspective views and animations as well as VR Objects and VR Scenes.

The chief purpose of the actual elements placed in the Floor Plan (or, in the case of the Detail Marker, in Section, too), is to set up the access point and configure the view displayed in the corresponding window.

The section that follows presents both the elements themselves and the special functionality available in the resulting windows and views.

Sections and Elevations

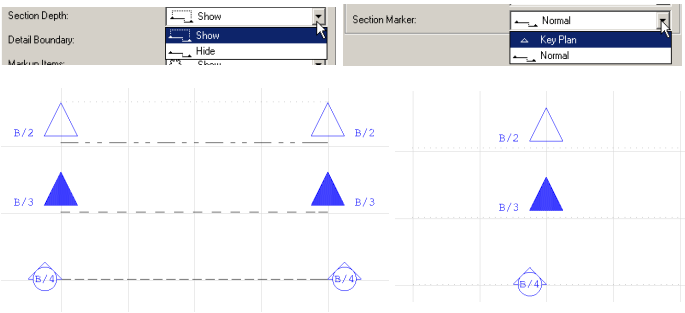
Definition

In ArchiCAD, Sections and Elevations consist of two elements. The Section Line created on the Floor Plan is used to generate a Section/Elevation window showing the model from the defined location.

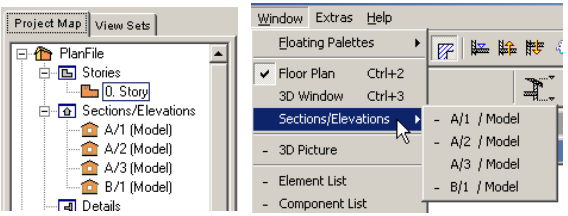
The Section Line is defined with the Section/Elevation tool located in the bottom section of the Toolbox. It places standard section/elevation symbols on the Floor Plan including optional breakpoints. The symbols may appear on all stories of your Project or on a range of stories only.

On the Floor Plan, what you see is the Section Line itself with Markers on both ends, an identifier and an optional dashed line marking the depth of sections with limited horizontal range.

In Options/Display Options, Section depth can be displayed or hidden on the Floor Plan. Section Marker display is also set there. The two choices are Normal and Key Plan. In the latter case, a simplified version of the Section Line with a uniform dotted line and a single Marker is shown.



The moment the Section Line is placed, a corresponding item is generated in the Navigator palette's Project Map and a command with the Section's name appears in the Window menu's Sections/Elevations hierarchical menu. Double-clicking the view in the Navigator or choosing the name of the view in the hierarchical menu will open the corresponding Section/Elevation window.



The contents of the Section/Elevation window depend on both the horizontal and vertical range you define for it. The vertical range is defined in the current Working Units set in Preferences. The horizontal range of the section can be of three types:

- Infinite: All elements behind the Section Line will be shown in the Section/Elevation window, provided that they are not hidden by other elements.

- Limited: Only the elements between the Section Line and the limit will be shown in the Section/Elevation window.
- Zero Depth: Only elements actually cut by the Section Line will be shown.

Each view you generate with the **Section/Elevation** tool remains a part of your Project as long as its corresponding Section Line is present. This also means that each view is saved with the Project.

Section/Elevation Windows

There are two types of Sections/Elevations: dynamic **Models** that are linked to the model and can be edited interactively with the Floor Plan, and static **Drawings** that are unlinked, editable drawings.

The contents of the Section/Elevation Window depends on the settings chosen for the corresponding section line in the **Section/Elevation Settings** dialog box (horizontal and vertical range), not on what is currently selected on the Floor Plan. Selections made on the Floor Plan do not affect the Section/Elevation Windows in any way.

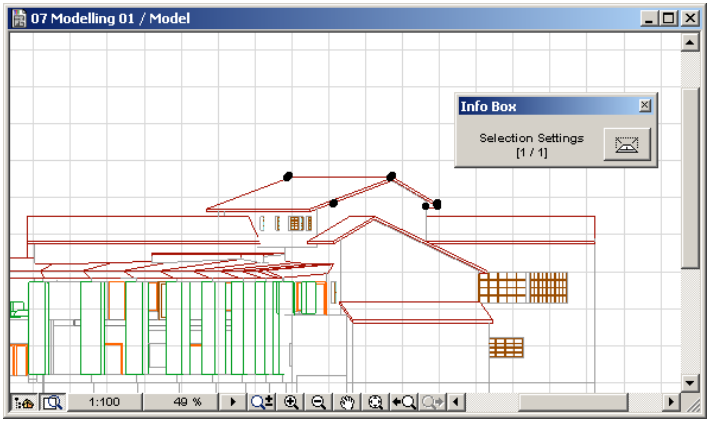
Selection made in a Section/Elevation Window is independent from any other selection made in other Windows (Floor Plan, 3D Window, other Sections/Elevations).

You can save the contents of the Section/Elevation Window as a separate file in a variety of formats.

Model Type Windows

Models are sections or elevations of the digital building. They consist of construction elements and any change made in one of the Section/Elevation Windows will automatically be updated in the Floor Plan Window, and, when activated, in any other Section/Elevation Window and the 3D Window.

The Model type Section/Elevation Windows are editable, but no new construction elements can be created in them, with the exception of duplicating existing Doors and Windows.



Note: Even by copying construction elements and pasting them back you can only obtain plain, additional drawing elements.

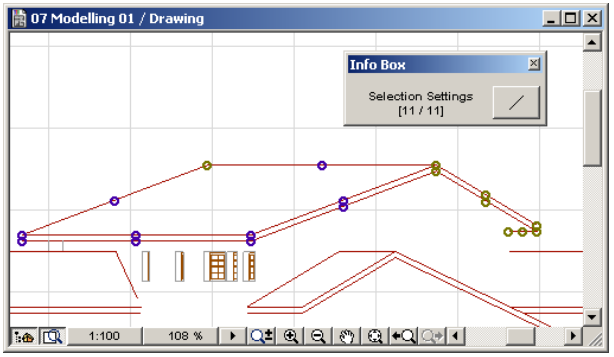
Changes made on construction elements in the 3D Window or in other Section/Elevations Windows will appear when next activating the Section/Elevation Window or on choosing **Display/Rebuild Model**. The update process works on construction elements only; additional 2D elements will remain unchanged.

You can modify construction elements in their tool's Settings dialog boxes or in the **Info Box**.

Warning: Clearing a construction element in a Model Window will also clear it from both the Floor Plan and the 3D model.

Drawing Type Windows

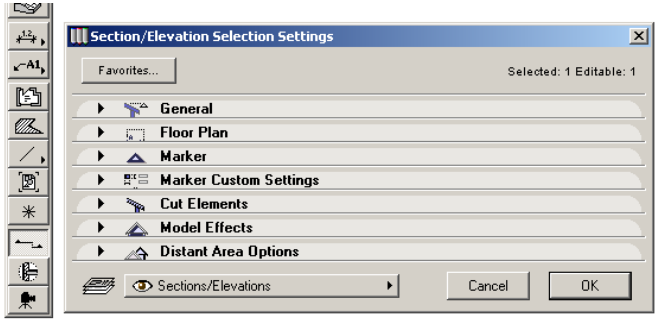
Models can be converted to simple Drawings by choosing **Display/Sections/Elevations/Unlink from Model**. All construction elements will then be converted to Lines and Fills. You can add drawing elements to this Window by using the 2D drafting Tools, by placing 2D objects and text blocks, and even through copy-paste.



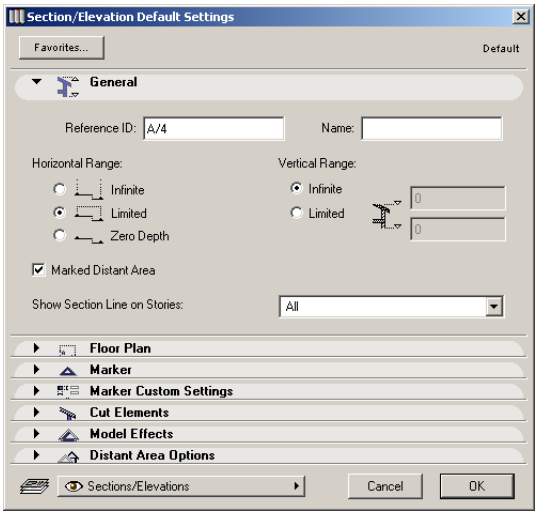
Changes made on construction elements can be displayed in the Drawing Window by choosing **Display/Section-Elevations/Rebuild from Model**. In this case, additional elements will remain unchanged, except for associative Dimensions.

Section/Elevation Tool and Settings

The **Section/Elevation** tool is located near the bottom of the Toolbox. Double-clicking it opens the Section/Elevation Settings which consists of seven panels: General, Floor Plan, Marker, Marker Custom Settings, Cut Elements, Model Effects and Distant Area Options. Some of the panels' settings concern the Floor Plan appearance of the Section Line, while others control the contents of the Section/Elevation window.



The first panel shows the **General** options. It contains the identification of the Section/Elevation window, the horizontal and vertical range of the view it displays and the accessibility of the Section Line on different stories.



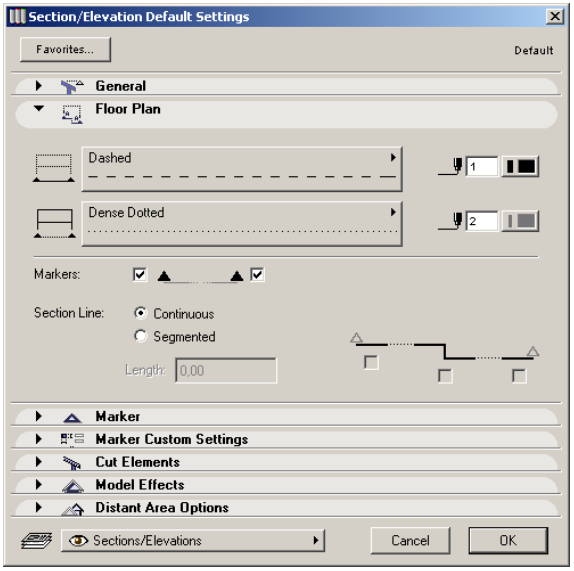
- The Reference ID can contain up to 31 characters in length. It will appear on the Floor Plan with the orientation arrowheads.
- The Name can contain up to 31 characters. This name will then appear in the Navigator palette, the Window menu and the title bar of the Section/Elevation window.
- The Marked Distant Area checkbox allows you to divide the view displayed in the Section/Elevation Window into a "closer" and "farther" area. The elements of the Distant Area can be assigned different colors, hatches and effects to indicate that they are at a longer distance from the Section Line. *See the Distant Area Options panel below.*

If you have selected the **Infinite** radio button under **Vertical Range**, the **Show Section Line on Stories** pop-up menu allows you to choose between showing the section line on all stories, or on the home story only.

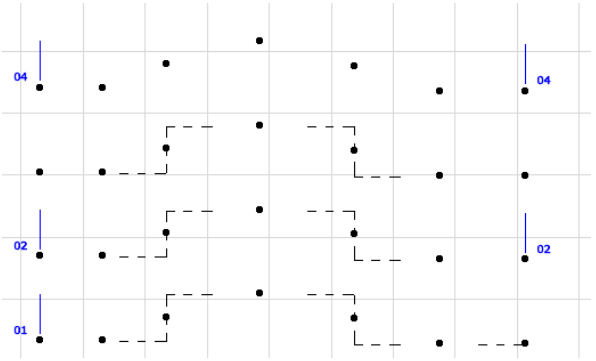
If you have selected the **Limited** radio button and entered height values, two additional options are active:

- The section line will appear on all stories that are entirely in the vertical range defined in the height value fields;
- The section line will appear on all stories that are at least partly included in the vertical range defined in the height value fields.

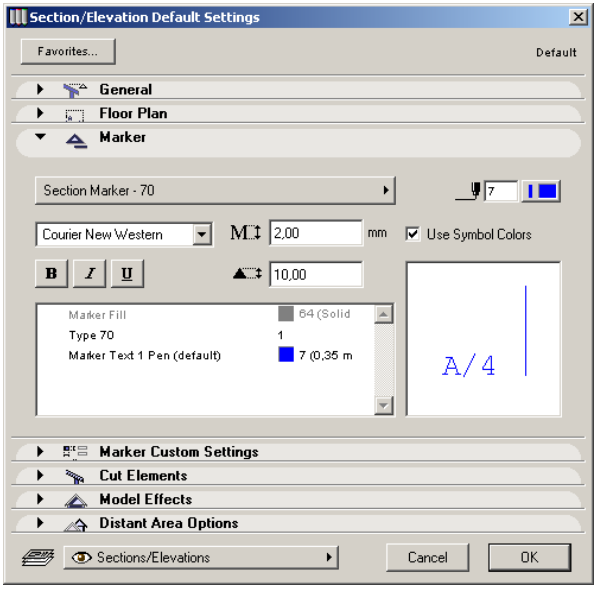
The second panel shows the **Floor Plan** options, that is, the appearance of the Section/Elevation symbol and its components.



- You can select different Pen Colors for the Section Line and the ID and different Line Types for the Section Line and the line that indicates the horizontal limitation (section depth).
- You can enable or disable the Markers at either or both ends of the Section Line.
- By choosing the Segmented option, you can display parts only of the Section Line. This allows you to display the Markers or the end sections only of the Section Line. Note that if both Markers are disabled, you cannot disable all of the segments.

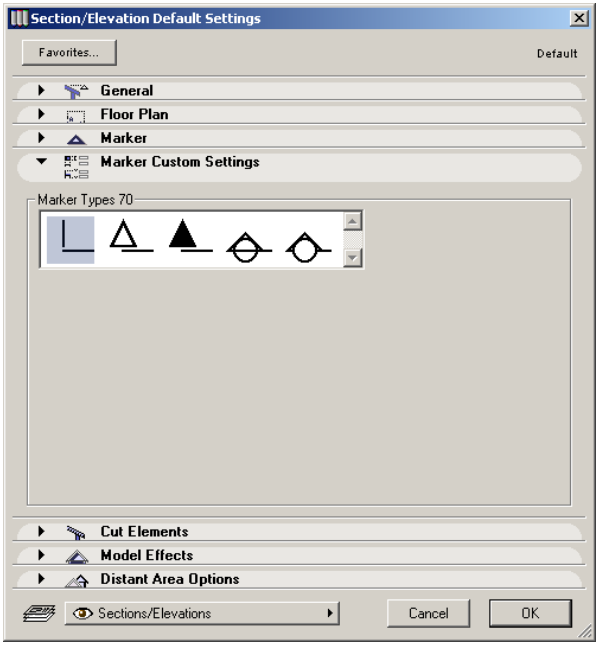


The third panel shows the **Marker** options. It contains the font and size settings of the marker text as well as the preview and parameters of GDL Object-type markers.



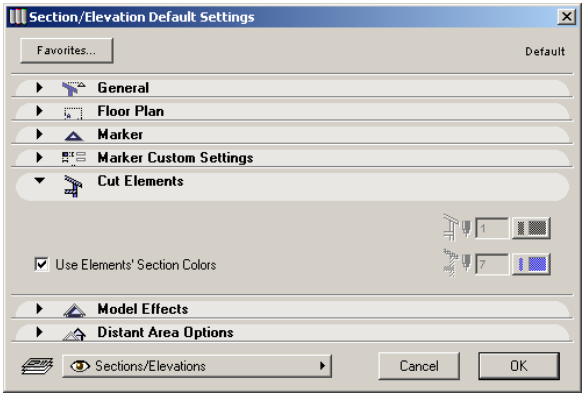
If you choose a parametric marker from the pop-up menu on top of the panel, the 2D Symbol and the parameters of the corresponding GDL Object appear in the preview and list fields respectively. The marker may include custom settings, as seen in the next panel.

The **Marker Custom Settings** of parametric, GDL Object type markers may include various options, mostly for the arrowhead.

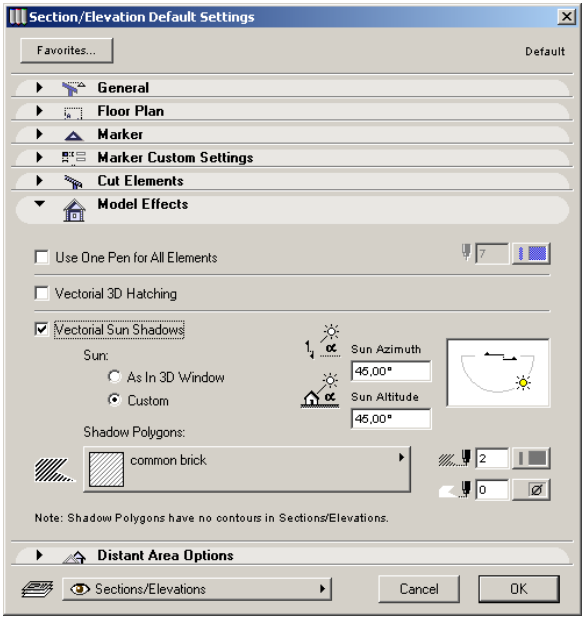


The next panel controls the options for **Cut Elements** in the Section/Elevation windows.

- You can either choose uniform Pen Colors for all cut elements, or use their own settings.
- Uncut but visible elements inherit their respective Floor Plan Pen Colors.



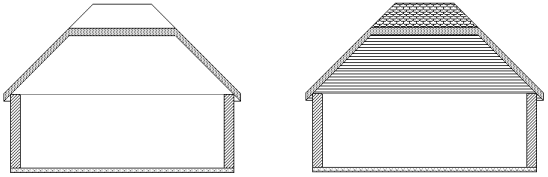
The sixth panel shows the **Model Effects**. With the help of these controls you can activate vectorial shadows and vectorial 3D hatch patterns on model surfaces for Section/Elevation views similar to model views in the 3D Window.



With the first checkbox on top, you can decide to use a single Pen Color for all of the element contours.

Vectorial 3D hatch patterns in Section/Elevation views can be activated by checking the corresponding box. In this dialog box there is no other control for vectorial 3D Hatching. The vectorial 3D hatch can be set individually for each window.

See the following figures for differences between Section/Elevation views with and without vectorial 3D hatches.



See also Vectorial 3D Hatching under Materials in Chapter 6: Project and Program Customization.

Vectorial sun shadows in Section/Elevation views are activated by checking the corresponding box. Shadows work independently of vectorial 3D Hatching patterns. Checking the **Vectorial Sun Shadows** box activates all the controls of the Model Effects panel.

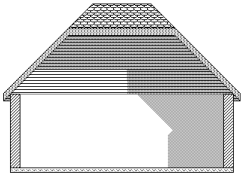
You can set the position of the sun relative to the Section Line. Alternatives include using the same sun position as in the 3D Window and custom settings specific to each Section/Elevation window.

- If you choose the **As in 3D Window** radio button, the other controls are disabled.
- If you choose the **Custom** radio button, you can control the sun position locally. Drag the sun with the cursor in the graphical sun dial or type the desired value in the corresponding field to set **Sun Azimuth**. Azimuth values are limited so that the sun is always behind the section/elevation line. Otherwise the visible side of the building would be overshadowed.

  Note: The sun position can be activated individually for every Section/Elevation window.

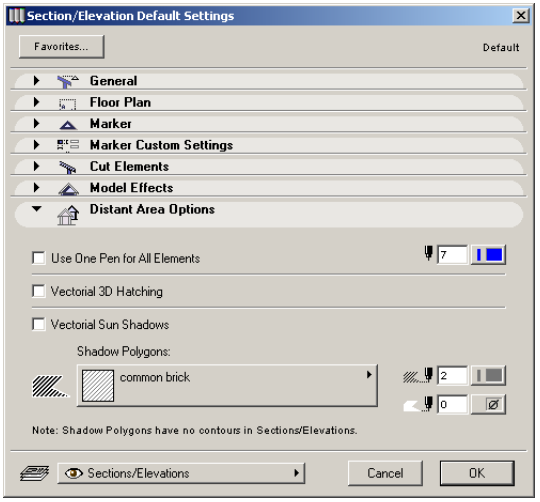
In Section/Elevation views shadows have no contours; however, the fill polygons are freely customizable. Choose the fill type, fill pen and fill background pen using the corresponding pop-up palettes.

Compare the following figure to the ones above for differences between Section/Elevation views with and without vectorial sun shadows.



See also the 3D Window Settings command's description in Chapter 11: Menu Command Reference.

The seventh panel shows the **Distant Area Options**. This panel is only active if you have checked the Marked Distant Area box in the General panel. The controls are the same as on the Model Effects panel, but you cannot set the Sun option separately here.



The Marked Distant Area is the "farther" area defined with the control in the General panel. If you have chosen a Limited horizontal range on the General panel, the secondary depth line representing the Distant Area will be placed by default halfway between the Section Line and the Depth Line.

Placing Section Lines

When you have made your choices in the Section/Elevation Settings dialog box, follow these steps to place a section line on the plan:

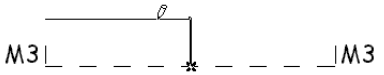
1) To start a section line, click with the mouse to begin drawing a rubberband on the Floor Plan.
2) With the second click you can designate the direction of the line and the length of the first segment. All the segments of the Section Line will be parallel to this first segment, although you may include perpendicular offsets as you extend the line.
3) To finish drawing the section line, either click twice at its endpoint or click the **OK** button in the **Control Box**.
4) By clicking with the **Eyeball** cursor you can set both the orientation and the depth for limited sections.
5) The arrowheads and IDs are automatically placed after the section line is completed.

Adjusting Section Lines

To manipulate a selected section line as a whole, you can use the **Arrow** tool, the **Marquee** tool or any **Edit** menu command. To change the length of a section line or the steps of a staggered section, you need to select it and activate the **Section/Elevation** tool. Then you can drag or stretch any of the section's line segments by its line or midpoint. For staggered sections, if you drag a segment beyond the next one, one step will be skipped. Note that this is a way of making a staggered section more simple.

Breaking Section/Elevation Lines

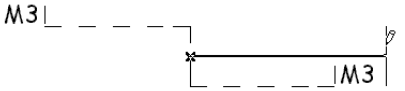
You can break straight Section/Elevation lines and add new segments to staggered sections.



Activate the **Section/Elevation** tool by clicking its icon in the **Toolbox**. Select the section or elevation line you wish to edit by holding down the Shift key and clicking on the line with the **Mercedes** cursor or on one of its nodes with the **Checkmark** cursor. (Reverse the procedure if you wish to select the element using the **Arrow Tool**.) With T straight lines, click the midpoint of the line. If you selected a staggered section, click the midpoint of any segment you wish to break. The click will break the line or the segment and the cursor will immediately move half of it. Click again to define the position of the moving segment. If you want to move the other half instead, simply click on the original midpoint and pick up the other segment with the **Mercedes** cursor. Click again to place the segment.

Staggered sections can have a maximum of five section segments.

> **Note:** Breaks of a staggered section line can be eliminated by pulling the break line out of the section range while the section line is selected.



Adjusting Section Depth and Distant Area Limit

You can change the depth of a selected section by repositioning the limit line to include either fewer or more objects. Make sure that the Selection/Elevation tool is active and move the line by clicking it and dragging to the desired position. Similarly, you can also move the secondary depth line representing the Distant Area limit.

Detail Drawings

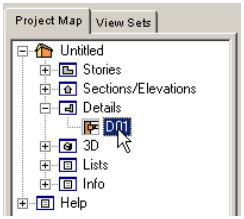
Definition

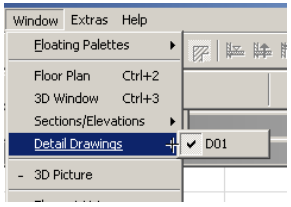
In ArchiCAD, Details consist of two parts. The Detail Marker created on the Floor Plan or a Section/Elevation window is used to indicate details on these drawings. By placing a Detail Marker, you can generate a Detail Drawing that either duplicates the area around the Marker with 2D-only elements or creates a brand new empty drawing. This means that an optional detail boundary can be defined, allowing you to copy elements automatically into the Detail Drawing.

There are four types of Detail Drawings:

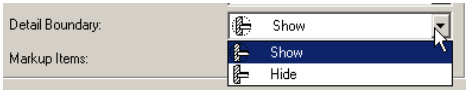
- Project-based Floor Plan details;
- Project-based Section/Elevation details;
- Independent marked details;
- Independent unmarked details.

The Detail Marker is defined with the Detail tool located in the bottom section of the Toolbox. It places standard detail symbols on the Floor Plan or in the Section/Elevation Window. As soon as a new Detail Drawing is generated by placing a new Marker, a corresponding item appears in the Project Map of the **Navigator** palette. Double-clicking the view in the Navigator will open the corresponding Detail Drawing. The names of opened Detail Drawings also appear in the Window menu's Detail Drawings hierarchical menu.





In the Options/Display Options menu, you can choose to show or hide the Detail Boundary, that is, the framing line that defines the area shown in the Detail Drawing window.



Detail Markers are always linked to Detail Drawings. A Detail Drawing can be linked to more than one Marker.

Note that deleting the linked Drawing Marker does not delete the Detail Drawing. It is still preserved in the Navigator Project Map and can be accessed by double-clicking it there. If you need to modify its settings, add a new Detail Marker and link the drawing to it.

The Detail Drawing Window

A new Project-based Detail Drawing only contains drawing primitives, that is, lines and fills. These originate from the construction elements copied from the Floor Plan or Section/Elevation.

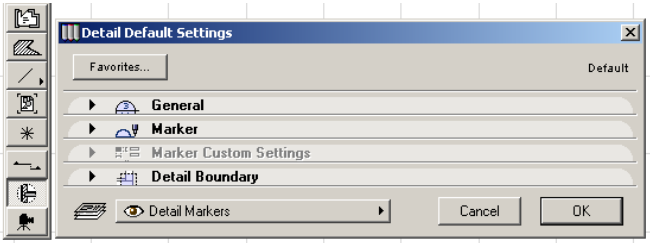
All types of 2D information can be added to the Detail Drawing: Lines, Fills, Hotspots, Text, Figures, Dimensions and 2D Symbols of Objects.

The contents of the Project-based Detail Drawing window can be regenerated by choosing Display/Rebuild Detail Drawing. Manually added data will be preserved, while the elements originating from the Floor Plan or Section/Elevation window will return to their original state.

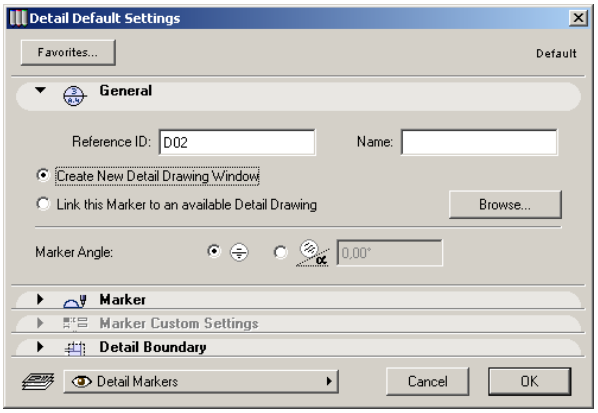
Section Details reveal the elevation of the original construction, which means the Elevation Dimensioning on Details Drawings shows correct elevation values, unless you displace drawing elements vertically.

Detail Tool and Settings

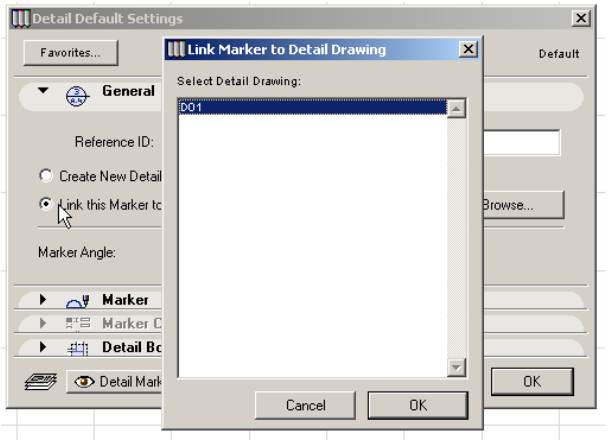
Double-clicking the Detail tool opens the Detail Settings dialog box which has four panels: General, Marker, Marker Custom Settings and Detail Boundary.



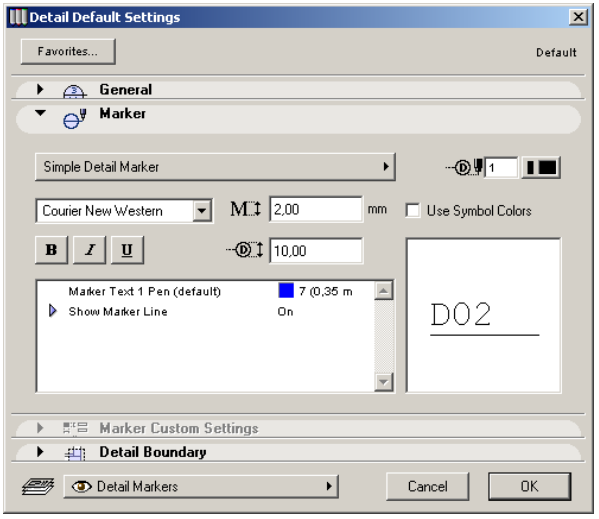
The **General** panel contains the identification of the Detail Marker and its placement angle.



- If you choose to create a new Detail Drawing when placing the Detail Marker, the Reference ID and Name fields are editable.
- If you wish to link the new Detail Marker to a previously created Detail Drawing, both of the identification fields are grayed. Clicking the **Browse...** button opens a dialog box in which you can choose among available Detail Drawings.



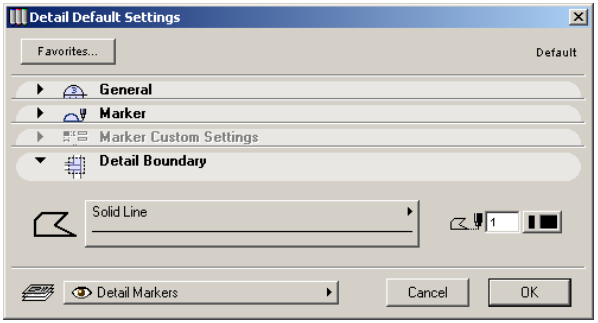
Note: By selecting a Detail Marker and opening its settings dialog box, you can change the Detail Drawing it is linked to, but you cannot change the ID and Name of the Detail Drawing here. You can only do this in the Navigator palette's Project Map.



The **Marker** panel contains controls for the Detail Marker's 2D Symbol. On the right, a preview area shows you how the Marker will look when placed. Detail Markers are parametric GDL Objects. If you have chosen a Marker in the pop-up on top of the panel, any number of parameters can appear next to the preview.

Parametric Markers can include additional options displayed on the **Marker Custom Settings** panel. If using a marker without additional options, this panel is not accessible. *See the Windows and Doors section for details.*

The **Detail Boundary** panel includes a Line Type and Pen Color setting for the frame of the Detail area.

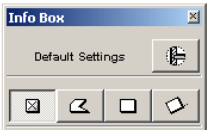


The Detail Boundary can be hidden in Display Options, as seen at the beginning of this section. However, the Detail Boundary is never present on printouts. Printable frames are available with the Detail Marker objects.

If you change a boundary of a detail, the markers linked to the same detail drawing can be updated in the Navigator. For updating markers, use the Update Detail Markers command in the context menu of a Detail folder in the Navigator Project Map or in the context menu of a Detail Clone in your View Sets.

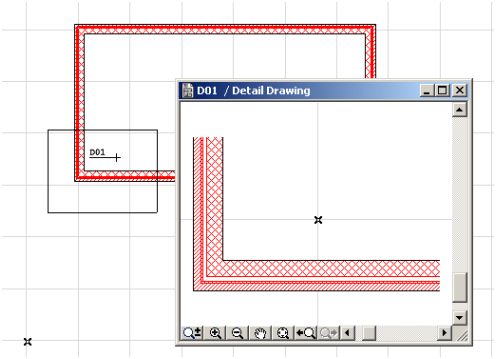
Creating Details

In the Info Box, there are four options for drawing Detail Markers.



When choosing the first icon, you can only place a Detail Marker without defining a detail boundary. If you have specified a Detail Drawing to attach before placing the Marker, it will be linked to it. Clicking in the Floor Plan or the Section/Elevation Window will place the Detail Marker with the settings you made in the Detail Settings dialog box.

When choosing one of the other three icons, you will create a Project-based detail by defining an area around the Detail Marker. Provided that you have chosen the Create New Detail Drawing Window option in the Detail Settings dialog box, the Polygonal, Rectangular or Rotated Rectangular area you draw will be copied into the new Drawing Detail window, together with the 2D-only duplicates of any element that is inside that area.



Cameras

Definition

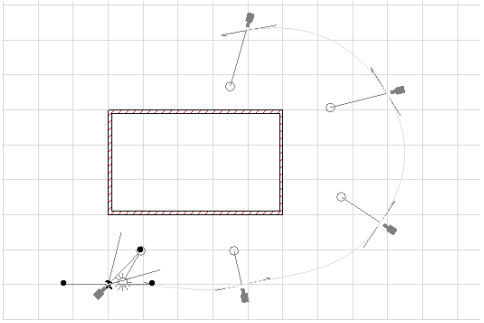
In addition to the default 3D views built into ArchiCAD, you can place any number of Cameras in the Floor Plan for generating perspective views in still image or animation (fly-

through) format as well as Virtual Reality panoramic scenes, a path for VR scenes and navigable VR object movies.

Note: You can find additional information on 3D related functions in the 3D Image Setup and Navigator sections of *Chapter 3: Project Organization and Navigation* and the Image menu section of *Chapter 11: Menu Command Reference*.

There are three types of **Cameras** available from either the Camera Settings dialog box or the Info Box: Perspective Cameras, VR Objects, and VR Scenes.

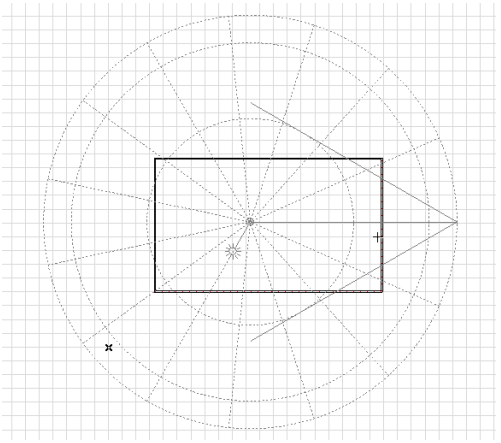
- Perspective **Cameras** are defined by a viewpoint, a target point and an opening angle. They generate images directly viewed in the 3D Window.



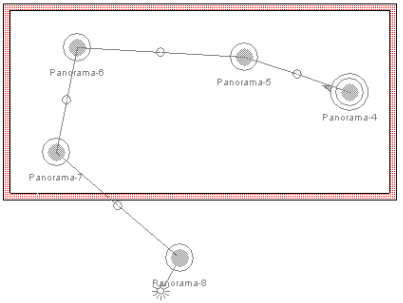
On the Floor Plan, all Cameras are shown with their target points and the handles that can be used to manipulate them. Only one camera is active at a time, as indicated by the sun and view angle markers.

The Display Options of perspective Cameras can be set with a pop-up menu in the Path Options dialog box accessed from Camera Settings. You can hide the Cameras altogether, show the Cameras with or without the Path line and with or without the in-between frames. You can also modify Cameras with the 3D Navigation palette and the Navigator and Navigator Preview palettes.

- **VR Objects** are navigable objects taking advantage of Apple's QTVR technology. They are defined by a spherical path along which the viewpoint can be positioned and navigated. This viewpoint is represented by a view cone. The navigable object can be viewed in Apple's QTVR Player application.



- Panoramic cameras define navigable **VR Scenes** using the QTVR or RealSpace technology. You place one or a series of cylindrical panoramas to be viewed in the corresponding player application. *For more information on these technologies, see the More Information section of Chapter 4: Element Creation in ArchiCAD Help.*



Only one type of Camera can be displayed at a time. Switching to another type in the Info Box, the Camera Settings palette or the Navigator palette automatically hides all the Cameras of the other two types.

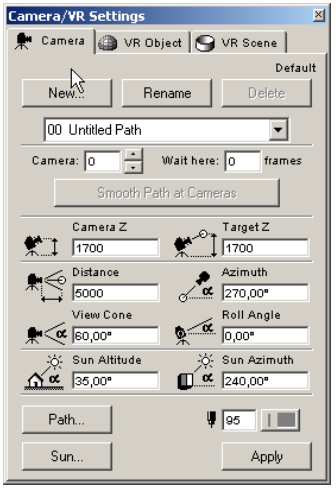
The Camera/VR Tool and Settings

The Camera icon is located at the bottom of the Toolbox. Double-clicking it will open the **Camera Settings** dialog box. The contents of this dialog box differ for the three types of Cameras, but most of the settings are identical or similar.

This palette and the Floor Plan are simultaneously active, so you can alter the settings, the camera locations and orientations without repeatedly opening and closing the window.

Perspective Cameras

When the perspective Camera type is active, the **Camera Settings** dialog box allows you to make settings for the default and selected Cameras, create and modify Fly-Through paths, and set a number of other parameters.



Under the Camera type tabs, a number of controls allow you to define and modify Fly-Through paths.

Every new Project has a default path named **00: Untitled Path** where the first cameras you place will reside. You can rename this set at will.

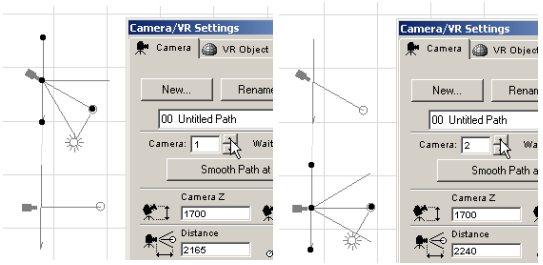
If there is more than one Fly-Through path in your Project, you can switch to any of them by using the path name pop-up list or the Navigator palette.

You can start a new collection of 3D projections by clicking the **New...** button. In the **Add New Path** dialog box you can type a name for the new path. The checkbox option lets you duplicate the current set when you define a new one. This allows you to keep an original while modifying a copy under a different name.

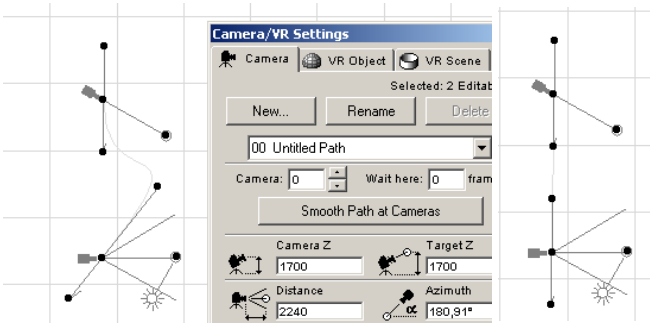
You can change the name of an existing Fly-Through path by selecting it in the path list pop-up menu and clicking the **Rename** button. Type the new name in the dialog box and click **OK**.

To delete the current set of projections, click the **Delete** button. You will then be prompted to confirm this action. If you do, the path name will be removed from the list and all the cameras it contains will be deleted. If there is a single path remaining, you cannot delete it.

The two numeric edit fields below the path name contain the sequential number of the Camera inside the current path and the number of time units (frames) during which the fly-through motion will remain frozen (i.e., "Wait here") at the given camera before moving on to the next one. You can navigate among the cameras of the current Fly-Through path by using the arrows beside the Camera number.



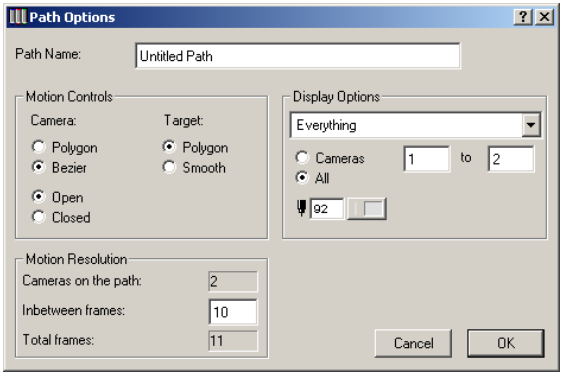
Below these two fields, the **Smooth Path at Cameras** button allows you to smooth the Bézier camera path at selected Cameras on the Floor Plan. This will restore the tangent line defining the path to its original condition if you have previously modified it.



Using the six boxes in the middle section of the dialog box you can enter parameter values numerically for viewpoint height, viewing distance, view cone, azimuth, roll angle and target height of the selected camera. Just below them, two further edit boxes allow you to define the sun angle's parameters.

You can a choose a Pen color for the Camera in the bottom right section of the dialog box. (To modify the color of the path line, see **Path Options** below.)

The Path... button opens the **Path Options** dialog box. Here you can define or modify the name of the current Path, set Motion Controls and Display Options for it, and choose a Pen Color for showing the path line on the Floor Plan.



The two **Camera** options define the shape of the camera path during the Fly-Through animation as follows:

- Choose either **Bézier** or **Polygon** to control the method used to create the path of the Camera. Bézier produces a very smooth camera movement, while Polygon paths are somewhat jumpier.
- **Open** or **closed** Camera motion controls whether a path will be completed (closed) from the last defined keyframe back to the first keyframe in the Path List.

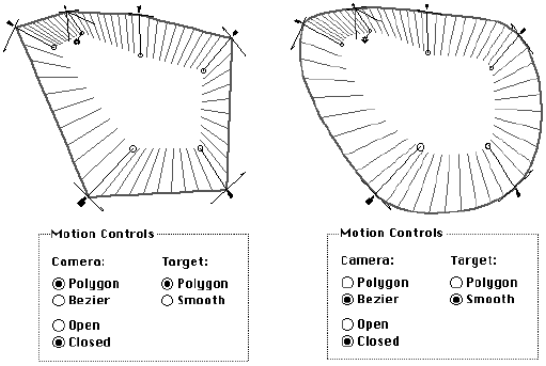
The **Target** option defines the target point path shape during the Fly-Through animation.

- If you choose **Polygon**, the target points of the in-between frames will be placed on the straight line that connects two consecutive target points. Choosing **Smooth** will make the path of the target points rounded, but it will always include the originally set target points in the keyframes. (Smooth is available only if you have specified Bézier for the camera motion.)

  Hint: Use Polygon target motion if your camera moves a lot but the target stands stills or moves just a little. This is the case when you fly around a building but keep the

same spot in sight. In other cases, try both methods to see which one suits you better.

The following two pictures show you examples of different Motion Control settings:

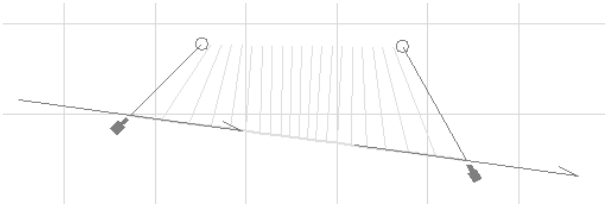


Motion Resolution: Each 3D Projection you add to the path is considered a keyframe. ArchiCAD can interpolate between keyframes to create In-between views which produce a smoother animation.

Increasing the number of In-between frames increases the smoothness of the apparent motion in the fly-through, but these additional images require more time to create and more disk capacity to store.

In the **Display Options** pop-up menu you can select from among four choices which aspects of the current Path you want to see on the Floor Plan.

If you choose **Everything**, the location of the in-between frames will also be shown.



Note: Since Cameras cannot be assigned to Layers, choosing None in Display Options here is the only way you can hide them on the Floor Plan.

The **Cameras** and **All** radio buttons allow you to specify a range of keyframe numbers to be displayed, or indicate that all the frames in the Projection path should be displayed. This setting will be used as a default in the **Create Fly-Through** dialog box, so that only the visible part of the path will be processed.

The **Sun** dialog box can be opened by clicking this button at the bottom of the **Camera Settings** dialog box. *See the Create Sun Study command description (Image menu) in Chapter 11.*

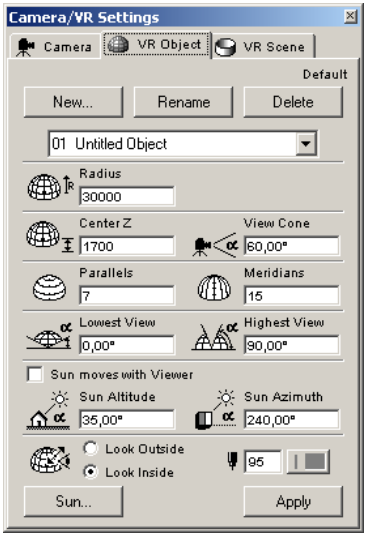
- To apply the settings made both to the Camera and the Path, click the **Apply** button bottom right of the dialog box. You do not need to close the dialog box to see your changes appear.
- To apply the view defined by a Camera on the 3D model, select the camera and activate the 3D Window.

  Note: If multiple cameras are selected, the last selected one will be applied.

VR Object Settings

Below the **New**, **Rename** and **Delete** buttons, you can find a pop-up list containing the names of available VR Objects. Each new Project has a default VR Object named **01 Untitled Object** whose name will be used for the first VR Camera you place.

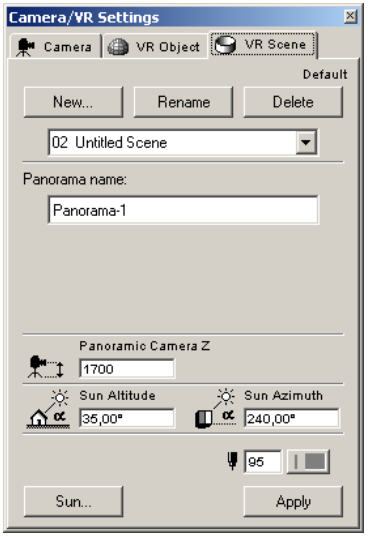
Using the edit boxes in the middle section of the **Camera/VR Settings** dialog box, you can enter parameter values numerically for object radius, center height, view cone, number of parallels and meridians, start and end angles of default or selected VR Objects.



- The more parallels and meridians you define for the object, the higher the resolution will be.
- With the Lowest View and Highest View values you can define a full sphere, a hemisphere or a particular section of a sphere for navigation.
- Checking the Sun Moves with Viewer checkbox will always define the Sun's position relative to the current viewpoint.
- Two radio buttons near the bottom of the dialog box allow you to define whether the viewing direction will point to or away from the center of the object.

VR Scene Settings

Below the **New**, **Rename** and **Delete** buttons, you can find a pop-up list containing the names of available VR Scenes. Each new Project has a default VR Scene named **01 Untitled Scene** whose name will be used for the first series of VR Cameras you place.



You can use enter parameter values numerically for the viewpoint height and the sun position for the selected camera.

Note: Only the VR Cameras belonging to the Scene currently selected in the dialog box will appear on the Floor Plan.

Placing Cameras

Placing a Perspective Camera

When you have made your choices in the Camera Settings dialog box, you are ready to place Cameras on the Floor Plan.

Your first click on the Floor Plan defines the location of the Camera itself. Draw a rubberband line to set the view direction, and click again to define the target's horizontal position. When the operation is completed, the sun icon appears with default settings.

Camera Settings and 3D Settings

Once applied to the 3D Window, the parameters of the perspective defined by the camera will be copied into the **3D Projection Settings** dialog box and the Navigator and Navigator preview palettes. However, modifying the view there will be effective *in the 3D Window only* and will **not** modify the Camera on the Floor Plan. To change the Camera, you must edit it on the Floor Plan and activate the 3D Window again when finished.

Defining perspectives in the **3D Projection Settings** is useful for:

- quickly switching to a perspective without having to change windows, or
- showing Library Parts in perspective (you cannot define Cameras when working with a Library Part).

See also 3D Image Setup in Chapter 3: Project Organization and Navigation.

Defining Fly-Throughs

Placing several Cameras defines a Fly-Through path whose parameters you can adjust in the Path Options dialog box (opened from the Camera Settings dialog box or the Navigator palette.)

Only one camera will be active at a time. This is the only camera displayed with its sun and view angle markers. The active camera is always the one that was last placed, unless you select another one. Any cameras placed on the Floor Plan will be attached to the current Fly-Through path after the active camera.

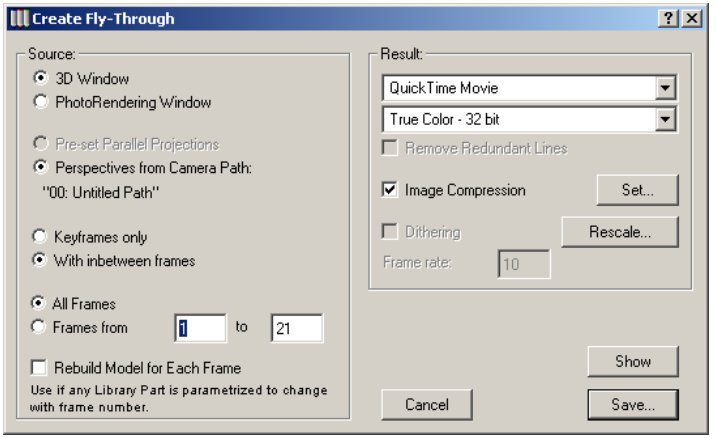
Note: Collections of 3D parallel projections can also be linked to create a Fly-Through, but these are handled differently from perspectives. Only a single set of parallel projections can exist, and you edit it in the **3D Projection Settings/Parallel Projections** dialog box, and not through the **Camera Settings**. Also, since the viewpoint distance is infinite for parallel projections, you cannot display them on the Floor Plan Worksheet.

If the simple Camera is selected in the **Camera Settings** dialog box, “Fly-Through” is added to the name of the Create command in the Image menu.

The **Create Fly-Through** command creates a series of normal or PhotoRendered 3D pictures defined by the parallel projection set or the current camera path. You can either have the resulting animation shown immediately on screen, or save these pictures in the desired file format and show them in the future using the PlayBack utility provided with ArchiCAD. This utility makes it possible to view a movie of your Project without having ArchiCAD installed or running.

In order to choose the **Create Fly-Through** command you must have at least one Preset Parallel Projection or an animation path with at least two Cameras.

The two main parts of the appearing dialog box allow you to set the source and results of the Fly-Through.



In the Source section, you can choose whether you want to use ordinary 3D views of your Project with settings from the **3D Window Settings** dialog box and the mode (Wireframe,

etc.) selected in the **Image** menu, or to create PhotoRendered images for the Fly-Through.

You can define the route of the Fly-Through either from the **Pre-set Parallel Projections** or from the current **Camera Path**.

By checking the **Rebuild Model for Each Frame** option you can create additional animation effects, provided that you have placed in your project any Library Parts whose appearance changes with every frame. You can learn how to achieve this by using the appropriate GDL Global variable. *See GDL Reference Manual.*

See also Presets under 3D Image Setup in Chapter 3: Project Organization and Navigation.

In the lower part of the Source section, you can decide whether you want to use only the keyframes of the chosen projection set, or the in-between frames as well, and specify whether the Fly-Through should contain all frames from the set, or only some of them.

Result: With the pull-down menus you can define the format and the number of colors for the saved pictures.

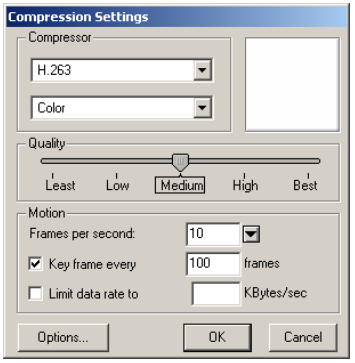
Output formats include still pictures such as PICT (MacOS) and BMP (Windows) as well as animations, for example QuickTime Movie and Video for Windows (AVI). Additional external formats may also be available.

In addition, you can:

- **Remove Redundant Lines** from Parallel Projections.
- **Compress** output files.
- Refine the views' appearance using **Dithering**.

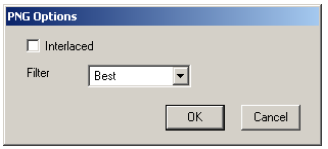
When using the QuickTime compression methods, check the Image Compression box to make the movie file's size smaller. On the MacOS, Apple Animation is recommended.

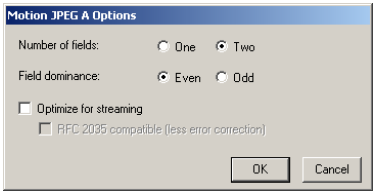
Some output formats support image compression. Related options can be defined in the dialog box that opens when you click the **Set...** button.



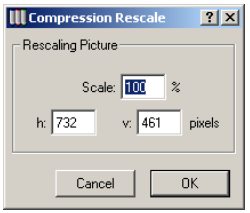
Specify the compression method and colors with the pull-down menus at the top of the dialog box.

- For some methods the color choices will be restricted to Color or Grayscale.
- The **Motion** controls will be enabled or disabled according to the choices available for the given method.
- The **Options** button is only active if the chosen method offers additional possibilities. Some of these are shown below.





By clicking the **Rescale** button, you can modify the scale of the compressed images.



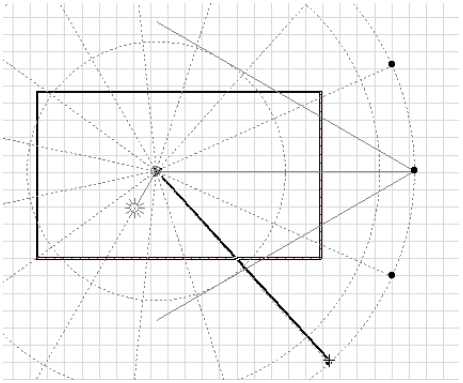
Click the **Show** button to have the Fly-Through processed and immediately displayed on your screen. You can save the resulting animation afterwards as described above.

Defining a VR Object and Creating a VR Object Movie

First, select VR Object in either the Camera Settings palette or the Info Box. You will also see that "VR Object Movie" is added to the **Create...** command name in the Image menu.

With a single click on the Floor Plan you can place a VR Object camera with default parameters. Further clicks on the Floor Plan will not create new cameras; you can only have one camera active at a time.

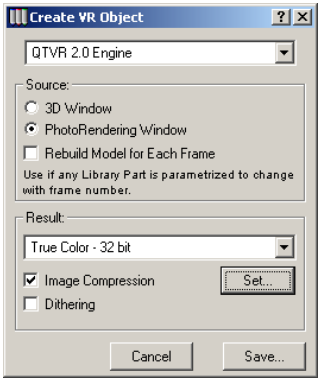
If the VR Object is selected and you go to the 3D Window, you can check its perspective elevation view from the viewpoint indicated by the view cone. To modify the location of the view cone, select it with the Camera tool active, drag its node and position it onto another node of the object.



Choosing **Create VR Object Movie** will open a dialog box where you can set a few options for creating a navigable object.

The Source and Result areas offer the same choices as for the Fly-Through, but output options are restricted to QTVR.

> **Note:** Apple and Graphisoft recommend using the Cinepack compression method.

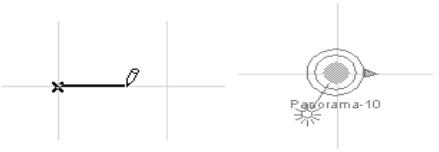


Clicking **Save...** in the dialog box will prompt you to name your navigable object file. All the 3D data you need will be exported into this new format. You can view the result by launching QTVR Player.

You may need to change the position of the VR Object. You can be manipulate it using the cursor or the **Drag**, **Mirror** or **Rotate** commands in the **Edit** menu. If the **Camera** tool is active, you can reposition any of the selection nodes to change the object's 2D position. The sun and the camera can be repositioned by their respective selection nodes.

Placing Panoramic Cameras for the VR Scene

The first click on the floor plan places a panoramic camera. You draw a rubberband line, and the second click defines the view direction. This camera will define your starting position and view direction in the VR Scene. When the operation is completed, the name of the panorama and the sun icon appear with default settings.

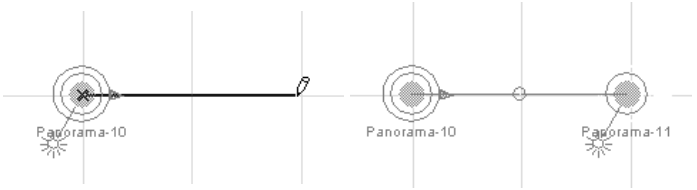


If you do not add more cameras to the current scene, you can generate a single node QTVR Scene.

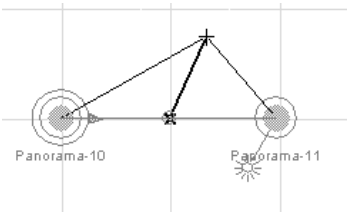
Placing several panoramic cameras defines a multi-node VR Scene. One of the cameras will be active at a time. This is the only camera displayed with its sun marker. The active camera is always the one which was last placed, unless you select another one. Each panoramic camera is assigned the name Panorama-x (x is the camera's sequence number) by default. The name can be changed in the **Panorama name** field in the middle section of the Camera Settings dialog window.

Each position has to be connected to at least one other, otherwise a warning will prompt you to do so when you try to generate the VR Scene using the **Create VR Scene...** command in the **Image** menu. The connections will define how you can change your position in the final VR Scene.

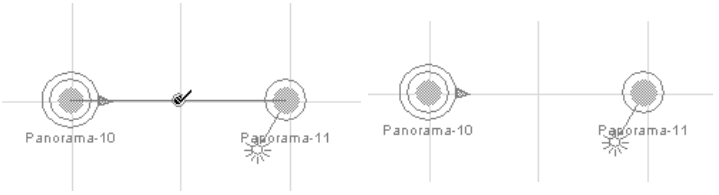
The connecting line between two positions can be drawn when you place a panoramic camera or after some unconnected cameras have already been placed. To place a new camera connected to another one, always start drawing it by clicking the center node of the camera you want it to be connected to. The second click will define the position of the new panoramic camera.



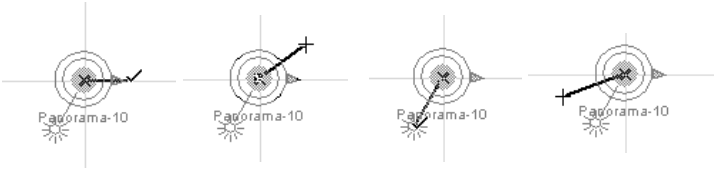
You can insert a break in a connection line by pulling its center node (defined by a circle) with the **Checkmark** cursor while the **Camera** tool is active. This allows you to define a connection that makes sense between two positions, for instance on opposite sides of a wall. Instead of jumping through the wall, you can then go to the next position through a door, without having to place an extra Camera at the opening.



Any connection can be cleared by selecting it by its center node and deleting it.



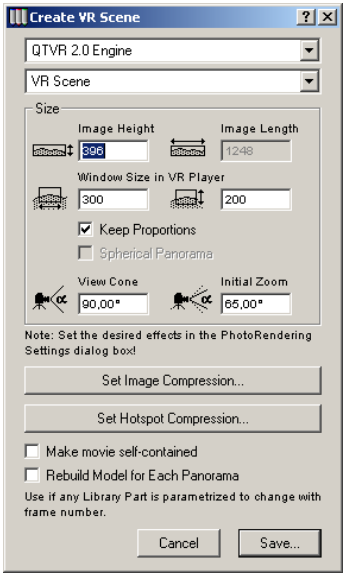
The view direction and the sun position can be changed by moving their nodes with the Checkmark cursor while the Camera tool is selected.



To define another node as the initial node, just select it (with the **Camera Tool** active) and drag the circle representing the starting position on top of another node's centerpoint.

If the **VR Scene** option is selected in the **Camera Settings** dialog box, "VR Scene" is added to the **Create...** command name.

Choosing the command will open a dialog box where you can set a few options for creating panoramas or pictures that you can then view in the appropriate player applications.



With the View Cone, you can define the camera's viewing angle, within which you can create an initial zoom factor as the default setting for the panoramic view. This initial zoom factor cannot be greater than the View Cone.

Three options are available for creating VR panoramic scenes.

- Choosing **Scene** (default) will allow you to save all the panoramas defined on the Floor Plan, together with a control file containing the navigation data. To properly view the scene in QTVR Player, you need to open this control file.
- Choosing **Panoramas** will allow you to save the panoramas defined on the Floor Plan without a control file. You can view any of the panoramas in QTVR Player individually, but you will not be able to navigate between them.
- Choosing **Pictures** will allow you to save pictures of your panoramas that you can then edit as bitmap images. These files cannot be viewed in QTVR Player. After editing the files (modifying the background, adding extra elements), you must use Apple's QTVR tools in order to manually create a file viewable in QTVR Player.

You can also set the image height and length as well as the Window size in QTVR Player (all measured in pixels). Checking the **Keep proportions** box will ensure that your image is not distorted.

Index

3D Navigation Palette 22, 48
3D Picture Windows 14
3D Projection Settings
~ command (Image menu) 42
3D View
Elements that will appear in ~ 46
3D View Modes 47
3D Window 12
navigation in the ~ 49

A

Absolute coordinates 28
Accessories 159
Active Layer
~ command (Options/Layers) 41
Actual Size
~ command (Display menu) 18
Add New Path
~ dialog box for Fly-Throughs 221
Add-Ons 16
Additional Palettes 23
Ambient Light
~ in 3D view 45
Angle Dimension Settings 184
Angle Dimensions 181
drawing ~ 193
Animation 44
~ Controls 51
Compressing ~ files 226
Annotation Elements 179
Apple's QTVR tools 229
ArchiCAD Layer 40
ArchiCAD Palettes 19
ArchiCAD Windows 12
Arcs 164
drawing circular ~ 166
drawing elliptical ~ 166
Area measurement 170
Arrowheads
~ & Scaling 26
Auto ID Increase 64
Automatic Dimensioning
~ command (Tools menu) 191
Automatic Zone Recognition 202
Autosave 37
Auxiliary Grid 30
Auxiliary Windows 15
Axonometric Views 43
navigation in ~ 50

B

Background
~ color 31
Barrel Vaulted Roof
drawing ~ 96
restrictions 96
Beams
~ & Walls/Columns 87
definition 82
drawing ~ 85
geometry 85
joining ~ 86
Bézier path
~ for Fly-Through 222
Bézier Splines 168
Block
~ command (Image menu) 47
Blocking
placing ~ 150
BMP
fly-throughs saved as ~ files 226
Bottom view 43

C

Camera Settings 221
Applying ~ 223
Camera tool
~ and Perspectives 43
Cameras 219, 225
~ types 220
Checking the View in 3D 223
display options 223
parameters 222
placing options 224
Target 222
viewpoint 222
Cartesian coordinates 28
Chain icon 127
Cinepack
~ compression method for QTVR Objects 227
Circles 164
drawing ~ 166
Circular Columns 80
Clean Wall Intersections
~ command (Options menu) 74, 122
Clear from Story 36
Clearing Elements in Section/Elevation Windows 211
Collar Beam
placing ~ 151
Columns 77
~ & composite Walls 80, 81
~ & Walls 80
3D views 81
drawing ~ 79
Roof trimming 100
Complex Roofs
drawing ~ 94
levels 95
Component List
~ window 15

Composite Walls 121
~ & Columns 80, 81
smart T connection of ~ 75
Construction Elements 61
Construction Grid 29, 30
snapping to ~ 32
Construction Tools 62
Construction Windows 12
Context Menus 23
Control Box 19
Cursor Snap Variants 19
Magic Wand 19
Relative Construction Methods 19
Snap On icon 32
Special Snap Points 19
Suspend Groups switch 19
Control File
~ for QTVR Scenes 229
Coordinate Box 19, 28
Elevation Values 32
Value Fields 28
Coordinate System
origin 27
Copies
creating multiple ~ of elements 110
Copy
~ from Story 36
Corner Windows 124
Create Fly-Through
~ command (Image menu) 225
Create VR Object Movie
~ command (Image menu) 227
Create VR Scene
~ command (Image menu) 228
Curved Elements
dimensioning ~ 186
Curved Walls
drawing ~ 69
Curves
approximation of ~ 108
Customized Axonometrics 44
Cut from Story 36

D

Dashed Lines
~ & Scaling 26
Deleting a Fly-Through Path 221
Detail Drawing 217
~ window 14, 217
creating ~ 219
rebuilding a ~ 18
Detail Marker 217
Dimension Settings 182
Dimension Text Settings
~ dialog box 185
Dimensioning Standards 181
Dimensions 26, 179
associative ~ in Sections/Elevations 194
associativity 180
automatic exterior ~ 191
automatic interior ~ 192
Canceling and confirming 186
chain components 179
Construction Methods 185
Deleting chain elements 189
dimension points 179
Editing a chain 188
Inserting chain elements 188
manual changes to ~ text 194
Markers 183
Merging chain elements 189
Overlapping Points 186
Pens 184
placing ~ 185
reference points 179, 186
Setting the Witness Line Length Manually 189
static ~ 183
units 179
values 179
Wall Thickness 188
DIN
dimension standard 181
Display bar 16
Displaying and Refreshing Views 16
Dome Roof
~ settings 95
drawing a ~ 95
strips and segments 96
Doors 117
Parameters 119
Doors/Windows
Construction Methods 124
contours in 2D 120
dislocated ~ 123
head depth 121
jamb depth 121
locations of ~ 122
Nominal Dimensions 119
orienting ~ 123
reveal depth 121
sill width 118
sill/threshold depth 121
Surface Materials 120
Drag a Copy 109
Drawing
~ type Section/Elevation 13
Drawing Elements 164
Drawing Hotspots 177

E

Eaves Purlins
placing ~ 150
Edit Mode
~ in 3D Navigation palette 48
Editing-Motion controls
~ in 3D Navigation Palette 48
Element Creation 61
Element Duplicates 109
Element Information Palette 23
Element Lists 15
Elevation
~ and Stories 34
~ and the 3D Window 34
~ values in Coordinate Box 32
~ values in the Info Box 33
Elevation Dimensions
placing ~ 187
Elevations 210
Ellipses
drawing ~ 166

F

Favorites
~ palette 23, 112
Figure Settings 175
Figures 175
copying ~ from the Model Picture window 14
placing ~ 177
Fill Settings 170
Fill Types
~ command (Options menu) 26
Link ~ to Project Origin 172
Fills 169, 170
adding Area Text 172
bitmap patterns 170
drawing ~ 171
framing options 170
orientation 170
Symbol ~ & Scaling 26
vectorial hatches 170
Finishes 159
Fit in Window
~ command (Display menu) 17
Fixed Size Elements 26
Floor Plan Scale
~ command (Options menu) 25
Floor Plan Window 12
Fly-Through 225
defining ~ 225
options 45
output formats 226
path 219
Viewing ~ on Screen 227
Fog 45
Freehand splines 168

G

Gable Walls 74
GDL Objects
~ types 115
Ghost Story
definition 36
printing ~ 37
Go Down a Story
~ command (Options/Stories) 37
Go To Story...
~ command (Options/Stories) 38
Go Up a Story
~ command (Options/Stories) 37
Gravity 33
Greek Text 173
Grid Display
~ command (Options menu) 30, 32
Grid Snap 32
Enabling ~ 32
Grids 29
Controlling the ~ 32
Defining the ~ 29
Disabling the ~ 32
skewed ~ 31
Grids & Background
~ command (Options menu) 29

H

Height
~ of a Dome Roof 95
Hidden Line
~ command (Image menu) 48
Hip Rafters
placing ~ 148
Holes
~ in Polygons 90
defining ~ in Beams 85
Home Zoom
~ command (Display menu) 18
Hotspot Settings 177
Hotspots 177, 178

I

ID Numbers
internal unique ~ 64
Imperial Unit Display
~ of Dimensions 182
Independent Labels 205
Info Box 20, 211
Interior Wizard 162

J

Jamb depth 121

L

Label Settings 206
Labels 205, 206
associative ~ 205
definition 205
Independent Label Orientation 208
placing associative ~ 209
placing independent ~ 209
pointer properties 207
symbols 205
Text Direction 209
Text style 207
Lamps 126
brightness 128
color 128
Geometry Methods 129
Parameters 127
Layer Combinations 40
Layer Settings…
command 39
Layers
~ command (Options menu) 38
definition 38
locking/unlocking ~ 39
showing & hiding ~ 39, 41
Level Dimension Settings 184
Level Dimensions
definition 180
drawing ~ 192
editing text 193
Markers 184
placing options on Slab or Roof 192
selecting ~ 193
Library Parts
trimming ~ to Roofs 100
Light
~ direction in 3D 43

Line Types
~ command (Options menu) 26
~ for Doors/Windows 120
~ of Meshes 102
Linear Construction Method
~ for Dimensions 185
Lines 164
drawing ~ 166
drawing chained ~ 169
Symbol ~ & Scaling 26
List Zones
~ command (Calculate menu) 197
Listing
~ type windows 15
Location of the Project
geographic ~ 46
Log Walls 73
Look to button
~ in 3D Navigation Palette 50
Low Ceiling Reduction
~ for Zones 204

M

Magic Wand 106
Magic Wand Settings
~ command (Tools menu) 108
Mark-Up Palette 23
Marker size 184
Marquee
~ and 3D views 47
Materials
GDL description 120
Menubar 23
Merge
dimension chains 189
Mesh Point Height
~ dialog box 104
Mesh Settings
~ dialog box 102
Meshes 102
adding new points 105
basis plane and ridges 102
drawing ~ 104
Elevation 102
Line Types 102
Model Attributes 103
Pen Colors 103
placing elements on ~ 33
Polygon Geometry Method 104
Regular Sloped Geometry Method 104
Rotated Geometry Method 104
Rotated Rectangle Geometry Method 104
User Defined Ridges 102
Mirroring
~ a Copy 109
~ Objects 128
Model
~ type Section/Elevation 13
Model Pictures
copying from the ~ window 14
Modify Wall
~ command (Tools menu) 76
More Sun
~ dialog box (Image/3D Projection Settings) 45
Motion Modes
~ in Axonometric Views 50
~ in Perspective Views 49
Motion Resolution
~ for Fly-Throughs 223
Motion Tools
~ in 3D Navigation palette 48
~ in Perspective Views 49
Multiply
~ command (Edit menu) 110
Options 110
Vertical Displacement 111

N

Natural Splines 168
Navigator 22
Navigator Preview 22
Next Zoom
~ command (Display menu) 18

O

Object Settings
~ dialog box 126
Objects 126
Geometry Methods 129
hotspots 129
linking horizontal and vertical values 127
Parameters 127
parametric ~ 115
placing ~ 128
positioning handle 127
primary hotspot 127
scaling ~ 26
Orientation
~ of the Project 46
Origin 27
~ indicator 27
Edit ~ 27
Project ~ 27
User ~ 27
Overlapping Elements 112

P

Palettes 19
Pan
~ command (Display menu) 17
Parallel Projection Points 178
Parallel Projection Settings
~ dialog box (Image/3D Projection Settings) 43
Parallel Projections 225
recording ~ 44
set to current projection 44
Parameter Transfer 112
Parameters
~ of Doors/Windows 119
~ of Objects/Lamps 127
Pencolors
~ for Dimensions 184
~ for Doors/Windows 120
~ for Meshes 103
Perpendicular Projection Points 178

Perspective Settings
~ dialog box (Image/3D Projection Settings) 42
Perspectives 219, 224
editing ~ 42
navigation in ~ views 49
one-point ~ 43
three point ~ 43
two-point ~ 43
Pet Palette 23
PICT
fly-through saved as ~ files 226
Pivot Line
~ of Roofs 94
Placing a Panoramic Camera 227
Plate Beams
placing ~ 150
PlayBack 225
Polar Coordinates 28
Polygon paths
~ for Fly-Throughs 222
Polygonal Walls 72
PolyLines 164
Polyroof Settings
~ dialog box 94
PolyWall Corners 75
PolyWalls 71
Pre-Sets
Adding the current Projection 44
projection ~ 44
Presentation Elements 210
Preset Zooms 17
Preview
~ of perspectives 42
Previous Zoom
~ command (Display menu) 18
Project Notes
~ window 16
Project Origin 27
resetting the ~ 28
Project Preview
~ Window 16
Project Zero Level
placing element on ~ 33
Projection Points
parallel and perpendicular ~ 178
Projection Types 43
Prompt Box 20
Purlins
placing ~ 149

Q

QTVR Player
~ application by Apple 220, 227
Quick Layers 23
QuickTime
compression methods 226
fly-throughs saved as ~ movies 226

R

Radial Dimensions 180
Construction Methods 183
drawing ~ 192
Label Orientation 183
Rafters
placing ~ 146
Rebuild
~ command (Display menu) 18
Rebuild All Models
~ command (Display menu) 19
Rebuild Model
~ command (Display menu) 18, 211
Rebuilding the 3D Window 18
Rectangle Walls 72
Redraw
~ command (Display menu) 18
Redrawing or Rebuilding a View 18
Reference Line
~ of Walls 74
moving a wall's ~ 76
Refreshing the screen 18
Relative Coordinate Values 28
Remote Intersections
Section points on ~ 178
Remote Roofs
Trimming Walls with ~ 101
Remote Tangential Points 178
Report Window 16
Reset
~ in 3D Navigation palette 50
Restoring a Wall/Column after Trimming 100
Ridges
~ of meshes 102
Right-Angle Columns 80
Roof Accessories 160
Roof Edges
trimming ~ 96
Roof Level Lines
~ command (Tools/Line Extras) 99
Roof Wizard 152
RoofMaker 146
~ Toolbox 154
Roofs 91
3D Intersections 98
drawing ~ 93
drawing a Barrel-Vaulted ~ in 3D 97
drawing a simple ~ in 3D 94
holes in ~ 99
placing elements on ~ 33
trimming construction elements to ~ 99
Rotate
~ a Copy 109
~ Zone Stamp 198
Rotated Columns 80
Rotated Rectangle Walls 72

S

Scale
~ & output 25
~ button 25
architectural ~ 25
Changing ~ 26
Drawing ~ 25
Output ~ 26
Scaled Elements 26

Secondary Dimensions
~ command (Tools menu) 190
Section Depth
~ in Display Options 210
adjusting ~ 216
Section Lines
Adjusting ~ 216
displaying ~ on stories 212
placing ~ 216
Section Points
~ on remote intersections 178
Section/Elevation Settings 212
Section/Elevation tool 13
Section/Elevation Windows 13, 210, 211
Drawing type 211
Model type 211
naming ~ 212
types 13
Sections 210
Sections/Elevations 210
Associative Dimensions 194
breaking ~ lines 216
displaying Section Depth 210
Font & size 213
Section Pens 214
vectorial 3D hatches 215
vectorial sun shadows in ~ 215
Vertical Range 212
Selection
Element Types for 3D Imaging 47
Selections Palette 23
Set City
dialog box (Image/3D Projection Settings) 46
Set Home Zoom
~ command (Display menu) 18
Shading
~ command (Image menu) 48
Side Views 43
Sill 121, 124
Simple Openings 123
Single Walls 69
Skewed Grid
setting up a ~ 31
Skylights 125
placing ~ 125
Slab Accessories 160
Slabs
drawing ~ 89
holes in ~ 90
Integrating ~ with Walls 90
placing elements on ~ 33
scaling 26
trim to Roof 101
Slopes 143
Smooth Path at Cameras 222
Snap Grid 29, 30
Special Zoom 17
Splines
drawing ~ 167
editing ~ 168
freehand geometry method 168
StairMaker 130
Stairs 130
creating custom ~ 144
geometry 133
placing ~ 132
railings 140
structure 137
Status Report Palette 23
Stories
~ command (Options menu) 34
Adding ~ 35
definition 34
displaying a ghost ~ 36
List of ~ 38
Numbering 35
Removing ~ 35
Selection 35
Story Settings…
~ command (Options/Stories) 35
Straight Walls 69
Sun 44, 45
~ light parameters 45
Sun Moves with Viewer
~ for QTVR Objects 224
Sun Options
~ for Fly-Throughs 223
Surveyor's unit 46
Symbol Colors 120
Symmetrical Vaulted Roofs 97

T

Target point 42
Text 174
Text Blocks 173
creating breaking ~ 175
creating non-breaking ~ 175
Justification & Anchor Point 174
placing ~ 175
scaling ~ 26
Text Settings
~ dialog box 174
Threshold 121
Tie Beams
placing ~ 152
Tool Settings Dialog Box 21
Toolbar 24
Toolbox 20
Top view
~ in perspective 43
axonometry 43
Tracing Elements in 3D 107
Tracing Method
~ for transforming curved elements 108
Trapezoid Walls 72
Trim to Roof
~ command (Edit menu) 99
Walls 100
Trim Zone
~ command (Edit menu) 197
Trimmers
placing ~ 150
Trimming Roof Edges 96
Trusses
creating ~ 154
TrussMaker 154

U

Unlink Section/Elevation
~ command (Display menu) 14, 211
Unwrapped Columns 80
Update Zones…
~ command (Tools menu) 204
US Builder
dimension standard 181
User Origin
~ button 27
~ in 3D 27
Creating a ~ 27

V

Valley Rafters
placing ~ 148
Vectorial 3D Hatching
~ in Sections/Elevations 215
Vectorial Hatches
~ & scaling 26
Vectorial Sun Shadows
~ in Sections/Elevations 215
Video for Windows
fly-through saved as ~ files 226
View Cone 42
~ for QTVR Scenes 229
Viewpoint 42
~ for Parallel Projections 44
Virtual Reality 220
VR Object Settings
~ dialog box 223
VR Objects 220, 227
defining ~ 227
Parameters 223
techniques 227
View Direction 224
VR Scene Settings
~ dialog box 224
VR Scenes 220
defining ~ 227
opening ~ in QTVR Player 229
panoramas 229
parameters 224
saving ~ as pictures 229

W

Wall & Column Subtraction
~ from Zone areas 204
Wall Accessories 161
Walls
~ & Columns 80
~ & Doors/Windows 77
~ & Roofs 77
~ & Slabs 77
connecting ~ with different hatches 74
definition 65
drawing ~ 68
drawing polygon ~ 72
geometry 68
intersections 74, 75
invert direction of ~ 77
modifying the structure of ~ 76
moving the reference line 76
scaling ~ 26
trim to Roof 100
Windows 117
Parameters 119
placing corner ~ 124
Wireframe
~ command (Image menu) 48
Witness Line
~ formats 184
Workplace
components of the ArchiCAD ~ 11
Wrapped Columns 81
Write Report
~ option in Preferences 16

Z

Zone Categories 196
~ command (Options menu) 201
creating ~ 201
defining ~ 201
Zone Fill 195
Zone Lists
~ window 15, 197
Zone Polygons
~ in Display Options 196
Zone Settings 197
Zone Shape
trimming the ~ 203
Zone Space
calculating ~ 203
Zone Stamps 195
~ in Display Options 196
default parameters 201
rotating ~ 198
Zones 195, 197
3D ~ spaces 196
Category Code 201
Category Name 201
Definition Methods 202
name and number 198
Parameters 198
Stamp Preview 199
updating zones 204
Zone Stamp 201
Zoom 16
~ in Navigator Preview 59
~ with wheelmouse 17
Zoom In
~ command (Display menu) 16
Zoom Level
~ button 18
Zoom Out
~ command (Display menu) 16
Zoom to Selection
~ command (Display menu) 17