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## **VectorWorks Fundamentals User's Guide**

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The RenderWorks Camera tool was developed by Julian Carr, OzCAD, Sydney, Australia.

The VectorWorks Fundamentals User's Guide was written and illustrated by Alexandra Duffy, Teresa Heaps, and Susan Collins.

Cover design by Kathleen Ryland.

Special thanks to Michael Huggins (Burrowes Huggins Architects, Vancouver, B.C. Canada) and to Riccardo Martire for their MasterWorks contest file submissions, which were used as the basis for a variety of illustrations.

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# Preface

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Welcome to VectorWorks® Fundamentals—a CAD program that includes all the 2D and 3D tools and technology you need in one easy-to-use, cost-effective package. In addition to precision drafting, it provides powerful tools for 3D modeling that can be used to create, present, and even manufacture designs. Built-in database and worksheet capabilities help track costs and materials. A host of import and export formats makes it easy to share files. VectorWorks Fundamentals also includes extensive symbol libraries, default drawing resources, and a built-in scripting environment that can be used to automate routine tasks.

## Installing VectorWorks Products

The VectorWorks installation program contains a Read Me file listing the installation system requirements, any known installation issues, and any information that did not make it into the user's guides by press time.

To ensure a smooth installation, read this file prior to installing VectorWorks. Confirm that system requirements are met and take note of any issues or incompatibilities. This file is available in [VectorWorks]\Release Notes\InstallationReadMe.txt for future reference.

The installation program can install VectorWorks Designer, RenderWorks, Architect, Landmark, Spotlight, Machine Design, and Fundamentals in any combination. The program determines which products to install based on the serial number.

Your software license allows for one copy to be made for backup purposes. VectorWorks should be backed up on a regular basis. These backups are invaluable in restoring user-customized settings that may be otherwise lost by either a computer failure or reinstallation of VectorWorks.

## Automatic Workspace Backup

The VectorWorks installer and updater both make backup copies of all workspaces. The installer places backup copies of workspaces in a folder entitled Original, within the [VectorWorks]\Workspaces folder. The updater places backup copies of workspaces in a sequentially-numbered folder entitled Backup, within the Workspaces folder. Each time the updater is run, another Backup folder is created. After the backup, both the installer and the updater overwrite the workspaces at the top level of the Workspaces folder.

Additionally, a file entitled Workspace Changes.rtf is provided in the Workspaces folder. It contains a list of all workspace changes for the current release, and can be used to easily identify what items need to be updated in custom workspaces. For more information on custom workspaces, see “Updating Custom Workspaces and Plug-in Objects” on page 727.

## Entering the Serial Number

During installation you are typically required to enter the serial number, which can be found on the labels inside the VectorWorks box. If you are not prompted to enter the serial number during installation, you must enter it the first time the application is accessed.

To enter the serial number(s):

1. Open the VectorWorks application.

The Serial Numbers dialog box opens the first time the application is accessed.

2. Click **Add** to add this serial number.

The Add New Serial Number dialog box opens.

3. Enter the **Serial Number** exactly as it appears on the label. The serial number is case sensitive. The letters o and i are not used in serial numbers; enter zero or one instead.
4. Click **Add**.  
The list of **Enabled Products** in the Serial Numbers dialog box displays all products enabled by this serial number.
5. Repeat steps 2 to 4 to enter additional serial numbers for additional licenses, as necessary.
6. When all serial numbers have been entered, click **Done**.

## Viewing the VectorWorks License Agreement

The VectorWorks license agreement can be viewed at any time.

To view the license agreement:

1. On Windows, select **Help > About VectorWorks**, or on Macintosh select **VectorWorks > About VectorWorks**.
2. Click **License** to display the license agreement text.
3. Click **OK** twice to return to the VectorWorks application.

## Network Protection

When running multiple copies of VectorWorks across the network, serial numbers are checked when the program is launched, and also periodically throughout the session.

If the same serial number is found to be in use, the All Serial Numbers In Use dialog box opens. From this dialog box, clicking **User Information** displays the User Name, if given, and the IP address of the other location. Clicking **Edit Numbers** allows a new serial number to be entered and an existing one to be deleted. Once the situation is resolved, click **Retry Numbers** to regain access to VectorWorks. If the serial number is still in use after three attempts, VectorWorks automatically shuts down.

## New Features

This release includes many new features and significant enhancements to VectorWorks Fundamentals, RenderWorks, and the standard workspace, as described in the following sections.

### New VectorWorks Fundamentals Features

The following table contains a list of new and improved features for this release, and indicates the section where the functionality is documented.

Feature	Purpose	Location
Context-sensitive help	The VectorWorks help system has been updated to reflect version 2008 functionality	Not applicable

Feature	Purpose	Location
Consolidated structural shapes	Structural shapes have been consolidated into eight plug-in objects for AISC (inch and metric) structural shapes; the new consolidated shapes are: angle, channel, I-beam, rectangular tubing, round tubing, square tubing, tee, and wide flange	"Migrating from Previous Versions" on page 5
Update Plug-in Objects command changes	New options allow selection of the type(s) of objects to update; select to update windows and doors, drawing borders, and/or structural shapes	"Migrating from Previous Versions" on page 5
Floating Data bar, Tool bar, and Message bar	<p>The Data bar now contains only data fields that are used to enter specific numeric values for an object. A menu on the right side of the Tool bar controls the Data bar, which can now either "float" next to the cursor in the drawing area or display in a user-specified location.</p> <p>The previous Mode bar is now called the Tool bar, and it displays only tool mode information.</p> <p>The Message bar now displays tool descriptions, minor alerts, undo text, the progress bar, and cursor location fields.</p>	"VectorWorks Standard Workspace" on page 12, "Using the 2D Data Bar" on page 183, and "Using the 3D Data Bar" on page 291
View bar improvements	The View bar replaces the Data Display bar at the top of the application window. The Zoom In/Out functions allow the entry of a zoom factor. The new Current View list provides quick access to all standard views. The Classes list and Design Layers list now appear on the View bar. The contents of the View bar can now be customized.	"The View Bar" on page 14, "Design Layer Scale" on page 51, "Zooming from the View Bar" on page 26, "Setting the Active Design Layer in the View Bar" on page 94, "Setting the Active Class in the View Bar" on page 101, "Creating or Editing Saved Views Using the Saved Views Menu" on page 107, "Using Standard Views" on page 403, "Fit to Objects" on page 418, "Fit to Page Area" on page 419, "Viewing History" on page 420, and "Rendering with VectorWorks" on page 431

Feature	Purpose	Location
New preference to enable highlighting of selected objects	A new VectorWorks preference displays selected objects with highlighted lines instead of the square handles that are used by default. Active layer objects, inactive layer objects, and locked objects can have different highlighting, so that they can be easily identified. With selection highlighting enabled, square handles display only when the selected object can be reshaped with the tool that is currently active.	"Selecting Objects" on page 28
New <b>2D Selection</b> tool mode	A new mode restricts scaling to only a single selected object	"2D Selection Tool" on page 30
Polygonal selection	The <b>2D Selection</b> and <b>3D Selection</b> tools both have a new polygonal marquee selection mode	"2D Selection Tool" on page 30 and "3D Selection Tool" on page 32
Context menus	Many more commands, and some tools, have a context menu equivalent	"Context Menus" on page 34
New preference to center on objects after view change	A new VectorWorks preference automatically centers the view on the selected objects when the view is changed to one of the standard views, such as Top or Left Isometric	"Display Preferences" on page 41
GDI+ imaging and anti-aliasing preferences	Provides layer transparency and anti-aliasing graphics capability for the Windows platform	"Display Preferences" on page 41, "Setting Design Layer Properties" on page 87, "Setting the Design Layer Opacity" on page 90, "Setting Class Properties" on page 98, and "Changing the Layer Properties of Sheet Layer Viewports" on page 623
<b>Reset Saved Settings</b> VectorWorks Preference	Provides an option to revert to default settings, rather than user-specified settings for tool modes, dialog box positions, dialog box values, and for always performing a selected action in alert dialog boxes	"Session Preferences" on page 42
Dialog box values saved	All values are now saved across application sessions for the following dialog boxes: Custom Tools, Duplicate Array, Eyedropper Preferences, Offset Tool Preferences, Paste Attributes, Purge Unused Objects, and Spelling Check Filter	"Session Preferences" on page 42

Feature	Purpose	Location
Certain dialog box values saved	<p>Certain values are now saved across application sessions for the following dialog boxes:</p> <ul style="list-style-type: none"> <li>• Chain Dimension Preferences - radio button</li> <li>• Create Batch Render Job - render mode</li> <li>• Create Symbol - radio buttons and checkboxes</li> <li>• Delete Class(es) - radio button</li> <li>• Delete Reference - radio button</li> <li>• Export Image File - export area, lock aspect ratio, resolution, file type</li> <li>• Object Info palette - Polar or Cartesian coordinate system</li> </ul>	"Session Preferences" on page 42
Dialog box positions saved	The following dialog boxes maintain their position in the drawing window across application sessions: Edit Marker List, Edit (Texture Name), Section Line Instances, Viewport Class Properties, and Viewport Layer Properties	"Session Preferences" on page 42
Alert dialog boxes can be suppressed	Thirteen operations which display an alert dialog provide an option to suppress the dialog box display in the future under similar circumstances	"Session Preferences" on page 42
Tool modes saved	Selected tool modes are now saved across application sessions	"Session Preferences" on page 42
Autosave improvements	VectorWorks autosave preferences have been moved to a new tab; new preferences allow multiple backup copies, and backup to a custom location	"Autosave Preferences" on page 45
User folders for preferences and custom content	<p>Each user can now designate a folder outside of the VectorWorks folder to hold user data and preferences, including log files, workspaces, and other customized content.</p> <p>Favorite files that are designated in the Resource Browser are now stored in the user folder. Favorites also can be placed in a workgroup folder manually for shared use. The Resource Browser has new commands to refresh the favorite files from disk, and to show the disk location of a favorite file.</p>	"User Folders Preferences" on page 46, and "Resources in Favorites" on page 148

Feature	Purpose	Location
New marker styles	Markers, formerly known as arrow heads, are much easier to create and apply. Different markers can be placed at each end of an object, and it is possible to create a wide variety of marker types.	“Setting Default Marker Types” on page 60, and “Marker Attributes” on page 233
Enhanced colors	Colors are applied with a new color palette set that can access unlimited color choices. Select colors from standard operating system colors, custom color palettes, palettes from another VectorWorks file, or color palettes that ship with VectorWorks. The color palette utility commands from previous versions are obsolete and have been removed.	“Setting Default Colors and Palettes” on page 62, and “Applying Colors” on page 229
Improved dash style creation	The process of creating default dash styles has been improved. Dash line and gap lengths can be entered directly or graphically.	“Setting the Default Dash Styles” on page 70
Grey level when printing	The gray level can be adjusted when printing grayed layers and classes	“Printing a File” on page 76
Improved layer and class creation	Layer and class names, properties, and objects can be imported from existing VectorWorks files, and new layers and classes can be edited immediately after creation	“Creating Layers” on page 85 and “Creating Classes” on page 96
Additional predefined layer scale option	The 3/8” Imperial layer scale option has been added to the Layer Scale dialog box	“Setting the Design Layer Scale” on page 88
Workgroup referencing improvements	<p>Workgroup references are now created and maintained in the new References tab of the Organization dialog box. New options check for outdated references at a specified interval, and update only references whose sources have changed (manual updates only).</p> <p>In the Design Series, design layers from other files can now be referenced with new “design layer viewports,” which are documented in the VectorWorks Design Series User’s Guide. Layer import referencing (the previous method) imports layers, resources, and classes from another file; this method is still available to both Fundamentals and Design Series users.</p> <p>If you use layer import referencing, you can choose to not save the referenced data to disk.</p>	“Workgroup Referencing” on page 111; “Layer Linking” on page 629
New default color palettes	A number of new default color palettes are now available for use	“VectorWorks Fundamentals Default Resources” on page 141

Feature	Purpose	Location
Resource Browser improvements	The Resource Browser makes it easier to display the resources of the active file and to navigate up symbol folder hierarchies; resource display settings (in Thumbnails mode) are saved between sessions	“Using the Resource Browser” on page 142
Additional predefined font size	A predefined font size of 11 points has been added for text	“Formatting Text” on page 189
New rotation modes	Rectangular objects (rectangles, rounded rectangles, and ovals) can now be rotated with new modes, and a new <b>Text</b> tool mode allows rotated text	“Creating Rotated Rectangles” on page 210, and “Creating Rotated Text” on page 187
<b>Ellipse</b> tool replacement	The <b>Ellipse</b> tool has been replaced by the <b>Circle</b> and <b>Oval</b> tools for a better separation of functionality	“Creating Circles” on page 218 and “Creating Ovals” on page 220
Object opacity	The opacity of objects can be set as an attribute or by class, expanding the presentation capabilities of VectorWorks	“Opacity Attributes” on page 231, and “Setting Class Properties” on page 98
Reusing images from image-based resources	If a resource with an image is present in the file, new image-based resources can reuse the image. This applies to image fills, and for RenderWorks, textures, image props, and RenderWorks backgrounds.	“Creating Image Resources” on page 247, “Creating Image-based Shaders” on page 639, “Creating Layer Backgrounds” on page 656, and “Creating Image Prop Objects” on page 654
New polygonal marquee for <b>2D Reshape</b> tool	A polygonal marquee is now available for selecting multiple vertices during polyline editing	“Performing Multiple Reshapes” on page 263
New <b>Edit Polyline</b> command	The <b>Edit Polyline</b> command allows changes to a polyline such as adding, deleting, reshaping, and extracting holes	“Reshaping Polylines” on page 263
Polygonal clipping shape	The <b>Clip</b> tool has new clipping object shapes, including polygonal and circular	“Clip Tool” on page 269
Scale objects by distance	The Scale Objects dialog box includes a new option to scale symmetrically based on a distance indicated on the drawing	“Scaling Objects” on page 271
New <b>Move by Points</b> tool	A new tool easily moves, duplicates, and distributes selected 2D and 3D objects, including symbols in a wall	“Moving Objects by Clicking” on page 369
<b>Duplicate Along Path</b> command	The <b>Duplicate Along Path</b> tool has been replaced with an enhanced command. Now, in addition to duplicating 2D objects along a 2D path, 3D objects can be duplicated along a 3D path.	“Duplicating Objects Along a Path” on page 379

Feature	Purpose	Location
Improved navigation when editing groups	Automatically centers the view on the components when editing CSG solids, extrudes, sweeps, and multiple extrudes	“Editing a Group” on page 397
SpaceNavigator support	VectorWorks supports the SpaceNavigator™ tool for view navigation	“Using a SpaceNavigator Mouse” on page 412
Hidden Line rendering improvements	Hidden line rendering performance has been improved by 50% for design layers and viewports. In addition, renderings will not require as much memory, and dashed lines now follow the perimeter of curved objects, improving the appearance of hidden line renderings.	“Rendering with VectorWorks” on page 431
New interactive shadow feature in OpenGL rendering	OpenGL can now render shadows interactively. This is much faster than the shadow rendering in RenderWorks, which makes it easier to adjust the lights quickly.	“OpenGL Render Options” on page 434
New option to draw edges in OpenGL rendering	OpenGL can now render objects with lines drawn around the edges	“OpenGL Render Options” on page 434
Dimensioning improvements	Multiple dimensions and chain dimensions can be modified at one time with the <b>2D Reshape</b> tool, and wall components can now be dimensioned associatively	“Modifying Dimensions” on page 454, and “Associative Dimensioning” on page 441
New title block only option	A new feature allows only the title block portion of the drawing border to be displayed	“Adding a Drawing Border” on page 458
Classable wall components	Wall preferences have been rearranged and improved, distinguishing the wall from the component parameters. Components can be named and provide class settings for fill and both pen styles, so the same wall can appear in various configurations. Components are easier to create, reorder, and view.	“Creating Walls” on page 471
Creation and editing of walls in 3D views	Walls can now be drawn, moved, joined, and reshaped in 3D views. Symbols can be inserted in 3D views.	“Creating Walls” on page 471
Improved selection of symbols within walls	Multiple symbols within a wall can now be selected for moving and editing	“Moving Symbols in Walls” on page 496
Retain or delete roof source object option	When creating a roof object, a new option allows you to retain or delete the source object(s)	“Creating Roof Objects” on page 500
Support for ACAD 2007	DXF/DWG Import and Export now supports AutoCAD version 2007	“Importing and Exporting Files” on page 517



Feature	Purpose	Location
Export worksheet images to DXF	Worksheet images can now be exported to DXF in a single step, without exporting a separate sheet and importing it into the DXF/DWG drawing. All cell formatting is now preserved, including: text font, size, style, color, and position inside the cell; cell border line style, thickness, and color; cell fills.	"VectorWorks 2008 Improvements" on page 526
Custom prefix for imported DXF layers	A custom prefix can be assigned to imported DXF layers for easy identification in VectorWorks layer and class lists	"Graphic Attributes Tab" on page 545
Foreground viewport render mode	Each viewport can now have both a background and foreground render mode, for a composite effect	"Viewport Parameters" on page 614
Adjusting flipped text in viewports	A new advanced viewport property adjusts flipped text for viewports separately from the VectorWorks preference setting, and viewports can be set to black and white only	"Advanced Sheet Layer Viewport Properties" on page 615
Improved navigation between viewport crop and annotation modes	This option maintains the view when exiting viewport annotation or crop modes	"Cropping Sheet Layer Viewports" on page 618
Navigate back to viewport from design layer	When editing a sheet layer viewport from a design layer, a convenient button makes it easy to return to the viewport	"Editing a Design Layer Displayed in a Sheet Layer Viewport" on page 621
Associative dimensions in viewports	Associative dimensions can be created in viewport annotation mode, for 2D objects, when the viewport is in Top/Plan view. If the objects change on the design layer, the dimensions update automatically.	"Creating Annotations for Sheet Layer Viewports" on page 621
Viewport layer overrides	New options control the presentation of viewport layer colors, stacking order, and opacity or transfer mode. These settings are made independently of the design layer settings or other viewport settings. A new <b>Eyedropper</b> tool preference allows viewport layer properties to be transferred to other viewports within the current file and between files.	"Changing the Layer Properties of Sheet Layer Viewports" on page 623 and "Transferring Attributes" on page 234
Cropped layer links	A layer link object, including layer links of workgroup-referenced layers, can now be cropped	"Cropping Layer Links" on page 631
Export workspace to text file	A new option in the Workspace Editor allows the current workspace settings, shortcut keys, and reserved keys to be exported to a text file	"Using the Workspace Editor" on page 719

Feature	Purpose	Location
Icon improvements	Icons throughout the VectorWorks application have been redesigned	Various locations
Dialog box modernization	Updates over 30 dialog boxes for interface consistency	Various locations
Open and Save folder improvements	VectorWorks now looks, by default, to the My Documents folder (Windows) or ~/Documents folder (Macintosh) when performing Open, Save, Import, or Export commands. In addition, the last used Open and Save folder is saved between sessions.	Not applicable
Workspace file format improvements	Workspace files have been changed to an XML format that is platform independent. In addition, VectorWorks tool and menu information is now cached, which improves the performance when the application is launched, when the workspace is switched, and when plug-ins are edited with the VectorScript Plug-in Editor.	Not applicable
New VectorWorks file extension	VectorWorks files are now created with a .vwx file extension, rather than an .mcd extension	Not applicable
Four alert dialog boxes demoted to minor alerts	Four operations which previously displayed an alert dialog box now generate a minor alert that do not require a user response: rotate view center of rotation, working plane specification, fillet of 2D objects, and fillet of illegal objects	Not applicable
Constraints palette settings saved	The Constraints palette settings are now saved within each VectorWorks file	Not applicable
Tool preferences saved	All tools that have tool preference dialog boxes now save the specified preferences across application sessions	Not applicable
Legacy <b>Custom Visibility</b> command	The <b>Custom Visibility</b> command has been removed from the workspaces and marked as a legacy command	Not applicable

New RenderWorks Features

The following table contains a list of new and improved features for this release, and indicates the section where the functionality is documented.

Feature	Purpose	Location
Improved dialog box functionality	The Set Image Size and Create Transparent Color Mask dialog boxes are now easier to use	"Setting the Texture Size by Image" on page 639 and "Mask Transparency" on page 646
OpenGL Backgrounds	The OpenGL render mode now supports one color, two color, and image backgrounds	"Applying RenderWorks Backgrounds" on page 676
Improved Custom RenderWorks and Custom Radiosity Options	Sliders have been added, and parameters have been added and rearranged, to improve the Custom RenderWorks Options and Custom Radiosity Options dialog boxes	"Custom RenderWorks Options" on page 689, and "Setting Custom Radiosity Options" on page 694
Final gather rendering	This new feature produces better indirect lighting, for more efficient, higher-quality rendering. Final gather rendering can be used with Custom RenderWorks, and is effective for models that are too complex to render with radiosity. It can also be combined with radiosity to clean up as well as increase the speed of rendering. It can also increase speed and quality when rendering with an HDRI background.	"Custom RenderWorks Options" on page 689, "Radiosity Workflow" on page 693, "Setting Custom Radiosity Options" on page 694, and "Creating HDRI Backgrounds" on page 658
<b>Render Bitmap</b> tool options	Rendering mode options can be set from the tool preferences	"Rendering a Selected Area" on page 705
New Visualization palette	A new palette accesses lights and cameras in both design layers and sheet layer viewports. Lights and cameras can easily be selected, modified, created, duplicated, and deleted. Selected sheet layer viewports can have lighting overrides for enhanced presentation.	"Managing Lights and Cameras" on page 709
New Forbo® flooring textures	Libraries include a variety of Forbo flooring textures from the Artoleum product line	"Object Libraries" on page 729
New arcitex® wood textures	Libraries include a variety of arcitex wood textures	"Object Libraries" on page 729
New shaders	A new paving color shader, as well as new bump shaders that are the equivalent of most color shaders, are now available. A new "From Color" bump shader sets bump parameters based on the current color shader.	"Shader Types" on page 733

# Learning VectorWorks

There are a number of ways to learn how to use VectorWorks, including both printed and online user’s guides, training CDs, and both online and classroom training.

## User’s Guides

- This guide is the VectorWorks Fundamentals User’s Guide. It is a comprehensive reference for all VectorWorks users describing the core tools, commands, and features in the VectorWorks Fundamentals product. The guide also describes the presentation capabilities of RenderWorks, for users who purchased RenderWorks.
- The VectorWorks Design Series User’s Guide describes the features in the VectorWorks Architect, Landmark, Spotlight, Machine Design, and Designer products. It is designed for users who have purchased one or more Design Series products.

The VectorWorks help system reflects the most up-to-date information; it may, therefore, be more current than the printed guides.

The following table describes the conventions used in the guides. All instructions in the guides are based on “click-click” drawing.

Convention	Meaning
(Macintosh)	Macintosh-specific instruction
(Windows)	Windows-specific instruction
<b>bold text</b>	Indicates a specific button, command, class, or explicitly named item
blue indented text	Indicates a note, tip, or warning
click	Click the mouse button and release. The left button is always implied in Windows.
double-click	Click two times quickly on the mouse button and release
right click	Click with the right mouse button and release; on the Macintosh, hold down the Ctrl key while clicking the mouse
Shift-click	Hold down the Shift key and click
click-click	Click the mouse button once and release. Move the cursor to the desired location and click again. This is the default drawing preference for VectorWorks at installation.
click-drag	Click once with the mouse button and do not release. Drag (move) the cursor to a desired location and then release.
Control+letter key	Hold down the Ctrl key and press the specified key
select	Click on an object with the mouse, or click-drag over an object with marquee selection, to highlight it. The object is highlighted, and/or “handles” display on the object to indicate that it is currently active. This term also refers to executing menu commands.

## VectorWorks Help System

The VectorWorks help system includes the following volumes:

- **Welcome to VectorWorks:** Instructions for using the help system within the VectorWorks program
- **VectorWorks Fundamentals:** Context-sensitive online version of the VectorWorks Fundamentals User’s Guide

- **Design Series:** Context-sensitive online version of the VectorWorks Design Series User's Guide
- **VectorScript Guide:** Description of the VectorScript language, which can be used to automate routine tasks
- **VectorScript Reference:** Comprehensive listing of procedures and functions in the VectorScript language

To access the Help system, select **Help > VectorWorks Help** from within the VectorWorks program. In the help system Table of Contents, open the **Welcome** book for complete instructions on how to use the system.

The help system allows quick access to comprehensive reference information about VectorWorks. Program commands and tools are linked to the appropriate help topic, providing instant information.

The help system also offers links to related topics, allows full text searches, and contains an index and table of contents to topics across all products.

[The Back button in the VectorWorks help system may not function on Safari due to Safari limitations.](#)

## Training

Visit [www.nemetschek.net](http://www.nemetschek.net) for details about the following training options:

- Training CDs
- Guided online training
- Onsite training
- Classroom training

## Other Resources

Visit [www.nemetschek.net](http://www.nemetschek.net) for details about the following additional resources:

- Documentation updates
- Independent local user groups
- LISTSERV® user lists

## Technical Support

Technical support is available for registered VectorWorks users in several ways. International users should contact their local reseller for details concerning technical support (see [www.nemetschek.net](http://www.nemetschek.net) for reseller information).

United States users can contact Technical Support using the following methods:

- Call 410.290.5114
- Send a fax to 410.290.8050
- Send an e-mail to [tech@nemetschek.net](mailto:tech@nemetschek.net)
- Visit the technical support message board at <http://techboard.nemetschek.net>
- Visit the technical support knowledge base at <http://kbase.nemetschek.net>
- E-mail VectorScript-specific problems to [vs\\_support@nemetschek.net](mailto:vs_support@nemetschek.net)

When you contact Technical Support, provide a brief description of the problem that includes specific details about what actions were taken prior to the problem's occurrence. The more information you can give your support representative, the easier it will be to solve your problem quickly.

When you contact Technical Support by phone, please have access to your computer and be ready to tell the representative:

- VectorWorks version number
- VectorWorks registration number
- Operating system

- Type of computer being used
- Amount of RAM installed in the computer
- List of any recent changes to the computer's setup (such as new fonts, software, or hardware)

## Troubleshooting

Troubleshooting a problem prior to calling Technical Support will also aid in a speedy resolution. Basic troubleshooting tips include:

- Test to see if the problem occurs in a new, blank file
- Test to see if the problem occurs system wide (especially print and font problems)
- Copy and paste part of the document to a new file to see if the problem persists
- Run the computer in Safe Mode (Windows) to see if there is a system conflict
- Check the technical support message board to see if the problem has already been reported or resolved (<http://techboard.nemetschek.net>)

# Introduction

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## Understanding VectorWorks

This section describes the core concepts behind VectorWorks' functionality; each concept is described briefly in this overview. The actual implementation of these concepts are described thoroughly in their relevant sections. Where possible, the relevant sections are referenced.

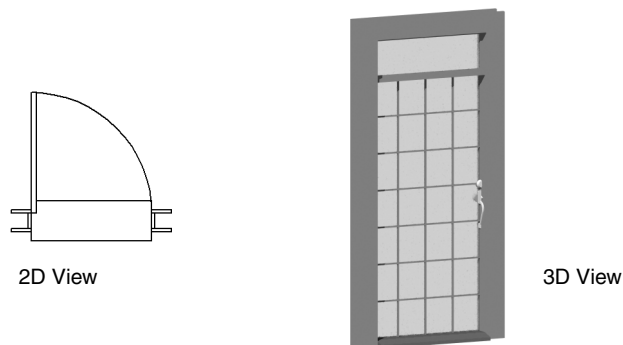
## Intuitive Design and Drafting Package

VectorWorks is an essential graphic design tool for anyone who wishes to use CAD software immediately. The program emphasizes rapid, accurate drawing and easy object selection. This ease of use minimizes the learning curve, so that ideas can be quickly converted into drawings.

## Hybrid Environment

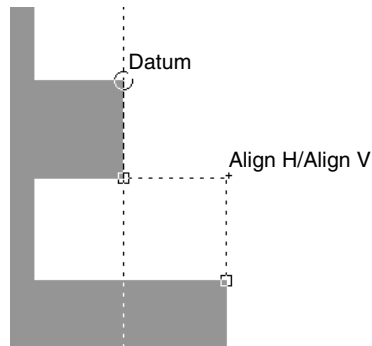
In most CAD programs, it is possible to create either a 2D or a 3D drawing. VectorWorks allows you to do both, with hybrid objects that display in a 2D or 3D representation of a drawing. In this hybrid environment, symbols display as 2D symbols in a 2D view, and as a fully-formed 3D object in 3D view. The program automatically displays the correct symbol according to the view. VectorWorks Fundamentals provides symbol libraries that contain a number of pre-made hybrid symbols; alternatively, create your own hybrid objects.

A good example of a hybrid object is a door. It displays as an abstract solid in a 2D view and as a fully formed door in a 3D view.



The advantage of working with hybrid objects is that 3D models can automatically be created from 2D drawings, or vice versa. For more information on the hybrid environment and symbols, see "Understanding Symbols" on page 153.

## SmartCursor



Design with precision using the SmartCursor™. By providing a series of cues (words or symbols that are displayed at the mouse pointer's current location) that update with every move of the mouse, the drawing options are clear. Use the SmartCursor to create snaps to specific points relative to other objects or to temporarily set a new origin (datum). Draw exact perpendiculars, angles, edge snaps and more. The SmartCursor is described in detail in "SmartCursor and Constraints" on page 119.

## Image Preview

An image preview is used for a variety of functions, including drawing objects, placing objects, and the SmartCursor. The image preview is the image displayed as the object is drawn, after a tool has been selected or an operation invoked, but before the object is physically placed in the drawing. The image preview may exactly resemble the object to be placed or may be a representation of that object, such as its bounding box. During the drawing process, the image preview contains a feedback segment, which gathers information for display in the Data bar. VectorWorks also uses this segment to properly invoke SmartCursor cues.

## Layers, Classes, and Views

Layers and classes provide the framework for VectorWorks drawings. Viewports and views display and present drawings. These features work together to provide flexible organizational and viewing capabilities.

VectorWorks "design" layers (where drawings are created) can have height. If a wall is eight feet high, the design layer can be as well. This allows for a true 3D representation of a model. Show and hide design layers as needed, to display certain aspects of a design. Objects placed together in design layers are related in space. Design layers help automate some aspects of wall creation as well as provide other advantages. Each VectorWorks design layer can have a different scale. Special "sheet" layers are used for creating viewports; these are multiple linked views of a drawing, complete with annotation, and ready for the presentation of a final design to a client. In VectorWorks Design Series, viewports also can be created on design layers, which can show one or more design layers from its own file, or from an external file.

Classes associate objects across layers. Classes are used to classify objects and can have specific display attributes, such as color. Classes are used to speed the drawing process, since attributes can be specified at object creation, and to control the visibility of these related groups. Each object can only be assigned one class, but each object can be composed of other nested objects, which can each be assigned a different class.

A particular view of the drawing, such as one which shows only certain layers and classes, can be saved. Take a snapshot of a combination of layers and classes and then print the view. Layers, classes, and views are described in detail in "Drawing Structure" on page 81.



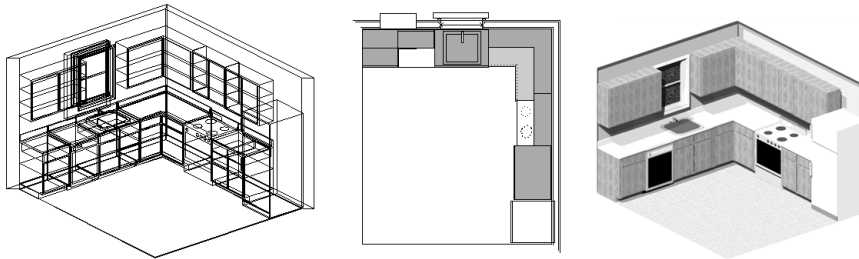
## Viewports

When a design is complete, it typically needs to be presented to a client with views from several different directions, complete with details, annotations, dimensions, and title blocks. To accomplish this in VectorWorks, create “viewport” objects, which can show other design layers in this file, or even design layers in other files.

Viewports can display entire as well as cropped views of a drawing, with specified layer and class visibility settings, projection, render mode, and orientation parameters. If the drawing changes, the viewports can be easily updated to reflect the changes.

In both VectorWorks Fundamentals and the VectorWorks Design Series, you can create one or more viewports on a sheet layer, and each viewport can show one or more design layers from the current file. Additionally, the VectorWorks Design Series allows you to create one or more viewports on a design layer, and the design layers shown can be either from the current file, or referenced from another file.

Viewports are described in “Presenting Drawings with Sheet Layer Viewports” on page 609 in this guide, and in “Presenting Drawings with Design Layer Viewports” on page 616 in the VectorWorks Design Series User’s Guide.



## Planes and 3D Space

Every VectorWorks drawing has a visible ground plane. This plane is permanently placed and can be used as a constant reference point for drawing in 2D or 3D space. In 3D space, however, a plane can be placed at a specific angle or rotation to better help create an object relative to that plane. This can help as views are changed or objects modified. This modifiable plane is called a working plane in VectorWorks. Working planes are described in detail in “Using Working Planes” on page 551.

## VectorScript

VectorWorks has a comprehensive script capability called VectorScript. Use existing scripts or create your own. Customize VectorWorks’ working environment with scripts, or create customized plug-in tools, commands, and objects that fit your needs. The VectorScript scripting language can be very useful and saves time and effort by creating reusable functions for drawings. Scripts can also be used to customize VectorWorks. See “Using Scripts” on page 593 for details on customizing VectorWorks.

See the VectorScript Language Guide for an introduction to the VectorScript language. The VectorScript Language Guide is available in the help system, and as a PDF file in [VectorWorks]\VWHelp\Additional Documentation. In addition, the VectorScript Function Reference is a comprehensive command reference available online. It is located in: <VWHelp/VectorScript Reference/VSFunctionReference.html>

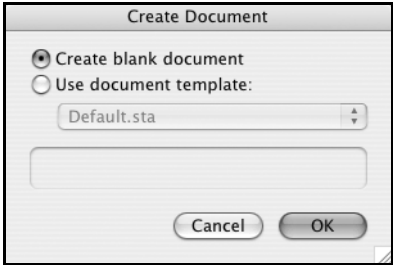
## Worksheets

VectorWorks provides comprehensive worksheet and database functionality. Object attributes and records can be listed in a worksheet, and spreadsheet calculations can be performed on this data. For example, list all the rooms in a drawing, and automatically calculate the number of bedrooms. Create a worksheet listing the items required to furnish the rooms and the cost. Worksheets are described in “Creating Worksheets” on page 563.

## Creating a New File

To create a new file:

1. Select **File > New**.  
The Create Document dialog box opens.
2. Select the type of document to create and click **OK** to open the new file.



Document Type	Description
Create blank document	Opens a new drawing file with the default VectorWorks settings (attributes, scale, units, etc.)
Use document template	Opens a new drawing with settings that were saved in a template file; select the template to use (see “Creating Templates” on page 73 to learn more about templates)

VectorWorks searches your user folder, your workgroup folders, and the VectorWorks system folder for template files. If no templates are found anywhere on the system, the Create Document dialog box does not open. Instead, a blank new document is created automatically.

## Opening a File

There are three ways to open a file that already exists. Up to eight VectorWorks files can be open at once.

To open a file that already exists:

1. Select **File > Open**.  
The Open dialog box opens.
2. Select the name of the file or template to open.
3. Click **Open**.  
VectorWorks opens the last saved version of the selected drawing file.

To open a file that was recently used:

Select **File > Open Recent** and select a name from the list of the last ten files that were opened or saved.

The file is opened; if the file is already open, it is moved to the front of the screen to become the current file.

To open a file from the operating system:

Double-click a file directly in Windows Explorer or Macintosh Finder.

If multiple versions of VectorWorks are installed, and VectorWorks is not yet open, the version that opens when you double-click a file depends on the operating system.

- On Windows, the version of VectorWorks that was installed most recently opens.
- On Macintosh OS X, VectorWorks 2008 opens when you double-click a version 2008 file. When you double-click an older version file, the older version of VectorWorks opens.

VectorWorks 2008 can only open files that were created in MiniCAD 7 or in VectorWorks versions 8 and above. Files that were created in versions earlier than MiniCAD 7 must be converted to at least version 7, with a version of VectorWorks earlier than version 12. If an earlier version of VectorWorks is not available, contact NNA Sales Support for assistance.

## Migrating from Previous Versions

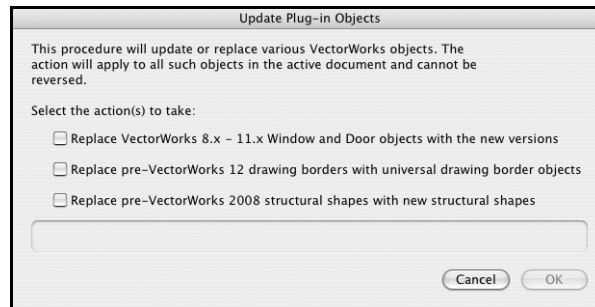
The **Update Plug-in Objects** command converts a variety of legacy objects—including windows, doors, drawing borders, and structural shapes—to the current application format. This command works across all file layers, and as applicable, on objects that are freestanding, inserted in walls, in a placed symbol, or in a symbol definition. All applicable parameter values, and any attached records are also transferred during the conversion.

*Saving a copy of the file prior to running the command is recommended, as the command cannot be undone.*

To update plug-in objects:

1. Open a file containing legacy objects.
2. Select **Tools > Utilities > Update Plug-in Objects**.

The Update Plug-in Objects dialog box opens.



3. Select the type(s) of objects to convert to the new format, and then click **OK**.

All older version objects of the selected type(s) are converted into the new format.

## Closing a File

To close the current file:

1. Select **File > Close** or click the close box on the drawing window.

2. If the file changed since it was last saved, click **Save** (Macintosh) or **Yes** (Windows) to save and close the file. Click **Don't Save** (Macintosh) or **No** (Windows) to close the file without a save.

To close all open files (Windows only):

1. Select **Window > Close All**.
2. If the files changed since they were last saved, click **Yes** to save and close the files. Click **No** to close the files without a save.

## Saving a File

The **Save** command saves the open file, which replaces the earlier version of the file. When you save a file for the first time, specify the file name and location. The **Save** command is disabled if no changes have been made to the file since it was first opened or created.

On Windows, the files require a “.vwx” or “.mcd” extension to be recognized by VectorWorks. If you do not enter an extension, VectorWorks adds the .vwx extension automatically.

To save the current file:

1. Select **File > Save**.  
If the file has not been saved before, the Save VectorWorks Drawing dialog box opens.
2. Enter a name for the file in the **Name** field, and then select the destination for the file.
3. Click **Save**.  
VectorWorks saves the file. The time required may depend on the file size.

## Save As

To save the current file with a different name:

1. Select **File > Save As**.  
The Save VectorWorks Drawing dialog box opens.
2. Enter a new **Name** for the file, and then select the destination for the file.
3. Click **Save**.  
VectorWorks saves a new copy of the file. The time required may depend on the file size.

## Save a Copy As

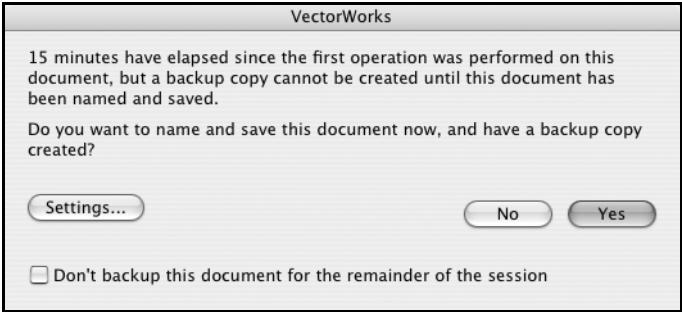
To save a copy of the current file and continue to edit the current file:

1. Select **File > Save A Copy As**.  
The Save dialog box opens.
2. Enter a new **Name** for the file, and then select the destination for the file.
3. Click **Save**.  
VectorWorks saves a new copy of the file and keeps the original file open for further edits. The time required may depend on the file size.

## Automatically Saving Files

The autosave feature automatically saves the current file after either a specified number of minutes or a specified number of operations, as defined in the Autosave tab of the VectorWorks Preferences dialog box. See “Autosave Preferences” on page 45 for more information.

If the **Confirm before save** preference is selected, a confirmation dialog box displays before the autosave is performed. The information that displays in this dialog box depends on the settings selected in VectorWorks preferences.



Parameter	Description
Yes	Saves the file; if the document has not been saved, the Save dialog box opens to name the file first
No	Cancels the save operation and resets the autosave counters
Settings	Opens the VectorWorks Preferences dialog box to edit the autosave parameters; select <b>Don't autosave this document for the remainder of the session</b> (or <b>Don't backup this document for the remainder of the session</b> ) to disable the autosave feature for the active document for the remainder of the session

When the save is complete, the message **Autosave complete** displays in the lower right corner of the window; the message clears when you click the mouse.

## Reverting to the Last Saved Version

The **Revert to Saved** command replaces the active drawing with the most recently-saved version. This deletes all changes made since the last save, which can remove several undesirable changes in one step.

To revert to the last saved version:

1. Select **File > Revert to Saved**.  
*This action cannot be undone. Confirm that changes should not be saved.*
2. Click **OK**.  
VectorWorks closes the active drawing and opens the last saved version of the file.

## Converting Previous Version Files

VectorWorks must translate files created in previous versions of VectorWorks into the current format. VectorWorks cannot convert MiniCAD 6 or earlier files, however. VectorWorks automatically applies PNG compression to images contained in converted files.

- To convert an entire folder of files at once, use the **Batch Convert** command as described in “Converting Previous Version Files as a Batch” on page 8.
- To convert one file at a time, open and save the file in the current version of VectorWorks as described in “Converting a Single Previous Version File” on page 10.

You may need to correct the visibility of crop objects and annotation objects in sheet layer viewports (see “Viewport Parameters” on page 614).

## Converting Previous Version Files as a Batch

During a batch conversion, VectorWorks scans all files in the source folder (and in sub-folders, optionally), and converts previous version files to the current format. Non-VectorWorks files and VectorWorks files that are too old to convert are skipped and recorded in the log file.

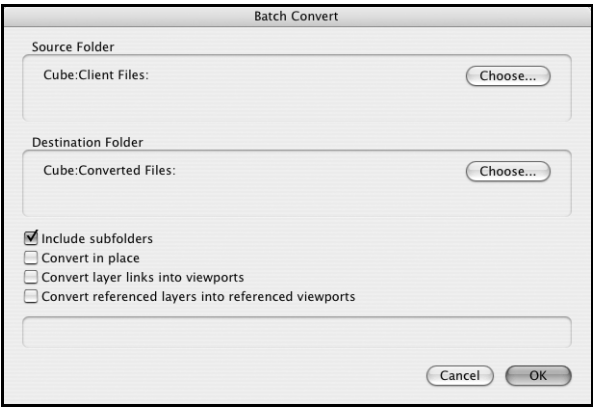
There are two options for VectorWorks files during batch conversions:

- By default, VectorWorks moves the previous version files to an archive folder and places the converted versions of those files in the source folder.
- Alternatively, VectorWorks makes no changes to the source folder. Instead, the converted files (and copies of any current version VectorWorks files) are placed in a specified folder.

To convert a batch of files:

1. Place all files to be converted in one folder, or in sub-folders within the source folder.
2. In VectorWorks, select **File > Batch Convert**.

The Batch Convert dialog box opens.



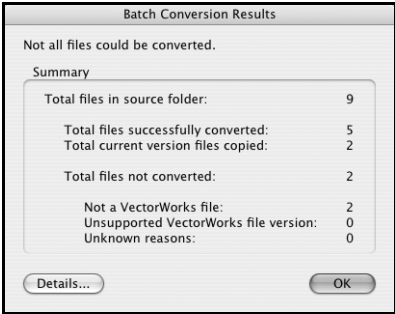
Parameter	Description
Source Folder	Click <b>Choose</b> to open either the Choose Source Folder dialog box (Macintosh) or the Browse for Folder dialog box (Windows); select the folder that contains the files you want to convert, and then click <b>Choose</b> (Macintosh) or <b>OK</b> (Windows) to return to the Batch Convert dialog box

Parameter	Description
Destination Folder	To place the converted files into a different folder, click <b>Choose</b> to open either the Choose Destination Folder dialog box (Macintosh) or the Browse for Folder dialog box (Windows). Select the folder, and then click <b>Choose</b> (Macintosh) or <b>OK</b> (Windows) to return to the Batch Convert dialog box. Then deselect <b>Convert in place</b> .
Include subfolders	Converts the files within the sub-folders of the source folder
Convert in place	Moves the original VectorWorks files to an archive folder, and places the newly converted files in the original source file locations. The archive folder is created within the source folder and is named "Old Version VectorWorks Files."  Deselect this option to place the converted files in the destination folder and make no changes to the source folder.
Convert layer links into viewports (Design Series required)	In VectorWorks 2008, instead of creating layer links, Design Series users can create viewports on design layers that reference one or more layers within the same file. Select this option to convert any layer links in the older version files into viewports. See "Presenting Drawings with Design Layer Viewports" on page 616 in the VectorWorks Design Series User's Guide.
Convert referenced layers into referenced viewports (Design Series required)	In VectorWorks 2008, instead of importing layer data from an external file, Design Series users can create viewports on design layers that reference one or more layers in an external file. Select this option to convert any referenced layers in the older version files into viewports. See "Presenting Drawings with Design Layer Viewports" on page 616 in the VectorWorks Design Series User's Guide.

3. Click **OK** to convert the files.

Each file is briefly opened and re-saved into the appropriate folder. Sub-folder names and hierarchies are recreated, if they are included in the conversion process. If **Convert in place** is selected, the original files are moved to the archive folder, in the original sub-folder structure.

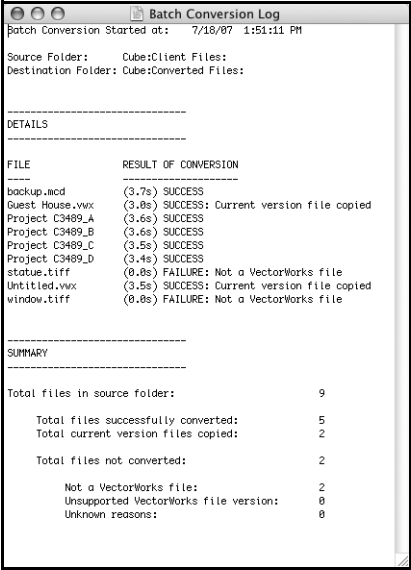
4. Once the conversion is complete, the Batch Conversion Results dialog box displays a summary.



Parameter	Description
Total files in source folder	The total number of files contained in the specified source folder
Total files successfully converted	The total number of files successfully converted by the <b>Batch Convert</b> command

Parameter	Description
Total current version files left in place (copied)	The total number of files that were already in the current version of VectorWorks; if <b>Convert in place</b> is selected, the files are left in place in the original folder; if <b>Convert in place</b> is not selected, the files are copied to the destination folder
Total files not converted	The total number of files that were not converted
Not a VectorWorks file	The number of files that were not converted because they were not VectorWorks files
Unsupported VectorWorks file version	The number of files that were not converted because they were MiniCAD 6 or an earlier version, which is not supported by the <b>Batch Convert</b> command
Unknown reasons	The number of files that were not converted, for which VectorWorks could not detect a reason

5. Click **Details** to view a log file with information about each file processed during the conversion.



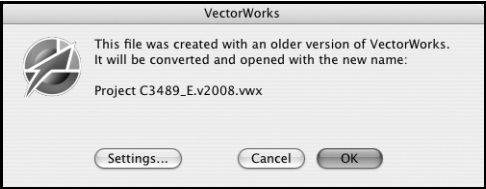
## Converting a Single Previous Version File

When you open an older file, VectorWorks automatically converts the file and assigns it an appropriate name. By default, VectorWorks renames the converted file and keeps the original file intact. Change the default setting to rename the original file and use the original file name for the converted file instead. In this case, if the original file is write-protected, VectorWorks cannot rename it; save the converted file and give it an appropriate name.

To convert a single file:

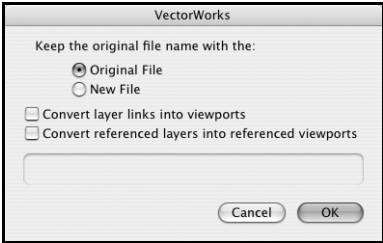
1. In the current version of VectorWorks, open a file that was created with a previous version of VectorWorks. A conversion alert box opens, showing which file will be renamed, along with the new name. The action described in the dialog box depends on the current setting for converting file names.





2. To change the way this file will be converted, click **Settings**.

The following dialog box opens.



Parameter	Description
Keep the original file name with the	Select which file will have the original file name: the original file or the new file
Convert layer links into viewports (Design Series required)	In VectorWorks 2008, instead of creating layer links, Design Series users can create viewports on design layers that reference one or more layers within the same file. Select this option to convert any layer links in the older file into viewports. See “Presenting Drawings with Design Layer Viewports” on page 616 in the VectorWorks Design Series User’s Guide.
Convert referenced layers into referenced viewports (Design Series required)	In VectorWorks 2008, instead of importing layer data from an external file, Design Series users can create viewports on design layers that reference one or more layers in an external file. Select this option to convert any referenced layers in the older version file into viewports. See “Presenting Drawings with Design Layer Viewports” on page 616 in the VectorWorks Design Series User’s Guide.

3. Specify the conversion settings and click **OK** to save the change; future file conversions will use this setting.
4. In the conversion alert box, click **OK** to complete the conversion.

## Exiting VectorWorks

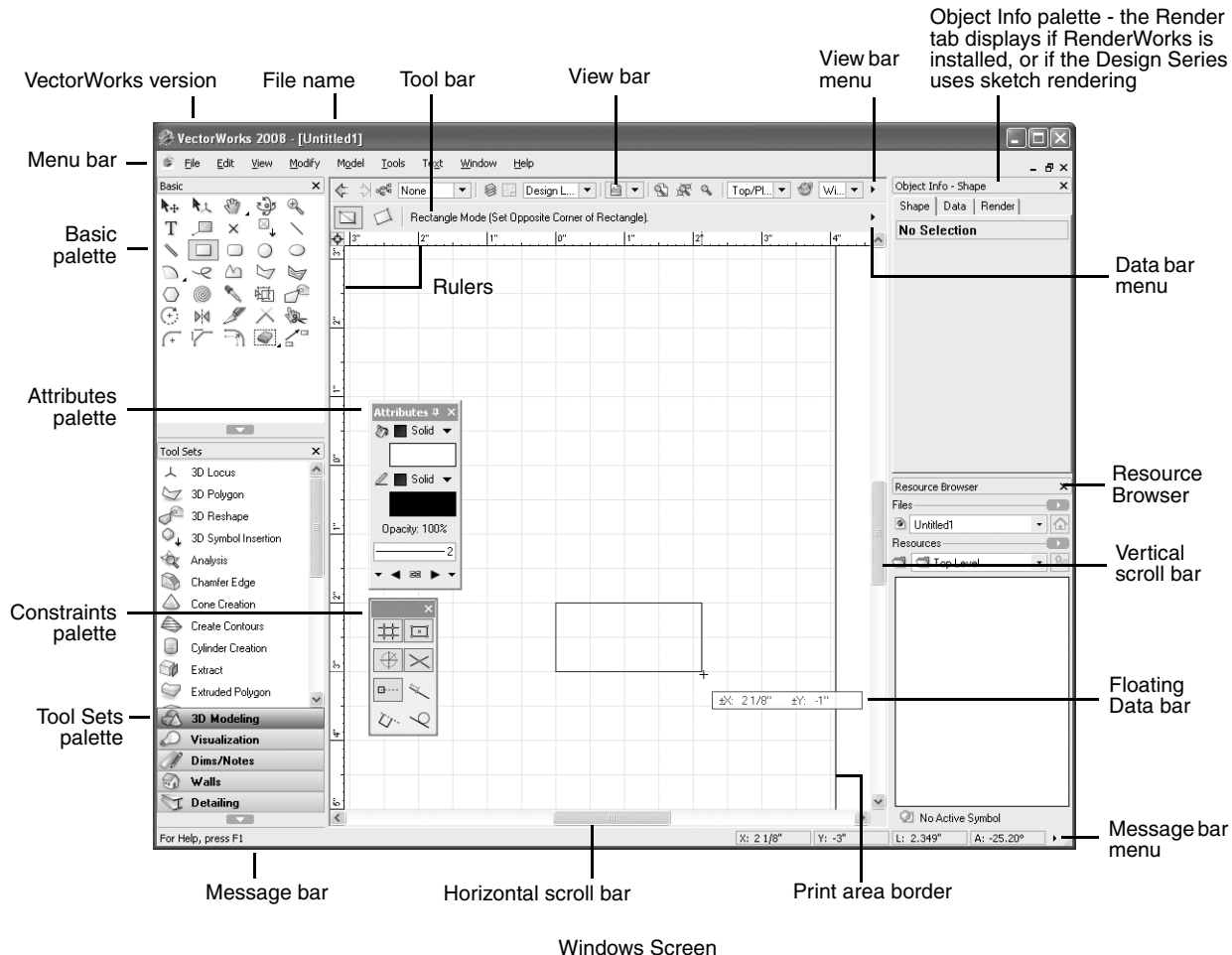
To close VectorWorks along with any open files:

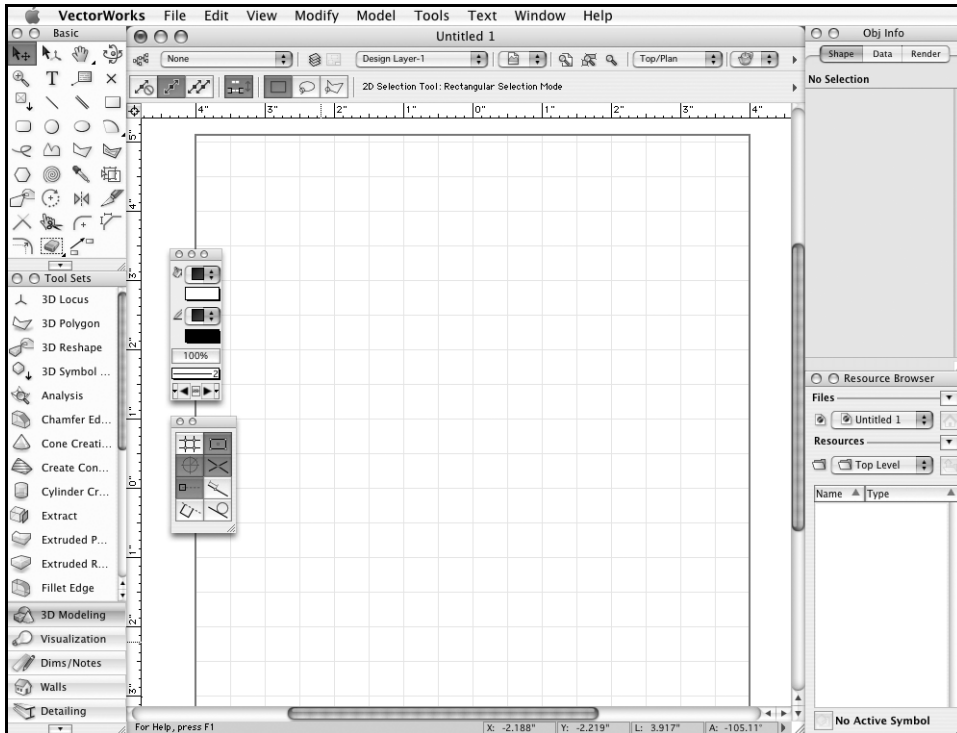
- From the **File** menu (Windows) or **VectorWorks** menu (Macintosh), select **Quit**.
- If there are any unsaved files, click **Save** (Macintosh) or **Yes** (Windows) to save the changes and exit. Click **Don’t Save** (Macintosh) or **No** (Windows) to exit without a save.

## VectorWorks Standard Workspace

When VectorWorks Fundamentals is started, the main window opens with a new, blank file. By default, the standard workspace is selected, and contains menus, palettes, and tool sets in a default layout. During a work session, palettes may be opened, closed, and moved around as necessary. When the application is closed, the last workspace settings are preserved and restored for the next session.

Custom workspaces can be created, as described in “Creating or Editing a Workspace” on page 719. To switch to another workspace, select **Tools > Workspaces**, and then select the workspace from the list of those available.





Macintosh Screen

Windows, palettes, tool sets, and dialog boxes that contain a sizing handle in their bottom right corner can be resized; click-drag the sizing handle to the desired location.

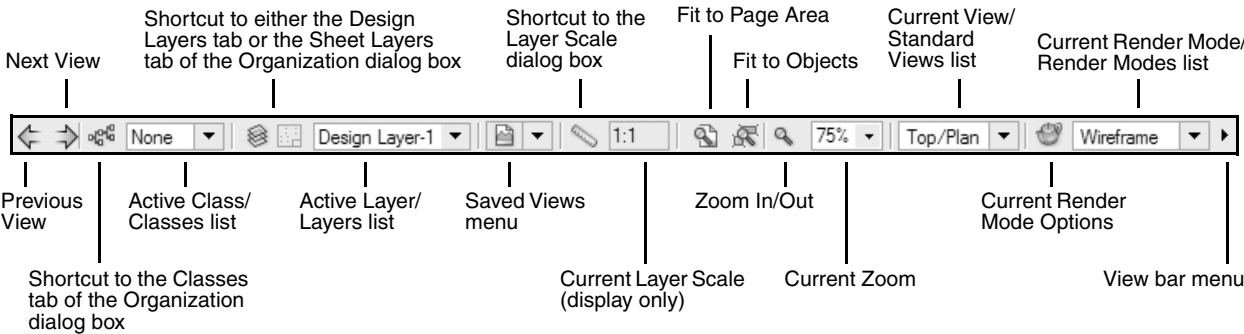
The following table describes some of the standard workspace features.

Component	Description
Menu bar	Contains pull-down menus that access the VectorWorks commands
Title bar	All windows, palettes, tool sets, and dialog boxes have a title bar; click and drag any title bar to move the item to the desired location. See “Palette Layout Options” on page 17.
Data bar	Depending on the tool and on the action being performed, the Data bar displays information such as coordinate data, length, and angle. Use the Data bar menu to set the Data bar either to “float” with the cursor, or to be stationary on the Tool bar. See “Using the 2D Data Bar” on page 183 and “Using the 3D Data Bar” on page 291 for more information.
Tool bar	Displays the various modes of the active tool; click a mode to select it. The bar also displays mode information and accesses the tool preferences, if any. The Tool bar is divided into sections grouped by mode function. To move easily through the mode sections from the keyboard, press the U, I, O, P, [ (left bracket), and ] (right bracket) keys. Each key corresponds to a consecutive Tool bar section (see the Mode Modifier shortcuts in “Modifying Constraint and Mode Shortcuts” on page 727).




Component	Description
View bar	Contains buttons and pulldown menus that control the view in various ways (see “The View Bar” on page 14)
Message bar	Displays tool explanations, undo messages, minor alerts, and a progress bar (when applicable). To also display cursor location fields on the Message bar, click the triangle at the far right of the bar; select the option to display all positional fields, only cursor-based location fields, or no cursor location fields.
Drawing area	This is the open portion in the middle of the VectorWorks application window where drawings are created; it includes both the print area and the space that surrounds it
Print area	Within the drawing area, a gray border defines the print area, if shown. Only the objects that are included within the print area are printed. The print area is divided into pages; each page equals a physical sheet of paper to be printed. A print margin is built in for each page (see “The Print Area” on page 74).
Rulers	Based on the current measurement system, rulers make it easier to precisely create and place objects within the drawing. The rulers can be hidden with an option in the VectorWorks preferences (see “Setting VectorWorks Preferences” on page 39).
Grids	Based on the current measurement system, two grid systems make it easier to precisely create and place objects within the file. To hide the reference grid, deselect <b>Show Grid Lines</b> (see “Snap and Reference Grids” on page 55).

The View Bar

The View bar is located along the top of the application window. It provides quick access to various options that affect the drawing view. Some View bar items have equivalent menu commands.



Component	Description
Previous View	Displays the previous view that was created by a pan, zoom, or scroll in the drawing area; VectorWorks keeps track of up to 50 views
Next View	Displays the next view; VectorWorks keeps track of up to 50 views
Classes tab shortcut	Opens the Classes tab of the Organization dialog box

Component	Description
Active Class/Classes list	Displays the active class, and activates a class that is selected from the list; an icon to the left of each name indicates the current visibility setting of the class (see “Setting Visibilities” on page 108 for more information). A triangle next to the class name indicates that the class has sub-groups that can be selected individually (for example, a wall class with exterior and interior sub-groups).
Design Layers tab/Sheet Layers tab shortcut	Depending on whether a Design Layer or a Sheet Layer is active, opens either the Design Layers tab or the Sheet Layers tab of the Organization dialog box
Active Layer/Layers list	<p>Displays the active layer, and activates a design layer or sheet layer that is selected from the list. The area to the left of each name indicates the view and visibility of the layer. Depending on the view, any of the following icons can display for design layers; sheet layers are always in Top/Plan view:</p> <div style="display: flex; justify-content: space-around; align-items: flex-end; margin: 10px 0;"> <div style="text-align: center;">  <p>Top/Plan view</p> </div> <div style="text-align: center;">  <p>Any standard view other than Top/Plan</p> </div> <div style="text-align: center;">  <p>Plan Rotation active (Design Series required)</p> </div> </div> <p>The visibility of the layer is indicated as follows:</p> <ul style="list-style-type: none"> <li>• Black icon — the layer is visible</li> <li>• Gray icon — the layer is grayed</li> <li>• No icon — the layer is invisible</li> </ul>
Saved Views menu	Activates a saved view that is selected from the list. Select <b>Edit View</b> to open the Saved Views tab of the Organization dialog box, or select <b>Save View</b> to open the Save View dialog box; see “Creating or Editing Saved Views Using the Saved Views Menu” on page 107.
Layer Scale shortcut	Opens the Layer Scale dialog box; the scale of the active design layer displays to the right. See “Changing the Scale of the Drawing or the Active Design Layer” on page 51.
Fit to Page Area	Displays the whole drawing (all pages) in the drawing window; see “Fit to Page Area” on page 419
Fit to Objects	Zooms in or out so that all of the objects in a drawing are visible. If an object or objects are currently selected, the zoom is relative to those object(s); see “Fit to Objects” on page 418.
Zoom In/Out	Click to double the magnification of the drawing; to reduce the magnification of the drawing by one-half, use Alt-Click (Windows) or Option-Click (Macintosh). The zoom centers on any objects that are selected; if nothing is selected, the zoom centers on the last empty spot that was clicked. See “Zooming from the View Bar” on page 26.
Current Zoom	Zooms in or out by the zoom factor that is selected or entered; this option is available when the Zoom - Long option is selected on the View bar menu
Current View/Standard Views list	Displays the current view, and activates a standard view (such as Top/Plan) that is selected from the list; see “Using Standard Views” on page 403. If the view is not standard (for example, if the <b>Flyover</b> tool was used), Custom View displays.
Current Render Mode Options	If the current render mode has options, displays the appropriate options dialog box; this option is available when the Render Mode - Long option is selected on the View bar menu

Component	Description
Current Render Mode/ Render Modes list	Displays the current render mode, and activates a render mode selected from the list; select <b>Options for Other Render Modes</b> to access the options for a particular mode. See “Rendering with VectorWorks” on page 431 and “RenderWorks Rendering Modes” on page 687.
View bar menu	Selects the options to display on the View bar

## Palettes and Tool Sets

The standard workspace contains various palettes for creating and editing objects in VectorWorks Fundamentals. Basic and Tool Sets are tool palettes, which have special functionality, as described in “Tool Palette Features” on page 18. If a keyboard shortcut is currently assigned to a menu command or tool, the shortcut displays when the mouse hovers over the command or tool; to set up or modify keyboard shortcuts, see “Modifying Menus and Commands” on page 720.

Depending on the initial settings, some palettes may be hidden when VectorWorks Fundamentals is launched.

Palette / Tool Set	Purpose
Constraints	Contains SmartCursor controls that can be toggled on or off
Attributes	Contains a selection of colors, fills, pens, and other object attributes
Object Info	Lists context-sensitive object information for viewing and editing
Working Planes	Contains controls for adding and modifying working planes
Resource Browser	Accesses VectorWorks’ gradient fills, hatch patterns, image fills, record formats, scripts and script palettes, symbols and symbol folders, worksheets, textures, and backgrounds
Visualization (RenderWorks required)	Accesses all lights and cameras in the file
Basic	Contains a single set of basic 2D and 3D object creation and editing tools; the palette can be customized through the Workspace Editor
Tool Sets	In the standard workspace, the palette includes the following tool sets, whose tools are grouped by similar functionality; the palette and its tool sets can be customized through the Workspace Editor
3D Modeling	Contains tools for creating and editing 3D objects, including solids and NURBS
Visualization	Contains tools for changing the drawing view in different ways, including the <b>Walkthrough</b> and <b>Light</b> tools
Dims / Notes	Contains tools for adding dimension and label objects
Walls	Contains basic wall creation tools
Detailing	Contains tools for adding architectural detail objects, such as tubing
Script Palettes	Contains palettes with VectorScript resources

## Palette Layout Options

The default palette layout in VectorWorks Fundamentals can be customized. Select the palettes to display or hide with the **Window > Palettes** menu (or select **Palettes** from the document context menu). Click on the title bar of any displayed palette and drag it to the desired location. Most palettes can be resized by the standard Windows or Macintosh resize method. Palette size, position, and visibility are saved upon exiting VectorWorks Fundamentals.

### Specifying Macintosh Palette Margins

On the Macintosh, the palettes can be placed in a margin on either side of the drawing area. When the palette margins are in use, the drawing area cannot expand past a fixed size, which allows the palettes to remain out of the way. The palette margin area can be turned on and off in the VectorWorks preferences as described in “Setting VectorWorks Preferences” on page 39.

### Minimizing Palettes

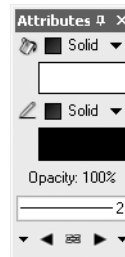
To increase the available drawing area, palettes can be minimized while not in use, and then maximized when needed.

On Macintosh, click the palette’s yellow title bar button or double-click the palette’s title bar to minimize the palette. Repeat the process to maximize the palette.

On Windows, click the palette’s pin icon in the title bar to toggle between minimized (horizontal pin icon) and maximized (vertical pin icon) display. Move the cursor over a minimized title bar to temporarily maximize the palette; move the cursor off the palette to minimize it again.



Minimized palette



Maximized palette

### Docking Windows Palettes

In Windows, most palettes can be docked to any of the four drawing window edges, or snapped to other docked palettes. The Object Info, Resource Browser, Attributes palette, and Working Planes palettes can only be docked to the left and right window edges.

The ability to dock palettes is enabled by default in the Session tab of the VectorWorks preferences dialog box. Deselect this option to disable docking. See “Setting VectorWorks Preferences” on page 39 for more information.

To dock or undock a palette by double-clicking:

1. Double-click a palette’s title bar.

If the palette was undocked, double-clicking docks it in its previous location. If the palette was docked, double-clicking undocks it and moves it to its previous location in the drawing area.

2. To toggle the docked/undocked status, double-click the palette’s title bar again, as necessary.

To dock a palette by dragging it:

1. Drag the title bar of the desired palette toward the edge of the window.

The palette's view switches to a gray outline. When the palette is in range of a window edge, the outline changes shape to represent the new docked shape.

2. Move the palette's outline to the edge of the docking location and release. Currently docked palettes adjust their location along the edge to accommodate the new palette.

To prevent a palette from docking, hold down the Ctrl key while dragging the palette near an edge.

To undock a palette by dragging it:

1. Drag the title bar of the desired palette away from the edge.

The palette's view switches to a gray outline. When the palette is out of window edge range, the outline changes shape to represent the new undocked shape.

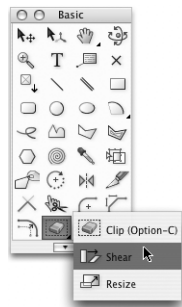
2. Drag the palette to the desired location within the drawing area.

## Tool Palette Features

Both the standard tool palettes (Basic and Tool Sets) and any custom tool palettes have special features that other palettes do not. Tool palettes and their tool sets can be created and customized using the Workspace Editor (see "Creating or Editing a Workspace" on page 719).

### Pop-out Tools

On tool palettes, an arrow on the right side of a tool icon or label indicates additional, related pop-out tools. Click and hold down the mouse button to open the menu of pop-out tools.



### Utility Menus

Each tool palette has a button at the bottom that opens a utility menu, which controls the palette and tool display.



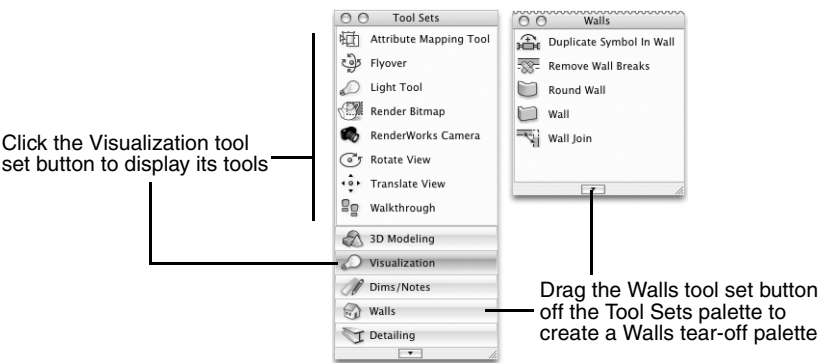


Menu / Command	Action
View Tools As	
Icons	Display only an icon for each tool
Icons and Text	Display both an icon and a text label for each tool
Text	Display only a text label for each tool
Sort Tools By	
Manual Placement	Display tools in the order appearing in the Workspace Editor
Ascending Alphabetical	Display tools in ascending alphabetical order according to text labels
Descending Alphabetical	Display tools in descending alphabetical order according to text labels
View Tool Sets As	(These options are available only for tool palettes with multiple tool sets)
Icons	Display only an icon for each tool set in the palette
Icons and Text	Display both an icon and a text label for each tool set in the palette
Text	Display only a text label for each tool set in the palette
Sort Tool Sets By	(These options are available only for tool palettes with multiple tool sets)
Manual Placement	Display tool sets in the order appearing in the Workspace Editor
Ascending Alphabetical	Display tool sets in ascending alphabetical order according to text labels
Descending Alphabetical	Display tool sets in descending alphabetical order according to text labels
Place Tool Sets At	(These options are available only for tool palettes with multiple tool sets)
Top of Palette	Display tool set selection buttons at the top of the tool palette
Bottom of Palette	Display tool set selection buttons at the bottom of the tool palette
Customize	Opens the Workspace Editor Options dialog box (see “Creating or Editing a Workspace” on page 719 for details)

## Tool Set Selection Buttons and Tear-off Palettes

If a tool palette has multiple tool sets (as does the Tool Sets palette), selection buttons for each tool set display on the palette. To display a tool set’s tools, click the appropriate button. The button is highlighted to indicate which tool set is active.

To see multiple tool sets at once, drag a tool set’s selection button off the main palette. This creates a separate, temporary palette for the tool set, with a “perforated” top edge. Like other palettes, these tear-off palettes can be docked, resized, and minimized. To close a tear-off palette, click its close button. On Windows, a docked tear-off palette does not have a perforated edge; instead, it has a special close button in the shape of a curved arrow.



List Box Functionality

Dialog boxes that contain long lists of information (such as the Organization dialog box) may have some or all of the following functionality.

Task	Action
Change the list’s sort key	Click the heading of the column to sort by; an arrow appears on the right side of the column heading to indicate that it is the sort key
Change a column’s sort order	Click the column heading; the sort arrow in the heading indicates whether the current sort is ascending or descending
Resize a column	Click the vertical line on the right side of a column’s heading and drag it left or right
Select a group of items	Click the first item, and then Shift-click the last item in the group
Select multiple items individually	Click the first item, and then Command-click (Macintosh) or Ctrl-click (Windows) each additional item
Select an item on the list	Type the first letter(s) of the desired item’s name
Edit an item on the list	Double-click the desired item
Open a context menu for an item on the list	Ctrl-click (Macintosh) or right-click (Windows) the desired item
For lists with a <b>Visibility</b> column, set the same visibility for all items on the list	Option-click (Macintosh) or Alt-click (Windows) the desired setting

Click the heading of a column without the sort arrow to sort the list by that column

The arrow indicates the current sort key and sort order; click the column heading to reverse the sort order

Drag the vertical line on the right side of a column heading to adjust the column size

Option-click (Macintosh) or Alt-click (Windows) one of the **Visibility** columns to set that visibility for all items on the list

Type the first letter of an item's name to select it

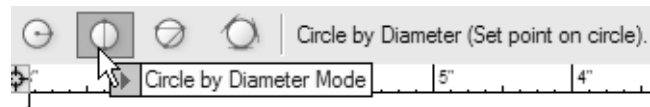
Additional Key Functionality

Several keys in VectorWorks have additional functionality beyond the standard conventions:

Key	Usage
Esc	Cancels the current operation. When a dialog box is open, this is the equivalent of pressing the <b>Cancel</b> button. Accepts the information in a field in the Data bar or Object Info palette, and then switches back to the document. Cancels rendering.
Return (Macintosh) / Enter (Windows)	When a dialog box is open, this is the equivalent to pressing the <b>Done</b> or <b>OK</b> button; accepts the information in a field in the Data bar or Object Info palette without switching back to the document
Tab	Moves the cursor from one field to the next in the Data bar, Object Info palette, and dialog boxes
Delete (Macintosh) / Backspace (Windows)	Removes the last segment of or cancels the creation of an object being drawn
Ctrl (Windows)	Prevents palettes from docking when they are moved near an edge
Space Bar	Engages the Pause/Boomerang mode. Holding down the Space Bar temporarily pauses the current tool. A second tool can then be selected and used. Release the Space Bar to return to the previous tool.
Command (Macintosh) / Shift (Windows)	Briefly expands the currently selected screen tip
Shift	Rotates certain 2D objects (such as rectangles, rounded rectangles, ovals, bitmaps, and PICT images) with the <b>2D Selection</b> tool at the object's selection handles

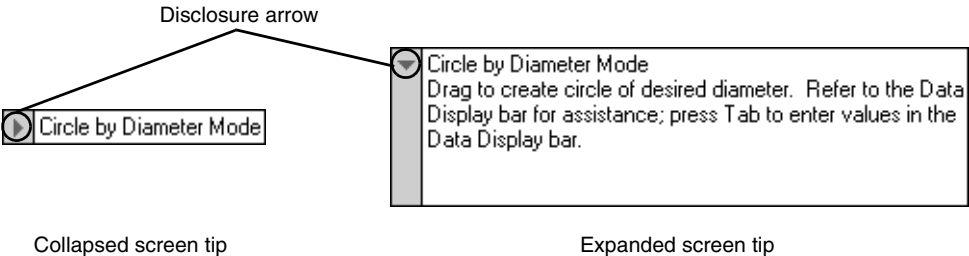
## Screen Tips

VectorWorks screen tips are available throughout the program to identify items such as tool, mode, and constraint names. To view a screen tip, hold the cursor briefly over the item in question.



Certain items have screen tips that can be collapsed (default) and expanded. When collapsed, only the name of the item displays. When expanded, additional help information is displayed below the name. To expand screen tips, hold the Command key (Macintosh) or Shift key (Windows) while the screen tip is visible.

On Windows, screen tips can also be collapsed or expanded by clicking on the disclosure arrow. When a screen tip is expanded, it remains expanded until it is manually collapsed again. Screen tips for all other items are expanded until a tip is collapsed again.



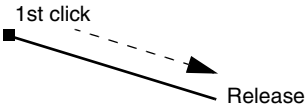
## Drawing Techniques

In VectorWorks, objects are created using the mouse, the keyboard, or a mouse and keyboard combination.

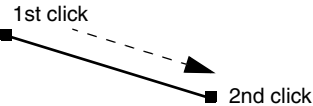
### Using the Mouse

The easiest way to draw in VectorWorks is to use the mouse. Select the appropriate tool button and create an object in either the click-drag or the click-click mode, depending on the type of object.

In click-drag mode, click and continue to hold down the mouse button while you create an object; release the button when the object is the desired size and shape.



In click-click mode, click the mouse to mark the start point of an object, and then click again at each of the object's corners or vertices.

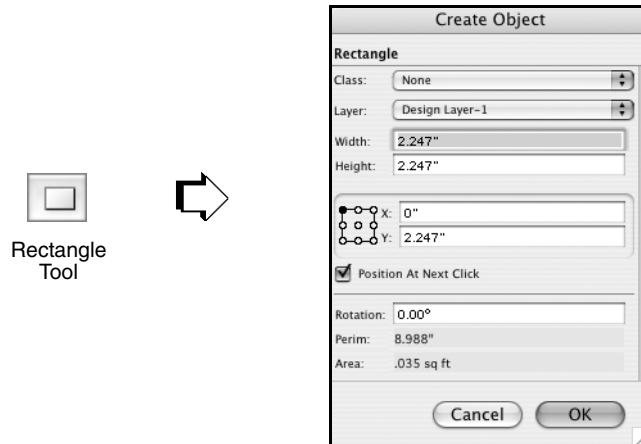


VectorWorks defaults to click-click mode, and all procedures in this guide are based on click-click drawing. This preference can be changed in VectorWorks preferences.

Use the Data bar for accurate object placement and creation. See “Using the 2D Data Bar” on page 183 and “Using the 3D Data Bar” on page 291.

## Creating Objects with Object Properties

Some of VectorWorks’ creation tools can be used in conjunction with the Object Properties dialog box.



To create objects with the Object Properties dialog box:

1. Double-click the desired tool (or press the tool’s shortcut key twice).  
The tool’s Object Properties dialog box opens.
2. Enter the desired criteria.
3. Click **OK** to accept the settings and exit the dialog box.

If **Position At Next Click** is selected, click the mouse to select the object’s location in the drawing.

## Using Arithmetic Expressions

Arithmetic expressions can be entered into most of the edit fields in VectorWorks, including the Object Info palette’s Shape tab and the Data bar. For this reason, the dash (-) cannot be used as a separator between feet and inches.

Parentheses can be used to override the default operator precedence. For example:

$1'' + 2'' * 3'' = 7''$  (without parentheses)

$(1'' + 2'') * 3'' = 9''$  (with parentheses)

Values can be entered in any unit; VectorWorks converts it into the current unit. For example, if the current unit is Inches and an entry of 4''+3 cm is made into the Object Info palette X field, VectorWorks converts the units automatically. The result, 5.1811'', is displayed.

## Moving Around

VectorWorks provides several ways to move around within a drawing file, which allows you to look at the whole drawing or at select portions of it. These navigation tools work for both 2D and 3D drawings.

## Panning

Use the **Pan** tool to move the drawing around the drawing window, changing the area of display.

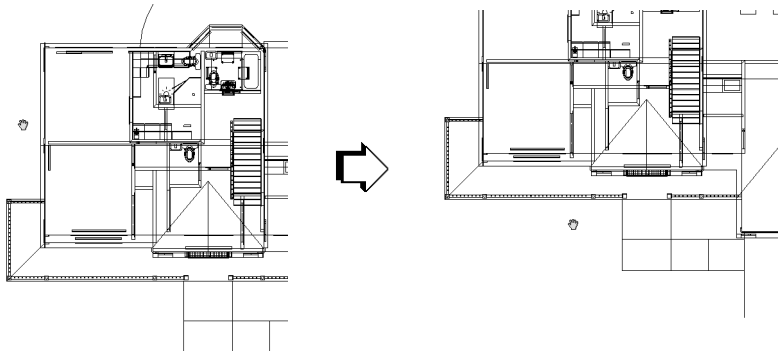


To pan around the drawing:

1. Click the **Pan** tool from the Basic palette.
2. Move the hand into the drawing window.
3. Click and hold down the mouse button, and drag the drawing around the screen.

The rulers move with the page.

4. When the drawing shows the desired area, release the mouse button.



Double-click the **Pan** tool to refresh the drawing view.

If navigation problems occur while panning, try disabling the **Hardware accelerated 2D navigation** VectorWorks preference (see “Display Preferences” on page 48) or adjusting the video card configuration.

### Panning with the Mouse Wheel

On a wheel-mouse, click and hold down the mouse wheel to pan at any time, regardless of which tool is currently selected.

This feature will not work properly if the wheel button has been assigned a custom function in the mouse setup. For example, if the wheel button is set to perform a delete when clicked, a wheel click in VectorWorks deletes rather than pans. (The specific setting required for this feature depends on the type of mouse being used.)

### Panning with the Arrow Keys

Use the arrow keys on the keyboard to pan at any time, regardless of which tool is currently selected. Specify the arrow shortcut keys for panning in VectorWorks preferences (see “Setting VectorWorks Preferences” on page 39). Press the shortcut key combination once to move the drawing one half-screen in the direction of the arrow.

## Moving the Page Print Boundary

The **Move Page** tool changes the position of the print boundary within the drawing area. Though the boundary moves, the rulers, origin, and objects remain fixed. In 3D, the working plane does not move along with the boundary.

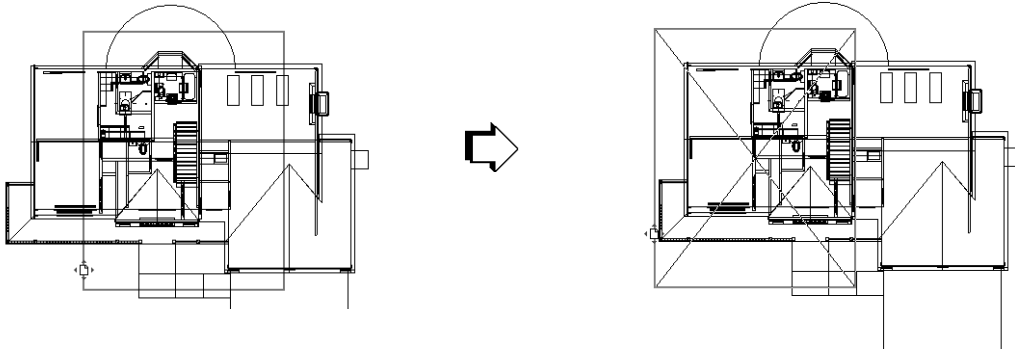


To move the page:

1. Click the **Move Page** tool from the Basic palette.
2. Click and drag the page outline to the desired location.

The original position of the page continues to display, helping to measure your movement.

3. Click to set the position of the page.



**Paste in Place** works from user origin. If the page is moved, the image is placed in relation to the origin, not the new page location.

Double-click the **Move Page** tool to set the page origin to be the same as the user origin.

## Zooming

Zoom controls the visual scale of a drawing. It does not affect the physical size of objects as set by the layer scale in the Organization dialog box. Like a magnifying glass, zoom controls how close or far away objects appear on the screen. Zoom in to get a close-up view of a detail, and zoom out to get a broader view of the whole drawing.

If navigation problems occur during a zoom, try disabling the **Hardware accelerated 2D navigation** VectorWorks preference (see “Display Preferences” on page 48) or adjusting the video card configuration.

VectorWorks includes zoom functionality through the mouse wheel, through buttons on the View bar, and through the **Zoom** tool on the Basic palette.

### Zooming with the Mouse Wheel

On a wheel-mouse, roll the mouse wheel forward to magnify the drawing (the **Zoom** tool on the Basic palette need not be selected). Roll the mouse wheel backward to zoom out from the drawing.

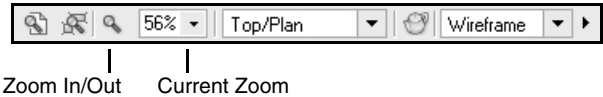
The mouse wheel behavior is controlled by the **Mouse wheel zooms** setting in the Edit tab of the VectorWorks Preferences dialog box. If the wheel is set to scroll by default, you must press the Ctrl (Windows) or Option (Macintosh) key while you roll in order to zoom. See “Edit Preferences” on page 39 for details.

This feature will not work properly if standard scrolling is disabled in the mouse setup. For example, if the mouse’s scrolling size is set to “none,” mouse zooming in VectorWorks is disabled. (The specific settings required for this feature depend on the type of mouse being used.)

### Zooming from the View Bar

From the View bar, click the **Zoom** button to double the magnification of the drawing (a single-click on this button performs the same function as a double-click on the **Zoom** tool on the Basic palette). To reduce the magnification by half, press the Alt key (Windows) or Ctrl key (Macintosh) when you click the **Zoom** button. To zoom by a specific amount, enter a zoom factor in the View bar, or select one from the pull-down list.

If an object or objects are currently selected, the zoom is centered on those object(s). To zoom on a specific area of the drawing (with nothing selected), click in an open area and then click the **Zoom** button.

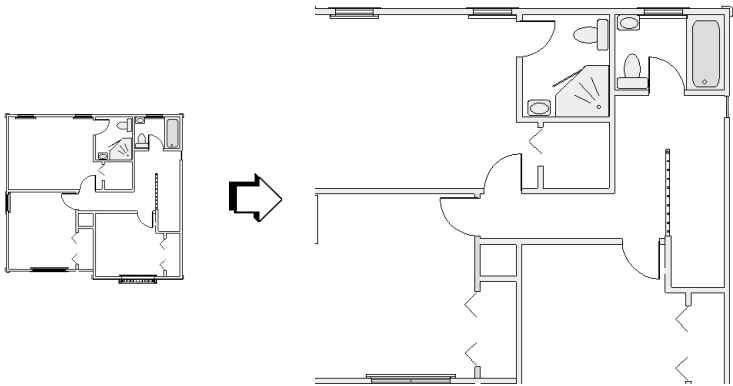


### Zooming with the Zoom Tool

The **Zoom** tool has two modes.



Mode	Description
Marquee Zoom	Magnifies the portion of the drawing that is within the marquee area; in click-drag mode, simply click once (do not create a marquee box) to double the zoom factor To zoom out, hold down the Option (Macintosh) or Alt (Windows) key during the zoom.
Interactive Zoom	Interactively zooms the drawing area



With the Zoom tool selected, double-click anywhere in the drawing to automatically activate either the **2D Selection** tool. (If the drawing is in a 3D view, the **3D Selection** tool is activated, otherwise, the **2D Selection** tool is activated.)

Double-click the **Zoom** tool on the Basic palette to double the magnification of the drawing. The **Zoom In** button on the View bar performs the same action.



## Marquee Zoom Mode

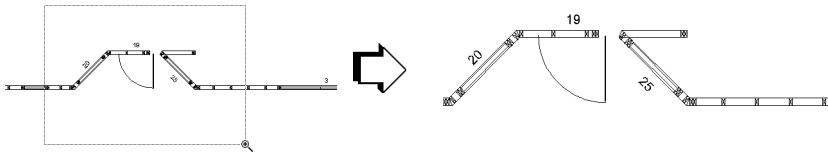
Select a portion of the drawing to magnify using marquee selection.



To marquee zoom:

1. Click the **Zoom** tool from the Basic palette.
2. Click the **Marquee Zoom** mode button.
3. Click and drag to create a marquee box around the portion of the drawing to magnify.
4. Click again to zoom in.

VectorWorks magnifies the selected section so that it fills the drawing window.



To zoom out, hold down the Option (Macintosh) or Alt (Windows) key while you draw a marquee box around a portion of the drawing. Click again to zoom out. VectorWorks reduces the magnification to display additional portions of the drawing around the selected section.

## Interactive Zoom Mode

Choose an area of the drawing to magnify interactively.



To interactively zoom:

1. Click the **Zoom** tool from the Basic palette.
2. Click the **Interactive Zoom** mode button.
3. Click in the drawing and hold down the mouse button (Macintosh) or left mouse button (Windows) while you move the mouse forward to zoom in on the drawing from the location of the click.

To zoom out, click in the drawing and hold down the mouse button (Macintosh) or left mouse button (Windows) while you move the mouse backward to zoom out of the drawing from the location of the click.

## Scrolling

### Automatically Scrolling While Drawing

VectorWorks automatically scrolls the drawing area when an object is being drawn.

To use autoscroll:

1. Select any drawing tool.
2. Press and hold down the mouse button to begin drawing.
3. Drag the cursor on top of or past a scroll bar or ruler.

The drawing window scrolls in the direction of the cursor.

In click-click mode, if you do not hold down the mouse button while you draw, the autoscroll is halted if the cursor passes a scroll bar or ruler; this allows interaction with the scroll bars, tool palettes, and tool sets.

Using the Scroll Bars

Use VectorWorks’ scroll bars to move the drawing around the screen. However, the scroll bars are best used for small movements, because they require the screen to redraw more frequently. For large movements, the **Pan** tool is faster. To display or hide the scroll bars, change the scroll bars setting in the VectorWorks Preferences dialog box.

If navigation problems occur during a scroll, try disabling the **Hardware accelerated 2D navigation** VectorWorks preference (see “Display Preferences” on page 48) or adjusting the video card configuration.

Scrolling with the Mouse Wheel

On a wheel-mouse, press the Ctrl (Windows) or Option (Macintosh) key while you roll the wheel forward or backward to scroll the window up or down. To scroll the window left or right, press the Shift key while you roll.

The mouse wheel behavior is controlled by the **Mouse wheel zooms** setting in the Edit tab of the VectorWorks Preferences dialog box. The wheel can be set to scroll by default, so that no additional key must be pressed while you roll in order to scroll. See “Edit Preferences” on page 39 for details.

This feature will not work properly if standard scrolling is disabled in the mouse setup. For example, if the mouse’s scrolling size is set to “none,” mouse scrolling in VectorWorks is disabled. (The specific settings required for this feature depend on the type of mouse being used.)

Selecting Objects

Use the **2D Selection** or **3D Selection** tool on the Basic palette to select objects, which makes the objects active. The Shift key and the Alt (Windows) or Option (Macintosh) key are modifiers for selection actions. Create rectangular, lasso, or polygonal marquees around objects to select single or multiple objects. The following table describes the various selection methods.

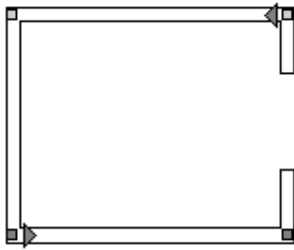
Method	Selection Action
Click	Standard selection method; selects a single object only
Option-click (Macintosh) or Ctrl-click (Windows)	Creates a copy of the object and places it directly over the selected object
Shift-click	Selects multiple objects as each object is clicked.; also can be used to deselect one or more objects without affecting other selected objects.
Option-drag (Macintosh) or Ctrl-drag (Windows)	Places a copy of the object where the mouse button is released
Rectangle, lasso, polygon marquee	Selects all objects that are completely contained within the marquee
Shift-marquee	Reverses the selection status of objects inside a marquee; if objects inside the marquee are selected, this method deselects those objects
Option-marquee (Macintosh) or Alt-marquee (Windows)	Selects all objects that the marquee passes through, as well as those contained within the marquee
<b>Invert Selection</b> command (on the Edit menu)	Deselects everything that is currently selected, and selects all visible objects in editable layers and classes that are not currently selected

To deselect all selected objects, click in an empty area of the drawing, or press the “x” key twice in rapid succession.

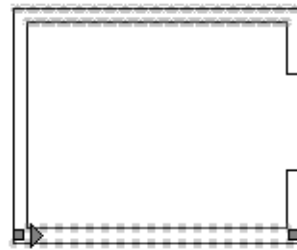
## Selection Indicators

By default, a selected object is indicated by square selection handles: the handles are blue for unlocked objects on the active layer, gray for locked objects on the active layer, and white for all objects on an inactive layer. Some of the handles can be used as reshape points, and some cannot, depending on the object, and on which tool is active.

In the VectorWorks Preferences, there is an option to highlight selected objects with colors and patterns. Different highlighting can be used for the active layer, the inactive layer, and locked objects. When highlighting is enabled, square reshape handles also appear on a selected object, if the object can be edited with the active tool. The handles are blue for objects on the active layer, and white for objects on an inactive layer; locked objects have no handles, since they cannot be edited.



With selection highlighting disabled, the locked wall (top) has gray handles; the unlocked wall (bottom) has blue handles

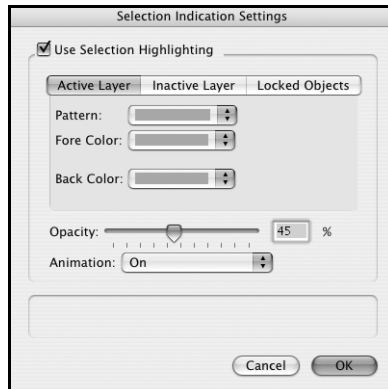


With selection highlighting enabled, the locked wall (top) is highlighted and has no handles; the unlocked wall (bottom) has blue handles and a different highlighting pattern

To set the selection indicators:

1. Select **Tools > Options > VectorWorks Preferences**.
2. Click the Display tab, and click **Selection Indication**.

The Selection Indication Settings dialog box opens.

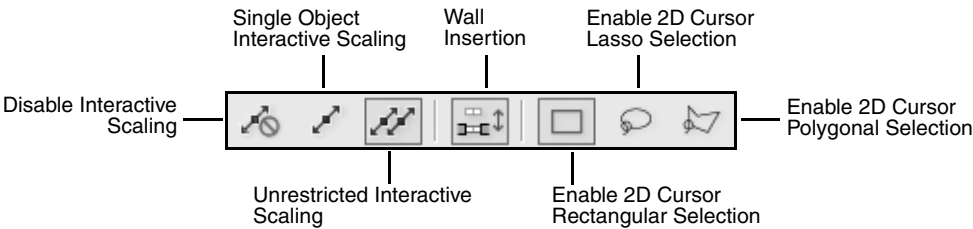


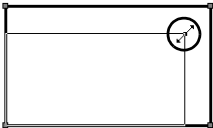
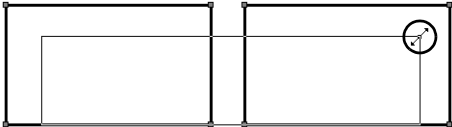
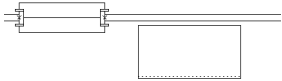
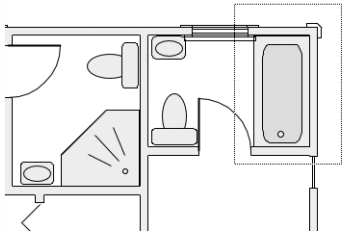
Parameter	Description
Use Selection Highlighting	Objects that are selected are highlighted with the specified colors and patterns, and square handles indicate points that can be used to reshape objects with the tool that is currently active. Specify the colors and patterns for the active layer, for the inactive layer, and for locked objects.  When this option is deselected, square handles indicate objects that are selected, and the handles may or may not be reshape points.
Active Layer, Inactive Layer, and Locked Objects tabs: Pattern / Fore Color / Back Color	Specifies the highlight options to indicate selected objects on the active design layer, inactive design layers, and locked objects. To use a solid color, select the color from the <b>Back Color</b> menu, and then select the solid pattern from the <b>Pattern</b> menu. To use a pattern, select from the <b>Pattern</b> , <b>Fore Color</b> , and <b>Back Color</b> menus.
Opacity	Controls the opacity of the selection highlight; enter a value or drag the slider to adjust opacity
Animation	If <b>Use Selection Highlighting</b> is selected, specify how the selection highlight will be animated: <ul style="list-style-type: none"><li>• Off turns off all animation of highlights</li><li>• On pulses the highlight when the cursor moves out of the drawing window or over a palette</li></ul>

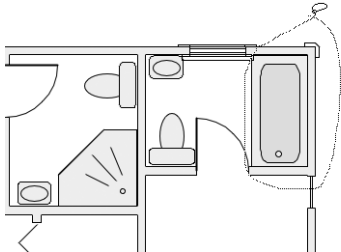
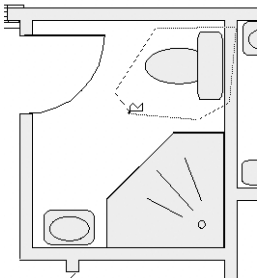
3. Click **OK** to save the settings and close the Selection Indication Settings dialog box.
4. From the VectorWorks Preferences dialog box, click **OK** again to save the preferences.

## 2D Selection Tool

Use the **2D Selection** tool to select objects, to move and resize objects, and to insert objects in or next to a wall. An additional mode, Enable Connected Walls, becomes available if the VectorWorks Design Series is installed. See “Moving Connected Walls” on page 61 in the VectorWorks Design Series User’s Guide for information.



Mode	Description
Disable Interactive Scaling	Objects can be moved from snap points without affecting their size (selection handles do not display for selected objects)
Single Object Interactive Scaling	Allows resizing by adjusting the selection handles that display on a single selected object 
Unrestricted Interactive Scaling	Allows resizing by adjusting the selection handles that display on the selected object(s) 
Wall Insertion	Allows symbols that are already on drawing to be placed into a wall segment. When disabled, symbols can be moved next to or on a wall without becoming part of the wall. See “Wall Insertion Mode” on page 162 for more information. 
Enable 2D Cursor Rectangular Selection	Creates a marquee box around objects when selecting. Click to set the start point, drag the mouse in the desired direction, and release to set the end point. All objects within the marquee are selected. 

Mode	Description
Enable 2D Cursor Lasso Selection	<p>Creates a free-form marquee, allowing a more exact selection of irregular 2D shapes. Click to set the start point, drag the mouse in the desired direction, and release to set the end point. All objects within the marquee are selected.</p> 
Enable 2D Cursor Polygonal Selection	<p>Creates a marquee with an irregular polygonal shape. Click to set the start point, and then continue clicking to define the shape. Double-click to finish the marquee. All objects within the marquee are selected.</p> <p>Press the Option (Macintosh) or Alt (Windows) key while drawing the marquee to select all objects that intersect the marquee.</p> 



To select 2D objects:

1. Click the **2D Selection** tool from the Basic palette.
2. Select the appropriate mode.
3. Select the desired object(s).

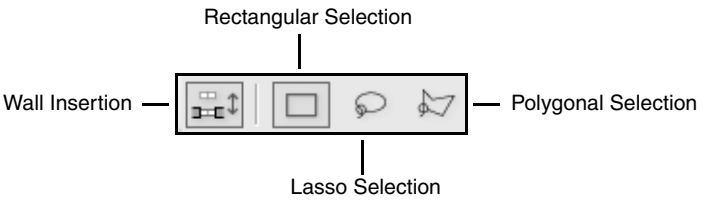
### 3D Selection Tool

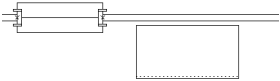
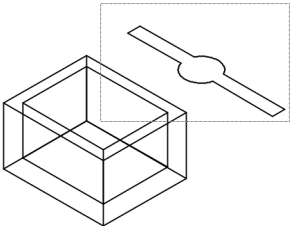
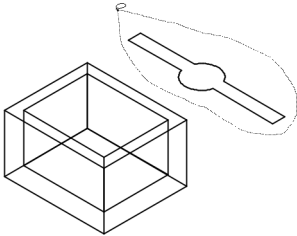
Use the **3D Selection** tool to select, move, or resize 3D objects in orthogonal views. When the tool is active, two smaller lines project from the X and Y locations in the drawing area. These lines help to identify the Z location of the tool in the drawing.

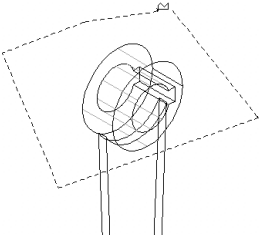
The reference for the view, whether working plane or ground plane, may depend on the selection in the Working Planes palette (see “Working Plane View and Modes” on page 557).

The last three modes allow the selection of 3D objects using a marquee shape.

An additional mode, Enable Connected Walls, becomes available if the VectorWorks Design Series is installed. See “Moving Connected Walls” on page 61 in the VectorWorks Design Series User’s Guide for information.



Mode	Description
Wall Insertion	<p>Allows symbols that are already on drawing to be placed into a wall segment. When disabled, symbols can be moved next to or on a wall without becoming part of the wall. See “Wall Insertion Mode” on page 162 for more information.</p> 
Rectangular Selection	<p>Creates a marquee box around objects when selecting. Click to set the start point, drag the mouse in the desired direction, and release to set the end point. All objects within the marquee are selected.</p> 
Lasso Selection	<p>Creates a free-form marquee, allowing a more exact selection of irregular 3D shapes. Click to set the start point, drag the mouse in the desired direction, and release to set the end point. All objects within the marquee are selected.</p> 

Mode	Description
Polygonal Selection	<p>Creates a marquee with an irregular polygonal shape. Click to set the start point, and then continue clicking to define the shape. Double-click to finish the marquee. All objects within the marquee are selected.</p> <p>Press the Option (Macintosh) or Alt (Windows) key while drawing the marquee to select all objects that intersect the marquee.</p> 



To select 3D objects:

1. Click the **3D Selection** tool from the Basic palette.
2. Select the view, if needed, and the appropriate selection mode.
3. Select the desired object(s).

## Select All

The **Select All** command selects all visible objects in editable layers and classes. The active layer is always editable, but other layers can be editable if they are visible and if the **Layer Options** are set to Show/Snap/Modify Others. For more information about setting layer and class visibility and layer and class options, see “Setting Visibilities” on page 108 and “Setting Class and Design Layer Options” on page 103.

To select all objects in the drawing area:

Select **Edit > Select All**.

Alternatively, select **Select All** from the object context menu.

VectorWorks selects all visible objects that can be modified. Each of these selected objects is displayed with selection handles. Locked objects are also selected so they can be unlocked for modification.

## Previous Selection

The **Previous Selection** command reselects the set of objects that were most recently selected. This is especially useful if a large number of objects were accidentally deselected.

To reselect previously selected objects, select **Edit > Previous Selection**.

## Context Menus

Click on an object, plug-in object, the drawing area, or a section of the Resource Browser with a right click (Windows) or Ctrl-click (Macintosh), to display a menu containing context-sensitive commands that pertain to the selected item or



items. If several similar items are selected, only the applicable context menu commands become available to all the items in the selection.

This list is not exhaustive, as the capability is continuously being extended to additional VectorWorks commands and tools.

Many different types of objects have the same global context commands available, such as **Cut**, **Copy**, and **Paste**. These are listed once, under “Object” rather than listing them repeatedly for each type of object.

Item and Context Commands	Description
<b>Document</b>	
Activate Class Activate Layer	Activates the class or layer of the object nearest to the last mouse click. These commands provide quick access to the class or layer of any object currently displayed.
Force Select	Activates the class, layer, or both (as necessary), and selects the object nearest to the last mouse click
Active Layer Scale	Accesses the Layer Scale dialog box; from there, change the scale of the active design layer (or all design layers)
Document Preferences	Provides a shortcut to the command of the same name on the <b>File &gt; Document Settings</b> menu
Palettes	Provides a shortcut to palette display options on the <b>Window &gt; Palettes</b> menu
Layer Options Class Options	Provide shortcuts to the commands of the same names on the <b>View</b> menu
<b>Object</b>	
Activate Class Activate Layer	Activates the class or layer of the object clicked upon, even if the object could not normally be selected due to a different layer scale, or the current class or layer option settings. These commands provide quick access to the class or layer of any object currently displayed.
Force Select	Activates the object’s class, layer, or both (as necessary) and selects the object, even if the object could not normally be selected due to a different layer scale, or the current class or layer option settings
Cut, Copy, Paste, Select All	Provide shortcuts to the commands of the same names on the <b>Edit</b> menu
Send, Rotate	Provide shortcuts to the commands of the same names on the <b>Modify</b> menu
Lock, Unlock	Provide shortcuts to the commands of the same names on the <b>Modify</b> menu
Add Surface, Clip Surface, Intersect Surface	When two or more closed 2D objects are selected, provides shortcuts to the commands of the same name on the <b>Modify</b> menu
Properties	Accesses the object’s properties dialog box, which is similar to the Object Info palette; it contains information specific to the selected object
<b>Plug-In Objects</b>	
Path Plug-In Object, Path Plug-in Object with Profile	Includes Extrude along Path and for the Design Series, Chain Extrude and Piping Run

Item and Context Commands	Description
Edit, Edit Path	Provides a shortcut to the <b>Edit Group</b> command on the <b>Modify</b> menu
Edit Profile	If permitted by the object type, allows you to switch from editing the path to editing the profile. Similarly, if editing the profile, use the context menu to switch to path editing.
<b>Group</b>	
Edit	Provides a shortcut to the <b>Edit Group</b> command on the <b>Modify</b> menu
Ungroup	Provides a shortcut to the command of the same name on the <b>Modify</b> menu
<b>Symbol</b>	
Edit	Provides a shortcut to the <b>Edit Symbol</b> command on the <b>Modify</b> menu
Replace	Similar to the <b>Replace</b> button on the Object Info palette, accesses the Choose a Symbol dialog box for replacing the symbol instance with a different symbol
Edit 2D Component or Edit 3D Component	Edits the 2D or 3D component of the symbol instance; if editing one of the components, the context menu allows you to switch directly to editing the other component.
<b>Resource Browser</b>	The resources context menu contains shortcuts for creating, applying, and managing resources and also for manipulating how resources display in the Resource Browser. Additional options display on the menu depending on the specific item clicked upon (see “Working with Resources” on page 151).
<b>Text</b>	
Format Text	Provides a shortcut to the command of the same name on the <b>Text</b> menu
Check Spelling	Checks the spelling in the current text block
Edit	Places the text in text editing mode
<b>Drawing Border</b>	
Show Grids	Toggles between showing and hiding grid text and lines in the drawing border margin
Title Block	Opens the Import Title Block dialog box, for adding a title block to the drawing border; see “Adding a Title Block” on page 463
<b>Wall or Round Wall</b>	
Join	Activates the <b>Wall Join</b> tool for joining wall segments; see “Joining Walls” on page 491. The tool defaults to the mode used previously with the tool
Remove Break	Activates the <b>Remove Wall Breaks</b> tool to clean up wall breaks or gaps; see “Removing Wall Breaks” on page 491
<b>Viewport</b>	
Edit Annotations, Edit Crop, Edit Design Layer	Provide shortcuts to edit the viewport’s annotations, crop, or design layer, bypassing the Edit Viewport dialog box (see “Cropping Sheet Layer Viewports” on page 618). The context menu commands can also be accessed when in an edit viewport mode (for example, to switch directly from editing a crop to editing annotations)

Item and Context Commands	Description
Edit	Opens the Edit Viewport dialog box
Edit Design Layer	Activates the design layer of the right-clicked object (if the right-clicked object does not belong to a design layer, the Edit Viewport dialog box opens)
Update	Updates the viewport, similar to the <b>Update</b> button on the Object Info palette
<b>Light</b>	
Turn On/Off	Toggles the light on or off
Set Light to View, Set View to Light	For directional, spot, or custom (RenderWorks required) lights, sets the orientation of the light to that of the current view, or the orientation of the view to that of the light
Edit (Design Series required)	For Spotlight lighting devices, edits the instrument properties
Edit Light (Design Series required)	For Spotlight lighting devices, edits the light contained within the instrument
<b>Worksheet on Drawing</b>	(Other worksheet context menu commands are described in “Worksheet Commands” on page 569)
Recalculate	Recalculates all formulas in the worksheet
<b>Dimension</b>	
Format Text	Provides a shortcut to the command of the same name on the <b>Text</b> menu
<b>Chain Dimension</b>	For more information on editing chain dimensions, see “Editing Chain Dimensions” on page 456
Add Dimension	Adds a dimension or witness line to the chain
Delete Segment/Witness Line	Deletes dimension or witness line
Edit Dimension	Edits the properties of an individual dimension
Format Text	Provides a shortcut to the command of the same name on the <b>Text</b> menu
<b>Layer Link (Design Series required)</b>	
Convert to Viewport	Converts the layer link to a design layer viewport
Edit Crop	Enters crop mode for a cropped layer link “Cropping Layer Links” on page 631
Edit Design Layer	Returns to the design layer of the object in the layer link
<b>Redline (Design Series required)</b>	
Pick Up Redline, Restore Redline	Toggles the redline status to picked up or restored
<b>Site Model (Design Series required)</b>	
Edit Source Data	Accesses the source data in Edit Group mode (see “Setting Site Model Properties” on page 158 in the VectorWorks Design Series User’s Guide)

Item and Context Commands	Description
Update	Updates the site model, similar to the <b>Update</b> button on the Object Info palette
<b>Plants (Design Series required)</b>	
Create Plant from Object	Creates a plant definition for the current plant symbol
Edit	Opens the Edit Plant dialog box, for editing the plant 2D/3D components, definition, or path (for multiple plant placements)
Replace Plant	Replaces the plant symbol, similar to the <b>Replace Plant</b> button on the Object Info palette
Export Plant	Exports the selected plant to the specified location; see “Exporting Resources” on page 23 in the VectorWorks Design Series User’s Guide

Double-clicking on an object performs the same function as clicking **Edit** from the context menu.

The context menus can be customized through the Workspace Editor; see “Modifying Context Menus” on page 723.

This chapter describes how to get started with VectorWorks Fundamentals. It describes how to set up basic program preferences, units, and default options. Printing and using tablets with VectorWorks are also described.

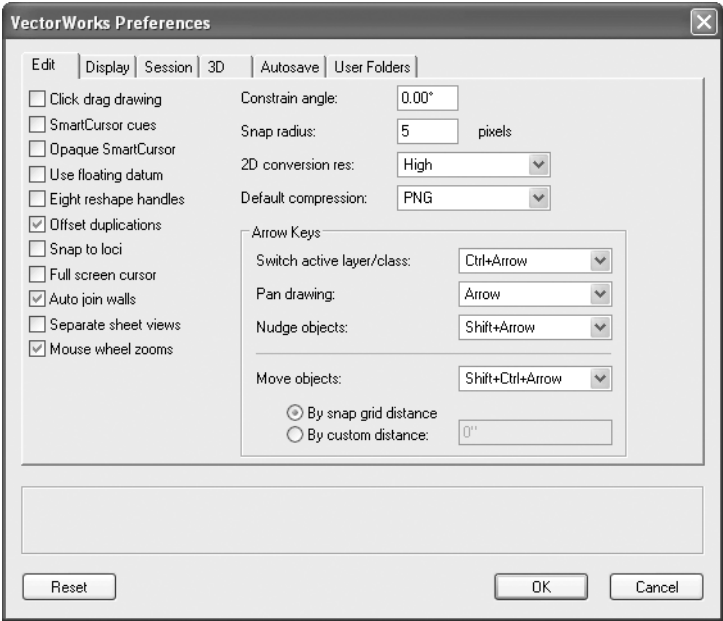
## Setting VectorWorks Preferences

VectorWorks preferences are options that apply to every VectorWorks file you open, every time you run VectorWorks. To change the VectorWorks preference settings:

1. Select **Tools > Options > VectorWorks Preferences**.  
The VectorWorks Preferences dialog box opens. There are six preferences tabs (Edit, Display, Session, 3D, Autosave, and User Folders).
2. Click one of the tabs to set the VectorWorks preferences for that tab.
3. Click **OK** to save the settings.

## Edit Preferences

Click the Edit tab to set preferences that control various edit functions in VectorWorks.

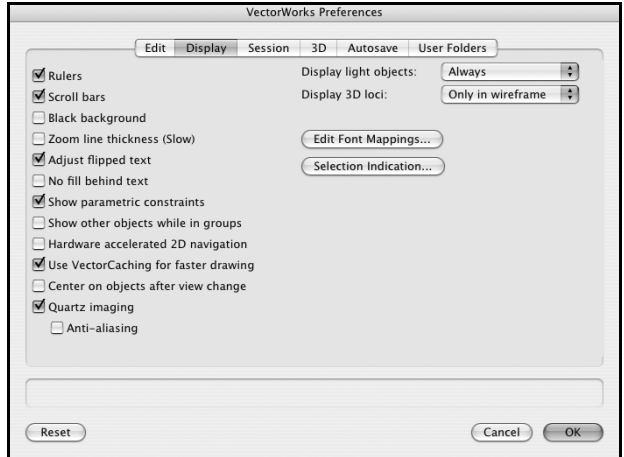
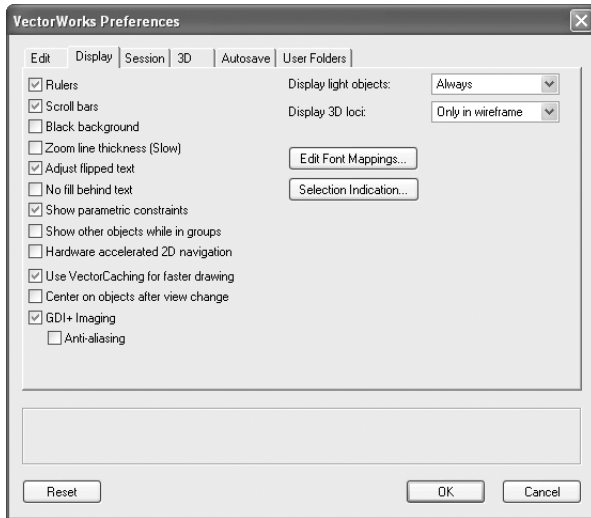


Parameter	Description
Click drag drawing	Lets you draw objects with the click-drag method rather than the click-click method (click-click is the default). Click once with the mouse button and do not release; drag the cursor to a desired location and then release. See “Using the Mouse” on page 22.
SmartCursor cues	Displays cues in full next to the cursor; deselect the option to hide the cues

Parameter	Description
Opaque SmartCursor	Displays SmartCursor cues that are opaque instead of transparent
Use floating datum	Sets a temporary data origin; when the option is deselected, this feature is only available manually (see “Smart Points” on page 123)
Eight reshape handles	Shows eight handles (four corner and four center) on most objects; deselect the option to display only four corner handles
Offset duplications	When you use the <b>Duplicate</b> command, places the duplicate object so that it is offset from the original object; deselect the option to place duplicates directly over the original
Snap to loci	Displays 2D loci with crosshairs that extend to the edges of the drawing window; these create snap zones to simplify the alignment of objects along a certain horizontal or vertical axis
Full screen cursor	Displays a crosshair cursor that extends to the edges of the drawing area
Auto join walls	When you use the <b>Wall</b> tool, automatically joins walls at corners and intersections; when walls are separated, their ends automatically heal (see “Automatically Joining Walls” on page 479)
Separate sheet views	Saves the view origin and zoom factor for each sheet layer; deselect the option to use the same view for all design layers and sheet layers
Mouse wheel zooms	Sets the default behavior of the mouse wheel and the Mighty Mouse scroll ball. When selected, the wheel zooms by default; when deselected, the wheel scrolls by default. See “Zooming with the Mouse Wheel” on page 25 and “Scrolling with the Mouse Wheel” on page 28 for details.
Constrain angle	Sets an alternate angle to use with the SmartCursor and Constrain angle constraint
Snap radius	Sets the number of pixels away from a snap point to activate the SmartCursor
2D conversion res	Sets the number of segments that will be used to represent polylines and circles when you draw and edit objects
Default compression	Specifies the default image compression to apply to images in a viewport cache and to images created by the <b>Render Bitmap</b> tool (RenderWorks required). PNG compression provides the best image quality but produces larger files, while JPEG creates smaller files, but with possible loss of detail. PNG is selected by default.
Arrow Keys	Select an arrow and modifier key combination as a shortcut for four common operations; each key combination can be assigned to only one operation
Switch active layer/ class	Select the key combination that switches the active layer (up and down arrows) and the active class (left and right arrows)
Pan drawing	Select the key combination that pans the drawing by half of the area currently in view
Nudge objects	Select the key combination that nudges objects by one pixel
Move objects	Select the key combination that moves objects, and select whether to move objects by the snap grid distance or by the specified custom distance

## Display Preferences

Click the Display tab to set the display preferences.

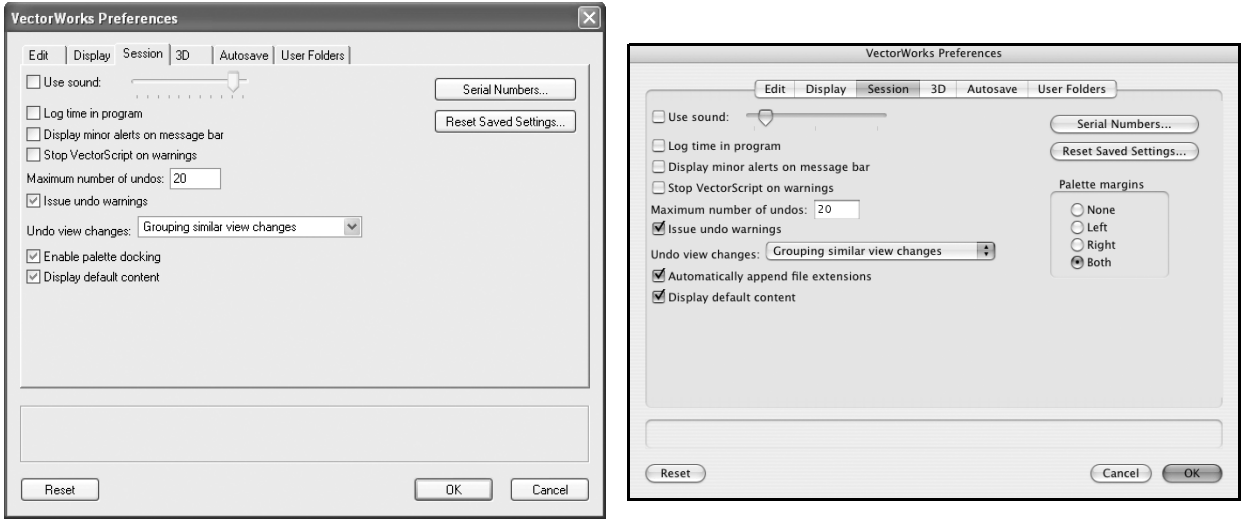


Parameter	Description
Rulers	Shows the rulers
Scroll bars	Shows the scroll bars
Black background	Uses a black drawing background instead of the default white
Zoom line thickness	Lines in the drawing appear thicker when you zoom in; the screens redraw slower if Quartz (Macintosh) or GDI+ (Windows) imaging is enabled
Adjust flipped text	Re-oriens rotated and flipped text so that it is always readable
No fill behind text	Displays text without a fill pattern so that objects beneath the text are not obscured
Show parametric constraints	Displays parametric constraints
Show other objects while in groups	Shows the rest of drawing when the <b>Edit Group</b> command is used; deselect the option to hide objects that are not in the group. This option also applies to viewports that are edited with the <b>Edit Viewport</b> command and layer links that are being cropped.
Hardware accelerated 2D navigation	If the computer's video card supports it, uses OpenGL hardware acceleration to speed up 2D navigation (scroll, pan, and zoom); text, patterns, and bitmaps in the drawing file display properly once the navigation is complete
Use VectorCaching for faster drawing	Caches vector information for complex document entities, such as polylines and hatches; while this makes screen redraws faster, it also can potentially increase RAM requirements by up to 50 percent
Center on objects after view change	When the view is changed to one of the standard views (such as Top or Left Isometric), automatically centers the view on the selected objects at the current zoom level; if no objects are selected, the view is set to the center of all objects

Parameter	Description
Quartz imaging (Macintosh) or GDI+ imaging (Windows)	Draws lines of equal thickness with round end caps; provides layer transparency, better support for large-format printouts, and PDF export (see “Exporting Files” on page 519)
Anti-aliasing	When Quartz (Macintosh) or GDI+ (Windows) imaging is enabled, blends the edges of fills and lines for a smoother appearance
Display light objects	Controls the visibility of light objects; hide light objects to reduce screen clutter but maintain light effects
Always	Light objects are always visible
Only in wireframe	Light objects are only visible in Wireframe mode; otherwise, they are hidden
Never	Light objects are hidden regardless of the render mode
Display 3D loci	Controls the visibility of 3D loci
Always	3D loci are always visible
Only in wireframe	3D loci are only visible in Wireframe mode; otherwise, they are hidden
Never	3D loci are hidden regardless of the render mode
Edit Font Mappings	Specifies the replacement fonts, when fonts are not available
Selection Indication	Opens the Selection Indication Settings dialog box to specify how selected objects are indicated in VectorWorks (see “Selection Indicators” on page 29)

Session Preferences

Click the Session tab to set general VectorWorks preferences.

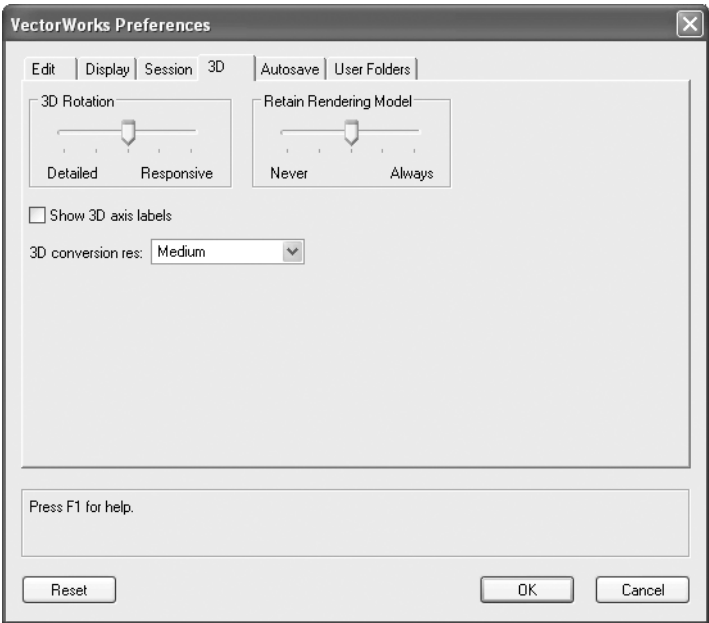




Parameter	Description
Use sound	Supplements the visual interface cues with audible cues; move the slider bar left (to reduce) or right (to increase) the VectorWorks volume relative to the system volume
Log time in program	Records in a log file the time spent in the program, as well as the time spent to open and close documents; the date format depends on the language and regional settings in the operating system. The log file is created in the User Data and Preferences Folder (User Folders tab).
Display minor alerts on message bar	Displays minor warnings on the Message bar instead of in a dialog box
Stop VectorScript on warnings	Halts the compile and execution of a VectorScript routine when a warning is generated
Maximum number of undos	Sets how many undo operations are kept in memory; the maximum number of undos is 100
Issue undo warnings	Presents a dialog box when an action that cannot be undone is about to be performed
Undo view changes	Sets how VectorWorks handles view changes when you undo actions <ul style="list-style-type: none"> <li>• Never - ignores all operations that are strictly view changes</li> <li>• Grouping All View Changes - treats all consecutive view changes as one single undoable action</li> <li>• Grouping Similar View Changes - treats similar consecutive view changes as a single undoable action</li> <li>• Individually - treats each individual view change as an undoable action</li> </ul>
Palette margins (Macintosh)	Sets whether the document window leaves a space for palettes when the window is opened
Enable palette docking (Windows)	Lets you dock palettes; deselect the option to disable docks and to undock all active palettes
Display default content	Enables pre-defined content (such as hatches and gradients) to display for selection throughout the program; this option is enabled by default
Automatically append file extensions (Macintosh)	Appends the appropriate file extension (.vwx, or .sta for template files) to a newly-created VectorWorks drawing on a Macintosh
Serial Numbers	Opens the Serial Numbers dialog box to add or remove serial numbers for all installed Nemetschek North America products (see "Entering the Serial Number" on page xi)
Reset Saved Settings	Click <b>Reset Saved Settings</b> to revert to default settings instead of user-specified settings. In the dialog box that opens, select whether to reset settings for always performing the selected action in alert dialog boxes. Also select whether to reset settings for all tool modes, dialog box positions, and dialog box values. Click <b>OK</b> to return to the VectorWorks Preferences dialog box.

### 3D Preferences

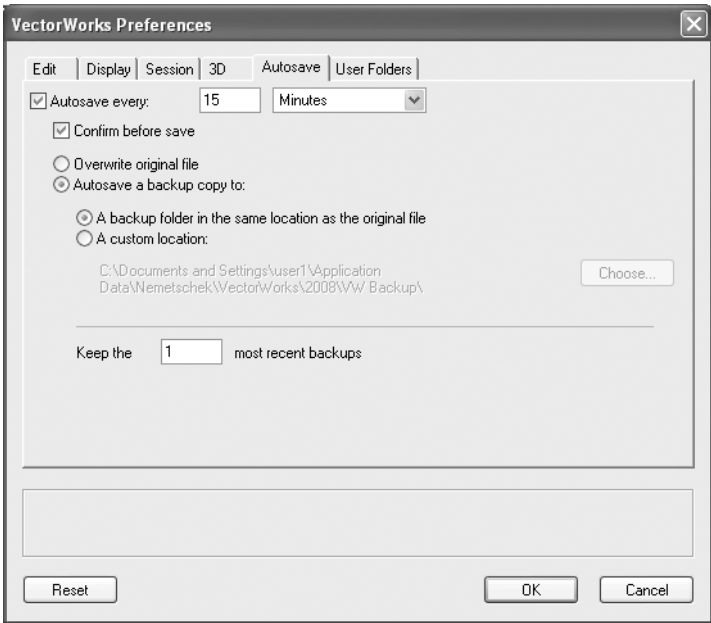
Click the 3D tab to set preferences for 3D edits.



Parameter	Description
3D rotation	Sets the detail level that displays while the 3D view is rotated. Select Detailed to display objects completely, but to rotate slower. Select Responsive to rotate faster, but to display objects with less detail during the rotation.
Retain rendering model	Determines the degree to which VectorWorks retains the rendered model in memory during 3D rotation. Select Never to force the model to always display in Wireframe mode; select Always to force the model to remain rendered.
Show 3D axis labels	Shows labels for each axis in the ground plane and working plane
3D conversion res	Sets the segmentation resolution used to display curved 3D objects; affects extruded and swept polylines, circles, and arcs

## Autosave Preferences

Click the Autosave tab to set preferences for automatic file saves and backups.



Parameter	Description
Autosave every	Enables the Autosave feature; also sets the number of minutes or operations between autosaves
Confirm before save	Before each save, opens a dialog box so that you can choose either to save or to continue to work without a save. The timer/counter resets regardless of which option is selected. See “Automatically Saving Files” on page 7.
Overwrite original file	Writes over the original file with the latest changes during a save
Autosave a backup copy to	Automatically saves a backup copy of the file either to a folder named VW Backup (in the same folder as the original file) or to a custom location, such as a network drive (click <b>Choose</b> to select a folder). The original file is not saved automatically; to save it, use one of the save commands on the File menu.  Backup files have unique names that include the word “Backup” and a date and time stamp appended to the original file name. Use backup file(s) to restore a project if something happens to the original file.
Keep the __ most recent backups	If <b>Autosave a backup copy to</b> is selected, specifies the maximum number of backup files to keep; the oldest backup file is replaced when a new backup is made

## User Folders Preferences

Users can designate which folder will hold user data and preferences files. The subfolders within this folder mirror several of the standard VectorWorks subfolders (Libraries, Plug-ins, Templates, and so on).

This duplication of folders in separate locations makes it easy for VectorWorks users to do the following:

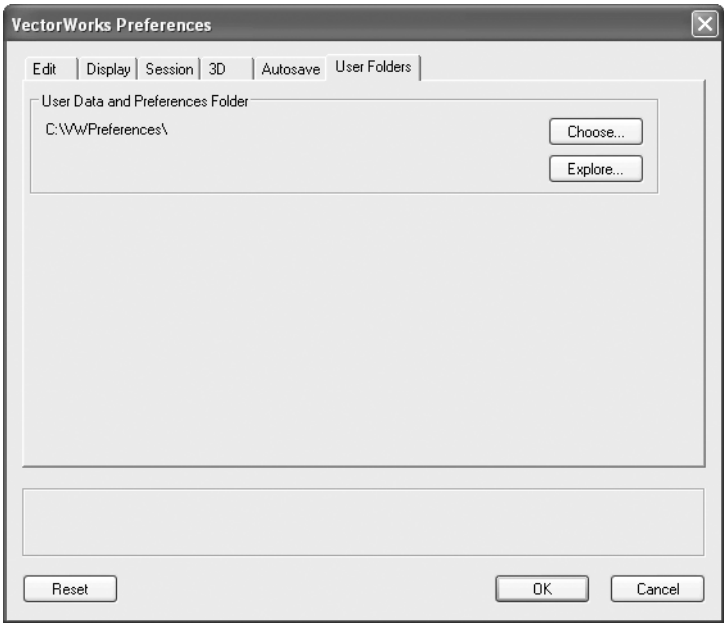
- Back up (or transfer to another computer) custom content and preferences
- Work in an environment where user permissions are limited (such as a school lab)
- Switch between users on the same computer
- Update VectorWorks with no loss of custom files

When VectorWorks presents data in the interface, it includes content from the user folder as well as the content it ships with. For example, select **Modify > Hatch** to edit a hatch; the Hatches dialog box shows all default hatches from your VectorWorks and user folders.

A file in the user folder takes precedence if a file name is repeated in any of the folders. For example, if both of the following files exist, only the content from the user folder shows in VectorWorks.

- [User]\Libraries\Defaults\Walls\Wall Styles Imperial.vwx
- [VectorWorks]\Libraries\Defaults\Walls\Wall Styles Imperial.vwx

Click the User Folders tab to specify the user folder.



Parameter	Description
User Data and Preferences Folder	Specifies the folder that contains VectorWorks preferences, log files, workspaces, and any personal content you create. This might be a folder on the local computer, or on a USB drive or network drive; this allows you to run VectorWorks from any computer.

Parameter	Description
Choose	Click <b>Choose</b> to change the user data folder. VectorWorks must be restarted if you change the location of the user data. See “User Folders Preferences” on page 46 for details.
Explore (Windows) or Reveal in Finder (Macintosh)	To look at the contents of the current folder, click <b>Explore</b> (to open Windows Explorer) or click <b>Reveal in Finder</b> (to open Macintosh Finder)

## User Data and Preferences Folder

The User Data and Preferences folder contains the VectorWorks files that are created and used by you. Within this folder, VectorWorks automatically creates subfolders for Libraries, Plant Database (VectorWorks Landmark required), Plug-ins, Settings, Standards, Templates, VWHelp, and Workspaces.

VectorWorks automatically adds your customizations (such as workspace changes and Resource Browser favorites) to the appropriate folders. To add content, place the file in the appropriate subfolder. For example, to add a custom template, place the custom file in the Templates folder.

VectorWorks defaults the following locations for the user data folder, but they can be changed. Note that, by default, Windows hides the Application Data folder; to keep the default folder, adjust the folder options in Microsoft Explorer to make hidden folders visible.

- **Windows:** C:\Documents and Settings\<Username>\Application Data\Nemetschek\VectorWorks\2008\
- **Macintosh:** ~Library/Application Support/VectorWorks/2008/

To change the user data folder:

1. From the User Folders tab, click **Choose**.
2. A confirmation dialog box displays. Click **Yes** to continue with the folder change.
3. Select a folder from the dialog box that opens, and click **OK** (Windows) or **Choose** (Macintosh).
4. Another confirmation dialog box displays. Click **Yes** to copy the user data to the new location, or click **No** to use the VectorWorks defaults.
5. If you copy the data to the new location, and the destination folder already contains a file with the same name as a file in the source folder, VectorWorks displays a notice that files in the destination folder will be overridden. Click **Yes** to continue.
6. If any unsaved files are currently open, you are prompted to save them. Click **Yes** to continue.
7. VectorWorks copies the files to the new location and then closes automatically.
8. Restart VectorWorks.

## Workgroup and Project Folders

If VectorWorks Design Series is installed, a section for Workgroup and Project folders displays at the bottom of this tab. See “Workgroup Folders” on page 24 in the VectorWorks Design Series User’s Guide for details about using workgroup folders.

## Resetting VectorWorks Preferences

Click the **Reset** button at the bottom of the VectorWorks Preferences dialog box to reset VectorWorks preferences to their defaults; this also clears the ten most recently opened files list and the font mapping table. Serial number(s), user name, and company name are left intact. This operation cannot be undone.

## Setting Document Preferences

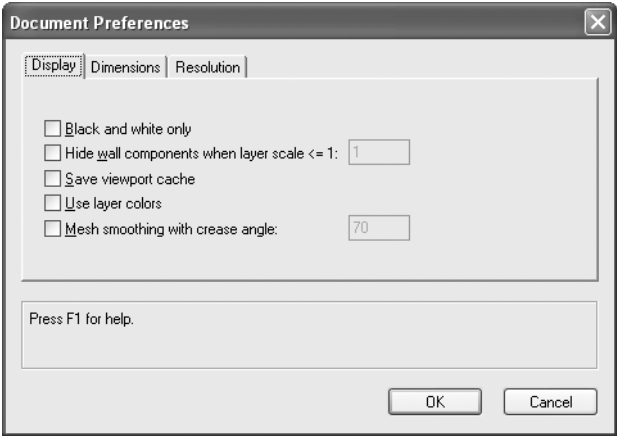
Document preferences apply only to the current drawing, and they remain in effect until they are changed. When you create a template, the current document preferences are saved with the template (see “Using Drawing Tablets” on page 78).

To change the preference settings in the document:

1. Select **File > Document Settings > Document Preferences**.  
*Alternatively, select Document Preferences from the document context menu.*  
The Document Preferences dialog box opens.  
There are three preferences tabs (Display, Dimensions, and Resolution).
2. Click one of the tabs to set the document preferences for that tab.

## Display Preferences

Click the Display tab to set the display preferences.

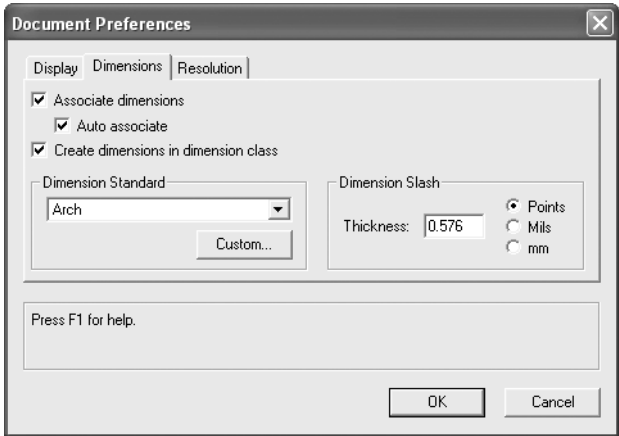


Parameter	Description
Black and white only	Objects are drawn using only the colors black and white; this choice overrides any other color settings (including viewport settings) and is used mainly for printing
Hide wall components when layer scale <= 1:	Select to hide wall components when the layer is set to, or is below, the scale ratio specified (does not affect wall component display in viewports; see “Advanced Sheet Layer Viewport Properties” on page 615 to show or hide components in viewports)

Parameter	Description
Save viewport cache	Indicates whether to save viewport caches and radiosity solutions in the file; saving the cache may increase file size, but saves time when files that contain viewports and viewports rendered with radiosity renderings (RenderWorks required) are opened. If deselected, any viewports will require updating when the file is opened, and any viewport radiosity solutions will require regeneration, but file size is reduced. Note that the viewport cache(s) are already compressed to PNG or JPEG format to save space (the format depends on the selection in VectorWorks preferences; see “Edit Preferences” on page 39 for more information).
Use layer colors	When specific pen and fill colors have been set for a design layer, draws all objects on that layer with the specified colors (see “Setting the Design Layer Color” on page 92)
Mesh smoothing with crease angle	Smooths mesh objects rendered with OpenGL or RenderWorks; enter a higher crease angle value for a smoother surface (valid values are 0 to 180).

## Dimension Preferences

Click the Dimensions tab to set the dimension preferences.



Parameter	Description
Associate dimensions	Associates dimensions with the applicable objects. When a dimension is associated with an object, the dimension automatically updates when the object it is applied to is modified. For more information about associative dimensioning, see “Dimensioning” on page 437.
Auto associate	Select this option to automatically associate a dimension to the top-most object when more than one object shares a dimension endpoint
Create dimensions in dimension class	Assigns dimensions to the Dimension class as they are created (default setting). If deselected, created dimensions are assigned to the active class.

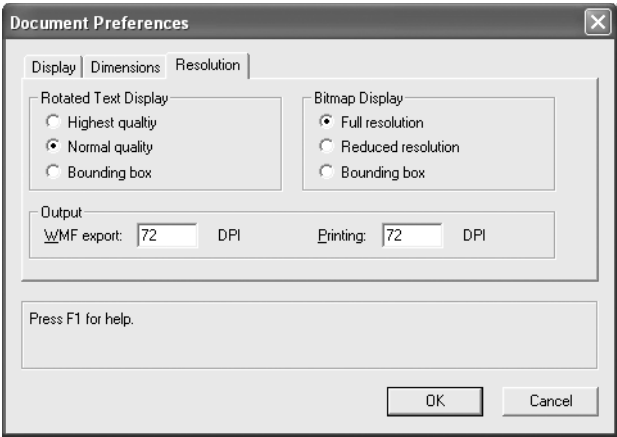
Parameter	Description
Dimension Standard	Select the default Dimension Standard to use. Alternatively, click <b>Custom</b> to add a custom dimension standard (see “Using Custom Dimension Standards” on page 437).
Dimension Slash	Sets the desired <b>Thickness</b> of the slash at each end of a dimension, in points, mils, or millimeters

Default dimension standards are presented in the following table.

Standard	Description	Text Placement		Marker Style		Text Rotation	
		Above Dim. Line	Within Dim. Line	Slash	Arrow	Aligned	Horiz.
Arch	Architectural Standards	X		X		X	
ASME	American Society of Mechanical Engineers		X		X		X
BSI	British Standards Institute	X			X	X	
DIN	German Standards	X			X	X	
ISO	International Standards Organization	X			X	X	
JIS	Japanese Standards	X			X	X	
SIA	Swiss Standards	X		X		X	
ASME Dual Side By Side	American Society of Mechanical Engineers		X		X		X
ASME Dual Stacked	American Society of Mechanical Engineers		X		X		X

## Resolution Preferences

Click the Resolution tab to set the resolution preferences.





Parameter	Description
Rotated Text Display	Sets how rotated text is displayed: <b>Highest quality</b> shows rotated text at the best quality available, <b>Normal quality</b> shows rotated text slightly jagged, and <b>Bounding box</b> shows only a bounding box representing the text's location
Bitmap Display	Sets how bitmaps are displayed: <b>Full resolution</b> shows bitmaps at the best resolution available, <b>Reduced resolution</b> shows bitmaps at a reduced detail, and <b>Bounding box</b> shows only a bounding box representing the bitmap's location. Reducing the resolution saves time when using the <b>Pan</b> tool or scroll bars.
PICT/PDF (Quartz Only) Export (Macintosh) or WMF Export (Windows)	Sets the resolution at which the model will render for export. On Macintosh, when <b>Quartz imaging</b> is enabled, sets the PDF export resolution; when <b>Quartz imaging</b> is not enabled, sets the PICT export resolution (see "Display Preferences" on page 41).
Printing	Sets the resolution at which the model will render for printing

## Setting Up the Drawing

Before beginning a new drawing, determine drawing properties like scale, color palettes, line thickness, and dimension standards. See "Palette Layout Options" on page 17 to set the preferred window options prior to setting up the drawing.

The combination of layers, classes, and views can produce a variety of drawings generated from a single file (see "Drawing Structure" on page 81). Proper file setup ensures maximum usability for multiple output.

The three required VectorWorks drawing settings are layer scale, units, and drawing size. Once these are established, optional drawing settings can be found in document preferences, scripts, snap and reference grids, layers and classes, and other defaults; although making these settings is not required, it is recommended.

Setting up the layers and classes while setting up the drawing is recommended. See "Managing Layers" on page 84 and "Managing Classes" on page 95 for more detailed information about creating layers and classes.

When using templates, many of these settings will have already been specified.

## Design Layer Scale

Layer scale is the ratio of the actual size of an object to its size in a drawing. For example, for VectorWorks' default layer scale of 1:1, every inch in the drawing represents an inch in the "real world." The best design layer scale to use obviously depends on what you are designing and whether it makes sense to work with a life-sized, reduced, or enlarged drawing.

VectorWorks can set one scale for all design layers in a drawing, or set a different scale for individual design layers.

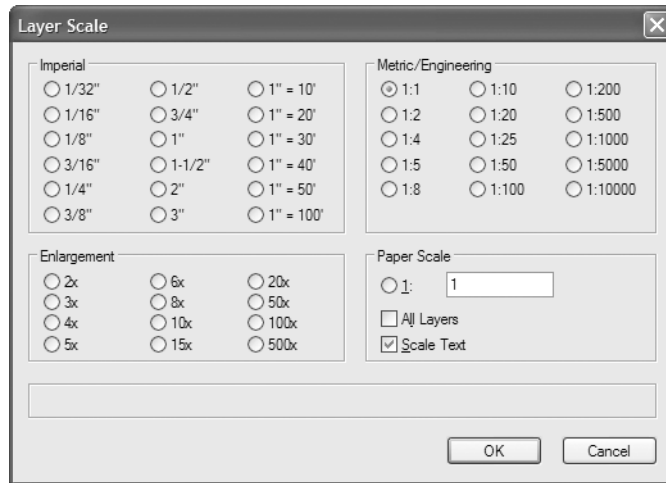
## Changing the Scale of the Drawing or the Active Design Layer



To change the scale of the active design layer or of the entire drawing:

1. Right-click (Windows) or Ctrl-click (Macintosh) in the drawing area to access the document context menu, and then select **Active Layer Scale**. Alternatively, if the layer scale is displayed on the View bar, click the **Layer Scale** button.

The Layer Scale dialog box opens.



2. Either select a scale, or enter a custom value in **Paper Scale**.
3. To simultaneously change the scale of all existing design layers in the entire drawing, select **All Layers**.
4. To scale text proportionally to the rest of the design layer, select **Scale Text**. Deselect **Scale Text** to keep the text at its current size even if the scale changes.
5. Click **OK** to return to the drawing.

## Changing the Scale of Selected Design Layers

To change the scale of one or more selected design layers:

1. Select **Tools > Organization**.  
The Organization dialog box opens. Click on the Design Layers tab.
2. Select the layer(s) to change from the **Design Layer** list and click **Edit** (or double-click a single layer name).  
The Edit Design Layers dialog box opens (see “Setting Design Layer Properties” on page 87).
3. Click **Scale**.  
The Layer Scale dialog box opens.
4. Either select one of the scales, or enter a custom value in **Paper Scale**.
5. To scale text proportionally to the rest of the design layer, select **Scale Text**. Deselect **Scale Text** to keep the text at its current size even if the scale changes.
6. Make sure that **All Layers** is not selected.
7. Click **OK**.

## Normal Scale

The **Normal Scale** command automatically displays the drawing file at 100% of its real-world scale. For example, if a drawing scale is set to 1:1, every inch on the monitor corresponds to an inch on paper. Normal scale is the scale at which the drawing is printed.

To set the drawing to normal scale:

1. Select **View > Zoom > Normal Scale**.

VectorWorks changes the view so that the objects' screen size and print size are the same.

2. If the drawing size is larger than the monitor's dimensions, scroll or pan around the drawing to see all elements.

## Units

VectorWorks provides a wide range of measurement systems to select from and also provides the flexibility to create a customized measurement system. VectorWorks applies the selected measurement system globally throughout the drawing, from the measurements that display on the rulers to those used in dimensions and worksheets.

The **Units** command opens the Units dialog box, which organizes units settings on three tabbed panes:

- The General Display tab settings affect the units throughout the drawing.
- The Dimension Objects (Primary) tab contains rounding settings for primary dimensions.
- The Dimension Objects (Secondary) tab contains units and rounding settings for secondary dimensions. If dual dimensions are not being used, these settings have no effect. For more information on dual dimensioning, "Dual Dimensioning" on page 448.

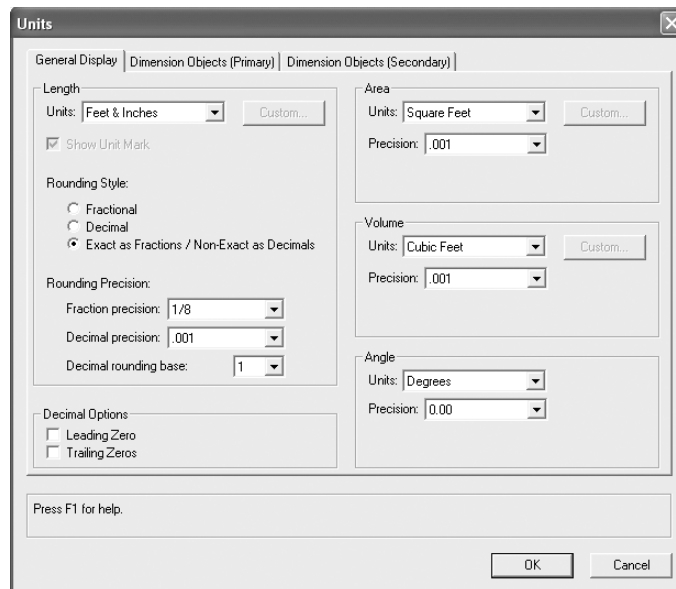
## Selecting a Unit System

To select or change the current measurement system:

1. Select **File > Document Settings > Units**.

The Units dialog box opens.

2. Specify the units display parameters, and then click **OK**.



Parameter	Description
<b>Length</b>	
Units	Select the desired length measurement system from the list
Custom	If the Custom unit is selected, click <b>Custom</b> to create a custom length measurement system; see “Creating a Custom Unit System” on page 54
Show Unit Mark	Select to display the unit mark along with the unit value; if the Feet & Inches unit is selected, VectorWorks automatically displays unit marks and therefore, <b>Show Unit Mark</b> appears dimmed
Rounding Style	Rounding only affects how numbers are displayed; if the number 1.23456 is entered with a rounding of .00, the value is recognized as 1.23456 but displays as 1.23
Fractional	Select for fractional rounding
Decimal	Select for decimal rounding
Exact as Fractions / Non-Exact as Decimals	Select for a combination of fractional and decimal rounding
Rounding Precision	For fractional rounding, select the fractional precision value; for decimal rounding, select up to ten digits of decimal precision; for a combination of fractional and decimal rounding, select both a fractional and decimal precision value
Decimal rounding base	Select whether decimal rounding is performed using multiples of tenths, quarters, or halves; the option selected is reflected in the <b>Decimal precision</b> field
<b>Decimal Options</b>	
Leading Zero	If one of the decimal rounding options is chosen, select to display a leading zero
Trailing Zeros	If one of the decimal rounding options is chosen, select to display trailing zero(s)
<b>Area / Volume / Angle</b>	
Units	Select the area, volume, and angular measurement system from the list
Custom	If the Custom area or volume unit is selected, click <b>Custom</b> to create a custom area or volume measurement system; see “Creating a Custom Unit System” on page 54
Precision	For area and volume measurement systems, select up to ten digits of decimal precision. For angular measurement systems, select to display angular units in degrees (there are 360 degrees in a circle, and the angle mark is °), radians (there are 2pi radians in a circle, and the angle mark is r), or gradians (there are 400 gradians in a circle, and the angle mark is g); also, select up to eight digits of angular precision or specify degrees, minutes, and/or seconds.

## Creating a Custom Unit System

To create a customized measurement system:

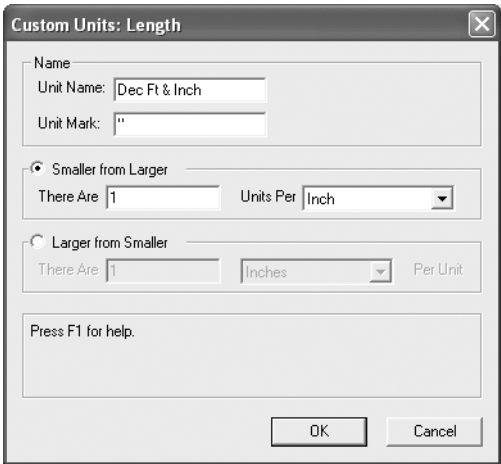
1. Select **File > Document Settings > Units**.

The Units dialog box opens.

2. Select **Custom** from the length, area, or volume **Units** list, or if editing an existing custom measurement system, select the custom name from the **Units** list.

3. Click **Custom**.

The Custom Units:Length, Custom Units:Area, or Custom Units:Volume dialog box opens, depending on the type of custom unit being created or edited. The available values in each field vary based on the custom unit type.

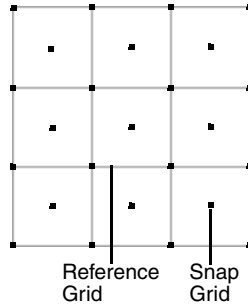


Parameter	Description
Unit Name	Name given to the custom measurement system—for example, “Cubit”
Unit Mark	Mark (abbreviation) used to represent a unit in the custom measurement system—for example, “cbt”
Smaller from Larger	Set the number of custom units that occur per selected unit—for example, “ <b>There Are 2 Units Per Inch</b> ”
Square Unit Mark	Set the number of selected units that occur per custom unit—for example, “ <b>There Are 2 Inches Per Unit</b> ”

- 4. Click **OK** to exit the Custom Units dialog box.
- 5. Enter the remaining criteria as described in “Units” on page 53.
- 6. Click **OK**.

## Snap and Reference Grids

VectorWorks has two separate grid systems for precise drawing. Both grids are set in the same dialog box; however, their functions are different.



The **Snap Grid** is an invisible grid that VectorWorks uses to assist in drawing and placing objects precisely. Select the **Snap to Grid** option on the Constraints palette. As the mouse moves across the screen, it automatically “catches” at each increment on the Snap Grid. When you are placing an object, the interactive image snaps to the grid and shows where the object should be placed.

With shortcut keys, objects can be moved constrained to the snap grid. See “Setting VectorWorks Preferences” on page 39 for more information.

The **Reference Grid** is displayed on the screen. The most useful way to set the Reference Grid is so that it is an extension of the set scale.

Depending on the drawing, these two grids can be made identical. In some cases, they should be different. For example, if you are designing kitchen cabinets with a tolerance of one-sixteenth of an inch, set the Snap Grid to 1/16”. It would be hard to draw on a screen that displayed 16 horizontal and vertical lines squeezed within every inch. For that reason, you might want to mark off only whole inches on the screen by setting the Reference Grid to 1”.

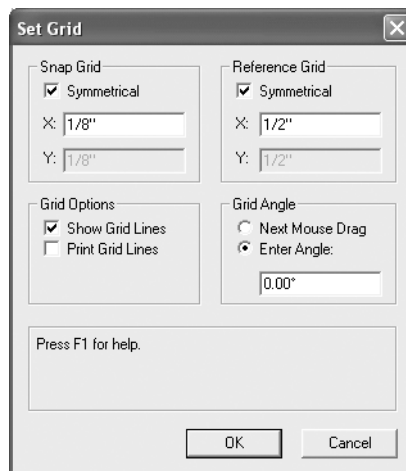
Sheet layers and design layers have individual grid settings.

[The Reference Grid may not always be visible, depending on the current zoom factor.](#)

To set snap and reference grids:

1. Select **Tools > Set Grid**.

The Set Grid dialog box opens. For sheet layers, the Set Sheet Layer Grid dialog box opens.



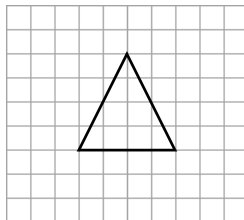
2. Enter the snap and reference grid settings to use for the design layers or sheet layers.

Parameter	Description
Snap Grid (or Sheet Layer Snap Grid)	The invisible grid VectorWorks uses to align objects during drawing and editing
Symmetrical	Select to constrain the Y setting to be the same as the X setting
X and Y	Enter the size increment for snapping in the X and Y directions; the Y setting appears dimmed if <b>Symmetrical</b> is selected
Reference Grid (or Sheet Layer Reference Grid)	The visible grid used for visually aligning objects during creation and editing
Symmetrical	Select to constrain the Y setting to be the same as the X setting
X and Y	Enter the size increment for viewing the grid in the X and Y direction; the Y setting appears dimmed if <b>Symmetrical</b> is selected
Grid Options	Sets how the reference grid behaves on screen and when printing
Show Grid Lines	Select to show the reference grid within the print area, when possible (even with this option selected, the reference grid may not display depending on the zoom factor)
Print Grid Lines	Select to print the reference grid on the drawing
Grid Angle (or Sheet Layer Grid Angle)	The angle between the X axis of the snap and reference grids and the normal X axis
Next Mouse Drag	Sets the grid angle by clicking and dragging the mouse in the drawing area upon exiting the dialog box
Enter Angle	Sets the grid angle using the specified value

- Click **OK**.
- If **Next Mouse Drag** was selected, draw the grid angle. Click in the drawing and drag the mouse until the desired angle is achieved. Click again to set the angle.

## Guides

The **Make Guide** command enables the placement of guidelines which can be used to visually align objects in the drawing. VectorWorks permits guides of any shape and size. In addition to providing visual clues, guides work with VectorWorks' SmartCursor and the settings on the Constraints palette to ensure precise alignments. Guide objects are locked into a class called "Guides" and are colored light purple. Guides are printed unless the **Hide Guides** command is selected, or the **Delete All Guides** command has permanently removed them.



To create a guide:

- 1. Create the object to become a guide.
- 2. Select the object.
- 3. Select **Modify > Guides > Make Guide**.

The object changes into a guide.

On the **Guides** command sub-menu, the following options can be selected.

Option	Description
Make Guides	The object becomes a guide
Select Guides	Selects all the guides in a drawing
Show Guides	Displays guides which were hidden
Hide Guides	Temporarily hides the guides in the drawing
Delete all Guides	Permanently removes all guides and the objects used to create them

You can snap objects to the guide(s) closest to it by using the **Snap to Object** constraint on the Constraints palette. The distance at which the objects snap to the guides is determined by the **Snap Radius** setting in the VectorWorks preferences. See “Setting VectorWorks Preferences” on page 39 for details on setting the snap radius setting.

To delete a single guide, highlight it and then select **Modify > Unlock**. The guide is now editable. Select **Edit > Clear** to remove it from the drawing. A guide can also be unlocked in order to move it to a new location. Select **Modify > Lock** to lock the guide into place once it is relocated.

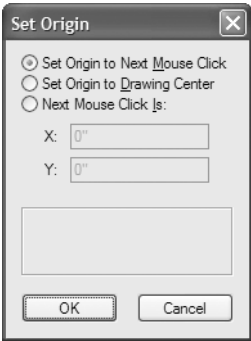
## Set Origin

Use the **Set Origin** command to change the placement of the origin in the drawing area. The origin is the point where the X and Y axes meet (0,0). Its default placement is at the exact center of the drawing area.

To set the origin:

- 1. Make sure the drawing is in Top/Plan view.
- 2. Select **Tools > Set Origin**.

The Set Origin dialog box opens.





Parameter	Description
Set Origin to Next Mouse Click	Changes the cursor to a bull's-eye cursor; click to set the origin to any point within the VectorWorks drawing area
Set Origin to Drawing Center	Sets the origin to the internal drawing center; the drawing center is a fixed internal point used to position all objects
Next Mouse Click Is	Sets the clicked point to specific coordinates. After selecting this option, enter the X and Y coordinates of the point. The origin is set according to the values entered when clicking a locus point or another reference point. This option is most useful for drawings that have a distant reference point.

3. Click **OK**.

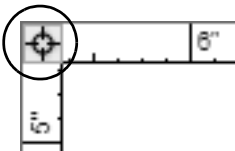
Switching Between Two Origins

One reason to change the origin is to make it easier to work with the ruler bars. For example, the Swiss use a reference point system for architectural measurements, where everything is in relation to a point in Europe. When a building is located at a site, that site is referenced to be a certain distance and direction from this point. Using this system creates large numbers on the ruler bars and in the Object Info palette. In the Set Origin dialog box, VectorWorks provides the ability to switch between the local origin (the building site) and the distant origin (the reference point).

After setting the local origin and a distant center, it is easy to switch between them. The offset values entered for the distant origin are saved with the file, so no information needs to be re-entered unless the origin is changed.

Set Origin Button

The **Set Origin** button is at the top left of the drawing window, at the junction of the two rulers. This button performs the same function as the **Set Origin to Next Mouse Click** option described in “Set Origin” on page 58.



To use the **Set Origin** button:

- 1. Click the **Set Origin** button, and then move the mouse to the new location for the origin.
- 2. Click to set the origin.

Double-click the **Set Origin** button to open the Set Origin dialog box.

Setting Default Object Attributes

Settings in the Attributes palette control both default and individual object attributes. These attributes are automatically applied to newly-drawn objects unless a class attribute is assigned (see “Setting Class Properties” on page 98 and “The Attributes Palette” on page 229 for more information).

Certain default attributes can be adjusted to accommodate office standards.

- Markers (Line endpoint styles)
- Color palette(s)
- Dash style
- Line thickness
- Patterns

Colors, dash style, and patterns are saved in the current drawing or in a template. Markers and line thickness are global settings and apply to all VectorWorks drawings.

Gradient and image fills are provided as default resources and can also be defined in the Resource Browser. See “VectorWorks Fundamentals Default Resources” on page 141, “Gradient Attributes” on page 242 and “Image Attributes” on page 247.

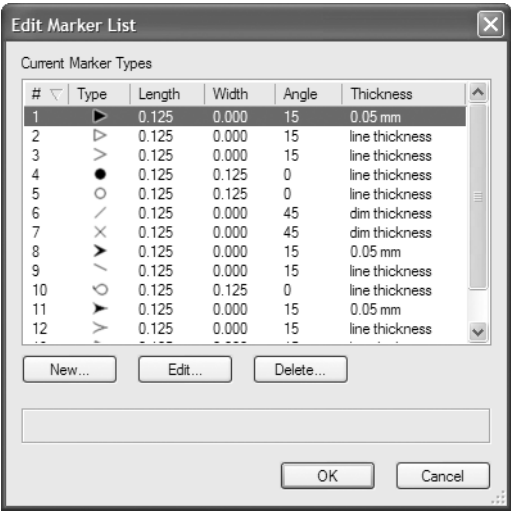
## Setting Default Marker Types

The marker list specifies which markers are available for selection.

To set the default markers:

1. Select **Tools > Options > Edit Marker List**.

The Edit Marker List dialog box opens.



Parameter	Description
Current Marker Types	Lists the marker types that are available for selection when drawing; change the list order by clicking and dragging in the # column
New	Creates a new marker type; see “Creating or Editing Marker Types” on page 61
Edit	Edits the currently selected marker type; see “Creating or Editing Marker Types” on page 61
Delete	Deletes the currently selected marker

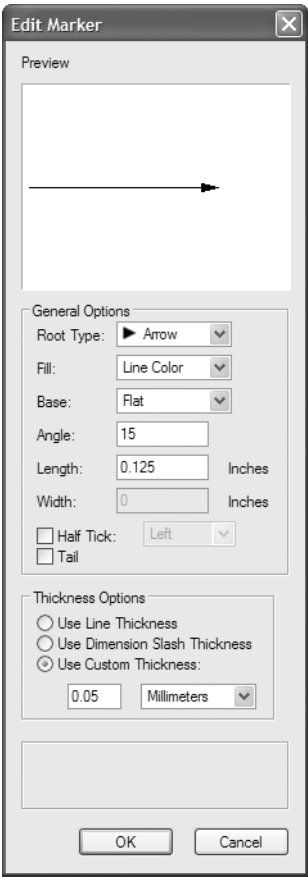
2. Click **OK** to set the default list of available marker types.

## Creating or Editing Marker Types

To create or edit marker types:

1. From the Edit Marker List dialog box, click **New** to create a new marker type, or click **Edit** to change the currently selected marker type.

The Edit Marker dialog box opens.



Parameter	Description
Preview	Displays a preview of the marker's appearance
General Options	Specifies the marker's shape and style
Root Type	Specifies the general shape of the marker
Fill	For closed root types, specifies the type of fill
Base	For triangular root types, specifies the shape of the base
Angle	For triangular and hexagonal root types, indicates the angle of the root
Length	Indicates the length of the marker, from base to tip

Parameter	Description
Width	Specifies the marker width, for marker types that have a width
Half Tick	For marker types except cone and lasso, displays half the marker on the indicated side
Tail	For markers which can be reversed, flips the marker direction to create a tail marker
Thickness Options	Specifies the marker pen thickness
Use Line Thickness	Uses the same thickness as that of the associated line, adjusting automatically along with any line thickness changes
Use Dimension Slash Thickness	Uses the same thickness as the dimension slash, set on the Dimensions tab of the document preferences (see “Dimension Preferences” on page 49)
Use Custom Thickness	Specifies a custom marker thickness and unit (mils, points, or millimeters)

- 2. Click **OK** to create or edit the marker.  
The new marker is listed at the top of the marker types list.

## Setting Default Colors and Palettes

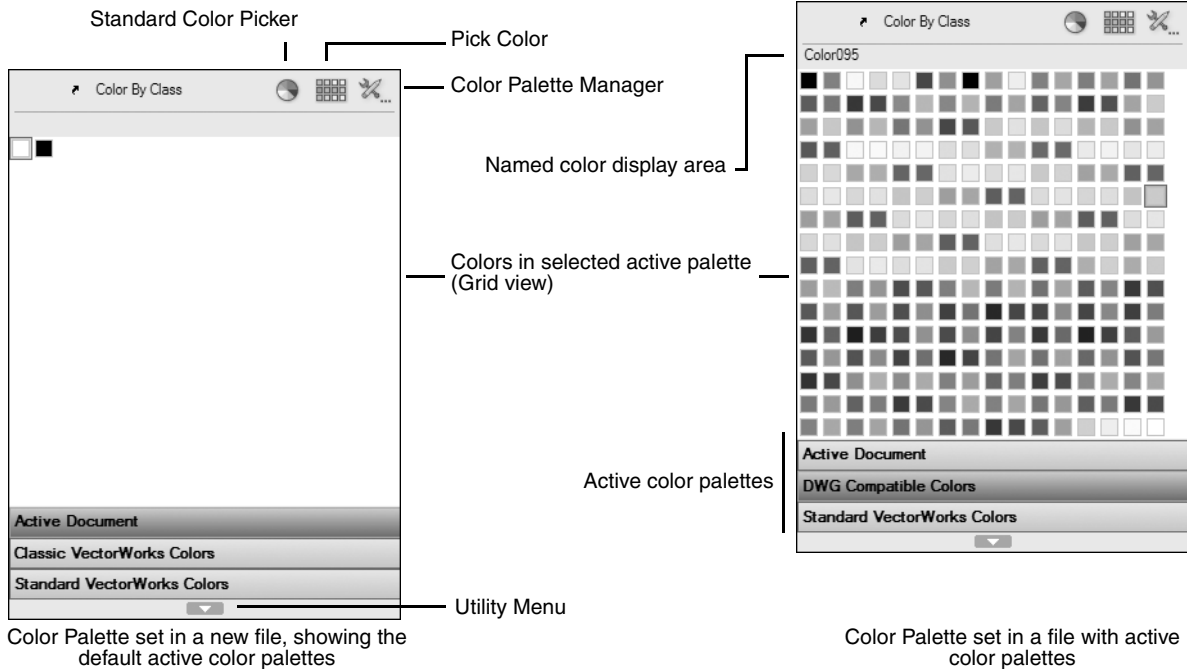
The Color Palette set provides colors for selection and specifies which colors are available in a VectorWorks file. Any set of unlimited colors can be included; colors are organized in standard and/or custom color palettes.

In a new file, the active document color palette is the only palette displayed in the Color Palette set, and it contains only the colors black and white. As colors are added to the file from color palettes as well as resources, the active document color palette expands to display all the colors used in the file.

To display and manage the colors available for the file:

- 1. From the Attributes palette, click on one of the color boxes for Fill color or Pen color, when a Solid style is selected. A similar interface is available from other areas in the application where colors are specified, although the Color By Class option is only available when accessed from the Attributes palette.

The Color Palette set opens, displaying the colors in the active color palette.




Parameter	Description
Color by Class	When using the Color Palette set to specify an object's color, causes the object to take on the color attribute set by the object's class; see "Applying Colors" on page 229
Standard Color Picker	Opens the operating system's color picker for selecting individual colors; see "Selecting Standard Operating System Colors" on page 64
Pick Color	Opens the Pick Color dialog box, for selecting a color from available color palettes; see "Selecting a Color from a Color Palette" on page 65
Color Palette Manager	Opens the Color Palette Manager dialog box, for managing available color palettes and activating additional palettes; see "Managing Color Palettes" on page 66
Named color display area	Displays any color name information associated with the selected color.  This area also serves to find a named color in the active color palette. To easily find a named color, begin typing; the letters display in the named color display area and the closest color match is selected. Press the Tab key to cycle through the closest matches; pause for several seconds to start the search over.
Colors in active palette	Displays the selected active palette's available colors in either Grid or List view; these colors are available for use in the file
Active palettes	Lists palettes which have been made active for the file with the Color Palette Manager; click on a palette name to display its colors for use in VectorWorks
Utility Menu	Opens a utility menu to control the color palette sorting and display

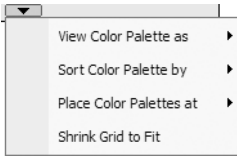
- 2. Either select a color from one of the file’s color palettes, or click off of the Color Palette set (in the drawing window, for example) to close the color window and set the file’s available colors.

Utility Menu

The options selected from the color palette Utility Menu button at the bottom of the main Color Palette set indicate the color sorting and display.

 To set the display and sorting of colors and palettes:

- 1. From the Color Palette set, click the **Utility Menu** button to open the utility menu.



Menu/Command	Action
View Color Palette as	Select to view the colors in the Color Palette set as a grid of colored squares, or a list of colors and associated names. (In either view, color names are always shown in the display area above the colors as the mouse moves over the colors.)
Sort Color Palette by	Specify the sorting method for the active color palette; select Color to sort by hue (HSV values), Manual to sort according to the order set in the Color Palette Manager, or Alphabetical to sort in ascending or descending order by color name
Place Color Palettes at	Select whether to display active color palettes at the top or bottom of the Color Palette set
Shrink Grid to Fit	In Grid view, color lists of less than 16 rows can be displayed with a Color Palette set option that shrinks to fit the available colors

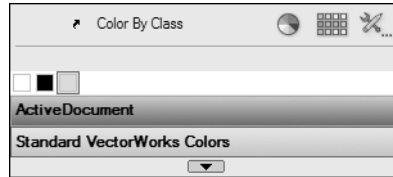
- 2. Select a utility command to change the color palette display or sorting option.

Selecting Standard Operating System Colors

When specifying or creating color palettes is not necessary, the operating system’s color picker adds individual colors to the active document color palette.

 To select a standard operating system color:

- 1. From the Color Palette set, click the **Standard Color Picker** button.  
The Colors (Macintosh) or Color (Windows) dialog box opens.
- 2. Select a color from among the standard operating system colors, and click **OK**.
- 3. The color is added to the active document color palette, and becomes available for use in VectorWorks.



## Selecting a Color from a Color Palette

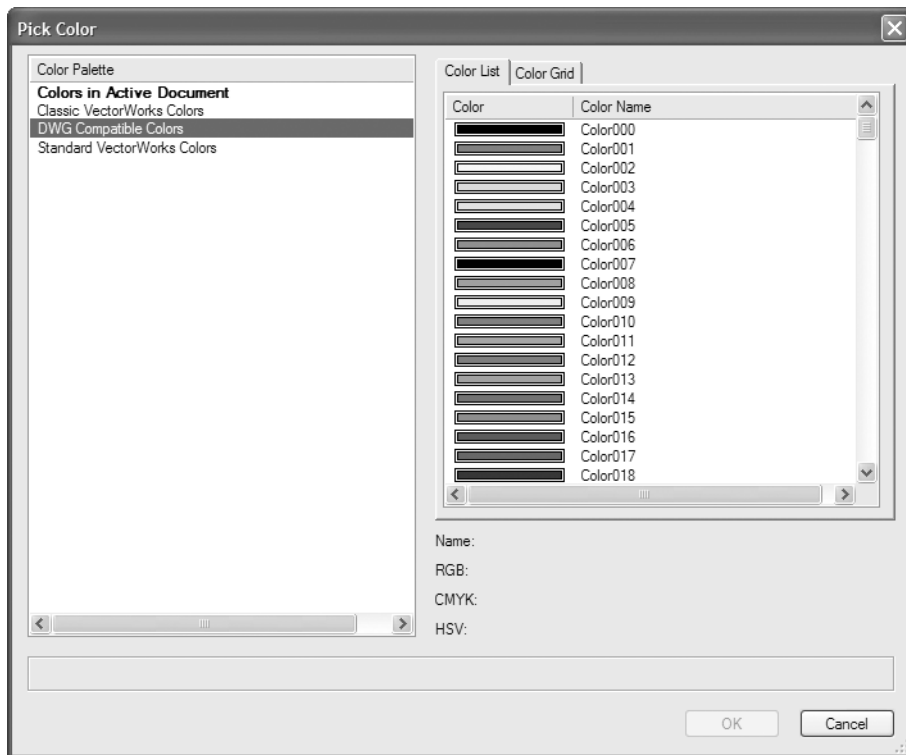
If a file requires colors beyond those available for the standard system color picker, but you do not wish to add and manage palettes in the Color Palette set, select a color from a specific color palette.



To add colors from a color palette:

1. From the Color Palette set, click the **Pick Color** button.

The Pick Color dialog box opens, listing the color palettes available. The Colors in Active Document palette is always available. Other palettes in the list either ship with VectorWorks, or have been added with the Color Palette Manager.



Parameter	Description
Color Palette list	Lists the color palettes from which colors can be selected. Click on the header to sort the palettes in ascending/descending alphabetical order. Select a palette to display its colors on the right.
Color List	Lists the colors in the selected palette; click on the header to sort by color or by color name. Select a color to add it to the Colors in the Active Document palette.
Color Grid	Displays the colors in the selected palette as a grid; select a color to add it to the Colors in Active Document palette
Color Information	Displays the color information of the selected color, including Name; Red, Green, Blue (RGB); Cyan, Magenta, Yellow, and Black (CMYK); and Hue, Saturation, and Value (HSV). This information also displays on a tooltip when the cursor hovers over a color.

- 2. Select a color palette from the left, and then select the color from the list or grid of colors on the right.
- 3. Click **OK** to add the color to the active document palette, and make it available for use in VectorWorks.

Managing Color Palettes

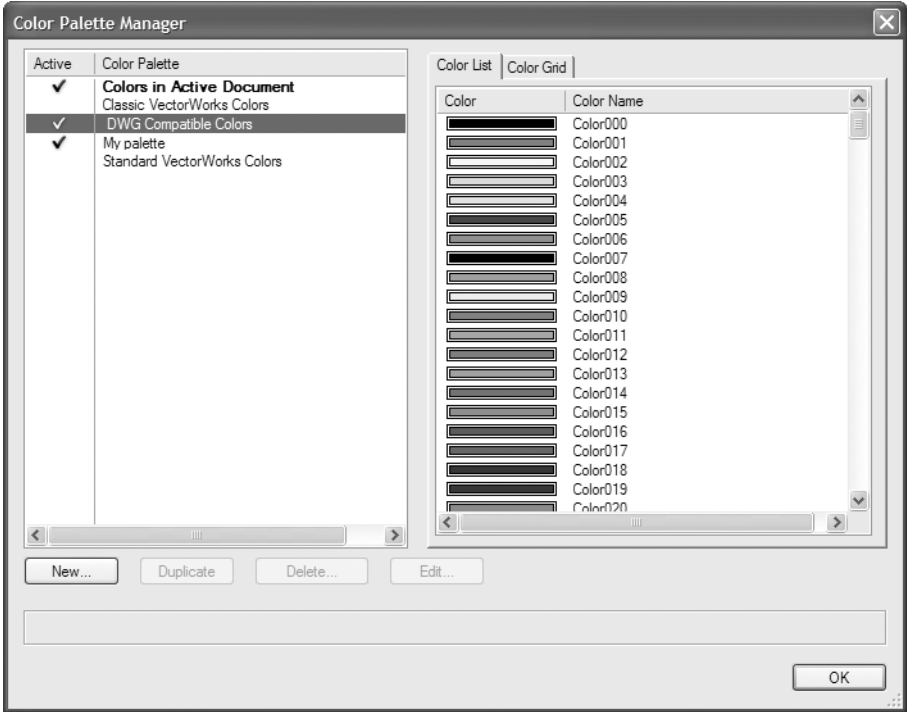
The Color Palette Manager determines which color palettes are available in the main Color Palette set and the Pick Color dialog box. With the Color Palette Manager, create or import custom color palettes, activate palettes for use in VectorWorks, add and delete colors from custom color palettes, and purge unused colors.



To manage the file’s color palettes:

- 1. From the Color Palette set, click the **Color Palette Manager** button.  
The Color Palette Manager dialog box opens. The palettes available here are located in the Color Palettes library of the default resources; see “VectorWorks Fundamentals Default Resources” on page 141.





Parameter	Description
Color palette list	Lists the file's available color palettes. Click on a header to sort the palettes by active status or color palette name. Click in the <b>Active</b> column of a selected palette to activate the palette and add it to the available palettes in the main Color Palette set.
Color List	Lists the colors in the selected palette; click on the header to sort by color or by color name
Color Grid	Displays the colors in the selected palette as a grid
New	Opens the New Palette dialog box, for creating a custom color palette or importing a color palette file; see "Creating or Editing Custom Color Palettes" on page 68
Duplicate	Copies the selected color palette and appends an incrementing number to the copy name (change or rename the copied palette by clicking <b>Edit</b> )
Delete	Deletes the currently selected color palette; only custom palettes can be deleted, but not the Colors in Active Document or standard color palettes
Purge Unused	When the Colors in Active Document palette is selected, removes any colors that are not in use in the file from the Colors in Active Document palette  <a href="#">Referenced colors remain in the active document color palette, even from an object that has been removed. Purging allows accumulated colors to be trimmed.</a>
Edit	Opens the Edit Palette dialog box, for editing the selected custom palette; see "Creating or Editing Custom Color Palettes" on page 68

2. When the list of color palettes and active color palettes is set, click **OK**.

Creating or Editing Custom Color Palettes

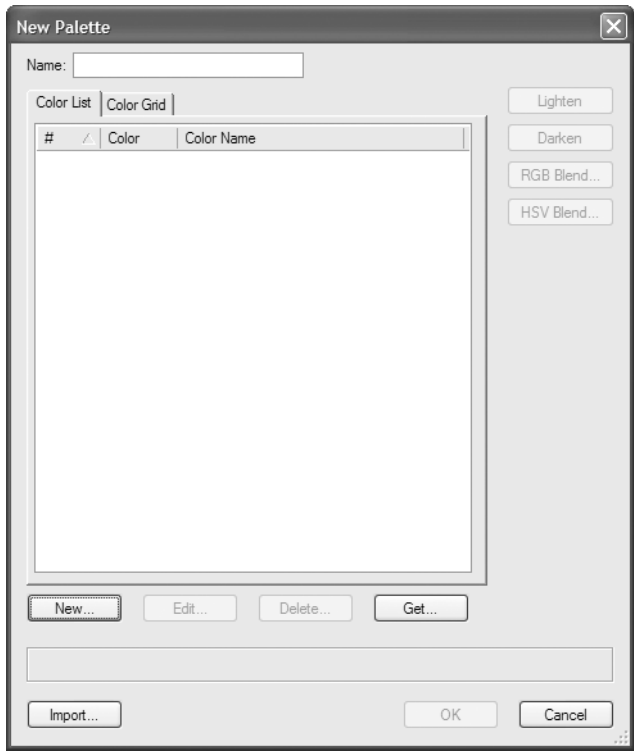
Custom color palettes can be created or edited from the Color Palette Manager.

Type the first few letters of a palette (or color, when the cursor is in the color list) to quickly select a color.

To create or edit a custom color palette:

- 1. Open the Color Palette Manager as described in “Managing Color Palettes” on page 66.
- 2. Click **New** to create a new palette, or **Edit** to make changes to the currently selected palette.

The New Palette or Edit Palette dialog box opens.



Parameter	Description
Name	Specifies a name for a new color palette, or edits the name of a custom color palette
Color List	Lists the colors in the custom palette; click on the header to sort by number in the list, color, or color name. To change the order of the colors, click in the # column and drag the selected color up or down in the list. (Select <b>Manual</b> from the color palette utility menu to sort the colors in the main Color Palette set in this order; see “Utility Menu” on page 64)
Color Grid	Displays the colors in the custom palette as a grid

Parameter	Description
New	Opens the New Color dialog box, for adding a new color from the operating system's color picker
Edit	Opens the Edit Color dialog box, for editing the selected color using the operating system's color picker
Delete	Deletes the currently selected color(s) from the custom color palette
Get	Opens the Pick Color dialog box, for adding one or more colors selected from the available color palettes (see "Selecting a Color from a Color Palette" on page 65)
Lighten	Incrementally lightens the selected color
Darken	Incrementally darkens the selected color
RGB Blend	Blends two selected colors according to their Red, Green, Blue (RGB) values, to create the specified number of new colors (up to 1000)
HSV Blend	Blends two selected colors according to their Hue, Saturation, and Lightness (HSV) values, to create the specified number of new colors (up to 1000)
Import	Imports all the colors from the Colors in Active Document palette of another current version VectorWorks file

- When the colors have been edited or added to the custom color palette, click **OK**.

The custom color palette is listed in the Color Palette Manager. By default, custom color palettes are saved in the user folder (see "User Folders Preferences" on page 46).

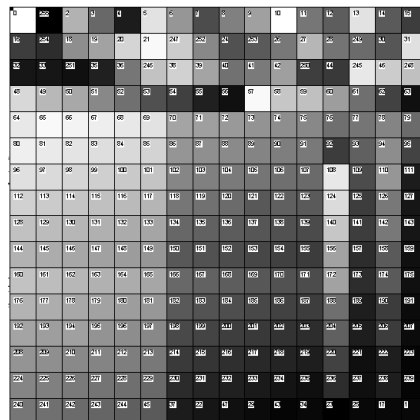
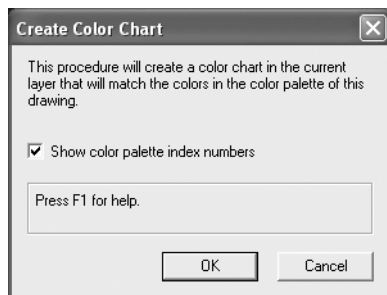
## Creating a Color Chart

This command creates a color chart in the active layer of the current file that reflects the colors in the color palette of the document. It can be used as a print color guide.

To create a color chart:

- Select **Tools > Utilities > Create Color Chart**.
- Confirm that a color chart of the active layer in the current file should be generated.

If desired, select **Show color palette index numbers** to show the color index numbers in the chart.



The index numbers are internal to the color palette and always remain in the same order.

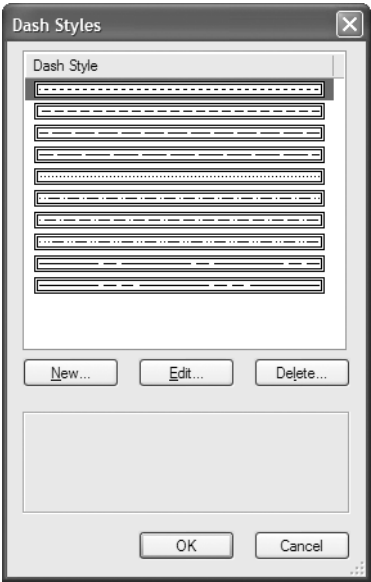
## Setting the Default Dash Styles

The Dash Styles dialog box specifies which dash styles are available for selection.

To set the file’s default dash styles:

- 1. Select **File > Document Settings > Dash Styles**.

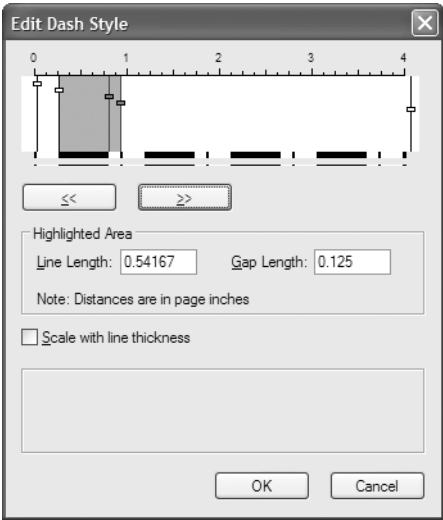
The Dash Style dialog box opens.



Parameter	Description
Dash styles	Displays a graphical list of the file’s dash styles
New	Opens the Edit Dash Style dialog box, to create a new dash style based on the currently selected dash style. Up to 22 customized styles can be added to the ten default dash styles, for a total of 32 styles. Once at the 32 style limit, this button is disabled.
Edit	Opens the Edit Dash Style dialog box, to edit the currently selected dash style
Delete	Deletes the currently selected dash style; if the deleted dash style has been applied to objects, the Map Dash Style dialog box opens to select the replacement dash style

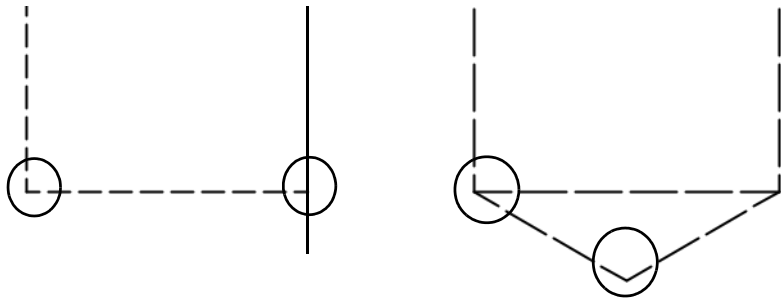
- 2. To create a new dash style, click **New**; to edit the currently selected style, click **Edit**.

The Edit Dash Style dialog box opens. Set the dash style by either dragging the levers of the highlighted section on the graph, or by highlighting the desired section with the arrow buttons and specifying **Line Length** and **Gap Length** values.



Parameter	Description
Dash graph	Lever indicates the distance (in page inches or page millimeters) between dash sections; a section consists of a line and a gap. Drag a new lever from the right edge of the dash graph to add a dash section, or drag a lever to the right to delete a section. Up to ten levers can define a dash style.  Define the section visually by dragging the levers of the highlighted section until the line and gap are at the desired distance. The distance between the first two highlighted levers indicates the line length, and the distance between the last two highlighted levers indicates the gap length.
<< or >>	Selects a highlighted section for editing; alternatively, click on the section to highlight
Line Length	Specifies the length of the line, in page units, for the highlighted dash section
Gap Length	Specifies the length of the gap, in page units, for the highlighted dash section
Scale with line thickness	Maintains the proportion between the dash style and the line thickness

The 2D line dash pattern is automatically adjusted to prevent spaces at either end of the line.



- Click **OK** to return to the Dash Styles dialog box.

- 4. Click **OK** to set the default dash styles for the file.

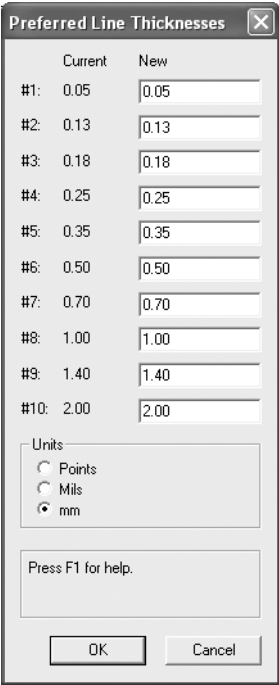
When exporting a file to a version prior to VectorWorks 12, the system truncates the number of dash styles to 24. In the Dash Styles dialog box, dash styles #1-24 are retained; on the Attributes palette and for the **Dash Style** within **View > Rendering > Line Render Options**, the first 24 dash styles beneath the solid line dash style are retained.

## Setting the Default Line Thickness

To set the default line thickness:

- 1. Select **Tools > Options > Line Thickness**.

The Preferred Line Thickness dialog box opens. Select the preferred line thickness criteria.



Parameter	Description
Units	Select the <b>Units</b> to be used for the thickness of the edited line
New	Enter the new thickness value to replace the current thickness value listed to its left

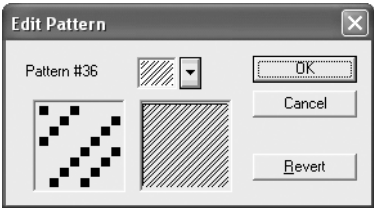
- 2. Click **OK** to set the default list of available line thicknesses.

## Setting Default Patterns

To set the file's default patterns:

- 1. Select **File > Document Settings > Patterns**.

The Edit Pattern dialog box opens. Enter the desired pattern criteria.



Parameter	Description
Pattern	Select one of the 36 patterns to edit from the <b>Pattern</b> list, and then click in the left pattern box to add/delete pixels; the edits change the overall pattern in the right box
Revert	Restores the pattern to its original settings

- Click **OK** to set the default list of available patterns.

## Creating Templates

Save a drawing file as a template to use it as a foundation for new files. Templates save layers, classes, title blocks, drawing borders, resources, and the current settings for attributes and units. (See “Creating a New File” on page 4 for details about using a template.)

When a template is opened, VectorWorks automatically opens a copy of the file. When the new drawing is saved the first time, VectorWorks prompts for a new file name. This makes it impossible to accidentally replace the master template with the new drawing file.

To create a template:

- Start with a new, empty file.
- Set up the file with all of the desired elements.
- Select **File > Save As Template**.
- Enter the name of the template (.sta) file and place it in an appropriate Templates folder. (See “User Folders Preferences” on page 46 for details about how to specify the folder for your user data.)
  - To save the template for personal use, place it in the Templates subfolder in your user data folder (which is the default).
  - If VectorWorks Design Series is installed, you can share the template with other users in a workgroup. To do so, place it in the Templates subfolder of a workgroup folder on a network drive; other users can then specify that workgroup folder in their VectorWorks preferences.

The .sta extension is required for Windows. It is recommended for use on the Macintosh if the file will be shared with Windows users.

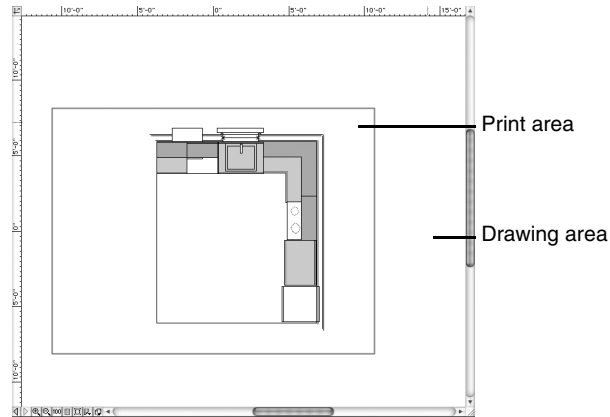
- Click **Save**.

VectorWorks launches with a blank drawing file, in 1:1 scale. To launch VectorWorks with a file containing different settings, name the template file Default.sta and save it in the Templates subfolder in your user data folder.

## Printing

### The Print Area

Within the drawing area is a gray border which defines the print area. Anything within the print area is printed and anything outside of the print area is not printed.



VectorWorks uses the settings from both the Page Setup and Printer Setup dialog boxes to determine the number of sheets of paper (pages) required to print the entire drawing on the selected printer.

This allows the same drawing to be printed or plotted to numerous sources without readjusting the drawing. By entering the dimensions of a “D” size sheet of technical paper in the Printable Area of the Page Setup dialog box, and selecting “Letter” paper size in the Printer Setup dialog box, VectorWorks determines that the drawing needs to be “tiled” across 12 sheets of 8-1/2” x 11” paper to a standard laser printer. The number of 8-1/2” x 11” pages required for printing horizontally and vertically are automatically updated in the Page Setup dialog box. When sending this same drawing to a plotter, change the settings in the Page Setup dialog box for a plotter, and VectorWorks converts the pages required accordingly.

[The page setup \(including the printable area\) is specified individually for each sheet layer \(see “Setting Sheet Layer Properties” on page 95\).](#)

### Page Setup

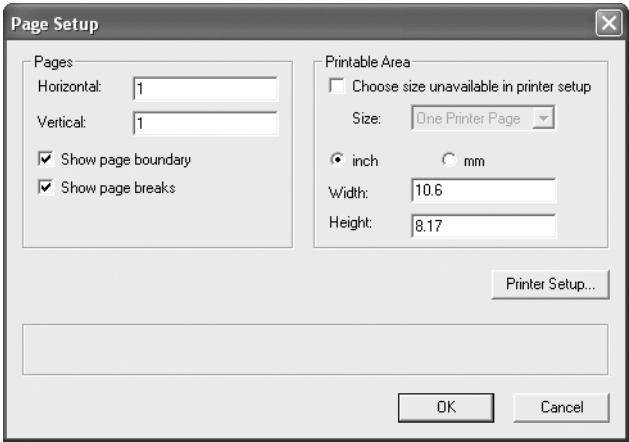
The Page Setup dialog box settings determine the number of sheets of paper (pages) required to print the entire drawing on the selected printer. It is also used to specify whether to display the gray drawing boundary box representing the print area for design layers, and whether to display page breaks in the drawing file.

To change the page setup settings:

1. Select **File > Page Setup**.

The Page Setup dialog box opens.





Parameter	Description
Pages	
Horizontal	Specify the number of pages in the horizontal direction
Vertical	Specify the number of pages in the vertical direction
Show page boundary	Select to display a gray border around the perimeter of the print area for design layers; alternatively, press Alt+B to toggle selection in this field Sheet layers always display the page boundary.
Show page breaks	Indicates how the drawing is divided over each printable page; for design layers, the page boundary must be displayed in order to see the page breaks
Printable Area	
Choose size unavailable in printer setup	If the desired paper size is not available in the Printer Setup dialog box (see “Printer Setup” on page 75), select this option, and then select the desired paper <b>Size</b> from the list; this is useful when sending files to a print bureau that has different paper sizes available than your printer
Size/Width/Height	To manually specify the paper size, select the appropriate drawing units (inch or millimeter) and enter the paper <b>Width</b> and <b>Height</b>
Printer Setup	Accesses the Printer Setup dialog box for specifying the printer, paper size, drawing scale, and orientation; see “Printer Setup” on page 75

2. Specify the page setup options, and click **OK**.

Printer Setup

The Printer Setup dialog box settings determine the printer, paper size, scale, and orientation of the drawing.

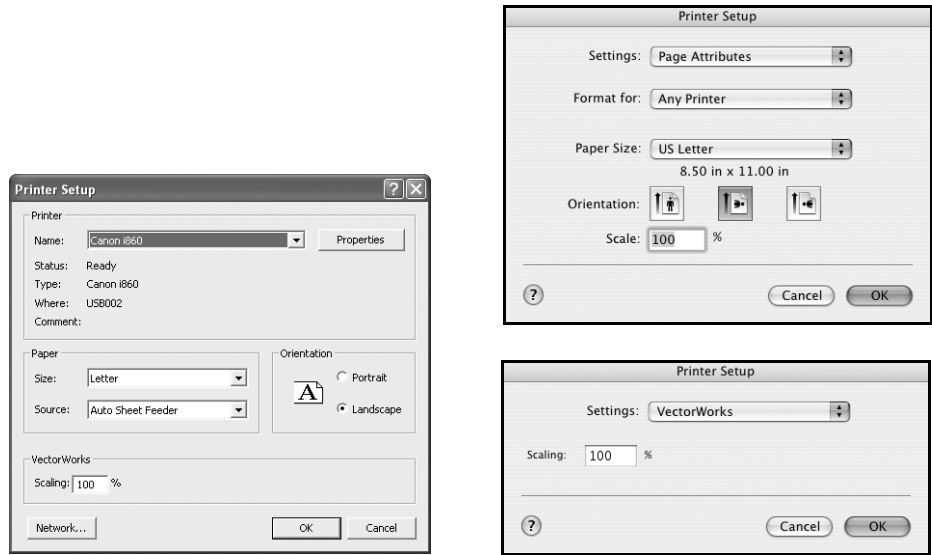
To change the printer setup settings:

- 1. Select **File > Page Setup**.

The Page Setup dialog box opens.

2. Click **Printer Setup**.

The Printer Setup dialog box opens, configured to the selected printer.



3. Scaling resizes the entire drawing by a specified percentage. To access the **Scaling** field in the Macintosh Printer Setup dialog box, select **VectorWorks** from the **Settings** list.

Selecting a printer in Printer Setup (Macintosh) only changes the drawing's settings; to change the printer used for the drawing, access the Macintosh System Preferences.

Printing a File

VectorWorks can print or plot to any device that is selected in the Print & Fax System Preferences (Macintosh) or Printer and Faxes Control Panel item (Windows). The actual parameters of the printed or plotted file are determined by the printer setup settings.

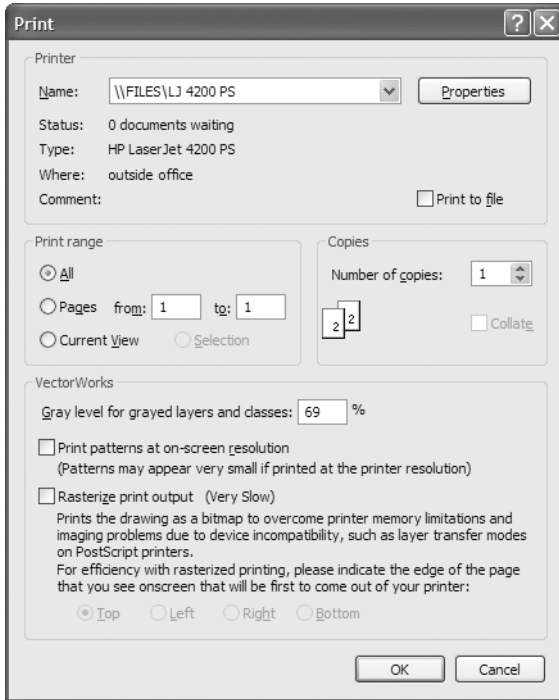
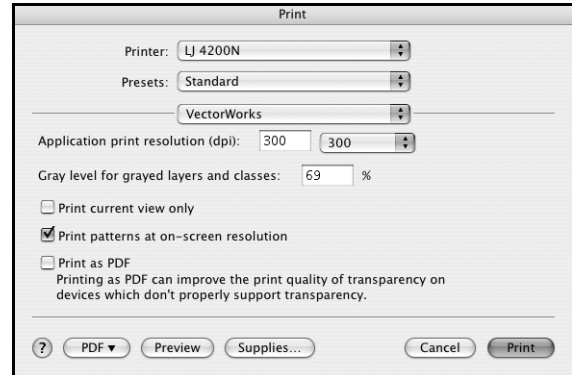
All visible objects, classes, and layers within the print area of the VectorWorks file are printed.

To print a file:

1. Select **File > Print**. On the Macintosh, specify the printer setup parameters and then click **OK**.

The Print dialog box opens; the options that display depend on which printer or plotter is selected.

To display additional print options on the Macintosh, select **VectorWorks** from the drop-down box that displays the default option, **Copies & Pages**.


 Windows Print dialog box with **GDI+ Imaging** enabled

 Macintosh Print dialog box with **Quartz Imaging** enabled

- Specify the print options, such as which pages to print and how many copies to make. The following VectorWorks print settings are available:

Platform	Setting	Description
Macintosh	Application Print Resolution (dpi)	Sets a resolution for the application output. Either select a recommended dpi value for this printer type (from the drop-down list), or manually enter a value.
Macintosh - QuickDraw imaging only	Print PostScript only	If you have a PostScript printer, you can select this option to send only PostScript commands to the printer; this can speed the print process
Windows and Macintosh	Gray level for grayed layers and classes	Adjusts the level of gray when printing with grayed layers and or/ classes
Windows and Macintosh	Enable special processing for transparent color bitmaps	When GDI+ imaging is disabled in the VectorWorks display preferences on Windows, or Quartz is disabled on the Macintosh, some printers (including PostScript printers) cannot support transparent color for raster images, which can affect bitmaps and picture objects that have the fill style set to <b>None</b> . Select this option to use a more detailed (and slower) imaging process to print transparency properly.

Platform	Setting	Description
Macintosh - QuickDraw imaging only	Disable driver text rotation	Translates rotated text into a bitmap image, to prevent problems with printer drivers that cannot interpret rotated text
Windows and Macintosh	Print current view only (Macintosh) or Current View (Windows)	Prints the view currently displayed in the file window; this view is scaled larger or smaller to fit the selected page size
Windows, Macintosh - QuickDraw imaging only	Rasterize print output	Prints the drawing as a raster bitmap. Select this option when the printer memory is insufficient, or when image problems occur (for example, to print design layer transfer modes on OS X or on PostScript printers).
Windows and Macintosh	Print patterns at on-screen resolution	Prints fill patterns at approximately the same size as they appear on the screen at a 100% zoom. (When QuickDraw imaging is enabled on Macintosh, this option has an effect only if the <b>Rasterize print output</b> option is also selected.)  Deselect this option to use the unscaled printer resolution (which is usually much lower); on non-PostScript printers, this prints faster.
Macintosh	Print as PDF	When Quartz is enabled, allows the file to be printed to a PDF file

3. If the **Rasterize print output** option is selected, specify the edge of the image onscreen that is the first edge to come out of the printer.
- The first edge to come out of the printer depends on the printer driver, the page orientation, and the rotation options that are supported by the driver. It cannot be predicted by VectorWorks. If the wrong page edge is selected, some portions of the drawing may fail to print if the printer runs out of memory.
- The **Rasterize Print Output** method can be significantly slower than other print methods.
4. Click **Print** (Macintosh) or **OK** (Windows) to print.

## Using Drawing Tablets

VectorWorks can be used with drawing, or digitizing tablets, providing an additional way to create drawings. The program is compatible with Apple Desktop Bus (ADB) digitizing tablets as well as digitizing tablets that support the WinTab standard.

A common use for a tablet involves tracing an existing hard copy of a drawing. Place the drawing on the tablet and trace along the lines to digitize the drawing. Because tablets usually have finer resolution than a mouse, there is better control for creating objects. Further, if the tablet uses a stylus for input, use of the tablet might feel more natural, similar to holding a pen or pencil versus using a mouse.

Using a digitizing tablet with VectorWorks requires the driver software that comes with the tablet. Select **Tools > Tablet**; VectorWorks searches for this driver. Once found, VectorWorks determines the size and resolution of your tablet. (If VectorWorks cannot find the driver, a dialog box opens.)

Once the driver is found, a gray box displays around the drawing area. This box outlines the boundary of the drawing tablet; the movement of the tablet's transducer is constrained to this boundary box. In order to access menus and palettes that are outside of this boundary, either toggle out of Tablet mode or keep the mouse connected and use it to select these items.

The tablet boundary depends on the size of the tablet as well as the current layer scale and zoom factor. A tablet with a 4" x 3" usable area with an imperial layer scale of 1" : 100' would be constrained to a drawing area 400' x 300' in VectorWorks. Naturally, adjusting the zoom factor will reduce the apparent physical size of the constrained area in relation to the screen, but the internally-represented dimensions remain constant.

The **Tablet** command synchronizes the tablet with the scale and units settings for the drawing. For example, if you have the **Scale** set to 1:1 and the **Units** set to Feet and Inches, then 1 inch on the tablet equals 1 inch in the drawing area on the screen. Further, if you have the **Units** set to Meters and the **Scale** set to 1:100, then 1 inch on the tablet equals 2 meters in the drawing area.

Due to differing tablet resolutions and sizes, these values might be different than what is obtained for the same settings. Experiment with the settings to achieve the desired results. For example, for one inch on the tablet to equal 2 meters in the drawing area, you might have to set the **Scale** to 1:50 versus 1:100.

To use a drawing tablet:

1. Select **Tools > Tablet**.

VectorWorks displays the tablet as a large gray border in the drawing area. This border may not be visible, depending on the zoom and scroll.

2. Follow the directions that came with the tablet for using it to trace or draw objects.

While in Tablet mode in Windows, using button 1 to click on a tool or menu outside of the drawing area has no effect. Use button 2 to toggle out of Tablet mode before selecting the tool or menu.

VectorWorks assigns certain functions to the buttons on the tablet cursor and supports cursors with up to four buttons. VectorWorks also provides the option of pressing the keyboard's F2, F3, and F4 keys for buttons 2, 3, and 4, respectively. This is particularly useful for drawing tablets that have fewer than four buttons. VectorWorks has an automatic scrolling feature which, when activated in Tablet mode, scrolls the screen image when moving the cursor past the displayed edge of the drawing. These functions are described in the following table.

Button No.	Function
1	Same function as a (left) mouse click
2	Toggles the Tablet mode on and off
3	Re-centers the display to the current position of the pointer; no effect when Tablet mode is disabled
4	Toggles automatic scrolling on and off

## Aligning a Tablet

When using a tablet, VectorWorks provides options for aligning it with the drawing area. Align the center of the drawing with the tablet's center, align the 2D locus point with the center of the tablet, or align the 2D locus point with the position on the tablet of the next tablet cursor click. By default, VectorWorks aligns the center of the tablet with the center of the drawing area.

To align the 2D locus with the center of a tablet:

1. Set a locus point.

See "Creating 2D Loci" on page 228 for details on setting loci. Keep the locus point selected.

2. Select **Tools > Tablet**.

If already in Tablet mode, deselect and select it again to align the tablet.

The Tablet to Screen Mapping dialog box opens.

3. Click **Align Tablet Center to Selected Locus**.

The **Align Next Tablet Click to Selected Locus** option allows you to trace multiple objects from different sources and have them display in the drawing at the correct coordinates. For example, if two buildings need to maintain a set distance from each other, set a locus point, align the tablet to that locus, and create the first building. When that building is completed, set a second locus where the second building is supposed to be, realign the tablet, and create the second building. The boundary for the tablet is moved and the relationship between the objects is maintained.

4. Click **OK**.

The center of the tablet is now aligned with the selected locus point. The tablet's boundary box moves to indicate the center of the drawing tablet in relation to the drawing area.

This action only affects the center of the drawing tablet. The drawing area's origin is unaffected.

# Drawing Structure

VectorWorks offers several features to help organize and display a drawing: design layers, sheet layers, classes, viewports, and views. Create a structured system with these features to make it considerably easier to select, view, and print drawing elements.

For efficiency and consistency, create master libraries of layers, classes, and resources that can be shared by multiple users via workgroup referencing.

This section describes these organizational aids and how to use them effectively.

## Organizing the Drawing

When you begin a drawing project, first develop a layer and class structure, along with a system for assigning items to the appropriate layers and classes. A VectorWorks layer is basically a container that holds items. Layers are comparable to the sheets of vellum that are used for hand-drafting; each item “belongs” to a layer in the same way that a hand-drafted item “belongs” to its vellum sheet. A class, however, is an attribute of an object. Classes span the layers and allow you to control the attributes and visibility of objects across multiple layers. To output specific elements of a drawing quickly and easily, simply select the appropriate layers and classes for display.

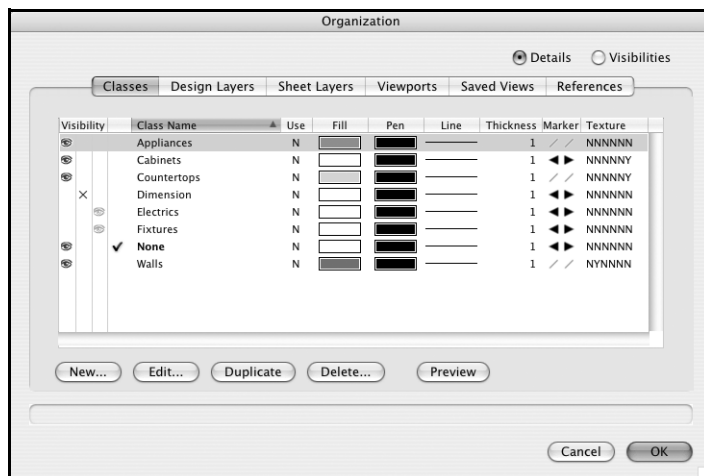
VectorWorks also provides ways to save the current drawing display with histories and saved views, and to present final drawings with viewports. Views and histories provide a “slice-of-time” look at the drawing. Histories record views of the drawing in a stack similar to the way Internet browsers do, while saved views store one or more aspects of the current display, such as the view, zoom, and layer and class visibility settings. Viewports are used to display final views of a drawing for client presentation.

Create and manage these structural elements using the Organization dialog box. This dialog box has specialized functions to sort and select its list items; see “List Box Functionality” on page 20.

To use the Organization dialog box:

1. Select **Tools > Organization**. Alternatively, click the **Classes** or **Layers** button on the View bar, or select **Edit View** from the Saved Views menu on the View bar.

The Organization dialog box opens.



2. Select the appropriate tab for the VectorWorks element to be created or edited: Classes, Design Layers, Sheet Layers, Viewports, Saved Views, or References.
3. From the top of the dialog box, select either **Details** or **Visibilities** view.

Generally, the Details view shows the current settings for each element, and enables editing of layer and class visibilities in the drawing area; the Visibilities view enables editing of layer and class visibilities in viewports and in saved views.

4. Buttons at the bottom of each tab provide creation and management functions. Alternatively, right-click (Windows) or Ctrl-click (Macintosh) on a list item to display a context menu, which has most of the same functions as the tab buttons.

Button	Function
<b>Classes tab</b>	
New	Click <b>New</b> to open the Class Options (Macintosh) or New Class (Windows) dialog box. See “Creating Classes” on page 96.
Edit	Select a class and click <b>Edit</b> to edit it in the Edit Class(es) dialog box. See “Setting Class Properties” on page 98.
Duplicate	Select a class and click Duplicate to create a copy of it. The name of the duplicate is the same as the original class, with a number added (as in cabinets-2); if the original name ends in a number, the number is incremented by one.
Delete	Select a class and click <b>Delete</b> to open the Delete Class(es) dialog box. Specify what to do with the objects currently assigned to the class(es) being deleted (delete them, or reassign them to another selected class). Click <b>OK</b> to return to the Organization dialog box. VectorWorks moves all objects in the deleted class(es) to the appropriate class, or deletes them, as specified.  Note that the Dimension and None classes cannot be deleted. These are default classes in every drawing.
Preview	Displays a preview of the current settings in the drawing area
<b>Design Layers tab</b>	
New	Click <b>New</b> to open the New Design Layer dialog box. See “Creating Layers” on page 85.
Edit	Select a layer and click <b>Edit</b> to edit it in the Edit Design Layers dialog box. See “Setting Design Layer Properties” on page 87.
Duplicate	Select a design layer and click <b>Duplicate</b> to create a copy of it. The name of the duplicate is the same as the original layer, with a number added (as in floorplan-2); if the original name ends in a number, the number is incremented by one.
Delete	Select a design layer and click <b>Delete</b> ; when prompted, click <b>Yes</b> to confirm the deletion. When a design layer is removed from the drawing, all objects in that layer are also removed.  Note that at least one design layer must remain in the drawing.
Preview	Displays a preview of the current settings in the drawing area
Update Reference (on the context menu only)	(Layer import referencing method only) This option is available if a design layer has been imported into this file with workgroup referencing (the name of the referenced layer displays in italics). From the layer’s context menu, select <b>Update Reference</b> to update this file with layer information from the master file. See “Workgroup Referencing” on page 111.



Button	Function
Page Setup	Opens the Page Setup dialog box. See “Page Setup” on page 74.
<b>Sheet Layers tab</b>	
New	Click <b>New</b> to open the New Sheet Layer dialog box. See “Creating Layers” on page 85.
Edit	Select a sheet layer and click <b>Edit</b> to edit it in the Edit Sheet Layers dialog box. See “Setting Sheet Layer Properties” on page 95.
Duplicate	Select a sheet layer and click <b>Duplicate</b> to create a copy of it. The name of the duplicate is the same as the original layer, with a number added (as in floorplan-2); if the original name ends in a number, the number is incremented by one.
Delete	Select a sheet layer and click <b>Delete</b> ; when prompted, click <b>Yes</b> to confirm the deletion
Preview	Displays a preview of the current settings in the drawing area
<b>Viewports tab</b>	
New	Select <b>New</b> to open the Create Viewport dialog box. For sheet layer viewports, see “Creating a Sheet Layer Viewport from a Design Layer” on page 610 in this guide. For design layer viewports (VectorWorks Design Series required), see “Creating a Referenced Design Layer Viewport” on page 618 in the VectorWorks Design Series User’s Guide.
Edit	Select a viewport and then select <b>Edit</b> to edit it in the Properties dialog box. For sheet layer viewports, see “Properties of Sheet Layer Viewports” on page 614 in this guide. For design layer viewports (VectorWorks Design Series required), see “Properties of Design Layer Viewports” on page 623 in the VectorWorks Design Series User’s Guide.
Duplicate	Select a viewport and click <b>Duplicate</b> to create a copy of it. The name of the duplicate is the same as the original viewport, with a number added (as in details-2); if the original name ends in a number, the number is incremented by one. VectorWorks places the duplicate viewport directly on top of the original, in the original sheet layer.
Delete	Select a viewport and click <b>Delete</b> ; when prompted, click <b>Yes</b> to confirm the deletion
Preview	Displays a preview of the current settings in the drawing area
<b>Saved Views tab</b>	
New	Click <b>New</b> to open the Save View dialog box. See “Creating Saved Views” on page 104.
Edit	Select a saved view and click <b>Edit</b> to edit it in the Edit Saved View dialog box. See “Editing Saved Views” on page 106.
Duplicate	Select a saved view and click <b>Duplicate</b> to create a copy of it. The name of the duplicate is the same as the original view, with a number added (as in deckview-2); if the original name ends in a number, the number is incremented by one.
Delete	Select a saved view and click <b>Delete</b> ; when prompted, click <b>Yes</b> to confirm the deletion
<b>References tab</b>	
New	Click <b>New</b> to open the Open File dialog box. For layer import references, see “Adding and Editing Layer Import References” on page 113 in this guide. For design layer viewport references (VectorWorks Design Series required), see “Creating a Referenced Design Layer Viewport” on page 618 in the VectorWorks Design Series User’s Guide.

Button	Function
Edit	Select a referenced file and click <b>Edit</b> to open the Edit Reference dialog box. For layer import references, see “Adding and Editing Layer Import References” on page 113 in this guide. For design layer viewport references (VectorWorks Design Series required), see “Creating a Referenced Design Layer Viewport” on page 618 in the VectorWorks Design Series User’s Guide.
Delete	Select a referenced file and click <b>Delete</b> . In the Delete Reference dialog box, specify what to do with the items in the file that are currently referenced. See “Deleting References” on page 117.
Update	Select a referenced file and click <b>Update</b> to update this file with information from the master file. See “Updating References” on page 115.
Settings	Click <b>Settings</b> to open the Reference Settings dialog box. See “Setting the Referencing Options” on page 112.

## Creating Classes and Layers from Standards

Design layers, sheet layers, and classes can be created by importing them from standard files. Layer standards use only approved layer names for a particular industry. Class standards use approved name and class settings for a particular industry.

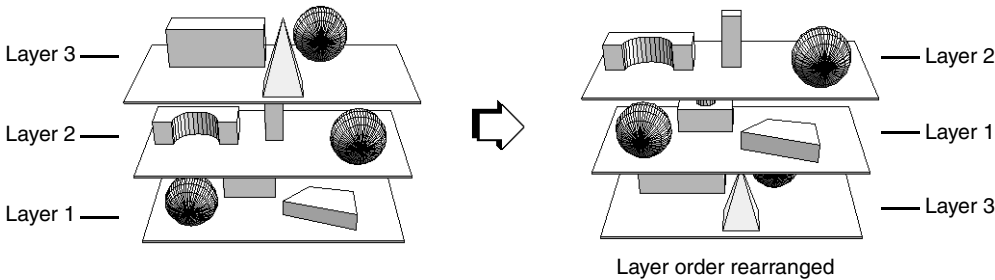
Standard files (.sta files) are provided with VectorWorks and are located in the Standards folder. To create a new layer or class, select the standard file from the list, or browse to locate it.

Custom layers or classes can be created in a blank file and saved as an .sta file in the Standards folder. Once placed in the Standards folder, these new layers or classes become part of the Standards list and are available when new layers or classes are created.

If a layer or class name in the current file matches that of one in the Standards folder, it is not displayed in the list.

## Managing Layers

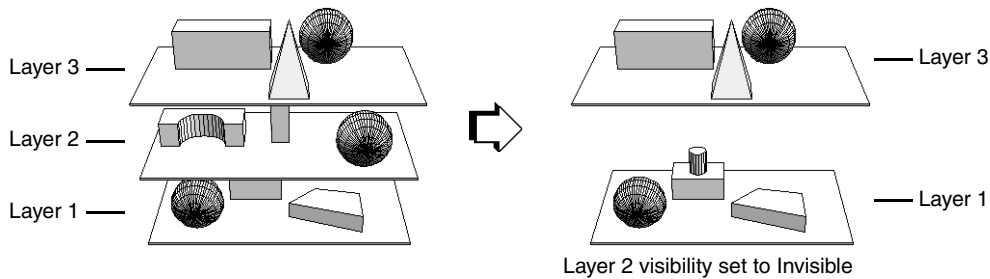
Create layers in a VectorWorks drawing to provide immediate flexibility. Stack the design layers in any order, or temporarily hide some of them. Reorder the layers, which moves all of the objects contained within each layer to another location without actually modifying the objects or their alignment with each other.



If you hand-draw a floor plan on two design layers, one vellum sheet with a master 2D drafting plan and another with an addition to the plan, it would be easy to look at the floor plan with or without the addition. In VectorWorks, the vellum is electronic, so far more can be done with it. A distance can be set between design layers rather than having them lie flat on top of each other. Additionally, with VectorWorks’ modeling capabilities, these layers can be used to create 3D objects. For example, if the first floor, second floor, basement, and roof of a house are each placed in their

own design layer, not only can the 2D drafting plan be printed for any one of those layers, but the design layers can be linked together, creating a model of a fully formed 3D house. Use viewports to display several views of the finished design, either on design layers (Design Series required) or on sheet layers, which are special presentation layers. The original design layers remain unchanged.

Layers have many other uses, as well. Move elements between design layers, or change the scale of a layer, instantly making a detail of an area of the drawing without re-drawing anything. Create design layers with objects that should always display, or layers that contain objects for display only at particular times. Control the visibility of the design layers to limit the need for creating new objects.



Use design layers to draw and model projects. Use sheet layers to create a presentation version of the finalized drawing; this can include viewports, title blocks, notes, and other annotations (see “Presenting Drawings with Sheet Layer Viewports” on page 609).

On the layers list in the View bar, sheet layers are listed first, and then design layers. A separator divides the two types of layers in the list.

Sheet layers display with a wide gray border representing the print margin area, as opposed to design layers, which have a thin gray border (when the page boundary is displayed). This makes it easier to distinguish the layer types at a glance.

## Creating Layers

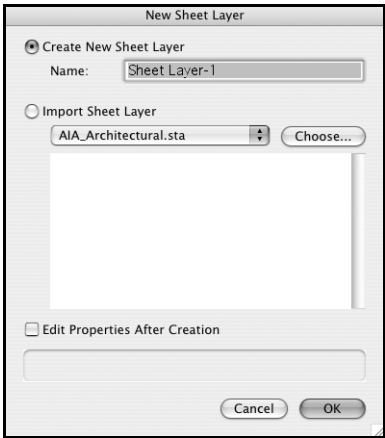
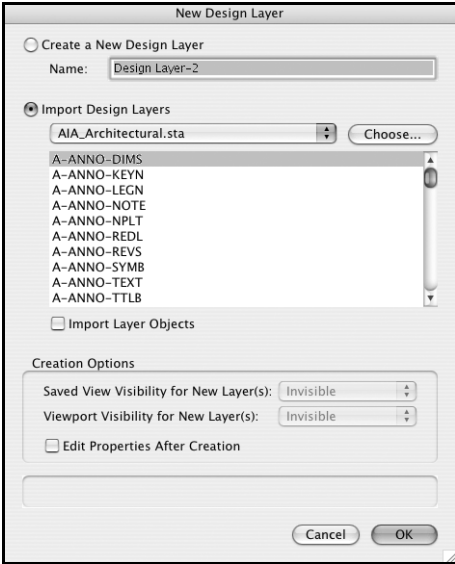
When a new drawing is created, it automatically contains an empty design layer entitled “Design Layer-1.” Add design layers to the drawing as needed to organize it. Add sheet layers as needed for presentation. Create new design layers and sheet layers, or import them (and optionally, the objects they contain) from other current version VectorWorks files or from standard files. In VectorWorks Design Series, create a design layer viewport to reference design layers in other files without importing them.



To create a new layer:

1. Select **Tools > Organization**. Alternatively, click the **Layers** button on the View bar.  
The Organization dialog box opens.
2. Select the Design Layers or Sheet Layers tab and click **New**.

The New Design Layer or New Sheet Layer dialog box opens. Create a new layer, or import a layer and its properties from standard or existing VectorWorks files.



Parameter	Description
Create a New Design Layer or Create New Sheet Layer	Creates a new design or sheet layer; enter a layer <b>Name</b>
Import Design Layers or Import Sheet Layer	Imports layers and their attributes from standard files or existing files. Files located in the Standards folder, as well as existing files selected previously, are displayed in the list. Select a file; included layers are listed beneath. Select the desired layer(s). For more information about standards, see “Creating Classes and Layers from Standards” on page 84.
Choose	Click <b>Choose</b> to select a file for layer import. Files must be in the current version.
Import Layer Objects (design layer only)	In addition to importing the design layer structure and attributes, imports the contents of the layers; if a file has become corrupted, this is a possible way of recovering its data. If there is a naming conflict with pre-existing symbols or pre-existing layers in the current document, rename the symbols or layers.
Creation Options	
Saved View Visibility (design layer only)	Sets the visibility of the new design layer in saved views (when saved views exist in the drawing)
Viewport Visibility (design layer only)	Sets the visibility of the new design layer in viewports (when viewports exist in the drawing)
Edit Properties After Creation	Immediately after creation, opens the Edit Design Layers or Edit Sheet Layers dialog box to set the properties of the new layer(s); see “Setting Design Layer Properties” on page 87 or “Setting Sheet Layer Properties” on page 95

To select multiple layers from the import list, hold down the Ctrl (Windows) or Command (Macintosh) key while you click.

If a layer name in the current file matches an imported layer name, that layer is not included in the list.

3. Click **OK** to create the new design or sheet layer(s).

The layers display in the layer list in the Organization dialog box, and also in the layers list on the View bar.

## Setting Design Layer Properties

Once created, the design layers display on the Design Layers tab of the Organization dialog box, where various properties can be set and edited.



To edit design layers:

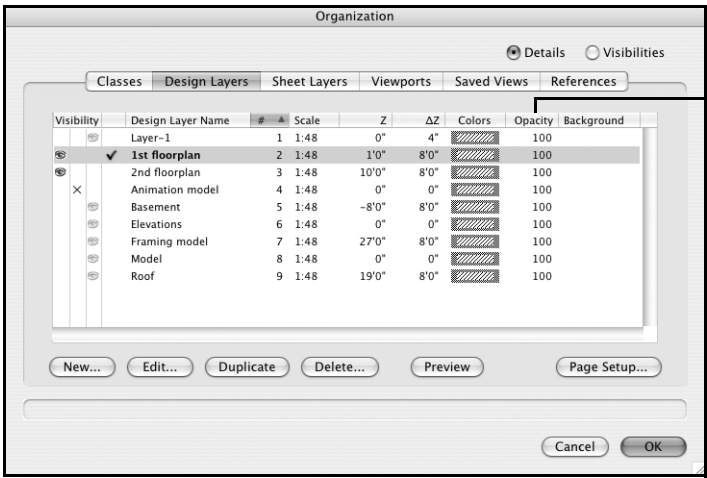
1. Select **Tools > Organization**. Alternatively, click the **Layers** button on the View bar.

The Organization dialog box opens.

2. Select the Design Layers tab.

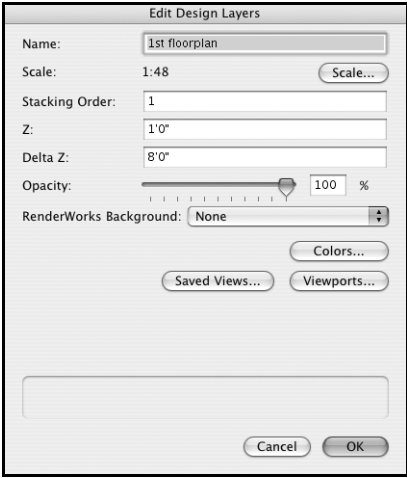
A list of the current layers in the drawing displays in their stacking order. Depending on which view option is selected at the top of the dialog box, either details or visibilities of the design layers display. Stacking order, drawing area visibility, and active layer can be changed in **Details** view. The visibility of layers in viewports and in saved views can be changed in **Visibilities** view.

Layers that are imported from another file for workgroup referencing display in italics.

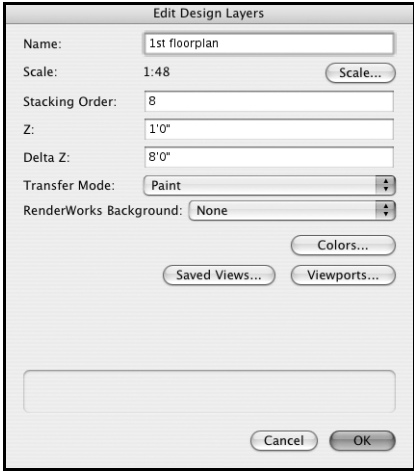


Displays when the VectorWorks preference for Quartz imaging (Macintosh) or GDI+ imaging (Windows) is enabled

3. To change other layer properties, select one or more layers and click **Edit** to open the Edit Design Layers dialog box.



Quartz (Macintosh) or GDI+ (Windows) imaging  
VectorWorks preference enabled



Quartz (Macintosh) or GDI+ (Windows) imaging  
VectorWorks preference disabled

Parameter	Description
Name	If one layer was selected, displays the layer’s name, which can be edited if necessary
Scale	Sets the scale for the selected layer(s); see “Setting the Design Layer Scale” on page 88
Stacking Order	Changes the stacking order of the layer(s); see “Changing the Design Layer Stacking Order” on page 89
Z, Delta Z	Specifies the base elevation height and the default height of walls for the selected layer(s); see “Setting the Design Layer Z and Delta Z Values” on page 90
Opacity / Transfer Mode	<b>Opacity</b> and <b>Transfer Mode</b> control how the selected layer(s) and other visible layers display; see “Setting the Design Layer Opacity” on page 90 or “Setting the Design Layer Transfer Mode” on page 91
RenderWorks Background	When RenderWorks is installed, select the RenderWorks background to use for the selected layer(s) from either the default resources or the current file’s resources; see “VectorWorks Fundamentals Default Resources” on page 141 and “Creating Layer Backgrounds” on page 656
Colors	Specifies the default layer color for the selected layer(s); see “Setting the Design Layer Color” on page 92
Saved Views	Specifies the visibility settings for the selected layer(s) in each saved view; see “Setting Visibilities” on page 108
Viewports	Specifies the visibility settings for the selected layer(s) in each viewport; see “Setting Visibilities” on page 108

Setting the Design Layer Scale

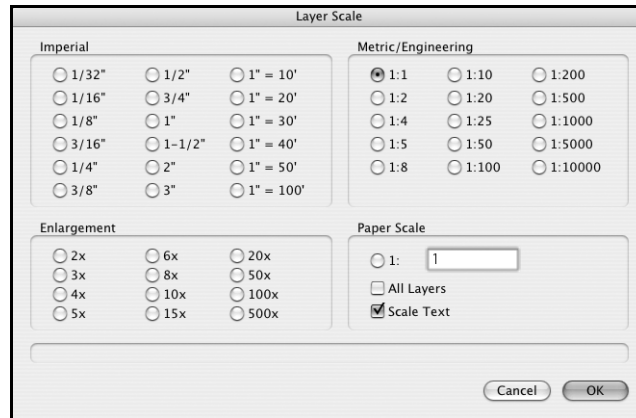
To set the design layer(s) scale:

1. From the Organization dialog box, select the Design Layers tab. Select one or several layers, and then click **Edit**.

The Edit Design Layers dialog box opens.

2. Click **Scale**.

The Layer Scale dialog box opens.



Alternatively, to access the Layer Scale dialog box for the active layer, right-click (Windows) or Ctrl-click (Macintosh) in the drawing area to access the document context menu, and then select **Active Layer Scale**. Or, if the layer scale is displayed on the View bar, click the **Layer Scale** button.

3. Select the desired scale.

Select **All Layers** for the new scale to apply it to all layers in the drawing. Select **Scale Text** to scale the text along with the layer.

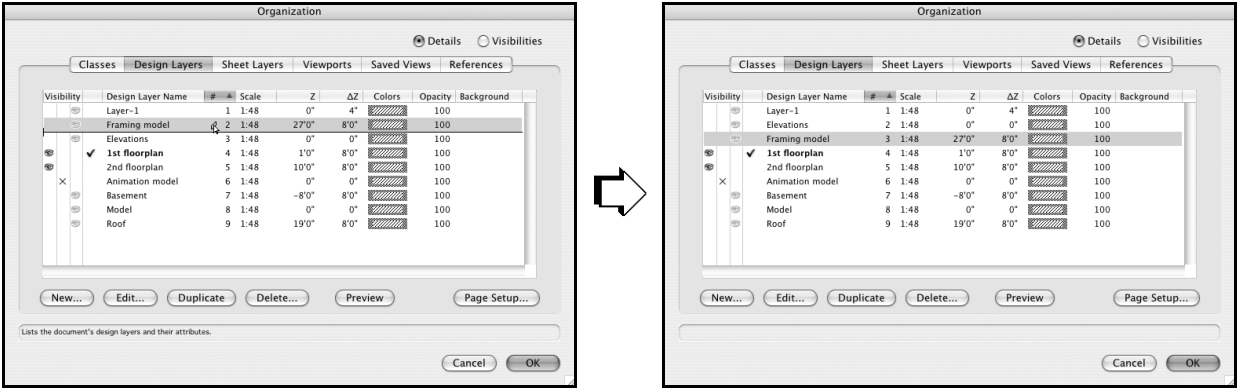
4. Click **OK** to close the Layer Scale dialog box.

## Changing the Design Layer Stacking Order

Design layers are viewed and printed in “stacking order,” the top-to-bottom order in the Layers Setup dialog box. Initially, layers are “stacked” in the order in which they are created, but their order can be changed at any time.

To change the stacking order of design layers:

- From the Organization dialog box, select the Design Layers tab in **Details** view to see the current stacking order. The # column to the right of the layer name indicates the layer’s current position in the stack, with 1 being the top layer.
- Use one of the following methods for changing the design layer stacking order:
  - If the list is not currently sorted by stacking order, click the # column heading to change it. Then click the # column of the layer(s) to be moved, and drag it up or down the list (the # column must be the current sorting column). A horizontal line indicates where the layer(s) will be inserted in the current order.
  - Select the layer(s) to move, and then click **Edit** (or double-click a layer row) to open the Edit Design Layers dialog box. In the **Stacking Order** field, enter the number for the new stacking order position of the layer(s). Click **OK** to accept the changes.
- The Design Layers tab displays the new stacking order. Click **OK** to close the Organization dialog box and save the changes.



Click layer 2 (Framing model) and drag it down to the third position on the list

Setting the Design Layer Z and Delta Z Values

The Z value of a layer represents its height above base elevation. The delta Z value represents the default height of walls created on that layer. For example, the second story of a building might be 12 feet above street level; its Z value is 12 feet. If the walls are to be drawn 10 feet high for that story, its delta Z value is 10 feet.

When a new layer is added to a drawing, its Z values are automatically entered based on the previous layer's Z and delta Z values.

To set the Z and delta Z values of the layer:

- 1. From the Organization dialog box, select the Design Layers tab. Select one or several layers, and then click **Edit**.  
The Edit Design Layers dialog box opens.
- 2. Enter the base elevation value for the layer in the **Z** field.  
In a 3D view, the layer displays at the specified elevation above or below the ground plane.
- 3. Enter the default height of walls created on the selected layer in the **Delta Z** field.
- 4. Click **OK** to close the Edit Design Layers dialog box, and then click **OK** again to close the Organization dialog box.

Setting the Design Layer Opacity

With the Quartz (Macintosh) or GDI+ (Windows) imaging VectorWorks preference enabled (it is enabled by default), design layers have a setting that controls the transparency of layer objects that overlap visible objects in another layer. An **Opacity** value of 100% means that nothing beneath the active layer is visible. Decrease the **Opacity** value to increase the transparency of the objects on the layer. (See "Display Preferences" on page 41 for information about setting this preference.)

To set the opacity for a design layer:

- 1. From the Organization dialog box, select the Design Layers tab. Select one or several layers, and then click **Edit**.  
The Edit Design Layers dialog box opens.
- 2. Drag the **Opacity** slider to the left to increase the transparency, or enter an opacity percentage (0-100) in the box to the right of the slider.



- Click **OK** to close the Edit Design Layers dialog box, and then click **OK** again to close the Organization dialog box.

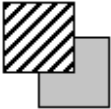
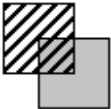


Individual objects can also have an opacity percentage applied. See “Opacity Attributes” on page 231.





### Setting the Design Layer Transfer Mode

When the Quartz (Macintosh) or GDI+ (Windows) imaging VectorWorks preference is disabled, design layers have a setting that controls the display of layer objects that overlap visible objects in another layer.

To set the transfer mode for a design layer:

- From the Organization dialog box, select the Design Layers tab. Select one or several layers, and then click **Edit**.  
The Edit Design Layers dialog box opens.
- Select the desired **Transfer Mode** from the list. Click **OK** to close the Edit Design Layers dialog box, and then click **OK** again to close the Organization dialog box.

Mode	Description
Paint	Makes objects in the new layer solid, obscuring objects in layers stacked below it (this is the default setting) <div></div>
Overlay	Makes it so objects in the new layer do not obscure stacked layers <div></div>
Invert	Makes a reversed, or photo-negative image display when an object in the new layer overlaps an object in another layer <div></div>
Erase	Makes objects in the new layer display all foreground patterns as white and all background patterns as transparent <div></div>

Mode	Description
Not Paint	Makes objects in the new layer solid and inverts any areas that overlap objects in stacked layers 
Not Overlay	Makes objects in the new layer transparent and inverts layer colors 
Not Invert	Makes objects in the new layer transparent and converts any black pixels from overlapping areas to white and white pixels to transparent 
Not Erase	Makes objects in the new layer transparent and converts any white pixels from overlapping areas to black and black pixels to transparent 

Most printer devices do not support all of these modes, especially PostScript printers and vector devices such as pen plotters. The **Rasterize print output** option may produce the best results for certain transfer modes. Macintosh OS X does not support layer transfer modes when printing, but they are available for on-screen viewing. On the Windows platform, the use of color in transfer modes may produce color blending.

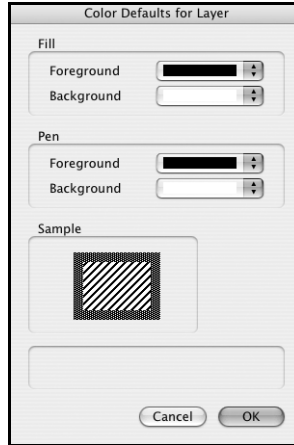
Setting the Design Layer Color

The fill and pen color of objects that are drawn on or moved to a design layer can be controlled by the color settings of the design layer. The **Use layer colors** setting in the Document Preferences dialog box must be turned on (see “Display Preferences” on page 41).

These settings are overridden by the **Black and white only** option in the Document Preferences dialog box, even with the **Use layer colors** option selected.

To control the color of objects by their design layers:

- From the Organization dialog box, select the Design Layers tab. Select one or several layers, and then click **Edit**.  
The Edit Design Layers dialog box opens.
- Click **Colors**.  
The Color Defaults for Layer dialog box opens.



- For both the fill and pen, set the **Foreground** and **Background** colors by clicking the appropriate list and selecting a color from the main Color Menu dialog box. A preview example is shown at the bottom of the dialog box.

The fill background color controls the appearance of objects with a solid fill.

- Click **OK**.

When the **Use layer colors** preference is selected, all objects on the layer are drawn with the specified colors.

Viewports have separate control of layer color (see “Advanced Sheet Layer Viewport Properties” on page 615).

## Setting the Active Design Layer

To be able to add, remove, or edit objects on a design layer, either the layer must be active or the layer options must be set to allow modifications to other layers (see “Setting Class and Design Layer Options” on page 103). There are several ways to change the active design layer.

If there are a small number of design layers, switch between layers with the **Switch active layer/class** shortcut key combination specified in VectorWorks preferences (see “Setting VectorWorks Preferences” on page 39). This selects a layer by moving up or down through the layer list one layer at a time. If the drawing has a large number of layers, use one of the following options.

### Setting the Active Design Layer in the Organization Dialog Box

To set the active design layer:

- From the Organization dialog box, select the Design Layers tab in **Details** view.

The active layer is indicated by a check mark to the left of the **Design Layer Name**. The name of the layer also is highlighted in bold text.

- To make a different layer active, click the column to the left of its name.
- Click **OK**.

The dialog box closes and the active layer displays.

## Setting the Active Design Layer in the View Bar

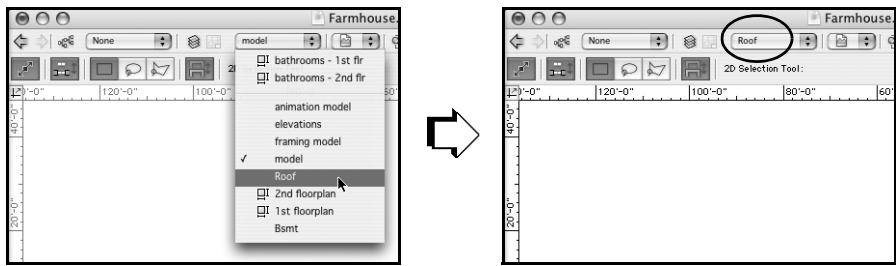
To set the active design layer:

1. Click the Active Layer on the View bar to display a list of all of the sheet layers (top section) and design layers (bottom section) in the drawing.

On Macintosh, the active layer is indicated by a check mark; on Windows, the layer name is highlighted in bold text.

2. Click the design layer to be activated.

The layers list closes and the active layer displays.



## Setting the Active Design Layer in the Document Context Menu

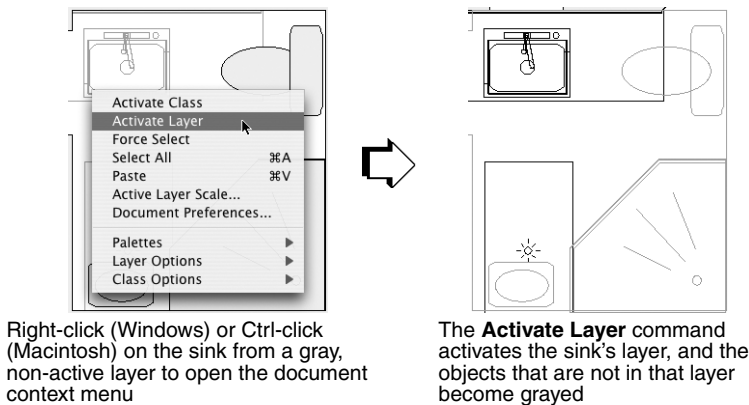
If multiple design layers are set to be visible, and the layer options are set to show those other layers, the drawing area may display objects that are on non-active layers. Use the **Activate Layer** command to make the layer of one of these objects active.

The **Force Select** command on the document context menu also changes the active class and layer (if necessary), and selects the clicked object.

To set the active design layer:

1. In the drawing area, right-click (Windows) or Ctrl-click (Macintosh) a visible object on a non-active design layer.
2. From the document context menu, select **Activate Layer**.

The object's layer becomes active.



Right-click (Windows) or Ctrl-click (Macintosh) on the sink from a gray, non-active layer to open the document context menu

The **Activate Layer** command activates the sink's layer, and the objects that are not in that layer become grayed

## Setting Sheet Layer Properties

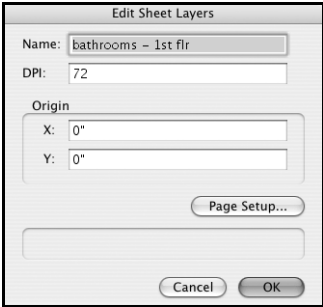
Once created, the sheet layers display on the Sheet Layers tab of the Organization dialog box, where various layer properties can be set and edited.

Sheet layers are always at a 1:1 scale, Active Only, and set to Top/Plan view.



To edit sheet layers:

1. Select **Tools > Organization**. Alternatively, click the **Layers** button on the View bar.  
The Organization dialog box opens.
2. Select the Sheet Layers tab and the **Details** view.  
The Sheet Layers tab opens, with a list of the current layers in the drawing. Only the active layer can be changed in **Details** view. **Visibilities** view does not apply to sheet layers.
3. To change layer properties, select one or more layers and click **Edit** to open the Edit Sheet Layers dialog box.



Parameter	Description
Name	Displays the selected layer name; to change this name, enter a new name
DPI	Specifies the printing resolution (Dots Per Inch) for printing the raster rendered viewports in the selected layer (does not affect vector geometry or bitmaps that are inside that viewport)
Origin	Specifies the X and Y coordinates of the sheet layer origin; each sheet layer has its own origin
Page Setup	Opens the Page Setup dialog box for entry of sheet layer printing parameters; this saves time later, when different sheet layers can be automatically sent to different printers with different print area settings (see “Page Setup” on page 74)

## Managing Classes

In addition to design layers, classes are a powerful way to organize the elements in a drawing project according to category. This allows the objects to be viewed, changed, and tracked as a group. Because classes work across design layers, they allow the grouping of similar objects in a drawing that for practical reasons need to exist on separate layers. Classes also allow the same file to be used for all stages of a project and for various purposes. For example, the classes shown for a license application could be different from those shown for the building contractor.

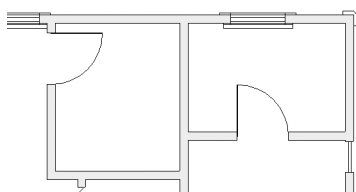
VectorWorks classes are similar in function to—and are exported as—AutoCAD layers. If a drawing will be exported to AutoCAD, use classes to make it easy to turn on or off selected portions of the drawing. For example, if a consultant using AutoCAD will be doing the duct layout for a building, a furniture class allows him or her to turn off the furniture layer, instead of deleting furniture objects.

Setting up the classes at the beginning of a project is recommended, so that objects can be assigned to appropriate classes as they are created.

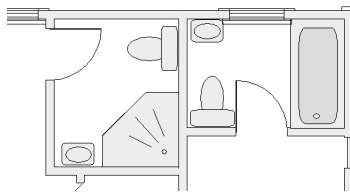
Every new drawing in VectorWorks automatically has two classes: Dimension and None. Any dimensions created are assigned, by default, to the Dimension class (this is a preference setting that can be changed; see “Dimension Preferences” on page 49). Group objects are assigned to the active class. All other objects and symbols are assigned to the None class, which is the default active class. These two classes can be renamed but not deleted.

If the drawing was created from a template, other classes may have been provided. VectorWorks also allows additional classes to be created. The new classes can be duplicated, edited, or deleted. The visibility of the classes can also be changed.

For example, for a drawing of a house with four separate plan layers (first floor, second floor, basement, and roof), assign all bathroom fixtures to a class called “Fixtures.” Make the Fixtures class invisible to print the floor plans without fixtures, and then make them visible to print the bathroom fixtures for each story of the house.



Fixtures class invisible



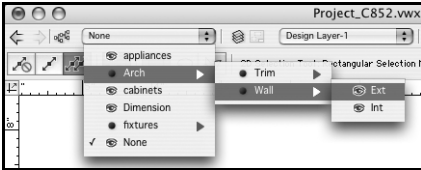
Fixtures class visible

VectorWorks provides flexible options when working with classes. In addition, class information can be linked to worksheets. Using the house example in the previous paragraph, not only can the plumbing fixtures plan for the house be printed, but a running inventory of the cost for all plumbing fixtures can be kept (see “Using Worksheets” on page 566).

## Creating Classes

Consider class names at creation. If there are a large number of classes, organize them by naming each class with a compound name consisting of up to three parts, separated by a dash. Each name part represents a different level in the class structure. For example, a drawing of a building might have a class structure that includes main groups for architecture, plumbing, and electrical objects. Within the architecture group, there might be door, floor, and wall groups. Those groups in turn have sub-groups—for example, the wall sub-group might have interior and exterior designations. A class is named according to its position in the class structure, as in Arch-Wall-Ext, Elec-Lite-Ceiling, or Plum-Equip-New.

In the classes list on the View bar, each main group is a menu option, with sub-menus for the sub-groups. In the following example, the Arch option has a Wall sub-menu, with Ext and Int options. This type of organization makes it easy to assign classes as objects are created.



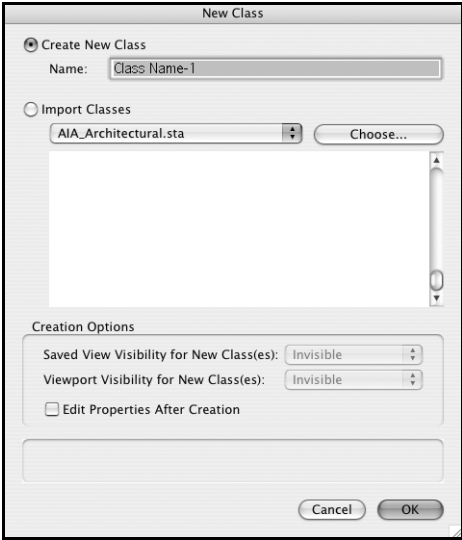
Classes can be created as new, or imported from other current version VectorWorks files or standard files.



To create a new class:

1. Select **Tools > Organization**. Alternatively, click the **Classes** button on the View bar.  
The Organization dialog box opens.
2. Select the Classes tab and click **New**.

The New Class dialog box opens. Create a new class, or import a class and its properties from standard or existing VectorWorks files.



Class Type	Action
Create New Class	Creates a class based on current Attributes palette settings; enter a class <b>Name</b>
Import Classes	Imports classes and their attributes from standard files or existing files. Files located in the Standards folder, as well as existing files selected previously, are displayed in the list. Select a file; included classes are listed beneath. Select the desired class(es). For more information about standards, see “Creating Classes and Layers from Standards” on page 84.
Choose	Click <b>Choose</b> to select a file for class import. Files must be in the current version.
Creation Options	

Class Type	Action
Saved View Visibility	Sets the visibility of the new class in saved views (when saved views exist in the drawing)
Viewport Visibility	Sets the visibility of the new class in viewports (when viewports exist in the drawing)
Edit Properties After Creation	Immediately after creation, opens the Edit Class(es) dialog box to set the properties of the new class(es) (see “Setting Class Properties” on page 98)

To select multiple classes from the import list, hold the Ctrl (Windows) or Command (Macintosh) key while you click.


If a class name in the current file matches an imported class name, that standard class is not included in the list.

- 3. Click **OK** to create the new class(es).

The classes display in the classes list in the Organization dialog box, and in the classes list on the View bar.

### Setting Class Properties

Once created, the classes display on the Classes tab of the Organization dialog box, where various properties can be set and edited.

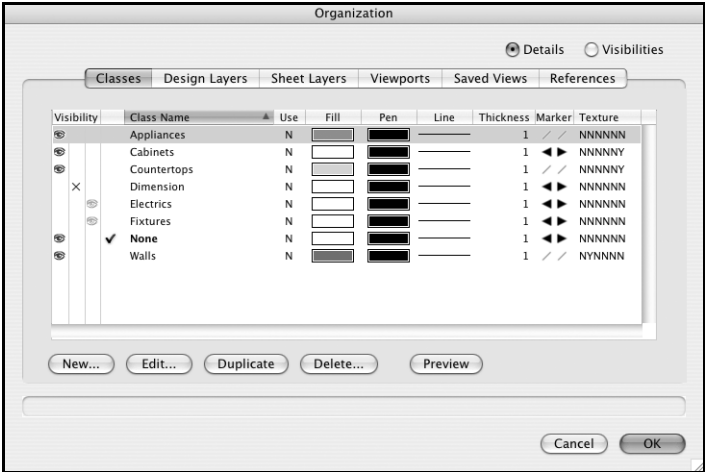
 To edit classes:

- 1. Select **Tools > Organization**. Alternatively, click the **Classes** button on the View bar.

The Organization dialog box opens.

- 2. Select the Classes tab.

A list of the current classes in the drawing displays. Depending on which view option is selected at the top of the dialog box, either details or visibilities of the classes display. The visibility of classes in the drawing area and the active class can be changed in **Details** view. The visibility of classes in viewports and in saved views can be changed in **Visibilities** view (see “Setting Visibilities” on page 108).



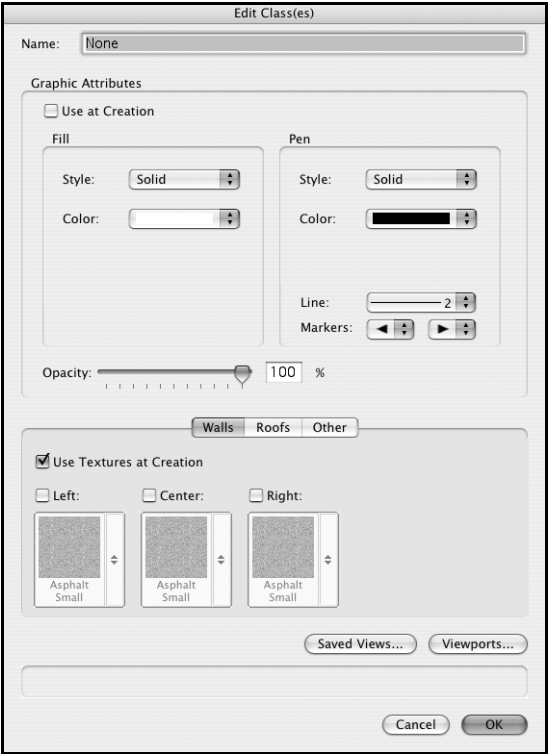
- 3. To change other class properties, select one or more classes and click **Edit** to open the Edit Class(es) dialog box.



4. If desired, enter a new name for the class in the **Class Name** field. Then, set the graphic attributes of the class. See “Setting Class Attributes” on page 100 for more information about graphic attributes.

Displays when the VectorWorks preference for Quartz imaging (Macintosh) or GDI+ imaging (Windows) is enabled

RenderWorks texture options



Parameter	Description
Use at Creation	Applies the attributes displayed in this dialog box when creating an object assigned to this class. If <b>Use at Creation</b> is not selected, these attributes can be applied to the object later by assigning the <b>Class Style</b> from the Attributes palette. See “Setting Class Attributes” on page 100 for more information.
Fill	
Style	Select one of the following fill styles from the list
None	No fill is applied to the objects in this class
Solid	Applies a solid fill to the objects in this class; click the color box to select the desired color from the main Color Menu dialog box
Pattern	Applies a patterned fill and color to objects in this class. Click the pattern box to select the desired pattern, and then select the foreground color and background color from the color boxes next to the pattern.
Hatch	Applies a hatch to objects in this class. Select the desired hatch from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141). Select <b>Hatch</b> from the list to create a new hatch to apply to the class.

Parameter	Description
Gradient	Applies a gradient to objects in this class; click the gradient preview to select a gradient resource from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141)
Image	Applies an image to objects in this class; click the image preview to select an image from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141)
Pen	
Style	Select None, Solid, Pattern, or Dash from the list
Color	Click the color box to select a pen foreground color
Line Style/Line Thickness	Select the line style and thickness for the class; to use a custom thickness, select <b>Set Thickness</b> from the line thickness list to access the Set Thickness dialog box
Markers	Select the marker style for each end of lines, dimensions, arcs, polylines, 2D polygons, or freehand lines in this class. Choose the marker style from the list of available markers. To use a custom marker style, select <b>Custom</b> and specify the marker settings, or select <b>Edit Marker List</b> from the marker style list to set the available marker types (see "Setting Default Marker Types" on page 60).
Opacity	When the Quartz (Macintosh) or GDI+ (Windows) imaging VectorWorks preference is enabled, specifies the class transparency; drag the slider to the left to increase the transparency, or enter an opacity percentage in the box to the right of the slider
Walls, Roofs, and Other tabs	If RenderWorks is installed, click these tabs to set the texture properties for wall, roof, and other objects assigned to the class. See "Applying Textures to Symbols, Walls, and Roofs" on page 671 for more information.
Saved Views	If there are saved views in the drawing, opens the Saved View Visibilities dialog box. Set the visibility for the new class(es) in the saved views (Visible, Invisible, Gray, or Don't Save). See "Setting Visibilities" on page 108.
Viewports	If there are viewports in the drawing, opens the Viewport Visibilities dialog box. Set the visibility for the new class(es) in the viewports (Visible, Invisible, Gray, or Don't Save). See "Setting Visibilities" on page 108.

- Click **OK** to return to the Organization dialog box. If objects in an edited class already exist in the drawing, and the class is set to **Use at Creation**, when prompted, specify how to apply the changes to the existing objects.
- Click **OK** from the Organization dialog box to save the changes.

If multiple classes are simultaneously selected for editing, and some are set to apply attributes while others are not, **Use at Creation** appears dimmed, indicating an unknown setting. Additionally, if some or all of the attribute values are different for the selected classes, the editing fields for those values indicate that the value is unknown. When the **OK** button is clicked, the currently defined settings shown are applied to all of the selected classes. Any information with an unknown setting is not applied.

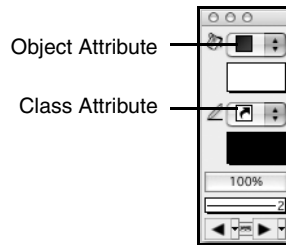
## Setting Class Attributes

There are two types of attributes available for each object: class attributes and object attributes. Class attributes represent the graphic attributes information assigned by the class. Object attributes are assigned directly from the

Attributes palette. The attributes that an object uses when it is created are controlled by **Use at Creation** in the Edit Class(es) dialog box.

When **Use at Creation** is selected for a class, objects created in that class or subsequently assigned to that class use the class attributes. The Attributes palette displays an arrow to indicate that the attributes have been set by class. If objects in that class already existed before **Use at Creation** was selected, you are prompted to decide how to apply the attributes to the existing objects.

Class attributes can be overridden by selecting the object(s) and applying the attributes directly from the Attributes palette. Later, class attributes can be selected again from the Attributes palette by selecting **Class Style** from the attribute list. If **Use at Creation** was not selected for a class, selecting **Class Style** for an attribute applies the class setting to the object(s) at that time.



Class attributes are represented by a curved arrow

For more information, see “The Attributes Palette” on page 229.

## Setting the Active Class

To be able to remove or edit objects in a particular class, either the class must be active or the class options must be set to allow modifications to other classes (see “Setting Class and Design Layer Options” on page 103). There are several ways to change the active class.

If there are a small number of classes, switch between classes with the **Switch active layer/class** shortcut key combination specified in the VectorWorks Preferences (see “Setting VectorWorks Preferences” on page 39). This selects a class by moving up or down through the class list one layer at a time. If the drawing has a large number of classes, use one of the following options.

### Setting the Active Class in the Organization Dialog Box

To set the active class:

1. From the Organization dialog box, select the Classes tab in **Details** view.

The active class is indicated by a check mark to the left of the **Class Name**. The name of the class also is highlighted in bold text.

2. To make a different class active, click the column to the left of its name.
3. Click **OK**.

The dialog box closes and the active class displays.

### Setting the Active Class in the View Bar

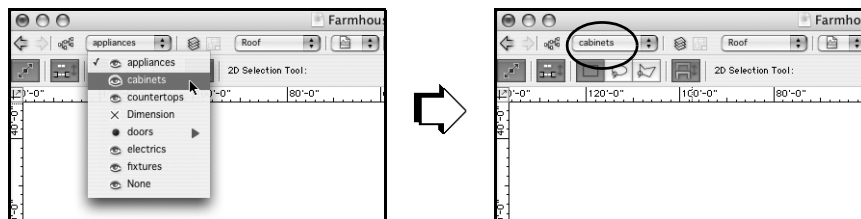
To set the active class:

1. Click the Active Class on the View bar to display a list of all of the drawing's classes.

On Macintosh, the active class is indicated by a check mark; on Windows, the class name is highlighted in bold text.

- Click the class to be activated.

The classes list closes and the active class displays.



## Setting the Active Class in the Document Context Menu

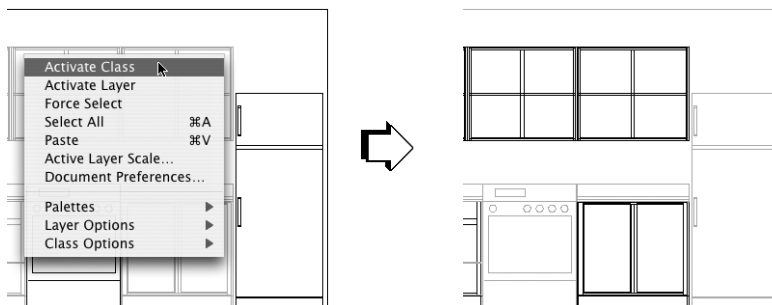
If multiple classes are set to be visible, and the class options are set to show those other classes, the drawing area may display objects that are in non-active classes. Use the **Activate Class** command to make the class of one of these objects active.

The **Force Select** command on the document context menu also changes the active class and the active layer (if necessary), and selects the clicked object.

To set the active class:

- In the drawing area, right-click (Windows) or Ctrl-click (Macintosh) a visible object in a non-active class.
- From the document context menu, select **Activate Class**.

The object's class becomes active.



Right-click (Windows) or Ctrl-click (Macintosh) on a cabinet in a gray, non-active class to open the document context menu

The **Activate Class** command activates the cabinet's class, and the objects that are not in that class become grayed

## Copying and Pasting Classed Objects

Objects in a class can be copied and pasted from one drawing to another, even if the destination drawing does not contain the same class as the original drawing. VectorWorks automatically creates a new class in the destination drawing and transfers all of the class information from the source drawing. If the destination drawing already has a class with the same name as the source drawing, only the object information is pasted. All of the class information for the destination drawing's class remains unchanged.

When you paste objects that could become invisible due to class visibility settings, specify whether the invisible classes should be made visible so that the pasted objects can be seen.

## Setting Class and Design Layer Options

The **Class Options** and **Layer Options** commands are very similar—they both control how all the classes or design layers in a drawing work together. For example, a drawing project can be set to display only the active class, temporarily hiding all objects assigned to other classes.

To change the options for displaying, snapping to, and editing objects in the current class or design layer:

1. Select **View > Class Options** (or **Layer Options**) and then the option.

Class and design layer options can also be accessed with the **Class Options** and **Layer Options** commands on the document context menu.

Parameter	Description
Active Only	Displays only objects in the active class/layer; only the active class/layer prints
Gray Others	Displays the active class/layer normally and all other classes/layers appear dimmed (except for those set to invisible); even though visible, objects in dimmed classes/layers cannot be edited
Gray/Snap Others	Displays the active class/layer normally and all other classes/layers appear dimmed (except for those set to invisible); objects in any normally displayed or gray class/layer can be snapped to. Only objects in the active class/layer can be edited.
Show Others	All classes/layers display normally, except for those set to invisible or grayed; even though visible, objects in classes/layers other than the active class/layer are not editable and cannot be snapped to
Show/Snap Others	All classes/layers display normally, except for those set to invisible or grayed; objects in any normally displayed or gray class/layer can be snapped to. Only objects in the active class/layer can be edited.
Show/Snap/ Modify Others	All classes/layers display normally, except for those set to invisible or grayed. Objects in any normally displayed or gray class/layer can be snapped to; only objects in normally displayed classes/layers can be edited. Locked objects display with selection handles that appear dimmed.

2. The current class or design layer display changes accordingly.

## Managing Viewports

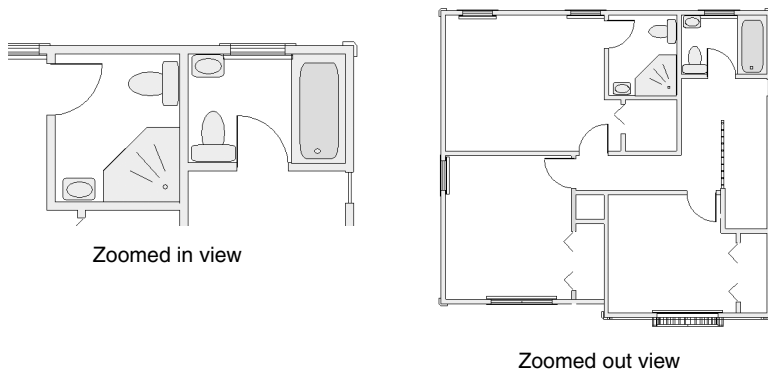
A sheet layer viewport or design layer viewport (Design Series required) shows a specific portion of one or more design layers. The original location of the viewport layers can be either within this file or another file. The view parameters in the viewport can be different from those of the original layers. For example, the scale, layer and class visibility, or render mode might be changed to create a certain effect. A sheet layer viewport does not always automatically change when the underlying drawing does. To see the drawing changes that were made after a sheet layer viewport was created, update the viewport. One or more viewports can be placed on a sheet layer or design layer, to show various parts of the drawing project in different ways.

Once created, viewports display in the Organization dialog box, where they can be edited, duplicated, or deleted. For detailed information about how to create, edit, annotate, and update viewports, see “Presenting Drawings with Sheet

Layer Viewports” on page 609 in this guide, and “Presenting Drawings with Design Layer Viewports” on page 616 in the VectorWorks Design Series User’s Guide.

## Managing Saved Views

Think of a saved view as a camera that is set up to show a drawing from a certain orientation, with a specific set of viewing parameters, including which class and design layer are active, the visibilities of the classes and the design layers, the current zoom and pan, the page location, and the plan rotation (Design Series required).



Views are also used to create Move Along Path animations (see “Creating Move Along Path Animations” on page 603 for more information).

Saved views can be created, edited, duplicated, and deleted from the Organization dialog box as described in the following sections.

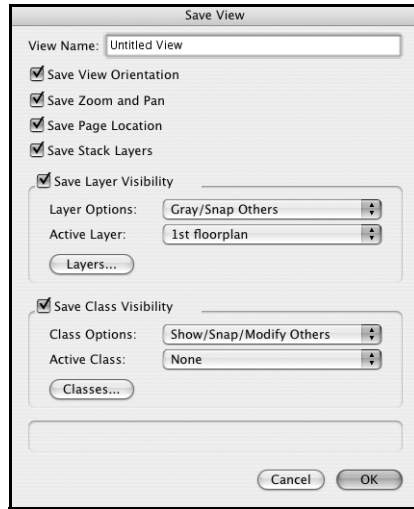
## Creating Saved Views

To save the current drawing area view:

1. Select **View > Save View**.

The Save View dialog box opens.

2. Specify the view options, the active layer and class, and the visibilities of layers and classes.



Parameter	Description
View Name	Specify the view name
Save View Orientation	Saves the general view parameters of the active layer, including plan rotation (Design Series required), projection, 3D orientation, and page origin settings
Save Zoom and Pan	Saves the zoom and pan settings of the active layer
Save Page Location	Saves the design layer page location with the view; if deselected, the current page location setting is used when the view is displayed. The page location of sheet layers cannot be saved.
Save Stack Layers (VectorWorks Architect required)	Saves the stacked layers status with the view; if deselected, the current stack layers setting is used when the view is displayed.
Save Layer Visibility	Specifies the layer visibility options to save; if deselected, the current layer visibility settings are used when the view is displayed
Layer Options	Select the design layer display options (see “Setting Class and Design Layer Options” on page 103)
Active Layer	Select the active layer; if a sheet layer is selected, the <b>Layers</b> button is disabled
Layers	Opens the Layer Visibilities dialog box; specify the design layer visibilities for the saved view (see “Setting Visibilities” on page 108)
Save Class Visibility	Specifies the class visibility options to save; if deselected, the current class visibility settings are used when the view is displayed
Class Options	Select the class display options (see “Setting Class and Design Layer Options” on page 103)
Active Class	Select the active class from the list of classes
Classes	Opens the Class Visibilities dialog box; specify the class visibilities for the saved view (see “Setting Visibilities” on page 108)

- Click **OK** to save the view with the specified settings. The saved view is then available from the Saved Views menu and from the Organization dialog box.

## Editing Saved Views

Set the active class and layer, the class and design layer options, and the class and design layer visibilities when you create the saved view (in the Save View dialog box). Those initial settings can be changed later from the Organization dialog box.

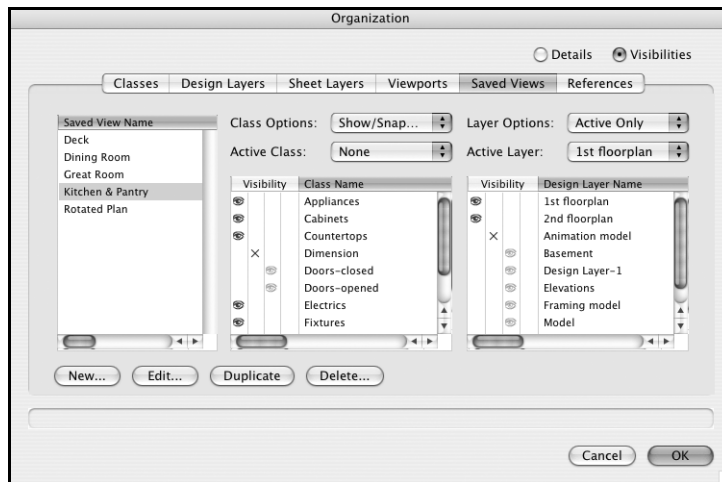
To edit a saved view:

- Select **Tools > Organization**.

The Organization dialog box opens.

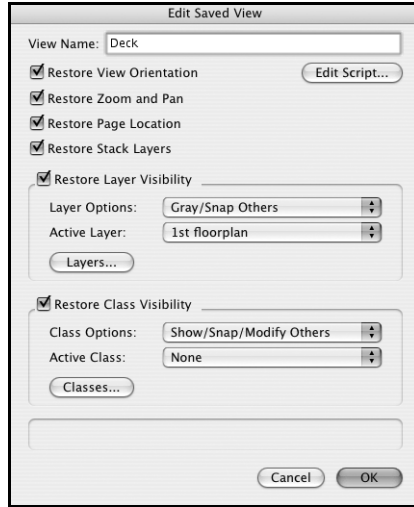
- Select the Saved Views tab in **Visibilities** view.

The visibilities of classes and design layers for the selected saved view display.



- Select a view to edit from the **Saved View Name** list.
- If **Save Class Visibility** was selected in the Save View dialog box, **Class Options** and **Active Class** are enabled in the Organization dialog box. If **Save Layer Visibility** was selected in the Save View dialog box, **Layer Options** and **Active Layer** are enabled in the Organization dialog box. Change the **Active Layer** and the **Active Class** as necessary. Change the **Class Options** and **Layer Options** as described in “Setting Class and Design Layer Options” on page 103.
- Change the visibilities of classes and design layers as necessary. See “Setting Visibilities” on page 108.
- To change other saved view properties, click **Edit**.  
The Edit Saved View dialog box opens.





The settings are the same as when the view is created (see “Creating Saved Views” on page 104). Classes and layers that were added after a view was created are listed as visible in the visibility settings.

If the layer or class visibility was saved when the view was created, **Restore Layer Visibility** and **Restore Class Visibility** are enabled. Click **Restore Layer Visibility** to restore the layer visibilities, the layer options, and the active layer that were set when the view was saved. Click **Restore Class Visibility** to restore the class visibilities, the class options, and the active class that were set when the view was saved.

Saved views are saved as VectorScript macros. If necessary, click **Edit Script** to edit the script.

7. Click **OK** to save the changes. Click **OK** again to close the Organization dialog box.

Another way to edit a saved view is through the Saved Views palette. Select **Window > Script Palettes > Saved Views**. Press the Option (Macintosh) or Alt (Windows) key and double-click the view name to edit. Double-click the view script name to switch the current drawing area to the saved view.

## Creating or Editing Saved Views Using the Saved Views Menu

The View bar has shortcuts to save a view, to edit a saved view, or to switch the current drawing area view to a previously saved view.

Views can also be accessed through the Saved Views palette. Select **Window > Script Palettes > Saved Views**. Double-click the view name to switch to that view.

To use the Saved Views menu:

1. Click the **Saved Views** menu on the View bar.



2. Select the desired item from the menu.

Menu Item	Description
Save View	Opens the Save View dialog box (see “Creating Saved Views” on page 104)
Edit View	Opens the Saved Views tab of the Organization dialog box (see “Editing Saved Views” on page 106)
List of saved views	Select a saved view from the list to switch to that view

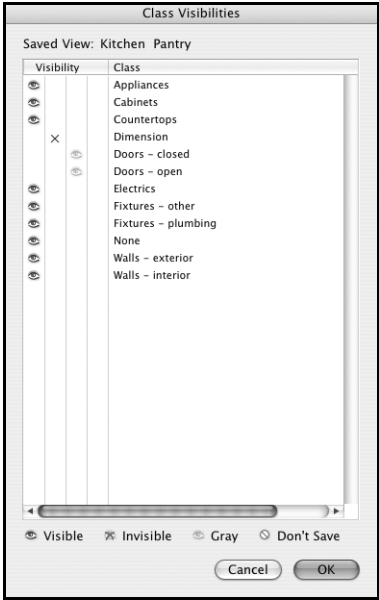
## Setting Visibilities

The active class and design layer are always visible; each inactive class and design layer can be set to be visible, invisible, or gray. The visibilities of inactive classes and design layers are controlled in a very similar way, and they both can be set independently for the drawing area, saved views, and viewports.

Class and design layer visibility in the drawing area and in saved views are also affected by the **Class Options** and **Layer Options** settings. See “Setting Class and Design Layer Options” on page 103 for details.




For maximum usability, visibilities can be set from multiple places, but the method of setting visibilities is the same.

The level of gray for grayed layers and classes can be adjusted for printing; see “Printing a File” on page 76.



To change the setting for a single class or design layer, click in one of its visibility columns. To change the settings for multiple items, click a visibility column as follows:

- Press the Ctrl key (Windows) or Cmd key (Macintosh) and click selected class or layer rows
- Press the Shift key and click the first and last rows of a group of classes or layers
- Press the Alt key (Windows) or Option key (Macintosh) and click any row to change all classes or layers

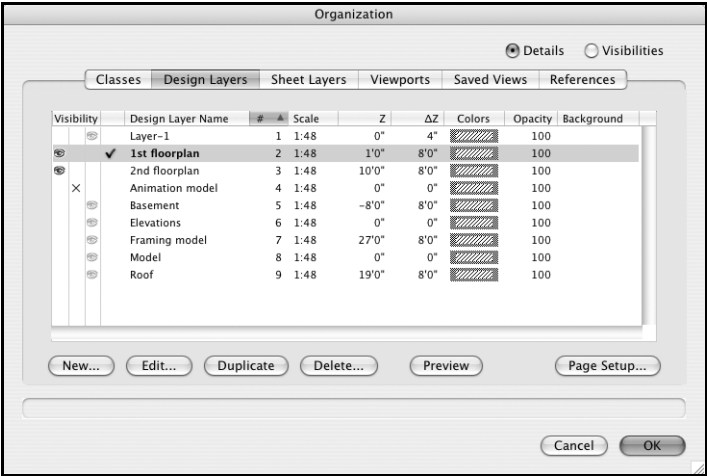
Parameter	Description
Visible column 	Class/design layer is visible; objects in this class/layer display when another class/layer is active
Invisible column 	Class/design layer is invisible; objects in this class/layer display only when the class/layer is active
Gray column 	Class/design layer is gray; objects in this class/layer are dimmed when another class/layer is active
Don't Save column	For saved views, a fourth column displays to the right of the other columns. When selected, class/design layer visibility is not saved for the saved view; the current class/layer visibility is used when the view is displayed.

## Setting Class and Design Layer Visibility for the Drawing Area

Use the Organization dialog box to set the visibilities of classes and design layers in the drawing area.

To set the visibility in the drawing area:

- From the Organization dialog box, select the Classes or Design Layers tab in **Details** view.
- Change the **Visibility** settings as desired. (See “Setting Visibilities” on page 108.)



- To see the changes before saving them, click **Preview**.
- Click **OK** to save the changes.

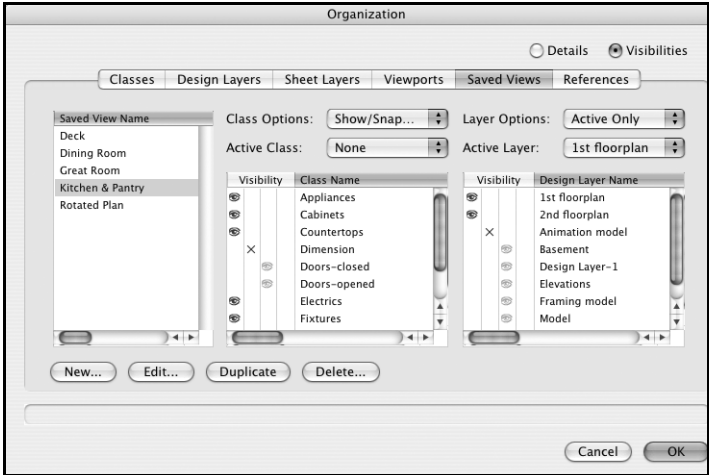
## Setting Class and Design Layer Visibility for Viewports and Saved Views

The visibilities of classes and design layers can be set during creation or editing of classes, design layers, viewports, or saved views. Those settings can also be changed in the Organization dialog box.

Create or Edit	Sets
Classes	Class visibility; see “Creating Classes” on page 96 and “Setting Class Properties” on page 98
Design Layers	Design layer visibility; see “Creating Layers” on page 85 and “Setting Design Layer Properties” on page 87
Viewports	Design layer or class visibility; see “Creating a Sheet Layer Viewport from a Design Layer” on page 610
Saved Views	Design layer or class visibility; see “Creating Saved Views” on page 104 and “Editing Saved Views” on page 106

To set the class and design layer visibility for viewports and saved views:

1. From the Organization dialog box, select a tab in **Visibilities** view.



Organization Dialog Box Tab	Sets Visibility of
Classes	Sets visibility of a class in viewports and saved views
Design Layer	Sets visibility of a design layer in viewports and saved views
Viewports	Sets visibility of classes and design layers in a viewport
Saved Views	Sets visibility of classes and design layers in a saved view

2. On the appropriate tab, select one or more class, design layer, viewport, or saved view names and change the **Visibility** settings for classes and design layers as described in “Setting Visibilities” on page 108.
3. On the Saved Views tab, change the active design layer and class, and the design layer and class options as described in “Editing Saved Views” on page 106.
4. To see the changes before saving them, click **Preview** (not available on the Saved Views tab).
5. Click **OK** to save the changes.

## Workgroup Referencing

### VectorWorks' Referencing Capability

A “workgroup” is several people who work together on a project. Group members may work on the same file or on different files for the same project. Additionally, it is often necessary to create standard elements and reuse them in different files. It can be difficult to share these standards with other members of a workgroup and to keep up with changes to them.

Referencing is the ability to link the current (target) file to a master file that contains the standards. Layers, classes, and resources (such as hatches, worksheets, or symbols) in other VectorWorks files can be referenced. In the VectorWorks Design Series, image files and PDF files can also be referenced. When a referenced item in a master file changes, the changes are reflected in the target file. Updates to target files can be performed automatically or only when manually requested.

VectorWorks can reference specific layers with all of the classes and resources used in those layers, as well as any resources from a master file. Workgroup-referenced design layers can be displayed in viewports.

Referenced items are indicated in the Resource Browser and in the Organization dialog box by italicized names. Referenced items in the target file are locked; they can be unlocked and edited, but the changes will be temporary. Each time a target file's references are updated, referenced items are over-written to reflect the master file. Therefore, any permanent change to a referenced item must be made in the master file.

There are two ways to reference design layers with VectorWorks:

- In VectorWorks Fundamentals, design layers are imported into the target file when they are referenced. For backward compatibility, VectorWorks Design Series supports this method; see “Setting the Referencing Options” on page 112.
- In VectorWorks Design Series, the recommended method is to create a design layer viewport and then reference the desired design layers from the master file. See “Creating a Referenced Design Layer Viewport” on page 618 in the VectorWorks Design Series User's Guide for details about this type of reference.

Keep the following concepts in mind for both referencing methods.

- Drawing information is shared and updated on a layer-by-layer basis.
- For layer import referencing, referenced layers should be treated as read-only layers.

This might not be obvious, since it appears that referenced layers can be edited. Moreover, it is possible to add information to referenced layers in the target document. However, any changes to referenced information and any information added to referenced layers are removed the next time the referenced layer is updated.

- Referenced layer names cannot be changed.
- Resources (symbol names) in layers that are referenced from the master file take precedence over resources in the target file.
- If there is a naming conflict with pre-existing symbols or pre-existing layers in the current file, rename the symbols or layers.
- Sheet layer viewports cannot directly reference layers in external master files. If you are using layer import referencing, create a reference to the master file, and select the external layers to import into the target file; then make the imported layers visible in a sheet layer viewport. If you are using design layer viewport referencing (Design Series required), create a design layer viewport from the master file and make the desired layers visible; then make the design layer that contains the viewport visible in a sheet layer viewport.

## Workgroup Referencing Strategies

Communication within the workgroup is essential when workgroup referencing is in use. Discuss a strategy for how to name, maintain, and update master files. Keep each other informed of major changes—especially the deletion of a master file or resources, which can affect multiple files.

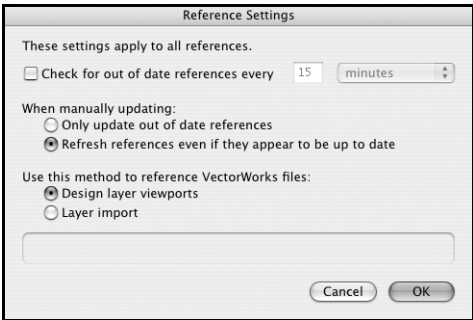
If either the file name or the location of a referenced file is changed, the reference is broken. Items referenced from that file cannot be updated until the broken reference is corrected.

## Setting the Referencing Options

The reference settings control how manual and automatic updates to references are performed in the current file. In addition, VectorWorks Design Series users have the option to change the layer referencing method for this file from design layer viewport referencing (the default for the Design Series) to layer import referencing.

To set the referencing options:

- 1. Select **Tools > Organization**.  
The Organization dialog box opens.
- 2. Select the References tab and click **Settings**.  
The Reference Settings dialog box opens.



Parameter	Description
Check for out of date references every ____	Automatically checks referenced files for changes after this time interval; if any references are out of date, an alert dialog box displays to allow the target file to be updated
When manually updating	Specifies what happens when the <b>Update</b> button on the References tab of the Organization dialog box is clicked: the button either updates only the selected references that are out-of-date, or it updates all of the selected references in the target file
Use this method to reference VectorWorks files (Design Series required)	Specifies which method to use to reference design layers in other VectorWorks documents. By default, Design Series uses design layer viewports, as described in “Creating a Referenced Design Layer Viewport” on page 618 in the VectorWorks Design Series User’s Guide. Select Layer import to use the referencing method described in “Adding and Editing Layer Import References” on page 113 in this guide.

- 3. Click **OK** to return to the Organization dialog box.

**Adding and Editing Layer Import References**

In the VectorWorks Design Series, you must first select the **Layer import** referencing option for the current file, as described in “Setting the Referencing Options” on page 112. (See “Creating a Referenced Design Layer Viewport” on page 618 in the VectorWorks Design Series User’s Guide for information about the design layer viewport referencing option.)

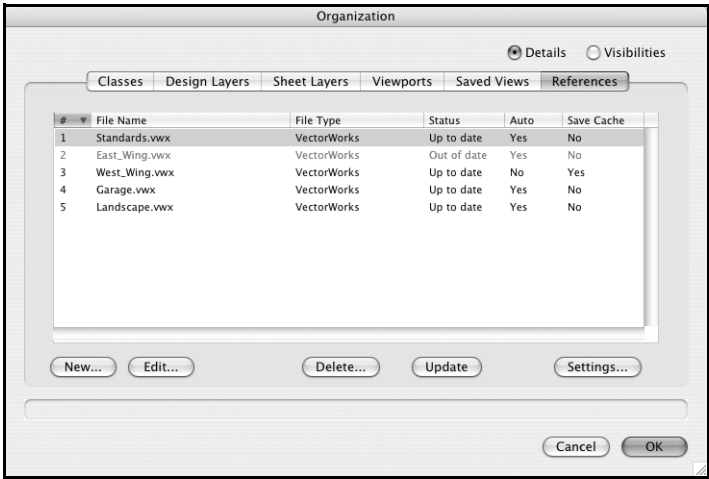
To add or edit references to design layers in other VectorWorks files:

- 1. In the active target file, select **Tools > Organization**.

The Organization dialog box opens.

- 2. Select the References tab.

Referenced files are listed in priority order, along with their current status, whether they are set to update automatically when the target file is opened, and whether they are set to save copies of the referenced items with the file.



Parameter	Description
New	Opens the Open File dialog box to select a new reference file
Edit	Opens the Edit Reference dialog box to change the parameters of a selected reference file
Delete	Opens the Delete Reference dialog box to delete a file from the list of referenced files, and to choose whether to keep the referenced layers and resources in the target file; see “Deleting References” on page 117
Update	Manually updates the referenced items from the selected file(s)
Settings	Opens the Reference Settings dialog box to set options for updates of referenced items; see “Setting the Referencing Options” on page 112

- 3. To edit a current reference file, select the file and click **Edit**.

The Edit Reference dialog box opens. Proceed to step 5.

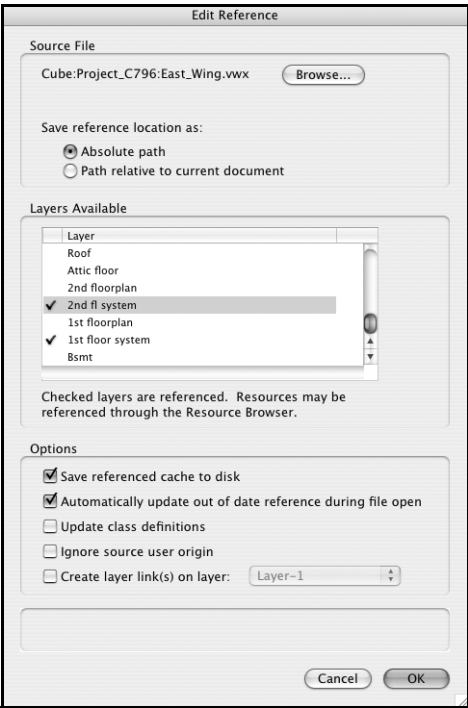
4. To add a new reference file, click **New**.

The Open File dialog box opens. Select the desired file, and then click **Open** to open the appropriate dialog box:

- **VectorWorks file:** New Reference dialog box
- **Image file:** Image Import Options dialog box (Design Series required)
- **PDF file:** Import PDF dialog box (Design Series required)

Referenced VectorWorks files must be the same version as the target file.

5. From the New Reference or Edit Reference dialog box, specify the parameters for the workgroup reference.



Parameter	Description
Source File	Displays the path and file name of the referenced master file; if the <b>Edit</b> option was selected, click <b>Browse</b> to edit the file location
Save reference location as	<p>Maintains either an absolute or relative file path reference from the current file to the referenced file. Use the absolute path when the location of the referenced file with respect to the current file is not going to change. Use the relative path when the files might be moved to another computer or platform; as long as the relative path between the files remains the same, the reference can be found. Both files must be saved on the save volume to select this option.</p> <p>The <b>Source File</b> path displays either an absolute or relative path, depending on the selection.</p>



Parameter	Description
Layers Available	Specify the design layers to be referenced; selected layers are indicated with a check mark. Sheet layers cannot be referenced. This step is optional; a layer does not have to be selected to reference its resources. Resources in the entire referenced file are available through the <b>Reference</b> command in the Resource Browser.
Options	Select the update options
Save referenced cache to disk	Saves a copy of the referenced data with the target file. When this option is deselected, a copy of the referenced data is not saved, which means that the target file size is smaller; the referenced data is refreshed when the target file is opened.
Automatically update out of date reference during file open	Updates the reference each time the target file is opened; when deselected, the reference is updated only when <b>Update</b> is clicked from the References tab of the Organization dialog box
Update class definitions	Updates class definitions along with the referenced objects that use those classes
Ignore source user origin	Ignores the user origin in the master file; referenced objects will not change location in the target file if the user origin changes in the master file
Create layer link(s) on layer	Creates a layer link for each newly referenced layer on the specified design layer; select the design layer from the list or select New Layer to specify a new design layer, set to the same scale as the first selected layer to reference

Workgroup referenced layers can be used in a sheet layer viewport. Because sheet layer viewports cannot directly reference design layers in other files, reference the layers and then create a sheet layer viewport that shows the referenced layers.

- Click **OK** to return to the Organization dialog box.

The selected layers are added to the target file, along with any new layers and layer links.

## Prioritizing Referenced Files

VectorWorks searches the referenced files in the order in which they are listed on the References tab, and uses the first instance of each referenced resource that is found. If there are multiple referenced files, organize them to ensure that references are updated appropriately.

To set the priority of referenced files:

- Select **Tools > Organization** to open the Organization dialog box.
- From the References tab, click the number in its # column to select the master reference file(s) to be moved; drag the item up or down the list to the new priority position. The first file listed on the References tab has the highest priority.

## Updating References

Referenced design layers and resources are either updated automatically when the target file is opened, or they are updated manually upon command. These preferences are set in either the New Reference or the Edit Reference dialog box. If the file is set to update automatically, manual updates can still be performed at any time.

Before an update, correct any broken references as described in “Correcting Broken References” on page 116.

To update references manually:

1. Select **Tools > Organization** to open the Organization dialog box.
2. From the References tab, select the master file(s) that contain the referenced items to be updated.

To update all references in the target file, select all of the files.

3. Click **Update** to update the target file from the selected files.

All referenced items are updated from the selected update files, according to the priority order on the References tab (see “Prioritizing Referenced Files” on page 115).

## Correcting Broken References

If a reference has a status of Broken in the References tab, VectorWorks cannot locate the master file. Items referenced from that file cannot be updated until the broken reference is corrected.

To correct broken references:

1. Select **Tools > Organization** to open the Organization dialog box.
2. From the References tab, select one or more master files that have broken references, and click **Update**.
3. An alert prompts you to locate the master file. If you selected multiple references, select **Look for subsequent broken references in all of the folders manually located** to have VectorWorks search the same location for all of them.

If a file is set to update automatically when it is opened, and one of its references is broken, this alert displays when you open the file.

4. Click **Yes** to open the Open Current-Version Drawing dialog box.
5. Locate the master file and click **Open**.

On the References tab, the status of the broken reference changes from Broken to Up to date or Out of date. If you selected the option to look for subsequent references in the same location, those references are corrected also.

6. Click **OK** to save the new name and/or location for the references.

## Referencing Resources

The resources of files listed in the References tab of the Organization dialog box, as well as the resources in any VectorWorks file of the same version number, can be referenced through the Resource Browser.

If a file's resources are referenced through the Resource Browser, the file name is automatically added to the list of referenced files in the Organization dialog box.

To reference the resources of a master file:

1. To display the resources of the master file in the Resource Browser, either make the master file a favorite or browse the master file (see “Accessing Existing Resources” on page 147).
2. Right-click (Windows) or Ctrl-click (Macintosh) on the desired resource to display the context menu. Select **Reference**.
3. The resource is added to the target file as a referenced resource. Referenced resources display with italicized names in the Resource Browser.
4. The following rules apply to referenced resources.

Situation	Description
Resource rename or edit	A referenced resource cannot be edited or renamed
Resource name conflict	If there is a name conflict between a referenced object and another object during an update, an alert allows the other object to be renamed. (If the other object is also a referenced object, it cannot be renamed and the update fails.)
Change user origin of master file	If the user origin of a master file is changed, the location of the referenced resources do not change, if <b>Ignore source user origin</b> is selected in the Edit Reference dialog box
Change master file classes	Changes to the class of a referenced resource are only reflected in the target file after an update if <b>Update class definitions</b> is selected in the Edit Reference dialog box
Resource deleted in master file	If a referenced resource is deleted in a master file and the resource does not exist in any other master file included in an update, when the reference to the master file is updated, an alert displays. Click <b>OK</b> to confirm that the resource is an “orphan,” or click <b>OK to All</b> to hide all alerts about orphaned resources during the current update. Orphaned resources are no longer referenced.

- To break a reference, right-click (Windows) or Ctrl-click (Macintosh) on the desired resource to display the context menu. Select **Break Reference**. The resource remains in the target file, but it is no longer referenced to the master file.

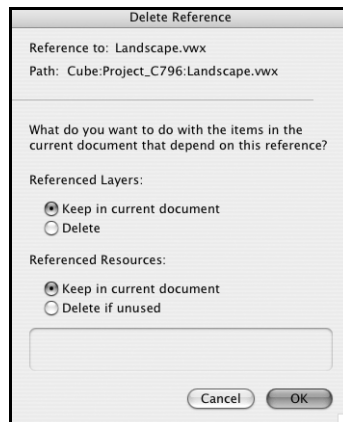
## Deleting References

You can stop referencing a file, and choose whether to keep the referenced layers and resources in the target file.

To delete a reference to a file:

- Select **Tools > Organization** to open the Organization dialog box.
- Select the file to stop referencing, and then click **Delete**.

The Delete Reference dialog box opens.



Parameter	Description
Reference to	Displays the master file name and path
Referenced Layers	Select an option for layers that are currently referenced in the target file from the master file
Keep in current document	Keeps the layers in the target file, but removes the reference
Delete	Removes referenced layers from the target file, including layer links and any objects on the layer
Referenced Resources	Select an option for resources that are currently referenced in the target file from the master file
Keep in current document	Keeps the resources in the target file, but removes the reference
Delete if unused	Deletes unused referenced resources; keeps resources that have been placed in the file, but removes the reference

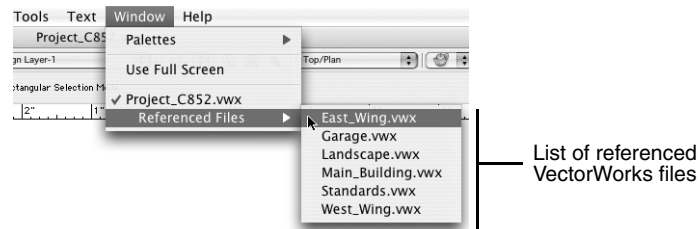
3. Click **OK**.

## Opening Referenced Files

VectorWorks provides easy access to the master files that a target file references.

To open a referenced file:

1. Access the **Window** menu. The bottom portion of the menu provides a submenu for each VectorWorks file that is currently open.
2. From the submenu for the target file, select **Referenced Files** to display the VectorWorks files that the target file references. Though PDF and image files can be referenced (in Design Series), they do not appear on the menu.
3. Select a referenced file to open it.



# SmartCursor and Constraints

Used in conjunction with drawing tools, the SmartCursor automatically finds important points on an object, and then precisely snaps the cursor to those points. While doing so, it provides feedback cues based on the selected constraints using cursor shapes, extension lines, text messages (tool tips), and sounds. These cues show the points the cursor is snapping to, explaining why those locations are important.

Parametric constraints maintain relationships between an object and world space, between two objects, or within an object itself. In this way, one can define how drawing elements interact with each other.

## The Constraints Palette

The Constraints palette specifies the types of cues to display; the on-screen feedback which displays is based on the constraint(s) selected. Constraints can be used individually or combined to create complex constraints. For example, the Snap to Object constraint can be combined with the Snap to Grid constraint in order to find points which are both on the edge of the object and on a grid line. Similarly, constraints can be combined with Data bar input to find a specific snap point along a defined location in the drawing area. The Constraints palette changes to reflect the tool selected. For more information on the SmartCursor and Constraints, see “Setting VectorWorks Preferences” on page 39.

Constraints can be used with both 2D and 3D tools; however, Smart Edge and Constrain Tangent are only available to 2D tools, and Constrain Working Plane and Constrain Perpendicular are only available to 3D tools.

To set constraints:

1. Click a constraint button to activate the constraint.
2. Double-click (where available) to open a dialog box with specific parameters for that constraint.
3. Enter the desired criteria, and then click **OK** to set.

## Data Bar and the SmartCursor

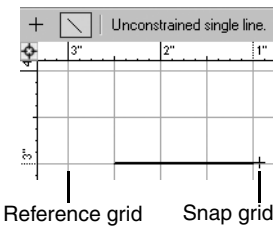
The SmartCursor can be controlled using the Data bar to lock a precise value. Once a value is locked, moving the mouse does not change that value. Enter values in the Data bar as described in “Drawing with the 2D Data Bar” on page 184. The SmartCursor locks the value and no longer accepts other conflicting values. For example, enter 10 for an X value. The SmartCursor still finds Y values, but X is always 10. Most values displayed in the Data bar can be locked. Editable values have an edit box around them.

An extension line displays when I, J, K, X, Y, or delta I, delta J, delta K, delta X, delta Y values are locked. Once a value is locked, the SmartCursor no longer finds points off the line which represent that value. However, it does find points on the locked line.

[Set the Smart Point constraint before locking any values with the Data bar. Then, lock angles before locking length \(if both are to be locked\).](#)

## Snap to Grid

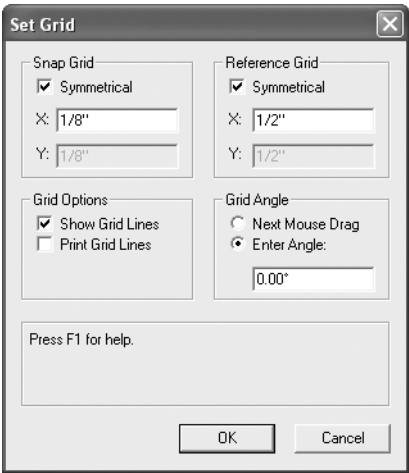
With **Snap to Grid**, the SmartCursor snaps to set points on the snap grid. For example, if the grid is set to 1”, as the mouse moves over the grid, it automatically “catches” every inch. When creating a line, the line’s first and last point should (if no other constraints are active) lie on the grid. Snap to Grid is the only constraint that does not provide any sort of visual cues. If Snap to Grid is on, the mouse is always on the grid, unless other constraints are also selected which override Snap to Grid.



To activate grid snapping:

1. Double-click the Snap to Grid constraint.

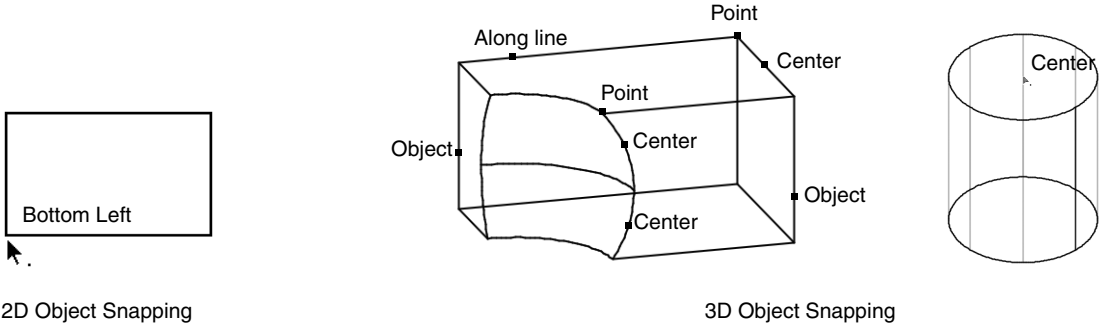
The Set Grid dialog box opens.



2. Set the snap grid parameters. See “Snap and Reference Grids” on page 55 for more information.

## Snap to Object

With **Snap to Object**, the SmartCursor finds specific parts of an object, such as corners, endpoints, or centers of linear and circular objects. Cues display near the snap point to identify the location.





To activate object snapping:

1. Double-click the Snap to Object constraint.

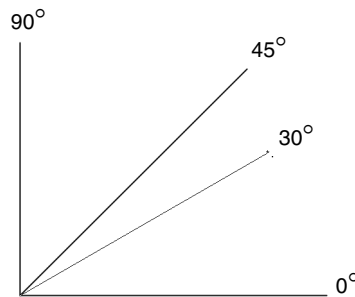
The 3D Snapping dialog box opens.



2. Select **Snap to edge points**, and then click **OK**.

## Constrain Angle

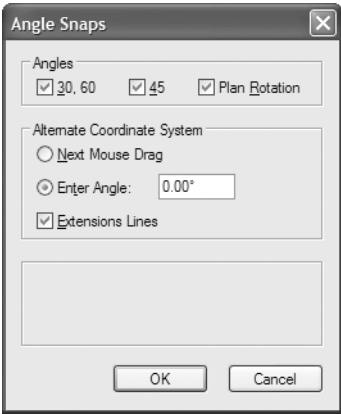
**Constrain Angle** only applies to the second point of a two point segment, such as a single line or side of a polygon. Two points define an angle. Constrain Angle means that the SmartCursor finds only the angles specified. By default, the SmartCursor finds horizontal and vertical angles, as well as common angles, such as  $30^\circ$ ,  $45^\circ$ , and  $60^\circ$ . Constrain Angle can also detect a plan rotation angle (Design Series required); items created along that angle when in a rotated plan view, appear horizontal when in a non-rotated, world coordinate view.



To select or define the snapping angle:

1. Double-click the Constrain Angle constraint.

The Angle Snaps dialog box opens.



Parameter	Description
30, 60	Finds angles at 30° or 60°; the SmartCursor finds angles with respect to any horizontal or vertical axis, which includes 30°, 60°, 120° (90+30), 150°(90+60), 210° (180+30), and so on
45	Finds angles at 45°; the SmartCursor finds angles with respect to any horizontal or vertical axis, which includes 45°, 135° (90+45), 225°(180+45), and so on
Plan Rotation (Design Series required)	Finds the angle of plan rotation; this snap is useful when drawing in a rotated top/plan view, and requiring objects to be horizontal when the plan is no longer rotated
Next Mouse Drag	Defines an alternate snap angle about the X axis based on the next mouse drag
Enter Angle	Sets an angle other than 30°, 45°, or 60°. Enter an alternate angle 'x'. The SmartCursor finds angles with respect to any horizontal or vertical axis, which includes x, 90+x, 180+x, and so on.
Extension Lines	Draws extension lines between the end of an angled line and a snap point

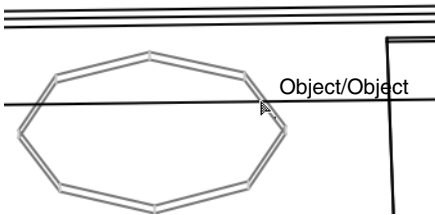
Holding the Shift key while drawing forces the SmartCursor to select the nearest drawn angle.

2. Click **OK** to set the Constrain Angle options.

Snap to Intersection



With the **Snap to Intersection** option, the SmartCursor finds the intersection between two objects, such as a line and a circle, or between parts of an object.



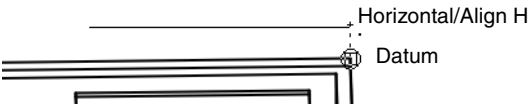


## Smart Points

With the **Smart Points** constraint option, the SmartCursor remembers points on objects previously snapped to. A small box is drawn around the smart point to show where it is. The SmartCursor remembers up to eight object points, and then the oldest points are replaced. To set a smart point, move the cursor over an object point while performing any operation. When an Object cue is shown, the SmartCursor has memorized the point.

Once a smart point has been defined, new points aligned to them horizontally, vertically, or perpendicular to angled lines can be located using extension lines.

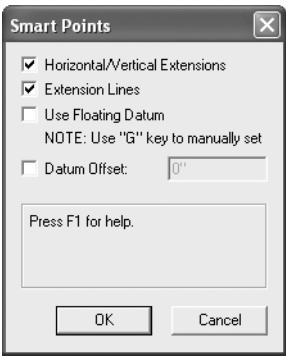
A special smart point, called a Datum, can be set to temporarily replace the origin of the drawing for measuring purposes. When a datum is set, all measurements along the X and Y axis are taken from that point, rather than the drawing's origin, until the datum is moved or deactivated. The Datum is shown as a small circle around the chosen point.



To set Smart Point options:

1. Double-click the Smart Points constraint.

The Smart Points dialog box opens.

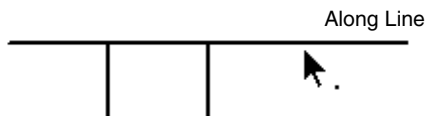


Parameter	Description
Horizontal/Vertical Extensions	Select to create an extension line when the SmartCursor finds a point near the cursor which aligns horizontally or vertically with a smart point
Extensions Lines	Select to create an extension line when the SmartCursor is aligned to a particular angle from a nearby smart point
Use Floating Datum	Select to use a floating datum to define the origin of the drawing; a datum can be set holding the cursor over the desired point for a few seconds, or by pressing the G key when over the desired point
Datum Offset	Select to set an offset from the datum that is defined by an extension circle; enter the offset value in the edit box

- Click **OK** to set the Smart Point options.

## Snap to Distance

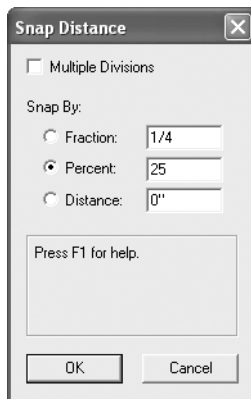
With the **Snap to Distance** constraint on, the SmartCursor finds points at a selected distance along a straight or curved line, polygon edges, wall edges, and other linear objects.



To set the snap distance:

- Double-click the Snap to Distance constraint.

The Snap Distance dialog box opens.



- Set the distance using a fraction, percentage, or a dimensional distance. In addition, select **Multiple Divisions** to repeat snap points along a line. For example, the SmartCursor can snap every quarter inch, or every 1/8 of the length of the line.

The SmartCursor measures from each endpoint to the center of the line. If a line is 10 units long and the distance is set to 6 units, the distance will not be found at all, since it is longer than half a line. Similarly, any fraction greater than 1/2 the length of the object or less than 0 cannot be used.

- Click **OK** to set the Snap to Distance options.

## Smart Edge (2D Only)

With the **Smart Edge** constraint on, the SmartCursor finds points on, or at a certain distance away from, a specified edge.

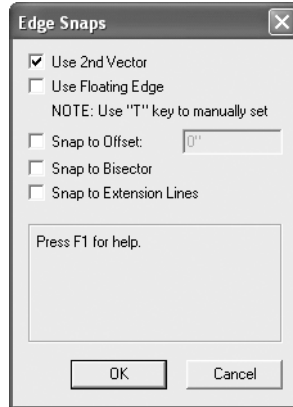




To set Smart Edge options:

1. Double-click the Smart Edge constraint.

The Edge Snaps dialog box opens.



Parameter	Description
Use 2nd Vector	Select to use two Smart Edges simultaneously; the SmartCursor drops the old edge from memory when a new edge is set
Use Floating Edge	To set an edge manually, move the mouse over the edge and press the T key; alternatively, move the cursor to the edge and move slowly along its side. When the edge is set, a Smart Edge extension line cue displays. The SmartCursor will intersect the extension line with the other objects and snaps to find a number of points.
Snap to Offset	Select to have the SmartCursor automatically find points at a distance from the Smart Edge, on either side of the edge
Snap to Bisector	Select to find points on the bisector between two Smart Edges, if they are active
Snap to Extension Lines	Select to generate extension lines from smart points perpendicular and parallel to the Smart Edge

2. Click **OK** to set the Smart Edge options.

## Constrain Tangent (2D Only)

The **Constrain Tangent** option uses the SmartCursor to locate tangents on circles, ovals, and arcs.

Object Drawn	Tangent Found On
Line	A tangent can be found on circles, ovals, and arcs, and also between two circles, arcs, or ovals
Circle	A tangent can be found on another circle, oval, or arc, and also between two circles or arcs
Oval	A tangent cannot be located on an oval created using the <b>Oval</b> tool in Oval by Box mode
Arc	A tangent can be found on a circle, oval, or another arc, and also between two circles or arcs

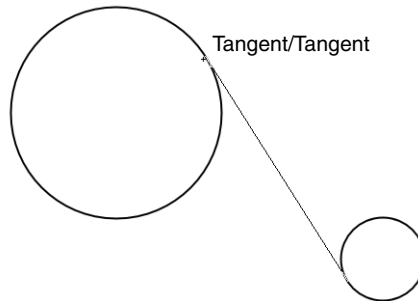
Tangents cannot be found on quarter arcs.



To find the tangent:

1. Select the **Line**, **Oval**, or **Arc** tool from the Basic palette.
2. Click **Constrain Tangent** from the Constraints palette.
3. Move the cursor to the object. Click to begin drawing. As the cursor is moved, the image preview rotates tangentially around the object.
4. Click to set the tangent.

When finding the tangent between two circles, arcs, or circular arcs: after clicking on the first object, move the cursor to the second object. Move the cursor along the second object until the cue “tangent/tangent” displays. Click to set the second tangent.



Hold down the Option (Macintosh) or Alt (Windows) key to switch the tangent to the opposite side of the object.

## Constrain Working Plane (3D Only)



With the **Constrain Working Plane** option on, the SmartCursor snaps/projects any point not on the working plane down to its shadow point on the working plane. With this option off, the SmartCursor finds object points and snaps to them even if they do not lie on the working plane.

## Constrain Perpendicular (3D Only)



The SmartCursor automatically draws objects so that they are perpendicular to the working plane. The **Constrain Perpendicular** constraint is only active when the working plane is at an angle to the ground plane.

## SmartCursor Cues

The following table lists the individual cues that the SmartCursor uses along with a description of each. In many cases, two cues are used together to indicate that two constraints have been activated. For example, the cue ‘Align H/Angle’ means that the point located is both aligned horizontally to the indicated snap point and also constrained to an angle.

Some cues display when a first point has already been found, and a second point is being sought. These two points form a line called the feedback segment. This segment forms an angle and length which the SmartCursor uses for some of its snaps.

For a line, the feedback segment is the same as the line being drawn. However, for other objects, the interactive image does not lie on the feedback segment. The SmartCursor always works on the feedback segment created from the first to the second points.

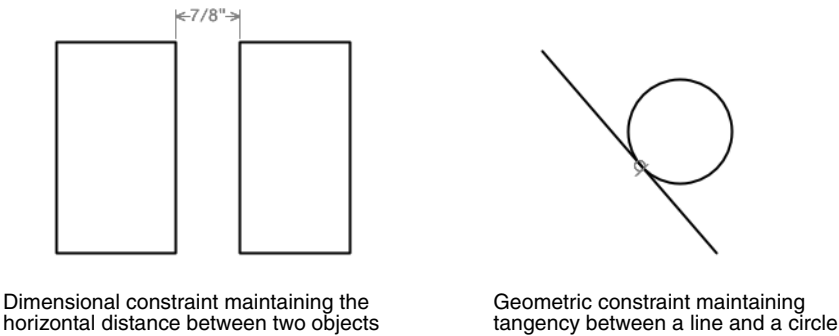
Cue	Description
Snap to Angle	
Horizontal	Feedback segment is horizontal
Vertical	Feedback segment is vertical
I	Feedback segment is parallel to rotated grid
J	Feedback segment is perpendicular to rotated grid
Alt	Feedback segment is parallel to alternative coordinate system angle
Alt 90°	Feedback segment is perpendicular to alternative coordinate system angle
delta 45°	Feedback segment is 45° from rotated grid
delta 30°	Feedback segment is 30° from rotated grid
Perpendicular	Feedback segment is perpendicular to an object
Parallel	Feedback segment is parallel to an object
Plan Rotation (Design Series required)	Feedback segment is aligned to the rotated plan angle
Symmetric	Feedback segment is sketching out a square or circle
Smart Point	
-----	Extension line used for all smart point cues except Datum
Align K	Point is aligned with a smart point parallel to the K axis
Align V	Point is aligned vertically with a smart point
Align I	Point is aligned to I axis of rotated grid
Align J	Point is aligned to J axis of rotated grid
Align K	Point is aligned to K axis of rotated grid
Align Edge	Point is aligned to Smart Edge
Align Edge 90°	Point is aligned perpendicular to Smart Edge
Align Alt	Point is aligned to user coordinate system
Align Alt 90°	Point is aligned perpendicular to user coordinate system
Datum	Point is the Datum
O	Circle around Datum

Cue	Description
Snap to Distance	
Along Line	2D—Point is specified distance along line 3D—Point is specified distance along line from the end point of a NURBS curve, 3D polygon, or edge of a solid object
Data bar	
-----	Extension line is used to indicate X or Y value is locked
Angle	Feedback segment is constrained to an angle
Length	Feedback segment is of a fixed length set in Data bar
Snap to Object	
Arc	Point is corner point of a polyline arc segment
Bézier	Point is corner point of a polyline Bézier segment
Corner	Point is corner point of a polyline segment
Fit	Point is corner point of a polyline cubic segment
Arc End	Point is end of an arc segment
Bottom Center	Point is on bottom center of rectangle or group
Bottom Left	Cursor is placed directly over this part of the object's boundary box
Bottom Right	Cursor is placed directly over this part of the object's boundary box
Center	2D—Cursor is placed directly over this part of the object's boundary box 3D—Cursor is on the middle point of a solid edge, NURBS curve, 3D polygon, or the center of a circular NURBS curve
Center Left	Cursor is placed directly over this part of the object's boundary box
Center Right	Cursor is placed directly over this part of the object's boundary box
Light, Aim, Pan, Tilt	Point is on a light
Locus	Point is on locus
Object	2D—Point is on an object's edge 3D—Point is on any non-specific point along a solid edge or NURBS curve; displays at all corner points when the Snap to edge points option is deselected
Point	2D—Point is on an object point 3D—Point is on one of the vertices of a solid, the control point of a NURBS curve, the control point of a NURBS surface, or NURBS curve interpolation point
Top Center	Cursor is placed directly over this part of the object's boundary box
Top Right	Cursor is placed directly over this part of the object's boundary box
Top Left	Cursor is placed directly over this part of the object's boundary box
Smart Edge	
Bisector	Point is on the bisector between two Smart Edges

Cue	Description
Edge	Feedback segment is parallel to a Smart Edge
Edge 90°	Feedback segment is perpendicular to a Smart Edge
Offset	Point is a preset distance from a Smart Edge
Surface	Point is on a smart edge, but not on the object itself
Snap to Tangent	
Tangent	Feedback segment is tangent to an arc
Tangent/Tangent	Feedback segment is tangent to two arcs

## Parametric Constraints

Parametric constraints maintain relationships between an object and world space, between two objects, or within the object itself. There are two types of parametric constraints: dimensional and geometric. Dimensional constraints maintain a measurable relationship by limiting the object’s geometry to a particular value. Geometric constraints maintain a physical relationship by limiting the allowed orientation of objects.



Dimensional constraint maintaining the horizontal distance between two objects

Geometric constraint maintaining tangency between a line and a circle

Parametric constraints can be placed on all 2D objects. They cannot be placed on 3D objects except for walls, symbols, and plug-in objects that have 2D components. Multiple constraints can be applied to an object. Parametric constraints can be placed across layers as long as both layers are in a **Top/Plan** standard view, are of the same scale, and Layer Options are set to **Show/Snap/Modify Others**.

Constraints attached to a single object move along with the object even if the object is copied or cut and pasted. When only one of a pair of constrained objects is duplicated or copied or cut and pasted, the constraint is removed.

When a parametric constraint is placed, red constraint indicators are drawn for the object(s) involved. To hide indicators, deselect **Show parametric constraints** in the Display tab of the VectorWorks preferences. Alternatively, select **View > Show > Show or Hide Constraints**; the command toggles between displaying or hiding constraints, as appropriate.

## Dimensional Constraints

Dimensional constraints maintain a measurable relationship. They resemble standard dimensions when placed.

## Constrain Angle

Constrain the angular relationship between separate objects or line segments of a single object. If one object or segment is rotated, the object or segment it is constrained to adjusts to maintain the angle.



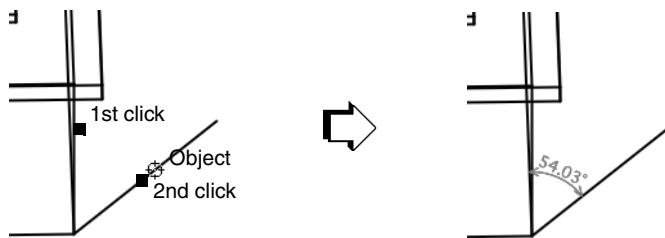
To constrain the angle between objects or line segments of a single object:

1. Click the **Constrain Angle** tool from the Dims/Notes tool set.
2. Click on one of the two objects or line segments to be constrained.

The cursor switches to the bull's-eye cursor.

3. Click on the second object or line segment to be constrained.

A red angle constraint is drawn between the two objects or line segments.



## Constrain Radius

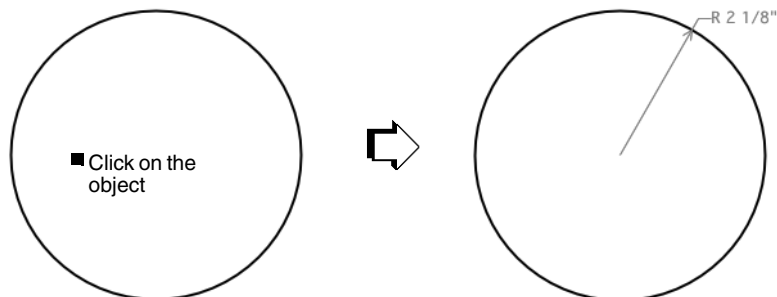
Constrain the radius of a single arc or circle. If the arc or circle is accidentally resized, the constraint prevents the operation, preserving the radius.



To constrain the radius of an arc or circle:

1. Click the **Constrain Radius** tool from the Dims/Notes tool set.
2. Click on the arc or circle to be constrained.

A red radius constraint is drawn on the object.



The **Constrain Radius** tool does not work on quarter arcs.



## Constrain Horizontal Distance

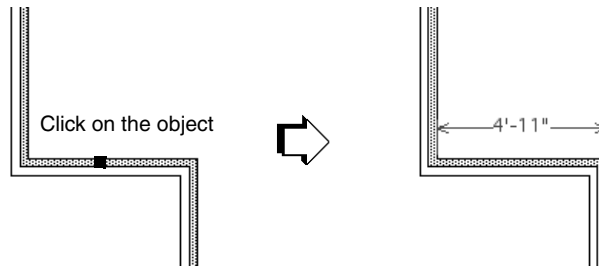
Constrain the horizontal distance of an edge of an object, a line segment, or between two points. If an object resize is attempted, the constraint prevents the operation, preserving the original horizontal distance. When the constraint is on two different objects, if one object is modified, the object it is constrained to moves to remain at the same constrained horizontal distance.



To constrain the horizontal distance of an edge of an object or a line segment:

1. Click the **Constrain Horiz Distance** tool from the Dims/Notes tool set.
2. Click on the object to be constrained.

A red horizontal distance constraint is drawn on the object.



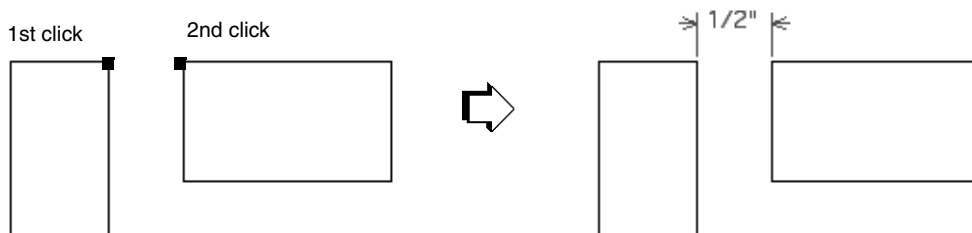
To constrain the horizontal distance between two points:

1. Click the **Constrain Horiz Distance** tool from the Dims/Notes tool set.
2. Click on the first point to be constrained.

The cursor switches to the bull's-eye cursor.

3. Click on the second point to be constrained.

A red horizontal distance constraint is drawn between the two points.



## Constrain Vertical Distance

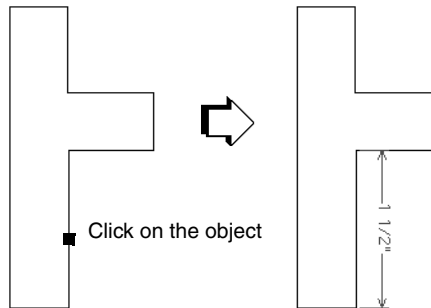
Constrain the vertical distance of an edge of an object, line segment, or between two points. If an object resize is attempted, the constraint prevents the operation, preserving the original vertical distance. When the constraint is on two different objects, if one object is modified, the object to which it is constrained moves to remain at the same constrained vertical distance.



To constrain the vertical distance of an edge of an object or line segment:

1. Click the **Constrain Vertical Distance** tool from the Dims/Notes tool set.
2. Click on the object to be constrained.

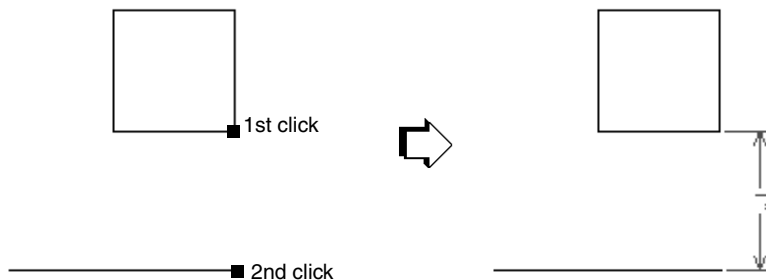
A red vertical distance constraint is drawn on the object.



To constrain the vertical distance between two points:

1. Click the **Constrain Vertical Distance** tool from the Dims/Notes tool set.
2. Click on the first point to be constrained.  
The cursor switches to the bull's-eye cursor.
3. Click on the second point to be constrained.

A red vertical distance constraint is drawn between the two points.



## Constrain Distance

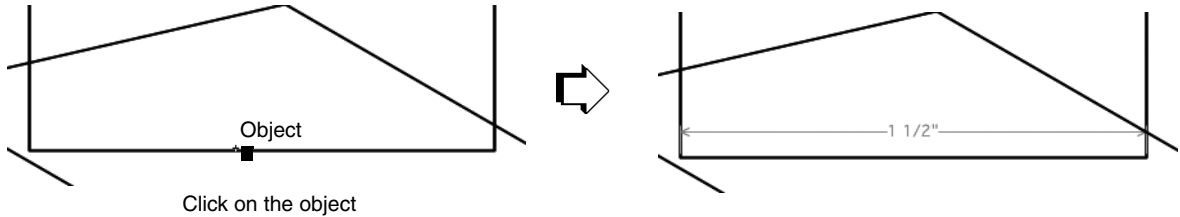
Constrain the distance of an edge of an object, line segment, or between two points regardless of the angle. If an object is accidentally resized, the constraint prevents the operation, preserving the original distance. When the constraint is on two different objects, if one object is modified, the object to which it is constrained moves to remain at the same constrained distance.



To constrain the distance of an edge of an object or line segment:

1. Click the **Constrain Distance** tool from the Dims/Notes tool set.
2. Click on the object to be constrained.

A red horizontal distance constraint is drawn on the object.



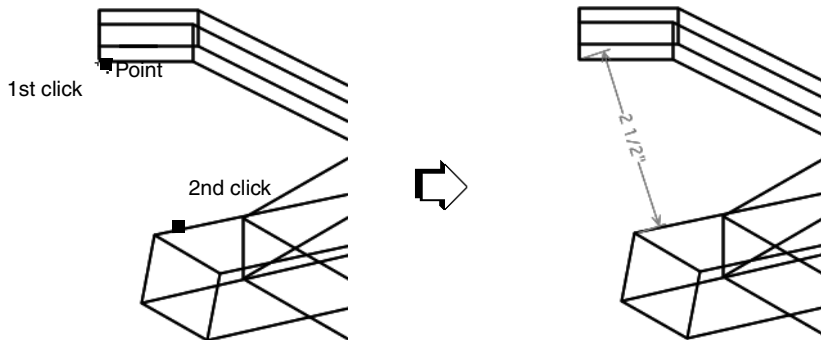
To constrain the distance between two points:

1. Click the **Constrain Distance** tool from the Dims/Notes tool set.
2. Click on the first point to be constrained.

The cursor switches to the bull's-eye cursor.

3. Click on the second point to be constrained.

A red distance constraint is drawn between the two points.



## Geometric Constraints

Geometric constraints preserve the geometric properties of objects.

### Constrain Horizontal-Vertical

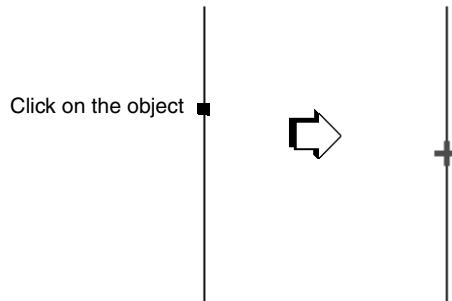
Constrain a linear object to remain horizontal or vertical. Once constrained, the object cannot be rotated to any other position. The object can be resized in length, but it always remains horizontal or vertical.



To constrain an object to remain horizontal-vertical:

1. Click the **Constrain Horiz-Vertical** tool from the Dims/Notes tool set.
2. Click on the linear object to be constrained.

A red horizontal-vertical constraint is drawn on the object.



If the object is diagonal when the constraint is placed, it rotates to become vertical or horizontal, depending on which angle it is closest to.

## Constrain Parallel

Constrain linear objects or line segments to be parallel to one another. If one object is rotated, the object constrained to it rotates to remain parallel to the first object. Lines do not need to be parallel when placing the constraints; the first line rotates to match the angle of the second line.



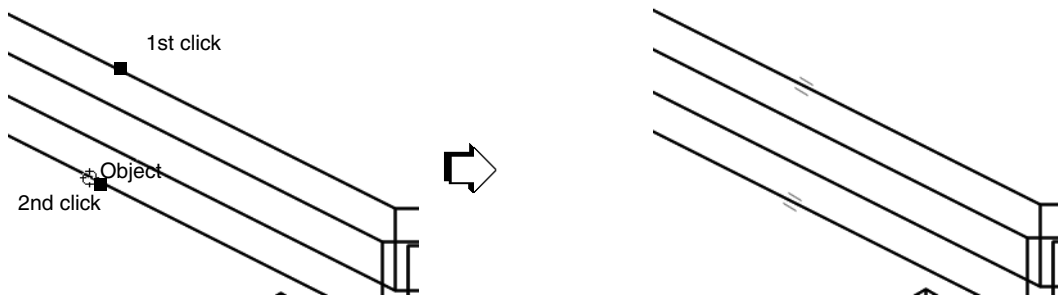
To constrain linear objects or line segments to be parallel:

1. Click the **Constrain Parallel** tool from the Dims/Notes tool set.
2. Click on the line to constrain.

The cursor switches to the bull's-eye cursor.

3. Click on the line to be constrained.

Red parallel constraint indicators are drawn around the two lines.



## Constrain Perpendicular

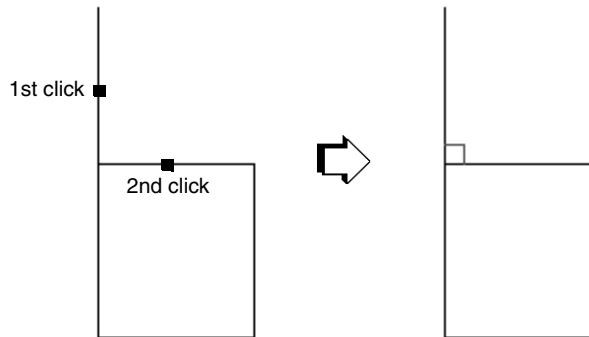
Constrain linear objects or line segments to be perpendicular to one another. If one line is rotated, the line it is constrained to adjusts to remain perpendicular to the first line. Lines do not need to be perpendicular when placing the constraints; the first line rotates to become perpendicular to the second line.



To constrain lines to be perpendicular:

1. Click the **Constrain Perpendicular** tool from the Dims/Notes tool set.
2. Click on the line to constrain.  
The cursor switches to the bull's-eye cursor.
3. Click on the line to be constrained.

A red perpendicular constraint is drawn, connecting the two lines.



## Constrain Colinear

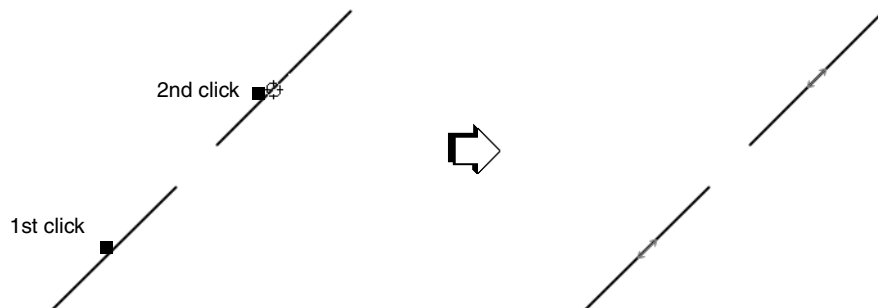
Constrain the colinearity between two linear objects. If one line is moved, the line it is constrained to adjusts to remain aligned. Lines do not need to be aligned when placing the constraints; the first line moves to become colinear to the second line.



To constrain the colinearity between two lines:

1. Click the **Constrain Colinear** tool from the Dims/Notes tool set.
2. Click on the line to constrain.  
The cursor switches to the bull's-eye cursor.
3. Click on the line to be constrained.

Red colinear constraint indicators are drawn on the two lines.



## Constrain Coincident

Constrain two selected points to remain attached. If one object is moved, the object it is constrained to adjusts to maintain the connection. The first point stretches to connect to the second point, if necessary.



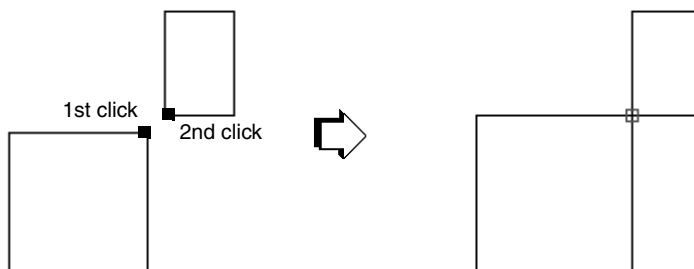
To constrain the connection between two points:

1. Click the **Constrain Coincident** tool from the Dims/Notes tool set.
2. Click on the point to constrain.

The cursor switches to the bull's-eye cursor.

3. Click on the point to be constrained.

A red coincident constraint is drawn where the two points touch.



## Constrain Concentric

Constrain circles and arcs concentrically. If a circle or arc is moved, the circle or arc it is constrained to moves so that their centers remain aligned. Circles and arcs do not need to be concentric when placing the constraints; the first object moves so that its center aligns to the second object's center.



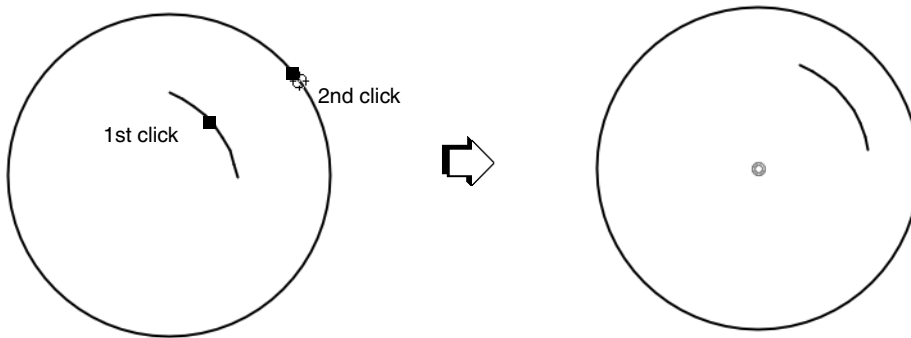
To constrain two circles or arcs concentrically:

1. Click the **Constrain Concentric** tool from the Dims/Notes tool set.
2. Click on the object to constrain.

The cursor switches to the bull's-eye cursor.

- Click on the object to be constrained.

A red concentric constraint is drawn at the center of the two objects.



## Constrain Tangent

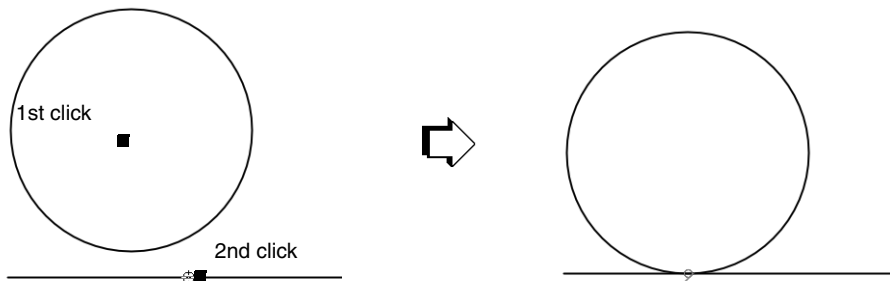
Constrain a circle, arc or line to be tangent to another circle or arc. If one object is moved, the other object it is constrained to adjusts to maintain the tangency. Objects do not need to be tangent to one another when placing the constraints; the first object moves to become tangent to the second.



To constrain a circle, arc or line to be tangent to a circle or arc:

- Click the **Constrain Tangent** tool from the Dims/Notes tool set.
- Click on the circle or arc to constrain.  
The cursor switches to the bull's-eye cursor.
- Click on the circle, arc or line to be constrained.

A red tangent constraint is drawn at the tangent point of the two objects.



## Editing Parametric Constraints

When a constrained object is deleted, the parametric constraint attached to it is also removed. To remove the constraint without removing the attached object, use the **Edit Constraints** command.

A situation may arise where the value of a dimensional constraint needs to be changed. A wall with a horizontal distance constraint value of 2' 6" may at a later point in the project need to be changed to 5' 6". This type of edit is also accomplished using the **Edit Constraints** command.

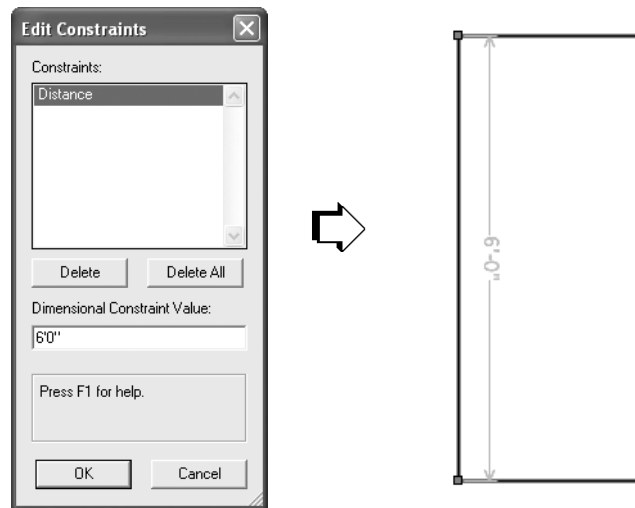
Individual constraints can be selected from a list of all constraints currently applied to a selected object. The selected constraint turns cyan to indicate which one is about to be edited. Geometric constraints, where appropriate, along with turning the constraint cyan, also show the connection between the two constrained objects for clarity.

## Deleting Parametric Constraints

To delete a parametric constraint from an object:

1. Select the object with the constraint.
2. Select **Modify > Edit Constraints**.

The Edit Constraints dialog box opens.



3. Select the constraint to be removed from the Constraints list.  
The selected constraint turns cyan.
4. Click **Delete** to remove the constraint.  
To delete all the constraints attached to an object, click **Delete All**.
5. Click **OK**.

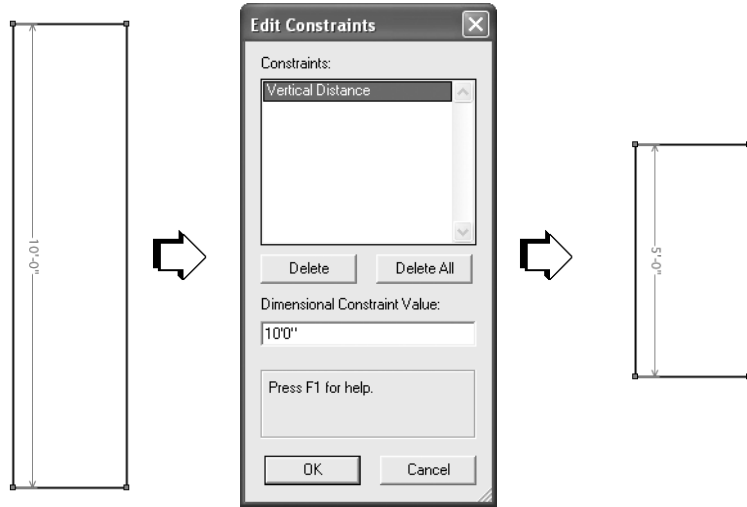
## Changing a Dimensional Constraint Value

To change a dimensional constraint value:

1. Select the object with the constraint.
2. Select **Modify > Edit Constraints**.

The Edit Constraints dialog box opens.





3. In the **Dimensional Constraint Value** field, enter the new dimension, and click **OK**.  
The dimensional value is updated and the object or objects are adjusted.



# Using VectorWorks Resources

VectorWorks provides a variety of resources to aid in drawing. It is also possible to create custom resources to your specifications. These resources are easily accessible from the Resource Browser, which is the central repository for all available VectorWorks resources (see “Object Libraries” on page 729).

Some of these resources are also available by default at the point of use to facilitate faster, easier drawing. Custom resources can also be made available by default. This provides the flexibility to choose among default resources, custom resources, or all available resources while drawing.

## VectorWorks Fundamentals Default Resources

The more commonly-used resources are available at the point of use while you draw; it is not necessary to first add them to the current file through the Resource Browser.

VectorWorks Fundamentals provides the following default resources.

Default Resource	Location
Cabinet handles	Libraries\Defaults\Cabinet - Handles
Color palettes	Libraries\Defaults\Color Palettes
Gradients	Libraries\Defaults\Attributes - Gradients
Hatches	Libraries\Defaults\Attributes - Hatches
Image fills	Libraries\Defaults\Attributes - Image Fills
RenderWorks backgrounds	Libraries\Defaults\RenderWorks - Backgrounds
RenderWorks textures	Libraries\Defaults\RenderWorks - Textures
Title blocks (simple)	Libraries\Defaults\Drawing Border - Title Blocks
Wall hatches	Libraries\Defaults\Walls - Hatches
Wall textures	Libraries\Defaults\Walls - Textures

The ability to use default resources is a preference on the Session tab of the VectorWorks preferences, which can be disabled if default resource use is not desired; see “Session Preferences” on page 42.

Default resources are available from a variety of dialog boxes that contain parameters that allow resource access. They are also available from the Attributes and Object Info palettes. Once a default resource is selected for use, it is automatically imported into the current file and displays in the Resource Browser. It can then be shared among other drawing files.

## Creating Custom Default Resources

To make a custom resource available as a default resource, use any of the following methods.

- Import custom resources to a default resource file
- Add a custom resource file to a default resource folder
- Create a custom resource file and place an alias of (Macintosh) or shortcut to (Windows) that file in a default resource folder

Files that contain custom resources can be placed in different folders, depending on who needs access to the resource. These folders must use the same structure as the VectorWorks Fundamentals default resources.

- To create a default resource for yourself only, put the file in the appropriate subfolder within [User]\Libraries\Defaults (where [User] is the user data folder specified in your VectorWorks preferences).
- If VectorWorks Design Series is installed, you can create a default resource that is project-specific, or that is shared with a workgroup. To do so, put the file on the network in the appropriate subfolder within [Workgroup]\Libraries\Defaults (where [Workgroup] is a workgroup folder specified in your VectorWorks preferences). When coworkers set up this workgroup folder in their preferences, they also have access to the default resource.

If a custom resource file contains multiple types of resources, VectorWorks only displays the resource type for the folder that contains the custom file (or an alias or shortcut to the file). For example, if a file contains both wall hatches and textures, and the file is in the Libraries\Defaults\Walls - Textures folder, only the wall textures are displayed.

## Identifying Duplicate Resources

When a resource name has been duplicated in the current file, VectorWorks checks to see if any difference exists between the two resources.

- If the two resources are identical, only one is listed for selection
- If there are variations between the resources containing duplicate names, VectorWorks appends the originating file name in parentheses to the default resource, and both resources display for selection

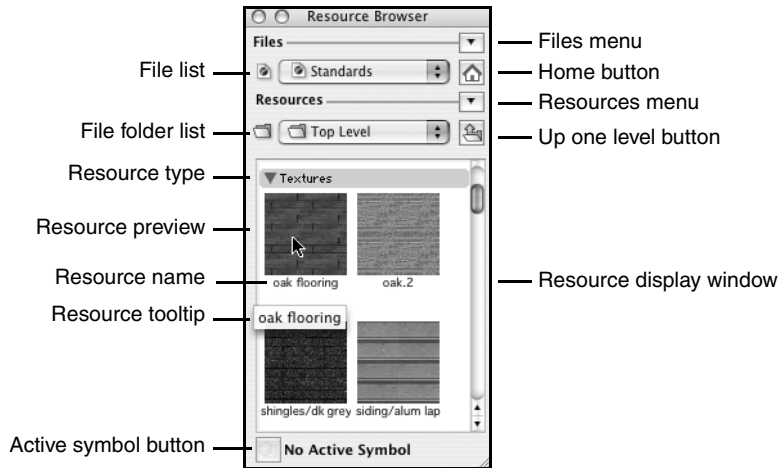
## Organizing Resource Display

The custom and default resources are displayed below the resources in the current file; each list is in ascending alphabetical order.

To display the custom or current file's resources first in a selection list, implement a naming standard that places the desired resources toward the top of the list alphabetically. To view only the current file's resources in a selection list, disable the **Display default content** VectorWorks preference.

## Using the Resource Browser

The Resource Browser is the central repository for all VectorWorks resources.



Parameter	Description
File list	Lists all open and favorite files, and temporarily shows the name of a browsed file; displays “Active Document” when <b>Always Display Active Document</b> has been selected from the File list
File folder list	Lists the file’s symbol folders; select a symbol folder to display the folder’s resources in the resource display window
Resource type	In Thumbnails mode, displays resources divided into categories by type; the types are displayed in headings that can be shown and expanded, or collapsed and hidden (see “Hiding and Showing Resources” on page 146). In List mode, click the column header to sort the columns by resource name or by resource type.
Resource preview	Displays resources with a preview image, or lists the resources with a representational icon (see “Viewing Resources” on page 144)
Resource name	Shows the resource name; a name in italics indicates a referenced resource. Type the first letter of a resource to quickly display resource names beginning with that letter. The color (black, red, or blue) indicates the type of resource (see “Symbol Types” on page 154).
Resource tooltip	Shows the full resource name as a tooltip when the mouse pointer is hovered over a resource; for referenced resources, the tooltip also shows the source file name
Active symbol button	Displays the currently active symbol in the resource display window
Files menu	Lists menu commands that are used to access resources; see “Accessing Existing Resources” on page 147
Home button	Displays the resources of the currently active file
Resources menu	Lists menu commands that are used to work with resources; see “Working with Resources” on page 151

Parameter	Description
Up one level button	Moves one level up the symbol folder hierarchy
Resource display window	Displays the resources from the file shown in the File list, and the symbol folder shown in the File Folder list. Each resource type must be selected for display in the Resource Browser (see “Hiding and Showing Resources” on page 146).

## Opening the Resource Browser

To open the Resource Browser:

Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

## Resource Display

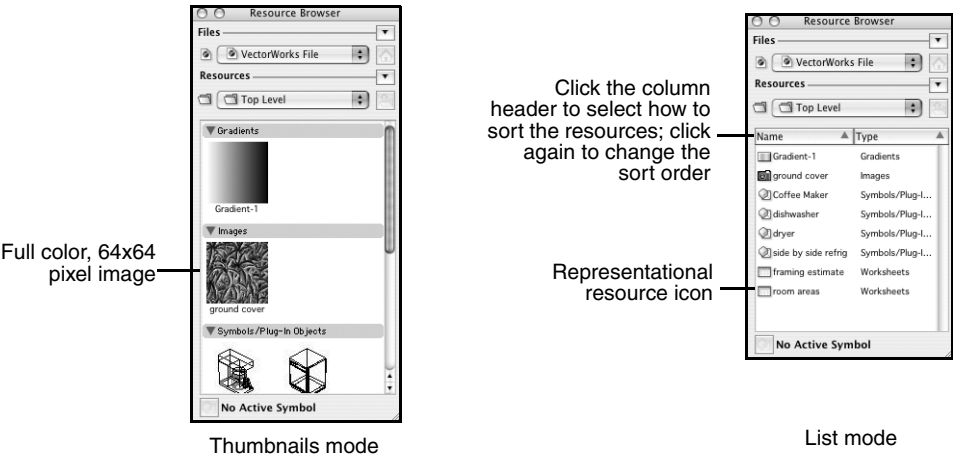
The resources displayed in the Resource Browser depend on several selections and settings:

- the file selected from the **File** list,
- the current, favorites or browsed file(s) selected from the Files menu (which determine what can be selected from the **File** list),
- the symbol folder selected in the File Folder list, and
- the resource types selected for display.

Select a file from the **File** list, and, if necessary, a symbol folder, to view that file’s resources. Click **Home** to view the resources of the currently active file. Select **Always Display Active Document** from the **File** list to always show the resources of the currently active file in the resource display window.































## Viewing Resources



Resources can be viewed in either Thumbnails (default) or List mode.



In Thumbnails mode, resources are displayed in 64x64 pixel full color. Symbols, plug-in objects, gradient fills, image fills, and hatch patterns are previewed with an actual image; other resources are previewed with a representational

icon. Long resource names display on two lines, and the number of characters displayed depends on the system font selected. In List mode, resources are displayed as 16x16 pixel representational icons.

Resource	Thumbnail Icon	List Icon
Gradient Fill (see “Gradient Attributes” on page 242)		
Hatch Pattern (see “Hatch Attributes” on page 236)		
Image Fill (see “Image Attributes” on page 247)		
Record Format (see “Record Formats” on page 170)		
Referenced Resource (see “Workgroup Referencing” on page 111)	Resource name displays in italics	
RenderWorks Background (RenderWorks required; see “Creating Layer Backgrounds” on page 656)		
RenderWorks Texture (RenderWorks required; see “Creating Textures” on page 637))		
RenderWorks Prop Texture (RenderWorks required)		
Sketch Style (Design Series required; see “Sketch Rendering” on page 584 in the VectorWorks Design Series User’s Guide)		
2D-only Symbols and Plug-in Objects (see “Understanding Symbols” on page 153)		
3D-only Symbols and Plug-in Objects (see “Understanding Symbols” on page 153)		
Hybrid Symbols and Plug-in Objects (see “Understanding Symbols” on page 153)		
Symbol Folder (see “Managing Symbol Folders” on page 169)		
VectorScript (see “Using Scripts” on page 593)		
VectorScript Palette (see “Using Scripts” on page 593)		
Wall Style (VectorWorks Architect required)		

Resource	Thumbnail Icon	List Icon
Worksheet (see “Creating Worksheets” on page 563)		

To change the view mode:

1. In the Resource Browser, select **View As** from the **Resources** menu.
2. From the list, select **Thumbnails** or **List**.

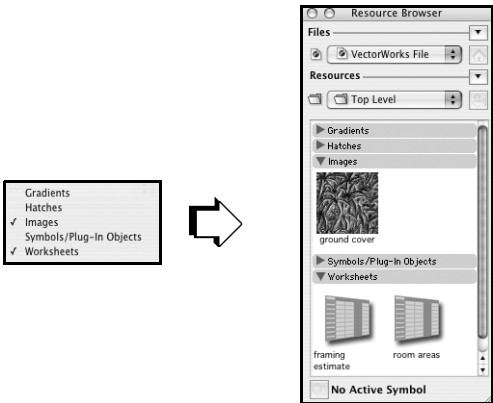
The selected view is saved with the workspace.

### Hiding and Showing Resources

When there are a large number of resource types, it may be useful to hide unused resource types from view.

To hide or show resource types:

1. Select **Show Object Types** from the **Resources** menu.
2. Select the resource type to hide or show. A currently visible resource type is indicated by a check mark next to its name. (In List view, hidden resources are not shown in the resources display window.)



In Thumbnails mode, click on the disclosure arrow next to the resource type name in the Resource Browser to hide or display resources. Alternatively, double-click on the resource name bar to hide or display resources.

The current hide/show status is saved with the workspace.

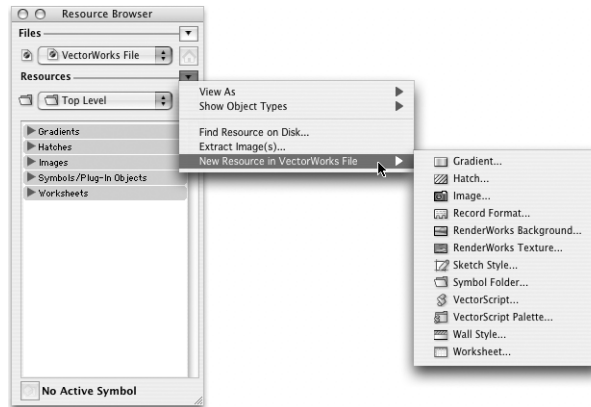
### Creating New Resources

Most new resources are created through the Resource Browser. However, custom selection, tool/attribute, visibility VectorScripts, and plug-ins are created through commands on the **Tools** menu, and symbols are created through **Modify > Create Symbol**. Hatches can be created either through the Resource Browser or through **Modify > Hatch**.

To create a new resource:

1. In the Resource Browser, select **New Resource** from the **Resources** menu. The New Resource menu opens.  
Alternatively, right-click (Windows) or Ctrl-click (Macintosh) in the Resource Browser to open the menu.





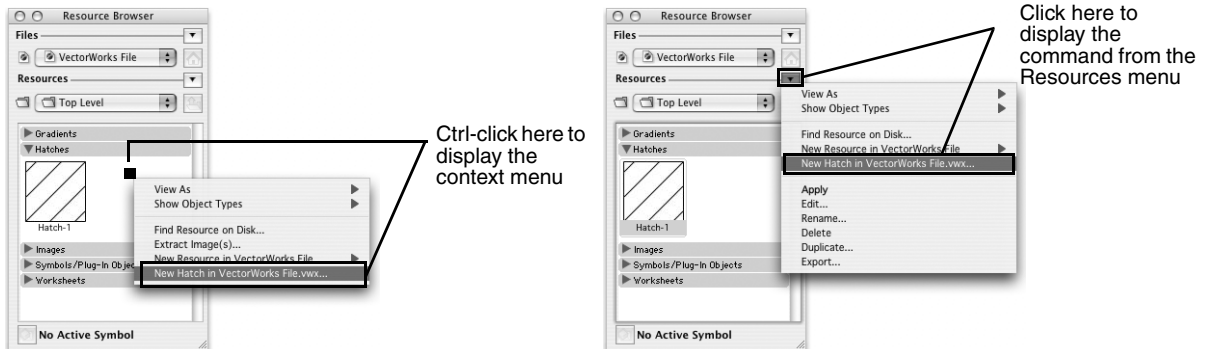
2. Select the resource type to create.  
The resource-specific dialog box opens.
3. Follow the specific creation procedures for that resource.  
Once created, the resource displays in the Resource Browser.

Alternatively, double-click in an unused area of the resource display area to open the Create Resource dialog box. The dialog box contains the same items as the New Resource menu.

## Quick Resource Creation

When right-clicking (Windows) or Ctrl-clicking (Macintosh) in an area of the Resource Browser that is associated with an existing resource type, the context menu contains an additional option for quickly creating another resource of the same type. For example, right-click or Ctrl-click in the Hatches section and the **New Hatch in (document)** option displays.

In addition, immediately after a new resource is created, the Resources menu contains an additional option for quickly creating another resource of the same type.



## Accessing Existing Resources

While new resources are automatically added to the Resource Browser upon creation, resources that exist in other files must be imported into the current file through the Resource Browser palette. Default resources are automatically

imported into the current file at the point of use, and display in the Resource Browser; see “VectorWorks Fundamentals Default Resources” on page 141.

## Quick Resource Browsing

Resources in another file can be quickly browsed to locate resources and to determine whether that file should be added as a favorite.

To view the resources available in another file that is not yet a favorite:

1. In the Resource Browser, select **Browse a Document** from the Files menu.

The standard Open dialog box opens.

2. Select the file to browse, and then click **Open**.

The resources in the selected file temporarily display in the Resource Browser. A resource from that file can be imported into the current file, but the browsed file is not saved as a favorite.

## Resources in Currently Open Files

The **File** list displays all currently open files and favorites.

“Active Document” displays when **Always Display Active Document** has been selected from the Files menu; the resources from the currently active file are always displayed.

To import a resource from an open file other than the active one:

1. In the Resource Browser, select the desired open file from the **File** list.

The file name is displayed in the **File** list, and its resources display in the resource display window.

2. Select the desired resource from the resource display window. Multiple resources can be selected and imported at the same time. To import the resource for future use, select **Import** from the **Resources** menu. To use the resource immediately, double-click it to activate it, or select **Apply** or **Make Active**, if applicable, from the **Resources** menu. (Alternatively, drag the resource onto an object or to a location in the current file.) If symbol folders are present in the drawing, specify the location of the imported resource.

Once the resource is placed or applied in the drawing, it is added to the current file’s Resource Browser (default resources are automatically imported into the current file at the point of use, and display in the Resource Browser; see “VectorWorks Fundamentals Default Resources” on page 141).

When you access symbols or VectorScripts within folders, the selected folder name is displayed in the Document Folder list, and its contents are displayed in the resource display window. To return to the main resource window, click on the Document Folder list, and then select **Top Level**. Alternatively, click the **Up One Level** button until the top level is reached.

## Resources in Favorites

For quick access, the Resource Browser can store links to VectorWorks files that contain resources that you use frequently. You can then import resources from a **Favorites** file into any VectorWorks file and not have to search for the file again. Remove the link when the file is of no further use. Favorite files are remembered for future sessions.

Use the **Files** menu in the Resource Browser to create, use, and manage your **Favorites** list. Alternatively, add files (or aliases or shortcuts to the files) to the appropriate Favorites folder manually.

### Making the Current File a Favorite

To make the current file a favorite:

In the Resource Browser, select **Add Current to Favorites** from the **Files** menu.

The file is added to the **File** list under **Favorites**.

The file must be saved to be added as a favorite.

### Making an Unopened File a Favorite

To make an unopened file a favorite:

1. In the Resource Browser, select **Add New Favorite Files** from the **Files** menu.  
The standard Open dialog box opens.
2. Select the file to make a favorite, and then click **Open**.

The file is added to the **File** list under **Favorites**.

The file must be saved in the same version of VectorWorks as the current file to be added as a favorite.

Multiple files can be selected and added as favorites at the same time; alternatively, press Ctrl+A (Windows) or Command+A (Macintosh) to select all files at once.

### Opening the Current Favorite

To open the current favorite:

1. In the Resource Browser, select the favorite file to open from the **File** list.
2. Select **Open Current Favorite** from the **Files** menu.

The file opens.

### Importing a Resource from a Favorite

To import a resource from a favorite file:

1. In the Resource Browser, select the favorite file to access from the **File** list.  
The file name is displayed as the current file in the **File** list, and its resources display in the resource window.
2. Select the desired resource from the resource display window. To import the resource for future use, select **Import** from the **Resources** menu. To use the resource immediately, double-click it to activate it, or select **Apply** or **Make Active**, if applicable, from the **Resources** menu. (Alternatively, drag the resource onto an object or to a location in the current file.)

Once the resource is placed or applied in the drawing, it is added to the Resource Browser for the current file.

Multiple resources can be selected and imported at the same time.

### Refreshing Favorites from Disk

To update the resources from all favorite files:

In the Resource Browser, select **Refresh Favorites from Disk** from the **Files** menu.

All current favorite files are reloaded into the Resource Browser, to reflect any changes that occurred since they were loaded when this VectorWorks session began.

### Revealing the Location of the Current Favorite

To reveal the location of a favorite file:

1. In the Resource Browser, select the favorite file to reveal from the **File** list.  
The file name is displayed as the current file in the **File** list, and its resources display in the resource window.
2. Select **Reveal Current Favorite** from the **Files** menu.

Either Windows Explorer or Macintosh Finder opens to the folder that contains the file.

Removing Favorites

To remove a single favorite file:

- 1. In the Resource Browser, select the favorite file to delete from the **File** list.
- 2. Select **Remove Current Favorite** from the **Files** menu.  
The file is removed from the **Favorites** list.

To remove all favorite files:

- 1. In the Resource Browser, select **Remove All Favorites** from the **Files** menu.  
A confirmation dialog box opens.
- 2. Click **Yes** to remove all favorites.  
All favorite files are removed from the **Favorites** list.

Adding a Favorite Manually

To create a favorite manually (not through the Resource Browser):

- 1. Place the file that you want to appear on the **Favorites** list (or a shortcut or alias that points to the file) in one of the following folders.

Favorites Folder	Effect on Favorites Lists
[User]/Libraries/Favorites	The file appears only in your <b>Favorites</b> list ([User] is the user data folder specified in your VectorWorks preferences)
[Workgroup]/Libraries/Favorites (VectorWorks Design Series required)	The file appears in the <b>Favorites</b> list of any user who has the workgroup folder set up in VectorWorks preferences

The file is added to the **File** list under **Favorites**.

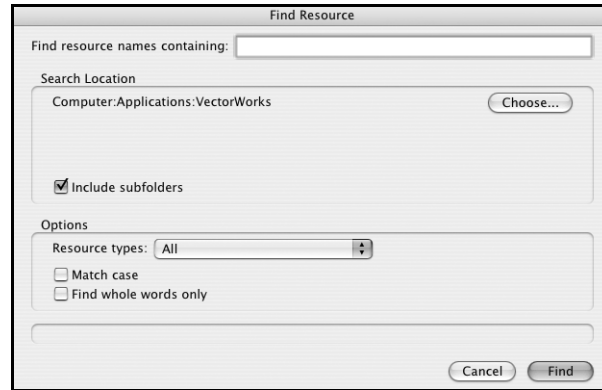
- 2. In the Resource Browser, select **Refresh Favorites from Disk** from the **Files** menu.  
Only files that are in your user Favorites folder can be removed with the commands in the Resource Browser. (See “User Folders Preferences” on page 46 for more information.) Files that were placed in a workgroup Favorites folder must be removed manually.

Finding a Resource

Use the **Find Resource on Disk** command to quickly locate a resource in a file created with the current version of VectorWorks, and optionally to select that resource in the Resource Browser.

To locate and use a resource:

- 1. In the Resource Browser, select **Find Resource on Disk** from the **Resources** menu.  
The Find Resource dialog box opens.



Parameter	Description
Find resource names containing	Enter the full or partial resource name to find
Search Location	Displays the current path from which to begin searching. Click <b>Choose</b> to search for the resource in a different folder; select the folder to search in, and then click <b>Choose</b> (Macintosh) or <b>OK</b> (Windows) to return to the Find Resource dialog box.
Include subfolders	Select whether to include subfolders in the search process
Options	
Resource types	Select to search for all resource types or for one specific resource type
Match case	Select whether the search is case sensitive
Find whole words only	Select this option to search for occurrences that are whole words only, and not part of a larger string of text

2. Enter the search criteria and click **Find**.

The Find Resource Results dialog box displays the resource name, type, and file location for all resources that match the specified search criteria. Select the resource name and click **Select** (or double-click the resource name) to open the file that contains the resource, and then select the resource in the Resource Browser.

3. To import the resource for future use, select **Import** from the **Resources** menu. To use the resource immediately, double-click it to activate it, or select **Apply** or **Make Active**, if applicable, from the **Resources** menu. (Alternatively, drag the resource onto an object or to a location in the current file.) Default resources are automatically imported into the current file at the point of use, and they display in the Resource Browser; see “VectorWorks Fundamentals Default Resources” on page 141.

Once the resource is placed or applied in the drawing, it is added to the current file.

## Working with Resources

Available commands are determined by the resource selected.

To quickly access a resource, click in the resource display window and begin to type the resource’s name. The resource display window scrolls to the first resource that has the letter(s) entered.

To use a resource:

1. Select the resource to use in the Resource Browser.
2. Select the desired command from the **Resources** menu. Some operations, such as Edit, Delete, and Move, can only be performed on the resources in the active file.

Right click (Windows) or Ctrl-click (Macintosh) on a resource to access a context menu. This menu lists the appropriate commands from the **Resources** menu for the selected resource.

Command	Description	Shortcut Key Equivalent
Apply	Applies the resource to the selected object(s)	Double-click or Enter key
Attach	Attaches the record to the selected object(s). Opens the Attach Record dialog box to attach a record to a plug-in object or symbol.	Double-click (Record Format only)
Delete	Deletes the resource from the Resource Browser	Delete key
Duplicate	Duplicates the resource with a new name, if applicable	Not applicable
Edit	Opens the edit dialog box of the resource	Ctrl + double-click (Windows) Option + double-click (Macintosh)
Enter	Opens the folder to display its symbol resources or VectorScripts	Double-click or Enter key
Extract Image(s)	Opens the Browse for Folder (Windows) or Export Image File (Macintosh) dialog box to save a .png file extracted from the selected resource  To extract images from all image-based textures, RenderWorks backgrounds, and image resources in the current document, execute this command with no resources selected.	Not applicable
Make Active	Activates the <b>2D or 3D Symbol Insertion</b> tool so that a symbol or plug-in can be inserted	Double-click
Move	Opens the Move Symbol dialog box to place a symbol or plug-in object resource in another folder	Not applicable
New [resource]	Allows quick creation of the resource type relevant to the section of the Resource window in which the context menu was invoked	Not applicable
Open	Opens the worksheet on screen for edits	Ctrl + double-click (Windows) Option + double-click (Macintosh)
Rename	Opens the Assign Name dialog box to rename the resource	Ctrl + double-click (Image fills only)

Command	Description	Shortcut Key Equivalent
Import	Imports a resource into the current file	Not applicable
Reference	Creates a referenced resource (see “Referencing Resources” on page 116)	Not applicable
Break Reference	Breaks the reference between a master file and the target file; the resource remains in the target file but is no longer referenced	Not applicable
Run	Runs the selected VectorScript. Text documents that contain VectorScripts must be run using the <b>Tools &gt; Scripts &gt; Run VectorScript</b> command.	Double-click or Enter key
Worksheet On Drawing	Places the worksheet on the drawing for display and printing	Double-click or Enter key

Image resources can be compressed to reduce the VectorWorks file size. See “Compressing Images” on page 399 for more information.

## Creating Resource Libraries

Resources can be stored in dedicated files that can then be added to a file’s favorites (see “Resources in Favorites” on page 148) or used as custom default resources (see “VectorWorks Fundamentals Default Resources” on page 141). These files become resource libraries that make it faster and easier to access a specific resource. These libraries do not increase the size of the current file or consume significant amounts of memory.

Save like resources in the same library file to make it easier to search for them.

To create a resource library:

1. Select **File > New**.
2. Import or create the resources to contain in this file.
3. Select **File > Save**.

The Save VectorWorks Drawing dialog box opens.

4. Select the location for saving the file.
5. Enter a name for the file in the **Name** field.
6. Click **Save**.

The file is saved.

## Understanding Symbols

### Symbol Advantages

2D and 3D objects can be saved as 2D, 3D, or hybrid (2D and 3D combined) symbol definitions. VectorWorks also ships with thousands of symbols. Symbol definitions save the object properties, such as size, color, and class, within the symbol definition; these properties are retained each time the symbol is placed, and when a symbol is imported into a different drawing.

Symbols provide several advantages:

- **Smaller file sizes:** The symbol and its definition are stored only once in the drawing file. Placement information (location coordinates, rotation) is all that is required for each symbol instance.
- **One-time editing:** Changes to the symbol definition automatically update all the instances of the symbol in the drawing.
- **Attached database information:** The information associated with a symbol can be used to generate reports and worksheets. Information attached to a symbol is specific to that instance, allowing each instance to be edited individually.
- **Ease of import:** With the Resource Browser, importing symbols from one file to another is fast and easy, and any database information attached to the symbol is also imported.

## Symbol Types

In VectorWorks, you can create 2D and 3D objects. Symbols, which are converted objects, can also consist of 2D, 3D, or hybrid objects.

In addition, there are special symbol categories which indicate the symbol’s behavior at placement. These categories are color-coded within the Resource Browser for identification. The category a symbol belongs to depends on the type of object converted to a symbol and the options selected at symbol creation.

Symbols can be nested within other symbols.

Symbol Type	Symbol Category
2D	2D symbols are designed for drafting alone. While they display in a 3D drawing view, they do not interact with the 3D environment. During a walkthrough or flyover, these items remain flat and do not rotate with the rest of the drawing.
3D	3D symbols have a height (Z coordinate) as well as widths and lengths (X and Y coordinates). 3D objects display flat in a 2D drawing view. However, they retain their 3D properties. Symbols created from 3D objects that are not hybrid objects appear flat in 2D views, but show dimension in 3D views.
Hybrid	A hybrid symbol contains both a 2D object and a 3D component, and displays correctly according to the view. For example, a hybrid door symbol displays as a “swing arc” in Top/Plan 2D view and as a fully formed door in a 3D view. The advantage of working with hybrid symbols is that 3D models can automatically be created from 2D drawings, or vice versa.
Black	This is the most common type of symbol, the static symbol. Its parameters are saved within the symbol definition, and set at placement. Changes made to the symbol definition affect all instances of the symbol.
Blue	When placed, this type of symbol is converted to a group. Any changes made to the symbol definition later have no effect on the group. At symbol creation, select <b>Convert to Group</b> in the insertion options to specify a “blue” symbol (see “Creating New Symbols” on page 156).
Red	When placed, this type of symbol is converted to a plug-in object. It has a specific insertion behavior (point, linear, rectangular, or path) and set parameters, and it can be modified, with many variations of the same object in the file. At symbol creation, select <b>Convert to Plug-in Object</b> in the insertion options to specify a “red” symbol (see “Creating New Symbols” on page 156). Changes to a “red” symbol definition affect future instances, but not existing ones.



## Plug-in Objects

Plug-in objects have all the power of standard symbols, with the added advantage of being customizable. Unlike symbols, plug-in objects have the option of being placed onto the drawing and remaining modifiable. This is useful if the drawing needs to contain many different variations of the same object.

Some tool sets and libraries in VectorWorks contain plug-in objects; for example, the **Scale Bar** tool, located in the Dims/Notes tool set, inserts a plug-in object. In addition to the tool sets, pre-defined plug-in objects are available in the Libraries folder (in sub-folders beginning with the word Object or Objects), and are accessed through the Resource Browser.

When a plug-in object from a tool set is inserted, an object properties dialog box may open the first time the item is placed in the drawing. The properties in this dialog box set the default values for the object during this session. Modify the properties prior to inserting the object, or accept the default values and click **OK**. Object instances can be modified through the Object Info palette after insertion.

Plug-in objects can be created manually through **Tools > Scripts > VectorScript Plug-in Editor** using VectorScript. See “VectorScript Plug-in Editor” on page 108 in the VectorScript Language Guide. Plug-ins are described in detail in “Using VectorScript Plug-ins” on page 83 in the VectorScript Language Guide. The VectorScript Language Guide is available in the help system, and as a PDF file in [VectorWorks]\VWHelp\Additional Documentation.

In addition, a symbol can be saved as a “red” symbol that becomes a plug-in object upon insertion.

There are four different types of plug-in objects: point, linear, rectangular, and path. Each type is different in how it is placed in the drawing and edited.

[Linear and rectangular objects cannot be inserted directly into a wall. However, once placed in the drawing, they can be dragged onto a wall to insert them.](#)

### Point Plug-in Objects

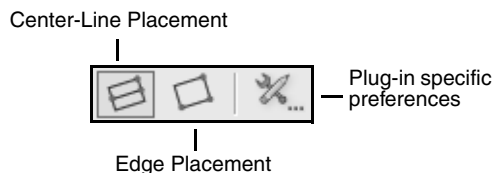
Point plug-in objects are placed by a single click in the drawing to specify the location, and then a second click to set the rotation angle. This is the same way symbols are placed using the symbol insertion tool. A preview image of the object is visible at the cursor location. Point plug-in objects cannot be edited (resized or rotated) with the cursor; they are edited using the Object Info palette.

### Linear Plug-in Objects

Linear plug-in objects are placed with two clicks. The first click sets the beginning point and the second sets the endpoint of a line. The orientation of the object is determined by this line. The object can be resized or rotated by clicking on a reshape handle at either end of the line. It can also be edited using the Object Info palette.

### Rectangular Plug-in Objects

Rectangular plug-in objects are placed by a sequence of three clicks in the drawing. There are two different placement modes which determine how these three clicks are interpreted.



- **Center-Line Placement Mode:** The first click specifies the origin of the object, the second click specifies the length, and the third click defines half the width of the rectangular object. After the second click, the cursor displays feedback symmetrically on both sides of the center-line of the rectangle.

- **Edge Placement Mode:** The first click specifies one corner of the rectangular object, the second click determines the length, and the third click specifies the entire width.

When a rectangular plug-in object is selected, there are eight selection handles visible. The object can be resized by dragging these handles, or edited through the Object Info palette.

**Path Plug-in Objects**

Path plug-in objects are created with a sequence of several clicks that define the vertex points along a path. There are two different types of path plug-in objects based on the type of path that is used. A 2D path plug-in object uses a polyline path and a 3D path plug-in object uses a 3D NURBS curve for its path.

Path plug-in objects can be edited using the **2D Reshape** tool or the **3D Reshape** tool directly. They may also be edited through **Modify > Edit Group**, or the Object Info palette.

Creating New Symbols

The **Create Symbol** command creates symbols from 2D and/or 3D objects, including text. Symbols can also be created from other symbols, from plug-in objects, groups, and worksheets. At placement, the symbol can convert automatically into a group or plug-in object. Viewports cannot be made into symbols.

For more information on symbol types and color categories, see “Symbol Types” on page 154.

Item	Convert to	Result
2D Object	2D Symbol	2D black symbol, for use in Top/Plan view
3D Object	3D Symbol	3D black symbol, for use in a 3D view
2D/3D Hybrid Object	Hybrid symbol	Hybrid black symbol, for use in 2D plans and 3D models
Symbol	Symbol	Saves any changes to the current symbol attributes as a new, black symbol definition
	Group	Creates a new blue symbol definition, to be inserted as a group
	Plug-in Object	Creates a new red symbol definition, to be inserted as a plug-in object
Group	Symbol	Creates a new black symbol definition, with multiple objects existing within a symbol container
Plug-in Object	Symbol	Creates a new black symbol definition. This allows all instances to change by editing the plug-in object inside the symbol, even though the actual symbol instance cannot be edited.
	Plug-in Object	Creates a new red symbol definition, to be inserted as a plug-in object. This allows an editable plug-in object to be placed in a drawing with saved parameters. For example, a door plug-in object, when saved with a width of 4’ and inserted as a plug-in object, is inserted with a width of 4’ rather than with the default width.
Worksheet	Group	Creates a new blue symbol definition, to be inserted as a group. For example, a worksheet can be saved as a preformatted report by saving it as a blue symbol definition.

To create a new symbol:

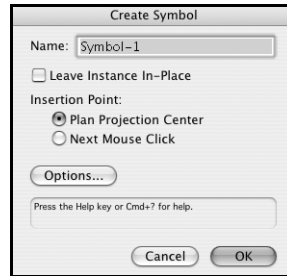
1. Select the object(s) to convert into a symbol.

To create a hybrid symbol, select both the 2D and 3D objects. In Top/Plan view, align the objects first (symbol alignment can be adjusted after creation with the **Edit Symbol** command). The symbol preview that displays in the Resource Browser is generated in the symbol view at creation or editing.

Two loci can be specified as wall break locations. In Top/Plan view, place two loci at opposing locations with the object to convert, and select them all before converting. When the symbol is inserted into the wall, the wall breaks at the loci locations instead of the symbol bounding box.

2. Select **Modify > Create Symbol**.

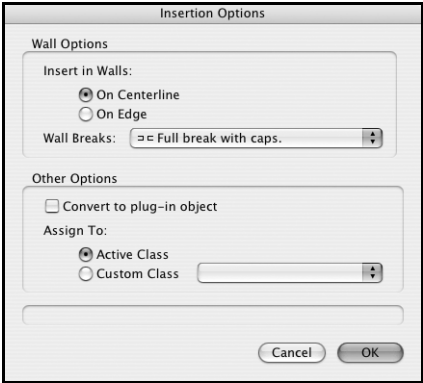
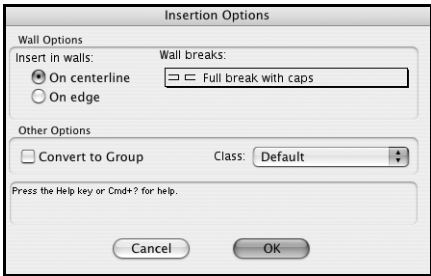
The Create Symbol dialog box opens.



Parameter	Description
Name	Provide a name for the new symbol. Do not use single quotes in symbol names. Single quotes in names are reserved for use in VectorScript.
Leave Instance in Place	When selected, replaces the current selection with a symbol instance; when deselected, the object is removed from the drawing. In both cases, the new symbol definition is added to the Resource Browser.
Insertion Point	<p>The insertion point controls how the symbol is inserted. Select <b>Plan Projection Center</b> (2D) or <b>3D Object Center</b> (3D) to place the symbol by using its geometric center (as determined by its bounding box) as the symbol insertion point.</p> <p>If converting a plug-in object, select <b>Plug-in Origin</b> to set the center of the object as the insertion point.</p> <p>Select <b>Next Mouse Click</b> to set the insertion point manually, with the cursor, after clicking <b>OK</b>.</p>
Options	Displays additional symbol insertion and conversion options

3. Click **Options** to select additional symbol insertion options.

The Insertion Options dialog box opens. The **Other Options** available depends on the original object selected.



Parameter	Description
Wall Options	
Insert in walls	Select how the symbol will be inserted in a wall. <b>On centerline</b> snaps the symbol's insertion point to the center line of the wall. <b>On edge</b> snap's the symbol's insertion point along either edge of the wall.
Wall breaks	Select how the wall breaks around the symbol when it is inserted into a wall
Other Options	
Convert to Group	Converts the symbol into a grouped object when inserted, disassociating it from the original symbol definition. Grouped objects are identified in the Resource Browser with a blue name.  Deselect to convert the symbol into a black, unmodifiable symbol; each instance is controlled by the symbol definition.
Convert to Plug-in Object	Converts the symbol into a plug-in object when inserted, allowing the current parameters to be pre-set when the plug-in object is inserted.  Deselect to convert the symbol into a black, unmodifiable symbol; each instance is controlled by the symbol definition.
Class	Select the class the symbol will be assigned to upon insertion; select Default to place the symbol in the active class

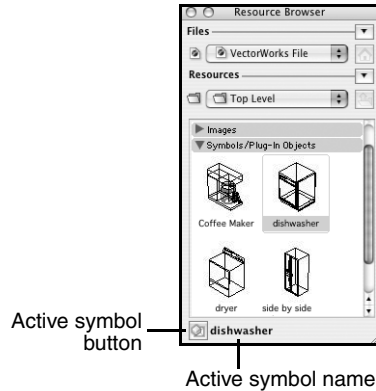
4. Click **OK** to exit the Insertion Options dialog box and click **OK** again to exit the Create Symbol dialog box. If the **Next Mouse Click** insertion point option was selected, click to specify the desired symbol insertion point.
- The new symbol is added to the Resource Browser.

## Inserting Symbols

Symbols are resources available from the Resource Browser. To open the Resource Browser, select **Windows > Palettes > Resource Browser**. Display the symbol to insert in the Resource Browser (see “Accessing Existing Resources” on page 147).

The currently active symbol is inserted; the active symbol's name displays at the bottom of the Resource Browser. Clicking on the active symbol button automatically displays the currently active symbol in the resource display window.

Symbols are inserted with different tools depending on the current view and projection. In 2D Top/Plan view, symbols are inserted with the **2D Symbol Insertion** tool, and in a 3D view, with the **3D Symbol Insertion** tool. Symbols can be inserted as individual objects or inserted to become part of a wall. Symbols can also be dragged from the Resource Browser into the drawing. Before inserting a symbol, consider the current view and which insertion mode to use.



## Drag and Drop Symbol Insertion Method



To insert a symbol by dragging it from the Resource Browser:

1. Click the symbol in the Resource Browser and drag it to the desired location in the drawing.

The symbol cannot be rotated during insertion, since the **2D Symbol Insertion** or **3D Symbol Insertion** tool is not automatically activated. When a symbol is dropped onto a wall, round wall, or roof, VectorWorks inserts the symbol into the object using the default flip value and insertion point.

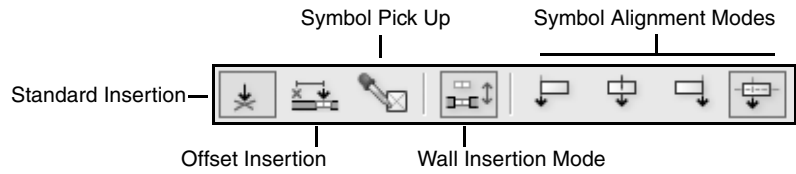
2. The symbol is inserted.

If necessary, edit the symbol rotation or flip in the Object Info palette.

## Inserting Symbols in 2D

Use the **2D Symbol Insertion** tool to place a symbol in the drawing when it is in 2D Top/Plan view. If not in Top/Plan view, selecting this tool automatically switches the view to Top/Plan and the projection to 2D Plan. During insertion, a preview of the symbol is shown to aid in placement. Symbols can also be inserted by dragging them from the Resource Browser.

Each symbol has its own insertion point, a location on the symbol shown by crosshairs in the Edit Symbol window, that controls how the symbol is placed into the drawing. The insertion point is specified during the symbol's creation. See "Creating New Symbols" on page 156 for more information.



Mode	Description
Standard Insertion	Inserts the symbol based on its specified insertion point, or aligned according to one of the symbol alignment modes
Offset Insertion	Inserts the symbol in a wall according to an offset reference point
Symbol Pick Up	Designates a symbol from the drawing as the active symbol
Wall Insertion	Toggles between inserting a symbol into a wall with wall breaks, and inserting a symbol near or on a wall without breaking it
Symbol Alignment Modes	These alignment modes apply to Standard Insertion mode, and temporarily override the insertion point. These modes change the alignment of the insertion point along the X axis of the bounding box surrounding the symbol. Alternatively, keep the original point as the insertion point.
Align Symbol Left	Moves the insertion point to the left edge of the symbol's bounding box, along the original X axis
Align Symbol Center	Moves the insertion point to the center of the symbol's bounding box, along the original X axis
Align Symbol Right	Moves the insertion point to the right edge of the symbol's bounding box, along the original X axis
Align Actual Insertion Point	Uses the symbol's originally specified insertion point

Standard Symbol Insertion Mode



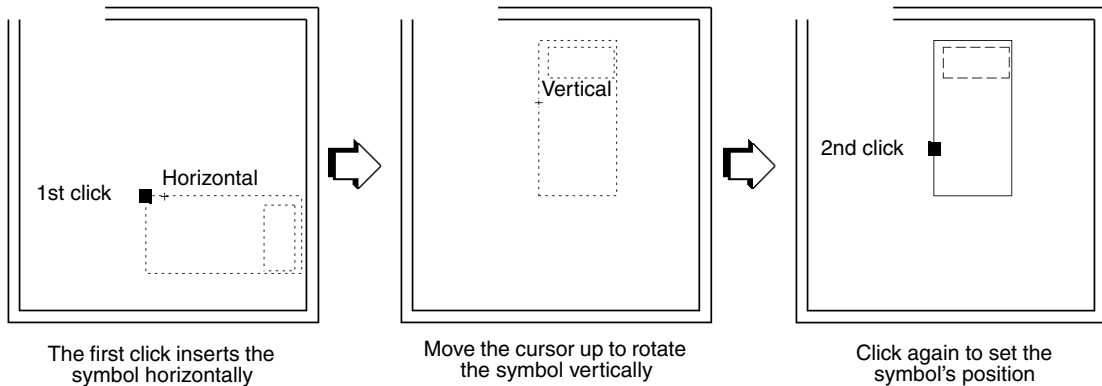
To insert a symbol in 2D:

1. In Top/Plan view, select the desired symbol from the Resource Browser.
2. Select **Make Active** from the **Resources** menu. The **2D Symbol Insertion** tool, on the Basic palette, becomes active, and the drawing switches to Top/Plan view and 2D Plan projection.  
[When in Top/Plan view, double-click the symbol in the Resource Browser to make the symbol active and select the 2D Symbol Insertion tool.](#)
3. Click **Standard Insertion** in the Tool bar. To insert into a wall with breaks, toggle **Wall Insertion** mode on.
4. Click the desired alignment mode (see “Inserting Symbols in 2D” on page 159).
5. Click to set the location of the symbol.
6. Click a second time, without moving the mouse, to position the symbol exactly as inserted. Alternatively, move the cursor slightly away from the insertion point to rotate or flip the symbol about its insertion point.

For symbols placed inside walls, moving the mouse flips the symbol about one of two axes: up and down, or left and right.

In click-drag mode, click and hold the mouse to insert the symbol and still be able to rotate it. A quick click eliminates the ability to rotate or flip the symbol and locks the orientation of the symbol as it is placed.

- Click to set the symbol.



To place another copy of the symbol in the drawing, move the cursor to another location and click. The selected symbol and **2D Symbol Insertion** tool remain active until another tool is selected.

## Offset Symbol Insertion Mode

An offset distance, from the insertion point to a reference point, can be set for symbol insertion.



To insert a symbol into a wall in 2D with offset insertion:

- In Top/Plan view, select the desired symbol from the Resource Browser.
- Select **Make Active** from the **Resources** menu. The **2D Symbol Insertion** tool, on the Basic palette, becomes active.

When in Top/Plan view, double-clicking the symbol in the Resource Browser makes the symbol active and selects the **2D Symbol Insertion** tool.

- Click the **Offset Insertion** mode button.
- Click the desired alignment mode.
- Click to set the reference point.

The reference point is the point at which measurement begins for calculating the offset distance to place the symbol. The reference point does not have to be within the wall.

The symbol preview displays when the cursor is over a wall.

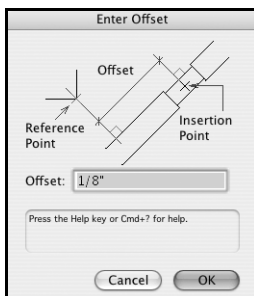
- Click to set the offset location of the symbol.
- Orient the symbol in the wall.

Clicking a second time, without moving the mouse, positions the symbol exactly as inserted. Alternatively, move the cursor slightly away from the insertion point, and then flip the symbol about its axis to the correct orientation.

In click-drag mode, click and hold the mouse to insert the symbol and still be able to flip it. A quick click eliminates the ability to flip the symbol and locks the orientation of the symbol as it is placed.

8. Click to set the symbol.

The Enter Offset dialog box opens.



This dialog box lists the calculated distance for the offset using the reference point specified.

9. If the offset distance is correct, click **OK**. To change the offset distance, enter the new value in the **Offset** field.

The symbol is inserted.

## Symbol Pick Up Mode

In Top/Plan view, the Symbol Pick Up mode “picks up” any 2D or hybrid symbol already inserted into the drawing and makes it the active symbol. This avoids having to locate and select the symbol in the Resource Browser.



To pick up and place a symbol:

1. Click the **2D Symbol Insertion** tool from the Basic palette.

The view automatically switches to Top/Plan.

2. Click the **Symbol Pick Up** mode button.
3. Click a symbol in the drawing.

The symbol becomes the active symbol. Note that the symbol clicked on is not highlighted (selection handles do not display).

Either the Standard Insertion mode or Offset Insertion mode is automatically enabled, depending on the last mode used. Select a different insertion mode, if desired.

4. Insert the symbol according to the instructions for that mode (see “Standard Symbol Insertion Mode” on page 160 or “Offset Symbol Insertion Mode” on page 161).

To switch to Symbol Pick Up mode quickly, press and hold the Option (Macintosh) or Alt (Windows) key while the **2D Symbol Insertion** tool is active, and then click on the desired 2D or hybrid symbol. The selected symbol is now ready to be inserted into the drawing.

## Wall Insertion Mode

The Wall Insertion mode allows a symbol to be inserted into a wall. With this mode turned off, a symbol can be placed near or on top of a wall without being inserted directly into it.

A symbol inserted into a wall is automatically made parallel to the wall’s center line, by rotating it to match the wall’s angle. To remove a symbol from a wall, click and drag it out of the wall. VectorWorks automatically seals the cut in the wall.



For more information on inserting and moving symbols into, out of, and within walls, see “Moving Symbols in Walls” on page 496.

## Inserting Symbols in 3D

Use the **3D Symbol Insertion** tool to place a symbol in the drawing when it is one of the 3D views. If not in a 3D view, selecting this tool automatically switches the view to Top and the projection to Orthogonal. During insertion, a preview of the symbol is shown to aid in placement. Symbols can also be inserted by dragging them from the Resource Browser.

Each symbol has its own insertion point, a location on the symbol shown by crosshairs in the Edit Symbol window, that controls how the symbol is placed into the drawing. The insertion point is specified during the symbol's creation. See “Creating New Symbols” on page 156 for more information.



To insert symbols in 3D:

1. In a 3D view, select the desired symbol from the Resource Browser.
2. Select **Make Active** from the **Resources** menu. The **3D Symbol Insertion** tool, on the Basic palette, becomes active.

*When in a 3D view, double-clicking the symbol in the Resource Browser makes the symbol active and selects the **3D Symbol Insertion** tool.*

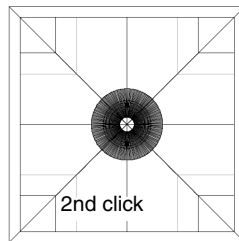
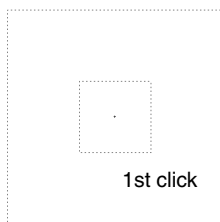
3. Click to set the location of the symbol.
4. Orient the symbol.

Clicking a second time, without moving the mouse, positions the symbol exactly as inserted. Alternatively, move the cursor slightly away from the insertion point; then move the cursor to rotate the symbol about its insertion point. In the Data bar, use the **A** (angle) and **WP A** (working plane angle) fields to help position the symbol.

*In click-drag mode, click and hold the mouse to insert the symbol and still be able to rotate it. A quick click eliminates the ability to rotate or flip the symbol and locks the orientation of the symbol as it is placed.*

5. Click to set the symbol.

To place another copy of the symbol in the drawing, move the cursor to another location and click. The selected symbol and **3D Symbol Insertion** tool remain active until another tool is selected.



## Editing Symbols

Once a symbol instance is placed in a drawing, its information can be displayed in the Object Info palette. Select a symbol instance to display its properties. A symbol's location can be adjusted, or its layer and class association can be changed by selecting a new class or layer from the appropriate list. A symbol can be replaced with another symbol, rotated in 2D or 3D space, and, for symbols located in walls, flipped, replaced, and repositioned.

Most of a black symbol's physical attributes cannot be directly changed in the Object Info or Attributes palette. Instead, the components of a symbol must be accessed and edited through the Edit Symbol window. Changes made to a symbol definition affect all existing and future instances of that symbol, unless the symbol was inserted as a group (blue) or plug-in object (red).

## Replacing Existing Symbols

To exchange a symbol instance's definition with another:

1. Select **Window > Palettes > Object Info**.

The Object Info palette opens.

2. Select the existing symbol.
3. Click the **Replace** button.

Alternatively, right-click on a symbol and select **Replace** from the context menu.

The Choose a Symbol dialog box opens.



4. Select the desired new symbol.

Only the symbols that are currently part of the active VectorWorks drawing are listed.

5. Click **OK**.

The old symbol instance is replaced with the new symbol instance.

The new symbol uses the settings from the replaced symbol. Future occurrences of the new symbol are unaffected by these settings.

## Rotating Existing Symbols

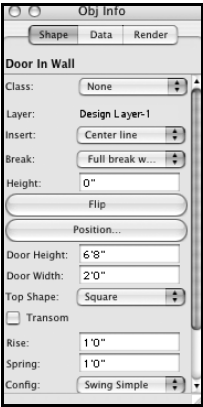
Rotate 2D symbols by entering a rotation angle in the **Rot** field of the Object Info palette. Rotate 3D symbols by clicking the **Rotate 3D** button in the Object Info palette. This button accesses the Rotate Object in 3D dialog box for specification of the rotation angle, center, and axis; see "Rotate Tool" on page 389.

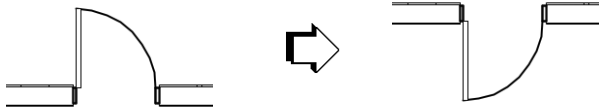
## Changing Symbols in Walls

Once a symbol has been placed in a wall, VectorWorks allows some special actions, each of which is performed within the wall structure. Flip the symbol in the wall, reposition it, or completely replace it (see “Replacing Existing Symbols” on page 164 for more information). Symbols can also be moved along or out of the wall, or into another wall (see “Moving Symbols in Walls” on page 496).

To change how a symbol interacts with a wall:

1. Select **Window > Palettes > Object Info**.  
The Object Info palette opens.
2. Select the desired symbol or symbols with the **2D Selection** or **3D Selection** tool.  
The Object Info palette displays the symbol’s information. If several symbols are selected, only the common information can be changed.
3. Change the insertion point location, the wall break style, and the height of the symbol in the wall.



Parameter	Description
Insert	Changes the insertion point location in relation to the symbol position
Break	Changes the wall break style where the symbol is inserted
Height	Changes the height of the symbol in the wall
Flip	Click to flip through a series of four rotations until the desired orientation is reached 
Position	Opens the Position Symbol in Wall dialog box; see “Repositioning Symbols in Walls” on page 165

## Repositioning Symbols in Walls

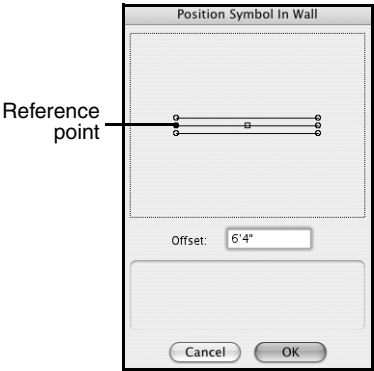
To reposition a symbol in a wall:

1. Select **Window > Palettes > Object Info**.

The Object Info palette opens.

- 2. Select the existing symbol.
- 3. Click the **Position** button.

The Position Symbol in Wall dialog box opens, with a graphical representation of the symbol and wall. The current reference point for the position is indicated by a black circle. Other possible reference points are indicated by unfilled circles. The current symbol's insertion point is indicated by a white rectangle. The offset value is the distance from the reference point to the insertion point.



- 4. Click a different reference point and/or enter the new **Offset** value.
- 5. Click **OK**.

### Editing Symbol Definitions

Most of a black symbol's physical attributes cannot be directly changed in the Object Info or Attributes palette. Instead, the components of a symbol must be accessed and edited through the Edit Symbol window. Changes made to a symbol definition affect all existing and future instances of that symbol, unless the symbol was inserted as a group (blue) or plug-in object (red).

Changes to the symbol definition are made from the Resource Browser. Changes to a symbol instance are made from the drawing.

Editing behavior and results depend on the symbol type (see "Symbol Types" on page 154).

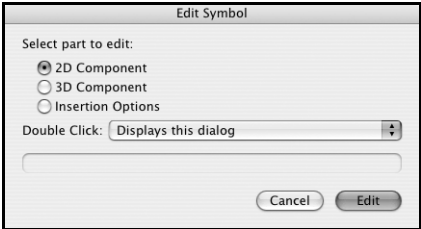
Symbol Type	Edit Behavior/Result
Black	Edit from the Resource Browser or the drawing by selecting <b>Edit</b> from the context menu, making changes in the Edit Symbol window. Changes to the symbol, whether made to the definition or the instance, affect both existing and future symbol instances.
Blue	Edit from the Resource Browser by selecting <b>Edit</b> from the context menu, making changes in the Edit Symbol window. Changes to the definition affect future symbol instances only. A blue symbol inserted on the drawing as a group cannot be edited from the drawing in the Edit Symbol window (make edits directly from the Object Info or Attributes palette, and by editing the group). Changes to a drawing instance affect that instance only.

Symbol Type	Edit Behavior/Result
Red	Edit from the Resource Browser by selecting <b>Edit</b> from the context menu, making changes in the Edit Symbol window. Changes to the definition affect future symbol instances only. A red symbol inserted on the drawing as a plug-in object cannot be edited from the drawing in the Edit Symbol window (make edits directly from the Object Info or Attributes palette). Changes to a drawing instance affect that instance only.

Only one component of a hybrid symbol can be edited at one time. Edit the 2D version of the hybrid symbol in 2D Plan projection. Then edit the 3D version separately by changing to a 3D projection and selecting the **Edit Symbol** command. For 3D objects, only the object’s contents (definition) can be edited in 2D.

To edit a symbol through the Resource Browser:

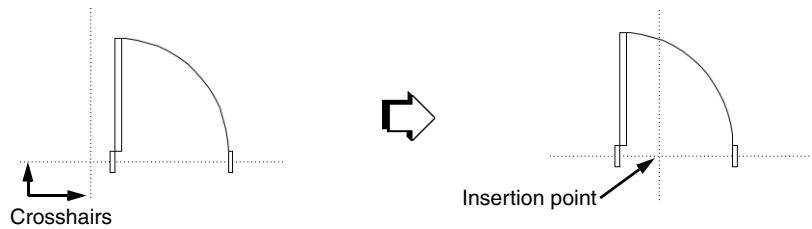
1. In the Resource Browser, select the symbol to edit, and select **Edit** from the **Resources** menu.  
  
Alternatively, edit a black symbol instance from the drawing by selecting it and selecting **Modify > Edit Symbol**, selecting **Edit** from the context menu, or double-clicking on the symbol. Edit the components of a hybrid symbol directly by selecting **Edit 2D Component** or **Edit 3D Component** from the context menu.
2. Only one component of a hybrid symbol can be edited at one time. If the symbol is hybrid, the Edit Symbol dialog box opens.



Parameter	Description
2D/3D Component	Edits the 2D or 3D component of the symbol
Insertion Options	Edits the method of inserting the symbol into a wall (see “Creating New Symbols” on page 156)
Double-click	Sets the future behavior when double-clicking on a symbol. Select whether to display the Edit Symbol dialog box, or directly edit the 2D or 3D component or insertion options. Select <b>Edits the Component based on current view</b> to automatically edit the 2D component if in Top/Plan view, or the 3D component if in one of the 3D views.

3. Click **Edit**.  
  
If editing the symbol wall insertion options, select **Insertion Options**, and then click **Edit** to access the Insertion Options dialog box. See “Creating New Symbols” on page 156 for information on wall insertion options.  
  
If editing components, the Edit Symbol window opens, containing the symbol to be edited. A colored border around the drawing window indicates that you are in an editing mode. The **Exit Symbol** command becomes available from the **Modify** menu, and the **Exit Symbol** button is visible in the top right corner of the drawing window.  
  
If editing nested symbols, select **Modify > Edit Symbol** again to edit.

- 4. When editing components, make the symbol edits in the Attributes or Object Info palette. To edit the symbol insertion point, select all the components of the symbol, and relocate the components about the insertion point crosshairs. The intersection of the crosshairs gives the feedback segment Locus when encountered.



The other component of a hybrid symbol is not automatically adjusted to match changes made to the insertion point. It must be edited separately. Switch easily to the other component from the context menu.

- 5. After editing, click the **Exit Symbol** button (or select **Modify > Exit Symbol**) to update all instances of the symbol and return to the drawing area.

If editing a symbol that is nested in other symbols, the button returns back to the symbol container.

### Converting a Symbol Instance to a Group

Changes made to a black symbol definition affect all instances of that symbol in the drawing. The **Convert to Group** command changes a selected symbol into a group of VectorWorks objects, allowing edits to be made to that object without affecting the other instances of the symbol in the drawing. This command “disassociates” the symbol instance from its definition. The edited symbol can then be turned into a new symbol if desired.

Before using this command to edit a symbol instance that has been inserted into a wall, first drag the symbol outside of the wall. This avoids converting the wall as well.

To convert a symbol to a group:

- 1. In the drawing, select the symbol instance to edit.
- 2. Select **Modify > Convert > Convert to Group**.

If a symbol contains multiple levels of grouped objects, other symbols, or plug-in objects, the **Convert to Group Options** dialog box opens. Select the desired criteria for converting the symbol.

Parameter	Description
Don't convert sub-objects to groups	Excludes any sub-objects, such as nested symbols, from the conversion process
Convert nested symbols and plug-in objects	Converts nested symbols and/or plug-in objects within the symbol to individual objects within the group
Convert all sub-objects	Converts all objects within the symbol to individual objects within the group

Use caution when converting hybrid symbols. If in 2D view, the 3D component of the symbol may be lost during the conversion. Similarly, in a 3D view, the 2D portion of the symbol may be lost.

- 3. Click **OK**.

The symbol is converted into a group. To make changes to grouped items, select **Modify > Edit Group** or **Ungroup**.

The object can be left as a grouped object or saved as a new symbol. Any changes to the original symbol definition do not affect this instance.

Instead of repeatedly converting a symbol to a group, create a “blue” symbol which automatically converts to a group upon insertion; see “Creating New Symbols” on page 156.

## Managing Symbol Folders

### Creating a New Symbol Folder

Create symbol folders to organize symbols within the Resource Browser.

To create a new symbol folder:

1. From the Resources menu, click **New Resource** to display the New Resource menu.
2. Select **Symbol Folder**.  
The Assign Name dialog box opens.
3. Enter the name to assign to the new symbol folder.
4. Click **OK**.

The new folder is added to the Resource Browser.

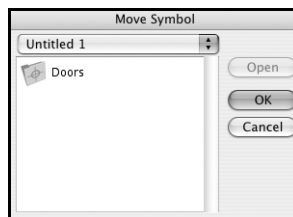
### Moving a Symbol into a Folder

Group symbols according to topic or placement by moving them into folders within the Resource Browser.

To move a symbol into a folder:

1. Select the symbol in the Resource Browser.
2. Select **Move** from the **Resources** menu.

The Move Symbol dialog box opens.



3. Select the folder for the symbol.  
Click **Open** to access sub-folders within the selected folder.
4. Click **OK**.

VectorWorks moves the symbol to the new folder.

## Importing a Symbol Folder

To import a symbol folder from another VectorWorks file:

1. Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

2. Locate the symbol folder to be imported.

For information using the Resource Browser to locate resources in other VectorWorks files, see “Accessing Existing Resources” on page 147.

3. Select the symbol folder to be imported, and then select **Import** from the **Resources** menu. (Alternatively, drag the symbol folder resource into the desired VectorWorks file.)

The symbol folder and any symbols it contains are imported into the active VectorWorks file.

## Record Formats

Record formats, which store a wide range of data (like price or part numbers), can be attached to any object or symbol. Records attached to an object or symbol definition become a permanent part of it, remaining with the object or symbol even when it is imported or cut and pasted into another drawing. Several record formats can be attached to a single object or symbol, and record values can be individually changed for each object to which the record is attached.

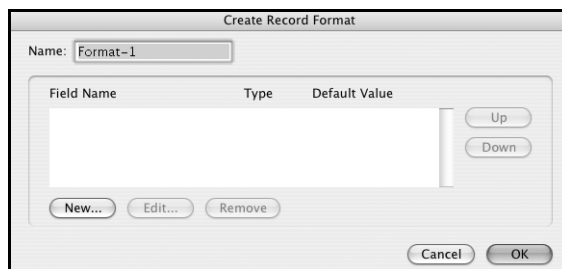
## Creating Record Formats

Creating record formats in a drawing file is an important step to creating meaningful database rows in worksheets (see “Specifying the Worksheet Row Type” on page 578).

To create a new record format:

1. In the Resource Browser, select **New Resource** from the **Resources** menu.
2. Select **Record Format**.

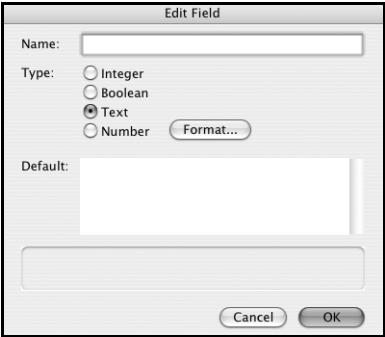
The Create Record Format dialog box opens.



3. Enter the **Name** of the Record Format.
4. Click **New**.

The Edit Field dialog box opens.

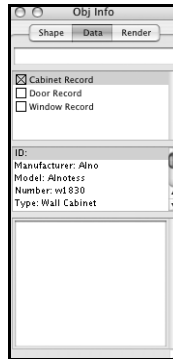




Parameter	Description
Name	Enter a name for the field
Type	Select the type of field
Integer	Select to use whole numbers ranging from -32,768 to 32,767 Using <b>Integer</b> requires less memory than <b>Number</b> .
Boolean	Select to use a data value of either True or False
Text	Select to enter a string of characters (default option), such as a word or a sentence
Number	Select to use numbers outside the range of <b>Integer</b> , fractions or decimals, or to specify a number format. Click <b>Format</b> to define the number format in the Number Format dialog box; click <b>OK</b> to return to the Edit Field dialog box.
General	The default format
Decimal	Uses decimal numbers; enter a value for the number of decimal places, and if desired, select to use commas as separators
Scientific	Uses scientific numbers; enter a value for the number of decimal places
Fractional	Uses fractional numbers; enter the rounding value for fractions
Dimension	Uses dimension numbers
Dimension Area	Uses dimension area format and displays the specified area units after the number
Dimension Volume	Uses dimension volume format and displays the specified volume units after the number
Angle	Determines the accuracy of angles and measurement system applied; measurement system is degrees, minutes, and seconds or decimal numbers up to eight decimal places
Date	Uses dates; select the desired date format from the list
Leader	When the Number Format dialog box is opened from a worksheet, enter the text to display before the cell value
Trailer	When the Number Format dialog box is opened from a worksheet, enter the text to display after the cell value
Default	Enter the data value in the <b>Default</b> text box, if desired

5. Click **OK** to return to the Create Record Format dialog box.
6. For each additional field to add, repeat steps 4 through 6.
7. Click **OK** to return to the drawing area.

When an object is selected, the Data tab of the Object Info palette displays all records contained in the current drawing.



## Attaching Record Formats to Symbols and Objects

Once a record format has been created, it can be attached to any object or symbol in the same drawing file as the record format. The Data tab of the Object Info palette indicates all record formats currently available to attach.

This section describes how to attach a record format to a selected symbol or object. For global symbol changes, use the utility described in “Attaching Records” on page 178.

There are two methods for attaching record formats to symbols. The first method attaches a record format to a single symbol instance or to an object in the drawing without affecting previous or future instances.

The second method attaches a record format to a symbol definition that applies to each symbol added to the drawing afterwards. Existing instances remain unaffected.

### Attaching Record Formats to a Single Symbol Instance or Object

To attach (or detach) record formats to a single symbol or object in the drawing using the Object Info palette:

1. Select the symbol.
2. Select **Window > Palettes > Object Info**.

The Object Info palette opens.



3. Select the Data tab.

The Object Info palette lists all record formats in the drawing.

4. In the checkbox next to the desired record format(s), click to attach or deselect to detach the record format.

If attaching a record format, an X displays in the box and the record is attached to that instance of the symbol or object.

If detaching a record format, confirm the procedure.

To attach record formats to a symbol or object in the drawing using the Resource Browser:

1. Select the symbol(s) in the drawing.
2. From the Resource Browser, select the record format to be applied. From the context menu, select **Apply**. (Alternatively, double-click the record format resource to apply it to the selection or drag the record format resource onto a symbol or object.)

## Attaching Record Formats to a Symbol Definition

To attach record formats to a symbol definition from the Resource Browser:

1. Select **Window > Palettes > Resource Browser**.
- The Resource Browser opens.
2. Select a symbol definition.
3. Select **Edit** from the **Resources** menu.
4. Select the symbol component to edit, and click **Edit**.
5. In the Edit Symbol window, deselect all by clicking in an empty area of the window.
6. In the Object Info palette, click on the Data tab.

When no items are selected, the Data tab displays \*SYMBOL DEFAULTS\* at the top.

7. Select the record to attach.

To attach multiple records to the same symbol definition, click on each of the records.

8. Click **Exit Symbol** at the top right of the Edit Symbol window.

The attached record(s) is included with the symbol each time the symbol is placed in the drawing or imported into another drawing. Symbols already present in the drawing are unaffected. Change the record values of the record format resource to set the default values for the symbol when placed in the drawing.

## Editing Record Formats

Record formats can be edited in a variety of ways, depending on the desired outcome.

Method	Result
Edit the record format resource, changing the field list and/or default field values (see “Editing Default Record Formats” on page 174)	Future objects or symbols with the record attached reflect the changes; existing attached records are unaffected
Edit the field values of a record attached to a selected object (see “Viewing and Editing Object Records” on page 175)	Changes to field values affect the selected object only; the field list cannot be changed. Existing and future objects with the record attached use the default values.
Edit the record field values of a symbol definition (see “Editing Symbol Default Record Values” on page 176)	Changes to field values affect future instances of the symbol; the field list cannot be changed. Existing symbols and other symbols with the record attached are unaffected.

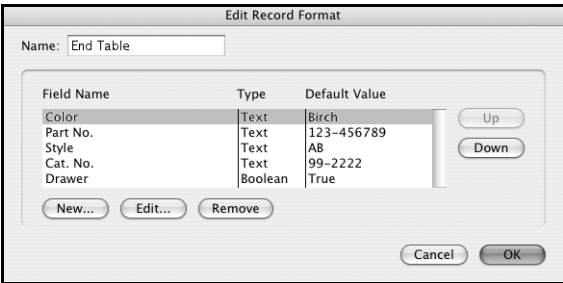
Alternatively, make global changes with the symbol utilities (see “Changing One Record Format Field” on page 179 and “Changing All Record Format Fields” on page 180).

## Editing Default Record Formats

A record format’s fields and default values can be edited from the Resource Browser.

To edit record format values:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Select the record format.
3. Select **Edit** from the **Resources** menu.  
The Edit Record Format dialog box opens.



Parameter	Description
Name	Displays the name of the current record format
Field list	Lists the fields of the current record format
New	Creates a new field (as described in “Creating Record Formats” on page 170)
Edit	Edits the selected field

Parameter	Description
Remove	Deletes the selected field
Down/Up	Changes the order of the fields by moving the selected field up or down

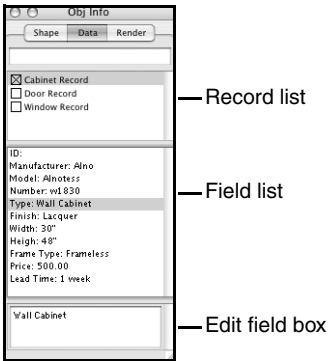
- 4. Select the record format field to edit and click **Edit** to change the default value, or click **New** or **Remove** to add or delete fields.
- 5. Click **OK**.

The edits do not affect existing values for attached records. Changes are applied to the default field values when attached to symbols or objects, or for future symbols with the record attached.

Viewing and Editing Object Records

The Object Info palette Data tab is used to attach, view, and edit the record values for specific instances.

If selecting multiple objects with different records attached, the Data tab displays records that are attached to objects with a grayed box, but does not indicate which records are attached to which objects.



The three list boxes on the Data tab can be resized by moving the bars between them.

To edit record field values for a selected object:

- 1. Select **Window > Palettes > Object Info**.

The Object Info palette opens.

- 2. Select the object.

Click the Data tab on the Object Info palette. The Object Info palette displays information about the record format(s) attached to the selected object(s).

Parameter	Description
Record List	Displays all records contained in the drawing; records attached to the selected object are indicated with an X in the checkbox to the left of the record name
Field List	Displays all the fields in the selected record; if a default value was assigned to the field, it displays after the field name
Edit Field	Edits the field values for the selected record; all entered values override any default values for the object

3. Select the desired record in the Record list, and then the desired field in the Field list. In the Edit Field box, make the change to the default value.

This information applies to the selected object only; other new and existing objects with that record attached will still use the original (default) record format values. If a selected chair has a different part number from the default value that was entered in the record format, enter the new part number for that chair only. If the part number for all chairs has changed, edit the default record format instead.

## Editing Symbol Default Record Values

The default values of a record attached to a symbol can be changed while editing a symbol definition (see “Editing Symbol Definitions” on page 166). This does not change the record format resource; if other symbols or objects have the record attached, they are unaffected. It does change the future default record values for that symbol.

To change the default field values of a symbol’s record format:

1. Select a symbol definition.
2. Select **Edit** from the **Resources** menu.
3. Select the symbol component to edit, and click **Edit**.
4. In the Edit Symbol window, deselect all by clicking in an empty area of the window.
5. In the Object Info palette, click on the Data tab.

When no items are selected, the Data tab displays \*SYMBOL DEFAULTS\* at the top.

6. Select the desired record in the Record list, and then the desired field in the Field list. In the Edit Field box, make the change to the default value.
7. Click **Exit Symbol** at the top right of the drawing window to return to the drawing.

The default field values of the record format for that symbol definition have been changed.

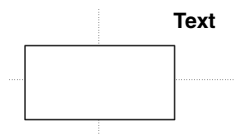
## Linking Text to Record Formats

The **Link Text to Record** command links the text within a symbol definition to a field of the attached record. This is particularly useful for labeling symbols in a drawing with unique information, such as a part list number or price. To use this command, symbols and record formats must already exist in the drawing file. The link is made within a symbol’s definition.

To link text to records within a symbol definition:

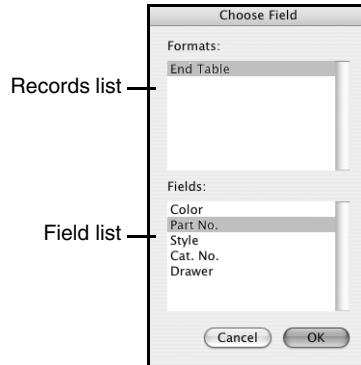
1. Edit the 2D symbol definition as described in “Editing Symbol Definitions” on page 166.
2. In the Edit Symbol window with nothing selected, create a line or block of text.

Ensure the text is formatted with the desired font and style. The actual text is not important at this point. If desired, create and assign a class to the text.



3. Select the text and place it in the exact location where the record data value is to display.
4. With the text still selected, select **Tools > Records > Link Text to Record**.

The Choose Field dialog box opens.

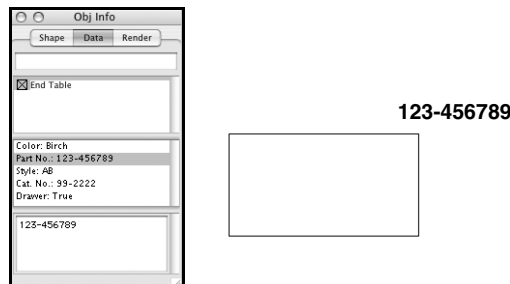


5. Select the record format from the **Records** list.
6. In the list of fields, select the field of the selected record to associate with the text.
7. Click **OK**.

VectorWorks adds the text object to the symbol definition, as well as all existing instances on the drawing. The default value of the selected field replaces the “dummy” text.

8. Click **Exit Symbol** at the top right of the drawing window to return to the drawing.

Place the symbol on the drawing. The text linked to the record displays the field information. If necessary, to edit the value for that particular instance, select the field where the text was assigned in the Object Info palette Data tab. In the Edit Field box, enter the text to display in the symbol; the linked field information displays on the attached symbol.



## Global Symbol Commands

The symbol commands manipulate record data attached to symbols in libraries and perform global data changes. Use these commands to change the default record format values of the field(s) attached to multiple symbol definitions, either after importing a file from a different source or during normal project changes.

The symbol utilities include the following commands:

- Attach Record
- Detach Record
- Change One Field
- Change All Fields
- Change Symbol Attributes
- List Symbols

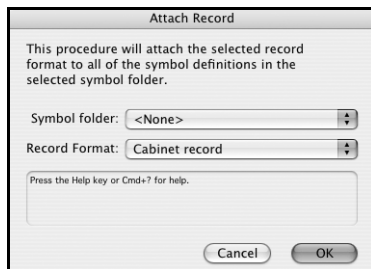
## Attaching Records

This command attaches the selected record format to all of the symbol definitions in a specified symbol folder.

To attach a record:

1. Select **Tools > Records > Attach Record**.

The Attach Record dialog box opens.



2. From the **Symbol Folder** list, select the criteria for attaching a record.

Select None to attach the record to the symbol definition(s) at the root of the symbol library (symbol definitions not in any folder). Select All to attach the record format to all of the symbol definition(s) in the file's symbol library. Selecting a symbol folder changes all of the symbol definitions only in that folder and any sub-folders.

3. From the **Record Format** list, select one of the record formats defined in the current file to be attached to the selected symbol definition(s).
4. Click **OK**.

Confirm the operation and the number of symbol definitions affected.

[Symbol instances already on the drawing are not affected.](#)

5. Click **OK**.

To quickly verify that a record has been attached to the symbol library, create a report. See “Creating Reports” on page 564.

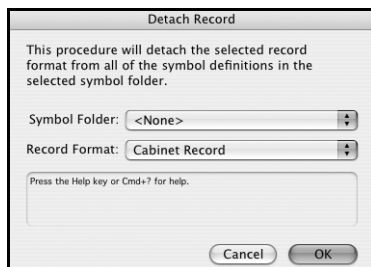
## Detaching Records

This command detaches the selected record format from all symbol definitions in a selected symbol folder.

To detach a record:

1. Select **Tools > Records > Detach Record**.

The Detach Record dialog box opens.





- From the **Symbol Folder** list, select None, All, or a symbol folder, if any.

Select None to detach the record from the symbol definition(s) at the root of the symbol library (symbol definitions not in any folder). Select All to detach the record format from all of the symbol definition(s) in the file's symbol library. Selecting a symbol folder changes all of the symbol definitions only in that folder and any sub-folders.

- From the **Record Format** list, select one of the record formats defined in the current file to detach from the symbol library.
- Click **OK**.

Confirm the operation and the number of symbol definitions affected.

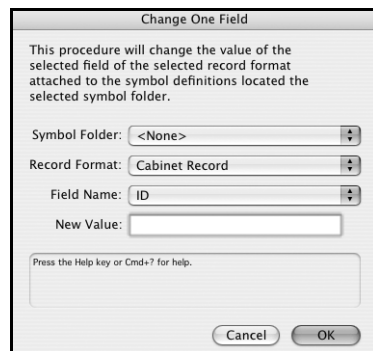
## Changing One Record Format Field

This command changes a specified field default value for a selected record format attached to symbol definitions. Symbols already placed on drawing are unaffected.

To change one record format field:

- Select **Tools > Records > Change One Field**.

The Change One Field dialog box opens.



- From the **Symbol Folder** list, select None, All, or a symbol folder, if any.

Select None to change the record of the symbol definition(s) at the root of the symbol library (symbol definitions not in any folder). Select All to change the record format of all of the symbol definition(s) in the file's symbol library. Selecting a symbol folder changes all of the symbol definitions only in that folder and any sub-folders.

- From the **Record Format** list, select the record format.

The **Field Name** selections depend on the record format selected.

- Select the **Field Name** to change.
- Enter the **New Value**.
- Click **OK**.

Confirm the operation and the number of symbol definitions affected.

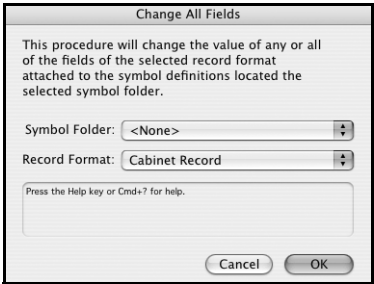
## Changing All Record Format Fields

This command changes several or all default field values for a selected record format attached to symbol definitions. Symbols already placed on drawing are unaffected.

To change several or all record format fields:

1. Select **Tools > Records > Change All Fields**.

The Change All Fields dialog box opens.

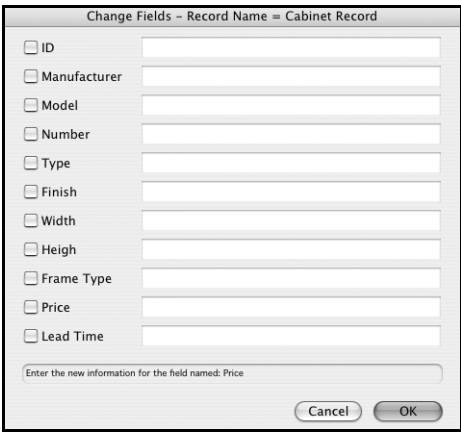


2. From the **Symbol Folder** list, select None, All, or a symbol folder, if any.

Select None to change the record of the symbol definition(s) at the root of the symbol library (symbol definitions not in any folder). Select All to change the record format of all of the symbol definition(s) in the file's symbol library. Selecting a symbol folder changes all of the symbol definitions only in that folder and any sub-folders.

3. From the **Record Format** list, select the record format.
4. Click **OK**.

The Change Fields dialog box opens. The title bar displays the name of the record being edited.



5. Select the field name(s) to change and enter the new information.

All of the field names of the record format are listed. If the record file has more than 16 fields, click **Next** to continue viewing the remaining fields in the record.

6. After making the desired changes, click **OK**.

Confirm the operation and the number of symbol definition(s) affected.

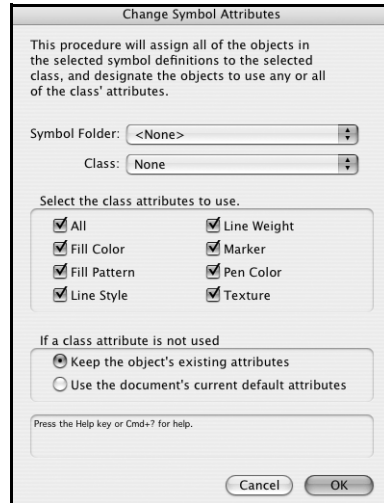
## Changing Symbol Attributes

This command assigns all of the objects within the selected symbol definitions to the specified class, and designates the objects to use any or all of the class attributes.

To change symbol attributes:

1. Select **Tools > Utilities > Change Symbol Attrs.**

The Change Symbol Attributes dialog box opens.



2. From the **Symbol Folder** list, select None, All, or a symbol folder, if any.

Select **None** to change the record of the symbol definition(s) at the root of the symbol library (symbol definitions not in any folder). Select **All** to change the record format of all of the symbol definition(s) in the file's symbol library. Selecting a symbol folder changes all of the symbol definitions only in that folder and any sub-folders.

3. Select the **Class** to assign the symbol definition.
4. Select the class attributes to use, and indicate how to treat class attributes that are not used.

Either keep the object's existing attributes, or use the current defaults if a class attribute is not specified.

5. Click **OK**.

Confirm the operation and the number of symbol definition(s) affected.

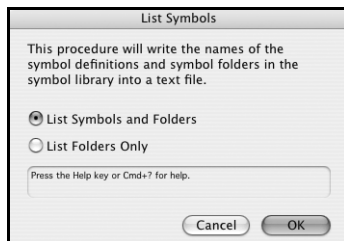
## Listing Symbols and Folders

This command creates a text file list all of the symbol definitions and symbol folders within the active drawing.

To list symbols and folders:

1. Select **Tools > Utilities > List Symbols.**

The List Symbol dialog box opens.



2. Select either **List Symbols and Folders** or **List Folders Only**.
3. Click **OK**.

The Save File dialog box opens.

4. Enter a new file name or use the default name, and then click **Save**.

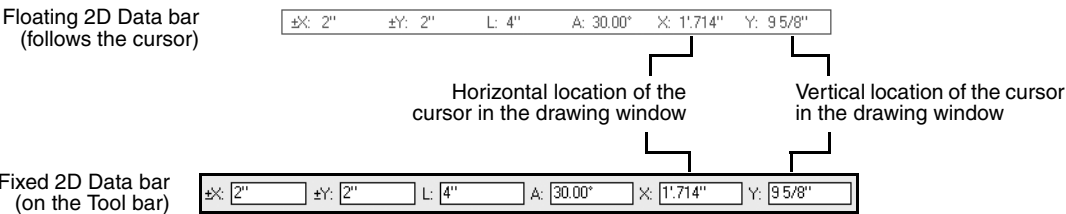
A text file is created listing the names of all the folders and, if chosen, symbols within the current file.

# Creating 2D Objects

VectorWorks provides robust 2D drafting functionality with a variety of tools and commands. 2D drawing tools create 2D objects; while these objects display in a 3D drawing view, they do not interact with the 3D environment. During walkthroughs and flyovers, 2D objects remain flat.

## Using the 2D Data Bar

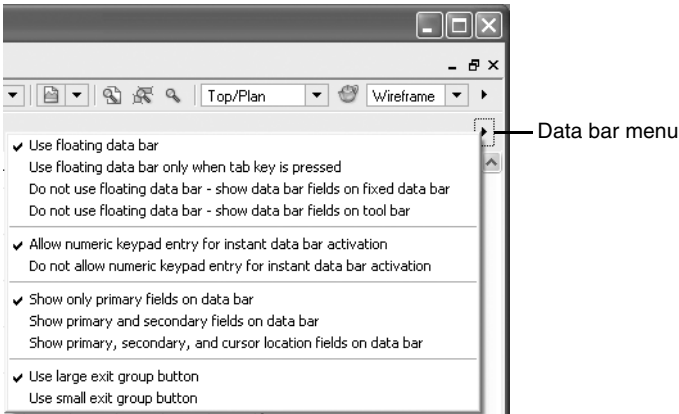
Use the Data bar when you draw to lock certain values for an object, such as the length of a circle radius or the angle of a wall. The fields that are available on the Data bar depend on the active tool and on the action being performed.



The data displayed in the bar is gathered from the feedback segment of the object being created. The coordinates are relative to a floating datum, if one exists; otherwise the coordinates are absolute. The more common Data bar fields are described in the following table; other fields that can display are described where their use is relevant.

Parameter	Description
Delta X	The offset distance from the previous click or position along the X axis
Delta Y	The offset distance from the previous click or position along the Y axis
L	The length or distance from 0,0, or the radius of the object that is being drawn
A	The angle or rotation of the object that is being drawn
X	The X (horizontal) location of the cursor in the drawing window
Y	The Y (vertical) location of the cursor in the drawing window

The Data bar is controlled by a menu on the far right side of the Tool bar.



Menu Command	Description
<b>Location of the Data bar</b>	
Use floating data bar	The Data bar “floats” with the cursor in the drawing area
Use floating data bar only when tab key is pressed	The Data bar floats with the cursor only when the Tab key is pressed; otherwise the bar does not display
Do not use floating data bar - show data bar fields on fixed data bar	The Data bar displays on the top left side of the window, at the top of the Tool bar
Do not use floating data bar - show data bar fields on tool bar	The Data bar displays on the right side of the Tool bar
<b>Activation of the Data bar</b>	
Allow numeric keypad entry for instant data bar activation	When the Data bar is displayed, enter numbers on the numeric keypad to activate the first field
Do not allow numeric keypad entry for instant data bar activation	When the Data bar is displayed, press the Tab key to activate the first field (press Shift+Tab to activate the last field)
<b>Field display on the Data bar</b>	
Show only primary fields on data bar	Show only the delta X and delta Y fields
Show primary and secondary fields on data bar	Show all fields except the cursor location fields (X and Y)
Show primary secondary, and cursor location fields on data bar	Show all fields
<b>Display of the Exit Group button</b>	
Use large exit group button	When a group is being edited, show a large button with the label <b>Exit Group</b> in the upper right corner of the drawing area
Use small exit group button	When a group is being edited, show a small button with an arrow icon in the upper right corner of the drawing area

## Drawing with the 2D Data Bar

To draw an object with the 2D Data bar:

1. Select a 2D drawing tool and click once to begin to draw the object.
2. Press the Tab key to activate the first field in the Data bar, or press Shift+Tab to activate the last field. Alternatively, if the Data bar options are set so that numeric keypad activation is enabled, you can type the value for the first field in the Data bar to activate it.  
[In click-drag mode, press and hold the mouse button when you press Tab or Shift+Tab.](#)
3. Enter values in the appropriate field(s), using the keys as follows.

Key	Action
Enter (Windows) or Return (Macintosh)	<ul style="list-style-type: none"><li>• When the focus is in a Data bar field, sets the value that is currently displayed, and moves the focus to the drawing area</li><li>• When the focus is in the drawing area, completes the object (or completes the current segment of the object, for path objects such as polygons, walls, and dimensions)</li></ul>
Tab	<ul style="list-style-type: none"><li>• When the focus is in a Data bar field, sets the entered value and moves to the next field (if no value was entered, the field is not set)</li><li>• When the focus is in the drawing area, moves the focus to the first field in the Data bar</li></ul>
Shift-Tab	<ul style="list-style-type: none"><li>• When the focus is in a Data bar field, sets the entered value and moves to the previous field (if no value was entered, the field is not set)</li><li>• When the focus is in the drawing area, moves the focus to the last field in the Data bar</li></ul>

To clear an entry before it is set, press the Backspace key. The previous value in that field redisplay.

If the SmartCursor option is enabled in VectorWorks preferences, a dotted line displays to represent the location of the values entered for the X and Y axes.

4. To complete the object according to the values you entered, click the mouse button. For non-path objects, you can also press Enter or Return to complete the object, if the focus is in the drawing area. For path objects, such as polygons, walls, and dimensions, you may need to click to complete the object.

## Inserting Text

VectorWorks allows both single lines and blocks of text to be created. Text can be moved, duplicated, duplicated in an array, and rotated. Its bounding box can be resized to adjust a block’s height or length. Text is placed relative to the alignment point, not the bounding box.

If a drawing is opened on a system that does not contain a specified font, a font mapping dialog box opens. Any missing fonts are mapped to a replacement font while the file is open on this system. If the file is saved with the new mapping, the original fonts are overwritten.

The **Text** tool has two modes.



Mode	Description
Horizontal Text	Creates horizontal text lines and text boxes
Rotated Text	Creates text at an angle

## Setting the Default Text Parameters

The initial (default) text parameters can be set. Once the default is set, all added text—in the current drawing or any other—has the specified font, size, style, justification, and line-spacing settings until the settings are changed.

To set default text settings:

1. Ensure that no objects or text are selected in the drawing.

If needed, click the selection arrow on an empty portion of the drawing.

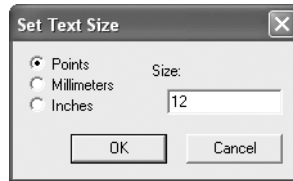
- From the **Text** menu, select the text options to change. See “Formatting Text” on page 189 for descriptions of available options.

Alternatively, the default text size can be changed from the **Set Size** command.

To specify the default text size:

- Ensure that no objects or text are selected in the drawing.  
If needed, click the selection arrow on an empty portion of the drawing.
- Select **Text > Size > Set Size**.

The Set Text Size dialog box opens.



- Select the desired unit of measure, enter the font **Size**, and then click **OK**.

If text or objects containing text are selected when changes are made in the Set Text Size dialog box, the size changes are applied to the selected items.

## Creating a Line of Text

Use the **Text** tool to create a single line of text, such as a page header, in the drawing file.

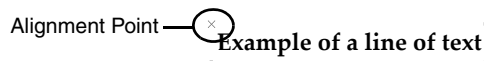


To type a single line of text:

- Click the **Text** tool from the Basic palette, and select **Horizontal Text** from the Tool bar.  
The text cursor indicates the alignment of the text to be placed.
- Click to designate the text insertion point; a text entry box with a blinking cursor displays.
- Enter the text.

To add another line of text to the drawing, move to a new location on the drawing, click and type the text.

When finished typing, deselect the **Text** tool by selecting another tool, such as the **2D Selection** tool. An X displays at the text insertion point. The X is only visible when the text is selected; it does not print.



Double-clicking on the text with the **2D** or **3D Selection** tool, or selecting **Edit** from the context menu, activates text editing mode.

## Creating Text Blocks

Create a block of text when more than a line of text is necessary.





To create a block of text:

1. Click the **Text** tool from the Basic palette, and select **Horizontal Text** from the Tool bar.

The text cursor indicates the alignment of the text to be placed.

2. Click and drag to create a text box of the approximate size needed.

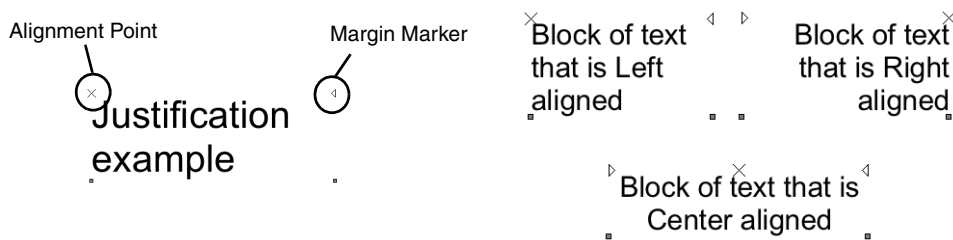
A text box displays, with a blinking cursor in the upper-left corner.

3. Enter the text.

Use hard returns to mark the end of a paragraph or section. VectorWorks automatically wraps text to the next line when it reaches the edge of a text box.

To add another text block, move to a new location, create another text box, and type the text.

When the text block is done, deselect the **Text** tool by selecting another tool, such as the **2D Selection** tool. An X displays at the text alignment point, and a triangular margin marker displays along the right, left, or both margins, depending upon justification. This clearly distinguishes between a line of text and a text block. These marks are only visible when the text is selected; the marks do not print.



Double-clicking on the text with the **2D** or **3D Selection** tool, or selecting **Edit** from the context menu, activates text editing mode.

## Creating Rotated Text

The Rotated Text mode of the **Text** tool creates text at an angle.



To create rotated text:

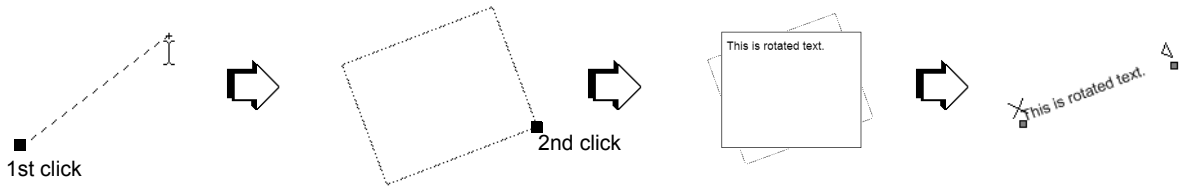
1. Click the **Text** tool from the Basic palette, and select **Rotated Text** from the Tool bar.
2. Click and hold the mouse to indicate the start point of text rotation.
3. Drag to specify the text angle, and release the mouse to set.

When drawing in rotated plan view (Design Series required), set **Constrain Angle** to snap to the plan rotation angle (see “Constrain Angle” on page 121) and display the Rotated Plan cue. If the text is created to the same angle as the plan, when the plan is unrotated, the text will align with the world coordinate system.

4. Drag to create the text box of the approximate size needed. Click to set.
5. A text box displays horizontally (regardless of the text angle), with a blinking cursor for text entry.
6. Enter the text.

Press **Enter** (Windows) or **Return** (Macintosh) to mark the end of a paragraph or section. VectorWorks automatically wraps text to the next line when it reaches the edge of a text box.

- When the text has been entered, deselect the **Text** tool by selecting another tool, such as the **2D Selection** tool. The text is rotated to the specified angle. See “Creating Text Blocks” on page 186 for information on justification, margins, and editing.



Double-clicking on the text with the **2D** or **3D Selection** tool, or selecting **Edit** from the context menu, activates text editing mode.

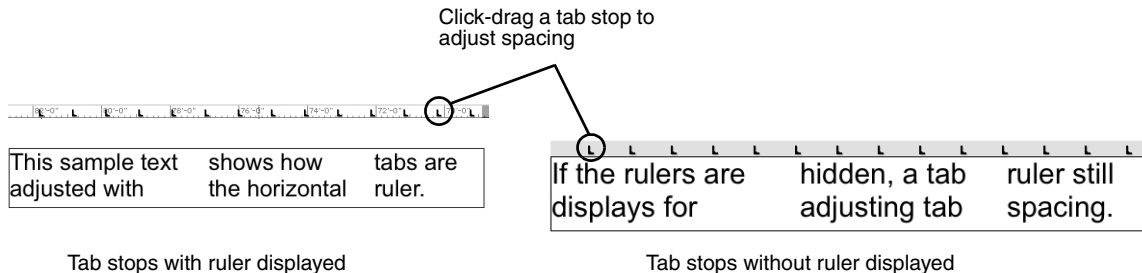
## Adding Tabs to Text

Left-aligned tabs can be inserted into text during creation and editing.



To add tabs to text:

- Click the **Text** tool from the Basic palette.
- Enter or edit the desired text.
- Press the Tab key to place tabs within the text.
- Click on a tab stop and drag it to adjust the spacing. Tab spacing is repeated equally throughout the text. Tab stops cannot be added or removed.



## Pasting Text

Text can be moved between VectorWorks files by selecting **Edit > Copy**, and then **Edit > Paste**. Text is added exactly as copied, including any VectorWorks-supported formatting. If a text block is first defined before pasting, the text pasted into the block is wrapped to fit within the text block.

When pasting text from a program other than VectorWorks, click on the drawing using the **Text** tool first. If text is pasted without first establishing an insertion point, each line of text is brought in as individual text blocks.

Embedded graphics are not supported and are removed when the text block is pasted into VectorWorks. In addition, multi-aligned text is converted to the current default alignment.

# Modifying Text

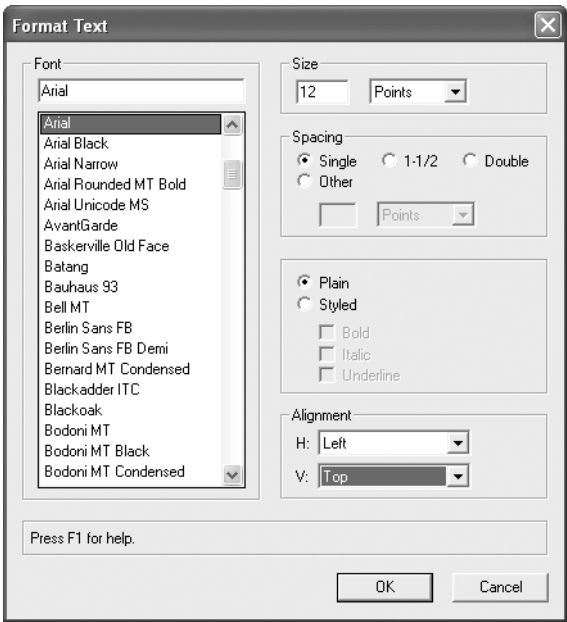
## Formatting Text

Text attributes can be formatted through various **Text** menu commands, such as the **Format Text** command, or through the Attributes and Object Info palettes. Formatting can be performed on entire blocks of text or just selected characters and words.

To format text:

- 1. Select the entire text box (handles mark the corners), a section of the text (click the **Text** tool and highlight the desired text by dragging over it in the text box), or a word (click the **Text** tool and double-click anywhere within the word).
- 2. From the **Text** menu, select the text option to be changed (for example, font, size, or style). Alternatively, select **Text > Format Text** to change any combination of font, size, style, spacing, and alignment in one dialog box.

Right-click on the text and select **Format Text** from the context menu.



Parameter	Description
Font	Displays font of currently selected or last formatted item(s) and lists all available, installed fonts. Select a font from the list, or type the first letter(s) of the desired font to highlight the closest match in the list. This field is blank when multiple items with different fonts are selected. Changes are applied to all selected items.
Size	Displays size and unit measurement (points, millimeters, or inches) of currently selected or last formatted item(s). Select a standard text size, or enter your own. This field is blank when multiple items with different size/unit measurement are selected. Changes are applied to all selected items.

Parameter	Description
Spacing	Displays line spacing of currently selected or last formatted item(s). If multiple items with different spacing are selected in the drawing, <b>Other</b> is selected in the dialog box and text boxes are enabled for user-specified spacing criteria. <b>Outline</b> and <b>Shadow</b> options are available for Macintosh only. Changes are applied to all selected items.
Style	Displays text style of currently selected or last formatted item(s). If multiple items with different styles are selected, all style fields are blank or deselected. Specify <b>Plain</b> or the desired <b>Styled</b> options. Changes are applied to all selected items.
Alignment	Displays alignment of currently selected or last formatted item(s). If multiple items with different alignments are selected, <b>Alignment</b> fields are blank. Specify horizontal and vertical alignment. Changes are applied to all selected items.

Capitalization can only be changed through **Text > Capitalization**. Choose from lowercase, uppercase, or title case options.

Apply color to any text by highlighting it and choosing a solid pen color from the Attributes palette (see “The Attributes Palette” on page 229).

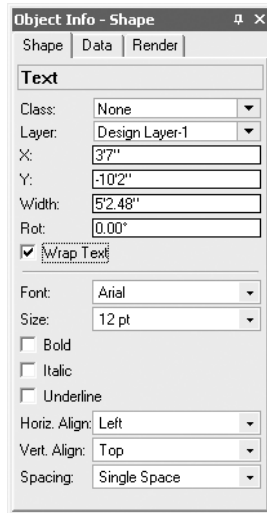
Additionally, the Object Info palette allows text objects to be moved along the X and/or Y axis. Select single or multiple text objects (without selecting other types of objects), and change the values in the **X** and/or **Y** field.

Recent Font List

VectorWorks stores recently-used fonts for quick access. When selecting **Text > Font**, the eight most recently-used fonts display at the top of the font list (with the most recent font listed first), followed by an alphabetical list of all available fonts. In addition, when the Object Info palette contains a **Font** field, the top of the drop-down list is populated with the eight most recently-used fonts, followed by an alphabetical list of the available fonts. Fonts changes made within the Format Text dialog box or Object Info palette also update the recent font list.

Wrapping Text

Text wraps automatically in text blocks, even if the text block is resized. To rewrap the text, select **Wrap Text** in the Object Info palette. **Wrap Text** can also be used to unwrap text in a block that has not been resized.



This is an example of wrapped text

This is an example of unwrapped text

## Creating Reversed Text

Create reversed text by adding a filled object and placing white text over it.

Text

To create reversed text:

1. Select **Tools > Options > VectorWorks Preferences**.

In the VectorWorks Preferences dialog box that opens, select the Display tab, select **No fill behind text**, and then click **OK**.

2. Create a rectangle that is slightly larger than the reversed text to be created.
3. Use the Attributes palette to change the rectangle's fill to black or any other dark color.
4. Click the **Text** tool from the Basic palette.
5. Type the text.
6. Use the Attributes palette to change the pen color of the text to white (or another reverse color).
7. Drag the white text on top of the filled rectangle.

If necessary, change the stacking order so that the text is truly on top of the rectangle.

Reverse text can also be created by setting the fill color of a text block to black and the pen color to white. Add a space before and after the text to extend the box.

## Converting TrueType Text to Polylines

The **TrueType to Polyline** command converts text created with any TrueType font into polylines. After it is converted, the text is no longer a font and can be edited just like any other polyline. This is useful when creating 3D text objects. By their nature, TrueType fonts are defined by Bézier curves and arc points. VectorWorks uses these same definitions when converting them.

The text conversion is not affected by the conversion resolution setting in the VectorWorks Preferences dialog box. However, if the converted polyline is extruded, the 3D resolution setting in this same dialog box affect how VectorWorks extrudes the polyline.



To convert TrueType text to polylines:

1. Select the text (lines or blocks) to convert.

2. Select **Text > TrueType to Polyline**.

The text is converted into a group of polylines.

3. To extrude the polylines, creating 3D text, select the group of polylines. Ungroup them by selecting **Modify > Ungroup**.

4. Select all of the individual polylines and select **Model > Extrude**.

The Create Extrude dialog box opens.

5. Specify the extrusion length and click **OK**.

## Creating Text Along a Path

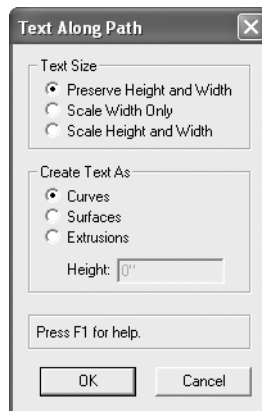
Selected 3D text can be placed along a path and the text appearance can be adjusted after placement.

To create 3D text along a path:

1. Select the text and a path object. The path must be long enough for the text, or text along path conversion will not occur.

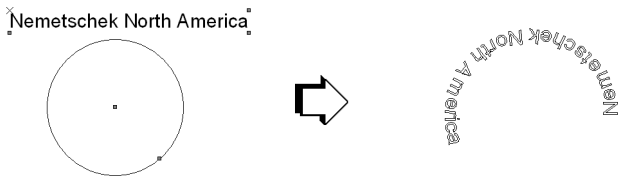
2. Select **Text > Text Along Path**.

The Text Along Path dialog box opens. Specify the options for creating the text along the path.



Parameter	Description
Text Size	Specifies text size options
Preserve Height and Width	Maintains the aspect ratio of the text, keeping width and height parameters the same as they were in the original text
Scale Width Only	Changes the width of the text to fit the path, but does not change the height accordingly (resulting in wider, shorter text, depending on the path)
Scale Height and Width	Changes the width of the text to fit the path, and then changes the text height to match (resulting in wider, tall text, depending on the path)
Create Text As	Specifies the format for converting the text
Curves	Converts the text into a group of polylines (if the path is drawn on the ground plane) or NURBS curves (if the path has a Z height or a <b>Rot about Path</b> greater than 0)
Surfaces	Converts the text into a group of NURBS surfaces
Extrusions	Converts the text into a group of extrude objects; specify the <b>Height</b> of the extruded letters

3. Click **OK**. The selected text follows the path object, and the original path object is deleted.



The Text Along Path parameters can be edited in the Object Info palette. The parameters are identical to those in the Text Along Path dialog box, with two additional parameters.

Parameter	Description
Above Path	Places the bounding box of the letters directly above the path; “above” depends on the direction that the path was drawn. Deselect this option to place the letters “below” the path. Depending on the path and letters, the appearance of the text may be improved by switching it above or below the path.
Rot about Path	Indicates the angle of rotation about the path, using the path as a rotation axis

The path object can be edited by selecting **Modify > Edit Group**, and then selecting Path. The path object can be edited with the **3D Reshape** tool. The direction of the path object can be reversed by clicking **Reverse Direction**; this affects the text placement above or below the path.

## Checking Spelling

Check the spelling of either selected text or all the text in a file with the **Check Spelling** command. Available dictionaries include:

- Danish
- Dutch
- English (American)
- English (British)
- Finnish
- French
- German
- Italian
- Norwegian
- Portuguese (Brazilian)
- Portuguese (Iberian)
- Spanish
- Swedish

Dictionaries can be edited and added. See “Adding and Editing Dictionaries” on page 196.

## Checking the Spelling

To check the spelling of a selected object, such as a text block:

1. Select the object.
2. Select **Text > Check Spelling**.  
*Alternatively, right-click on the text and select **Check Spelling** from the context menu.*
3. If a spelling error is detected, the Selection Spelling Check dialog box opens so that corrections can be made.

To check the spelling of all objects in the file:

1. Do not select any objects.
2. Select **Text > Check Spelling**.

The Spelling Check Filter dialog box opens.



Parameter	Description
Text Blocks	Checks text contained in text blocks
Symbols	Checks text contained in symbol definitions
Records	Checks text contained in records
Worksheets	Checks text contained in worksheets
Viewports	Checks text annotations contained in viewports

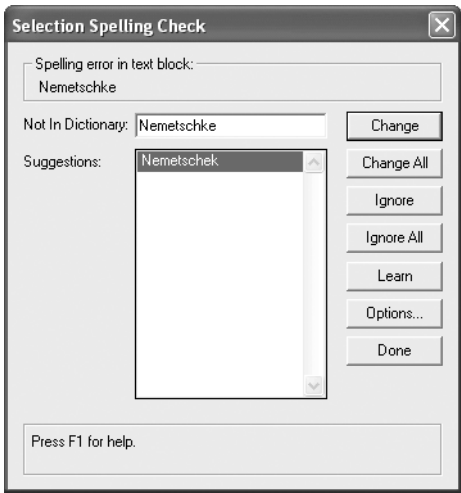


- 3. Select the items to have spelling checked, and then click **OK**. If a spelling error is detected, the Document Spelling Check dialog box opens so that corrections can be made.

If no spelling errors are detected, a message displays to indicate that the spelling check is complete.

Correcting Spelling Errors

If a spelling error is found, either the Selection Spelling Check (when checking a selection) or the Document Spelling Check (when checking all text) dialog box opens. Both dialog boxes contain the same options.



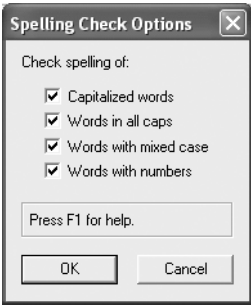
Parameter	Description
Spelling error in	Identifies the location of the object containing the potential spelling error
Not in Dictionary	Lists the potentially misspelled word; if none of the suggested corrections in the <b>Suggestions</b> list is an acceptable replacement, type the correction into the <b>Not in Dictionary</b> field (or delete the word by leaving the field blank). Then click <b>Change</b> or <b>Change All</b> to replace the error with the typed word. The word is replaced and the spelling check resumes.
Suggestions	Suggests the closest matching word(s) from the dictionary
Change / Change All	Select one of the suggested words from the list of <b>Suggestions</b> to replace the misspelled word and click <b>Change</b> . The misspelled word is replaced with the suggested word. Alternatively, press Enter with the suggestion selected. To replace all occurrences of the same error in the file, click <b>Change All</b> . The word is replaced and the spelling check resumes.
Ignore / Ignore All	If the word is spelled correctly, but it is not present in the dictionary, click <b>Ignore</b> to leave the word as is and continue the spelling check. Click <b>Ignore All</b> to ignore all occurrences of the word in the file. The word is ignored and the spelling check resumes.
Learn	Click to add the word to the dictionary; this allows the spelling checker to recognize all future occurrences of the word

Parameter	Description
Options	Click to customize the spelling check options; see “Spelling Check Options” on page 196
Done	Click to discontinue the spelling check; all changes up to that point are saved, but can be undone by selecting <b>Edit &gt; Undo</b>

The spelling of layers, classes, symbol names, object names, script palette names, dimension text, locked objects or records attached to locked objects is not checked.

### Spelling Check Options

Click the **Options** button in the Spelling Check dialog box to customize the spelling check function. The Spelling Check Options dialog box opens.



Specify the types of misspelled words for the spelling checker to find. If a checkbox is not selected, the spelling checker ignores errors for that category of words. Examples include:

- Capitalized words: Canada
- Words in all caps: ANGLE
- Words with mixed case: VectorWorks
- Words with numbers: Q4

Customize the spelling checker to reduce unnecessary spelling checks in your typical files. Click **OK** to return to the Selection Spelling Check or Document Spelling Check dialog box.

### Adding and Editing Dictionaries

The user dictionary, UserDictionary.txt, is a text file located in [VectorWorks]\Plug-ins\Dictionaries. It can be edited, if desired. When manually editing a dictionary, type the word followed by a tab and the letter “i” to indicate that the spelling checker should ignore the word.

Additional dictionaries, such as a foreign language dictionary, can be added by placing the dictionary file into the [VectorWorks]\Plug-Ins\Dictionaries folder. The spelling checker automatically uses all the dictionaries with the .clx extension in the folder to check the spelling. However, the addition of multiple dictionaries can slow down the spelling check process. Additional dictionaries are available on the VectorWorks downloads page of [www.nemetschek.net](http://www.nemetschek.net)

### Finding and Replacing Text

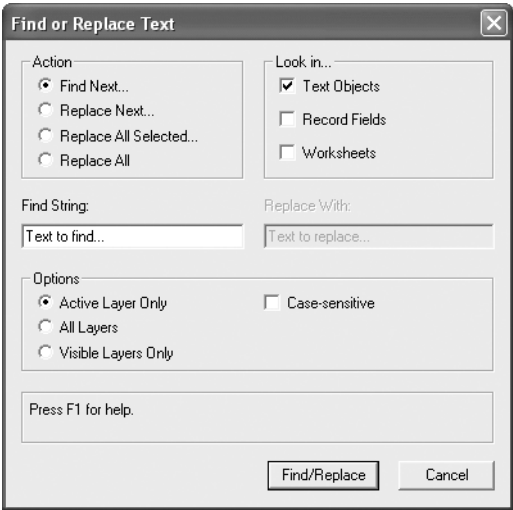
The **Find-Replace Text** command searches for and optionally replaces text strings within a VectorWorks file. It can search for and replace text strings within text objects, record fields, and worksheet cells.

Use this command to find a text item, replace it, search for more occurrences, or replace all occurrences. All settings are retained from one use to the next, including find and replace text strings.

To find-replace text:

- 1. Select **Text > Find-Replace Text**.

The Find or Replace Text dialog box opens.



Parameter	Description
Action	Locates and, if selected, replaces a given text string with a new text string
Find Next	Finds the next occurrence of the text string
Replace Next	Replaces the next occurrence of the text string
Replace All Selected	Replaces all selected occurrences of the text string
Replace All	Replaces all occurrences of the text string
Look in	Searches for occurrences in the specified parts of the document
Text Objects	Searches in all text objects
Record Fields	Searches in all record fields, including Callout objects
Worksheets	Searches in all worksheets; appears dimmed if <b>Replace All Selected</b> is chosen, since there is no selection attribute for a worksheet
Find String	Enter text string to search for
Replace With	Enter replacement text string; dimmed if <b>Find Next</b> is selected
Options	Specifies the depth of the search
Active Layer Only	Searches in the active layer only
All Layers	Searches on all layers within the document, regardless of visibility

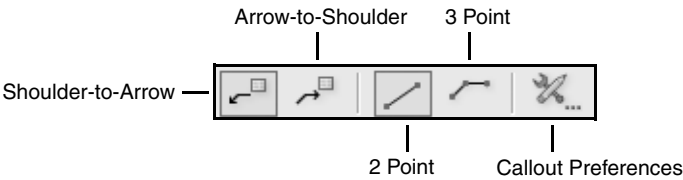
Parameter	Description
Visible Layers Only	Searches in all currently visible layers
Case-sensitive	Searches for text that exactly matches the criteria, including capitalization

- 2. Enter the desired search and, if using, replace criteria.
- 3. Click **Find/Replace**.

## Inserting Callouts


The **Callout** tool places callout objects on a drawing. A callout object is a block of text attached to a leader line with an optional bubble surrounding the text. Use callout objects to annotate items in a file.

In the Design Series, the **Callout** tool includes extended capabilities which allow it to be used for keynotes, and in conjunction with an external notes database (see “Notes Management” on page 547 in the VectorWorks Design Series User’s Guide).

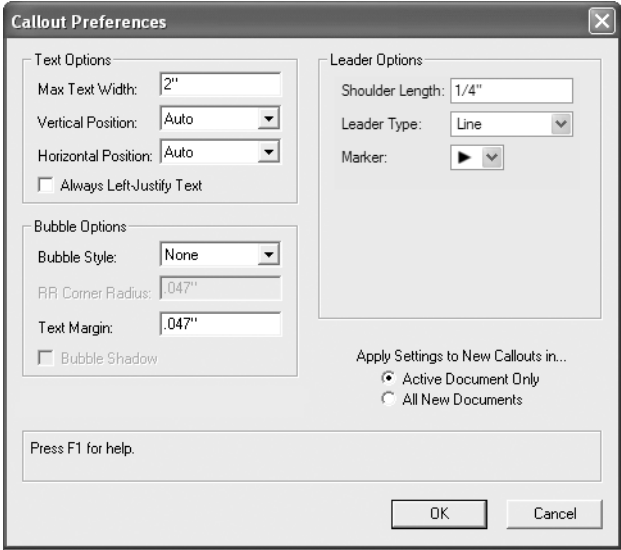


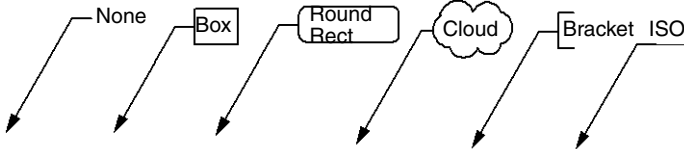
Mode	Description
Shoulder-to-Arrow	Click first where the callout text is to be placed, and then near the object to be annotated
Arrow-to Shoulder	Click first near the object to be annotated, and then where the callout text is to be placed
2 Point	Two clicks are required to place the callout object; in 2 Point mode, the length of the shoulder is determined in the callout preferences or Object Info palette
3 Point	Three clicks are required to place the callout object; in 3 Point mode, the third click determines the length of the shoulder
Preferences	Opens the Preferences dialog box

## Creating a Callout Object

 To create a callout object:

- 1. Click the **Callout** tool from the Basic palette.
- 2. Click the **Preferences** button on the Tool bar. Specify the callout object preferences, which apply to new callouts created either in this file or all files. These parameters can be changed later for a selected callout object in the Object Info palette.

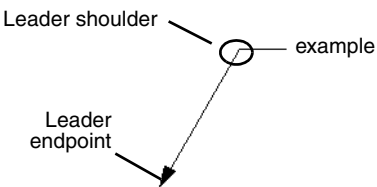


Parameter	Description
Text Options	
Max. Text Width	Indicates the maximum text width before text wraps; if the text string is shorter than maximum width, the bubble sizes to fit the text
Vertical Position	Sets the vertical position of the text relative to the shoulder; select <b>Auto</b> to align the top text line to the shoulder if the leader is on the left, or to align the bottom text line to the shoulder if the leader is on the right
Horizontal Position	Sets the horizontal position of the text relative to the shoulder; select <b>Auto</b> to position the text to the right if the leader is on the left, or to the left if the leader is on the right
Always Left-Justify Text	Forces the text to be left-justified, even when the text is to the left of the leader
Bubble Options	
Bubble Style	Select the type of bubble to draw around the text 
RR Corner Radius	For Round Rect bubble styles, sets the corner radius
Text Margin	Sets the distance between the bubble and the text
Bubble Shadow	Select to draw the bubble with a drop shadow (does not apply to None, Bracket, or ISO styles)

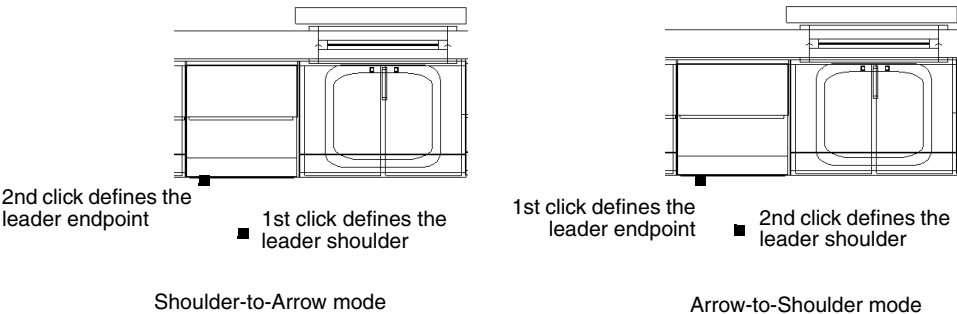
Parameter	Description
Leader Options	
Shoulder Length	Sets the length of the line between the text and the start of the leader; can be changed by moving a control point or in the Object Info palette. In 3 Point mode, this length is set by the third mouse click.
Leader Type	Select Line, Arc, or Bézier; curved leader lines contain additional control points for controlling the curve shape
Marker	Select a marker style from the marker style list, or select <b>Custom</b> to create a custom marker. Select <b>Edit Marker List</b> to open the Edit Marker List dialog box; see “Setting Default Marker Types” on page 60.
Apply Settings to New Callouts in	Select whether these callout preferences should apply to new callouts in this file only or globally, to all future files

- 3. Click **OK** to set the callout preferences.
- 4. Click the desired insertion modes from the Tool bar, and then click in the drawing to select the insertion point of the callout object.

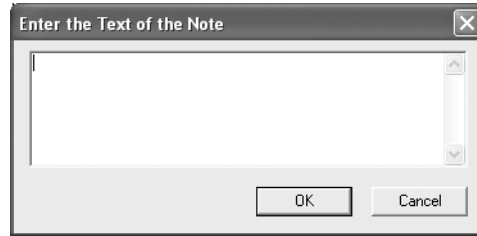
Depending on the mode, the first click defines the leader shoulder or the leader endpoint.



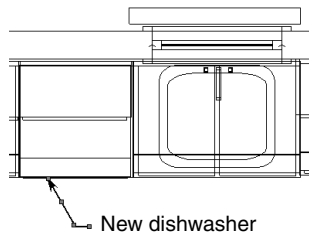
- 5. Click again to determine either the leader endpoint or leader shoulder, depending on the mode.



- 6. If in **3 Point** mode, click a third time to define the shoulder length.
- The Enter the Text of the Note dialog box opens. Enter the callout object text; text wraps if longer than the specified maximum text width. Press Enter to add a carriage return.



- Click **OK** to create the callout object in the drawing.



## Editing a Callout Object

### Editing Callout Text

To edit the text of an existing callout object:

- Select the callout object to edit.
- Either double-click on the callout object with the **2D Selection** tool, or click **Edit Note** from the Object Info palette.

The Enter the Text of the Note dialog box opens.

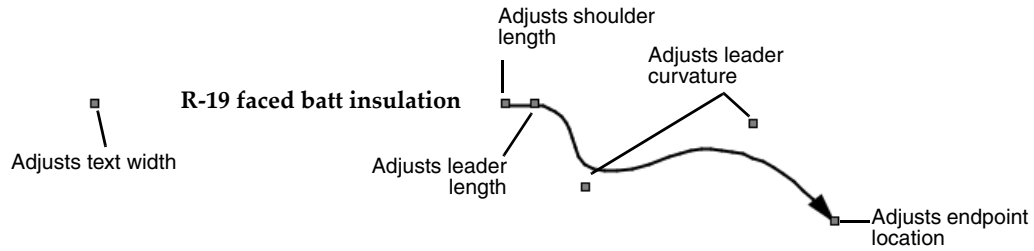
- Enter the desired text changes.
- Click **OK**.

The callout text attributes are editable by the **Format Text** command; line weight and marker style can be modified through the **Attributes** palette.

### Editing Callout Parameters

To edit the callout properties:

- Select the callout object.
- In the Object Info palette, change the parameters as desired. The parameters are described in “Creating a Callout Object” on page 198. An additional parameter that is available in the Object Info palette is **Leader Length**, which allows the length of the leader line to be specified precisely with numeric values rather than with the mouse.
- On the drawing, a callout object contains control points which can be moved with the mouse to change the callout text width, shoulder length, and endpoint position. A curved callout leader includes additional control points for adjusting the leader curvature.



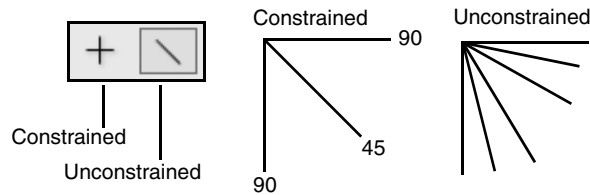
## Re-scaling Callout Objects

Callout objects are specified and drawn in page scale; they draw to the same apparent size, regardless of the layer scale. If the layer the callout object is on is re-scaled, or the callout object is cut and pasted between layers of different scales, the callout object automatically re-scales.

## Creating Lines

### Creating Single Lines

Single lines created with the **Line** tool can be drawn constrained to certain angles or unconstrained.



To create single lines:

1. Click the **Line** tool from the Basic palette.
2. Click either the **Constrained Line** or the **Unconstrained Line** mode button.

Constrained lines are drawn at 30°, 45°, and 90° angles, and their complements are drawn in increments of 30°, and 45°.

Unconstrained lines can be drawn at any angle.

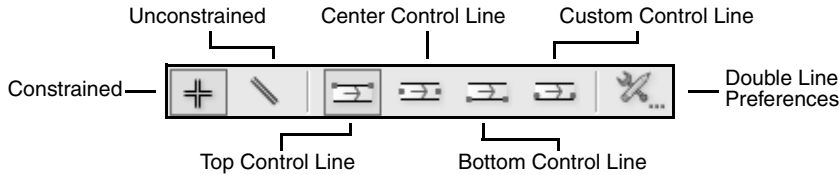
[Press and hold the Shift key while drawing a line in Unconstrained mode to snap the line to predetermined angles.](#)

3. Click at the line's start point.
4. Click at the line's end point.

### Creating Double Lines

The **Double Line** tool creates a wide variety of constrained and unconstrained double lines. Set the width between the double lines, the offset from the cursor, and whether to create components between the double lines.





To create double lines:

1. Click the **Double Line** tool from the Basic palette.
2. Click either the **Constrained Double Line** or the **Unconstrained Double Line** mode button.

Constrained lines are drawn at 30°, 45°, and 90° angles, and their complements are drawn in increments of 30°, and 45°.

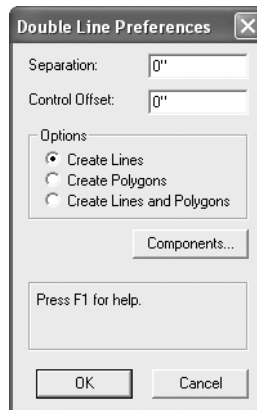
Unconstrained lines can be drawn at any angle.

Press and hold the **Shift** key while drawing a line in **Unconstrained** mode to snap the line to predetermined angles.

3. Click the desired **Offset** mode button to specify the offset method.

Offset Mode	Description
Top Control Line	Cursor creates the right line
Center Control Line	Lines are equidistant from the line drawn by the cursor
Bottom Control Line	Cursor creates the left line
Custom Control Line	Specify an offset value from the line drawn by the cursor

4. Click **Double Line Preferences** and set the preferences.



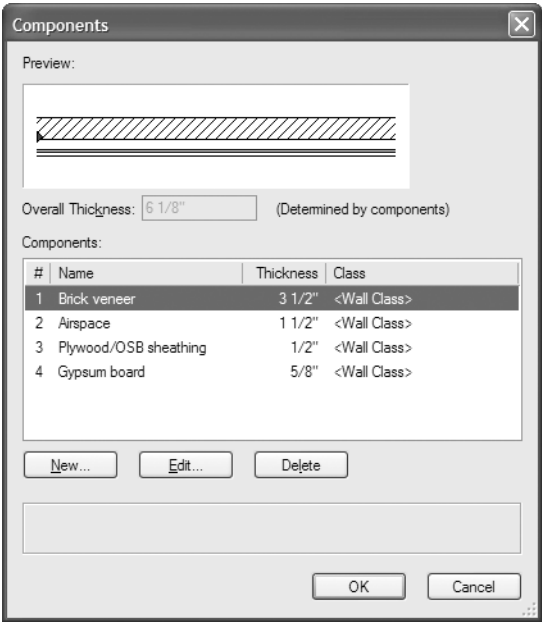
Parameter	Description
Separation	Distance between the double lines
Control Offset	For Custom Control line mode, enter the distance from the top/right line of the cursor
Create Lines	Creates parallel lines
Create Polygons	Creates a double-line polygon with closed ends
Create Lines and Polygons	Creates parallel lines with a polygon between them; the polygon has a line weight of zero
Components	Click to define components between the double lines (see “Applying Components Between Double Lines” on page 204)

- 5. Click **OK** to accept the changes.
- 6. Click at the double line’s start point.
- 7. Click at the double line’s end point.

### Applying Components Between Double Lines

To apply a component between the double lines:

- 1. In the Double Line Preferences dialog box, click **Components**.  
The Components dialog box opens.



Parameter	Description
Preview	Displays a preview of the components between the double lines, including the defined components; the preview is drawn from left to right, so the “top” of the preview, by default, indicates the left part of the double lines as they will be drawn. The arrow shows the drawing direction.
Overall Thickness	The thickness of the double line with components is defined by the sum of the component thicknesses
Components	Lists the components that form the structure of the double line, in order from left to right as displayed in the preview. To change the order of a component, click and drag within the # column.
New	Click to define the components between the double lines; see “Creating Wall Components” on page 480
Edit	Opens the Component Attributes dialog box to edit the selected component’s thickness and attributes (you can also double-click on a component to open the Component Attributes dialog box)
Delete	Deletes the selected component; the double line thickness is adjusted accordingly

2. When the components have been defined, click **OK**.

## Creating a Break Line

The **Break Line** tool creates one of three types of break lines: straight, curved, or arc.



To draw a break line:

1. Click the **Break Line** tool from the Dims/Notes tool set.
2. Click in the drawing to place the break line and drag to indicate the line length. Click again to set the end of the break line.

If this is the first break line placed in this session, the Break Line Object Properties dialog box opens. The settings displayed apply to all break lines created during this session and can be edited in the Object Info palette after placement.

3. Click **OK**.



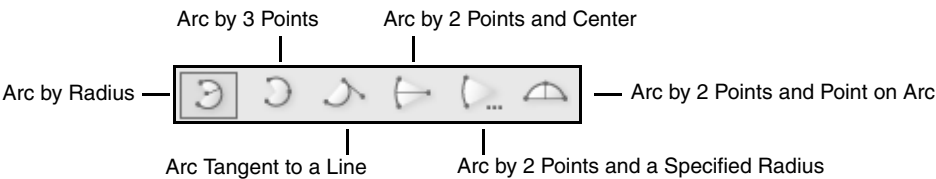
4. The break line parameters can be edited in the Object Info palette.

Parameter	Description
Break Style	Selects the style of the break line (Straight, Curved, or Arc)
Break Width	Indicates the width of the break only

Parameter	Description
Break Height	Indicates the height of the break only
Break Radius	Sets the radius of the break only
Number of Breaks	Indicates whether a single or multiple break should be drawn

Creating Arcs


The **Arc** tool, which creates circular arcs of any angle, has six modes. Create an arc by radius, three points, tangent, two points and center, two points and radius, or two end points and another point on the arc.



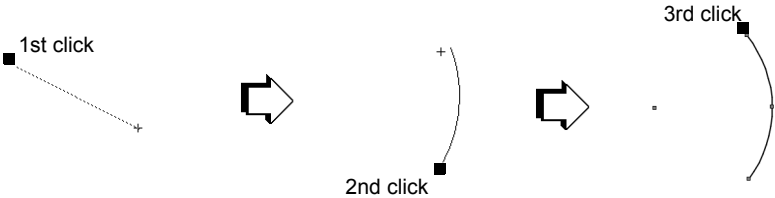
Either drag the mouse to draw the arc or use the Data bar to enter an angle. Degrees start on the positive X axis (the “East” direction), and increase going counter-clockwise. (“East” is 0 degrees; “North” is 90 degrees; and “West” is 180 degrees.) To draw a quarter-circle wall beginning at 0 degrees and ending at the 6 o’clock position, enter -90 (minus 90) degrees. Enter 270 to draw an arc three-quarters of a circle around.

To edit an arc, click the middle handle with the 2D Selection tool and drag to change the arc radius. Press the Option key (Macintosh) or Alt key (Windows) to change the arc’s size.

Arc by Radius

 To create an arc by radius:

- 1. Click the **Arc** tool from the Basic palette.
- 2. Click the **Arc by Radius** mode button.
- 3. Click to set the center of the arc.
- 4. Click the start point of the arc. Move the mouse until the desired arc orientation and size is previewed.
- 5. Click to set the end point of the arc.

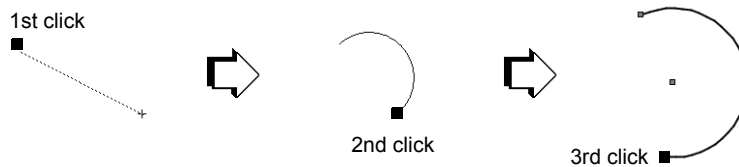


## Arc by 3 Points



To create an arc by three points:

1. Click the **Arc** tool from the Basic palette.
2. Click the **Arc by 3 Points** mode button.
3. Click to set the start point of the arc.
4. Click to set the point for the arc to pass through. Move the mouse until the desired arc orientation and size is previewed.
5. Click to set the end point of the arc.

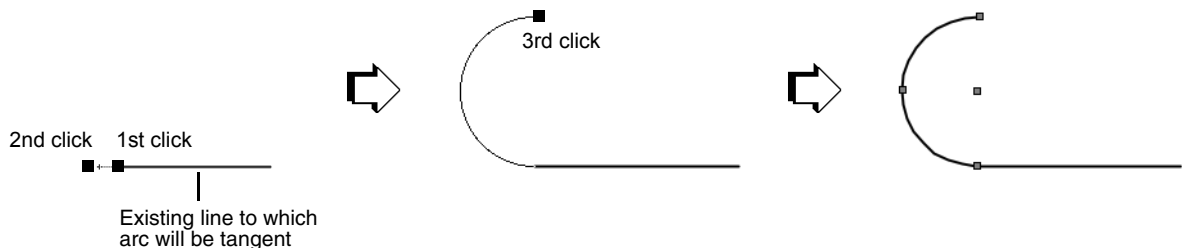


## Arc Tangent to a Line



To create an arc by tangent:

1. Click the **Arc** tool from the Basic palette.
2. Click the **Arc Tangent to a Line** mode button.
3. Click to set the start point of the arc.
4. Click to define the line to which the arc will be tangent. Move the mouse until the desired arc orientation and size is previewed.
5. Click to set the end point of the arc.



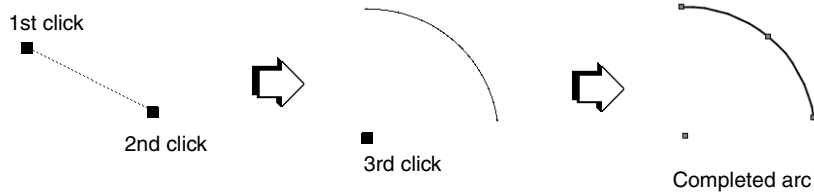
## Arc by 2 Points and Center



To create an arc by 2 points and center:

1. Click the **Arc** tool from the Basic palette.
2. Click the **Arc by 2 Points and Center** mode button.

3. Click to set the start point of the arc.
4. Click to set the end point of the arc.  
As the cursor moves, the center of the arc is manipulated.
5. Click outside the arc to set the center.



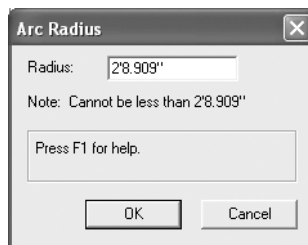
## Arc by 2 Points and a Specified Radius



To create an arc by 2 points and a specified radius:

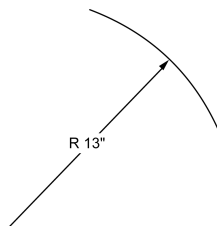
1. Click the **Arc** tool from the Basic palette.
2. Click the **Arc by 2 Points and a Specified Radius** mode button.
3. Click to set the start point of the arc.
4. Click to set the end point of the arc.

The Arc Radius dialog box opens.



5. Enter the length of the radius.
6. Click **OK**.

The arc is created.

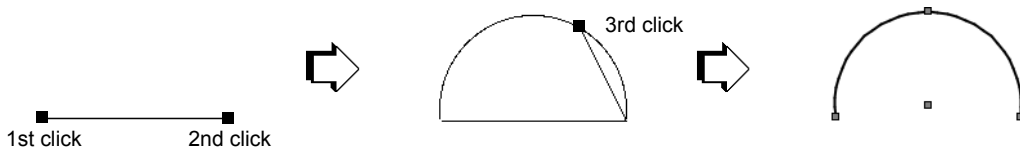


## Arc by 2 Points and a Point on the Arc

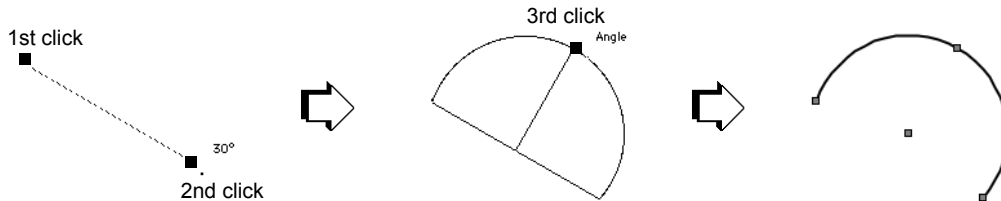


To create an arc by two end points and another point on the arc:

1. Click the **Arc** tool from the Basic palette.
2. Click the **Arc by 2 Points and Point on Arc** mode button.
3. Click to set the start point of the arc.
4. Click to set the end point of the arc.
5. Move the mouse until the desired arc shape and size is previewed, and then click to set the arc. To constrain the angle of the line between the arc endpoints, press the Shift key when drawing the arc.



Without the Shift key, the angle of the line between the arc endpoints (1st and 2nd clicks) is unconstrained, and the chord defining the arc height is an unconstrained line drawn from the second endpoint



When the Shift key is pressed, the angle of the line between the arc endpoints (1st and 2nd clicks) is constrained, and the chord defining the arc height is perpendicular to the center of that line

## Creating Quarter Arcs

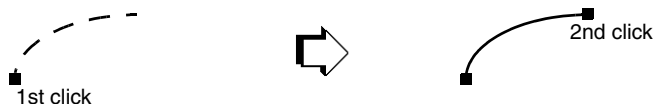
The **Quarter Arc** tool creates circular 90° arcs or 90° elliptical arc polyline objects.

[Quarter arcs are listed as polylines in the Object Info palette.](#)

To create quarter arcs:

1. Click the **Quarter Arc** tool from the Basic palette.
2. Click at the start point for the arc.
3. Click at the end point for the arc.

[The ratio of the arc's height to its width displays in the Data bar \(a quarter arc for a circle has a ratio of 1.000\). Use the Data bar to verify or modify an arc's angle, length, and location in a drawing.](#)



## Creating Rectangles

### Creating Rectangles

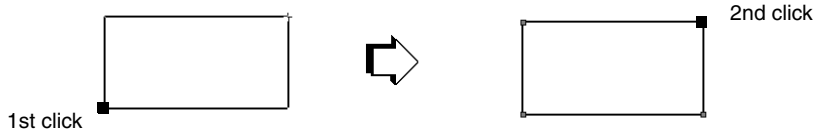
The **Rectangle** tool can be used to create a rectangular or rotated rectangular shape.

Two modes are available.



To create a rectangle:

1. Click the **Rectangle** tool from the Basic palette, and click **Rectangle** from the Tool bar.
2. Click at the rectangle's start point. Move the mouse until the desired rectangle orientation and size is previewed.
3. Click at the rectangle's end point.

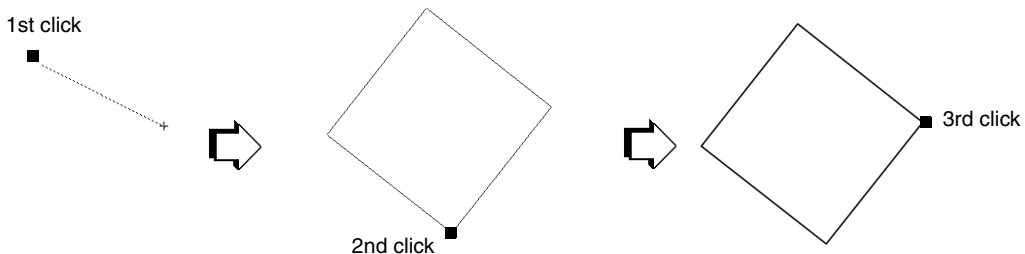


To create a square, press and hold the Shift key while drawing with the **Rectangle** tool.

### Creating Rotated Rectangles

Rotated rectangles are rectangles that are rotated at a specified angle.

1. Click the **Rectangle** tool from the Basic palette, and click **Rotated Rectangle** from the Tool bar.
2. Click to set the start of the rectangle. Move the mouse to set the rotated rectangle angle.
3. Click to set the rectangle rotation angle. Move the mouse until the desired rotated rectangle size is previewed.
4. Click to create the rotated rectangle.



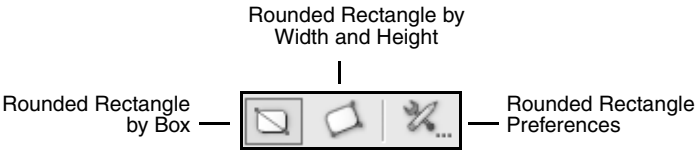
### Creating Rounded Rectangles

Rounded rectangles can be created with symmetrical and/or proportional corners. VectorWorks' default is set for proportional corners. This creates rectangles with corners that always round to be one third of both the X and the Y lengths. Symmetrical corners have the same X and Y measurements for the rounded corners. Rounded rectangles with




both symmetrical and proportional corners have the same horizontal and vertical arc lengths. Rounded rectangles can also be created using exact X and Y measurements.

Two modes are available.



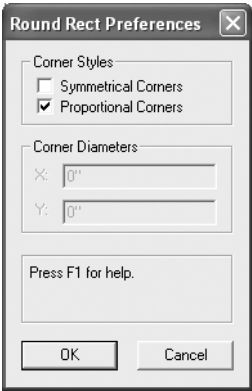
Mode	Description
Rounded Rectangle by Box	Defines the dimensions of the box containing the rounded rectangle
Rounded Rectangle by Width and Height	Defines the height and width lengths to create the rounded rectangle, which can be rotated if desired



Rounded Rectangle by Box

 To create rounded rectangles by box:

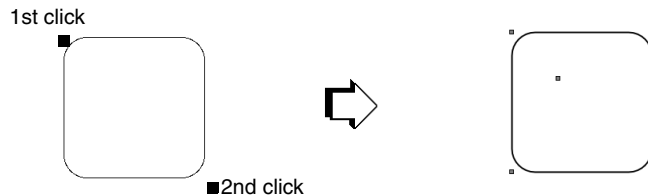
1. Click the **Rounded Rectangle** tool from the Basic palette, and click **Rounded Rectangle by Box** from the Tool bar.
2. Click the **Preferences** button.

The Round Rect Preferences dialog box opens.



Parameter	Description
Corner Styles	Select to use either symmetrical and/or proportional corners <div>   </div> <div> Symmetrical corners Proportional corners </div>
Corner Diameters	Alternatively, type in the precise corner X and corner Y measurements

3. Click **OK**.
4. Click to set the start point.
5. Click to set the end point of the rectangle.

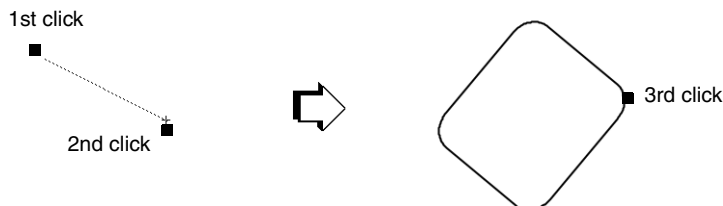


## Rounded Rectangle by Width and Height



To create rounded rectangles by width and height:

1. Click the **Rounded Rectangle** tool from the Basic palette, and click **Rounded Rectangle by Width and Height** from the Tool bar.
2. Set the rounded rectangle preferences as described in “Rounded Rectangle by Box” on page 211.
3. Click to set the start point.
4. Click to define the rounded rectangle rotation angle and width.
5. Click to define the rounded rectangle height.



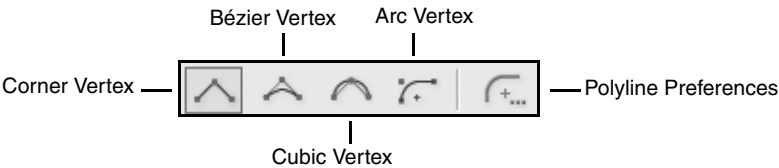
## Creating Polylines

### Polyline Tool


The **Polyline** tool creates open and closed polylines—objects made of a series of connected arcs, curves, or lines.

While drawing a polyline, the type of control point, or vertex, for each segment can be set either by clicking on the desired mode while drawing or using the keyboard shortcuts (see “Creating or Editing a Workspace” on page 719) to select the desired mode. A polyline can have different combinations of vertices.

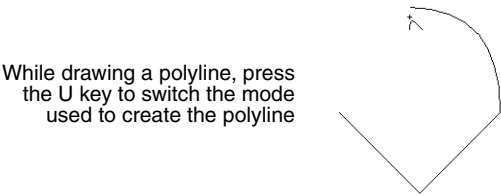
The corners of the polyline can be “smoothed” with the **Smoothing** command (see “Editing Object Surfaces” on page 282). Markers can be added with the Attributes palette (see “Marker Attributes” on page 233).



Mode	Description
Corner Vertex	Creates a polyline object with straight lines and angled vertices at the control points
Bézier Vertex	Creates a polyline object with curves pulled toward, but not touching the control points
Cubic Vertex	Creates a polyline object with curves that pass through the control points
Arc Vertex	Creates a polyline object with curves that look like a fillet placed at the control points; click <b>Polyline Preferences</b> to set the radius of the fillet

 To create a polyline:

1. Click the **Polyline** tool from the Basic palette.
2. Click to set the polyline’s start point.
3. Click to set the end of the segment and the beginning of the next.



Press and hold instead of clicking to create a Bézier vertex instead of a Corner vertex.

4. Continue drawing segments in this manner until the polyline is complete.
5. Click the mouse at the start point to complete a closed polyline object (end point of the last segment is at the exact start point of the first segment), or double-click the mouse to complete an open polyline object (end point of the last segment is at a different location than the start point of the first segment).

The resulting polyline object, whether open or closed, is a filled object. If desired, remove the fill through the Attributes palette to see objects behind the polyline.

### Drawing Freehand Polylines

Use the **Freehand** tool to draw a freehand polyline in a manner similar to drawing with a pen. Once the object is drawn, it can be reshaped (see “Reshaping Objects with the Freehand Tool” on page 214).



Mode	Description
Freehand Edit	Reshapes the singularly-selected polyline, polygon, rectangle, circle, or arc; for more information, see “Reshaping Objects with the Freehand Tool” on page 214
Freehand Preferences	Sets the smoothing level when drawing a curve. Increasing the degree of smoothing decreases the vertices, and therefore it is easier to reshape the curve. Decreasing the degree of smoothing increases the vertices which produces a more accurate representation of the curve. Select Off to draw the curve without using the smoothing feature.



To draw a freehand polyline:

- 1. Click the **Freehand** tool from the Basic palette.
- 2. Click the **Freehand Preferences** mode button.

The Freehand Tool Preferences dialog box opens.



- 3. Select the smoothing level when drawing a curve.
- 4. Click **OK**.
- 5. Click in the drawing to set the polyline start point. Drag the mouse to create the desired freehand polyline shape.
- 6. Click again when the object is complete.

The number and placement of polyline vertices is determined by the object shape and specified degree of curve smoothing. For example, an object consisting of a series of arcs and curves created with a low degree of curve smoothing contains more vertices than a series of lines created with a high degree of curve smoothing. Markers can be added with the Attributes palette (see “Marker Attributes” on page 233). By default, the Freehand tool applies a fill of “None.” Change the fill type before sweeping a freehand polyline, if rendering of the sweep volume is desired.

### Reshaping Objects with the Freehand Tool

A polyline, polygon, rectangle, circle, or arc can be reshaped using the **Freehand Edit** mode of the **Freehand** tool. The direction of the curve drawn determines the new object shape. An edited object is converted to a polyline after editing is complete.

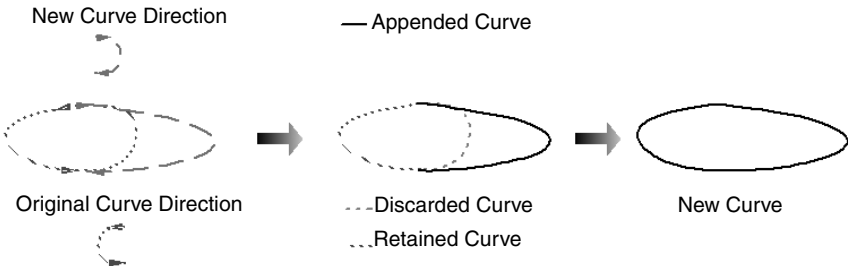
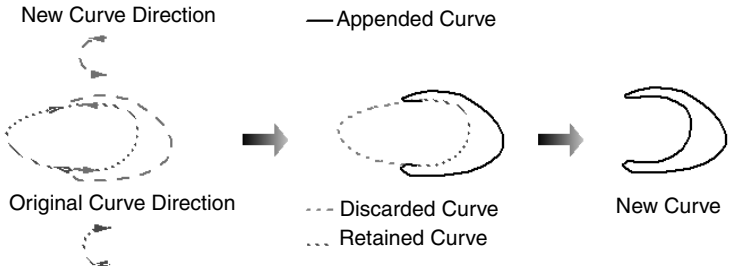


To reshape objects using the **Freehand** tool:

- 1. Select a valid 2D object.

2. Click the **Freehand** tool from the Basic palette.
3. Click **Freehand Edit** mode from the Tool bar.
4. Click to draw the new curve, editing the valid 2D object using the following curve direction guidelines:

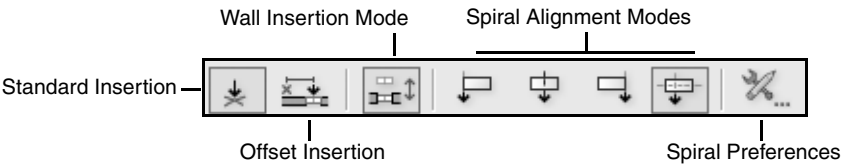
Action	Guidelines
Change existing curve	
Connect two points with new curve	
Create closure with new curve	
Add a new curve to an existing curve	

Action	Guidelines
Extend existing curve	
Retain partial curve	

5. Click again to finish drawing the freehand polyline edit. The valid 2D object is edited and converted to a polyline.

## Creating Spirals

The **Spiral** tool draws an Archimedes spiral. The number of turns, distance per turn, start radius and thickness can be specified, as well as the number of points used to define the curve. Use the alignment modes on the Tool bar to temporarily override the insertion point. These modes change the alignment of the insertion point along the X axis of the bounding box surrounding the spiral.



Spiral Alignment Mode	Description
Align Object Left	Moves the insertion point to the left edge of the spirals's bounding box, along the original X axis
Align Object Center	Moves the insertion point to the center of the spiral's bounding box, along the original X axis
Align Object Right	Moves the insertion point to the right edge of the spiral's bounding box, along the original X axis
Align Object Origin	Leaves the insertion point at the actual or original position

For information on using the Offset Insertion and Wall Insertion modes, see “Offset Symbol Insertion Mode” on page 161 and “Wall Insertion Mode” on page 162.

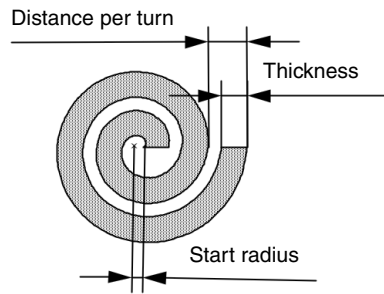


To draw a spiral:

1. Click the **Spiral** tool from the Basic palette.
2. Select the insertion type and alignment from the Tool bar.
3. Click to define the center of the spiral.

If this is the first time a spiral is placed in this session, the Spiral Properties dialog box opens. These parameters apply to subsequently created spirals; they can be changed later by accessing them from the Object Info palette.

4. Specify the spiral properties.



Parameter	Description
Distance per Turn	Enter the distance between the outer edges of each turn in the spiral
Number of Turns	Specify the number of turns which determine the total sweep angle of the spiral; one turn equals 360 degrees
Start Radius	Enter the distance from the center to the beginning of the spiral
Increment (deg)	Specify the number of points used to define the curve; the higher the increment, the fewer the number of points (for example, an increment of five degrees means $360/5=72$ points per turn)
Thickness	Specify the thickness value of the area between the outer and inner edge of the turn

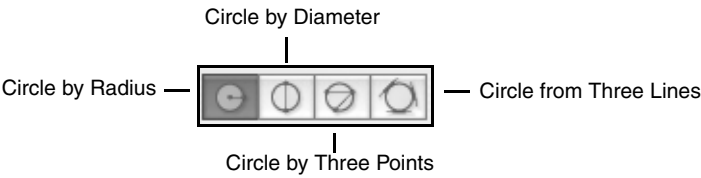
5. Click **OK**.

A spiral with the specified parameters is placed on the drawing.

To create a 3D spiral, see “Creating Helix-Spirals” on page 346.

## Creating Circles

The **Circle** tool has four modes.



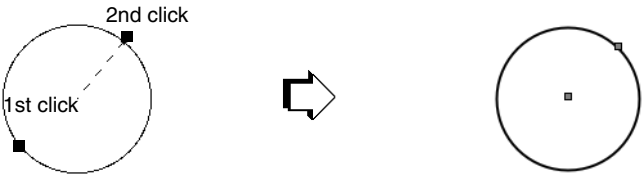
Mode	Description
Circle by Radius	Defines the circle by radius
Circle by Diameter	Defines the circle by diameter
Circle by Three Points	Defines the circle by circumference
Circle from Three Lines	Defines the circle by making it tangent to two or three selected lines

### Circle by Radius



To create a circle by radius:

1. Select the **Circle** tool from the Basic palette, and select **Circle by Radius** mode.
2. Click to set the center of the circle.
3. Drag the mouse to the desired radius and click to set the radius of the circle.



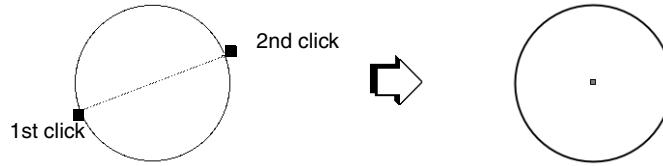
### Circle by Diameter



To create a circle by diameter:

1. Click the **Circle** tool from the Basic palette, and select the **Circle by Diameter** mode.
2. Click to set the first point on the circle diameter.
3. Drag the mouse to the desired diameter and click to set the diameter of the circle.



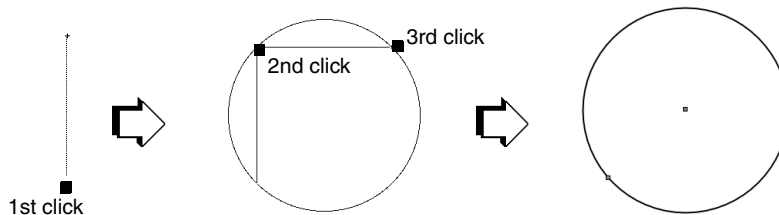


## Circle by Three Points



To create a circle by three points:

1. Click the **Circle** tool from the Basic palette, and select the **Circle by Three Points** mode.
2. Click to set the first point on the circle diameter.
3. Drag the mouse and click to set the second point on the circle and click again to set the third point on the circle.

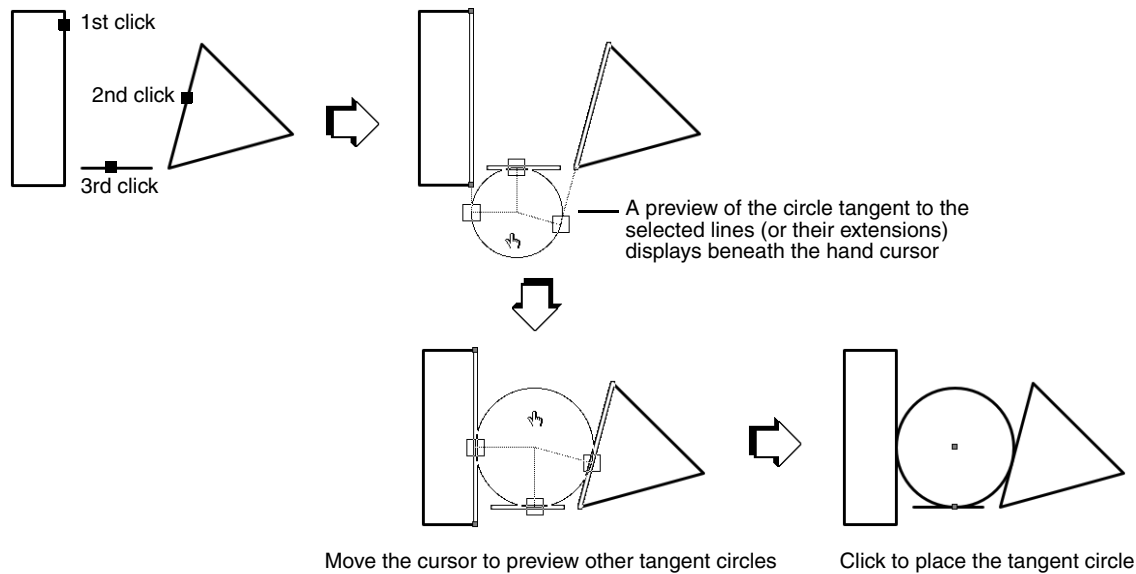


## Circle from Three Lines



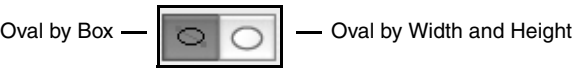
To create a circle tangent to three lines:

1. Click the **Circle** tool from the Basic palette, and select the **Circle from Three Lines** mode.
2. Click to select the three lines or linear segments to which the circle will be tangent. Each line is highlighted as it is selected. The lines (or their extensions) must intersect in at least two places.
3. When the third line is selected, a preview of a tangent circle displays where the cursor is currently located. VectorWorks can create circles tangent to two or three lines. In places where only two lines intersect, the size of the circle is controlled by the cursor location. Move the cursor until the desired tangent circle displays, and then click to set the circle.




## Creating Ovals

The **Oval** tool has two modes.



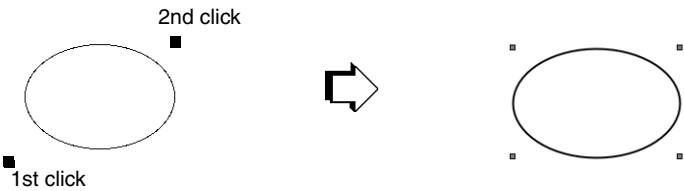
Mode	Description
Oval by Box	Defines the dimensions of the box containing the oval
Oval by Width and Height	Defines the height and width lengths to create the oval

### Oval by Box

 To create an oval by box:

- Click the **Oval** tool from the Basic palette and select **Oval by Box** mode.
- Click to set the first point of the box containing the oval and then click again to set.

To create a true circle, press the Shift key while creating the oval.

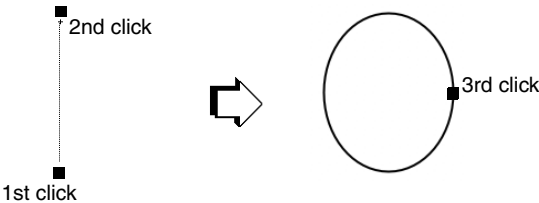


## Oval by Width and Height



To create an oval by width and height:

- 1. Click the **Oval** tool from the Basic palette and select **Oval by Width and Height** mode.
- 2. Click to set the first point of the oval height, and then drag to define the height.
- 3. Drag the mouse, and then click to define the oval width.



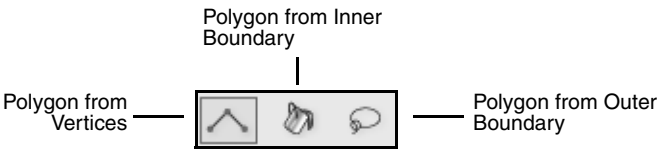
## Creating 2D Polygons

VectorWorks provides several ways to create 2D polygons. Single-line polygons, double-line polygons, and regular polygons can be created; a polygon always has square vertices. Polygons can be created automatically from existing geometry, which is especially useful for illustrating the elements of a hidden-line rendered viewport.

### 2D Polygon Tool

The **2D Polygon** tool creates open and closed polygons with single lines. Polygons can have as few as three vertices or as many as 32,767 vertices. The **2D Polygon** tool can also automatically create polygons by filling or outlining existing geometry, to easily annotate a drawing graphically by outlining, filling, or texturing (with an image or gradient fill) the new polygons.

Three modes are available.



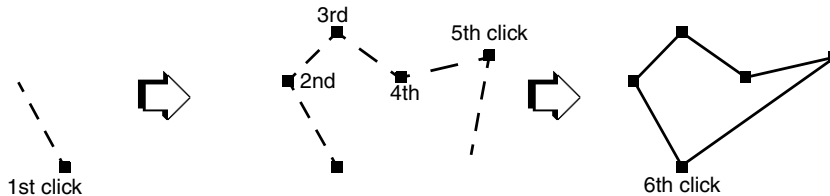
Mode	Description
Polygon from Vertices	Creates a polygon by clicking to set each vertex
Polygon from Inner Boundary	Creates a polygon out of existing geometry by clicking within the boundary of a 2D object
Polygon from Outer Boundary	Creates a polygon out of the outer boundary of existing geometry by defining geometry with a lasso marquee

## Creating Single-line 2D Polygons



To create a single-line 2D polygon:

1. Click the **2D Polygon** tool from the Basic palette, and select **Polygon from Vertices** from the Tool bar.
2. Click to set the polyline's start point (first vertex).
3. Click at each vertex.
4. Double-click at the final vertex to end an open polygon, or click at the starting vertex (a point cue displays) to end a closed polygon (the first and last vertex are automatically joined).



## Creating a Polygon from an Inner Boundary

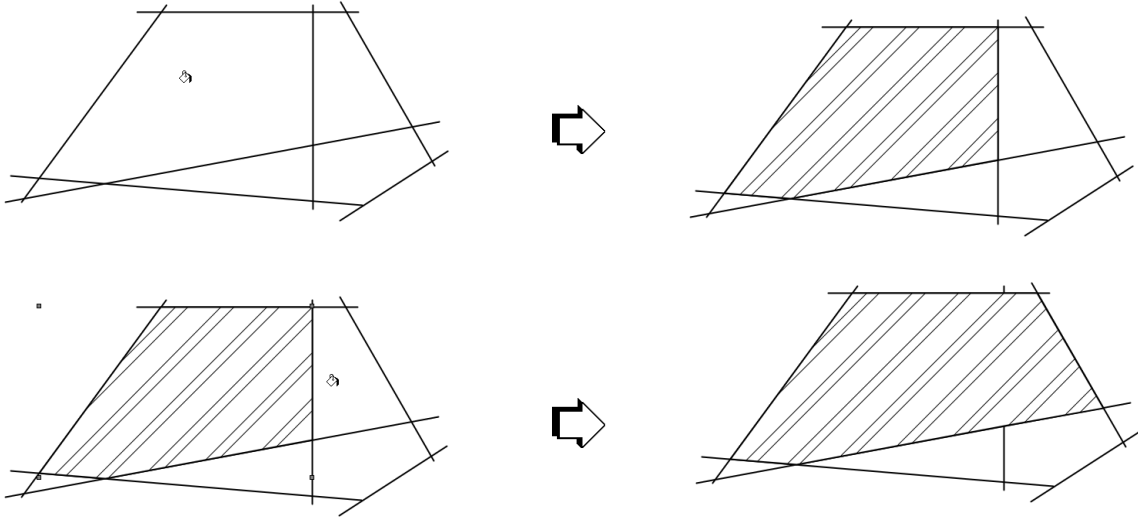
The **2D Polygon** tool can create a new polygon based on the inner boundary of existing geometry. Existing geometry refers to visible 2D objects in the active layer or the viewport cache of a hidden-line rendered viewport in Edit Annotation mode. The stacking order of 2D objects does not apply; objects that are overlapped by other objects can still have their boundaries considered. If the object is a polyline (open or closed), a polygon with holes, or is curved, a polyline is created instead of a polygon.

*Polygons cannot be created from symbols. Convert the symbol to a group, and then ungroup.*



To create a 2D polygon from the inner boundary of existing geometry:

1. Switch to 2D view by selecting **View > Standard Views > Top/Plan**.
2. Click the **2D Polygon** tool from the Basic palette, and select **Polygon from Inner Boundary** from the Tool bar.  
If desired, set the attributes in the Attributes palette (fill style, pen style, line and line endpoint style). The attributes of the polygon can also be specified after creation.
3. Click on an object to create a polygon based on the inner boundary of the 2D object. Alternatively, press the Option key (Macintosh) or the Alt key (Windows) while clicking to create a polygon based on the 2D object and any other additional selected objects.



First polygon selected, and Alt/Option key pressed while clicking in second area

When creating a polygon from a selection with the Option/Alt key pressed, the attributes of the bottom selected object are applied to the new polygon, and the original selected objects are combined to form the new polygon. This is similar to the **Add Surface** command described in “Add Surface” on page 283.

To speed up the polygon fill for complex images, zoom in on the area first.

## Creating a Polygon from an Outer Boundary

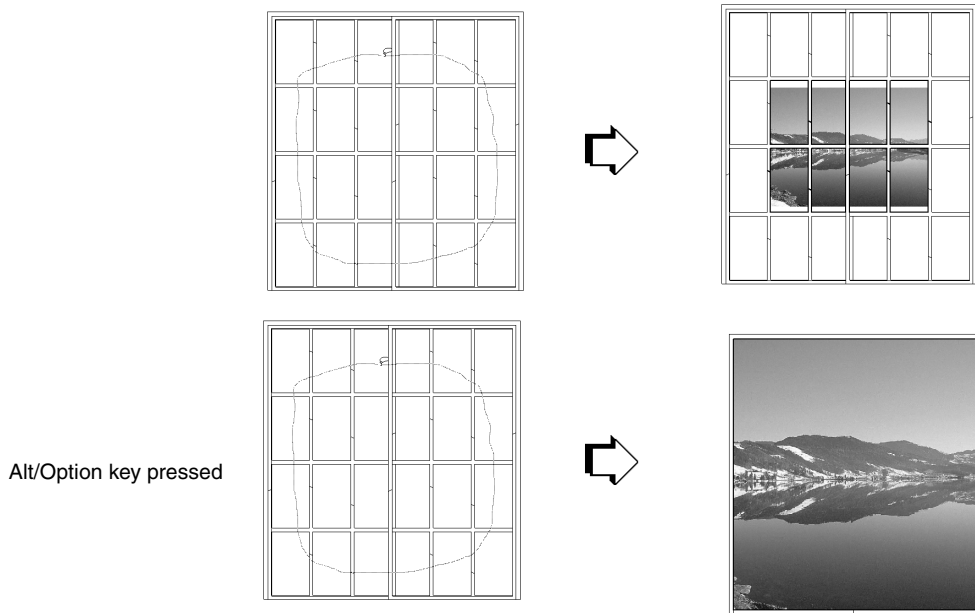
The **2D Polygon** tool can create a polygon based on the outer boundary of existing geometry. Existing geometry refers to visible 2D objects in the active layer or the viewport cache of a hidden-line rendered viewport in Edit Annotation mode. The stacking order of 2D objects does not apply; objects that are overlapped by other objects can still have their boundaries considered. If the object is a polyline (open or closed), a polygon with holes, or is curved, a polyline is created instead of a polygon.

Polygons cannot be created from symbols. Convert the symbol to a group, and then ungroup.



To create a 2D polygon from the outer boundary of existing geometry:

1. Switch to 2D view by selecting **View > Standard Views > Top/Plan**.
2. Click the **2D Polygon** tool from the Basic palette, and select **Polygon from Outer Boundary** from the Tool bar.  
If desired, set the attributes in the Attributes palette (fill style, pen style, line and line endpoint style). The attributes of the polygon can also be specified after creation.
3. Click in the drawing and drag to create the lasso marquee. A polygon is created based on the outer boundary of any 2D objects completely enclosed within the marquee. Alternatively, press the Option key (Macintosh) or Alt key (Windows) while creating the marquee, and the polygon is based on the outer boundary of any 2D objects that are encountered by the marquee.



## Creating Boundary Polygons in a Hidden Line Rendered Viewport

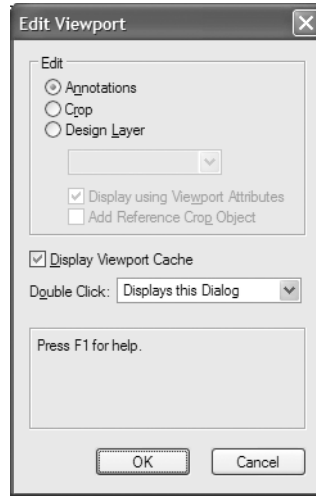
The creation of polygons based on the inner and outer boundaries of existing geometry is very useful for graphically annotating the elements of a sheet layer viewport that is rendered with hidden line rendering. (Sheet layer viewports are described in “Presenting Drawings with Sheet Layer Viewports” on page 609.)



To create a 2D polygon from the inner/outer boundary of existing geometry in a viewport:

1. Create a sheet layer viewport from a design layer as described in “Creating a Sheet Layer Viewport from a Design Layer” on page 610.
2. For the Rendering mode of the viewport, select **Hidden Line**. Update the viewport rendering by clicking **Update** from the Object Info palette.
3. Edit the viewport in annotation mode by selecting **Modify > Edit Viewport**.

The Edit Viewport dialog box opens. Select **Annotations** and **Display Viewport Cache**.

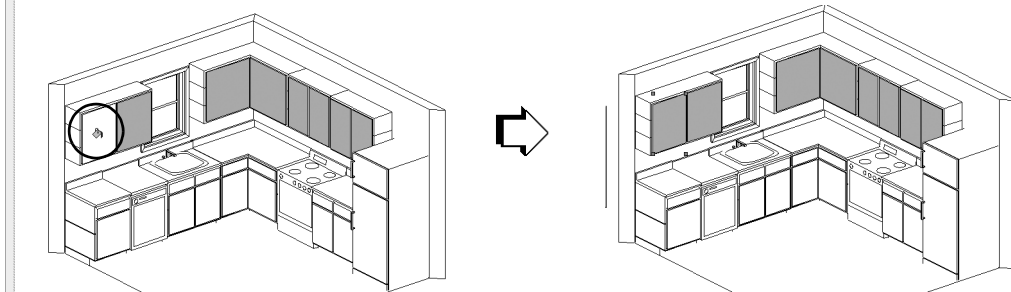


4. Click **OK** to enter viewport annotation mode.
5. Click the **2D Polygon** tool from the Basic palette, and select **Polygon from Inner Boundary** or **Polygon from Outer Boundary** from the Tool bar.

If desired, set the attributes in the Attributes palette to the desired fill settings (Fill Style, Pen Style, Line and Line Endpoint Style). The attributes of the polygon can also be specified after creation.

Apply an image fill to the polygon to simulate a texture (see “Image Attributes” on page 247).

6. Because the viewport is rendered with hidden line and the viewport cache is used for annotations, any of the objects in the drawing can be used as the basis for new polygons. If in **Polygon from Inner Boundary** mode, click the paint bucket cursor on the desired drawing objects. If in **Polygon from Outer Boundary** mode, create a lasso marquee to include the desired objects. A 2D polygon is created based on the inner or outer boundary of the geometry.



The **2D Polygon** tool works on 2D objects in the design layer. It does not apply to 2D objects or annotations that have been added to the sheet layer.

7. Click **Exit Viewport Annotation** at the top right corner of the drawing window to return to the sheet layer.

An alert dialog box may ask if keeping the viewport cache is necessary. The viewport cache can be removed, if desired, as it is no longer necessary for creating the polygons.

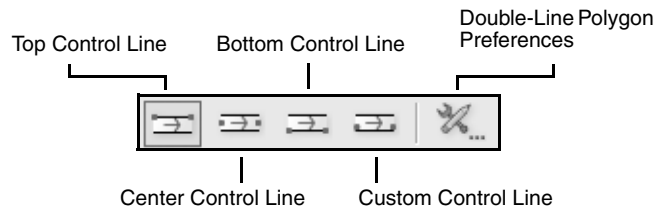
## Double-Line Polygon Tool

Use the **Double-Line Polygon** tool to create a wide variety of open or closed polygons that have two parallel lines, a double-lined polygon with a width, or two parallel lines with a polygon fill. Double-line polygons can have as many as 32,767 vertices.



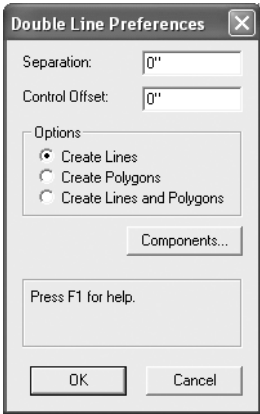
To create a double-line polygon:

- 1. Click the **Double-Line Polygon** tool from the Basic palette.
- 2. Select the offset method.



Mode	Description
Top Control Line	The cursor creates the right line
Center Control Line	Creates lines equidistant from the cursor
Bottom Control Line	The cursor creates the left line
Custom Control Line	Specify an offset value

- 3. Click the **Double-Line Polygon Preferences** button and enter the criteria.

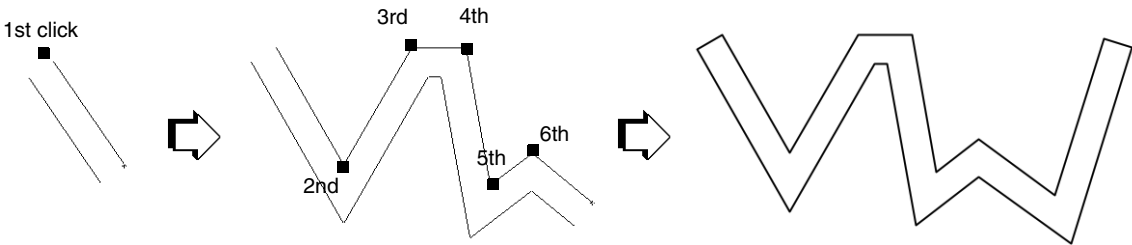


Parameter	Description
Separation	Distance between the double lines
Control Offset	For the Custom Control Line mode, enter the distance from the top/right line of the cursor



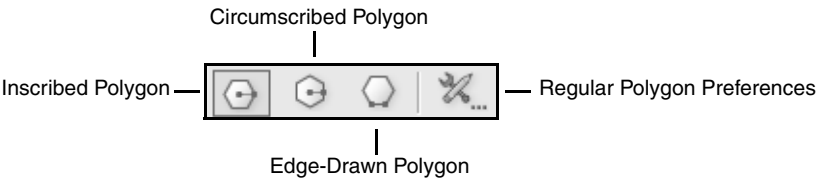
Parameter	Description
Options	
Create Lines	Creates a series of lines
Create Polygons	Creates a double-line polygon
Create Lines and Polygons	Creates parallel lines with a polygon between them; the polygon has a line weight of 0
Components	Click to define components between the double lines (see “Applying Components Between Double Lines” on page 204)

- 4. Click **OK**.
- 5. Click to set the polygon’s start point (first vertex).
- 6. Click at each vertex.
- 7. Double-click to mark the polygon’s end point (final vertex).



Regular (Equal-sided) Polygon

The **Regular Polygon** tool is used to create single-line closed polygons in which all sides of the polygon are the same length. It has three modes; each mode creates regular polygons with as few as three sides or as many as 4,000 sides.



Mode	Description
Inscribed Polygon	Creates a polygon by drawing its radius
Circumscribed Polygon	Creates a polygon with a radius equidistant from the center of the polygon and the mid-point of any of its sides
Edge-drawn Polygon	Creates a polygon by drawing one of its sides

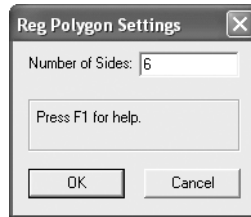
Press and hold the Option (Macintosh) or Ctrl (Windows) key while drawing to toggle between circumscribed and inscribed modes.



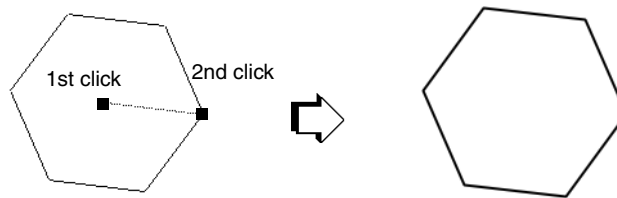
To create a regular polygon:

1. Click the **Regular Polygon** tool from the Basic palette.
2. Select the mode button to specify the method for creating the polygon.
3. Click the **Regular Polygon Preferences** mode button.

The Reg Polygon Settings dialog box opens.



4. Enter the **Number of Sides** for the polygon.
5. Click **OK**.
6. Click to set the start of the polygon.
7. Click to set the end point of the polygon.



## Creating 2D Loci

A locus is a reference point that is used to draw and measure objects. Loci do not print. Loci can also be used as pivot points or fixed points for rotating and aligning objects. For example, to snap the cursor to a 2D locus, select **Snap to loci** in the VectorWorks Preferences dialog box.

The **2D Locus** tool places a 2D locus in a drawing when it is in Top/Plan view. Because they are merely movable reference points, loci cannot be reshaped or resized.



To place a 2D locus:

1. Click the **2D Locus** tool from the Basic palette.
2. Click to place the locus.
3. Click to place additional loci if necessary.

# Applying Object Attributes

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The Attributes palette applies characteristics to 2D and 3D objects. Attributes include fill and pen styles, opacity, images, gradients, hatches, line style and thickness, and markers.

## The Attributes Palette

The Attributes palette applies attributes to 2D and 3D objects, and displays the current attributes applied to an object. Select **Window > Palettes > Attributes** to open the Attributes palette.

Hatches, images, and gradients, and fill and pen styles, such as color and opacity, can be applied to all VectorWorks objects except text. The only text characteristics that can be changed with the Attributes palette are pen color and opacity; however, the text box itself can accept fill attributes. All other text attributes are controlled by the **Text** menu commands (see “Formatting Text” on page 189). Line styles and the presence and location of markers are also set in the Attributes palette.

If using the same attribute settings for groups of objects, it is preferable to create a class for those objects and apply the class attributes at creation. Class attributes can also be set for selected objects; see “Setting Class Attributes” on page 100.

The **Eyedropper** tool can transfer attributes from one object to another.

## Attribute Types

Most of the attribute types (fill, pen, opacity, line style, and marker) are specified directly from the Attributes palette. Default attributes specify which options are available from the palette. See “Setting Default Object Attributes” on page 59 for more information.

Hatch, gradient, and image attributes are resources, defined or selected from default resources (see “VectorWorks Fundamentals Default Resources” on page 141).

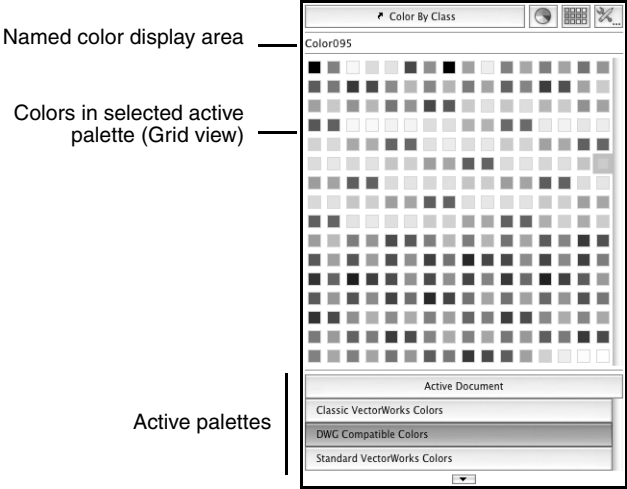
Image and gradient attributes are designed to function like the objects to which they apply. If an object with a gradient or image is rotated, the gradient or image also rotates.

## Applying Colors

The Color Palette set provides colors for selection and specifies which colors are available in a VectorWorks file. To access the Color Palette set from the Attributes palette, click on one of the color boxes for Fill color or Pen color, when a Solid style is selected.

A similar interface is available from other areas in the application where colors are specified, although the Color By Class option is only available when accessed from the Attributes palette.

See “Setting Default Colors and Palettes” on page 62 for information on how to set up and activate color palettes.



Select an active color palette, and then select the color to apply. To easily find a named color, begin typing; the letters display in the named color display area and the closest color match is selected. Press the Tab key to cycle through the closest matches; pause for several seconds to start the search over.

Select **Color By Class** to use the color attributes set by the object’s class.

- If **Use at Creation** is enabled for the object’s class, the object’s color is automatically set by the class.
- If **Use at Creation** is disabled for the class, the object only takes on the class color when the **Color By Class** option is selected.

See “Setting Class Attributes” on page 100.

Fill Attributes

VectorWorks objects can be filled with a solid color, fill pattern, hatch, gradient, or image. Alternatively, set the object fill default to None to create transparent objects with no fill.

Fill Style	Description
None	No fill is applied
Solid	Applies a solid fill; click the color box to select the fill color. To set the color by class, select the <b>Color by Class</b> option from the color palette. See “Applying Colors” on page 229.
Pattern	Applies a patterned fill style; click the pattern box to select the desired pattern, and then select the foreground color and background color from the color boxes next to the pattern. To set the pattern colors by class, select the <b>Color by Class</b> option from the color palette.
Hatch	Applies a hatch. Select the desired hatch from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141). If default content is not enabled, VectorWorks asks if a default hatch definition should be created. Another option is to create a new hatch to apply to the object by selecting <b>Hatch</b> from the Attributes palette list to create a new hatch to apply to the object (see “Hatch Attributes” on page 236).

Fill Style	Description
Gradient	Applies a gradient. Select the desired gradient from either the list default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141). If default content is not enabled, applies a gradient defined in the Resource Browser; click the <b>Fill Gradient Settings</b> button to specify gradient settings ("Gradient Attributes" on page 242).
Image	Applies an image. Select the desired image from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141). If default content is not enabled, applies an image defined in the Resource Browser; click the <b>Image Gradient Settings</b> button to specify image settings (see "Image Attributes" on page 247).
Class Style	<p>The object takes on the fill attribute set by the object's class.</p> <ul style="list-style-type: none"> <li>• If <b>Use at Creation</b> is enabled for the object's class, the object's fill style is automatically set by the class.</li> <li>• If <b>Use at Creation</b> is disabled for the class, the object only takes on the class style when the <b>Class Style</b> option is selected.</li> </ul> <p>See "Setting Class Attributes" on page 100.</p>

## Pen Attributes

In VectorWorks, the pen setting for object outlines includes solid, dashed, or a pattern line of any thickness.

Pen Style	Description
None	No pen is applied
Solid	Applies a solid pen style; click the color box to select the pen color. To set the color by class, select the <b>Color by Class</b> option from the color palette. See "Applying Colors" on page 229. Select the line thickness for the pen from the Line Style list.
Pattern	Applies a patterned pen style; click the fill pattern box to select the desired pattern, and then select the foreground color and background color from the color boxes next to the pattern. To set the pattern colors by class, select the <b>Color by Class</b> option from the color palette.
Dash	Applies a dashed pen style; click the color box to select the pen color. To set the color by class, select the <b>Color by Class</b> option from the color palette. Select the desired dash style and line thickness from the Line Style list.
Class Style	<p>The object takes on the pen attribute set by the object's class.</p> <ul style="list-style-type: none"> <li>• If <b>Use at Creation</b> is enabled for the object's class, the object's pen style is automatically set by the class.</li> <li>• If <b>Use at Creation</b> is disabled for the class, the object only takes on the class style when the <b>Class Style</b> option is selected.</li> </ul> <p>See "Setting Class Attributes" on page 100.</p>

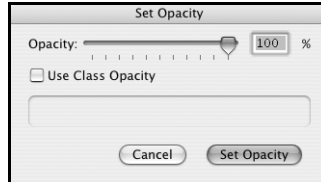
## Opacity Attributes

In addition to the overall layer opacity settings described in "Setting the Design Layer Opacity" on page 90, an opacity setting is available for individual objects in Top/Plan view. Opacity can be applied to any type of planar 2D object, including 2D walls, text, worksheet backgrounds, and plug-in objects that include a 2D object.

If layer opacity is set in addition to object opacity, the results are additive; for example, a layer opacity of 50% and an object opacity of 50% will display the object at 25% opacity. Similarly, the opacity settings of nested and container objects are combined.

The Quartz (Macintosh) or GDI+ (Windows) imaging VectorWorks preference must be enabled to apply and display the opacity attribute. See “Display Preferences” on page 41.

From the Attributes palette, click the **Opacity** button to open the Set Opacity dialog box.



Drag the **Opacity** slider to the left to increase the transparency, or enter an opacity percentage (0-100) in the box to the right of the slider. Click **Set Opacity** to make the setting.

Select **Use Class Opacity** to use the opacity value set by the object's class.

- If **Use at Creation** is enabled for the object's class, the object's opacity is automatically set by the class.
- If **Use at Creation** is disabled for the class, the object only takes on the class style when the **Use Class Opacity** option is selected.

See “Setting Class Attributes” on page 100. Class opacity can be overridden in viewports.

## Line Style Attributes

Line style attributes include line thickness and dash style parameters, and apply to the pen style of an object. Apply line thickness attributes to 2D and 3D objects; apply dash styles to 2D objects and walls in 2D views.

From the Attributes palette, select the line thickness and dash style from the Line Style list. When a dashed line style is selected, the Pen attribute automatically changes to Dash. Available dash styles are determined by the **Dash Styles** command; see “Setting the Default Dash Styles” on page 70.

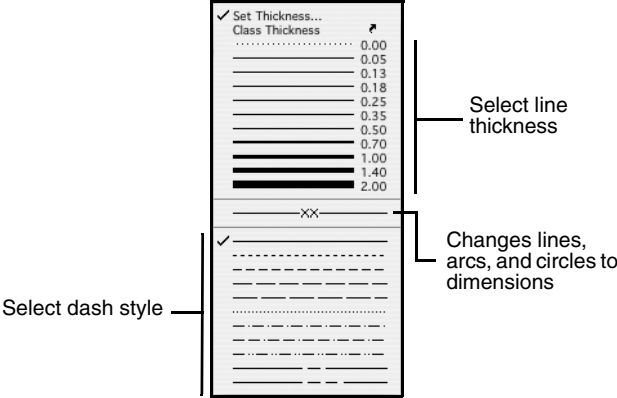
Line thickness values available in the Line Style list are determined by the **Line Thickness** command. See “Setting the Default Line Thickness” on page 72 for more information. Click **Set Thickness** to temporarily adjust the line thickness to a value that is not available in the list. The Set Thickness dialog box opens. Select the **Thickness Units**, enter the **Thickness Value**, and click **OK**.

Select **Class Thickness** to use the line style attributes set by the object's class.

- If **Use at Creation** is enabled for the object's class, the object's line style is automatically set by the class.
- If **Use at Creation** is disabled for the class, the object only takes on the class style when the **Class Thickness** option is selected.

See “Setting Class Attributes” on page 100.

A line, double line, arc, or circle can be changed to a dimension by selecting the dimension line style. Lines change to linear dimensions, arcs to angular dimensions, and circles to radial dimensions. See “Dimensioning” on page 437 for more information on dimensions.



Marker Attributes

Markers can be applied to each end of open objects, including lines, dimensions, arcs, polylines, 2D polygons, and freehand lines.

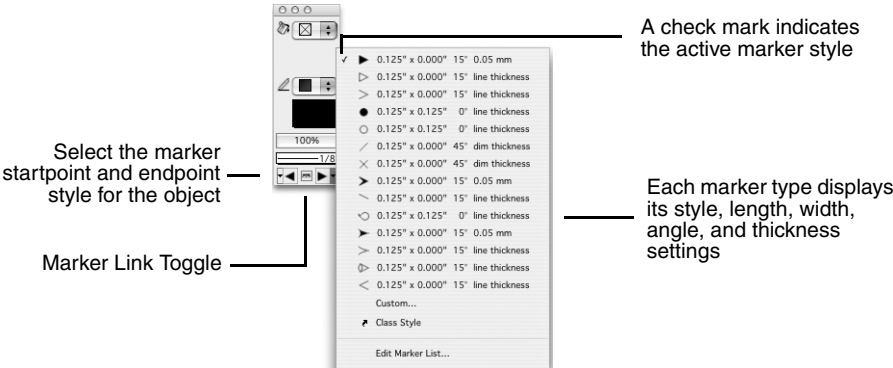
In the Attributes palette, the active marker type displays for toggled selection for the line start and the line end. When the active marker is selected for the end of an object, the marker selection box is highlighted. Click the starting marker button, ending marker button, or both buttons to specify the end(s) to receive the selected marker. Alternatively, click the **Marker Link Toggle** button (it becomes highlighted when enabled) to apply the active start marker type to both ends.

To switch to a different marker style, click **Line Startpoint Style** or **Line Endpoint Style**. Select the active marker style from the list, or click **Edit Marker List** to create a new style. See “Setting Default Marker Types” on page 60 for more information.

Select **Class Style** to use the marker attributes set by the object’s class.

- If **Use at Creation** is enabled for the object’s class, the object’s marker style is automatically set by the class.
- If **Use at Creation** is disabled for the class, the object only takes on the class style when the **Class Style** option is selected.

See “Setting Class Attributes” on page 100.



## Applying Attributes

Attributes palette characteristics can be applied by default as objects are created, or applied to individual objects after creation.

Attributes can also be applied by class settings. See “Setting Class Attributes” on page 100.

To set default attributes:

1. Ensure that no objects are selected.
2. Select **Window > Palettes > Attributes**.  
The Attributes palette opens.
3. Select the desired attributes. Objects created after that point use those attributes by default.

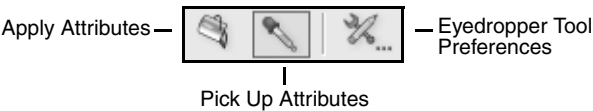
The defaults can also be set with the **Eyedropper** tool (see “Transferring Attributes” on page 234).

To apply attributes to existing objects:

1. Select the object or objects.
2. Select **Window > Palettes > Attributes**.  
The Attributes palette opens.
3. Set the desired attributes for the object(s) from the Attributes palette.  
The object’s attributes are updated.

## Transferring Attributes

The **Eyedropper** tool transfers attributes from one object to another in a single step, including fill, pen, line, text, wall, and other attributes. The **Eyedropper** tool has two modes.



Mode	Description
Apply Attributes	Transfers selected attributes to another object
Pick Up Attributes	Selects an object’s attributes

Pressing the **Option** (Macintosh) or **Ctrl** (Windows) key switches between the **Pick up** and **Apply** modes.

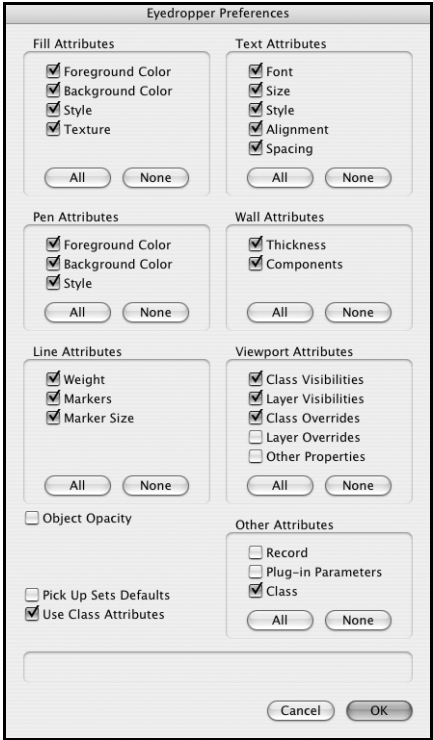


To transfer object attributes:

1. Click the **Eyedropper** tool from the Basic palette.
2. Click **Eyedropper Tool Preferences** from the Tool bar.

The Eyedropper Preferences dialog box opens. Specify the attributes to be selected and applied by the **Eyedropper** tool, and click **OK**.

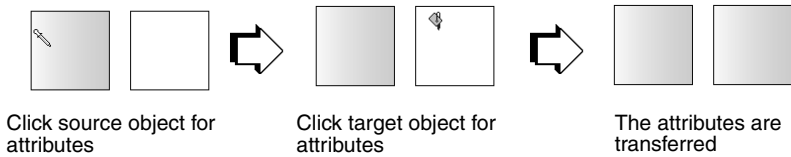




Parameter	Description
All	Selects all attributes in the group for transfer
None	Deselects all attributes in the group, clearing any selections that were already made
Fill Attributes	Transfers fills, including foreground and background colors, styles (pattern, hatch, gradient or image fill), and textures
Pen Attributes	Transfers pen foreground and background colors and styles (pattern or dash)
Line Attributes	Transfers line weight (thickness), presence of markers, and marker attributes
Text Attributes	Transfers text attributes to another text object, dimension, or plug-in object, including font, size, style, alignment and spacing Alignment and spacing are transferred to text objects only
Wall Attributes	Transfers wall thickness and component settings for walls and round walls; components define wall thickness, so components cannot be transferred without also transferring the thickness parameter
Viewport Attributes	Transfers viewport attributes to another viewport, including class and layer visibility settings and attribute overrides. Other Properties refers to the remaining viewport options such as view, render mode, projection, and advanced properties. Viewport attributes can be transferred between files; class, layer, and other resources specified in an attribute override are resolved by the name of the class, layer, or resource, respectively.

Parameter	Description
Object Opacity	Transfers an object's opacity setting
Other Attributes	
Record	Transfers the database record attributes
Plug-in Parameters	Transfers plug-in parameters between plug-in objects, including objects inserted in walls
Class	Selects the class for transfer (makes the target object the same class as the source object)
Pick Up Sets Defaults	Changes the default Attributes palette settings to match those of the source object; objects created from then on use the attributes of the source object
Use Class Attributes	Transfers the "by-class" settings of the source object, provided the target object is in the same class as the source object

3. Click **Pick Up Attributes** from the Tool bar.  
The cursor changes to an eyedropper.
4. Click the object that is the source of the attributes.
5. Click **Apply Attributes** from the Tool bar.  
The cursor changes from an eyedropper to a paint bucket.
6. Click the target object for the attributes.  
The attributes are transferred to the object.



If transferring attributes between files, the target objects, classes, records, dash patterns, textures, and other attributes must already be present in the target file. The eyedropper tool does not create objects or attributes.

## Hatch Attributes

Hatches can be applied to 2D objects and walls in a 2D view. If default content is not enabled in VectorWorks preferences, a default hatch is provided; see “VectorWorks Fundamentals Default Resources” on page 141.

Two different types of hatches exist in VectorWorks: associative and non-associative. The appearance of both types of hatches are determined by hatch pattern definitions. Associative hatches are similar in nature to fills and are one of the selections under the **Fill Style** list on the Attributes palette. Non-associative hatches are a pattern of lines grouped into a single object and placed with the **Hatch** command.

### Associative Hatches

Associative hatches are applied to an object as a fill from the Attributes palette or Resource Browser. Since the hatch pattern start point cannot be specified, this type of hatch is best for large objects where the hatch start point is not

important. If the size of the object changes, the hatch fills the new object dimensions. Associative hatches can be specified as a default class attribute (see “Setting Class Properties” on page 98).

## Non-associative Hatches

Non-associative hatches are placed on objects or areas of the drawing with the **Hatch** command. They obtain most of their attributes from hatch pattern definitions, but they do not use the color definitions for the lines that make up the hatch. Non-associative hatches obtain the color definitions from the current default attributes. They do not use any background definitions, and therefore have no background color. A non-associative hatch is similar to a screen that displays over other objects; the spaces between the lines are empty, and display portions of any objects behind the hatch.

Non-associative hatches are placed inside an area that is defined by selected objects or lines. The start point of the hatch is set with the **Hatch** command. Unlike associative hatches, non-associative hatches can be moved to another area or object. However, unless the new area is the same shape and size as the previous one, the pattern will not fit.

Non-associative hatches are groups that are not associated with an object. They do not rotate with the object or act like a fill. They can be broken down into their individual elements with the **Ungroup** command. For a non-associative hatch to become part of an object, it must be grouped with the object.

## Defining Hatches

A hatch definition is required for both associative and non-associative hatches.

A hatch definition is a repetition of the elements in a series of lines in all directions from the beginning point. After specifying where the hatch line begins (the **Start Point**), where it stops (the **Dash Factor**), where it begins to repeat (the **Repeat**), and the distance separating the line from a neighboring line (the **Offset**), the pattern is repeated in all directions.

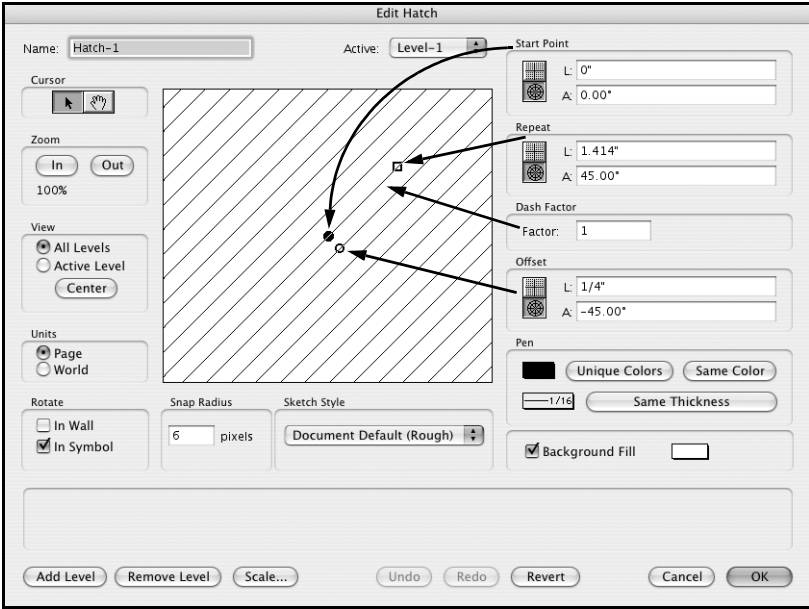
A hatch can consist of several levels, or layers, of pattern definitions. Each level is edited individually to create the overall hatch. (Hatch layers are named hatch levels in order to distinguish them from the layers in the drawing area.)

A new hatch can be created by editing an existing hatch; see “Editing Hatches” on page 242.

To create a new hatch pattern definition:

1. Open the Resource Browser by selecting **Window > Palettes > Resource Browser**.
2. From the Resources menu, select **New Resource** to display the New Resource menu.
3. Select **Hatch**.

The Edit Hatch dialog box opens.



Parameter	Description
Name	Enter a name for the hatch; this name identifies the hatch in the Resource Browser and in the Select Hatch dialog box ( <b>Modify &gt; Hatch</b> )
Active	Select the active hatch level from the list. A level can also be selected by clicking on one of its pattern lines, or by using the keyboard right and left arrow keys. Levels are numbered in the order of creation.
Cursor	Switches between the pointer and pan functions. The pointer adjusts the four control handles in the hatch window. The pan moves the elements of the hatch around the preview window.
Zoom	Zooms in and out by a factor of two. The center of the view remains at its current coordinates. The current zoom ratio is also displayed. The initial zoom setting when the dialog box opens corresponds to the best setting for editing Level 1.
View	Select whether to view <b>All Levels</b> or only the <b>Active Level</b> ; click <b>Center</b> to center the start point of the active level
Units	Switches between <b>Page</b> and <b>World</b> settings for the hatch. <b>Page</b> is absolute in screen coordinates, where one inch in the hatch equals one inch on the screen (at 100% zoom). <b>World</b> sets the hatch to use the unit values for the layer where the hatch will be placed; for example, one inch in the hatch equals one inch in the drawing area as defined by the rulers (this may not equal one inch on the screen depending on the unit setting). When switching between <b>Page</b> and <b>World</b> , the hatch settings are adjusted for all levels to preserve the hatch appearance.
Rotate	Select whether to rotate the hatch to match the orientation of any symbols or walls where it will be placed
Snap Radius	Set the snap radius for snapping to the end points and mid points of pattern lines when moving a line by dragging

Parameter	Description
Sketch Style	For the Design Series, specifies a hatch sketch style; see “Applying Sketch Styles to Hatches” on page 590 in the VectorWorks Design Series User’s Guide
Background Fill	Select to use a background color and click the color box to select a color; background color applies only to associative hatches
Start Point	Controls the location of the start of the first hatch line in relation to the hatch origin for the active level. The default mode uses polar coordinates (L = distance, A = angle). Enter values or move the Start Point handle in the preview window.
Repeat	Sets the distance, for the active level, between the beginning of a segment and the beginning of the next colinear segment. <b>Repeat</b> directly relates to the <b>Dash Factor</b> , with the two determining if the line is dashed or solid, as well as the length of the dashes and line segments. The default mode uses polar coordinates (L = distance, A = angle). Enter values or move the Repeat handle in the preview window.
Dash Factor	Represents, for the active level, the percentage of the distance between the <b>Start Point</b> and the <b>Repeat</b> that is shown as a line. Set to 1 to create a solid line. Enter a value or move the Dash Factor handle in the preview window.
Offset	Determines the distance and direction between lines for the active level. The values entered are relative to the <b>Start Point</b> . The default mode uses polar coordinates (L = distance, A = angle). Enter values or move the Offset handle in the preview window.
Pen Color	Sets the color for the active level hatch lines; click the color box to select a color. Click <b>Unique Colors</b> to set a unique color for each level; click <b>Same Color</b> to apply the active level color selection to all levels.
Pen Line Weight	Sets the hatch line weight for the current level. Click the line to select a weight from the list. Create a custom weight by selecting <b>Set Thickness</b> . The <b>Set Thickness</b> dialog box opens. Enter the <b>Thickness Value</b> and <b>Thickness Units</b> . Click <b>Same Thickness</b> to apply the active level line thickness to all levels.
Add/Remove Level	Click <b>Add Level</b> to create an offset duplicate of the active level. Alternatively, create a duplicate level by clicking and dragging the <b>Start Point</b> handle with the Option (Macintosh) or Alt (Windows) key. Click <b>Remove Level</b> to remove the active level.
Scale	Opens the Scale Hatch Definition dialog box. Enter a <b>Scaling Factor</b> to change the hatch definitions for the active level (except for the Dash Factor value, which remains unchanged). Select <b>Apply to All Levels</b> to change the scale factor for all levels.
Undo	The last five actions can be undone by clicking <b>Undo</b>
Redo	Click to redo the last action that was undone. Must be clicked directly after an action was undone. Appears dimmed when there are no actions to undo.
Revert	Returns the hatch definition to its status at the time the Edit Hatch dialog box was opened

The **Start Point**, **Repeat**, **Dash Factor**, and **Offset** functions correspond to the four control handles in the preview window. When a handle is moved, the corresponding function’s values change to reflect the move. The Shift key constrains the drag when using the control handles, affecting each of the four functions differently.

For the **Start Point**, **Repeat**, and **Offset** parameters, enter values according to either the polar coordinate system or the Cartesian system. The text box labels for these four controls change to correspond to the selection of Cartesian or polar.

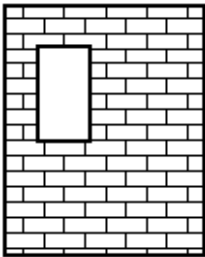
Coordinate System	Description
Polar	Defines the hatch line segments by length and angle values entered in relation to the origin. In polar mode, angles are represented as positive or negative values from 0 to 180. Values from 180 to 359 are automatically converted to negative. VectorWorks considers 0 to be at the 3 o'clock position.
Cartesian	Cartesian coordinates are the same as those used in the drawing area, with positive and negative X and Y axes

4. Click **OK**. The new hatch definition is saved under the specified name.

**Example: Creating a Brick Hatch**

The following Edit Hatch values demonstrate how to create a brick pattern. The hatch requires two levels. The bricks will be 8" x 3" and the first set of lines will be the vertical components of the bricks. This procedure creates a hatch that scales appropriately when it is placed into a drawing.

All values are entered in World units and Cartesian mode.



Parameter	Level 1 Values	Level 2 Values
Start Point	X = 0, Y = 0	X = 0, Y = 0
Repeat	X = 0, Y = 6	X = 2, Y = 0
Dash Factor	0.5	1
Offset	X = 4, Y = 3	X = 0, Y = 3

**Applying Hatches**

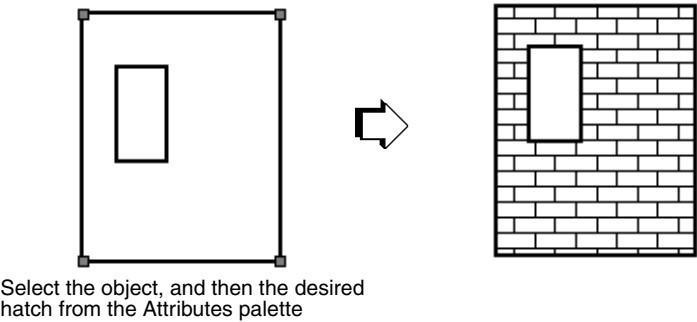
Associative and non-associative hatches are applied differently.

**Applying Associative Hatches**

To apply an associative hatch from the Attributes palette:

1. Select **Window > Palettes > Attributes**. The Attributes palette opens.
2. Select the object(s) which requires a hatch.
3. Select **Hatch** from the Attributes palette's **Fill Style** list.
4. Select the desired hatch from either the default resources or the current file's resources; see "VectorWorks Fundamentals Default Resources" on page 141.

The hatch is applied to the selected object(s).



To apply an associative hatch resource from the Resource Browser:

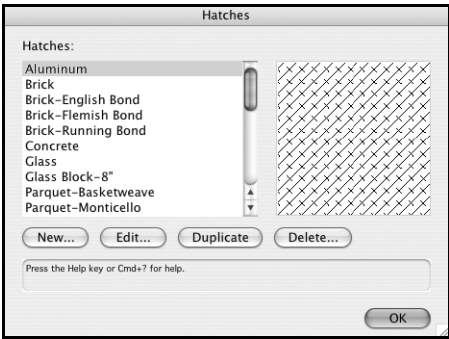
- 1. Select the object(s).
- 2. From the Resource Browser, select the hatch to be applied. From the context menu, select **Apply**. (Alternatively, double-click the hatch resource to apply it to the selection or drag the hatch resource onto an object.)

Applying Non-Associative Hatches

To apply a non-associative hatch:

- 1. Select the object which requires a hatch.
- 2. Select **Modify > Hatch**.

The Hatches dialog box opens.



Parameter	Description
Hatches list	Lists the available hatches from the default resources, the current file’s resources, or from a referenced file (referenced hatches display in italics)
Hatch preview	Displays a preview of the selected hatch at 100% zoom
New	Opens the Edit Hatch dialog box, for creating a new hatch (see “Defining Hatches” on page 237)
Edit	Opens the Edit Hatch dialog box, for editing or renaming an existing hatch
Duplicate	Creates a copy of the selected hatch (button is disabled if referenced hatches are present)
Delete	Deletes the selected hatch

3. Select the hatch to apply from the **Hatches** list.

A preview of the hatch is displayed.

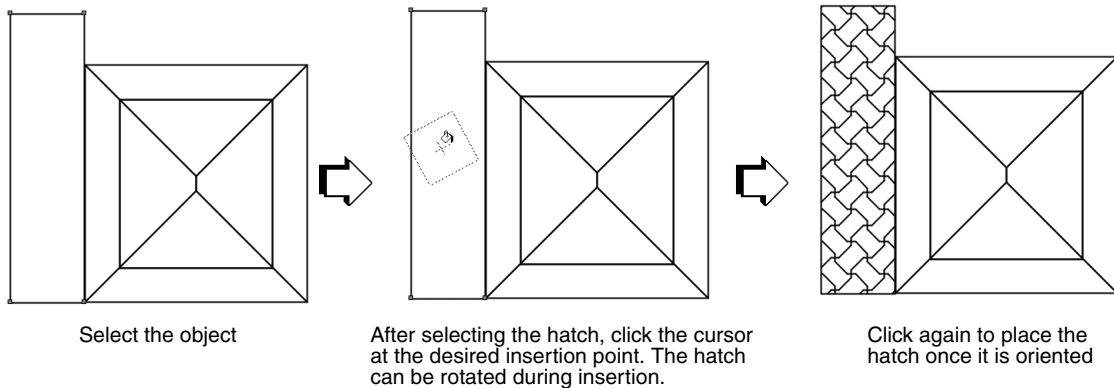
4. Click **OK** to return to the drawing area.

The cursor changes to a paint bucket.

5. Position the paint bucket on the object where the hatch should begin. Click to specify the hatch origin. Drag to specify the hatch orientation and click again.

The hatch fills the space from the paint bucket's location to the boundary created by the object.

When applying a hatch to an object, the tip of the paint from the paint bucket marks the hatch origin. The hatch start point within the object can be precisely specified.



## Editing Hatches

Changes to the hatch affect the previous instances of associative hatches in the drawing file.

To edit a hatch:

1. Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

2. Select the desired hatch, and select **Edit** from the context menu.

Alternatively, select **Modify > Hatch**, and click **Edit** for the selected hatch in the Hatches dialog box.

The Edit Hatch dialog box opens.

3. Edit the hatch.

See “Defining Hatches” on page 237 for details on the Edit Hatch dialog box.

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

Any associative instance of the edited hatch in the drawing file changes according to the new definition.

## Gradient Attributes

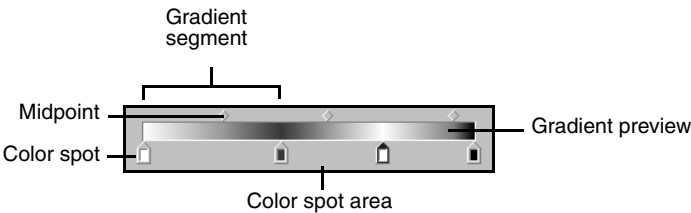
Gradients are created or imported into the current file through the Resource Browser (default resources are automatically imported into the current file at the point of use, and display in the Resource Browser); see “VectorWorks Fundamentals Default Resources” on page 141 and “Accessing Existing Resources” on page 147.



Gradients can be applied to any type of 2D object that accepts a fill, including 2D walls, text boxes, worksheet backgrounds, and plug-in objects that include a 2D object.

## Creating Gradients

Gradients are defined and stored in the Resource Browser.



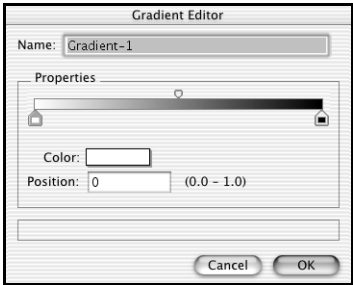
VectorWorks Term	Definition
Gradient	One color linearly blended to another color
Midpoint	Point between two colors where each color is of equal intensity; a midpoint is associated with the color spot to its left
Color spot	Point where the selected color is at full intensity
Gradient segment	Two adjacent color spots

To create a gradient definition:

1. Open the Resource Browser by selecting **Window > Palettes > Resource Browser**.
2. From the Resources menu, select **New Resource** to display the New Resource menu.
3. Select **Gradient**.

The Gradient Editor dialog box opens. Specify a name for the gradient resource, and select the segment starting and ending colors. Gradients can consist of several segments and more than two colors. To create a gradient with more than two colors, click in the color spot area. This adds a color spot and midpoint to the gradient.

Specify the location of a selected color spot or midpoint by dragging it into position, or entering its position in the **Position** field.



Parameter	Description
Name	Specifies a name for the gradient resource; this name is displayed in the Resource Browser and Attributes palette
Midpoint	Point between two colors where each color is of equal intensity
Gradient Preview	Displays the gradient in a preview bar
Color Spot	Specifies the starting or ending color of each gradient segment. To specify the color, double-click on a color spot, or select a color spot and click <b>Color</b> . To add a new gradient segment, click in an empty location in the color spot area. A new color spot and midpoint are created. Drag a color spot to a new location in the color spot area; its associated color is retained. Remove a color spot and its associated midpoint by selecting the color spot dragging it from the color spot area.
Color	Specifies the color of the selected color spot; click to select the color
Position	Indicates the position (0.0 – 1.0) of the selected color spot or midpoint; the midpoint position is relative to its location between two adjacent color spots

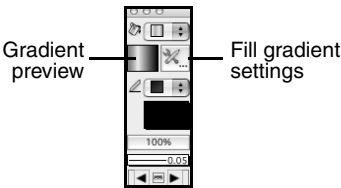
4. Click **OK** to save the gradient resource with the specified name.
- Gradient definitions can be edited by accessing the Gradient Editor from the Resource Browser. Select a gradient and select **Edit** from the **Resources** menu. See “Working with Resources” on page 151 for information on other Resource Browser commands.
- Gradients are saved in VectorWorks drawing files. If the file is not saved and the gradient is not a default resource, the gradient is lost when VectorWorks is exited.

## Applying Gradients

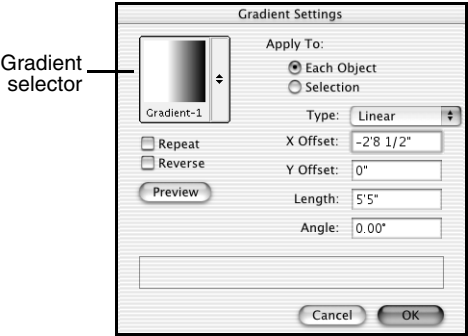
Gradient settings are specified through the Attributes palette and applied to a 2D object through the Resource Browser or the Attributes palette. In addition, a gradient fill can be specified as a default class attribute (see “Setting Class Properties” on page 98).

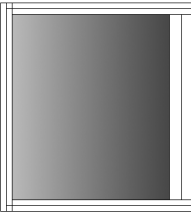
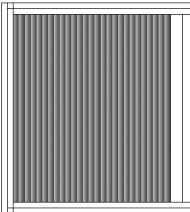
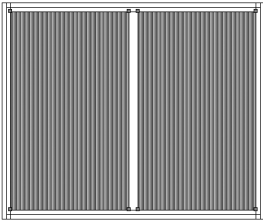
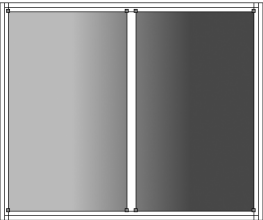
To apply a gradient resource from the Attributes palette and specify the gradient settings:


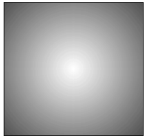
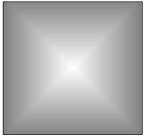
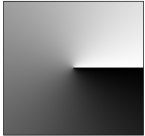
1. Select the object(s), and then select **Gradient** from the Attributes palette fill list. To change to a different gradient, click on the gradient preview and select a different gradient from the list of default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141).



2. Specify the settings for the current gradient by clicking the **Fill Gradient Settings** button next to the gradient preview bar.
- The Gradient Settings dialog box opens.



Parameter	Description
Gradient selector	Select a gradient resource from either the default resources or the current file’s resources
Repeat	Select to repeat the gradient segment(s) over the object; deselect to apply a single instance of the gradient segment(s) to the object <div><div></div><div></div></div>
Reverse	Select to draw the colors in reverse order from the order specified in the Gradient Editor dialog box
Apply To	Select <b>Each Object</b> to apply the gradient to each selected object individually; choose <b>Selection</b> to apply the gradient across the selected objects, spanning the objects. <div><div></div><div></div></div> <p>When applying a gradient across several selected objects, group the objects to retain the effect.</p>

Parameter	Description
Type	Select the gradient type from the list
Linear	Applies the gradient to the selection with linear geometry 
Radial	Applies the gradient to the selection with circular geometry 
Rectangular	Applies the gradient to the selection with rectangular geometry 
Angular	Applies the gradient to the selection in a counterclockwise direction from the specified starting point 
X/Y Offset	Indicates the gradient starting point coordinates relative to the center of the selection bounding box (in the file's current units)
Length	Specifies the length of a single gradient segment (in the file's current units)
Angle	Specifies the angle of the gradient fill

- 3. If desired, click **Preview** to view the results of the gradient settings.
- 4. Click **OK** to apply the gradient settings.

To apply a gradient resource from the Resource Browser:

- 1. Select the object(s).
- 2. From the Resource Browser, select the gradient to be applied. From the context menu, select **Apply**. (Alternatively, double-click the gradient resource to apply it to the selection or drag the gradient resource onto an object.)

The gradient settings can be edited from the Attributes palette.

## Image Attributes

Image fills are created or imported into the current file through the Resource Browser (default resources are automatically imported into the current file at the point of use, and display in the Resource Browser); see “VectorWorks Fundamentals Default Resources” on page 141 and “Accessing Existing Resources” on page 147.

Images can be applied to any type of 2D object that accepts a fill, including 2D walls, text boxes, worksheet backgrounds, and plug-in objects that include a 2D object.

### Creating Image Resources

Images are imported and stored in the Resource Browser.

To import an image for use as an image resource:

- 1. Open the Resource Browser by selecting **Window > Palettes > Resource Browser**.
- 2. From the Resources menu, select **New Resource** to display the New Resource menu.
- 3. Select **Image**.
- 4. If a resource with an image is already present in the file, the Choose Image dialog box opens.

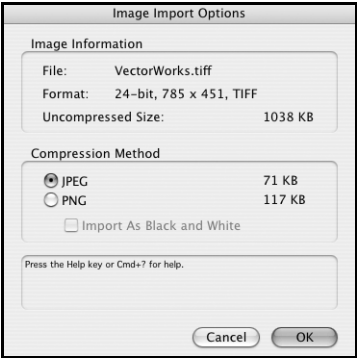


Parameter	Description
Import an Image File	Imports a new image; click <b>OK</b> and proceed to Step 5.
Reuse an Image from Another Resource	Reuses a previously imported image; select the resource that contains the image. Click <b>OK</b> and proceed to Step 6.

- 5. The Open dialog box is displayed. Select the image file to use as an image resource, and click **Open**.
- 6. If the image is in JPEG format, it is imported immediately. For images not in JPEG format, the Image Import Options dialog box opens. Specify the imported image options.

The current image information is displayed at the top, along with the image’s uncompressed size. Two compression methods are available; depending on the graphic, one of the methods may be more suitable. The compression method which produces the smallest file size is selected by default. Select the desired balance between compression and detail display. The resulting file size for each type of compression is displayed to help with the selection.

If the selected option results in a file size larger than the uncompressed size, the image is imported uncompressed.



Compression Method	Description
JPEG	Provides a high amount of compression, resulting in the smallest VectorWorks file size. However, fine detail may be obscured. JPEG compression is most suitable for photographic images.
PNG	Provides a moderate amount of compression, while preserving image details; an image compressed as a PND can also be imported as a 1-bit monochrome image by selecting <b>Import as Black and White</b>

7. Click **OK** to import the image with the selected compression type. The image resource is saved, by default, with the name of the original image file.

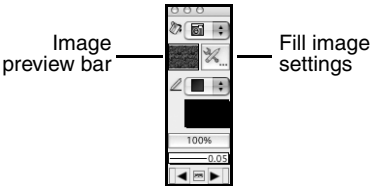
Image resources imported into the file that are not in JPEG format can be compressed by JPEG with the **Compress Images** command. See “Compressing Images” on page 399.

Applying Image Resources

Image settings are specified through the Attributes palette and applied to a 2D object through the Resource Browser or the Attributes palette. In addition, an image fill can be specified as a default class attribute (see “Setting Class Properties” on page 98).

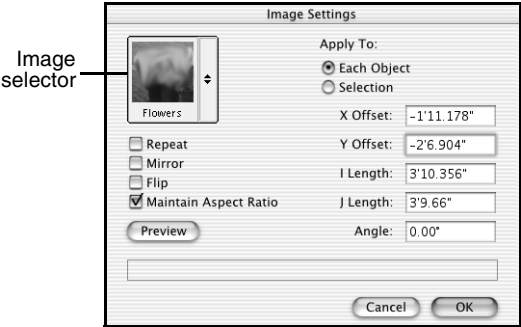
To apply an image resource from the Attributes palette and specify the image settings:

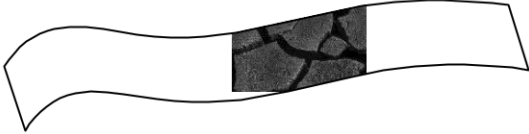

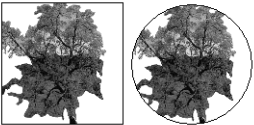
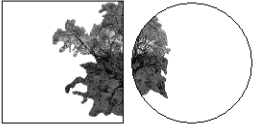
1. Select the object(s), and then select **Image** from the Attributes palette fill list. To change to a different image, click on the image preview bar and select a different image from the list of default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141).



2. Specify the settings for the current image by clicking the **Fill Image Settings** button next to the image preview bar.

The Image Settings dialog box opens.

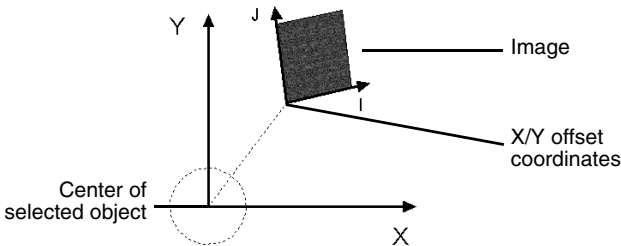


Parameter	Description
Image selector	Select an image resource from either the default resources or the current file's resources
Repeat	Select to repeat the image over the object; deselect to apply a single instance of the image to the object  <div><div>No repeat</div> <div>Repeat</div></div>
Mirror	Select to use a mirrored image of the image resource
Flip	Select to use a flipped image of the image resource
Maintain Aspect Ratio	Select to maintain the image aspect ratio when changing the <b>Length</b> values
Apply To	Select <b>Each Object</b> to apply the image to each selected object individually; choose <b>Selection</b> to apply the image across the selected objects, spanning the objects  <div><div>Each Object</div><div>Selection</div></div> When applying an image across several selected objects, group the objects to maintain the image.
X/Y Offset	Indicates the image starting point coordinates relative to the center of the selection bounding box (in the file's current units)

Parameter	Description
I/J Length	Specifies the distance in the I/J direction for a single instance of the image fill (in the file's current units)
Angle	Specifies the angle of the image fill

- 3. If desired, click **Preview** to view the results of the image settings.
- 4. Click **OK** to apply the image settings.

The X and Y axes are file-based, relative to the center of the selected object(s). The I and J axes are image-based.



To apply an image resource from the Resource Browser:

- 1. Select the object(s).
- 2. From the Resource Browser, select the image to be applied. From the context menu, select **Apply**. (Alternatively, double-click the image resource to apply it to the selection or drag the image resource onto an object.)

The image settings can be edited from the Attributes palette.

## Editing Gradient and Image Fills

The **Attribute Mapping** tool edits the size, position, and angle of image fills and gradients for an object with a gradient or image applied.

When working in 3D in RenderWorks, the **Attribute Mapping** tool maps textures directly in the drawing window. See “Direct Texture Mapping” on page 669.

### Editing Gradient Fills



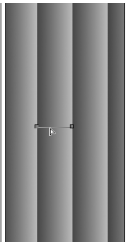
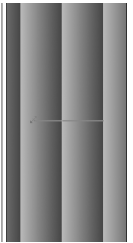

To modify an object's gradient fill:

- 1. Click the **Attribute Mapping** tool from the View/Draw or Visualization tool set.
- 2. Click on an object containing a gradient fill. Only one object at a time can be edited.
- 3. An editing object with two handles is placed over the gradient.






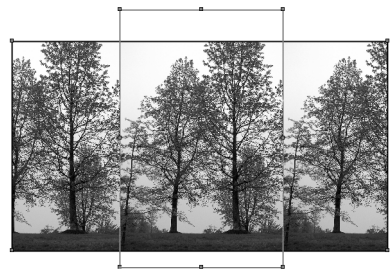
4. Use the editing object to set the gradient origin location, i-axis length, and rotation angle. Hold down the Shift key to constrain the editing object line; the fill can also be nudged.

Action	Description
Edit the location of the fill (gradient origin)	Click and drag the entire editing object, moving it to the desired location. Click to set. <div></div>
Edit the gradient i-axis location	Click on a handle at the end of the editing object, and drag to set the editing object to a new length. Click to set. <div></div>
Edit the gradient rotation	Click on a handle at the end of the editing object, and move to create a fulcrum line; click to set the rotation. <div></div>

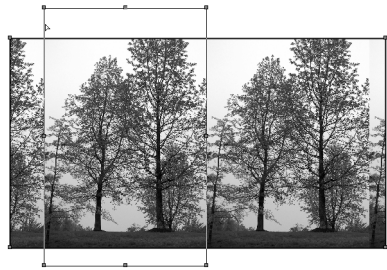
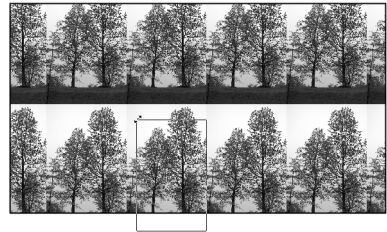
Editing Image Fills

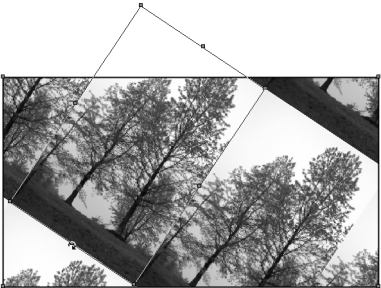
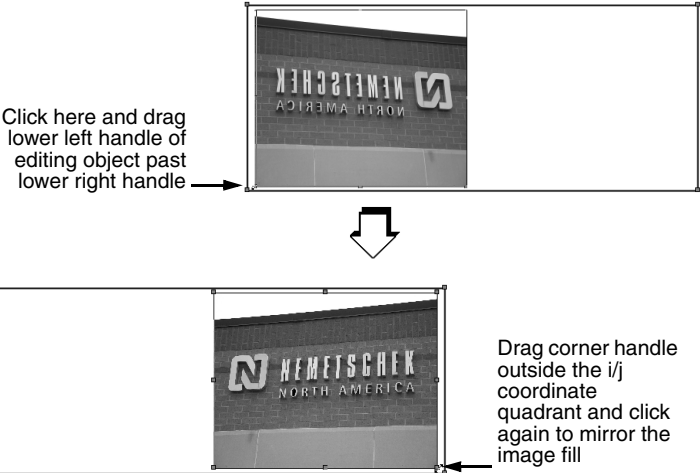
 To modify an object's image fill:

- 1. Click the **Attribute Mapping** tool from the View/Draw or Visualization tool set.
- 2. Click on an object containing an image fill. Only one object at a time can be edited.
- 3. An editing object with eight handles is placed over the image.



- 4. Use the editing object to set the image origin location, i-axis and j-axis lengths, and rotation angle. The fill can also be nudged.

Action	Description
Edit the location of the fill (image origin)	<div>Click and drag the entire editing object, moving it to the desired location.</div> 
Edit the image i-axis and j-axis location	<div>Click on a corner handle (the resize cursor displays) and drag the handle to the new size; holding the Shift key during this operation constrains the image aspect ratio. Click to set.</div> 

Action	Description
Edit the image rotation	<p>Click on a side handle (the rotate cursor displays) and drag the handle to the new rotation angle. Click to set. Press the Ctrl key (Windows) or Command key (Macintosh) while rotating to rotate about the image center.</p> 
Flip or mirror the image	<p>Click and drag a corner of the editing object past another corner of the editing object; click again to redraw the image within the new drawing area. Drag horizontally to mirror the image; drag vertically to flip the image; drag diagonally to both flip and mirror the image.</p> 

Options in the Image Settings dialog box (accessed from the Attributes palette) also affect image attribute mapping. When **Maintain Aspect Ratio** is selected, the image cannot be flipped or mirrored by dragging the editing object's handles vertically or horizontally; only diagonal dragging is allowed. Use the **Mirror** or **Flip** options in this dialog box to change the fill image orientation without moving or resizing the image.



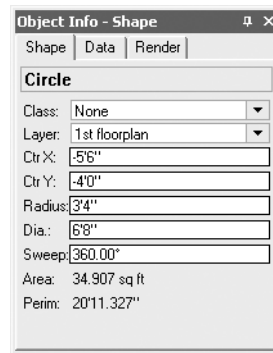
# Editing 2D Objects

Once a 2D object is created, it may require editing. Editing generally involves changing the size, shape, or number of objects in a drawing.

This chapter details the commands and tools available for editing 2D objects in VectorWorks.

## Editing Object Information

The Object Info palette provides information about the selected object(s) in a VectorWorks drawing. The information displayed depends on the type of objects selected. In addition, the palette can be used to change the parameters.



The Object Info palette organizes data into three tabbed panes:

Tab	Description
Shape	Displays information about a selected object's geometry, class, and layer (see "Shape Tab" on page 256)
Data	Lists any database records attached to a selected object (see "Data Tab" on page 258)
Render	When RenderWorks is installed, this tab is added for the assigning and mapping of textures to 3D objects (see "Applying Textures with Basic Mapping" on page 664). When sketch rendering with the Design Series, the <b>Sketch</b> parameter is available on the Render tab, even if RenderWorks is not installed.

Object Info palette drop-down list items can be selected by using the mouse or by typing the first letter(s) of the desired item to highlight the closest match in the list (excluding class and layer lists).

## Copying and Pasting Object Info Palette Data

Data contained in certain Object Info palette fields can be copied and pasted into the VectorWorks drawing or other locations, such as your computer's calculator.

To copy and paste Object Info palette data:

1. Select the object with data to copy.
2. Select **Window > Palettes > Object Info**.

The Object Info palette opens.

3. Click the tab containing the desired information. Move the mouse over the field containing the data for copying.

The cursor changes to an I bar in a field which permits copying.

4. Click-drag over the data to select it.
5. Select **Edit > Copy**.
6. Select **Edit > Paste** to paste the data into the desired location.

## Shape Tab

Object properties can be directly edited through the Object Info palette from the Shape tab. Objects can also be edited with the tools on the Basic palette throughout this chapter.

The Shape tab always displays class and layer information. The detailed object information that is also displayed depends on the type of object selected. Keep the following points in mind when changing object information through the Shape tab:

- To change individual objects in a group, first select the **Modify > Edit Group** or **Ungroup** command, and then select the desired object(s).
- In single vertex mode, only that vertex changes. However, in entire object mode, all the vertices are changed.

To view and edit object information for a single object:

1. Select **Window > Palettes > Object Info**.

The Object Info palette opens.

2. Click the Shape tab.
3. Select the desired object.

Editable information for that object is displayed.

4. Change the desired information.

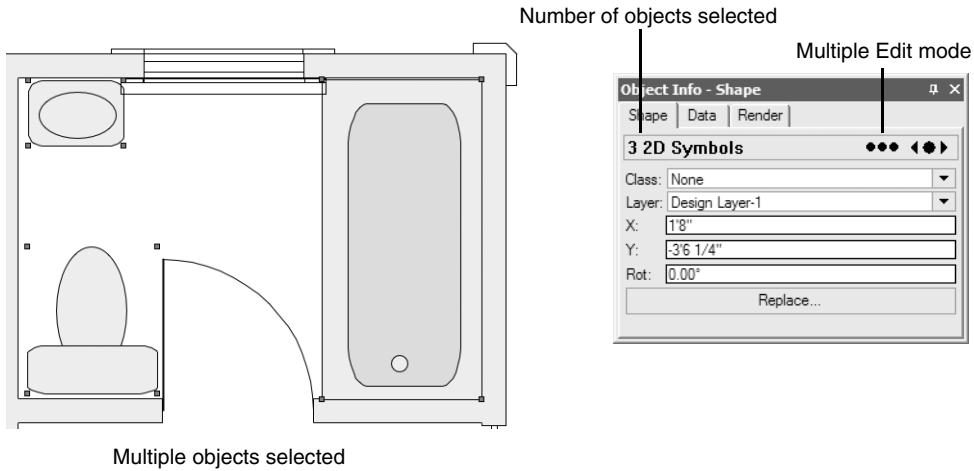
Press the Enter or Tab key to make the change.

To view and edit object information for multiple objects:

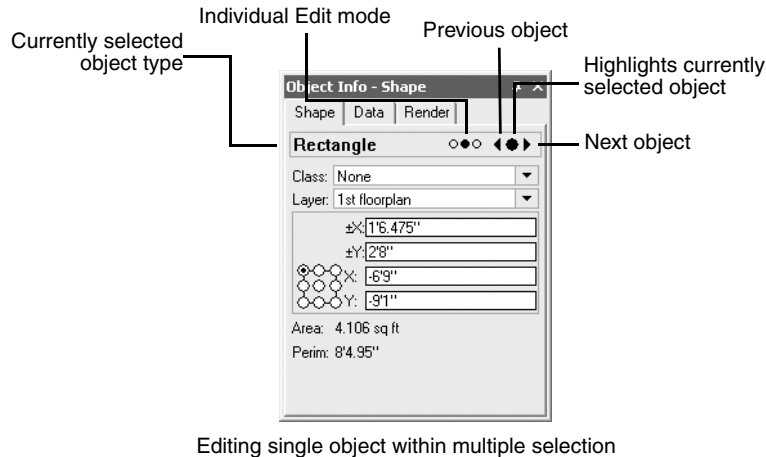
1. Select **Window > Palettes > Object Info**.

The Object Info palette opens.

2. Click the Shape tab.
3. Select the desired objects.



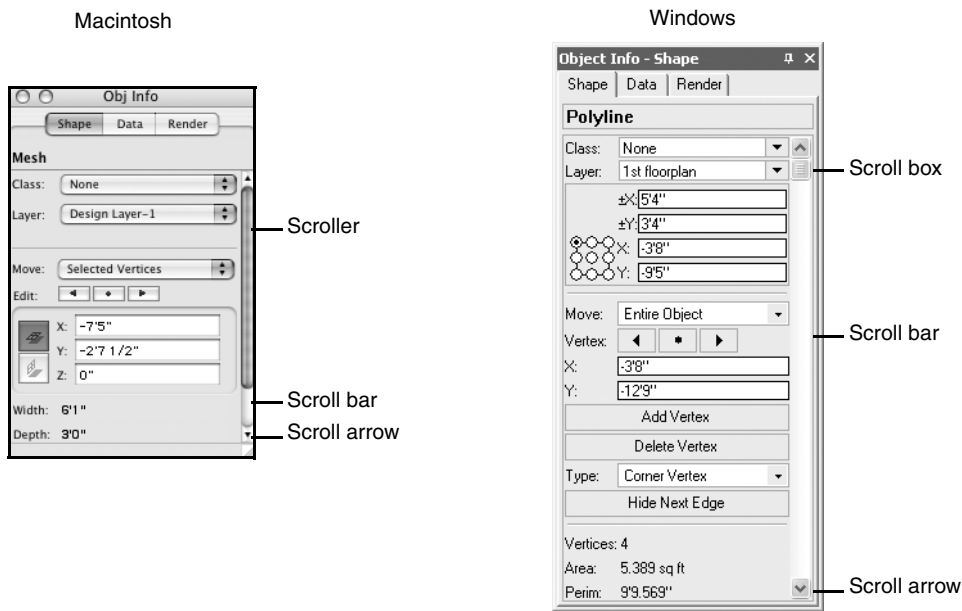
- To edit each object in a selection separately, click the **Multiple Edit** mode button. This switches to Individual Edit mode. Once in Individual Edit mode, use the Next arrow button to move forward through the selected objects and the Previous arrow button to move backward through the selections. Each object highlights briefly as it is selected. To be sure which object is currently selected, click the center circular button to highlight it again. If either arrow appears dimmed, the end of the selected objects in that order has been reached.



Editing single object within multiple selection

Alternatively, select multiple objects of the same type, and then modify them at one time in Multiple Edit mode. When several objects of the same type have been selected, the palette operates in "batch" editing mode. If the parameter settings of the objects are different, the field displays as blank, or a checkbox displays with an "indeterminate state." Any parameter edits affect all the selected objects in multiple edit mode.

Some objects have more editable fields than others. If the Object Info palette is not fully extended when an object of this type is selected, scroll options are provided. To scroll up and down, click the scroll arrows, any area of the scroll bar, or click-drag the scroll box (Windows) or scroller (Macintosh).

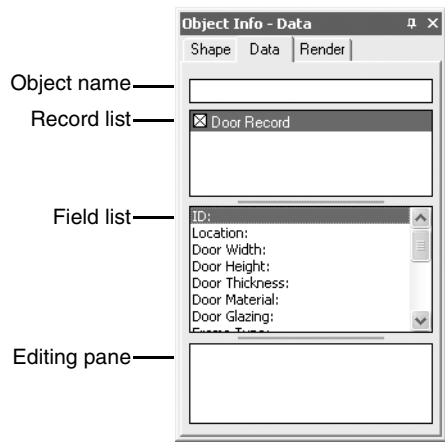


Data Tab

The Data tab lists all records in the drawing, along with checkboxes showing which records are attached. The Object Info palette can be used to make changes to record settings.

To view and edit record information:

- 1. Select **Window > Palettes > Object Info**.
- 2. Click the **Data** tab.



- 3. Select the desired object in the drawing area.
- The following information is displayed.



Parameter	Description
Object Name	Displays the name, if any, given to an object
Record List	Displays all the records that are active in the drawing; if any of these records are attached to the selected object, the box to the left of the record name displays an X
Field List	Provides a list of all the record fields if a record is attached to the selected object; if any field has a default value assigned, it displays after the field name
Editing Pane	Provides an area for entering record information

Resize the list boxes by selecting and dragging the bars between them.

If any records are attached to the selected object, the box to the left of the record name displays an X. If more than one object is selected, only the records attached to all objects display an X.

See “Record Formats” on page 170 for more information on attaching, editing, and deleting record formats.

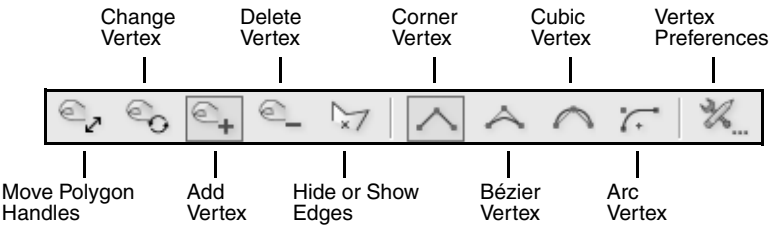
## Reshaping Objects

The **2D Reshape** tool reshapes an object after it has been created. Change the length of objects (including dimensions) reshape single objects, or reshape multiple objects at once.

With this tool, reshape all polygons and polylines, including lines drawn with the **Freehand** tool (which are considered polylines in VectorWorks). In addition, specify exact radius measurements for circular arc control points.

Certain objects (polylines, polygons, rectangles, circles, and arcs) can also be reshaped with the **Freehand** tool. See “Reshaping Objects with the Freehand Tool” on page 214.

The **2D Reshape** tool has five different reshape modes. It also has four control point modes for changing the existing vertex. In addition, the tool can operate in marquee selection mode.



Mode	Description
Move Polygon Handles	Drag a vertex by clicking it, or drag a segment by clicking on the midpoint.  Click and drag to create a rectangular marquee around several vertices. To create a lasso marquee, press the Option (Macintosh) or Alt (Windows) key when creating the marquee. Press the Command and Option (Macintosh) or Ctrl and Alt (Windows) keys for polygonal marquee selection mode.
Change Vertex	Changes an existing vertex into a corner, Bézier, cubic spline, or fillet (circular arc) point
Add Vertex	Adds a vertex as a corner, Bézier, cubic spline, or fillet (circular arc) point
Delete Vertex	Removes the selected vertex

Mode	Description
Hide or Show Edges	Clicking on the midpoint hides the polyline or polygon segment; clicking on a vertex hides the segment that follows the vertex
Corner Vertex	Vertex forms a straight angle
Bézier Vertex	Curve of polygon/polyline pulls towards but does not touch the vertex
Cubic Vertex	Curve of polygon/polyline passes through the vertex
Arc Vertex	Vertex becomes a fillet; click the <b>Preferences</b> mode button, enter a <b>Fillet Radius</b> in the Fillet Settings dialog box, and click <b>OK</b> (for the largest possible fillet, set the <b>Fillet Radius</b> to zero)

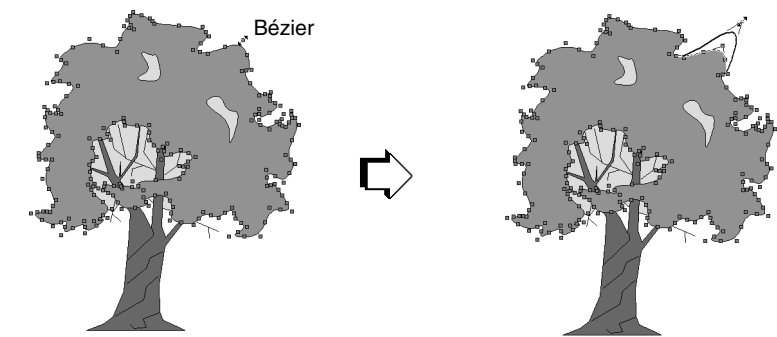
## Move Polygon Handles Mode

Select this mode to reshape a 2D polyline or polygon by moving one of its vertices.



To reshape a 2D polyline or polygon by moving a vertex:

1. Select the polyline or polygon to change.
2. Click the **2D Reshape** tool from the Basic palette.
3. Click the **Move Polygon Handles** mode button.
4. Click the vertex to move and drag it to its new location. Click to set the new location.



Click on the desired vertex; when the Resize cursor displays, drag it to the new location

Any object that cannot be reshaped with this tool continues to display standard bounding box handles only.

## Change Vertex Mode

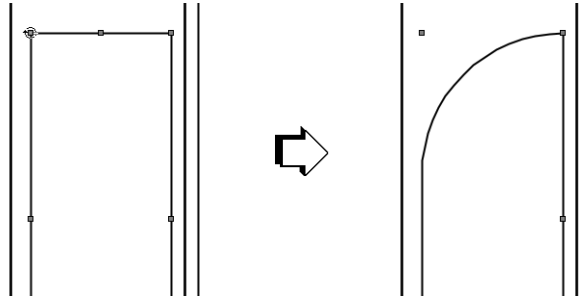
Select this mode to change an existing vertex to a different type of control point: corner, Bézier, cubic spline, or fillet (circular arc) point.



To reshape a 2D polyline or polygon by changing a vertex:

1. Select the polyline or polygon to change.
2. Click the **2D Reshape** tool from the Basic palette.

3. Click the **Change Vertex** mode button.
4. From the Tool bar, select the new type of control point for the vertex.  
[Change vertex does not work on a midpoint handle. Select only a vertex point.](#)
5. Click to change the vertex.



Click on the vertex when the Change Vertex cursor displays

## Add Vertex Mode

Select this mode button to add a vertex to the polyline/polyline. The vertex can be any of the following: corner, Bézier, cubic spline, or fillet (circular arc) point.

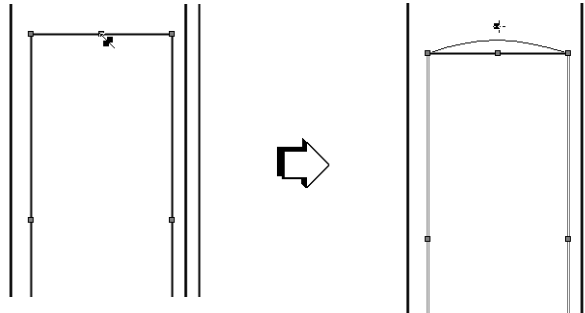


To reshape a 2D polyline or polygon by adding a vertex:

1. Select the polyline or polygon to change.
2. Click the **2D Reshape** tool from the Basic palette.
3. Click the **Add Vertex** button on the Tool bar.
4. From the Tool bar, select the type of control point for the new vertex.
5. Move the cursor to an existing vertex near the location where the new vertex is to be added. The cursor becomes an arrow with two black diamonds when a vertex can be added.

[Clicking on the handle at a center point along an edge adds a new vertex exactly at that center point.](#)

6. Drag the cursor to the desired location for the new vertex.
7. Click at the new location.



With the Add Vertex cursor, click-drag to the new location

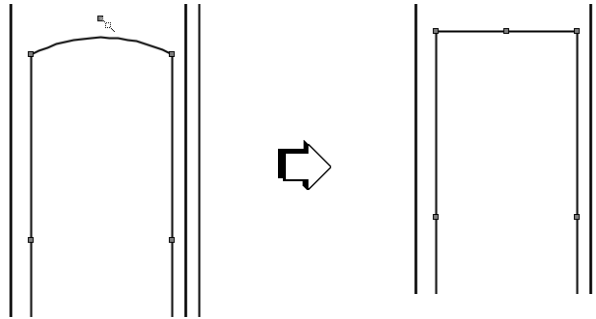
## Delete Vertex Mode

An existing vertex on the polyline/polyline can be deleted.



To reshape a 2D polyline or polygon by deleting a vertex:

1. Select the polyline or polygon to change.
2. Click the **2D Reshape** tool from the Basic palette.
3. Click the **Delete Vertex** mode button.
4. Click the existing vertex to delete it.



With the Delete Vertex cursor, click the vertex to remove it

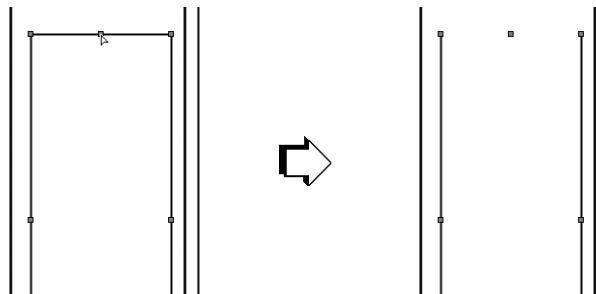
## Hide or Show Edges Mode

Select this mode button to hide, but not delete, a portion of the object's boundary.



To hide or show the edge of a 2D polyline or polygon:

1. Select the polyline or polygon to change.
2. Click the **2D Reshape** tool from the Basic palette.
3. Click the **Hide or Show Edges** mode button.
4. Click a vertex near the edge to be hidden.



With the Hide/Show Edges cursor, click a vertex near an edge to show or hide the edge

Click again to show the hidden edge.

## Performing Multiple Reshapes

Instead of individually reshaping the vertices of objects, one at a time, several vertices and even several objects can be reshaped at one time. In addition, vertices and holes can be deleted from objects. Multiple reshaping can be performed on lines, polylines, walls, dimensions, and polygons. Polygons include all regular and irregular polygons, as well as objects drawn with the **Freehand** tool. For example, use this function to resize walls without moving any of the doors or windows placed inside them, or affecting intersections with other walls.

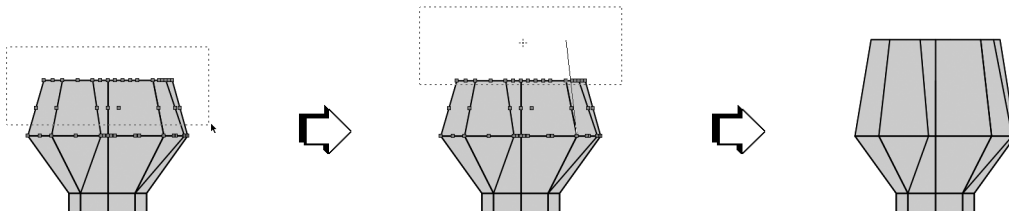
This function must be executed in Top/Plan view. This function does not work on objects drawn with the **Rectangle**, **Oval**, or **Arc** tools.



To resize objects with multiple reshape:

1. Select the objects to resize.
2. Click the **2D Reshape** tool from the Basic palette, and select **Move Polygon Handles** from the Tool bar.  
The cursor changes to a cross-hair.
3. Click and drag to create a rectangular marquee around multiple vertices of the objects to be resized or deleted.  
To create a lasso marquee, press the Option (Macintosh) or Alt (Windows) key when creating the marquee. Press the Command and Option (Macintosh) or Ctrl and Alt (Windows) keys for polygonal marquee selection mode.
4. Change the location of the vertices by either clicking and dragging with the mouse or by using the **Move** command (see “Editing Object Surfaces” on page 282).

To use the mouse, click-drag on the vertices and move them to the desired location. A preview displays the current and future location of the object vertices.



Create marquee to select multiple vertices, and then drag selected vertices to new location

Press the Delete key (Macintosh) or Delete or Backspace keys (Windows) to delete the vertices or holes.

Alternatively, enter an exact length in the Data bar. Press the Tab key while still pressing the mouse button until the L field is highlighted, enter a value for the length, and release the mouse button.

The walls are resized with the wall intersections, doors, or other symbols maintained in place. The marquee remains on the screen until another tool or command is selected.

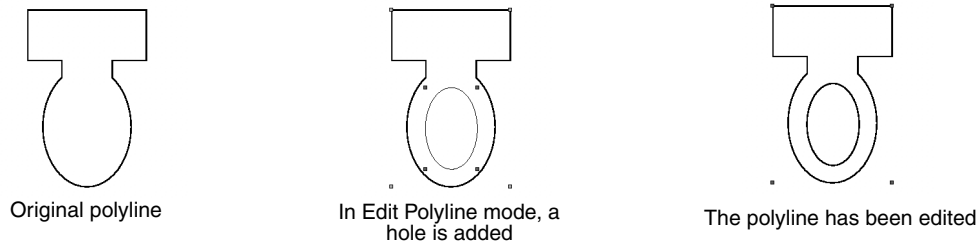
## Reshaping Polylines

Polylines can be reshaped in a manner that is similar to an Edit Group operation. The polyline itself is locked in this process, but holes can be added to it, filleted, chamfered, offset, duplicated, extracted, and deleted from it.

To reshape a polyline:

1. Select the polyline to change.
2. Select **Modify > Edit Polyline**.

3. Select polyline holes and move, delete, or reshape them. Add new holes to the polyline, or move a hole out of the polyline to extract it, creating individual polylines.
- The original polyline is locked and cannot be edited.
4. Click **Exit Polyline** to return to the drawing.



## Offsetting Objects

The **Offset** tool either creates a duplicate object offset from the original, or offsets the selected object from its original location. Use this tool to easily create parallel objects, such as lines and walls. Also use it to produce a larger or smaller version of closed objects, such as ovals and connected walls. NURBS surfaces are offset by the offset distance along the surface normal direction.

The Offset tool can be used with the following objects (see the Design Series User’s Guide for information about the Design Series objects).

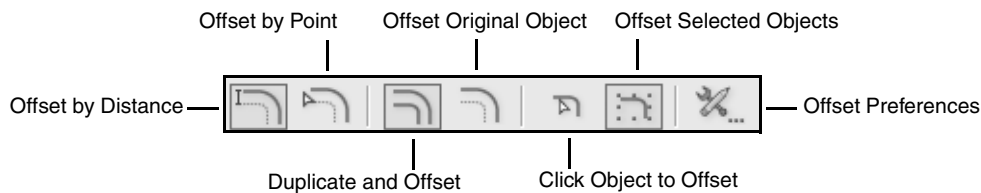
### VectorWorks Fundamentals Objects

- Open 2D objects (arcs, lines, polylines)
- Closed 2D objects (circles, ovals, rectangles, polylines, polygons)
- NURBS curves
- NURBS surfaces
- Walls
- Revision clouds

### VectorWorks Design Series Objects

- Hardscapes
- Seating layouts
- Stipples
- Massing models
- Site modifiers
- Plants
- Property lines
- Spaces
- Redlines

The **Offset** tool has six modes, which are also options in the Offset Tool Preferences dialog box.



There are two options for selecting objects to offset: either pre-select one or more objects with the **2D Selection** or **3D Selection** tool, or select one object at a time after selecting the **Offset** tool.

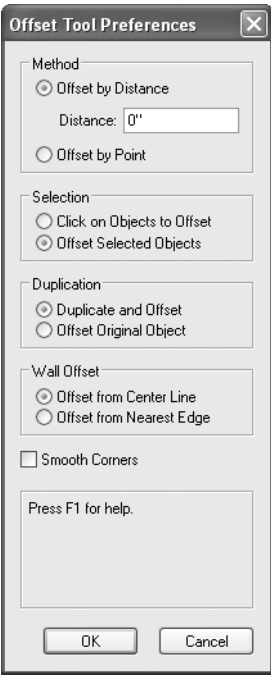
The **2D conversion res** field, on the Edit tab of the VectorWorks Preferences dialog box, adjusts the degree of smoothing. The higher the conversion resolution, the higher the degree of smoothing, which produces a more accurate offset of objects. For more information on 2D conversion resolution, refer to “Setting VectorWorks Preferences” on page 39.



To offset one or more objects:

- 1. Select the object(s) to be offset, if desired.
- 2. Click the **Offset** tool from the Basic palette.
- 3. Click **Offset Preferences** from the Tool bar.

The Offset Tool Preferences dialog box opens.



Parameter	Description
Method	
Offset by Distance	Places the offset object at the specified <b>Distance</b> from the original location (same as selecting the Tool bar button)
Offset by Point	Places the offset object at a distance specified by a mouse click (same as selecting the Tool bar button)
Selection	
Click on Objects to Offset	Offsets objects selected with the <b>Offset</b> tool (same as selecting the Tool bar button)

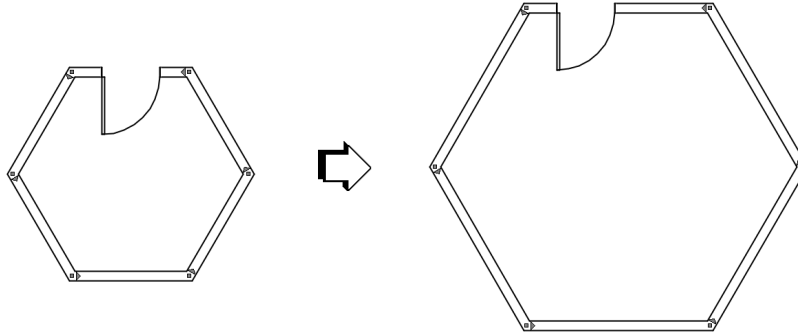
Parameter	Description
Offset Selected Objects	Offsets objects selected with the <b>2D Selection</b> or <b>3D Selection</b> tool (same as selecting the Tool bar button)
Duplication	
Duplicate and Offset	Creates a duplicate of the object at the offset location (same as selecting the Tool bar button)
Offset Original Object	Moves the original object to the offset location (same as selecting the Tool bar button)
Wall Offset	
Offset from Center Line	Offsets walls from the center line of the wall's original location
Offset from Nearest Edge	Offsets walls from the nearest edge of the wall's original location
Smooth Corners	Rounds sharp corners in the offset object

- 4. Specify the desired preferences and click **OK**.
- 5. Depending on the offset preferences, do one of the following:

Offset Method	Description
Offset by Distance	
Click on Objects to Offset	Select the object to be offset; the object is highlighted. Click to specify the offset location relative to the selected object, and to place the offset object. To continue offsetting objects, click another object to highlight it, and then click again to indicate the offset location.
Offset Selected Objects	Click in the drawing to specify the offset location relative to the originally-selected object, and to place the offset object. The offset object is now selected; to offset from that object, click again to indicate the offset location.
Offset by Point	
Click on Objects to Offset	Select the object to be offset; the object is highlighted. Move the mouse to adjust the offset preview if necessary, and then click to place the offset object. To continue offsetting objects, click another object to highlight it, and then click again to indicate the offset location.
Offset Selected Objects	Click to set the offset point (move the mouse to adjust the offset preview if necessary), and then click again to place the offset object. The offset object is now selected; to offset from that object, click again to indicate the offset location.

Depending on the offset preferences, either a duplicate object or the original object is placed at the offset location.





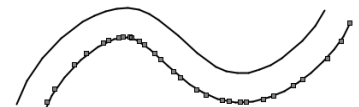
Select the walls with the **2D Selection** tool, and then select the **Offset** tool. Select **Offset by Distance** mode, and set the offset **Distance** to 2'. Click outside the walls to offset them 2' beyond the original location.



In **Offset by Point** mode, click the object to be copied and offset; the object is highlighted



Click the point where the offset is to be placed; a preview displays



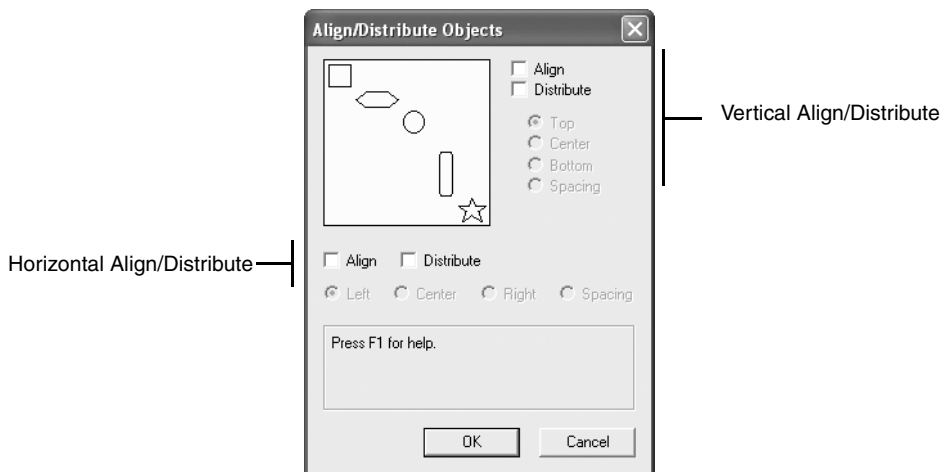
Click again to place the offset object

## Aligning and Distributing 2D Objects

The **Align/Distribute** command aligns and distributes multiple 2D objects. Alignment and distribution is based upon the vertical and horizontal axes, relative to the screen.

To align/distribute objects:

1. Select the objects to be aligned/distributed.
2. Select **Modify > Align > Align/Distribute**. The Align/Distribute Objects dialog box opens.

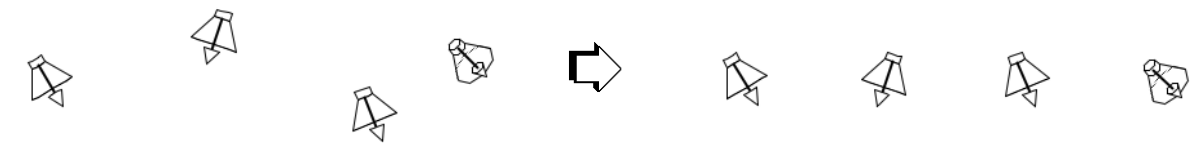


3. Select the object alignment/distribution criteria. 2D objects are only moved along the horizontal and vertical axes.

Parameter	Description
Align	Select to align items along the horizontal or vertical axis
Distribute	Select to distribute items along the horizontal or vertical axis
Horizontal	
Left	Align/distribute by the left side of the selected objects
Center	Align/distribute by the centers of the selected objects
Right	Align/distribute by the right side of the selected objects
Spacing	Distribute the spacing equally between the left and right sides of adjacent objects
Vertical	
Top	Align/distribute by the top of the selected objects
Center	Align/distribute by the centers of the selected objects
Bottom	Align/distribute by the bottom of the selected objects
Spacing	Distribute the spacing equally between tops and bottoms of adjacent objects

4. Click **OK**.

VectorWorks aligns/distributes the selected objects.



Loci and locked objects are special objects and behave differently when present during an alignment/distribution operation.

If a locus point is one of the selected objects, all objects are aligned relative to that locus. If there are multiple loci in the selection, then the loci are aligned/distributed like any other object.

Locked objects in a selection do not move. Other objects are aligned/distributed relative to the locked objects.

## Trimming and Clipping Objects

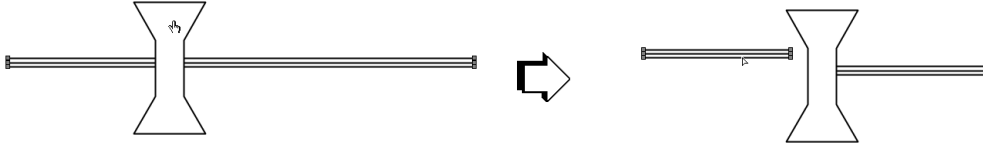
### Trim Command

Use the **Trim** command to trim lines or walls where they intersect with another object.

To trim objects:

1. Position the object you want to cut with over the object(s) to be trimmed.
2. Select the cutting object.
3. Select **Modify > Trim**.
4. Click on the object to be trimmed.

The trim command is executed and the pieces can be moved independently.



## Trim Tool

The **Trim** tool trims a portion of the selected object. Objects that can be edited in this manner include lines, arcs, rectangles, circles, ovals, polylines, and polygons.



To trim a portion of an object:

1. Position the object you want to cut with over the object(s) to be trimmed.

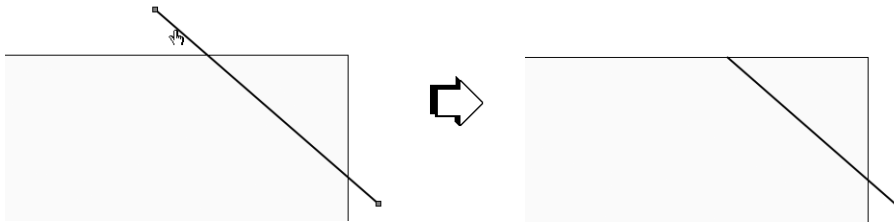
2. Click the **Trim** tool from the Basic palette.

The standard arrow cursor changes into a hand.

3. Click the portion of the object to be trimmed.

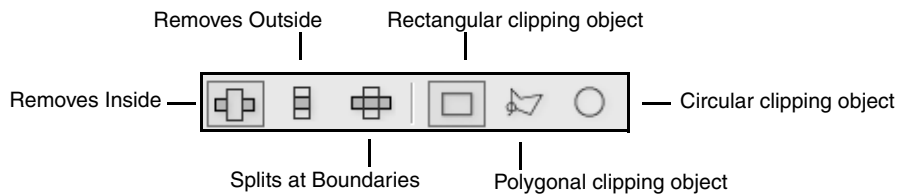
That portion of the object is trimmed back to the closest intersection with another object.

To trim another portion of the same object, move the hand to that section and click.



## Clip Tool

The **Clip** tool cuts out pieces from the 2D objects, such as lines, arcs, rectangles, circles, ovals, polygons, and polylines. In addition, this tool can be used to split an object.



Mode	Description
Removes Inside	Cuts a hole in the object(s) according to the clipping object shape
Removes Outside	Trims everything away from the outside of the clipping object shape

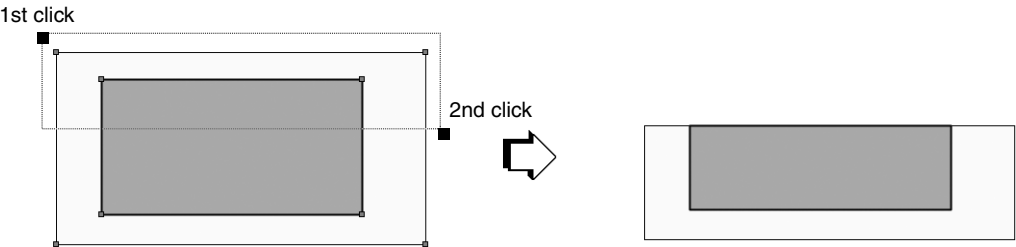
Mode	Description
Splits at Boundaries	Splits the object(s) and the clipping area into separate objects
Clipping object shape	Each mode can use one of the clipping shapes; select rectangular, polygonal, or circular



To clip objects:

1. Select the object or objects to cut.
2. Click the **Clip** tool from the Basic palette.
3. Select the clipping mode and the clipping object shape.
4. Click and drag to create a marquee box.

The object is clipped as defined by the clipping object shape.



## Resizing Objects

### Fixed Point Resize Tool

The **Fixed Point Resize** tool resizes rectangles, polygons, circles, and ovals using a fixed point on the drawing as the point of reference. It is best used to scale an object relative to a particular location in the drawing. To rescale an object symmetrically or asymmetrically by a specific factor, use the **Scale Objects** command. See “Scaling Objects” on page 271.



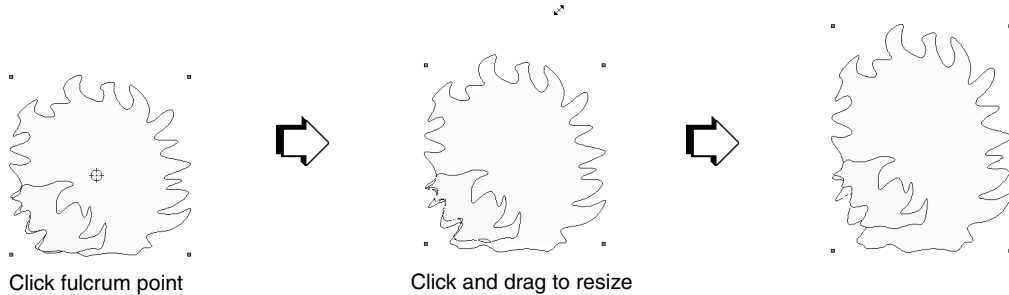
To resize an object:

1. Select the object or objects to change.
2. Click the **Fixed Point Resize** tool from the Basic palette.
3. Click on the point in the drawing to serve as the fulcrum.

To scale the resized object symmetrically, select a fulcrum point that is at the exact center of the object.

If the fixed point is not at the center of the object, the resized object changes proportions.

4. Click on an object edge and drag the object into its new size, shape, and/or location.



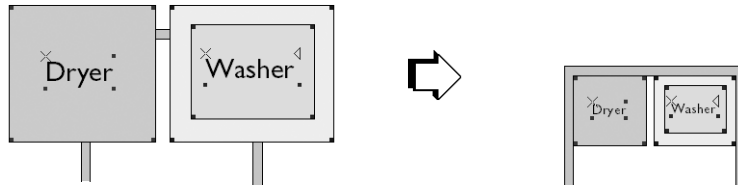
If the drag point is moved past the selected fulcrum, the object is reversed.

The starting point for dragging cannot be the same as the fulcrum point or exactly horizontal or vertical to it.

## Scaling Objects

The **Scale Objects** command rescales the X and/or Y dimension of any selected solid, object, or group, or rescales the selected items uniformly in the X,Y, and Z dimensions. The selected item is rescaled using its center point. The object can be rescaled by indicating a segment on the drawing and entering a new distance for the segment. In addition, text and/or all visible objects in the drawing can be scaled.

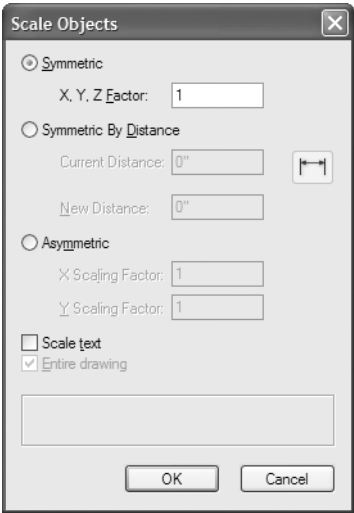
*Spheres, hemispheres, and cones cannot be scaled asymmetrically. Symbols and layer links cannot be scaled.*



To scale objects:

1. Select the object(s) to scale.
2. Select **Modify > Scale Objects**.

The Scale Objects dialog box opens. Specify the scaling method and parameters.



Parameter	Description
Symmetric	Scales uniformly along X, Y, and Z axes
X, Y, Z Factor	Enter the scaling factor (for example, enter 2 to double or .5 to halve the scale)
Symmetric By Distance	Scales symmetrically using the ratio of the current and new distance values as a scale factor
Current Distance	Enter the current distance to be scaled, or click the button to use a temporary tool to indicate the distance on the drawing
New Distance	Enter the new value for the distance
Asymmetric	Scales along only the specified X and Y axes; when asymmetrically scaling a solid, the current view must be aligned with the solid’s matrix for scaling to occur
X / Y Scaling Factor	Enter the scaling factor (for example, enter 2 to double or .5 to halve the scale)
Scale text	Scales selected text to the new scaling factor
Entire drawing	Scales all visible objects in the active layer

- 3. If specifying the scale factor with the **Symmetric by Distance** option, click the button to switch temporarily to the drawing. Click to indicate the start of the segment, drag the mouse, and click to indicate the end of the segment. You are returned to the Scale Objects dialog box, and the **Current Distance** value has been specified. Enter the **New Distance** for the segment.
- 4. Click **OK**.

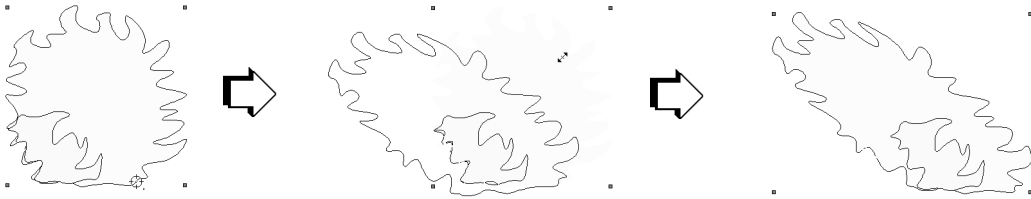
Shearing Objects

The **Shear** tool simultaneously skews all of the vertices of a rectangle, polygon, circles, ovals, or polyline, using a fixed point on the drawing as a point of reference. It is like placing a thumbtack on one point of an object, or the drawing, and reshaping every other object point except the one tacked down. The **Shear** tool can be used to fake a 3D perspective.



To shear an object:

1. Select the object or objects to change.
2. Click the **Shear** tool from the Basic palette.
3. Click on the point in the drawing to tack down.
4. Click on the object and drag the resize cursor to shear the object. A preview object displays.
5. Click to set the shear position.



Click to tack down a point then drag the resize cursor to shear the object

## Joining Objects

### Join Command

The **Join** command can be used to join two single lines, two double lines, or two walls together. Joined lines intersect but remain as individual objects.

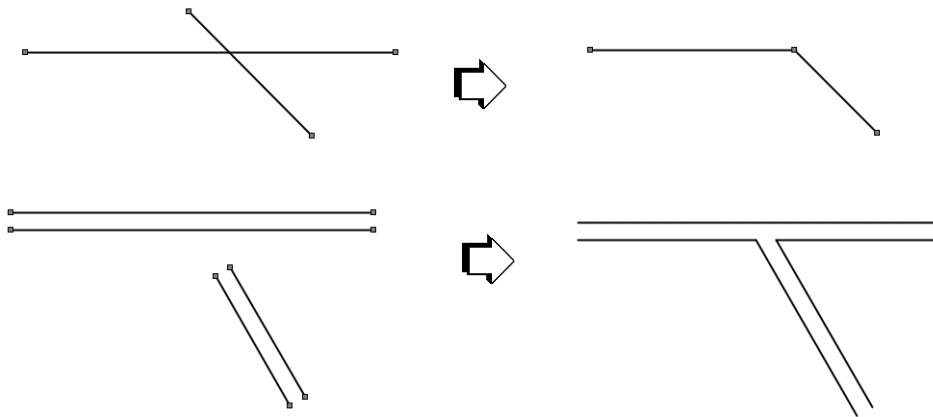
Object	Specifications
Individual Lines	An individual line can be joined to another individual line
Double Lines	Double lines can be joined to another set of double lines or to a wall. Double lines drawn with the <b>Create Polygons</b> option (set in Double Line preferences) cannot be joined. Only the line elements of double lines drawn with the <b>Create Lines and Polygons</b> option can be joined.
Walls	A wall can be joined to another wall or to double lines created with the <b>Create Lines</b> option (set in Double Line preferences). Walls will join to the line elements of double lines drawn with the <b>Create Lines and Polygons</b> option.

### Join

To join walls, single lines, or double lines:

1. Select the two non-parallel walls, lines, or double lines to join.
2. Select **Modify > Join > Join**.

The selected walls/lines are joined together with any excess trimmed away.



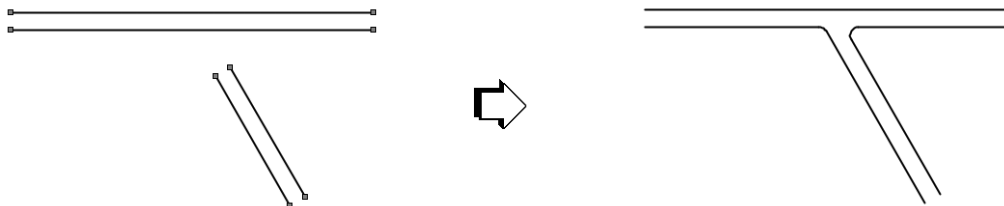
## Join and Fillet

To join and fillet double lines:

1. Select the two sets of non-parallel double lines to join.
2. Select **Modify > Join > Join and Fillet**.

If a fillet measurement has already been specified for this drawing, VectorWorks automatically connects the two double lines and creates a fillet using the default value.

If a fillet measurement has not been specified for this drawing, the Fillet Settings dialog box opens. Enter the desired fillet radius and click **OK**. VectorWorks automatically connects the two double lines and creates a fillet using the specified value.



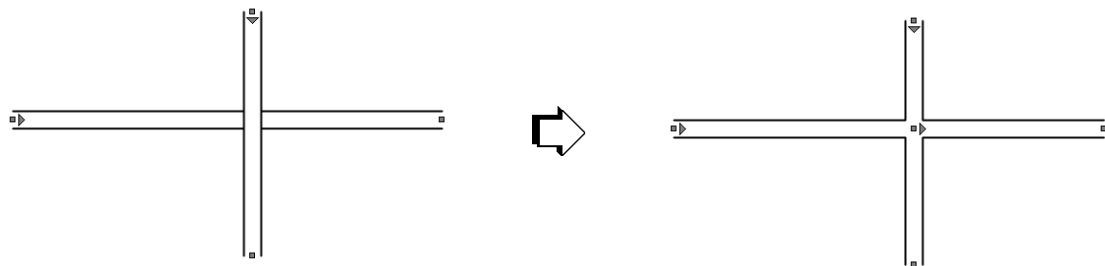
## Join (No Trim)

To join two overlapping walls or individual lines, without trimming away the excess:

1. Select the two non-parallel walls or lines to join.
2. Select **Modify > Join > Join (no trim)**.

The selected walls/lines are joined without trimming any excess.





## Splitting Objects and NURBS Surfaces

The **Split** tool splits the following objects (see the Design Series User’s Guide for information about the Design Series objects).

Note that splitting an object may change its type; for example, trimming a roof face creates a solid section, which can no longer be edited as a roof face.

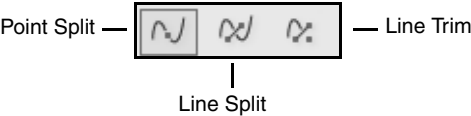
### VectorWorks Fundamentals Objects

- 2D objects (arcs, lines, polylines, polygons, ovals, circles, rectangles)
- Revision clouds
- NURBS curves
- NURBS surfaces
- Viewports
- 3D solid objects (extrudes, cylinders, spheres, hemispheres, cones)
- Pillars
- Walls
- Floors
- Roof faces

### VectorWorks Design Series Objects

- Property lines
- Massing models
- Site modifiers
- Spaces
- Redlines
- Stipples
- Seating layouts
- Hardscapes

The following modes are available for the **Split** tool.



Mode	Description
Point Split	Cuts an object or NURBS surface at a specified point
Line Split	Splits an object or NURBS surface along a cutting line
Line Trim	Splits an object or NURBS surface along a cutting line, and then keeps a designated side

Surfaces generated by successive splitting can be joined together with the **Compose** command (see “Composing and Decomposing Objects and Surfaces” on page 387).

This tool may not be able to manipulate certain types of surface geometry (see “Surface Geometry Requirements” on page 314).

## Point Split Mode

The **Point Split** mode cuts an object at a specified location.

### Splitting Objects by Point



To split an object at a specific point:

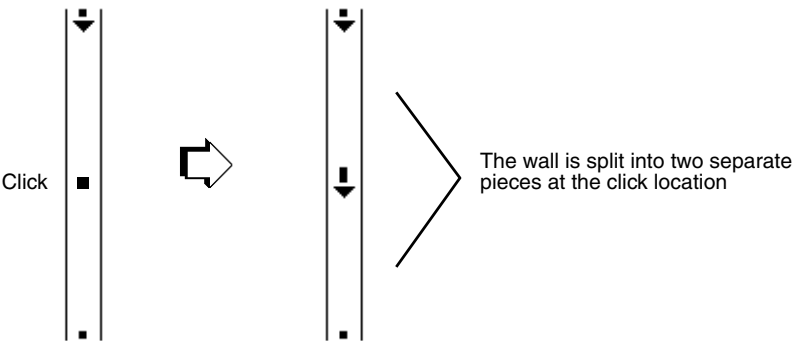
- 1. Click the **Split** tool from the Basic palette.
- 2. Click the **Point Split** mode from the Tool bar.
- 3. Click on the object at the point to be split.

If multiple objects are within range of the specified point, the Select Split Candidate dialog box opens.



Highlight the object to split by using the **Next** and **Prev** buttons.

- 4. The object is split into two pieces.



If the object is closed, as in a circle or rectangle, the object is converted so that its endpoints meet unjoined at the split. Some objects are not truly closed, and instead break into two segments.

## Splitting NURBS Surfaces by Point

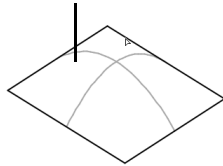


To split a NURBS surface in point split mode:

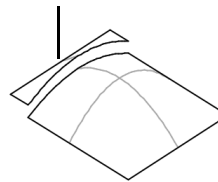
1. Click the **Split** tool from the Basic palette.
2. Click the **Point Split** mode from the Tool bar.
3. In Wireframe view, click on the NURBS surface to split.

See “Selecting the Edges and Faces of a Solid” on page 311 for information on selecting surfaces.

Click to split the NURBS surface

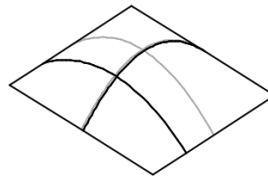
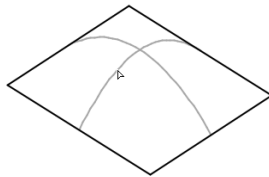


The surface is split at that point



The smaller surface has been moved for clarity

The surface is split by iso-parametric curves passing through the click point along U and V parametric directions. If the split point is on an existing iso-parametric curve, the surface is split in both directions (U and V).



Clicking once on the iso-parametric curve (shown in light gray) with the **Split** tool creates four split surfaces (in black)

## Line Split Mode

The **Line Split** mode splits 2D objects, NURBS curves/surfaces, solids, and viewports along a cutting line. After the split, all the objects remain on the drawing.

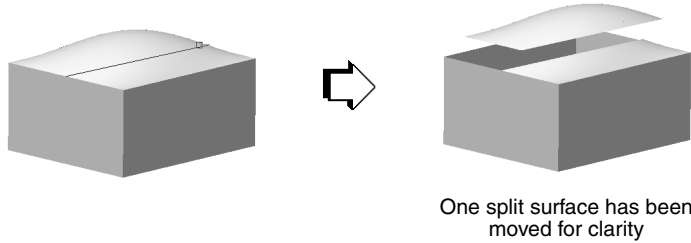
To split only the selected object, press the **Alt** (Windows) or **Option** (Macintosh) key while drawing the split line.



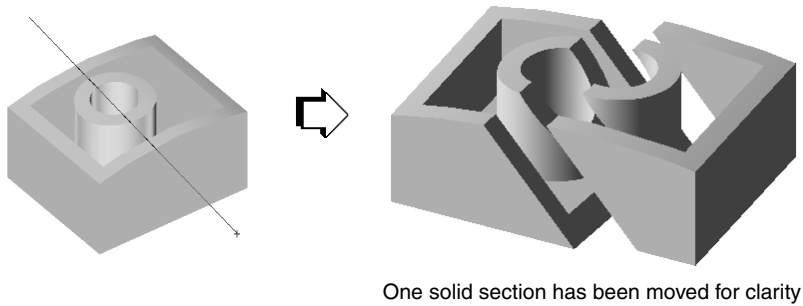
To split an object along a cutting line:

1. Click the **Split** tool from the Basic palette.
2. Click the **Line Split** mode from the Tool bar.
3. Draw a line through the object to split.

The object is split by the line.



Solids can also be split in **Line Split** mode. Two section solid objects will result.



## Line Trim Mode

The **Line Trim** mode splits 2D objects, NURBS curves/surfaces, solids, and viewports along a cutting line; it keeps a specified side, and trims away the other side.

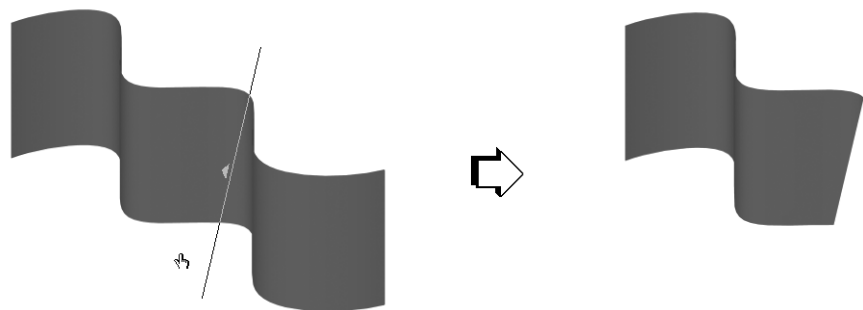
To trim only the selected object, press the **Alt** (Windows) or **Option** (Macintosh) key while drawing the trim line.



To split and trim an object along a cutting line:

1. Click the **Split** tool from the Basic palette.
2. Click the **Line Trim** mode from the Tool bar.
3. Draw a line through the object to split.
4. An arrow points to the side to be kept. Click to indicate which side of the split line should be kept; the other side is trimmed away.

The object is split by the line, and the indicated side remains.



## Creating Fillets and Chamfers

### Fillet Tool

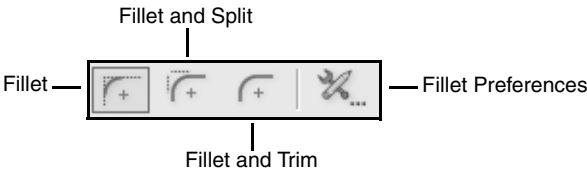
The **Fillet** tool adds a highly-specific fillet (arc) between two objects in the drawing, making each of the fillet's end points tangent to one of the objects. Apply fillets to lines, rectangles, polygons, polylines, circles, circular arcs, and walls. With rectangles, polygons, or polylines, use the tool to place a fillet between adjacent sides of the object. In addition, this tool trims or splits objects at the fillet's end points by selecting various fillet modes.

A fillet cannot be placed between parallel or concentric objects. If “split” or “trim” fillets are placed between a mixture of objects that can and cannot be split/trimmed, the fillet works only on the objects that can be split/trimmed, and ignores the others.

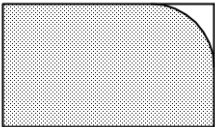
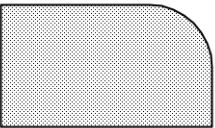


To place a fillet:

- 1. Click the **Fillet** tool from the Basic palette.
- 2. Click the desired mode from the Tool bar.



Mode	Description
Fillet	Places a fillet without affecting the original object; the fillet and the object must be grouped to form a single object <div></div>

Mode	Description
Fillet and Split	Places a fillet and splits the filleted object. If the fillet is between two objects, the fillet and the objects must be grouped to make a single object. If filleting the corners of a polygon, the fillet takes the place of the corner and becomes a part of the object. <div></div>
Fillet and Trim	Places a fillet and trims the filleted object. If the fillet is between two objects, the fillet and the objects must be grouped to make a single object. If filleting the corners of a polygon, the fillet takes the place of the corner and becomes a part of the object. <div></div>


- Click the object where the fillet will begin.
- Click the object where the fillet will end.

If this is the first time the **Fillet** tool is used, the Fillet Settings dialog box opens. Enter a fillet radius and click **OK**.  
The fillet radius specified is used for all subsequent fillet operations. To change this radius, click **Fillet Preferences** from the Tool bar, enter a new radius, and click **OK**.  
If an object is too short, it extends to match the selected fillet radius.

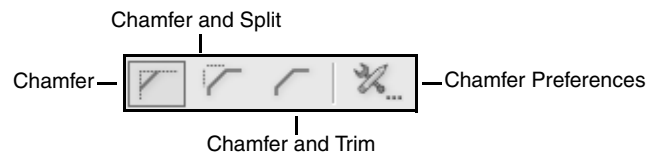
## Chamfer Tool

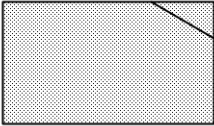
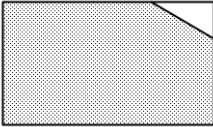
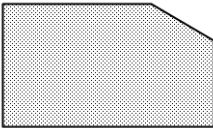
The **Chamfer** tool places a chamfer, or line, between two objects or adjacent sides of an object such as rectangles, polygons, polylines, or line segments. However, a chamfer cannot be placed between parallel lines.

A chamfer can be placed at a specified distance from where the objects intersect. Chamfers can trim or split objects at the chamfer endpoints by selecting specific chamfer modes from the Tool bar.

 To create a chamfer:

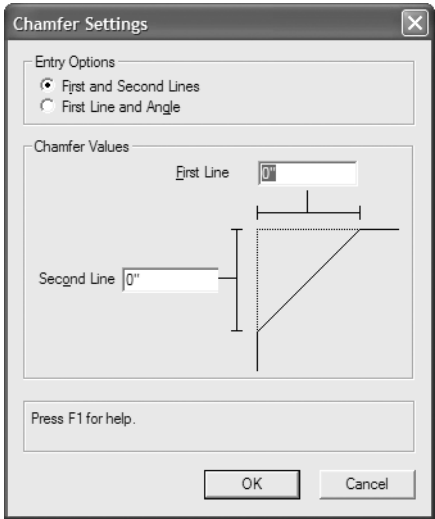
- Click the **Chamfer** tool from the Basic palette.
- Select the mode from the Tool bar.



Mode	Description
Chamfer	<p>Places a chamfer without affecting the original object; to create a single object, group the chamfer and the chamfered object together</p> 
Chamfer and Split	<p>Places a chamfer and splits the chamfered objects. This mode extends lines, if needed, for the chamfer to connect. To create a single object, group the chamfer and the chamfered object together. If chamfering the corner of a polygon, the chamfer takes the place of the corner.</p> 
Chamfer and Trim	<p>Places a chamfer and trims the chamfered objects. If chamfering the corner of a polygon, the chamfer takes the place of the corner. This mode extends lines, if needed, for the chamfer to connect.</p> 

3. Click the object where the chamfer will begin.

If this is the first time the **Chamfer** tool is used, the Chamfer Settings dialog box opens. Otherwise, click **Chamfer Preferences** from the Tool bar to change chamfer settings.



Parameter	Description
Entry Options	Select the method for specifying the chamfer size
First and Second Lines	Specify the chamfer size by entering the <b>First Line</b> and <b>Second Line</b> distances
First Line and Angle	Specify the chamfer size by entering the <b>First Line</b> distance and an <b>Angle</b> value

Select whether VectorWorks should draw using two lines of a specified length or one line and an angle. Enter the appropriate values and click **OK**.

The specified chamfer settings are used for all subsequent chamfers. To change these settings, click the **Chamfer Settings** button and enter new criteria.

4. Click the object where the chamfer will end.
- The chamfer is drawn according to the mode selection.

## Editing Object Surfaces

VectorWorks has four commands for editing object surfaces: Intersect Surface, Add Surface, Combine into Surface, and Clip Surface. Use these commands with the following objects (see the Design Series User’s Guide for information about the Design Series objects).

### VectorWorks Fundamentals Objects

- 2D primitive objects that can be filled and are not grouped (arcs, polygons, polylines, ovals, circles, rectangles)
- Revision clouds
- Floors
- Roof faces
- Pillars



## VectorWorks Design Series Objects

- Property lines
- Massing models
- Site modifiers
- Spaces
- Redlines
- Stipples
- Seating layouts
- Hardscapes

If a combination of 2D and 2D/3D hybrid objects (such as floors or pillars) will be used in an operation, the view must be set to Top/Plan.

## Intersect Surface

The **Intersect Surface** command provides an easy way to create a new object that is the exact size and shape of the overlapping area of two objects.

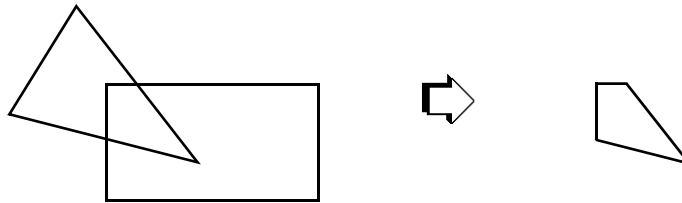
To intersect surfaces:

1. Select the two overlapping objects to use to create a third object.

The new object's properties are based on the object on the bottom of the stack of objects. If the bottom object is a 2D primitive (such as a rectangle or circle), the new object will have its attributes. If the bottom object is something other than a 2D primitive (such as a floor or pillar), the new object will be the same type, with the same properties. If necessary, use the **Send** command to stack the objects to produce the desired attributes or object type.

2. Select **Modify > Intersect Surface**.

VectorWorks places the new object directly on top of the two original intersecting objects. To see the new object, select it and drag it to the side.



## Add Surface

The **Add Surface** command creates a single object from two or more objects, as long as all of the following are true:

- The objects are not symbols.
- The objects touch or overlap each other.
- The objects are not locked or grouped.

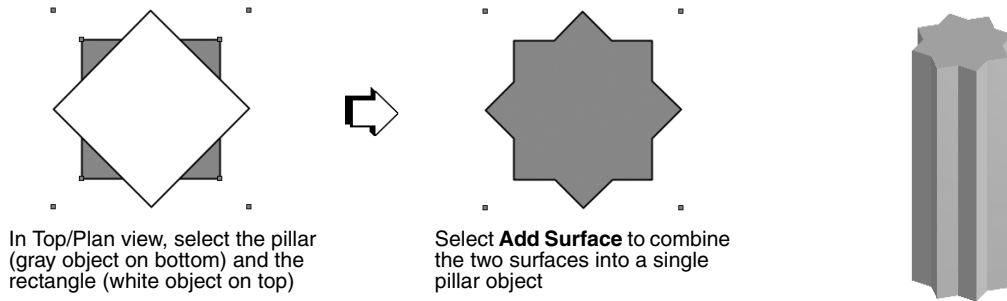
Note that any open polygons will be converted to closed polygons.

To add surfaces:

1. Select the two or more objects to be combined.

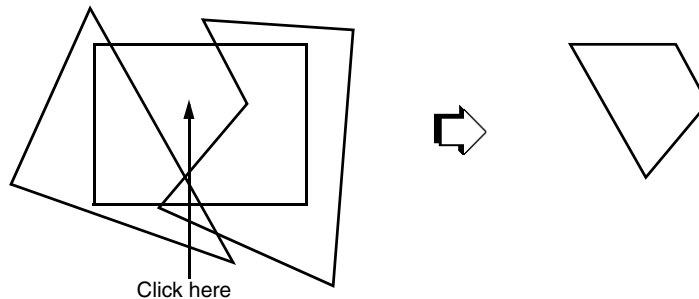
The new object's properties are based on the object on the bottom of the stack of objects. If the bottom object is a 2D primitive (such as a rectangle or circle), the new object will have its attributes. If the bottom object is something other than a 2D primitive (such as a floor or pillar), the new object will be the same type, with the same properties. If necessary, use the **Send** command to stack the objects to produce the desired attributes or object type.

2. Select **Modify > Add Surface**.



## Combine into Surface

The **Combine into Surface** command creates a new object that is formed from a group of objects. The objects must currently intersect and form a closed polygon or polyline shape. Depending on the types of objects selected and the location of the mouse click, you can create several different polygons or polylines from the same selection of objects. For example, with this set of three objects, the following polygon can be created:



To combine surfaces:

1. Select the two or more closed objects to use to create a new polygon or polyline.
2. Select **Modify > Combine into Surface**.  
The cursor changes into a paint bucket.
3. Place the paint bucket inside the area to be combined and click.

VectorWorks creates a single polygon or polyline object from the selected objects. The new object uses the current attributes.

## Clip Surface

The **Clip Surface** command trims the bottom object in a selection so that any areas overlapped by the top object are cut out of it. Multiple objects can be used as clipping objects in one operation. Symbols and grouped objects cannot be clipped or be used as clipping objects.

If there is a stack of more than two overlapping objects, then each object under the clipping object (the top object in the stack) will be clipped.

There are two important things to remember about this command:

- If the object to be clipped is an open polygon, it is automatically converted to a closed polygon before it is clipped.
- Depending on the objects selected, the command may change the bottom object's type; for example, if a hole is clipped into a rectangle, the "clipped" rectangle is automatically changed into a polyline.

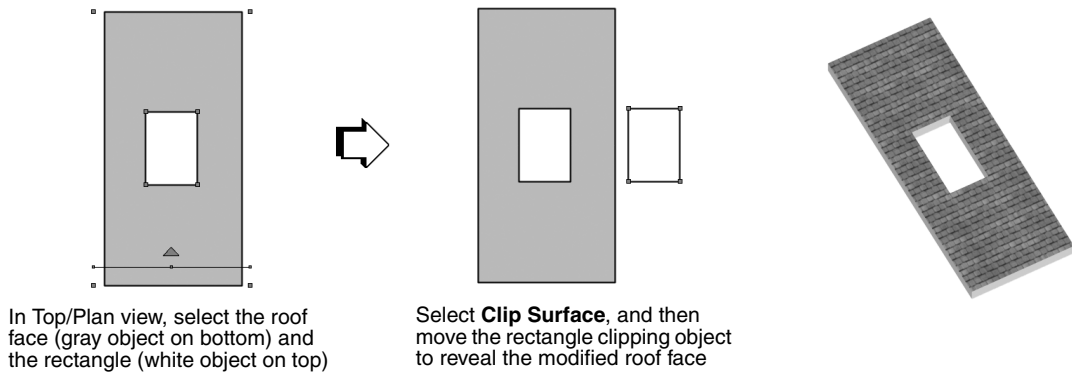
To clip a surface:

1. Ensure that the object to clip is the bottom object.

If necessary, change the objects' order with the **Send** command (see "Changing Object Stacking Order" on page 372).

2. Select the objects to clip.
3. Select **Modify > Clip Surface**.

The bottom object is clipped; the clipping object can be deleted if it is no longer needed.



## Engineering Properties

The **Engineering Properties** command automatically calculates the engineering properties of a 2D object. This includes the object's perimeter and area, as well as the moment of inertia and radius of gyration about the centroidal X and Y axes of the object. It also calculates the coordinates of the centroid and places a locus at the centroid, if desired. If a single locus is selected along with the object when the command is executed, the moments of inertia and radii of gyration about the X and Y axes passing through the locus are also calculated.

To determine the engineering properties of an object:

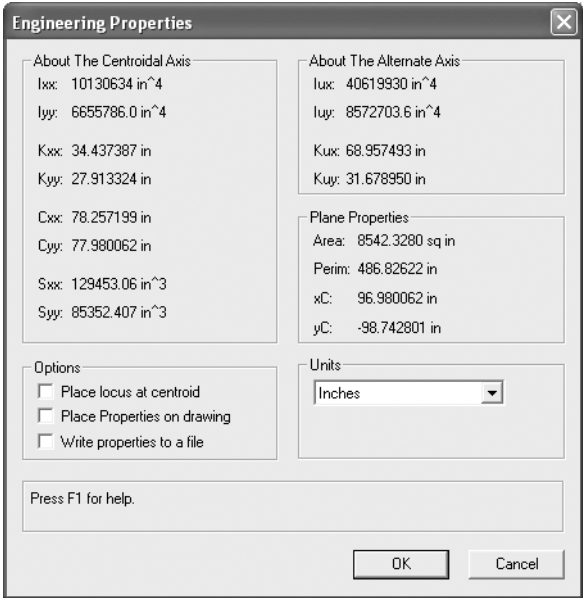
1. Select a single object, or select a single object and a locus point.
2. Select **Model > Engineering Properties**.

The Engineering Properties dialog box opens. The data that displays is selection-dependent.

For a single closed surface, the following displays:

- Area of the object
- Perimeter of the object
- Moments of inertia about the object’s centroidal axes
- Absolute coordinates of the centroid of the object
- Radii of gyration about the object’s centroidal axes
- Plane properties (area, perimeter and coordinates)

For a single closed surface and a locus point, the Moments of Inertia about the axes that pass through the locus and the Radii of Gyration about these axes are also displayed.



3. Select the desired options and Units.

Parameter	Description
Place locus at centroid	Select to add a locus at the centroid of the selected object after closing the Engineering Properties dialog box
Place properties on drawing	Select to place a list of the properties at the next mouse click after closing the Engineering Properties dialog box
Write properties to a file	Select to send the properties to a text file; specify the file name and location after closing the Engineering Properties dialog box
Units	Update the displayed information to reflect the selected unit of measurement

4. Click **OK**.

## Drafting Aids

### Arc by Segment Length

With the **Arc by Segment Length** command, an arc can be drawn based on specific arc and chord lengths.

To draw an arc by segment length:

1. Select **Modify > Drafting Aids > Arc by Segment Length**.

The Arc by Segment Length dialog box opens.



Parameter	Description
Arc Length	Enter the arc length value
Chord Length	Enter the chord length value, or select <b>Use mouse clicks</b> to use the mouse to determine the chord length

2. Click **OK**.
3. Click to define the arc location, and click to set the chord direction.

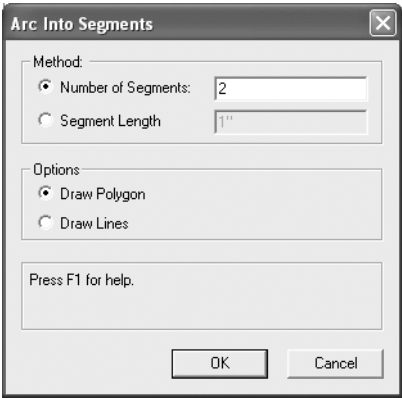


### Arc into Segments

The **Arc into Segments** command converts a selected arc or circle into an equal number of segments, or divides the arc or circle into segments of a given length. The segments can be drawn as lines or polygons; the original object remains unchanged.

To convert a circle or arc into segments:

1. Select the arc or circle to be converted.
2. Select **Modify > Drafting Aids > Arc into Segments**. The Arc into Segments dialog box opens.



Parameter	Description
Method	
Number of Segments	Draws the specified number of equal segments along the arc
Segment Length	Draws segments of the specified length along the arc
Options	
Draw Polygon	Draws the segments as polygons
Draw Lines	Draws the segments as lines

3. Click **OK** to create the segments.



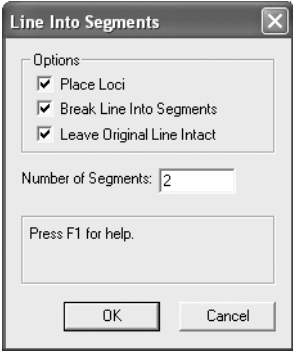
## Line into Segments

The **Line into Segments** command converts a selected line into the indicated number of equal length segments. The original line can be converted, or an identical line placed on top of the original and converted.

To convert a line into segments:

1. Select the line to be converted.
2. Select **Modify > Drafting Aids > Line into Segments**.

The Line into Segments dialog box opens.



Parameter	Description
Place loci	Places loci at the segment divisions
Break Line Into Segments	Creates segments from the original line, converting it; deselect to place loci only
Leave Original Line Intact	Retains the original line, and creates segments from a copy of the line
Number of Segments	Specifies the number of segments to create

3. Click **OK** to draw either a new segmented line or convert the selected one.





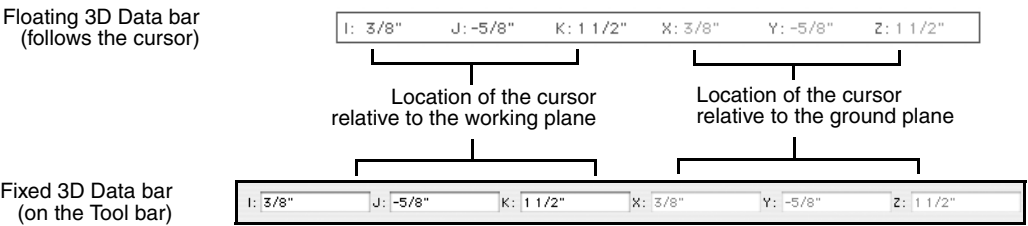
# Creating 3D Objects

With the 3D Modeling tool set and various commands, draw objects in 3D, change 2D objects into 3D objects, or create hybrid objects that display in both 2D and 3D. 3D objects can have height (Z coordinate) as well as width and length (X and Y coordinates). This section presents methods of creating a variety of 3D objects. Unlike their 2D counterparts, 3D objects must be rendered to display a fill.

A 3D tool can only be used in a 3D view. If the view is currently Top/Plan, it automatically changes to Top when a 3D tool is selected.

## Using the 3D Data Bar

Use the Data bar when you draw to lock certain values for an object, such as the length of a hemisphere radius or the height of an extruded rectangle. The fields that are available on the Data bar depend on the active tool and on the action being performed.

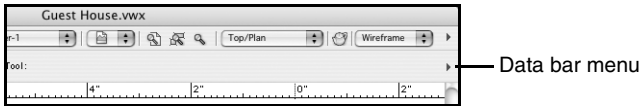


The data displayed in the bar is gathered from the feedback segment of the object being created. The more common Data bar fields are described in the following table; other fields that can display are described where their use is relevant.

Parameter	Description
A	Angle
I	The absolute location of I in working plane coordinates
J	The absolute location of J in working plane coordinates
K	The absolute location of K in working plane coordinates
L	Length
Z	The Z (depth) of the object being drawn
Ctrl X	The center of the object along the X axis
Ctrl Y	The center of the object along the Y axis
Delta I	The offset distance from the previous click or position of I in working plane space
Delta J	The offset distance from the previous click or position of J in working plane space
Delta K	The offset distance from the previous click or position of I in working plane space
Delta X	The offset distance from the previous click or position of X
Delta Y	The offset distance from the previous click or position of Y

Parameter	Description
Delta Z	The offset distance from the previous click or position of Z
Radius	The radius of the object being drawn

The Data bar is controlled by a menu on the far right side of the Tool bar.



Menu Command	Description
<b>Location of the Data bar</b>	
Use floating data bar	The Data bar “floats” with the cursor in the drawing area
Use floating data bar only when tab key is pressed	The Data bar floats with the cursor only when the Tab key is pressed; otherwise the bar does not display
Do not use floating data bar - show data bar fields on fixed data bar	The Data bar displays on the top left side of the window, at the top of the Tool bar
Do not use floating data bar - show data bar fields on tool bar	The Data bar displays on the right side of the Tool bar
<b>Activation of the Data bar</b>	
Allow numeric keypad entry for instant data bar activation	When the Data bar is displayed, enter numbers on the numeric keypad to activate the first field
Do not allow numeric keypad entry for instant data bar activation	When the Data bar is displayed, press the Tab key to activate the first field (press Shift+Tab to activate the last field)
<b>Field display on the Data bar</b>	
Show only primary fields on data bar	Show only the delta I, delta J, and delta K fields
Show primary and secondary fields on data bar	Show all fields except the cursor location fields (X, Y, and Z)
Show primary secondary, and cursor location fields on data bar	Show all fields
<b>Display of the Exit Group button</b>	
Use large exit group button	When a group is being edited, show a large button with the label <b>Exit Group</b> in the upper right corner of the drawing area
Use small exit group button	When a group is being edited, show a small button with an arrow icon in the upper right corner of the drawing area

## Drawing with the 3D Data Bar

To draw an object with the 3D Data bar:

1. Select a 3D drawing tool and click once to begin to draw the object.

2. Press the Tab key to activate the first field in the Data bar, or press Shift+Tab to activate the last field. Alternatively, if the Data bar options are set so that numeric keypad activation is enabled, you can type the value for the first field in the Data bar to activate it.
- In click-drag mode, press and hold the mouse button when you press Tab or Shift+Tab.
3. Enter values in the appropriate field(s), using the keys as follows.

Key	Action
Enter (Windows) or Return (Macintosh)	<ul style="list-style-type: none"><li>When the focus is in a Data bar field, sets the value that is currently displayed, and moves the focus to the drawing area</li><li>When the focus is in the drawing area, completes the object (or completes the current segment of the object, for path objects such as polygons, walls, and dimensions)</li></ul>
Tab	<ul style="list-style-type: none"><li>When the focus is in a Data bar field, sets the entered value and moves to the next field (if no value was entered, the field is not set)</li><li>When the focus is in the drawing area, moves the focus to the first field in the Data bar</li></ul>
Shift-Tab	<ul style="list-style-type: none"><li>When the focus is in a Data bar field, sets the entered value and moves to the previous field (if no value was entered, the field is not set)</li><li>When the focus is in the drawing area, moves the focus to the last field in the Data bar</li></ul>

To clear an entry before it is set, press the Backspace key. The previous value in that field redisplay.

If the SmartCursor option is enabled in VectorWorks preferences, a dotted line displays to represent the location of the values entered for the X and Y axes.

4. To complete the object according to the values you entered, click the mouse button. For non-path objects, you can also press Enter or Return to complete the object, if the focus is in the drawing area. For path objects, such as polygons, walls, and dimensions, you may need to click to complete the object.

## Creating 3D Polygons

### Extruded Rectangles

The **Extruded Rectangle** tool creates rectangles that have a height in any 3D layer and projection. Because they have a location in 3D space, extruded rectangles can be manipulated like other 3D objects. They can be rotated, placed in perspective, and translated in 3D space. Because VectorWorks considers these rectangles to be mesh objects (not true extruded objects), their individual vertices can be edited later.

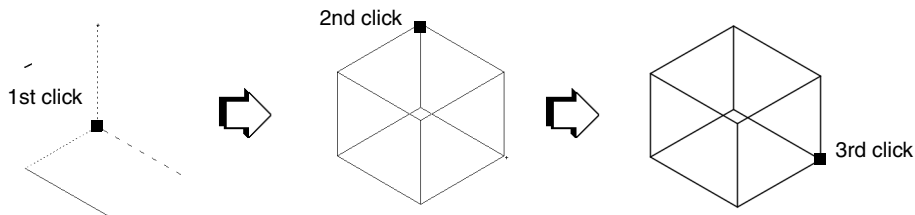


To create an extruded rectangle:

- Click the **Extruded Rectangle** tool from the 3D Modeling tool set.
- Click to set one of the rectangle's corner points. The height of the extruded rectangle is set in one of two ways.

View	Action
2D view or 3D elevation view	Enter the extruded rectangle's height in the Set Extrusion Height dialog box that opens at the first mouse click. Click <b>OK</b> .
3D isometric view	Move the mouse vertically and then click to set the height. For more information on the different views, see "Using Standard Views" on page 403.

3. Click to set the end point of the extruded rectangle.



## Extruded Polygons

The **Extruded Polygon** tool creates 3D polygons that have a height.

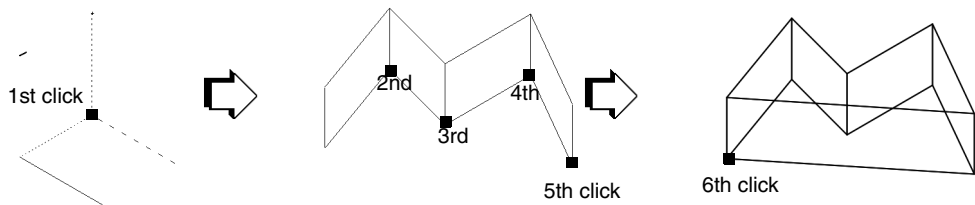


To create an extruded 3D polygon:

1. Click the **Extruded Polygon** tool from the 3D Modeling tool set.
2. Click to set the polygon's start point (first vertex). The height of the extruded polygon is set in one of two ways.


View	Action
2D view or 3D elevation view	Enter the extruded polygon's height in the Set Extrusion Height dialog box that opens at the first mouse click. Click <b>OK</b> .
3D isometric view	Move the mouse vertically and then click to set the height. For more information on the different views, see "Using Standard Views" on page 403.

3. Click at each vertex.
4. Double-click at the final vertex to end an open polygon; click at the starting vertex (a point cue displays) to end a closed polygon (the first and last vertex are automatically joined).

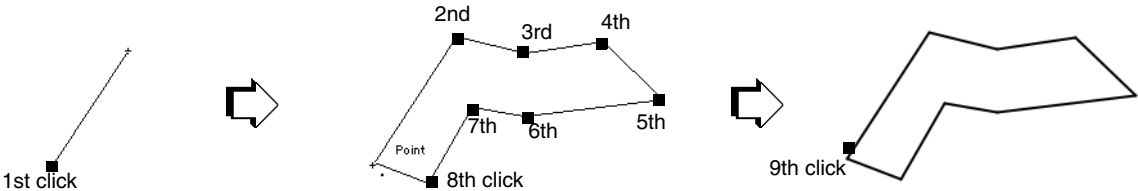


### 3D Polygons

The **3D Polygon** tool creates polygons that have a location in 3D space, but no height. While they are planar, they can be rotated, placed in perspective, and translated in space like any other 3D object.

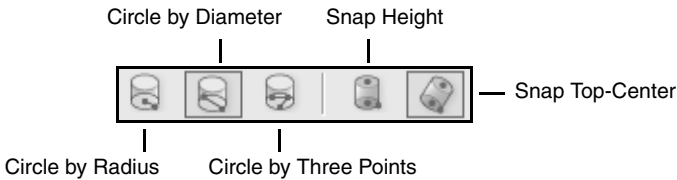
 To create a planar 3D polygon:

- 1. Click the **3D Polygon** tool from the 3D Modeling tool set.
- 2. Click to set the polygon's start point (first vertex).
- 3. Click at each vertex.
- 4. Double-click at the final vertex to end an open polygon; click at the starting vertex (a point cue displays) to end a closed polygon (the first and last vertex are automatically joined).



### Creating Cylinders

The **Cylinder** tool has five modes for creating cylinders.



Mode	Description
Circle by Radius	Defines the base of the cylinder by radius
Circle by Diameter	Defines the base of the cylinder by diameter
Circle by Three Points	Defines the base of the cylinder by circumference
Snap Height	Sets the new cylinder height to the same height as an existing 3D object (available in a 3D isometric view only)
Snap Top-Center	Snaps the top-center of the new cylinder to a snap point on an existing 3D object (available in a 3D isometric view only)

When in a non-isometric view, the height of the cylinder is set in the Set Extrusion Height dialog box. In an isometric view, the cylinder height can be set by dragging with the mouse or entering the height in the Data bar. For more information on the different views, see “Using Standard Views” on page 403.

The cylinder height and radius can be changed with the **3D Reshape** tool (see “Reshaping 3D Objects” on page 359), the radius can be modified in the Object Info palette, and the resolution can be adjusted through the **3D Conversion Res** setting (see “Setting VectorWorks Preferences” on page 39).

## Cylinder by Radius



To create a cylinder by radius:

1. Click the **Cylinder** tool from the 3D Modeling tool set, and select **Circle by Radius** mode.
2. Click to set the center of the cylinder base.
3. Drag the mouse to the desired radius and click to set the radius of the cylinder base. The radius can also be set in the Data bar.
4. Move the mouse vertically and click to set the cylinder height.

## Cylinder by Diameter



To create a cylinder by diameter:

1. Click the **Cylinder** tool from the 3D Modeling tool set, and select **Circle by Diameter** mode.
2. Click to set the first point on the cylinder base diameter.
3. Drag the mouse to the desired diameter and click to set the diameter of the cylinder base.
4. Move the mouse vertically and click to set the cylinder height.

## Cylinder by Three Points



To create a cylinder by three points:

1. Click the **Cylinder** tool from the 3D Modeling tool set, and select **Circle by Three Points** mode.
2. Click to set the first point on the cylinder base diameter.
3. Drag the mouse and click to set the second point on the cylinder base, and click again to set the third point on the cylinder base.
4. Move the mouse vertically and click to set the cylinder height.

## Cylinder by Height

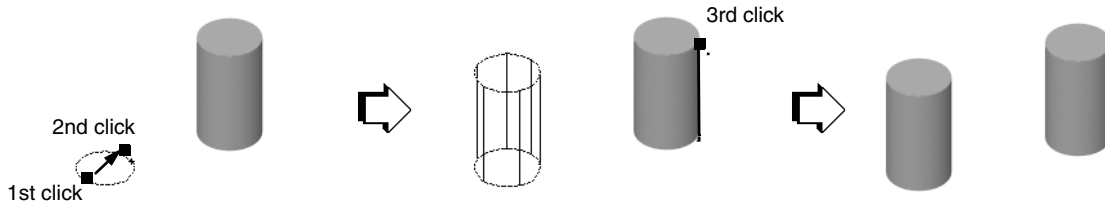


To create a cylinder with the same height as another 3D object:

1. Ensure that the Smart Points constraint is enabled (see “Smart Points” on page 123).
2. In a 3D isometric view, click the **Cylinder** tool from the 3D Modeling tool set. Select the cylinder base drawing mode, and then select **Snap Height** mode.

The drawing procedure depends on the mode type selected (circle by radius, diameter, or three points).

- Click to set the center of the cylinder or to set the first point on the cylinder base diameter.
- Drag the mouse to the desired base radius or diameter and click to set. Or, if creating a cylinder by three points, drag the mouse and click to set the second point on the cylinder base, and click again to set the third point on the cylinder base.
- Using the Smart Points constraint, align the top of the cylinder with the top of another snap point on a 3D object that has the desired height.
- Click on the 3D object's Smart Point to set the cylinder height.



## Cylinder by Top-Center

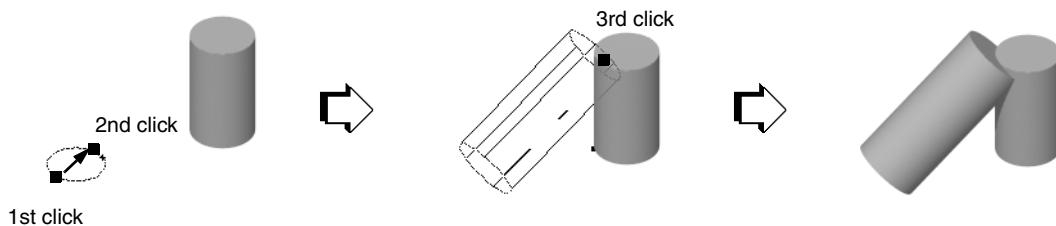


To create and snap a cylinder by its top center to a snap point on another 3D object:

- Ensure that the Smart Points constraint is enabled (see “Smart Points” on page 123).
- In a 3D isometric view, click the **Cylinder** tool from the 3D Modeling tool set. Select the cylinder base drawing mode, and then select **Snap Top-Center** mode.

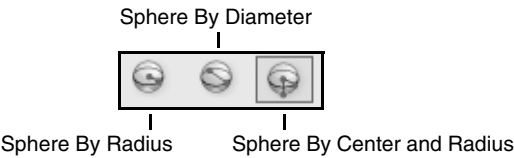
*The drawing procedure depends on the mode type selected (circle by radius, diameter, or three points).*

- Click to set the center of the cylinder or to set the first point on the cylinder base diameter.
- Drag the mouse to the desired base radius or diameter and click to set. Or, if creating a cylinder by three points, drag the mouse and click to set the second point on the cylinder base, and click again to set the third point on the cylinder base.
- Using the Smart Points constraint, snap the top center of the cylinder to a snap point on another 3D object. A preview object displays. Click to create the cylinder.



## Creating Spheres

The **Sphere** tool creates spheres using one of the three modes.



Mode	Description
Sphere by Radius	Defines the base of the sphere by radius
Sphere by Diameter	Defines the base of the sphere by diameter
Sphere by Center and Radius	Defines the base of the sphere by center (according to the height above the working plane) and radius

The sphere radius can be changed with the **3D Reshape** tool (see “Reshaping 3D Objects” on page 359), the radius can be modified in the Object Info palette, and the resolution can be adjusted through the **3D Conversion Res** setting (see “Setting VectorWorks Preferences” on page 39).

### Sphere by Radius



To create a sphere by radius:

1. Click the **Sphere** tool from the 3D Modeling tool set, and select **Sphere by Radius** mode.
2. Click to set the center of sphere base.
3. Drag the mouse to the desired radius and click to set the radius of the sphere base. The radius can also be set in the Data bar.

### Sphere by Diameter



To create a sphere by diameter:

1. Click the **Sphere** tool from the 3D Modeling tool set, and select **Sphere by Diameter** mode.
2. Click to set the first point on the sphere base diameter.
3. Drag the mouse to the desired diameter and click to set the diameter of the sphere base.

### Sphere by Center and Radius



To create a sphere by center and radius:

1. Click the **Sphere** tool from the 3D Modeling tool set, and select **Sphere by Center and Radius** mode.
2. Click to set the center of the sphere base on the working plane.



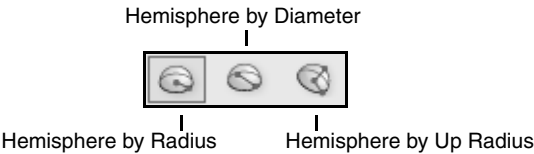
3. Move the mouse vertically and click to set the height of the sphere above the working plane.
4. Drag the mouse to the desired radius and click to set the radius of the sphere base. The radius can also be set in the Data bar.

The center and height, relative to the working plane, of the sphere is automatically established if the first click is on a snap point, for example a 3D locus or vertex on another 3D object.

When in a non-isometric view, the sphere is created centered on the working plane.

## Creating Hemispheres


The **Hemisphere** tool creates hemispheres using one of three modes.



Mode	Description
Hemisphere by Radius	Defines the base of the hemisphere by radius
Hemisphere by Diameter	Defines the base of the hemisphere by diameter
Hemisphere by Up Radius	Defines the base of the hemisphere by center and rotation


The hemisphere radius can be changed with the **3D Reshape** tool (see “Reshaping 3D Objects” on page 359), the radius can be modified in the Object Info palette, and the resolution can be adjusted through the **3D Conversion Res** setting (see “Setting VectorWorks Preferences” on page 39).

### Hemisphere by Radius

 To create a hemisphere by radius:

1. Click the **Hemisphere** tool from the 3D Modeling tool set, and select **Hemisphere by Radius** mode.
2. Click to set the center of the hemisphere base.
3. Drag the mouse to the desired radius and click to set the radius of the hemisphere base. The radius can also be set in the Data bar.

### Hemisphere by Diameter

 To create a hemisphere by diameter:

1. Click the **Hemisphere** tool from the 3D Modeling tool set, and select **Hemisphere by Diameter** mode.
2. Click to set the first point on the hemisphere base diameter.
3. Drag the mouse to the desired diameter and click to set the diameter of the hemisphere base.

## Hemisphere by Up Radius



To create a hemisphere by up radius:

1. Click the **Hemisphere** tool from the 3D Modeling tool set, and select **Hemisphere by Up Radius** mode.
2. Click to set the center of the hemisphere base.
3. Move the mouse and click to set the rotation and top of the hemisphere.

## Creating Cones

The **Cone** tool creates cones using one of two modes.

Cone By Radius and Height



Cone By Radius and Tip

Mode	Description
Cone by Radius and Height	Defines the base of the cone by radius and tip of the cone by height
Cone by Radius and Tip	Defines the base of the cone by radius and, if desired, snaps the tip of the cone to a point

When in a non-isometric view, the height of the cone is set in the Set Extrusion Height dialog box. In an isometric view, the cone height can be set by dragging with the mouse or entering the height in the Data bar. For more information on the different views, see “Using Standard Views” on page 403.

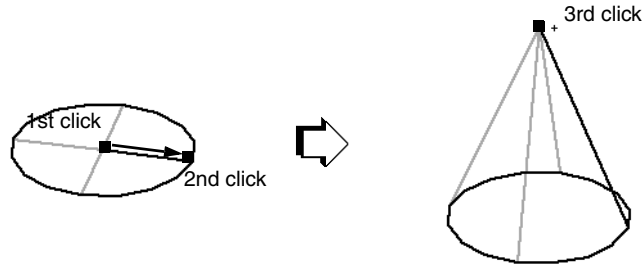
The cone height can be changed with the **3D Reshape** tool (see “Reshaping 3D Objects” on page 359), the radius can be modified in the Object Info palette, and the resolution can be adjusted through the **3D Conversion Res** setting (see “Setting VectorWorks Preferences” on page 39).

## Cone by Radius and Height



To create a cone using radius and height:

1. In a 3D isometric view, click the **Cone** tool from the 3D Modeling tool set, and select **Cone by Radius and Height** mode.
2. Click to set the center of the cone base.
3. Drag the mouse to the desired radius and click to set the radius of the cone base. The radius can also be set in the Data bar.
4. Move the mouse vertically and click to set the cone height.

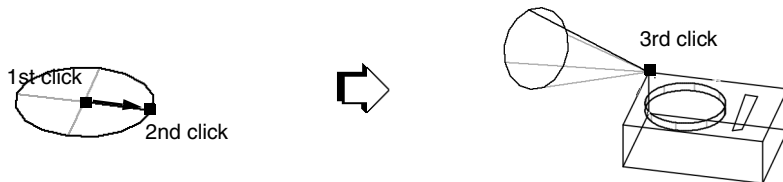


## Cone by Radius and Tip



To create a cone using radius and tip:

1. Ensure that the Smart Points constraint is enabled (see “Smart Points” on page 123).
2. In a 3D isometric view, click the **Cone** tool from the 3D Modeling tool set and select **Cone by Radius and Tip** mode.
3. Click to set center of the cone.
4. Drag the mouse to the desired radius and click to set the radius of the cone base. The radius can also be set in the Data bar.
5. Using the Smart Points constraint, snap the top of the cone to a snap point on another 3D object. A preview object displays. Click to create the cone.

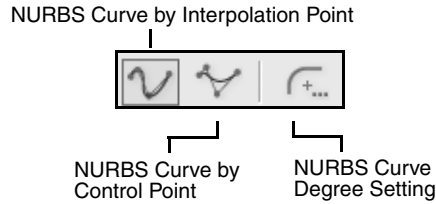


## Creating NURBS Curves, Circles, and Arcs

NURBS (Non Uniform Rational B-Splines) are used to create curves, circles, and arcs in 3D space. They can also be used as defining objects for extrusions along a path. NURBS are created along the working plane.

### NURBS Curves

NURBS curves can be created using one of two modes. Specify the NURBS curve degree prior to selecting a mode.



## Setting the NURBS Curve Degree



To specify the NURBS curve degree:

1. Click the **NURBS Curve** tool from the 3D Modeling tool set, and click NURBS Curve Degree Setting from the Tool bar.
2. The Curve Degree dialog box opens. Specify the curve degree for the **NURBS Curve** tool to use. Click **OK**.  
[Set the degree value to 1 to create a NURBS curve with linear segments \(similar to a 3D polygon\).](#)

## NURBS Curve by Interpolation Point



To create a NURBS curve by interpolation point:

1. Click the **NURBS Curve** tool from the 3D Modeling tool set, and select **NURBS Curve by Interpolation Point** mode.
2. Click to set the first point on the curve.
3. Click to set the point about which the curve passes through.
4. Double-click to set the end point of the curve.

Double-clicking ends the operation. To create a multi-curved NURBS curve, continue to click points.

## NURBS Curve by Control Point



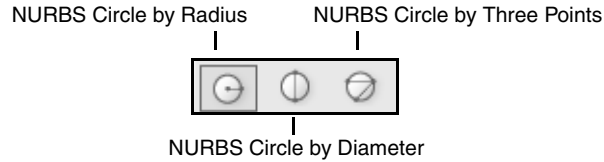
To create a NURBS curve by control point:

1. Click the **NURBS Curve** tool from the 3D Modeling tool set, and select **NURBS Curve by Control Point** mode.
2. Click to set the first point on the curve.
3. Click to set the point about which the curve pulls toward but does not touch.
4. Double-click to set the end point of the curve.

Double-clicking ends the operation. To create a multi-curved NURBS curve, continue to click points.

## NURBS Circles

NURBS circles can be created using one of three modes.



## NURBS Circle by Radius



To create a NURBS circle by radius:

1. Click the **NURBS Circle** tool from the 3D Modeling tool set, and select **NURBS Circle by Radius** mode.
2. Click to set the center of the circle.
3. Click to set the end point of the radius that defines the circle.

## NURBS Circle by Diameter



To create a NURBS circle by diameter:

1. Click the **NURBS Circle** tool from the 3D Modeling tool set, and select **NURBS Circle by Diameter** mode.
2. Click to set a point on the circle.
3. Click to set the end point of the diameter that defines the circle.

## NURBS Circle by Three Points



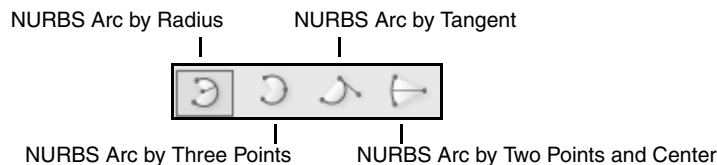
To create a NURBS circle by three points:

1. Click the **NURBS Circle** from the 3D Modeling tool set, and select **NURBS Circle by Three Points** mode.
2. Click to set the first point on the circle.
3. Click to set the second point on the circle.
4. Click to set the third (and final) point on the circle.

The third point defines the radius of the circle.

## NURBS Arcs

NURBS arcs can be created using one of four modes.



## NURBS Arc by Radius



To create a NURBS arc by radius:

1. Click the **NURBS Arc** tool from the 3D Modeling tool set, and select **NURBS Arc by Radius** mode.
2. Click to set the center of the arc.
3. Click to fix the radius and set the starting point for the arc.
4. Click to set the end point of the arc.

## NURBS Arc by Three Points



To create a NURBS arc by three points:

1. Click the **NURBS Arc** tool from the 3D Modeling tool set, and select **NURBS Arc by Three Points** mode.
2. Click to set the starting point of the arc.
3. Click to set end point of the radius that defines the arc.
4. Click to set the end point of the arc.

## NURBS Arc by Tangent



To create a NURBS arc by tangent:

1. Click the **NURBS Arc** tool from the 3D Modeling tool set, and select **NURBS Arc by Tangent** mode.
2. Click to set the start point of the arc.
3. Click to set the tangent.
4. Click to set end point of arc.

## NURBS Arc by Two Points and Center



To create a NURBS arc by two points and center:

1. Click the **NURBS Arc** tool from the 3D Modeling tool set, and select **NURBS Arc by Two Points and Center** mode.
2. Click to set the start point of the arc.
3. Click to set end point of the arc.
4. Click to set the radius of the arc.

## Converting to NURBS

The **Convert to NURBS** command converts 2D objects and 3D polygons into 3D NURBS curves, and converts the faces of solids to NURBS surfaces. This is a quick way of creating NURBS surfaces from an extrusion, sweep, or other solids.

To convert to NURBS curves or surfaces:

1. Select the object or solid to convert to NURBS surfaces.

2. Select **Modify > Convert > Convert to NURBS**.

The selection is converted to NURBS surface(s) or a 3D NURBS curve, as reflected in the Object Info palette.

If the solid consisted of several faces, the conversion results in a group of NURBS surfaces. Select **Modify > Ungroup** to access the individual NURBS surfaces that make up the solid.

## Creating 3D Loci

### 3D Locus Tool

The **3D Locus** tool places a snappable 3D locus or reference point onto the drawing. Like 2D loci, they are reference points. They can be moved, but they cannot be reshaped and they do not print.



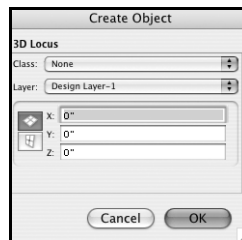
To manually insert a 3D locus:

1. Click the **3D Locus** tool from the 3D Modeling tool set.
2. Click to place the locus.  
VectorWorks places the locus on the working plane if it is not snapped to an object.
3. Click to place each additional locus.

To insert a 3D locus by dialog box:

1. Double-click the **3D Locus** tool from the 3D Modeling tool set.

The Create 3D Locus dialog box opens.



2. Select the 3D locus **Class** and **Layer**. Enter the **X**, **Y**, and **Z** position where the 3D locus is to be located.
3. Click **OK**.

To place 3D loci more reliably, turn on the [Snap to Objects](#) constraint.

## Extruding Objects

### Single Extrude

The **Extrude** command changes 2D objects into 3D objects. The type of object and its attributes determines the type of extrude that is produced. Lines are extruded as flat planes, while all other objects are extruded as wireframe 3D objects. While more than one object can be extruded at a time, grouped objects must first be ungrouped in order to be extruded. Objects that are locked must first be unlocked in order to be extruded.

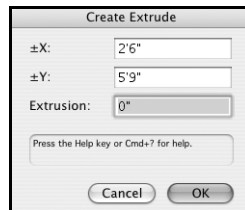
Objects are extruded into the current viewing projection. They can be rotated afterwards if desired. See “Rotate Tool” on page 389 or “Preset Rotation Angles” on page 391. The extruded object height can be edited interactively with the **3D Reshape** tool; see “Reshaping Extruded Objects and Solid Primitives” on page 359 for more information.

When extruding a selection of objects, VectorWorks turns the objects into a single 3D group of objects. To edit an individual object, either ungroup the set or use the **Edit Group** command to access the individual objects.

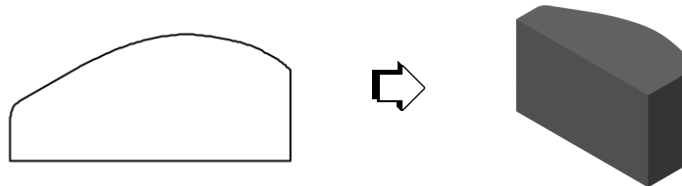
To extrude an object:

1. Select the 2D object(s) to extrude.
2. Select **Model > Extrude**.

The Create Extrude dialog box opens.



3. Enter the **Extrusion** height and specify any change in size along the X and Y axes, and then click **OK**.



## Multiple Extrude

A pyramid, sphere, or other 3D object can be created from a series of 2D objects using the **Multiple Extrude** command. Using locus points can provide a point of reference with this command.

To create a multiple extrude:

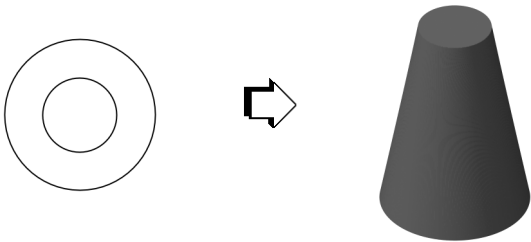
1. Select the 2D objects to extrude.
2. Select **Model > Multiple Extrude**.

The Create Extrude dialog box opens.

3. Enter the **Extrusion** height and specify the change in size along the X and Y axes.
4. Click **OK**.

VectorWorks extrudes the set of objects/locus points by connecting one to another in their stacking order, turning the objects into a single 3D object.





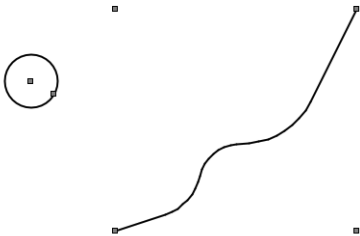
## Extrude Along Path

The **Extrude Along Path** command extrudes profile objects along a given path. Profile objects can be 2D objects, 3D polygons, and NURBS curves. Profile objects cannot be non-planar, self-intersecting, or a mixture of 2D and 3D profiles. If the path is not a NURBS curve, it is converted into a NURBS curve during this operation.

When using the **Edit Group** command on a 3D object created using **Extrude Along Path**, a dialog box opens with the choice to either edit the original path or profile object.

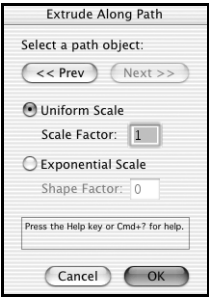
To extrude along a path:

1. Select the object to be extruded, and the object to use as the path.



2. Select **Model > Extrude Along Path**.

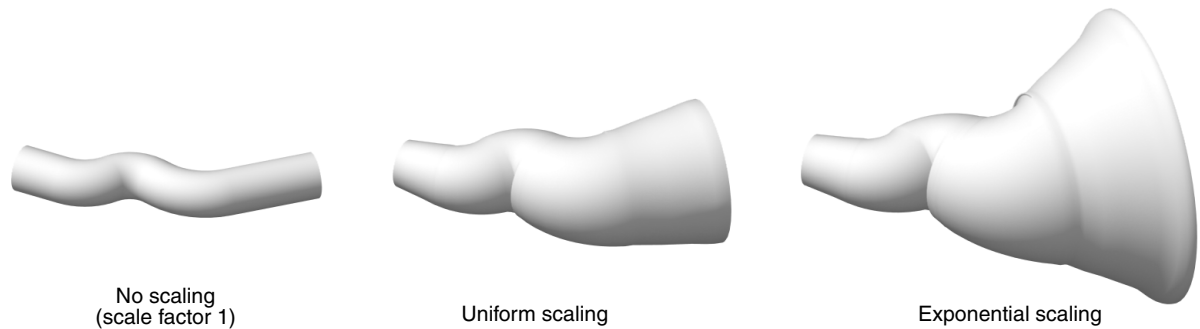
The Extrude Along Path dialog box opens. Enter the extrusion parameters.



Parameter	Description
Select a path object	Click the <b>Next</b> or <b>Prev</b> button to select the object that represents the path
Uniform Scale	Scales the object linearly along the designated path; enter a <b>Scale Factor</b> of 1 to perform no scaling, or enter a positive scale factor other than 1 for uniform scaling
Exponential Scale	Scales the object exponentially along the designated path; enter a <b>Shape Factor</b> of 0 to perform no scaling, or enter a shape factor other than 0 for exponential scaling

Scaling options are available when the path object is a single continuous curve without sharp corners or discontinuities.

- Click **OK** to extrude the object along the selected path.



- The type of **Scale** and **Shape/Scale Factor** of an Extrude Along Path object can be edited in the Object Info palette.

## Creating a Tapered Extrude

A tapered extrude can be created from 2D objects, 3D polygons, and NURBS curves, circles, and arcs. This command easily creates wavy extrusions by entering a taper value of zero.

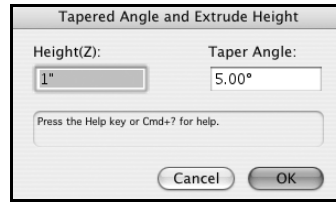
The command also extrudes 2D objects into 3D objects with a defined taper. Use it to convert a single object or several objects at the same time. Once created, the height and taper can be edited in the Object Info palette.

The tapered extrude object height can be edited interactively with the **3D Reshape** tool; see “Reshaping Extruded Objects and Solid Primitives” on page 359 for more information.

To create a tapered extrude:

- Select the object(s) to turn into a tapered extrude.
- Select **Model > Tapered Extrude**.

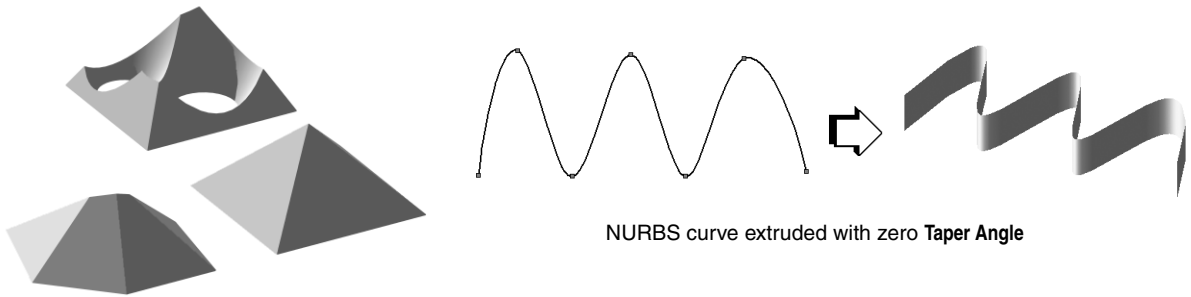
The Tapered Angle and Extrude Height dialog box opens.



3. Enter the **Height (Z)** of the extrude and the **Taper Angle**. A positive taper degree shrinks the object as it extrudes, while a negative taper degree widens the object.

Set a **Taper Angle** of 0 to create an extrusion with no taper.

4. Click **OK** to create the tapered extrude.



If a tapered extrude fails, the object reverts to the last known “good” value.

## Sweeping Objects

The **Sweep** command converts 2D objects into 3D cylindrical objects. Use it to convert a single object at a time, or to convert several selected objects. While more than one object can be swept at a time, grouped objects must first be ungrouped. Locked objects must first be unlocked in order to create a sweep.

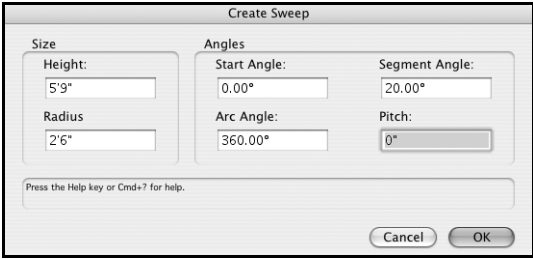
A sweep has four basic elements: a centroid (locus), an arc angle, a segment angle, and a pitch. The locus acts as the sweep’s center of rotation. If a locus is not selected, VectorWorks automatically sweeps the object around its left edge or point farthest on the left if more than one object is selected. A locus can be relocated or added after creation using the **Edit Group** command. The other three elements (arc angle, segment angle, pitch) can be edited after the sweep has been created through the Object Info palette.

If more than one object is selected when creating a sweep, the objects are automatically grouped. To edit an object within the sweep, use the **Edit Group** command.

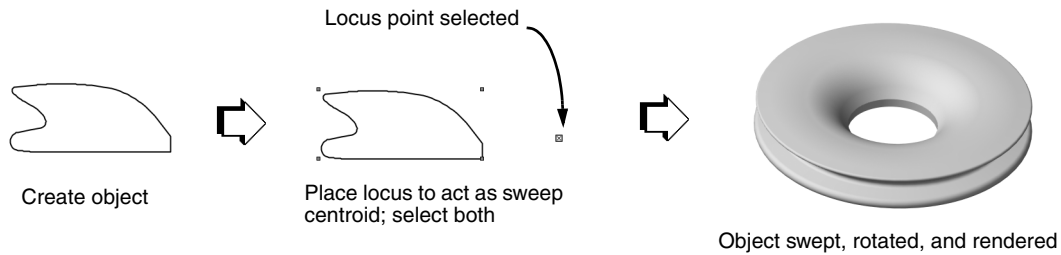
To create a sweep:

1. Select the 2D object(s) to sweep and, if created, the locus.
2. Select **Model > Sweep**.

The Create Sweep dialog box opens. Enter the sweep criteria and click **OK**.



Parameter	Description
Size	
Height	Indicates the sweep height
Radius	Indicates the sweep radius
Angles	
Start Angle	Specifies the angle to begin the sweep; normally start at 0
Arc Angle	Specifies the degree of the sweep. By default, objects are swept a full 360°.
Segment Angle	Indicates the number of segments that make up the sweep. The default is 36 segments, each one 10° from the next on the arc. The angle setting must be a positive number. A large number of segments can slow down performance.
Pitch	Sets the degree to which the sweep spirals. A sweep's pitch is represented in the plus- or minus-height per revolution. For example, if the pitch is 1", every revolution raises the object a single inch. The default is 0.



The 3D Power Pack technology is fully integrated with VectorWorks to provide significantly expanded NURBS (Non Uniform Rational B-Splines) functionality.

NURBS is a mathematical formulation that represents the geometry of curves, circles, arcs, and surfaces in 3D space.

The 3D Power Pack provides the following features and benefits:





- Advanced solid modeling operations
- Advanced surface modeling operations
- Solid-surface interactions
- Participation of surfaces in Boolean operations
- Easy manipulation of surface geometry
- Simple 3D user interface

For information on backwards compatibility with 3D Power Pack objects, see “3D Power Pack Compatibility” on page 525.

## 3D Power Pack Fundamentals

### 3D Power Pack Cursors

Special cursors display during certain operations to help determine the current mouse function; they do not display when an active selection is about to occur.

Cursor/Operation	Where Used
Edge Selection 	<b>Extract</b> tool’s <b>Point</b> and <b>Curve</b> modes, <b>Chamfer Edge</b> tool, and the <b>Fillet Edge</b> tool
Face Selection 	<b>Extract</b> tool’s <b>Surface</b> modes and <b>Shell Solid</b> tool, as well as the <b>Chamfer Edge</b> and <b>Fillet Edge</b> tools with the Select Faces option turned on
Curve Selection 	<b>Loft Surface</b> tool and <b>Project</b> tool
Surface Selection 	<b>Project</b> tool

### Selecting the Edges and Faces of a Solid

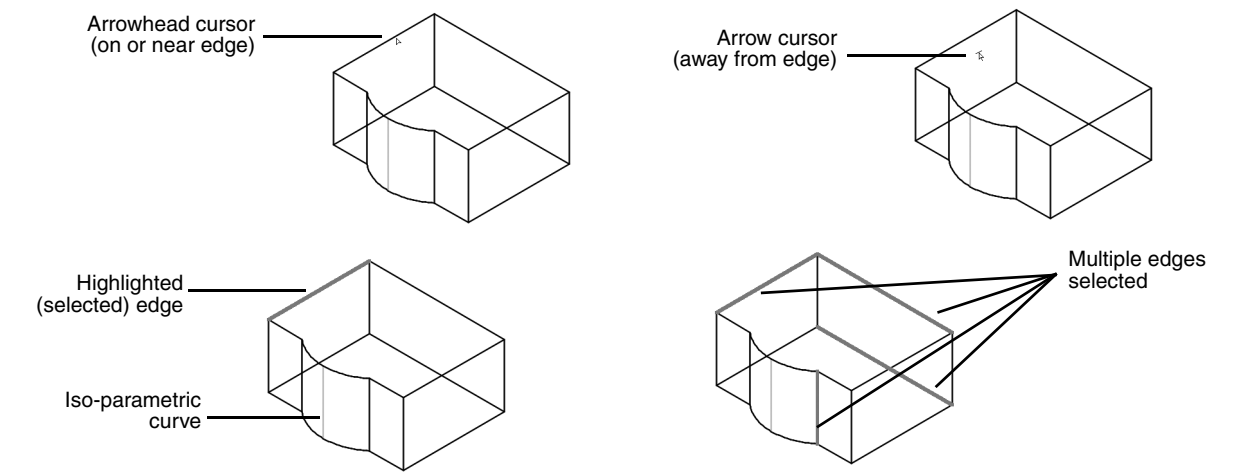
Several 3D Power Pack tools require the selection of edges or faces of a solid. The **Extract** tool’s Surface mode and the **Shell Solid** tool require face selection. The **Chamfer Edge** and **Fillet Edge** tools can require both face and edge selection, depending upon the option selected in the preferences dialog box.

### Selecting Edges

The cursor changes to an arrowhead when on or near an edge. If more than one edge is near the cursor, the nearest edge is selected. Click the edge to select it.

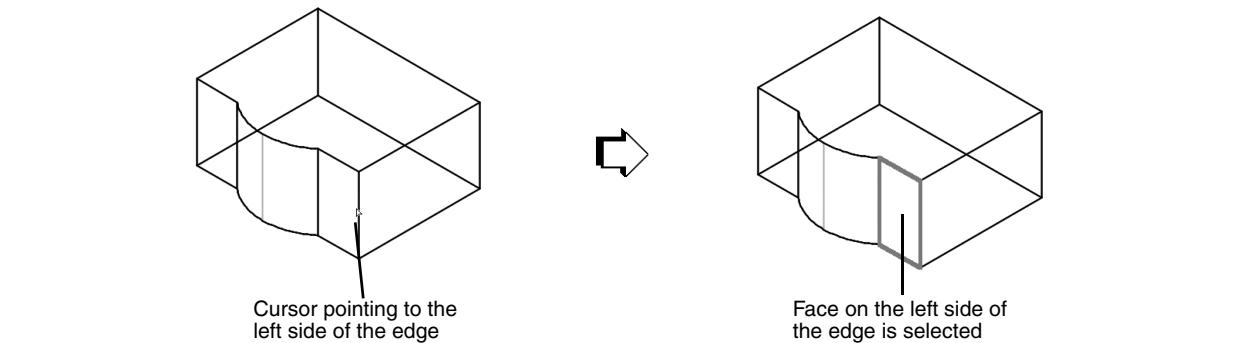
The cursor also changes to an arrowhead when on or near an iso-parametric curve (which displays in a lighter shade of pen color than the edge); however, an iso-parametric curve cannot be selected.

Action	Description
Select more than one edge	Press the Shift key and select the edges
Deselect a selected edge	Click on the edge again with the Shift key pressed
Deselect edges that have been selected	Click on an empty area
Deselect the last selection	Press the Backspace (Windows) or Delete (Macintosh) key, or double-click on the edge

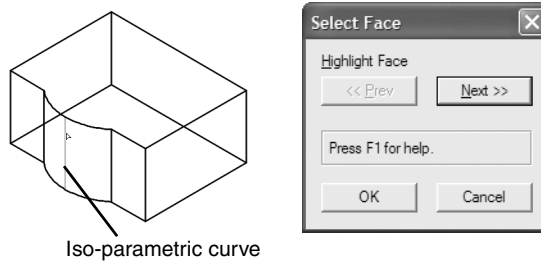


### Selecting Faces

Face selection in VectorWorks is actually an edge-based selection. When the cursor is on or near an edge or near an iso-parametric curve, you can select the face on either side of the edge depending on the cursor position.



If the cursor is positioned over more than one face, or near an iso-parametric curve on a face, the Select Face dialog box opens to specify which face to select.



Click **Next** or **Prev** until the desired face is selected. Click **OK** to select the face.

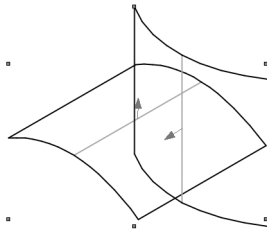
Multiple faces can be selected while pressing the Shift key, much like the edge selection described earlier. Deselecting faces is also similar to deselecting edges.

## Displaying Surface Normals

The surface normal of NURBS surfaces can be displayed in order to clarify the surface direction and facilitate the creation of fillet surfaces (see “Creating a Fillet Surface” on page 325), and the sectioning of solids (see “Sectioning Solids” on page 365).

To display the surface normal of a NURBS surface:

1. Select one or more NURBS surfaces.
2. In the Object Info palette, select **Show Normal**. The NURBS surface normal displays as a red arrow.



If desired, click **Reverse Normal** when a single NURBS surface is selected to reverse the direction of the surface normal. The arrow changes direction accordingly to indicate the new direction.

## Displaying Curve Direction

The direction of NURBS curves can be displayed to help perform 3D operations.

To display the direction of a NURBS curve:

1. Select one or more NURBS curves.
2. In the Object Info palette, select **Show Direction**. The NURBS curve direction displays as a red arrow.

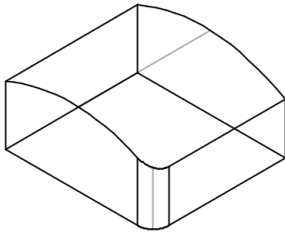


If desired, click **Reverse Direction** when a single NURBS curve is selected to reverse the direction of the curve. The arrow changes direction accordingly to indicate the new direction.

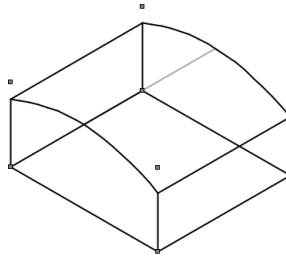
## Editing a Fillet/Chamfer or Shell Object

A fillet, chamfer, or shell object follows certain editing conventions.

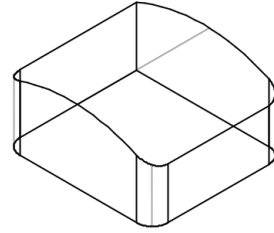
The set of edges or faces used to create the fillet/chamfer or shell cannot be changed once the operation is performed; edges or faces cannot be deleted from or added to the existing set. To add or delete edges or faces, first ungroup the object, and then perform the operation again.



Fillet operation performed



Ungroup to change existing set of edges



Fillet operation performed with new set of edges

The properties that can be changed from the Object Info palette include the thickness of a shell, direction of shelling (inside/outside), the radius of a fillet or setback distance of a chamfer. In the case of variable radius fillets, the percentage of length and radius value at each point can be edited. However, only the parameters of the topmost object can be changed.

For example, if a shell is created, and then some of the shell edges are filleted, only the fillet parameters can be changed directly from the Object Info palette. To change the shell thickness, the fillet object must first be ungrouped. To change the original extrusion, both the fillet and the shell must be ungrouped. Once changes have been made, reapply the shell and fillet.

[The \*\*Modify > Edit Group\*\* command cannot be used for these objects.](#)

## Surface Geometry Requirements

Some surface geometry can contain degenerate patches, singularities, or self-intersections. These types of surfaces could potentially be produced with the **3D Reshape** tool, **Loft Surface** tool, or **Create Surface from Curves** command, and can produce undesirable results in the finished model. Surface operations, such as trim and stitch surfaces, split, and other operations, like creating contours and solid operations, may not be able to manipulate these types of surfaces.

[Decomposing such surfaces may help by separating the surfaces into NURBS surfaces without discontinuities. See “Decomposing Objects and Surfaces” on page 387.](#)



## NURBS Surfaces

### Interpolated NURBS Surfaces

An interpolated surface is a NURBS surface that passes through a two-dimensional array of 3D interpolation points. Regular NURBS surfaces are defined by their control points, which may not lie on the surface and can be difficult to use for reshaping the surface (it is difficult to know how much the control point should be moved in order to reshape the surface by a specific distance). Because interpolation points lie on the surface, it is much easier to modify these points with the **3D Reshape** tool or the Object Info palette, and have the surface pass through the points.

An interpolated surface can be created, or an existing untrimmed NURBS surface can be converted to an interpolated surface, for easier reshaping.

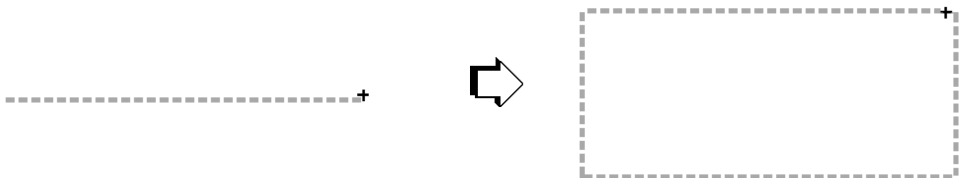
*When an interpolated surface is used in another operation, such as a Boolean operation or trimming, the surface becomes a control point surface.*

### Creating an Interpolated Surface

A new interpolated NURBS surface can be created with the **Create Interpolated Surface** command.

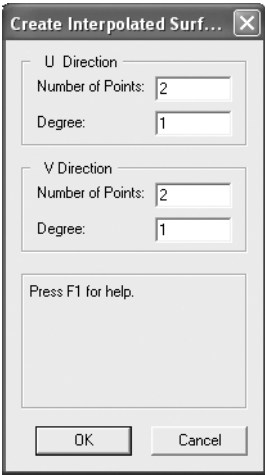
To create an interpolated surface:

1. Select **Model > 3D Power Pack > Create Interpolated Surface**.
2. Click to define the start of the interpolation point row, and then click again to define the end of the row. Click a third time to define the column of interpolation points.



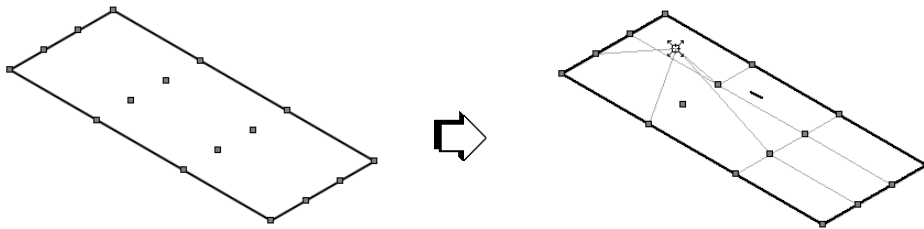
The Create Interpolated Surface dialog box opens.

3. Specify the number of interpolation points and degree of flexibility to create for both the U and V direction.



Parameter	Description
U Direction	
Number of Points	Specifies the number of interpolation points (up to 1000) to create in the U direction; this number must be greater than the U degree number
Degree	Indicates the flexibility of the surface in the U direction, from 1 to 28; a larger number results in a more variable surface
V Direction	
Number of Points	Specifies the number of interpolation points (up to 1000) to create in the V direction; this number must be greater than the V degree number
Degree	Indicates the flexibility of the surface in the V direction, from 1 to 28; a larger number results in a more variable surface

4. Click **OK** to create the interpolated surface. Select **Show Vertices** in the Object Info palette to display the interpolation points. Use the **3D Reshape** tool to reshape the interpolated NURBS surface.



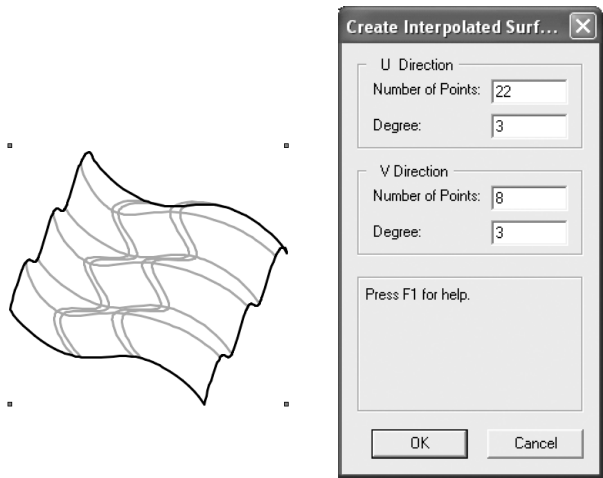
### Converting to an Interpolated Surface

An existing untrimmed NURBS surface can be converted to an interpolated NURBS surface for easier reshaping. To convert an untrimmed NURBS surface to an interpolated surface:

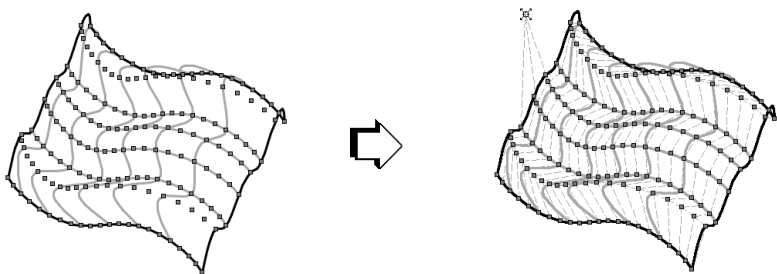
1. Select an untrimmed NURBS surface.

2. Select **Model > 3D Power Pack > Create Interpolated Surface**.

The Create Interpolated Surface dialog box opens, with a suggested number of interpolation points and degree values for the conversion. These parameters can be changed (see “Creating an Interpolated Surface” on page 315).



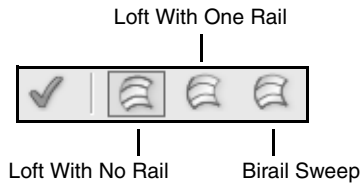
3. Click **OK** to create the interpolated surface. Select **Show Vertices** in the Object Info palette to display interpolation points. Use the **3D Reshape** tool to reshape the interpolated NURBS surface.



### Creating a Loft Surface

The **Loft Surface** tool creates complex NURBS surface(s) from two or more cross sections with no rail, with a rail and one or more cross sections, or with two rails and one cross section. A rail is a guide curve which determines the shape of the resulting surfaces, in the one rail mode. In Birail Sweep mode, the rails do not need to intersect the cross sections.

Three modes are available.



Mode	Description
Loft With No Rail	Creates a NURBS surface using two or more cross sections
Loft With One Rail	Creates a NURBS surface using a rail and one or more cross sections
Birail Sweep	Creates a NURBS surface using two rails and one cross section

Similar to the **Multiple Extrude** command, the **Loft Surface** tool creates a 3D object from a series of other objects. Unlike **Multiple Extrude**, the cross sections do not need to be equally spaced, and the resulting profile can be manipulated to avoid self-intersection and to control twist.

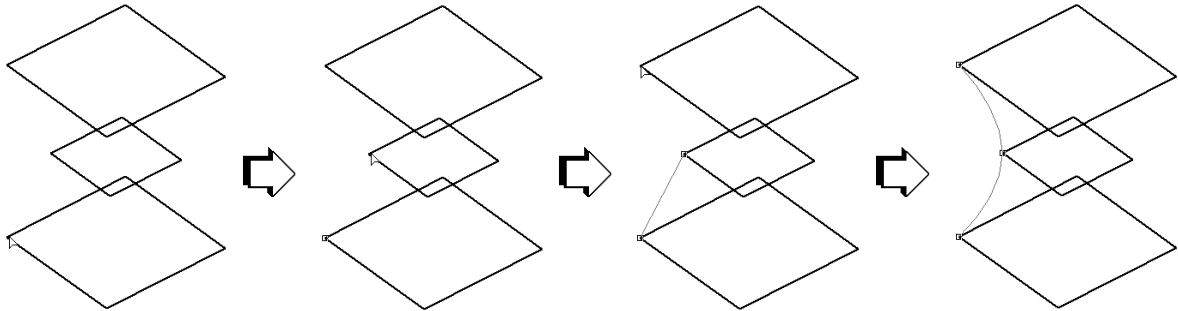
This tool can potentially create surfaces which cannot be further manipulated in the 3D Power Pack. See “Surface Geometry Requirements” on page 314.

Loft Surface Using No Rails



To create a NURBS surface from two or more cross sections:

- 1. Click the **Loft Surface** tool from the 3D Modeling tool set, and then select **Loft With No Rail** from the Tool bar.
- 2. Click on each cross section. The cursor changes into an arrowhead when over a valid cross section. The point nearest to the click is selected.

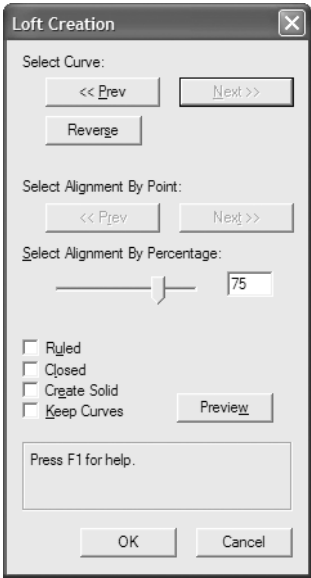
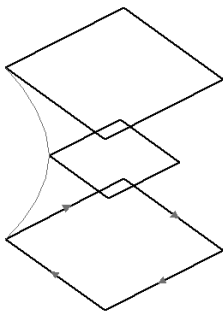


The proposed curve alignment displays in red as each section is selected.

Cross sections are created using NURBS curves which do not need to be the same shape or planar. All NURBS curves must be either closed or open objects, not a mixture of the two. 3D loci can be used in a loft, but must display at the ends of the loft.

- 3. Once all curves are selected, press Enter (Windows) or Return (Macintosh) or click the check mark button on the Tool bar.

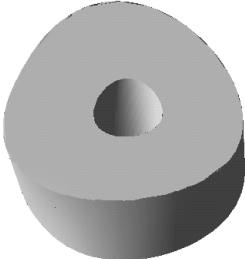
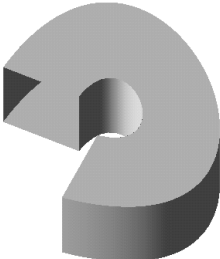
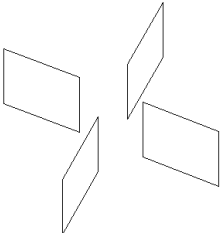

The Loft Creation dialog box opens.



4. Specify the desired loft creation settings.

Parameter	Description
Select Curve	Selects the previous or next cross section curve. <b>Reverse</b> changes the direction of the curve to twist or untwist the loft surface.
Reverse	Click to reverse the curve direction
Select Alignment by Point	Selects the previous or next point on the selected cross-section curve. If the cross section does not have any corners, this option is disabled.
Select Alignment by Percentage	Selects points along a geometrically-continuous cross section (such as a circle) by a specified percentage, or by adjusting the slider
Ruled	Creates a linearly-interpolated object



Parameter	Description
Closed	<p>Creates a loft surface that closes in on itself. Because the start point cannot be selected as the end point of a loft, the <b>Closed</b> option automatically completes the connection.</p> <div></div>
Create Solid	<p>Creates a solid loft surface with capped ends</p> <div></div>
Keep Curves	Retains the cross sections after the loft is created
Preview	Displays the proposed loft surfaces based on the current settings

5. Click **OK** to close the dialog box and create the loft surface(s).

Loft Surface Using One Rail

 To create a NURBS surface using one rail:

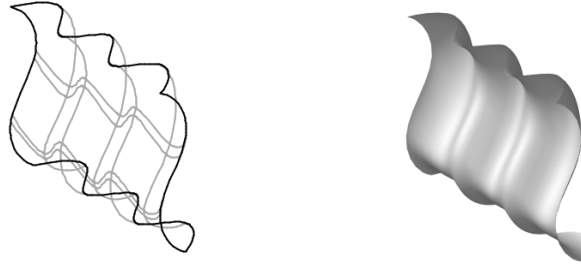
1. Click the **Loft Surface** tool from the 3D Modeling tool set, and then select **Loft With One Rail** from the Tool bar.
2. Click on the rail, and then click on each cross section.



- Once all curves are selected, press Enter (Windows) or Return (Macintosh) or click the check mark button on the Tool bar.

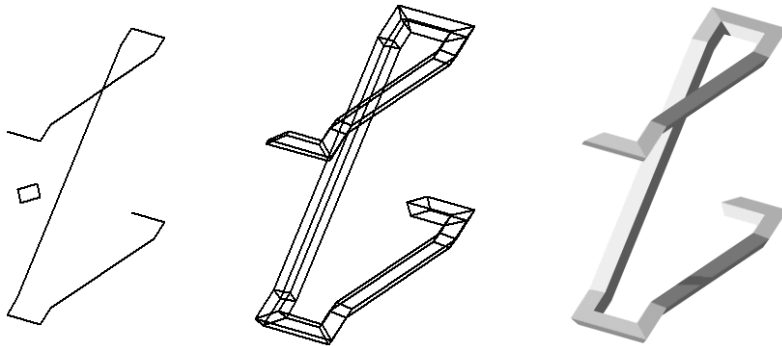
The Loft Creation dialog box opens.

- Specify the desired loft creation settings (see “Loft Surface Using No Rails” on page 318).
- Click **OK** to close the dialog box and create the loft surface(s).



The rail curve should intersect all cross-section curves if there is more than one curve.

When a single cross section is used, the curve is swept along the rail and the cross section does not need to intersect the rail.



## Loft Surface Using Two Rails



To create a NURBS surface using two rails:

- Click the **Loft Surface** tool from the 3D Modeling tool set, and then select **Birail Sweep** from the Tool bar.
- Click on each rail, and then click on the cross section. The cross-section profile curve does not need to intersect the rail curves.

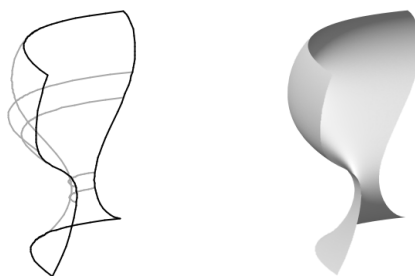
In this mode, only one cross section can be selected.



3. Once the profile curve is selected, press Enter (Windows) or Return (Macintosh) or click the check mark button on the Tool bar.

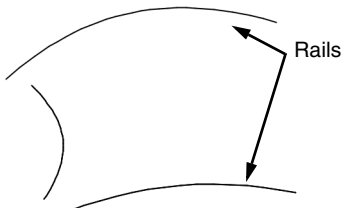
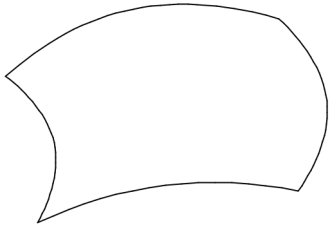
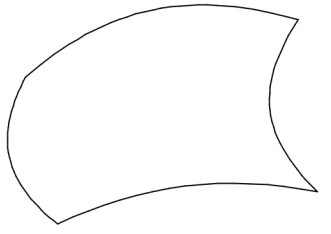
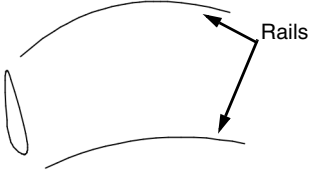
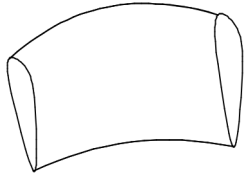
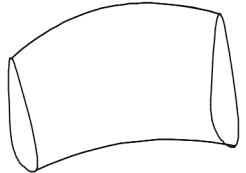
The Loft Creation dialog box opens.

4. Specify the desired loft creation settings (see “Loft Surface Using No Rails” on page 318).
5. Click **OK** to close the dialog box and create the loft surface(s).



The loft surface is created differently depending on whether the profile curve is open or closed, and how the start/end of the rails touch the profile curve. In certain instances, the click order (which rail is clicked first) and location (part of the profile curve that is clicked) will produce a different loft surface.



Status of Profile Curve and Rails	Effect of Rail Click Order/Profile Click Location
Open Profile Curve	
Start/end of one of the rails touches the start/end of the open profile	The rail click order and profile click location do not affect the loft surface creation
Start/end of the rails do not touch the start/end of the open profile, or do not touch the open profile at all	Both the rail click order and the location where the profile is clicked affect how the loft surface is created
 <p>Rails do not touch the open profile curve</p>	 <p>Top rail clicked first, then bottom rail, and then the top of the profile curve</p> <p>OR</p> <p>Bottom rail clicked first, then top rail, and then the bottom of the profile curve</p>  <p>Top rail clicked first, then bottom rail, and then the bottom of the profile curve</p> <p>OR</p> <p>Bottom rail clicked first, then top rail, and then the top of the profile curve</p>
Closed Profile Curve	
Start/end of one of the rails touches the closed profile curve	The click order and location do not affect the loft surface creation
Start/end of the rails do not touch the closed profile at all	The click order affects how the loft surface is created
 <p>Rails do not touch the closed profile curve</p>	 <p>Top rail clicked first, then bottom rail, and then the profile curve</p>  <p>Bottom rail clicked first, then top rail, and then the profile curve</p>

### Creating Surfaces from Curves

The **Create Surface from Curves** command creates a NURBS surface from a network of single closed curves (including closed 2D objects) or two or more open NURBS curves. These NURBS curves can be planar or non-planar, but NURBS in the U direction must intersect NURBS in the V direction at only one point.

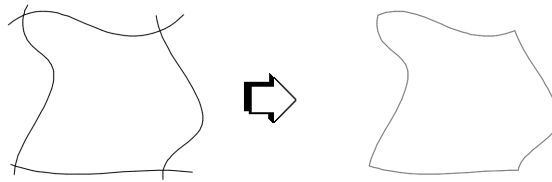
[This command can potentially create surfaces which cannot be further manipulated in the 3D Power Pack. See “Surface Geometry Requirements” on page 314.](#)

To create a NURBS surface from curves:

1. Draw two or more open NURBS curves to create an enclosed region.
2. Select the NURBS objects being used to create the NURBS surface.

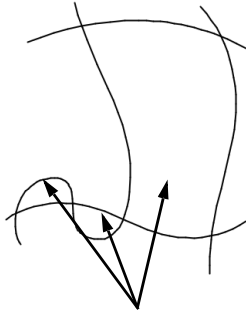
3. Select **Model > 3D Power Pack > Create Surface from Curves**.

A NURBS surface is created with a red pen color.

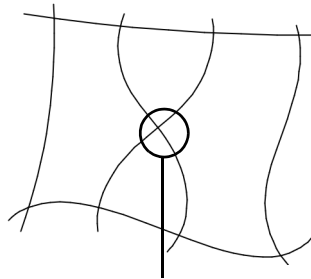


Multiple open NURBS that form both boundary and interior curves can be used to create a NURBS surface, but must have an equal number of intersections.

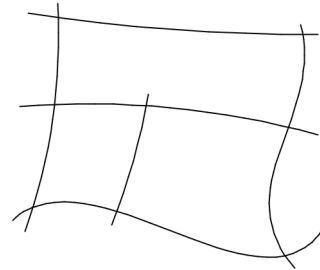
A NURBS surface is not created if there is more than one intersection created by the selected curves, creating multiple enclosed regions. It is also not created if there is an intersection between selected curves in the same parametric direction or if there are an unequal number of intersections.



Only one enclosed region allowed



Intersection between curves in the same parametric direction



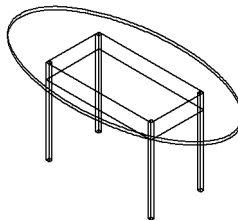
Unequal number of intersections

## Creating a Drape Surface

VectorWorks can automatically create a rectangular, draped NURBS surface over an object, up to a specific Z plane value. This is useful for creating surfaces that represent curtains or tablecloths.

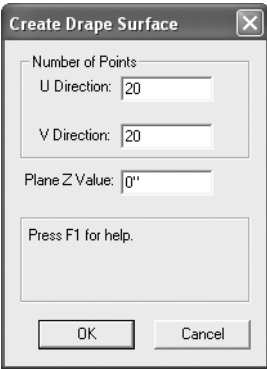
To create a drape surface:

1. Select one or more objects to be draped.



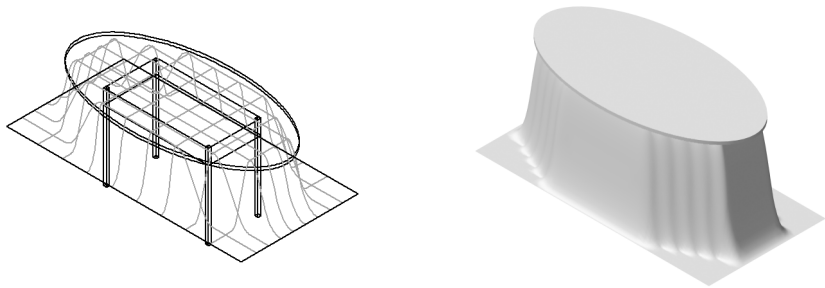
2. Select **Model > 3D Power Pack > Create Drape Surface**.

The Create Drape Surface dialog box opens.



Parameter	Description
Number of Points	Specifies the number of control points on the drape surface; the greater the number of points, the closer the drape surface is to the object
U Direction	Enter the number of points to create in the U direction; this number must be at least 3
V Direction	Enter the number of points to create in the V direction; this number must be at least 3
Plane Z Value	Specify the base level of the drape surface, which must be less than the highest Z coordinate of the object

3. Click **OK** to create the drape surface.



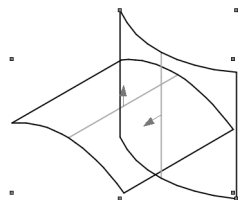
### Creating a Fillet Surface

The **Create Fillet Surface** command creates a surface between two selected surfaces, leaving the original surfaces unmodified.

This command is useful for sheet metal design (for example, for car bodies) to provide a smooth transition between two adjacent surfaces—perhaps for aesthetic quality or because of a manufacturing requirement.

To create a fillet surface at the intersection of two selected NURBS surfaces:

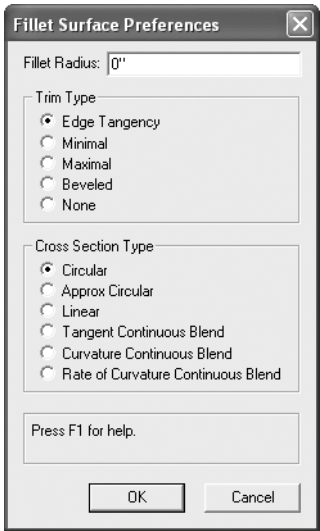
1. Select two NURBS surfaces. The position of the fillet surface depends on the normal of the NURBS surfaces; select **Show Normal** in the Object Info palette to display the surface normals (see “Displaying Surface Normals” on page 313).



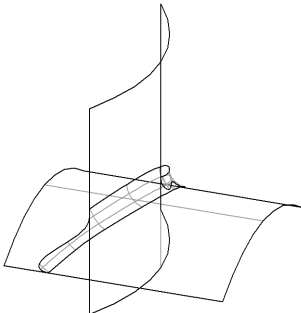
- 2. Select **Model > 3D Power Pack > Create Fillet Surface**.

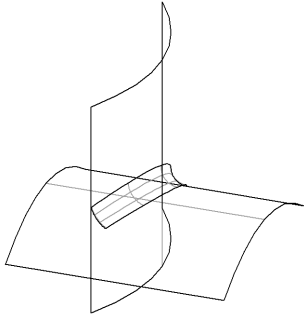
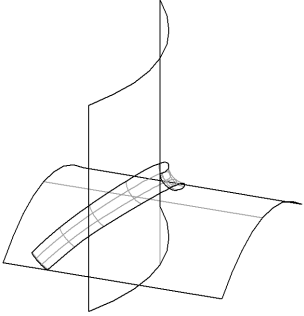
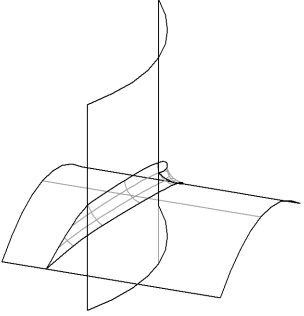
The Fillet Surface Preferences dialog box opens. Enter the desired **Fillet Radius**, and then select the trim and cross section type for the fillet.

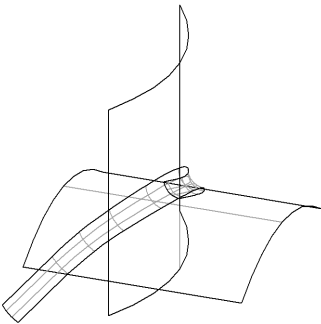
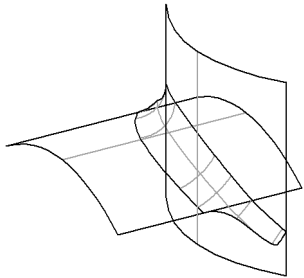
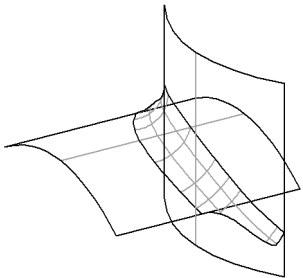
The following trim type examples shown use a circular cross section type, and the cross section examples use an edge tangency trim type.

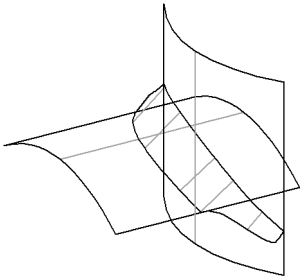
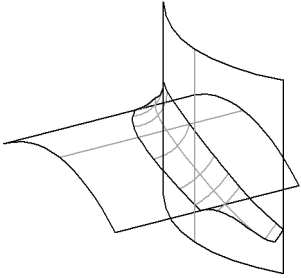
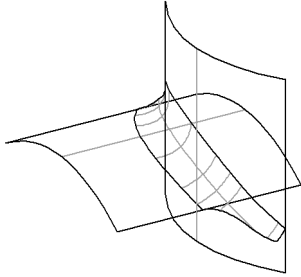


Parameter	Description
Edge Tangency	Creates a blend between the minimal and maximal intersections on each end of the fillet



Parameter	Description
Minimal	Trims the fillet surface to the minimal intersecting areas on the face boundaries 
Maximal	Trims the fillet surface to the maximal intersecting areas on the face boundaries 
Beveled	Creates a bevel between the minimal and maximal intersections on each end of the fillet 

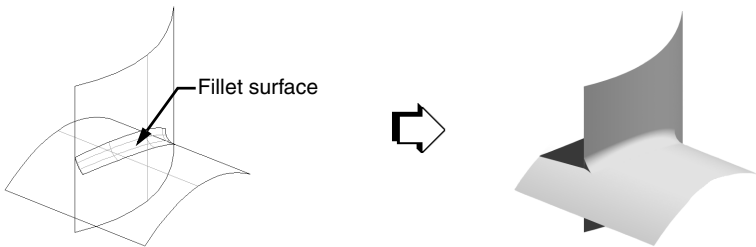
Parameter	Description
None	Generates the entire fillet without trimming 
Circular	Creates a fillet surface with a circular cross section 
Approx Circular	Creates a fillet surface with an approximately circular cross section 

Parameter	Description
Linear	<div>Creates a fillet surface with a linear cross section</div>  <p>The diagram shows two intersecting planes. A fillet surface is created between them, with a linear cross-section indicated by a straight line segment connecting the two planes.</p>
Tangent Continuous Blend	<div>Creates a fillet surface with a tangent continuous G1 cross section</div>  <p>The diagram shows two intersecting planes. A fillet surface is created between them, with a tangent continuous G1 cross-section indicated by a curved line segment connecting the two planes, ensuring tangency at the endpoints.</p>
Curvature Continuous Blend	<div>Creates a fillet surface with a curvature continuous G2 cross section</div>  <p>The diagram shows two intersecting planes. A fillet surface is created between them, with a curvature continuous G2 cross-section indicated by a curved line segment connecting the two planes, ensuring both tangency and curvature continuity at the endpoints.</p>

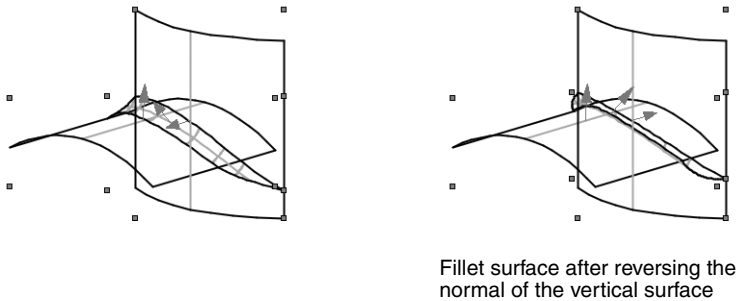
Parameter	Description
Rate of Curvature Continuous Blend	Creates a fillet surface with a G3 cross section, matching the rate of change between the adjacent surfaces

3. Click **OK**.

A NURBS surface is created between the two objects.



The position of the fillet surface depends on the surface normals. The fillet is created differently if the **Reverse Normal** button is clicked for one or both of the surfaces in the Object Info palette.



Creating a Seamless Join

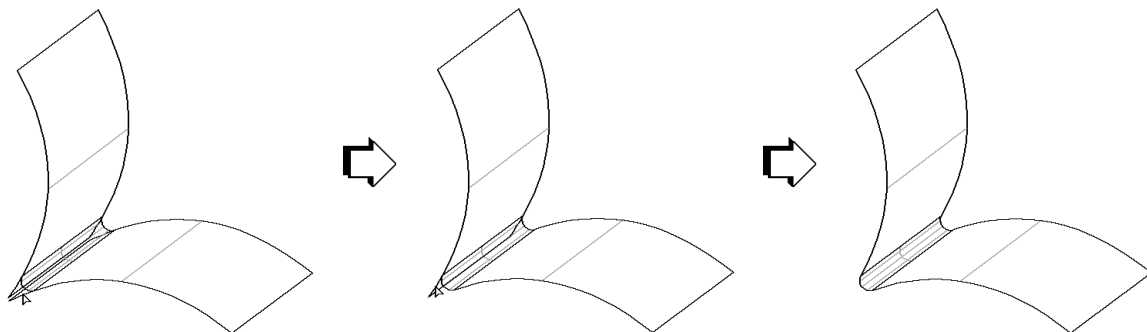
The resulting fillet can then be used to create a seamless join between NURBS surfaces.

To create a seamless join between NURBS surfaces:

- 1. Select all NURBS surfaces, and then select **Model > Add Solids** to add the fillet surface to the NURBS surfaces.
- 2. With the surfaces still selected, select **Modify > Convert > Convert to NURBS** to convert all the surfaces of the solid to NURBS surfaces.



3. Select **Modify > Ungroup** to display all individual surfaces.
4. Click on the drawing area to deselect the objects. Delete the surfaces that are not to be used in the final object.

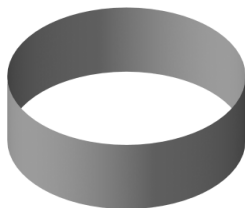


## Creating Planar Caps

The **Create Planar Caps** command closes off the ends of open-ended solids by creating planar NURBS surfaces. These surfaces can then be added to the rest of the surfaces with the **Add Solids** command.

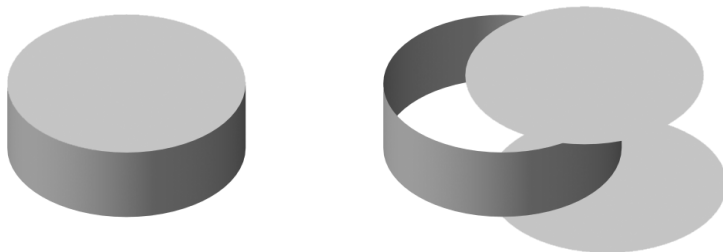
To create planar caps:

1. Select the open-ended solid.



2. Select **Model > 3D Power Pack > Create Planar Caps**.

Planar NURBS surfaces are created to close off the ends of the solid.



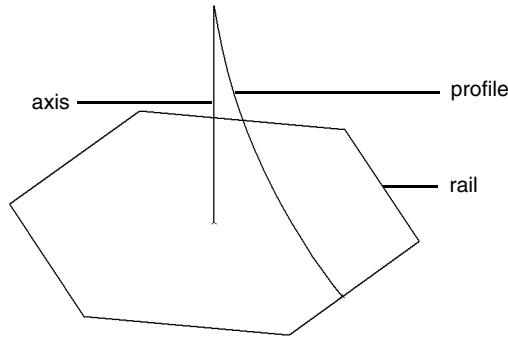
Planar caps moved for clarity

3. Add the solid and the planar cap surfaces by selecting them all and choosing **Model > Add Solids**.

## Creating a NURBS Surface by Revolving a Profile Along a Rail

Complex NURBS surfaces can be created by revolving a profile along a guide curve (rail). This is an alternate, and sometimes easier, method of creating NURBS surfaces than using the **Loft Surface** tool, especially when creating tent-like structures.

The **Revolve with Rail** command creates the NURBS surface by revolving a planar NURBS curve about an axis. The revolution is guided by a rail curve on a plane perpendicular to the plane containing the profile curve and axis.



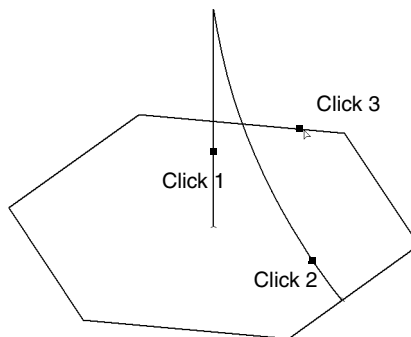
To create a NURBS surface with profile and rail:

1. Create the axis, rail and profile out of NURBS curves.

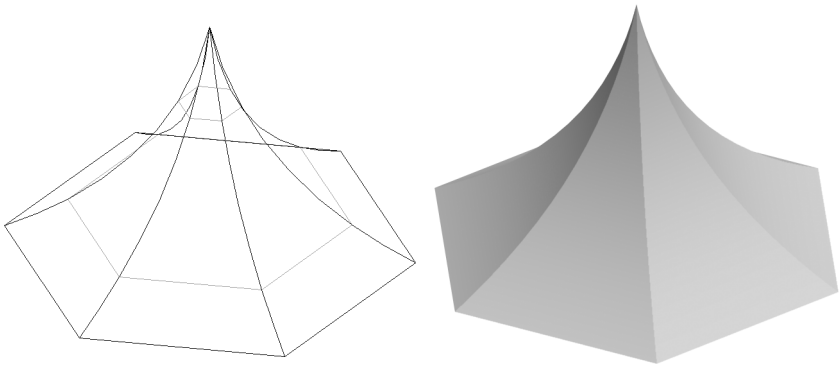
Conditions must meet the following requirements:

- The axis must be a linear NURBS curve
- The profile must be a planar NURBS curve
- The profile cannot intersect the axis, though it can touch
- The axis must lie on the same plane as the profile
- The rail must be a planar NURBS curve that lies on a plane perpendicular to the plane containing the axis and profile

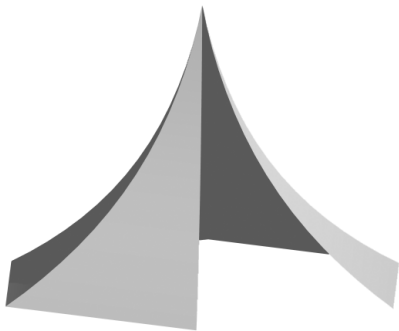
2. Select **Model > 3D Power Pack > Revolve with Rail**. Select, in order, the axis, profile and rail.



3. The NURBS surfaces are automatically created.



The rail defines the extent of the revolution. An open rail curve generates surfaces until the rail ends.



## NURBS Surface Properties

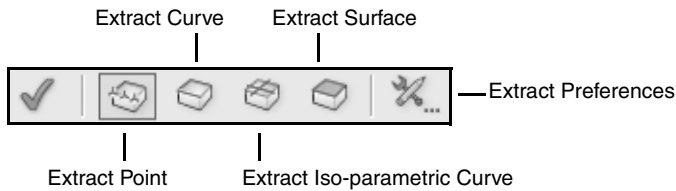
The properties of a NURBS surface are displayed in the Object Info palette, where they can also be edited. NURBS surfaces can also be reshaped with the **3D Reshape** tool; see “Reshaping 3D Objects” on page 359 for more information.

Parameter	Description
Move	Select <b>Entire Object</b> to edit all the vertices of the surface, <b>Vertex Only</b> to edit only the selected vertex, <b>U Vertices</b> to edit all of the vertices in a row in the U direction, and <b>V Vertices</b> to edit all of the vertices in a row in the V direction
Edit U/V	Scrolls through the vertices of the selected NURBS surface in either the U parametric direction or V parametric direction
X, Y, Z / I, J, K	Depending on the selection in the <b>Move</b> list, displays the position of the current surface or vertex; edit the values to change the surface/vertex position
U Degree	Degree in the U parametric direction; increasing this value adds vertices that can then be manipulated
V Degree	Degree in the V parametric direction; increasing this value adds vertices that can then be manipulated

Parameter	Description
Weight	NURBS curves and surfaces are represented mathematically by weighted control points. The weight value can be anywhere between .01 and 100. A weight above 1 pulls the curve or surface toward the control point; a weight below 1 has the reverse effect.
Reverse Normal	Flips the surface normal direction
Untrim	Creates a NURBS surface, if the surface has been trimmed
NURBS Surface parameters (display only)	Displays the NURBS surface parameters
Show Vertices	Select to display the surface's vertices
Show Normal	Displays the surface normal as a red arrow for the selected NURBS surface

## Extracting Geometry

The **Extract** tool can be used to extract geometry from the edge or surface of a NURBS surface or solid object, leaving the original unmodified. The extracted geometry can then be used for snapping to or for other surface operations.



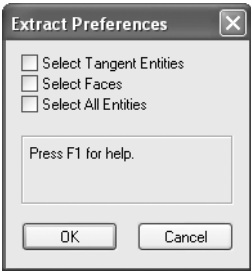
Mode	Description
Extract Point	Extracts 3D loci from the edges of a NURBS surface or solid object. 3D loci are placed at the start, end, and mid-points of the selected edges. For circular edges, a 3D locus is created at the circle center as well.
Extract Curve	Extracts a NURBS curve from the edge of a solid object
Extract Iso-parametric Curve	Extracts an iso-parametric curve from the surface of a solid object
Extract Surface	Extracts a NURBS surface from the face of a solid
Extract Preferences	Provides options for extracting tangent entities, faces, or all entities; the specific items extracted depends on which mode is selected. These options have no effect in Extract Iso-parametric Curve mode.



To extract geometry from the edge or surface of a NURBS surface or solid object:

1. In the desired view, click the **Extract** tool from the 3D Modeling tool set, and then select the desired mode from the Tool bar.
2. If **Extract Iso-parametric Curve** mode was selected, skip to step 4. For all other modes, click **Extract Preferences** from the Tool bar.

The Extract Preferences dialog box opens.



Parameter	Description
Select Tangent Entities	In <b>Extract Point</b> or <b>Extract Curve</b> mode, extracts loci or curves from tangentially-connected edges of the selected object; in <b>Extract Surface</b> mode, extracts surfaces from tangentially-connected faces of the selected object
Select Faces	In <b>Extract Point</b> or <b>Extract Curve</b> mode, extracts loci or curves from all edges of the selected face(s)
Select All Entities	In <b>Extract Point</b> or <b>Extract Curve</b> mode, extracts loci or curves from all edges of the selected object; in <b>Extract Surface</b> mode, extracts surfaces from all faces of the selected object

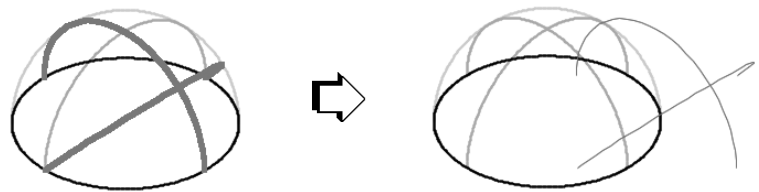
- 3. Specify the desired preferences and click **OK**.
- 4. Select the edge(s) or surface(s) from which geometry will be extracted. To select multiple edges or surfaces, hold the Shift key while selecting.

See “Selecting the Edges and Faces of a Solid” on page 311 for information on selecting surfaces.

- 5. Press Enter (Windows) or Return (Macintosh) or click the check mark button on the Tool bar to extract the 3D loci, curves, or surfaces.

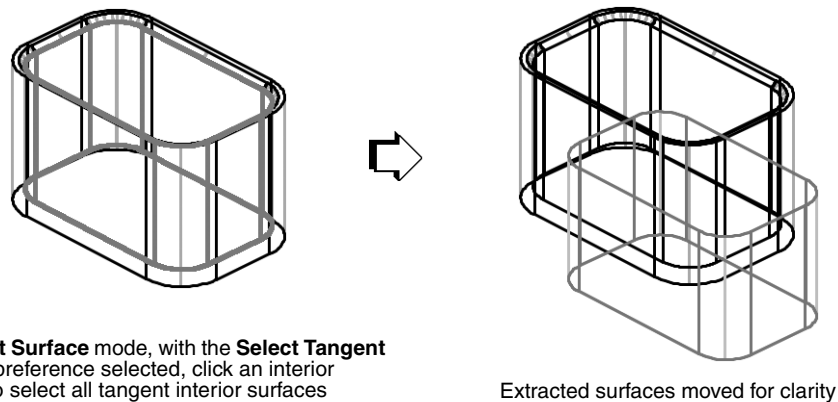
The extracted entities display in red, because they are automatically placed in either the RedCurves or RedSurfaces class.

To edit extracted groups, select **Modify > Ungroup**.



In **Extract Iso-parametric Curve** mode, click the hemisphere surface to select curves

Extracted curves moved for clarity



## NURBS Surface-curve Interaction

### Analyzing NURBS Curves and Surfaces

The **Analysis** tool provides proximity, intersection, and curvature information for NURBS curves and surfaces. Two modes are available.



Mode	Description
Proximity	Determines the minimum distance between NURBS curves/surfaces and 3D loci, or the intersection between NURBS curves/surfaces
Interrogation	Interactively determines the curvature of NURBS curves and surfaces and displays curvature parameters

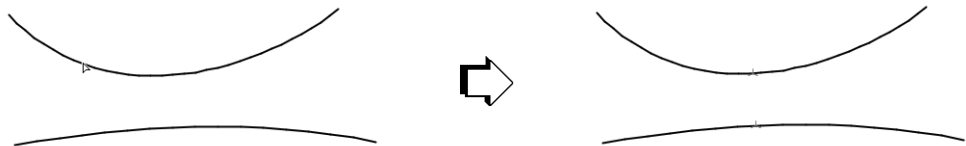
### Determining NURBS Curve and Surface Proximity

In **Proximity** mode, the **Analysis** tool places a 3D locus at the minimum distance or intersection between two NURBS curves, a NURBS curve and NURBS surface, and a 3D locus and NURBS curve or surface. The tool places a NURBS curve at the intersection of two NURBS surfaces.

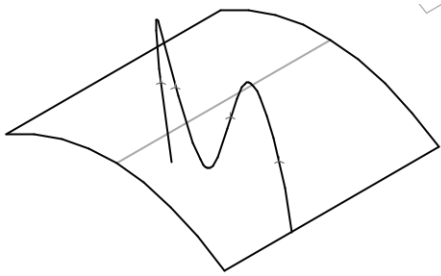


To analyze NURBS proximity or intersection:

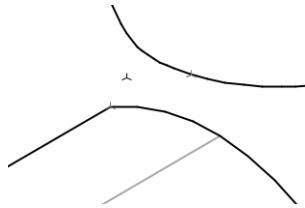
1. Click the **Analysis** tool from the 3D Modeling tool set, and then select **Proximity** from the Tool bar.
2. Click on a NURBS curve, NURBS surface, or 3D locus, and then click on another NURBS curve or surface.



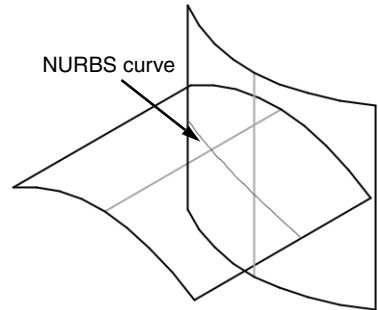
A red 3D locus is placed on each NURBS curve at the closest minimum distance or intersecting points between the two items, or a NURBS curve is placed at the intersection of two NURBS surfaces.



Locus points placed at each intersection between a NURBS curve and NURBS surface



Locus points placed at the minimum distance from a 3D locus point to both a NURBS curve and a NURBS surface



NURBS curve placed at the intersection of two NURBS surfaces

## Determining NURBS Curvature

The **Analysis** tool, in **Interrogation** mode, provides curvature parameters for NURBS curves and NURBS surfaces, and interactively displays curvature circles.

### Analyzing NURBS Curves

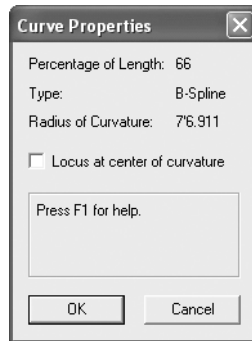


To determine the curvature of a NURBS curve:

1. Click the **Analysis** tool from the 3D Modeling tool set, and then select **Interrogation** from the Tool bar.
2. Click on the NURBS curve of interest and move the cursor along the curve to display the curvature circle at the cursor position.



3. Click the curve to obtain curve properties at a specific location along the curve. The Curve Properties dialog box opens, displaying curvature parameters for that location.



4. Select **Locus at center of curvature** and click **OK** to place a 3D locus and curvature circle, as well as a 3D locus at the center of curvature of that location.

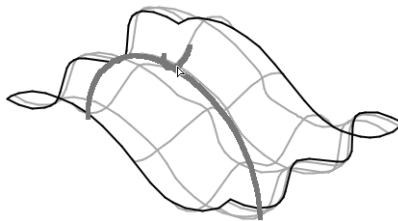


## Analyzing NURBS Surfaces



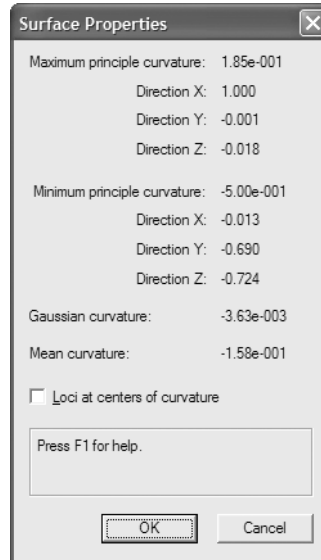
To determine the curvature of a NURBS surface:

1. Click the **Analysis** tool from the 3D Modeling tool set, and then select **Interrogation** from the Tool bar.
2. Click on the NURBS surface of interest and move the cursor along the surface to display the curvature circles at the cursor position.

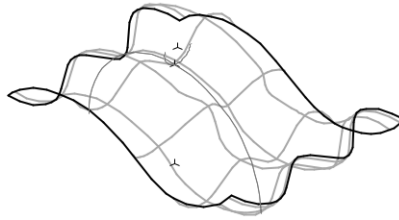


3. To obtain surface properties at a specific location along the surface, click. The Surface Properties dialog box opens, displaying curvature parameters for that location.





4. Select **Loci at centers of curvature** and click **OK** to place a 3D locus at the point on the surface where the curvature parameters are being calculated, and a curvature circle with a 3D locus at the center of the curvature circle for each curve at that location.



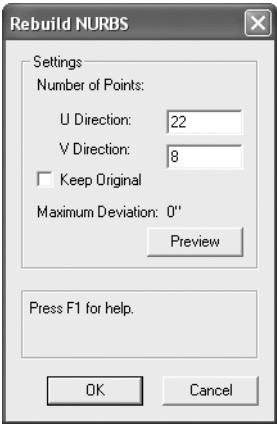
## Rebuilding NURBS Curves and Surfaces

The number of vertices in one or more selected NURBS curves or untrimmed surfaces can be changed with the **Rebuild NURBS** command. Reducing vertices simplifies the geometry, making it easier to manipulate, and increases the speed and ease-of-use for other objects that are based upon it.

To rebuild NURBS a curve or surface:

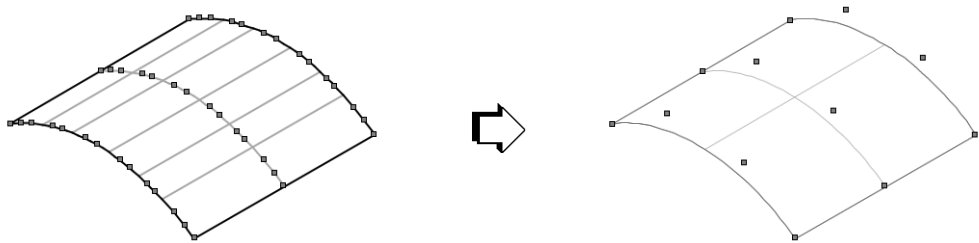
1. Select the NURBS curve(s) or surface(s).
2. Select **Model > 3D Power Pack > Rebuild NURBS**.

The Rebuild NURBS dialog box opens. Enter the number of points to use; specifying fewer points simplifies the NURBS curve or surface, but increases the difference between the original geometry and the rebuilt geometry.



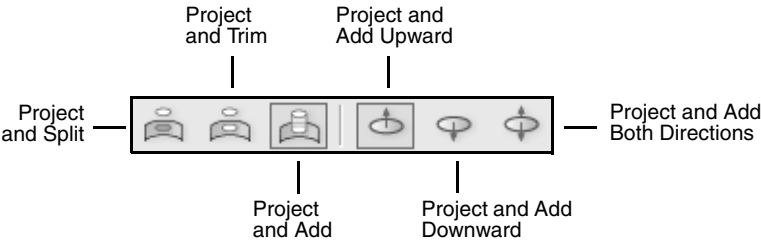
Parameter	Description
Number of Points	Specifies the number of points to use; for a NURBS curve, enter the number of points, which must be at least 3
U Direction	For a NURBS surface, enter the number of points to use along the U direction; this number must be at least 3
V Direction	For a NURBS surface, enter the number of points to use along the V direction; this number must be at least 3
Keep Original	Retains the original curve or surface, and adds a new, rebuilt curve or surface
Maximum Deviation	After clicking <b>Preview</b> , displays the maximum deviation between the original and rebuilt surface or curve
Preview	Displays a red preview of the new, rebuilt curve or surface

3. Click **OK** to rebuild the NURBS curve(s) or surface(s).



### Splitting or Trimming NURBS Surfaces

The **Project** tool projects a 2D object or NURBS curve onto a NURBS surface, and then splits the NURBS surface or trims the NURBS surface according to the region selected. This allows nonlinear splitting or trimming of surfaces to create different shapes or cut a hole in an object.



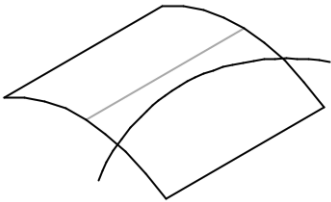
Mode	Description
Project and Split	Splits a NURBS surface with a projection
Project and Trim	Trims a NURBS surface with a projection
Project and Add	Adds a projection to a NURBS surface
Project and Add Upward	In <b>Project and Add</b> mode, adds the projection in the profile plane normal direction
Project and Add Downward	In <b>Project and Add</b> mode, adds the projection in the opposite direction from the profile plane normal direction
Project and Add Both Directions	In <b>Project and Add</b> mode, adds the projection in both the profile plane normal direction and the opposite direction

Project and Split



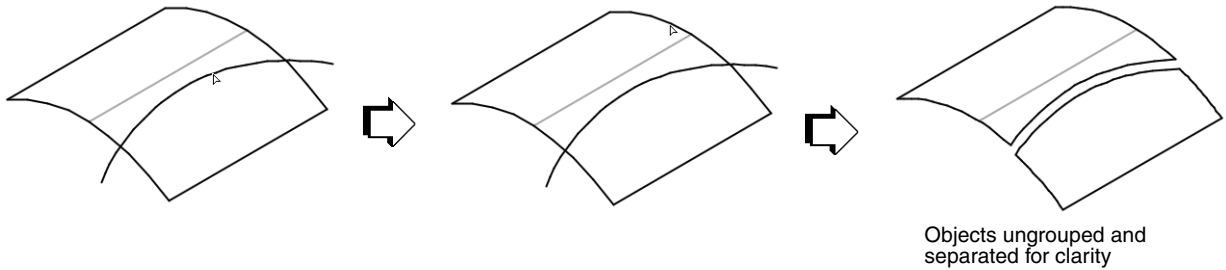
To split a NURBS surface with a projection:

1. In the desired view, draw a 2D object or NURBS curve on top of a NURBS surface.



If the object to be projected is an open NURBS curve or open 2D object, both end points must be outside the NURBS surface.

2. Click the **Project** tool from the 3D Modeling tool set, and then select **Project and Split** from the Tool bar.
3. Click on the splitting object, and then click on the NURBS surface.



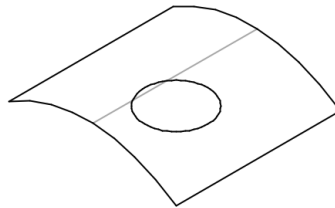
The splitting object is projected onto the NURBS surface, resulting in a group of NURBS surfaces.

## Project and Trim



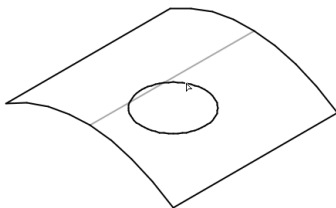
To trim a NURBS surface with a projection:

1. In the desired view, draw a 2D object or NURBS curve on top of a NURBS surface.

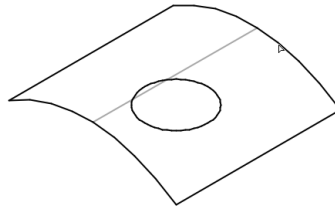


If the object to be projected is an open NURBS curve or an open 2D object, both end points must be outside the NURBS surface.

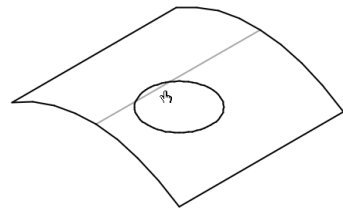
2. Click the **Project** tool from the 3D Modeling tool set, and then select **Project and Trim** from the Tool bar.
3. Click on the trimming object, and then click on the NURBS surface. The cursor changes into the pointing hand cursor. Click on the side of the intersection to be trimmed away.



Select the project and trimming object



Select the NURBS surface



Select the region to be trimmed

The trimming object is projected onto the NURBS surface, and the region selected to be trimmed away is removed from the NURBS surface at the point of intersection.

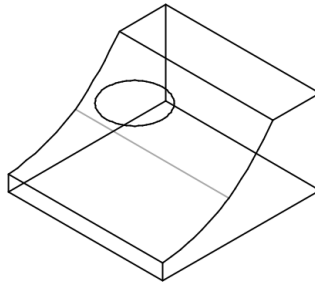


## Project and Add



To add a projection to a NURBS surface:

1. In the desired view, draw a 2D object or NURBS curve on top of a NURBS surface.

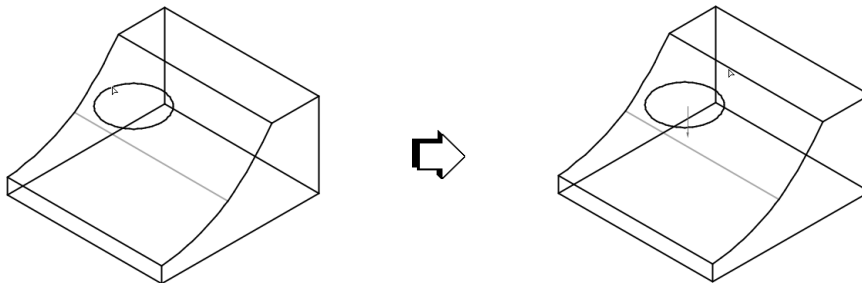


The 2D object or NURBS curve must be closed and planar.

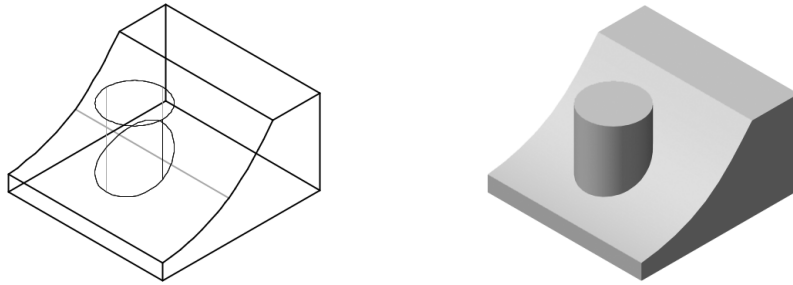
2. Click the **Project** tool from the 3D Modeling tool set.
3. Select **Project and Add** from the Tool bar. Select the appropriate direction mode so that the projection direction intersects the NURBS surface (**Project and Add Upward**, **Project and Add Downward**, or **Project and Add Both Directions**).

The projection direction must intersect with the NURBS surface, or no projection is created.

4. Click on the object to add; the projection direction is indicated by a red arrow. Click on the NURBS surface.



The object's projection is added to the NURBS surface at the point of intersection.



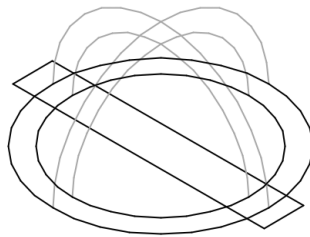
## Creating a Rib

The **Project and Add** mode of the **Project** tool can be used to create ribs.



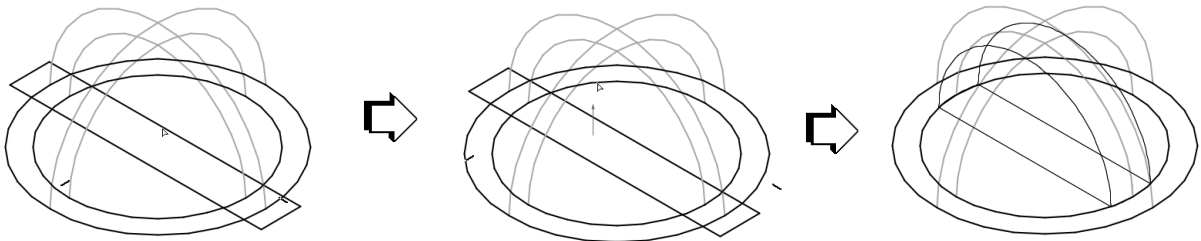
To create a rib:

1. In the desired view, draw a 2D object or NURBS curve on top of a solid.



The 2D object or NURBS curve must be closed and planar.

2. Click the **Project** tool from the 3D Modeling tool set, and then select **Project and Add** from the Tool bar.
3. Select the appropriate projection direction mode.
4. Click on the object to add, and then click on the solid.



The rib profile is projected until it meets the next surface it encounters. The profile is trimmed at the extremities automatically.

## Extending NURBS Curves and Surfaces

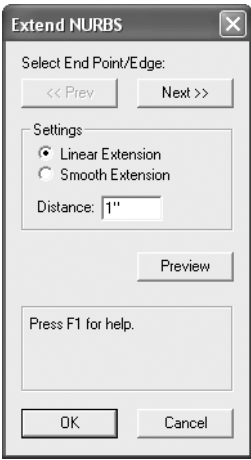
NURBS curves and surfaces can be extended by a specified distance with the **Extend NURBS** command.

Closed NURBS curves and trimmed NURBS surfaces cannot be extended. In addition, a NURBS surface cannot be extended in the direction (U or V) that it is closed.

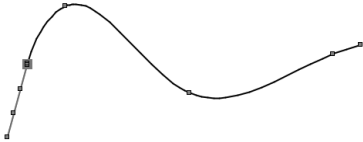
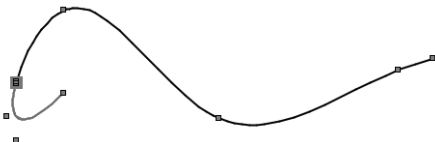
To extend a NURBS curve or surface:

- 1. Select the NURBS curve or surface to extend.
- 2. Select **Model > 3D Power Pack > Extend NURBS**.

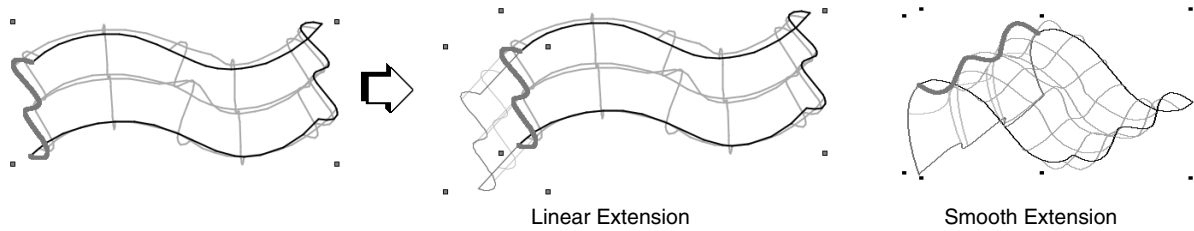
The Extend NURBS dialog box opens. Select the end point (for NURBS curves) or edge (for NURBS surfaces) to extend. On the drawing, the selected edge or end point is displayed in red. Select the type of extension to make and specify the extension distance.



Parameter	Description
Select End Point/Edge	Click the arrows to select the end point or edge to extend. The selected end point or edge is displayed in red on the drawing. <div></div>
Linear Extension	Extends the edge or end point tangentially
Smooth Extension	Extends the edge or end point by continuing the current curvature
Distance	Specifies the extension distance

Parameter	Description
Preview	<div>Click to see a preview of the extension in red</div> <div><div> Linear Extension</div><div> Smooth Extension</div></div>

3. Click **Preview** to check the extension, and then click **OK** to extend the NURBS curve or surface.



## Creating Helix-Spirals

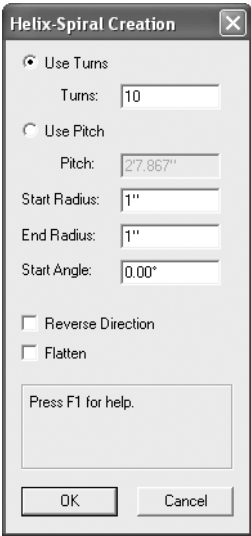
The **Create Helix-Spiral** command creates a helix-shaped or spiral-shaped 3D object from one or more path objects. The paths can be 2D objects or NURBS curves.

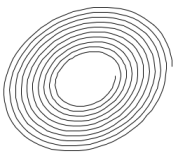
To create a helix or spiral:

1. Select the object(s) to use as the path.
2. Select **Model > 3D Power Pack > Create Helix-Spiral**.

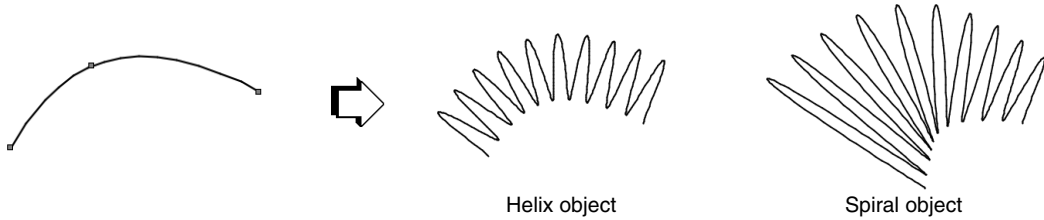
The Helix-Spiral Creation dialog box opens.





Parameter	Description
Use Turns	Select to create a helix/spiral by a specified number of turns along the path
Turns	Enter the total number of turns to be created along the path
Use Pitch	Select to create a helix/spiral by pitch
Pitch	Enter the pitch value (the distance between successive turns)
Start Radius	Enter the radius of the perpendicular starting circle
End Radius	Enter the radius of the perpendicular ending circle. To create a helix, enter a value matching the start radius. To create a spiral, enter a different value.
Start Angle	Enter the starting point of the twist on the starting circle
Reverse Direction	Select to change the rotation direction of the helix/spiral from clockwise to counter-clockwise or vice-versa
Flatten	Select to flatten the helix/spiral into a 2D spiral. <b>Use Pitch</b> is not available with this option. <div></div>

3. Click **OK**.
- A helix or spiral is created.



A helix or spiral object can be used, without further conversion, as a path object for the **Extrude Along Path** command.

Ungrouping a helix-spiral object results in a NURBS curve.

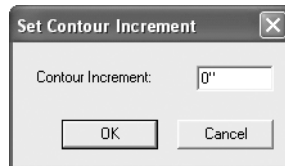
## Creating Contours

Contours are intersections of a solid or surface with a plane passing through the line specified with the **Create Contours** tool. This tool creates contours at specified intervals, which can then be used to create a loft surface in order to re-create a solid shape.



To create contours:

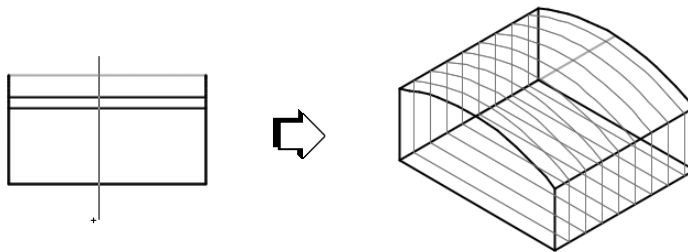
1. Click the **Create Contours** tool from the 3D Modeling tool set, and then select **Preferences** on the Tool bar to specify the contour interval.



To create a single contour, specify a **Contour Increment** of zero.

2. Click and drag to indicate the position of the intersecting plane.

The contours, a group of NURBS curves, are drawn in red.



# Solids Operations

## Modifying Edges

The **Chamfer Edge** and **Fillet Edge** tools remove the sharp corners of a solid by modifying the shape of its edges. The **Chamfer Edge** tool modifies the surface with a linear cross section while the **Fillet Edge** tool modifies the surface with a circular cross section.

Edges are usually modified during the detailed design phase of a project. This may reduce the heat and/or stress concentration in manufacturing and can provide a more realistic or aesthetic appearance to a model.

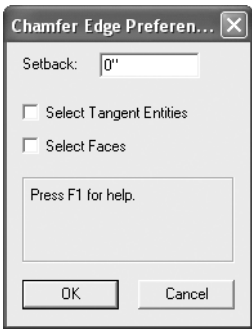
## Modifying Edges by Chamfering



To chamfer the edges of a solid:

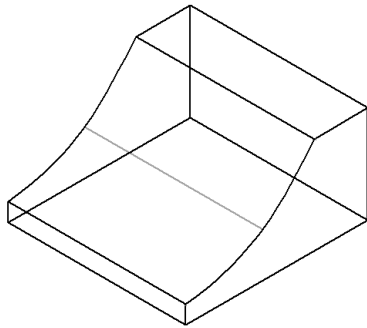
- 1. Click the **Chamfer Edge** tool from the 3D Modeling tool set, and then select **Preferences** on the Tool bar to specify chamfer edge preferences.

The Chamfer Edge Preferences dialog box opens.

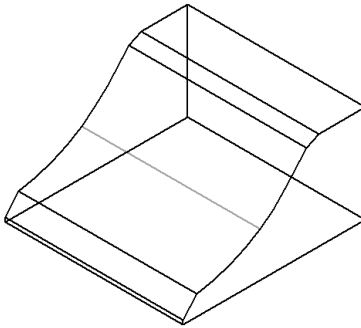


Parameter	Description
Setback	Specify the distance by which the faces are set back
Select Tangent Entities	Choose this option to select tangentially-connected edges and faces for chamfering
Select Faces	Choose this option to select faces for chamfering

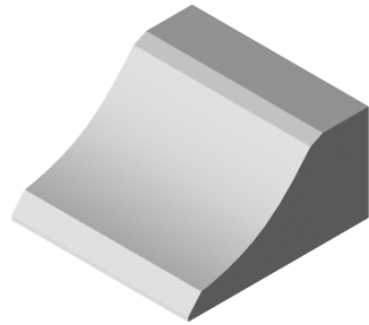
- 2. Click **OK** to close the Chamfer Edge Preferences dialog box.
- 3. For tangent entity selections, select the tangentially-connected edges and faces to be modified. For face selections, select the faces to be modified. Hold the Shift key down to select several faces and edges.  
[See “Selecting the Edges and Faces of a Solid” on page 311 for information on selecting edges and faces.](#)
- 4. Press Enter (Windows) or Return (Macintosh) or click the check mark button on the Tool bar to perform the edge modification.



Before chamfering



After chamfering



Results rendered

The **Setback** value for the chamfered edge can be edited through the Object Info palette.

Once the modification is complete, the edge set used to create the modification cannot be changed. The modified edge can be ungrouped, and a new modification with different edges can be created.

If one modification has been created over another, the first modification cannot be edited in the Object Info palette unless the last one is ungrouped (see “Editing a Fillet/Chamfer or Shell Object” on page 314).

A chamfer edge operation may fail due to:

- complex surface geometry adjacent to an edge or corner involved in the modification;
- an attempt to modify one edge in a sequence of tangential edges (select all the edges for a better chance of success); or
- an attempt to modify without selecting all the edges at a vertex.

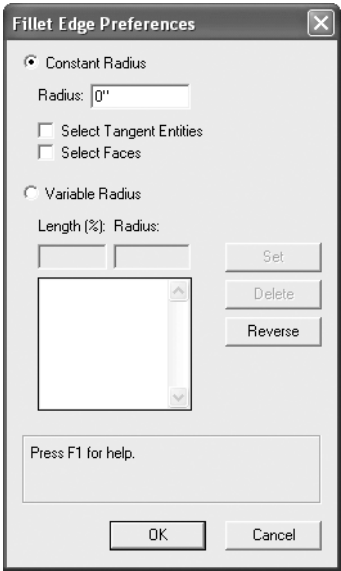
## Reshaping Edges by Fillet



To fillet the edges of a solid:

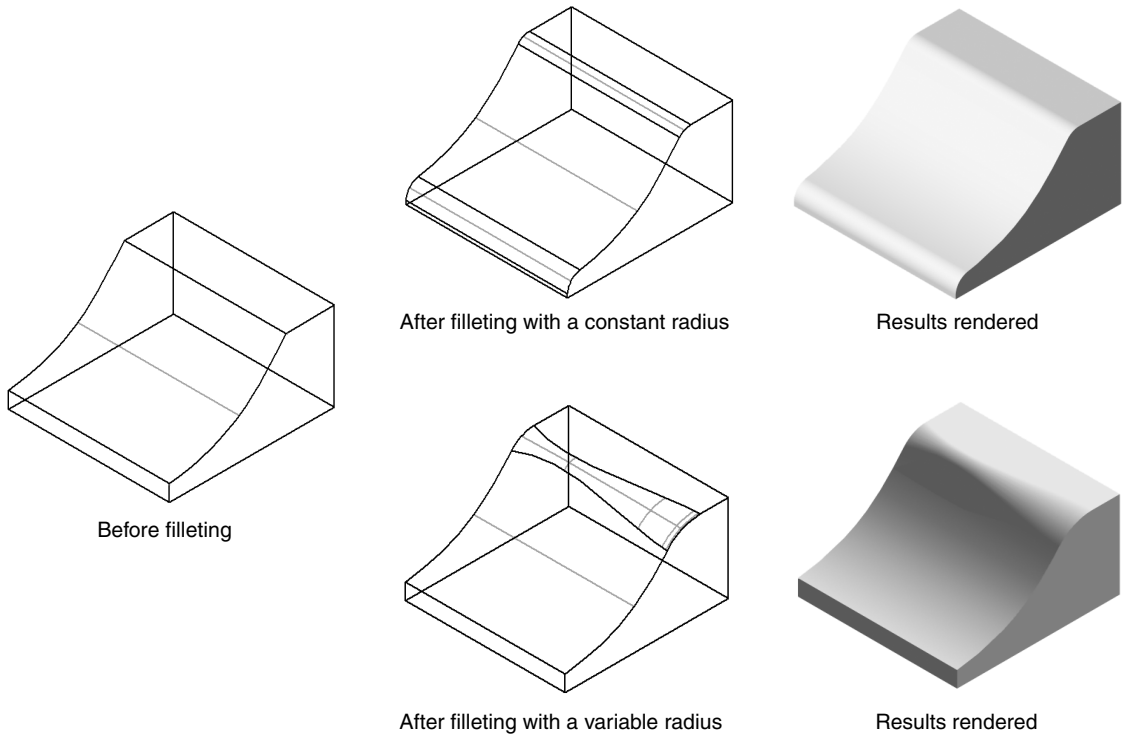
1. Click the **Fillet Edge** tool from the 3D Modeling tool set, and then select **Preferences** on the Tool bar to specify fillet edge preferences.

The Fillet Edge Preferences dialog box opens.



Parameter	Description
Constant Radius	Create a filleted surface based on a constant radius
Radius	Indicate the radius of the fillet edge
Select Tangent Entities	Choose this option to select tangentially-connected edges and faces for filleting
Select Faces	Choose this option to select faces for filleting
Variable Radius	Create a filleted surface based on a variable radius
Length (%)	Enter the length up to the point as a percentage of the total edge length
Radius	Enter the radius value at the corresponding percentage of length value
Set	Click to add or modify the length/radius value pair after the highlighted row
Delete	Click to delete the highlighted length/radius value
Reverse	Reverses the order of the values

- Click **OK** to close the Fillet Edge Preferences dialog box.
- For tangent entity selections, select the tangentially-connected edges and faces to be modified. For face selections, select the faces to be modified. Hold the Shift key down to select several faces and edges.  
[See “Selecting the Edges and Faces of a Solid” on page 311 for information on selecting edges and faces.](#)
- Press Enter (Windows) or Return (Macintosh) or click the check mark button on the Tool bar to perform the edge modification.



The **Radius** value for the filleted edge can be edited through the Object Info palette. For the fillet by variable radius, press the **Edit** arrow buttons to highlight each point along the edge for editing.

Once the modification is complete, the edge set used to create the modification cannot be changed. The modified edge can be ungrouped, and a new modification with different edges can be created.

Only one edge can be filleted at a time when using variable radius.

If one modification has been created over another, the first modification cannot be edited in the Object Info palette unless both are first ungrouped (see “Editing a Fillet/Chamfer or Shell Object” on page 314).

A fillet edge operation may fail due to:

- complex surface geometry adjacent to an edge or corner involved in the modification;
- a radius value that is too large;
- an attempt to modify one edge in a sequence of tangential edges (select all the edges for a better chance of success); or
- an attempt to modify without selecting all the edges in a vertex.

## Creating a Shell from Solids and NURBS Surfaces

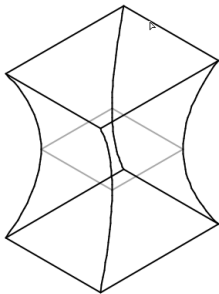
The **Shell Solid** tool creates a hollow shell from a solid object or NURBS surface. The shell can be created outside or inside the solid; for NURBS surfaces, it gives the object a thickness. Most injection-molded plastic parts have a shell.

## Shell from a Solid Object



To create a shell solid from a solid object:

1. Click **Shell Solid** from the 3D Modeling tool set.
2. Click on the face of the solid object where the shell will be created.



The Shell Solid Preferences dialog box opens. Specify the shell settings.



Parameter	Description
Shell	
Inside	Creates an interior shell
Outside	Creates an exterior shell
Thickness	Enter the thickness of the shell wall
Select Tangent Faces	Selects the tangentially-connected chain of faces

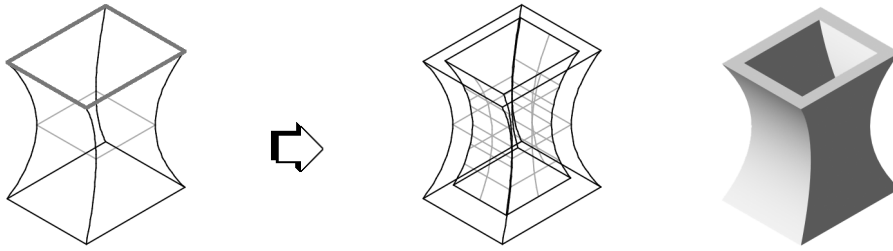
Click **Shell Solid Preferences** on the Tool bar to edit the settings.

3. Click **OK**.

The selected face of the object is highlighted in red.

If the wrong face is highlighted, select the correct face before pressing **Enter**.

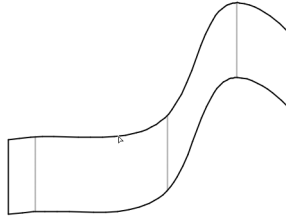
4. Press **Enter** (Windows) or **Return** (Macintosh), or click the check mark button on the Tool bar, to create the shell.



## Shell from a NURBS Surface

To create a shell solid from a NURBS surface:

1. Click **Shell Solid** from the 3D Modeling tool set.
2. Click on the NURBS surface to thicken.



The Shell Solid Preferences dialog box opens.

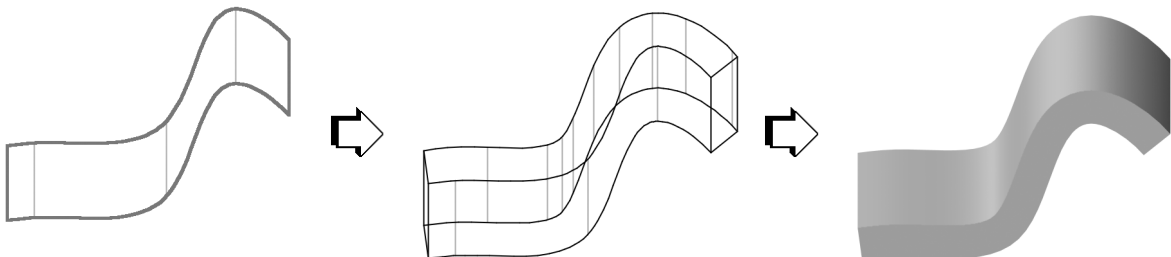
3. Specify the desired shell settings as described in “Shell from a Solid Object” on page 353.

[Click Shell Solid Preferences on the Tool bar to edit the settings.](#)

4. Click **OK**.

The selected face of the object is highlighted in red.

5. Press Enter (Windows) or Return (Macintosh), or click the check mark button on the Tool bar, to create the shell.



## Stitching and Trimming Surfaces

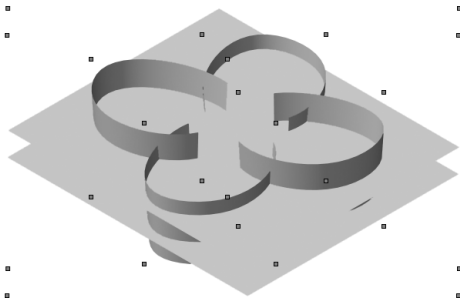
The **Stitch and Trim Surfaces** command creates a group of trimmed NURBS surfaces from several intersecting surfaces (including NURBS surfaces or solids such as extrudes or sweeps).

[This command may not be able to manipulate certain types of surface geometry. See “Surface Geometry Requirements” on page 314.](#)



To stitch and trim intersecting surfaces:

- 1. Select the intersecting surfaces.



The surfaces must enclose a volume.

- 2. Select **Model > 3D Power Pack > Stitch and Trim Surfaces**.

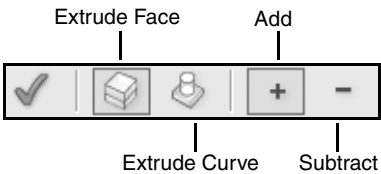
The surfaces enclosing the volume are stitched together and then trimmed, resulting in a group of trimmed NURBS surfaces.



### Creating Protrusions and Cutouts

The **Protrusion/Cutout** tool interactively creates bosses (protrusions) or cutouts on solids by adding or subtracting volume from a solid. The volume is created or subtracted by extruding a face in **Extrude Face** mode or extruding a planar NURBS curve (or group of closed, non-intersecting NURBS curves) in **Extrude Curve** mode.

Four modes are available. The first two modes set the type of operation and the second two determine whether an addition or subtraction of volume occurs.



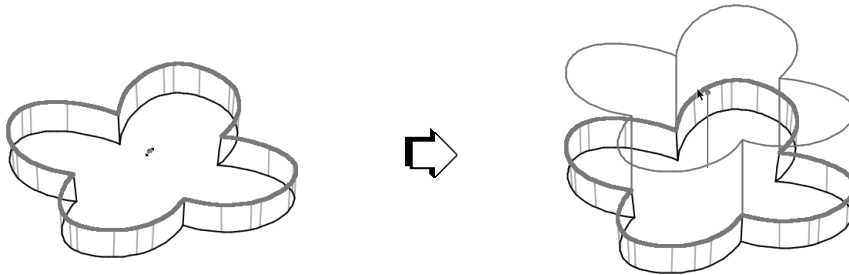
Mode	Description
Extrude Face	Selects the planar face of a solid to add to or subtract volume from the solid
Extrude Curve	Selects a curve or group of curves to add to or subtract volume from a solid
Add	Creates a protrusion by adding volume to the solid
Subtract	Creates a cutout by subtracting volume from the solid

## Face-based Addition or Subtraction

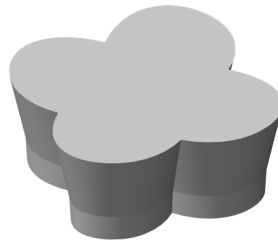


To add to or subtract from a solid in **Extrude Face** mode:

1. Click the **Protrusion/Cutout** tool from the 3D Modeling tool set, and then select **Extrude Face** from the Tool bar.
2. Select either **Add** or **Subtract** from the Tool bar to specify whether the solid will have volume added or subtracted.
3. Click on the desired planar face. The Select Face dialog box opens to help select the correct face, as described in “Selecting the Edges and Faces of a Solid” on page 311. When the correct face is selected, click **OK**.
4. A green grab handle is displayed in the middle of the face. Click on the handle and drag to expand (**Add** mode) or decrease (**Subtract** mode) the solid volume. The distance of the protrusion or cutout can also be specified by entering a value in the **Distance** field on the Tool bar. The new solid is previewed on the drawing in red.



5. Press the Enter (Windows) or Return (Macintosh) key or click the check mark button on the Tool bar to create the protrusion or cutout.
6. The result can be edited by selecting **Modify > Edit Group**. The protrusion or cutout is a tapered extrude object; an **Angle** can be specified in the Object Info palette (see “Creating a Tapered Extrude” on page 308).



## Curve-based Addition or Subtraction

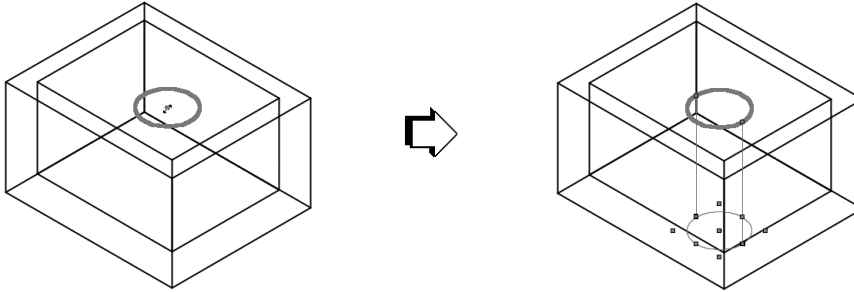


To add or subtract from a solid in **Extract Curve** mode:

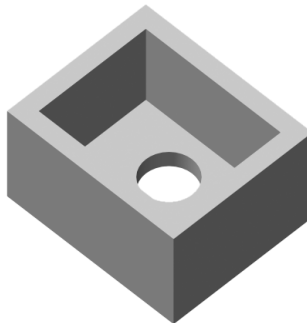
1. Click the **Protrusion/Cutout** tool from the 3D Modeling tool set, and then select **Extract Curve** from the Tool bar.
2. Select either **Add** or **Subtract** from the Tool bar to specify whether the solid will have volume added or subtracted.
3. Select the NURBS curve or group of NURBS curves that will be used to create the protrusion or cutout, and then select the solid.

4. A green grab handle is displayed in the middle of the solid face. Click on the handle and drag to expand (**Add** mode) or decrease (**Subtract** mode) the solid volume. The distance of the protrusion or cutout can also be specified by entering a value in the **Distance** field on the Tool bar. The new solid is previewed on the drawing in red.

In **Subtract** mode, the distance value can exceed the solid perimeter; the cutout operation is only performed on the selected solid.



5. Press the Enter (Windows) or Return (Macintosh) key or click the check mark button on the Tool bar to create the protrusion or cutout.



6. The result can be edited by selecting **Modify > Edit Group**. The protrusion or cutout is a tapered extrude object; an **Angle** can be specified in the Object Info palette during editing (see "Creating a Tapered Extrude" on page 308).

## Converting to Generic Solids

Solid objects created using such commands as **Add Solid**, **Subtract Solid**, and tools such as **Fillet/Chamfer Edge** and **Shell Solid**, contain a history composed of the original elements used to make the new object. This also includes any editing performed with other solids operations. The **Convert to Generic Solids** command removes this history from the solid objects, reducing the file size (though the object is no longer editable).

For example, use this command on a copy of the final drawing to reduce file size when sending a file to a print bureau.

To convert an object into a generic solid:

1. Select the solid object(s) to convert.
2. Select **Modify > Convert > Convert to Generic Solids**.
3. A warning dialog box opens. Click **OK** to convert the object(s).

The object is converted.

If objects are selected that cannot be converted, a dialog box opens stating that these objects have been deselected.

# Editing 3D Objects

While 3D objects can often be edited using many of the same tools available for editing 2D objects, VectorWorks also contains tools specifically tailored to 3D object editing.

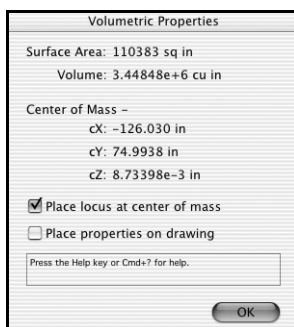
## Obtaining Volumetric Properties

The volumetric properties of a 3D object can be obtained with the **Volumetric Properties** command.

To obtain the volumetric properties of a 3D object:

1. Select the 3D object.
2. Select **Model > Volumetric Properties**.

The Volumetric Properties dialog box opens, displaying the surface area, volume, and center of mass of the object.



Parameter	Description
Place locus at center of mass	Places a 3D locus at the center of mass of the object
Place properties on drawing	Places the volumetric properties as text on the drawing at a specified location

3. Click **OK**. If **Place locus at center of mass** was selected, the 3D locus is placed automatically on the object. If **Place properties on drawing** was selected, click in the drawing file to specify the location of the text.

## Reshaping 3D Objects

The **3D Reshape** tool changes the height and radius of an extruded object, tapered extrude, or a 3D object that is not a mesh object. In addition, use it to reshape walls (see “Editing Walls” on page 487), 3D polygons, and solid primitives (such as cylinders, hemispheres, cones, and spheres), change the angle (rise/run) of roofs created with the **Roof Face** command, and reshape roof objects created with the **Create Roof** command (see “Reshaping Roof Objects” on page 506).

### Reshaping Extruded Objects and Solid Primitives

The **3D Reshape** tool changes the height, and when applicable, the radius of extrudes, cylinders, spheres, hemispheres, and cones, and the height and angle of tapered extrudes.



To reshape an extrude, cylinder, sphere, hemisphere, cone, or tapered extrude:

1. Select the object to reshape.
2. Click the **3D Reshape** tool from the 3D Modeling tool set.

A resize handle is added to both top and bottom of an extruded object. Multiple resize handles are added around cylinder, sphere, hemisphere, and cone objects. For a tapered extrude object, one resize handle is added to its top for changing its height, and one to the side for changing its taper angle.

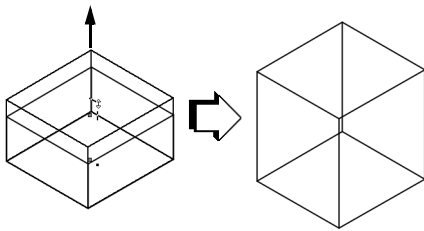
*Tapered extrudes with a taper angle of zero have an additional resize angle at the bottom.*

3. Click and drag the resize handle to change the object's height, radius, or taper angle.

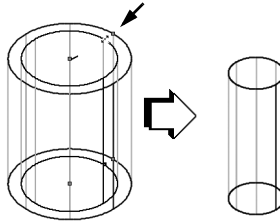
When the cursor is over a radius resize handle, the standard arrow cursor changes into a double-headed arrow. It changes to an unfilled double-headed arrow over a height resize handle.

4. Click again when the object is at the desired height, radius, or angle.

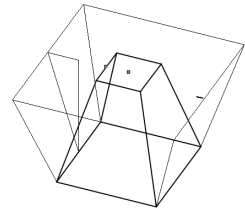
Alternatively, press the Tab key and enter a numeric value for the height, radius, or angle in the Data bar.



With the 3D Reshape cursor, drag the resize handle up (or down) to the desired extrude height



Change the radius of a cylinder, sphere, hemisphere, or cone by dragging the resize handle to the desired radius



Change the angle of a tapered extrude by dragging the side resize handle to the desired angle

## Reshaping NURBS Surfaces

The **3D Reshape** tool, located on the 3D Modeling tool set, can be used to manipulate NURBS surface control points and to reshape NURBS surfaces. For example, a dome or bell-curve effect can be created by manipulating the vertices.

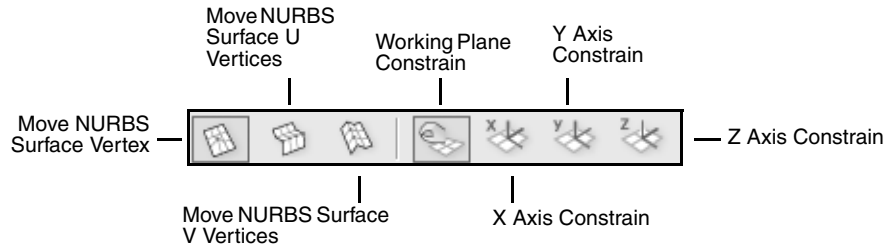
*This tool can potentially create surfaces which cannot be further manipulated in the 3D Power Pack. See "Surface Geometry Requirements" on page 314.*



To reshape a NURBS surface:

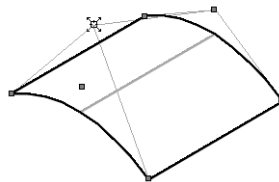
1. Select the NURBS surface to reshape.
2. Click the **3D Reshape** tool from the 3D Modeling tool set.

Select the mode from the Tool bar.



Mode	Description
Move NURBS Surface Vertex	Changes the position of the selected vertex or vertices only
Move NURBS Surface U Vertices	Changes the position of all vertices in a row in the U direction
Move NURBS Surface V Vertices	Changes the position of all vertices in a row in the V direction
Working plane constrain	Moves the selected vertex or vertices on a working plane
X axis constrain	Moves the selected vertex or vertices along the X axis
Y axis constrain	Moves the selected vertex or vertices along the Y axis
Z axis constrain	Moves the selected vertex or vertices along the Z axis

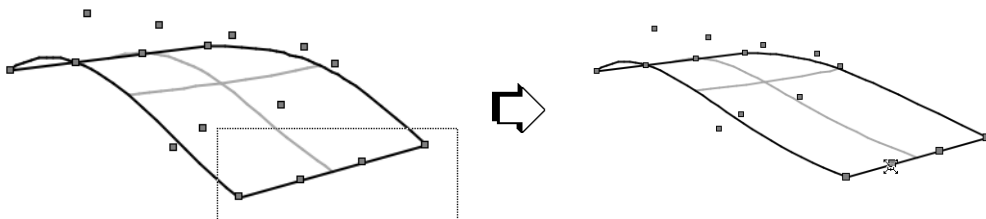
To select one vertex or row of vertices, position the cursor over one of the NURBS surface vertices. When the cursor is over a vertex, the standard arrow cursor changes to an unfilled, four-way arrow.



To select several vertices at one time, click with the Shift key pressed or click and drag to create a marquee around the desired vertices.

If several vertices are selected, position the cursor over one of them.

- Click-drag the mouse to move the vertex or vertices.
- Release the mouse at the desired location.



## Aligning and Distributing 3D Objects

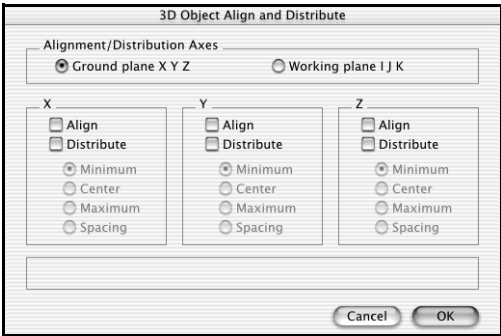
3D objects can be aligned and/or distributed in relation to each other. 3D object alignment/distribution is based on either the ground or working plane.

The **Align/Distribute 3D** command aligns and distributes multiple 3D objects. Alignment and distribution is based upon the X, Y, and Z axes of the ground plane or the I, J, and K axes of the working plane.

To align/distribute 3D objects:

1. Select the objects to be aligned/distributed.
2. Select **Modify > Align > Align/Distribute 3D**.

The 3D Object Align and Distribute dialog box opens.



3. Select the alignment/distribution criteria.

Parameter	Description
Alignment/ Distribution Axes	Select whether to align/distribute about the ground plane or the working plane
Align/Distribute	Select <b>Align</b> and specify the coordinate value to use when aligning objects, or select <b>Distribute</b> to distribute objects
Minimum	Align/distribute objects along the specified axis by the minimum coordinate value of each object
Center	Align/distribute objects along the specified axis by the center coordinate value of each object
Maximum	Align/distribute objects along the specified axis by the maximum coordinate value of each object
Spacing	Distribute spacing between objects along the specified axis, ensuring that the space between the objects is equal along the axis

4. Click **OK**.

VectorWorks aligns/distributes the selected 3D objects.

3D loci and locked objects are special objects and behave differently when present during an alignment/distribution operation.



If a 3D locus point is one of the selected objects, all objects are aligned relative to that locus. If there are multiple loci in the selection, then the loci are aligned/distributed like any other object.

Locked objects in a selection do not move. Other objects are aligned/distributed relative to the locked objects.

Selected 2D objects are ignored by the **Align/Distribute 3D** command.

## Editing 3D Object Surfaces

The 3D editing commands are similar to the 2D **Add** or **Clip Surface** commands, but in a 3D environment. In 3D, the editing commands are: Intersect Solids, Add Solids, Subtract Solids, and Section Solids.

**Intersect Solids** creates a single model from the volume created where two or more 3D objects intersect. **Add Solids** joins two or more 3D objects into a single model. **Subtract Solids** cuts (subtracts) a 3D object(s) from another 3D object, creating a new model. **Section Solids** discards a portion of solids or NURBS surfaces, allowing the creation of planar or stepped sections through a solid or surface.

These commands work with the following solid objects: extrudes, multiple extrudes, straight walls, sweeps, meshes, solid primitives (cylinders, hemispheres, spheres, and cones), and objects created using the **3D Polygon**, **Extruded Polygon**, and **Extruded Rectangle** tool, provided the following applicable conditions are met.

Object	Criteria
Sweeps	Cannot contain lines, or be swept around a locus which is between the left and right bounds of the swept 2D primitive; if not swept around a locus, should have a vertical segment on the left edge
Helical Sweep	Must be swept around a locus outside the left and right bounds of the object
Multiple Extrude	Must have planar polygons
Meshes	Cannot have interpenetrating polygons; every edge of every polygon in the mesh must be shared with one other polygon
Walls	Must not have symbols that extend above the top or below the bottom of the wall

2D objects must have a fill applied prior to being converted to 3D to be considered a solid object. If the converted 3D object did not have a fill applied prior to conversion, it can be added using the **Enter Group** command to return to the original 2D object.

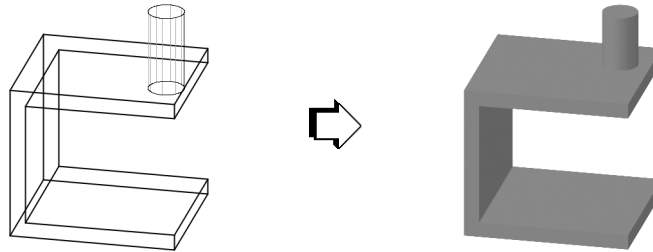
## Adding Solids

The **Add Solids** command joins two or more 3D objects into a single model.

To add solids in 3D:

1. Select two or more 3D objects to combine.
2. Select **Model > Add Solids**.

VectorWorks creates a single solid model from the object.



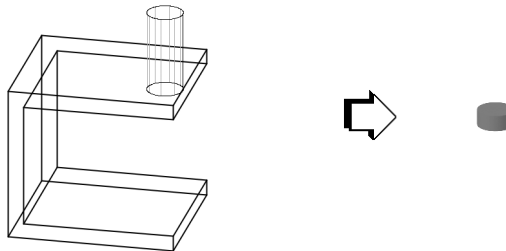
## Intersecting Solids

The **Intersect Solids** command creates a single model from the volume created where two or more 3D objects intersect.

To intersect solids:

1. Select the two or more 3D objects to combine.
2. Select **Model > Intersect Solids**.

VectorWorks creates a single solid model from the objects; it is the size and shape of the overlapping volume of the selected objects.



## Subtracting Solids

The **Subtract Solids** command cuts (subtracts) one or more 3D objects from another 3D object, creating a new model.

*The subtracting object should extend beyond the surface of the original object.*

To subtract solids:

1. Select both the object(s) to subtract and the object to subtract from (the base object).
2. Select **Model > Subtract Solids**.

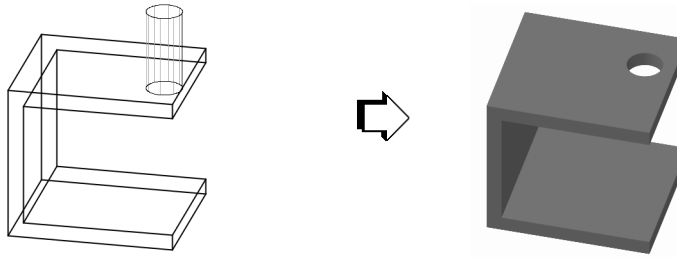
A dialog box opens.

3. Select the desired object to subtract.

Use the forward and back arrows to select the base object, which is shown with a thick outline.

4. Click **OK**.

VectorWorks creates a single solid model with the selected object subtracted.

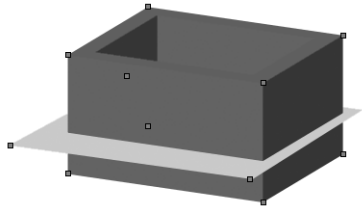


## Sectioning Solids

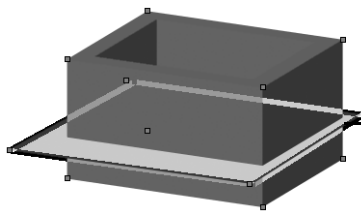
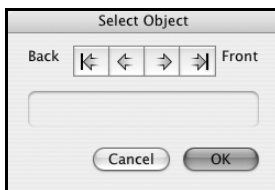
The **Section Solids** command discards a portion of solids or NURBS surfaces, allowing the creation of planar or stepped sections through a solid or surface. The sectioned surface can be “marked” by the sectioning surface color.

To section a solid:

1. Select the solid or surface to be sectioned, along with the sectioning surface. The sectioned surface selection depends on the normal of the NURBS surfaces; select **Show Normal** in the Object Info palette to display the surface normals (see “Displaying Surface Normals” on page 313).



2. Select **Model > Section Solids**. In the Select Object dialog box, specify which object is to be used as the sectioning surface. By default, the most recently created object is highlighted, but a different object can be selected by clicking the arrows.

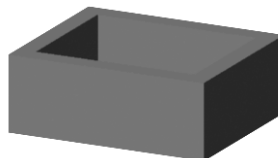


The sectioning surface is highlighted (select it with the arrows in the dialog box)

The sectioning surface must be larger than the solid being sectioned.

3. When the desired sectioning surface is selected, click **OK**.

The solid is sectioned by the sectioning surface. The remaining object becomes a solid section.



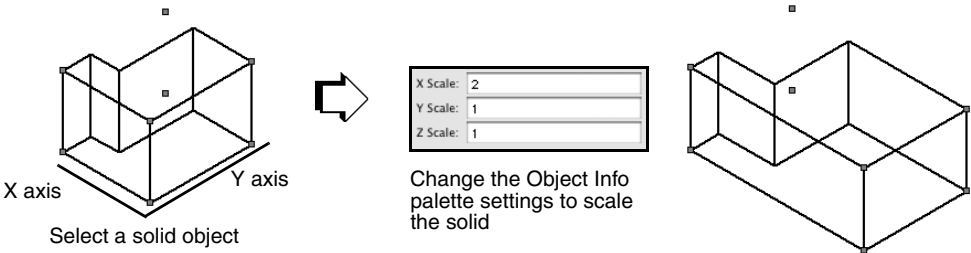
The solid section parameters can be edited in the Object Info palette.

Parameter	Description
Width/Depth/Height (display only)	Displays the parameters of the solid section surface
Reverse Section Side	Switches the remaining side of the solid being sectioned
Use Section Color	Applies the color of the sectioning surface to the sectioned surface

## Scaling Solids Asymmetrically

Solids can be scaled asymmetrically, through both the **Scale Objects** command (see “Scaling Objects” on page 271) and the Object Info palette. The internal components of the solid do not change, and the solid can still be edited after the scaling operation.

In the Object Info palette, enter a scale factor in the **X Scale**, **Y Scale**, or **Z Scale** field to scale the selected solid along the specified axis.



A selected solid can also be scaled asymmetrically by selecting the **Modify > Scale Objects** command and entering an Asymmetric scale factor. However, the current view must be aligned with the solid’s matrix for scaling to occur.

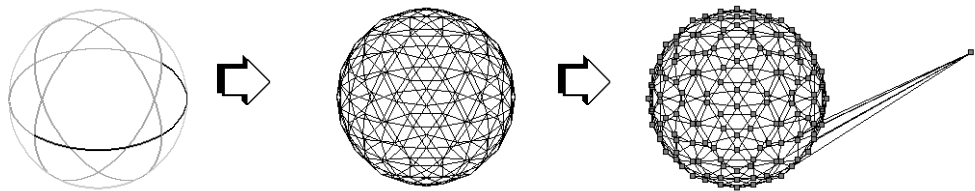
## Convert to Mesh

The **Convert to Mesh** command converts any extrude, multiple extrude, sweep, or wireframe object into a mesh object. Use the 2D and 3D selection tools or the Object Info palette to edit the mesh object vertice(s). The command can also collect a number of separate 3D polygons into a single mesh object.

To convert to mesh:

1. Select the 3D object to convert.
2. Select **Modify > Convert > Convert to Mesh**.

The object changes to a mesh object. Once the 3D object has been converted into a mesh, each vertex has its own handle and can then be moved individually.



# Common Functions and Utilities

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VectorWorks provides several tools to perform editing functions that are common to both 2D and 3D objects. Also provided are utilities for converting objects, compressing images, and tracing bitmap images.

## Undoing and Redoing Actions

Specify preferences to control how many actions can be undone and redone in VectorWorks.

### Undoing Actions

One or more of the most recent actions can be undone. Specify the number of actions that can be undone on the Session tab of VectorWorks preferences. See “Session Preferences” on page 42 for information on this tab. The maximum number of actions that can be undone is 100. Select **Issue undo warnings** to open a warning dialog box when attempting to undo an action that cannot be undone.

To undo recent changes:

Select **Edit > Undo**.

The most recent change is undone. Continue to select the **Undo** command to undo changes in the reverse order in which they were performed.

*The higher the maximum number of undos, the more memory may be required.*

### Redoing Actions

Actions that have been undone can then be redone. The number of actions that can be redone is determined by how many undos were performed.

To redo actions that were undone:

Select **Edit > Redo**.

The most recent undo is reversed and the action is executed again. Continuing to select the **Redo** command will redo changes in the reverse order that they were undone.

## Moving Objects

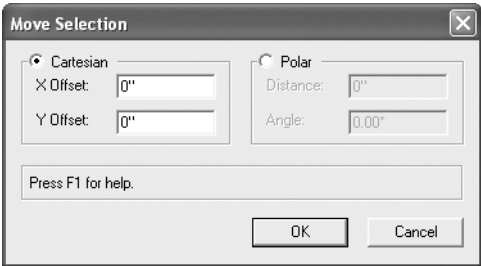
Objects can be moved in several ways. The exact distance can be specified for a 2D or 3D object to move with **Move** command. The **Move by Points** tool moves both 2D and 3D objects by clicking. Selected objects can be nudged one pixel at a time, or nudged by the snap grid (see “Setting VectorWorks Preferences” on page 39). In addition to these methods, objects can be selected with selection tools, and then moved by clicking and dragging.

### Moving 2D Objects

To move a 2D object with the **Move** command:

1. Select the object(s) to move.
2. Select **Modify > Move > Move**.

The Move Selection dialog box opens. Move the objects according to Cartesian or Polar coordinates.



Parameter	Description
Cartesian	Specify the distance to move the object; for Cartesian coordinates, select <b>Cartesian</b> and enter the <b>X</b> and <b>Y Offset</b> distances
Polar	Specify the distance to move the object; for Polar coordinates, select <b>Polar</b> and enter the <b>Distance</b> and <b>Angle</b>

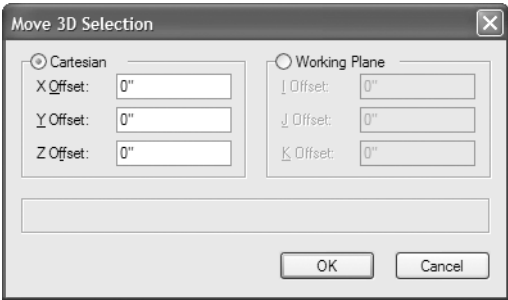
3. Click **OK**.  
The object is moved according to the criteria specified.

## Moving 3D Objects

To move a 3D object with the **Move** command:

1. Select the object(s) to move.
2. Select **Modify > Move > Move 3D**.

The Move 3D Selection dialog box opens.



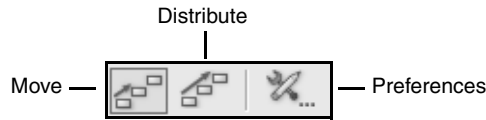
Parameter	Description
XYZ	Select the X, Y, Z (Cartesian) coordinate system
X, Y, Z Offset	For Cartesian coordinates, specify the distance to move the object
IJK	Select the I, J, K (working plane) coordinate system
I, J, K Offset	For working plane coordinates, specify the distance to move the object

3. Click **OK**. The object is moved according to the criteria specified.

## Moving Objects by Clicking

Both 2D and 3D objects can be moved, duplicated, and distributed along a specified distance by clicking with the **Move by Points** tool. This tool also moves symbols within walls.

The **Move by Points** tool has two modes.



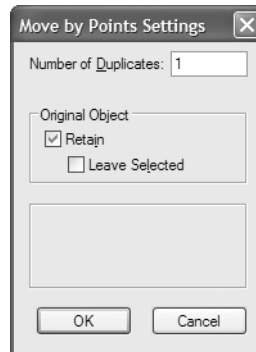
Mode	Description
Move	Moves and duplicates selected objects according to the distance and direction specified by two mouse clicks
Distribute	Moves and distributes duplicates between the points specified by two mouse clicks



To move selected objects:

1. Select the object(s) to move and/or duplicate.
2. Click the **Move by Points** tool from the Basic palette and click **Preferences** from the Tool bar.

The Move by Points Settings dialog box opens. Select the settings and click **OK**.

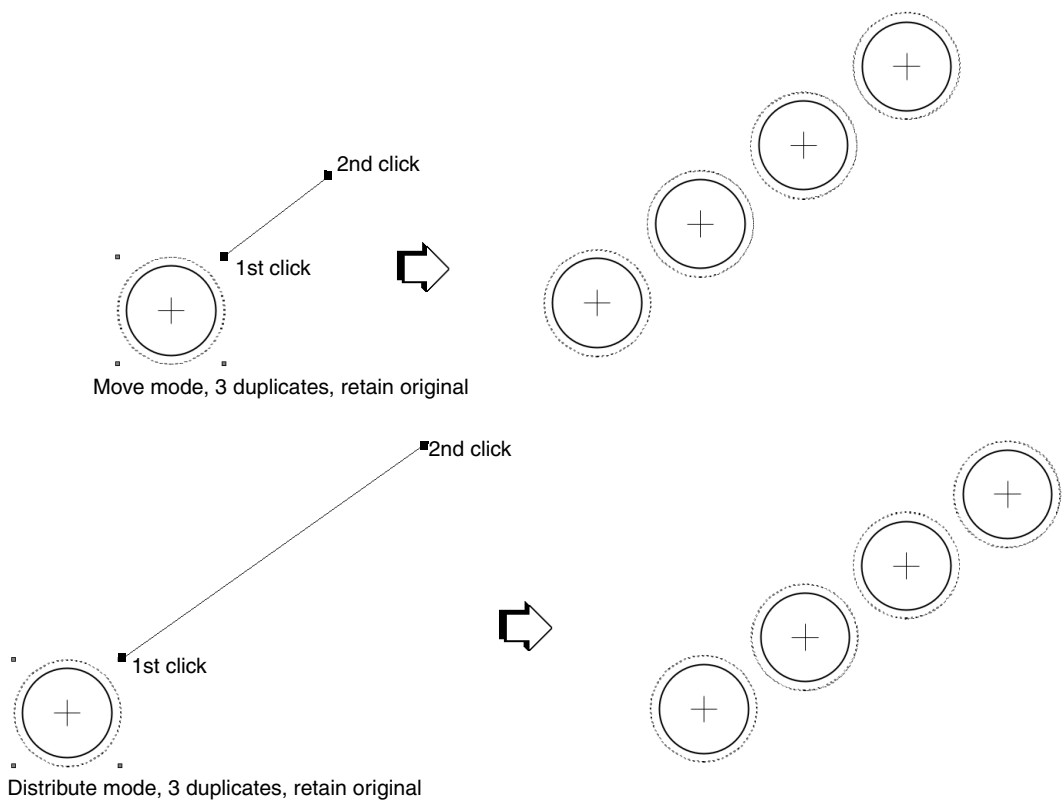


Parameter	Description
Number of Duplicates	Specifies the number of copies of the original object(s) to create (must be at least 1)
Original Object	
Retain	Keeps the original object(s); the Alt (Windows) or Option (Macintosh) key also retains the original while using the tool
Leave Selected	Keeps the original object(s) selected for further action

3. Select either the Move or Distribute mode, depending on the desired outcome.

Mode	Number of Duplicates	Original Object Retained	Result
Move or Distribute	1	No	Moves original object(s) to the location specified by clicking
Move or Distribute	1	Yes	Creates one duplicate of the original object(s), placed at the location indicated by clicking
Move	> 1	Yes or No	Creates duplicates of the original object(s), placing the first duplicate at the location specified by the second click, and placing additional duplicates the same distance apart from each other along the vector created by the two click points
Distribute	> 1	Yes or No	Creates duplicates of the original object(s), distributing the duplicates between the two click points, and along the vector created by the two points

4. Click once (anywhere on the drawing) to indicate the vector start point, and click again to indicate the vector end point. Duplicates are placed in the vector direction, at the distance specified by the click points, along the line defined by the click points.



Symbols in a wall are duplicated or moved within the wall, by a projected distance along the length of the wall. The maximum number of allowable duplicates is placed when a click point outside the wall has been specified.



## Cutting, Copying, and Pasting Objects

### Cutting Objects

The **Cut** command removes an object from the drawing, temporarily storing the object in the clipboard.

To cut an object:

1. Select the 2D/3D object(s) to remove.
2. Select **Edit > Cut**.

*Alternatively, select **Cut** from the object context menu.*

The object is moved from the drawing to the clipboard.

### Copying Objects

The **Copy** command copies an object to the clipboard, where it is temporarily stored. The original object remains on the drawing.

To copy an object:

1. Select the 2D/3D object(s) to copy.
2. Select **Edit > Copy**.

*Alternatively, select **Copy** from the object context menu.*

VectorWorks places a copy of the object in the clipboard.

### Pasting Objects

The **Paste** command places the clipboard object into the same drawing file, into another VectorWorks file, or into another software program's file (if that program also has copy, cut, and paste commands). As long as VectorWorks remains open while the object is in the clipboard, the object retains all its object information for pasting into VectorWorks documents.

*Some image quality can be lost when pasting into other programs.*

To paste an object:

1. Open the file and layer where the object is to be added.
2. Select **Edit > Paste**.

*Alternatively, select **Paste** from the object context menu.*

VectorWorks pastes the object centered on the location of the last mouse click, unless the last mouse click is outside the current view. In that case, the object is pasted at the center of the drawing. When pasting a clipboard object into a different VectorWorks file, VectorWorks automatically centers the object in the drawing area.

*When a raster image is pasted into a VectorWorks file, it is automatically compressed to PNG format to reduce the VectorWorks file size.*

## Paste as Picture

Like the **Paste** command, the **Paste as Picture** command places a copy of the clipboard contents in the active VectorWorks drawing file. However, VectorWorks places the entire clipboard contents as a single object/picture. Because the contents are now one item, individual objects (including symbols and text) can no longer be edited.

There are two advantages to using the **Paste as Picture** command. First, as a single item, the clipboard objects are more quickly placed into the drawing file. In addition, the pasted objects retain any PostScript comments, as well as all other embedded information.

To paste as a picture:

- 1. Open the file and layer where the object is to be added.
- 2. Select **Edit > Paste as Picture**.

## Paste in Place

The **Paste in Place** command works exactly like the **Paste** command, except that the clipboard contents are pasted into the active drawing at the same coordinates they appeared in the original.

To paste in place:

- 1. Open the file and layer where the object is to be added.
- 2. Select **Edit > Paste in Place**.

## Changing Object Stacking Order

As each object is drawn in VectorWorks, it is automatically stacked in the order of creation. The first object created is at the bottom of the stack and the most recent object created is at the top of the stack. The send commands change the stacking order of objects within a layer. Objects can be sent forward or backward one position in the stack, or all the way to the front or back of the stack in one step.

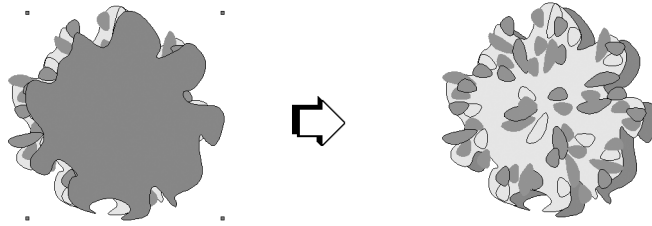
To change the stacking order of objects:

- 1. Select the 2D or 3D object to restack.
- 2. Select **Modify > Send**. From the sub-menu, select the send method to use.

Alternatively, select **Send** from the object context menu.

Method	Description
Send Forward	Sends the object one level up in the stacking order
Send Backward	Sends the object one level down in the stacking order
Send to Front	Sends the object to the top of stacking order
Send to Back	Sends the object to the bottom of the stacking order

The object’s stacking order is changed.



## Removing Objects

### Clearing Objects

The **Clear** command deletes any selected object or objects. It has the same effect as pressing the Delete key, meaning that the object(s) are not stored on the clipboard. The only way to retrieve a “cleared” object is to select **Undo**. This command provides an additional way of removing an object from the drawing without deleting the current contents of the clipboard.

To clear an object from the drawing:

1. Select the object or objects to remove from the drawing.
2. Select **Edit > Clear**.

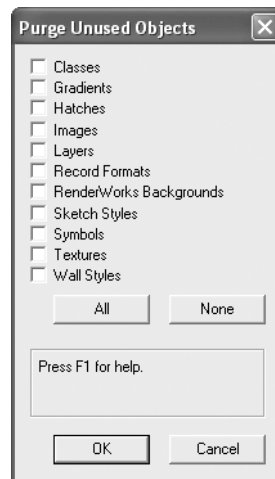
### Purging Unused Objects

The **Purge Unused Objects** command permanently removes specified unused object types from the drawing and reduces the file size.

To purge unused objects:

1. Select **Tools > Purge Unused Objects**.

The Purge Unused Objects dialog box opens.



2. Select the unused items to remove from the drawing file.

Element	Description
Classes	Permanently deletes any classes that are not used
Gradients	Permanently deletes any gradients that are not used
Hatches	Permanently deletes any hatches that are not used
Images	Permanently deletes any images that are not used
Layers	Permanently deletes any layers that do not contain any objects
Record Formats	Permanently deletes any record formats that are not used
RenderWorks Backgrounds (RenderWorks required)	Permanently deletes any backgrounds that are not used
Sketch Styles (Design Series required)	Permanently deletes any sketch styles that are not used
Symbols	Permanently deletes any symbols that are not used
Textures (RenderWorks required)	Permanently deletes any textures that are not used
Wall Styles (VectorWorks Architect required)	Permanently deletes any wall styles that are not used
All	Selects all object types listed in the Purge Unused Objects dialog box
None	Clears all previously selected object types in the Purge Unused Objects dialog box

- 3. Click **OK**.  
A confirmation dialog box opens.
- 4. Click **OK** to confirm the purge.  
The purge command cannot be undone.

## Duplicating Objects

### Duplicating Single

The **Duplicate** command makes a copy of an object or group of objects and places it on the drawing. Depending on the setting in VectorWorks preferences, the duplicated object or objects will either be offset or placed directly on top of the original.

To duplicate any object:

- 1. Select the 2D/3D object(s) to copy.
- 2. Select **Edit > Duplicate**.

VectorWorks places a copy of the selected object(s) in the drawing according to the settings in the VectorWorks preferences dialog box.

When objects with an offset are duplicated, the offset is maintained with the duplicate.

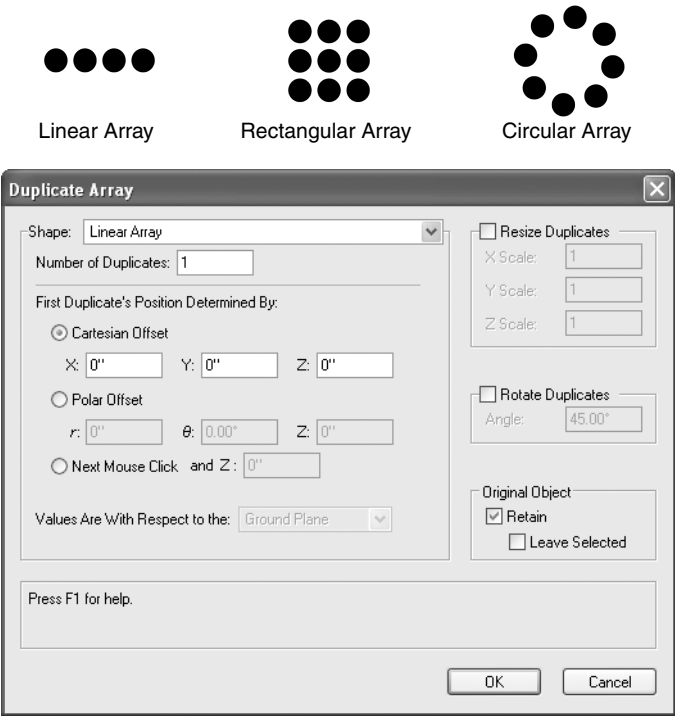
## Duplicate Array

The **Duplicate Array** command controls how many copies of selected objects are made and how these copies are arrayed, or placed, in the drawing. The drawing must be in Top/Plan view if 2D objects are being duplicated.

To create a duplicate array:

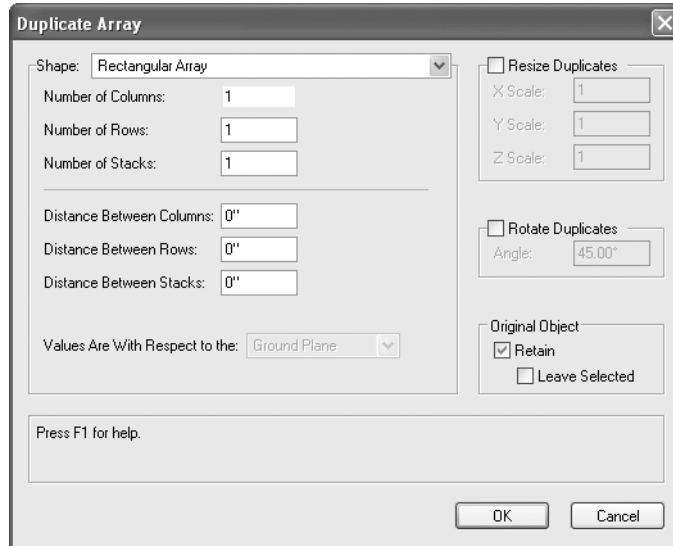
- 1. Select the 2D/3D object or objects to copy.
- 2. Select **Edit > Duplicate Array**.

The Duplicate Array dialog box opens. Select the desired duplication array **Shape**. The dialog box dynamically displays the appropriate fields based on the selected linear, rectangular, or circular array shape.



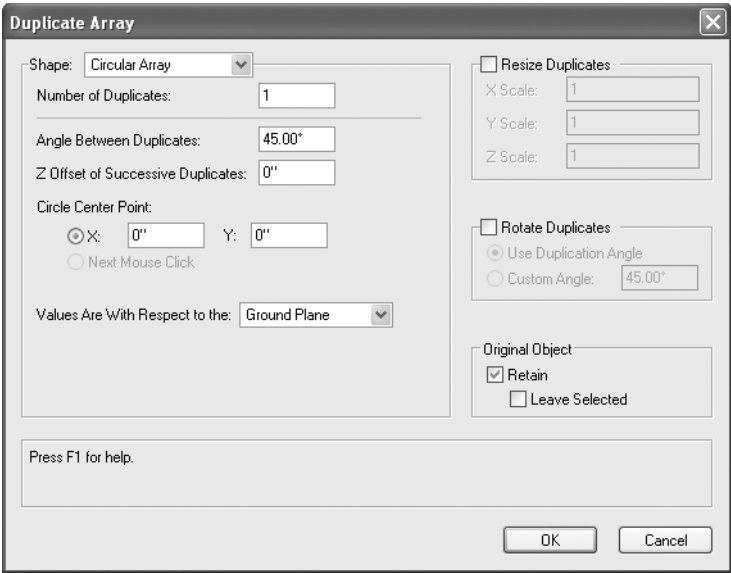
Linear Array Parameter	Description
Number of Duplicates	Specify the number of copies of the original object to create
First Duplicate's Position Determined By	Specify the start point for the first copied object, by either specifying coordinates or placing the object with the mouse

Linear Array Parameter	Description
Cartesian Offset	To use Cartesian coordinates, click this option and specify the distance of the center of the copy from the center of the original object by entering <b>X</b> , <b>Y</b> , and <b>Z</b> coordinates. If the view is something other than Top/Plan, and <b>Values Are With Respect to the</b> is set to Working Plane, the labels on the coordinate fields are <b>I</b> , <b>J</b> , and <b>K</b> instead of <b>X</b> , <b>Y</b> , and <b>Z</b> . <b>Z</b> (or <b>K</b> ) must be zero when only 2D objects are being duplicated.
Polar Offset	This option is always enabled if 2D objects are selected; if 3D or hybrid objects are selected, or if both 2D and 3D objects are selected, this option is enabled only in Top/Plan view. To use polar coordinates, click this option and specify the distance of the center of the copy from the center of the original object by entering <b>r</b> (radius), theta (angle), and <b>Z</b> coordinates; <b>Z</b> must be zero when only 2D objects are being duplicated.
Next Mouse Click and Z (or K)	This option is always enabled if 2D objects are selected; if 3D or hybrid objects are selected, or if both 2D and 3D objects are selected, this option is enabled only in Top/Plan view. To place the copy with the mouse, select <b>Next Mouse Click</b> . To offset the first copy from the original object's plane, enter a <b>Z</b> (or <b>K</b> ) value; <b>Z</b> (or <b>K</b> ) must be zero when only 2D objects are being duplicated.
Values Are With Respect to the	This option is enabled for 3D objects if the view is something other than Top/Plan; specify whether the array should be built relative to the Ground Plane or Working Plane
Resize Duplicates	Select <b>Resize Duplicates</b> to resize each successive copy with the specified <b>X Scale</b> , <b>Y Scale</b> , and <b>Z Scale</b> values; to leave the copies at the same scale as the original object, ensure that <b>Resize Duplicates</b> is deselected
Rotate Duplicates	Select <b>Rotate Duplicates</b> to rotate each successive copy at the specified <b>Angle</b> ; to leave the copies at the same rotation as the original object, ensure that <b>Rotate Duplicates</b> is deselected
Original Object	To include the original object in the array, select <b>Retain</b> ; otherwise, the original object is deleted. To leave the original object selected after duplication, also click <b>Leave Selected</b> .



Rectangular Array Parameter	Description
Number of Columns	Specify the number of copies of the original object to create in the array's X direction (Ground Plane duplication) or I direction (Working Plane duplication)
Number of Rows	Specify the number of copies of the original object to create in the array's Y direction (Ground Plane duplication) or J direction (Working Plane duplication)
Number of Stacks	For 3D objects, specify the number of copies of the original object to create in the array's Z direction (Ground Plane duplication) or K direction (Working Plane duplication)
Distance Between Columns	Specify the distance between each column in the array (measured from the copied objects' centers)
Distance Between Rows	Specify the distance between each row in the array (measured from the copied objects' centers)
Distance Between Stacks	For 3D objects, specify the distance between each stack in the array (measured from the copied objects' centers); this value must be zero when only 2D objects are being duplicated
Values Are With Respect to the	This option is enabled for 3D objects if the view is something other than Top/Plan; specify whether the array should be built relative to the Ground Plane or Working Plane
Resize Duplicates	Select <b>Resize Duplicates</b> to resize each successive copy with the specified <b>X Scale</b> , <b>Y Scale</b> , and <b>Z Scale</b> values; to leave the copies at the same scale as the original object ensure that <b>Resize Duplicates</b> is deselected
Rotate Duplicates	Select <b>Rotate Duplicates</b> to rotate each successive copy at the specified <b>Angle</b> ; to leave the copies at the same rotation as the original object, ensure that <b>Rotate Duplicates</b> is deselected

Rectangular Array Parameter	Description
Original Object	To include the original object in the array, select <b>Retain</b> ; otherwise, the original object is deleted. To leave the original object selected after duplication, also click <b>Leave Selected</b> .



Circular Array Parameter	Description
Number of Duplicates	Specify the number of copies of the original object to create
Angle Between Duplicates	Specify the angle of separation between the centers of each object in the array
Z (or K) Offset of Successive Duplicates	To offset copies from the original object's plane, specify the distance between each successive copy. If the view is something other than Top/Plan, and <b>Values Are With Respect to the</b> is set to Working Plane, the label is <b>K</b> instead of <b>Z</b> . <b>Z</b> and <b>K</b> must be zero when only 2D objects are being duplicated.
Circle Center Point	Specify the center point for the circular array, by either specifying coordinates or placing the array with the mouse
X and Y (or I and J)	To place the array using coordinates, enter the <b>X</b> and <b>Y</b> coordinates of its center point. If the view is something other than Top/Plan, and <b>Values Are With Respect to the</b> is set to Working Plane, the labels on the coordinate fields are <b>I</b> and <b>J</b> instead of <b>X</b> and <b>Y</b> .
Next Mouse Click	This option is always enabled if 2D objects are selected; if 3D or hybrid objects are selected, or if both 2D and 3D objects are selected, this option is enabled only in Top/Plan view. Select <b>Next Mouse Click</b> to place the array so that its center is at the next clicked point.
Values Are With Respect to the	This option is enabled for 3D objects if the view is something other than Top/Plan; specify whether the array should be built relative to the Ground Plane or Working Plane

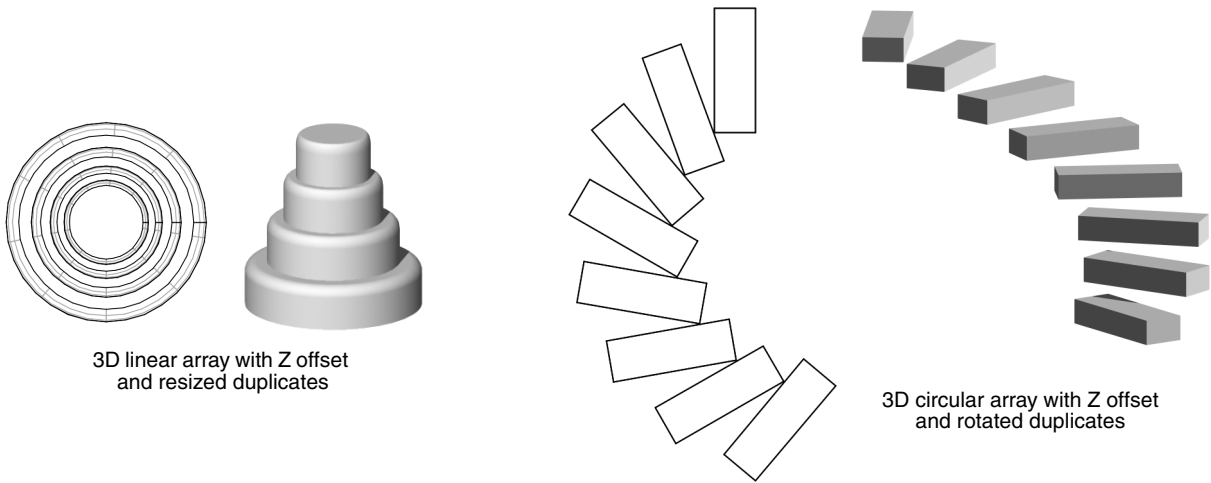


Circular Array Parameter	Description
Resize Duplicates	Select <b>Resize Duplicates</b> to resize each successive copy with the specified <b>X Scale</b> , <b>Y Scale</b> , and <b>Z Scale</b> values; to leave the copies at the same scale as the original object, ensure that <b>Resize Duplicates</b> is deselected
Rotate Duplicates	Select <b>Rotate Duplicates</b> to rotate each successive copy at either the <b>Angle Between Duplicates</b> or the specified <b>Custom Angle</b> ; to leave the copies at the same rotation as the original object, ensure that <b>Rotate Duplicates</b> is deselected
Original Object	To include the original object in the array, select <b>Retain</b> ; otherwise, the original object is deleted. To leave the original object selected after duplication, also click <b>Leave Selected</b> .

3. Click **OK**.

If the array location is already specified, VectorWorks automatically places the duplicate array.

If **Next Mouse Click** was selected, move the mouse where the copies are to be placed, and click. For circular and rectangular arrays, click the mouse at the center of the array.



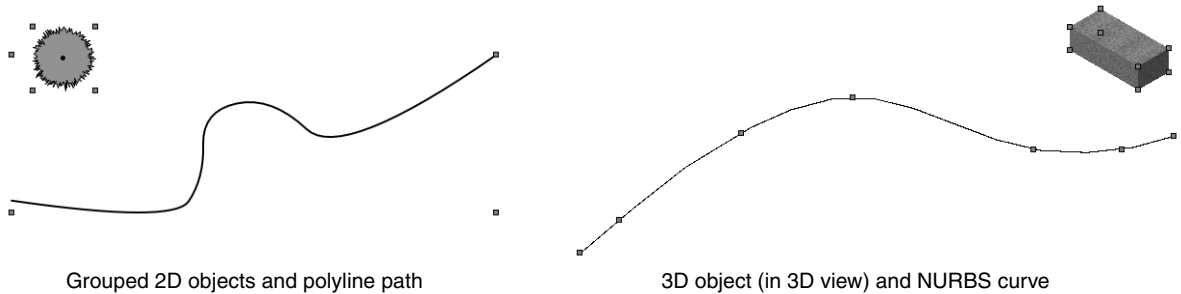
## Duplicating Objects Along a Path

The **Duplicate Along Path** command creates and places several copies of a 2D or 3D object or objects along an existing 2D or 3D path.

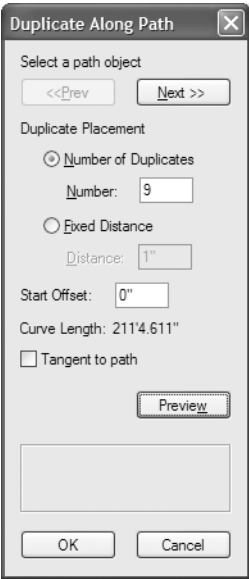
If a 2D object and 3D path are selected, the 2D object is projected onto the path.

To duplicate objects along a path:

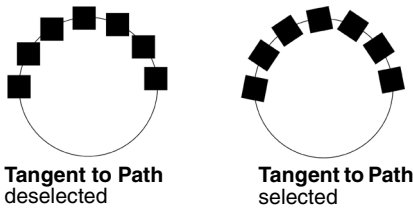
1. Select the object or objects to duplicate, and select the path object.



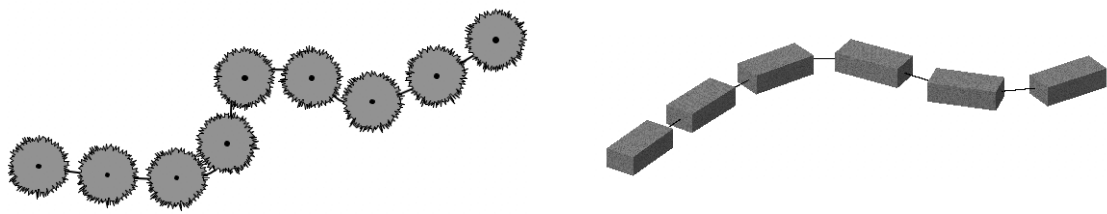
2. Select **Edit > Duplicate Along Path**.  
The Duplicate Along Path dialog box opens.



Parameter	Description
Select a path object	Click <b>Prev</b> or <b>Next</b> to select the object that represents the path; the selected path object is highlighted
Duplicate Placement	Specifies the duplicate object placement parameters
Number of Duplicates	Creates the specified <b>Number</b> of duplicate objects, equally spaced along the path
Fixed Distance	Duplicates objects at the fixed intervals specified in <b>Distance</b>
Start Offset	Specifies the distance from the end of the path to the first duplicated object; enter zero to place the first object at the start of the path
Curve Length	Displays the length of the path object, for reference

Parameter	Description
Tangent to path	Rotates the duplicates so they are always tangent to the path 
Preview	Click to preview the effect of parameter changes before clicking <b>OK</b>

3. Click **OK**.
- The duplicates are arrayed with their centers along the selected path object.



## Smoothing Objects

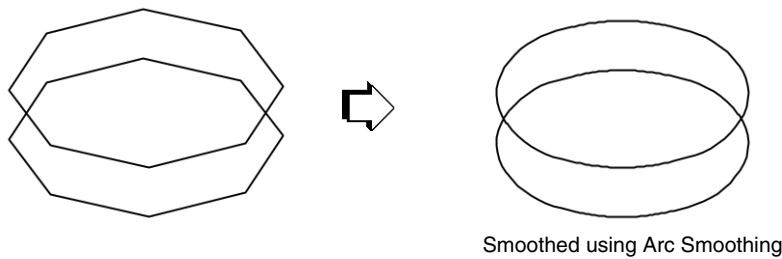
The smoothing commands smooth all selected polygon and polyline vertices in one step. There are three smoothing options—Bézier Spline, Cubic Spline, or Arc. The **No Smoothing** command changes smoothed vertices back into unsmoothed corners.

To smooth an object:

1. Select the object(s) to smooth.
2. Select **Modify > Poly Smoothing**. From the sub-menu, select the smoothing method to use.

Option	Description
No Smoothing	Creates straight lines and angled vertices at the control points
Bézier Spline Smoothing	Creates curves pulled towards but not touching the control points
Cubic Spline Smoothing	Creates curves that pass through the control points
Arc Smoothing	Creates fillet-like curves at the control points. The arc radius is based on the current fillet radius of the <b>Fillet</b> tool (see “Fillet Tool” on page 279). If no radius is set, the largest radius that can fit between each vertex is used.

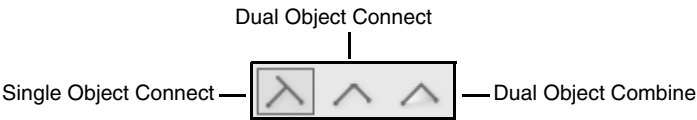
The object is smoothed.



## Combining and Connecting Objects

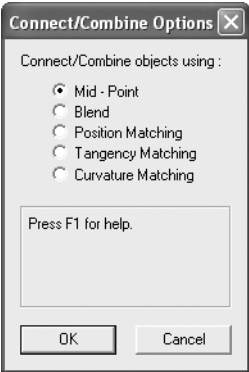
### Connect/Combine Tool

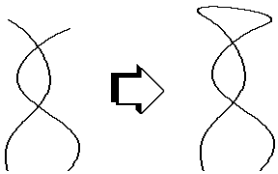
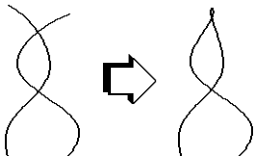
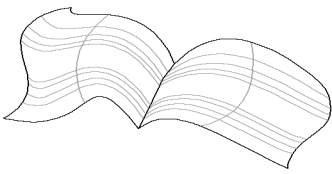
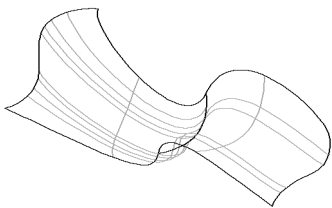
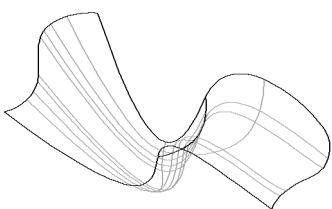
The **Connect/Combine** tool joins objects by their endpoints or at their intersections using one of three modes: Single Object Connect, Dual Object Connect, or Dual Object Combine.



Mode	Description
Single Object Connect	Trims or extends the first selected object to join a second or boundary object
Dual Object Connect	Trims or extends to join two objects at their endpoints or intersections
Dual Object Combine	Trims or extends to join two objects into one object at their endpoints or intersections

When connecting or combining a pair of NURBS, polylines, or open polygons by their endpoints, VectorWorks may require additional information to complete the process. In this situation, the Connect/Combine Options dialog box opens.



Option	Description
Mid-Point	<p>Connects/combines the two objects by joining the two endpoints midway between them</p> 
Blend	<p>Connects/combines the two objects by creating another object between them</p> 
Position Matching (NURBS curves and surfaces only)	<p>Connects/combines two NURBS curves or surfaces by moving the first object's selected end point to the selected end point of the boundary object (not available if the end points are coincident)</p> 
Tangency Matching (NURBS curves and surfaces only)	<p>Connects/combines two NURBS curves or surfaces by making the first object's selected end point tangent to the selected end point of the boundary object</p> 
Curvature Matching (NURBS curves and surfaces only)	<p>Connects/combines two NURBS curves or surfaces by making the first object's selected end point match the curvature of the selected end point of the boundary object</p> 

### Single Object Connect

The **Single Object Connect** mode trims or extends an object to join a second or boundary object. Only open objects, such as lines, arcs, open polygons, and NURBS curves and lines, can be connected. Closed objects, such as circles, rectangles, and closed polygons cannot be connected; they are treated as boundary objects.

By pressing Alt (Windows) or Option (Macintosh), this mode allows multiple objects to be connected to a boundary object.

#### Connecting Single Objects



To connect a single object to a boundary object:

- 1. Click the **Connect/Combine** tool from the Basic palette, and select **Single Object Connect** from the Tool bar.
- 2. Click on the object to connect, and then click on the boundary object. The first object is resized to join the boundary object.

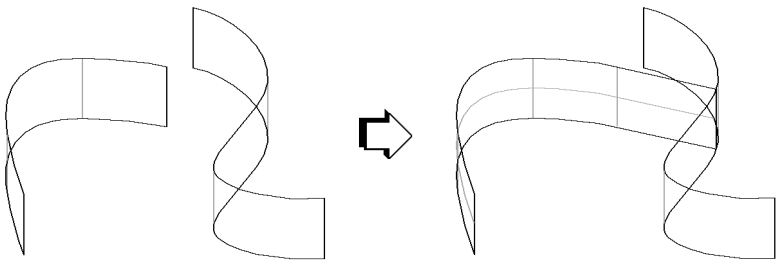
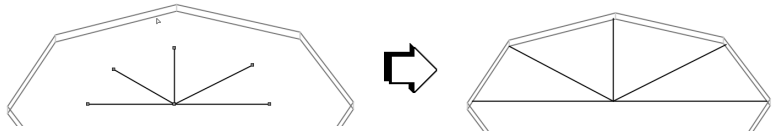
#### Connecting Multiple Objects



To connect multiple selected objects to a boundary object:

- 1. Select the objects.
- 2. Click the **Connect/Combine** tool from the Basic palette, and select **Single Object Connect** from the Tool bar. Press and hold Alt (Windows) or Option (Macintosh) to allow multiple selection.
- 3. Click on one of the objects to connect, and then click on the boundary object. The selected objects are resized to join the boundary object.

Connection Type	Example
2D object extended to boundary object	
2D object trimmed at boundary object	

Connection Type	Example
NURBS surface to NURBS surface	
Multiple selection connecting 2D objects to boundary object	

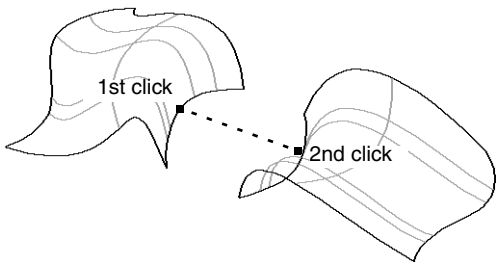
Dual Object Connect

The **Dual Object Connect** mode trims or extends two objects to connect them at their endpoints or intersections. Only open objects, such as lines and polylines, can be connected. Closed objects, except for NURBS surfaces, cannot be connected.

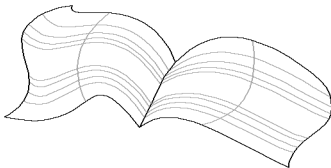
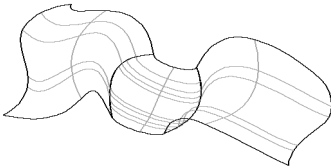
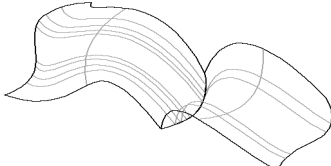
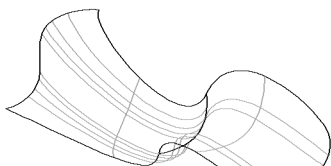
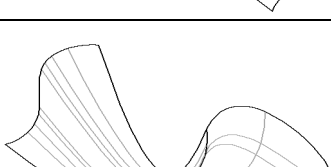


To connect two objects:

- 1. Click the **Connect/Combine** tool from the Basic palette, and select **Dual Object Connect** from the Tool bar.
- 2. Click the first, and then the second, object to connect.  
The Connect/Combine Options dialog box opens. Select a method for resizing and connecting the two objects (see “Connect/Combine Tool” on page 382).  
The two objects are resized to connect to each other.



NURBS surface being connected to NURBS surface

Connection Type	Example
Mid-Point	
Blend	
Position Matching	
Tangency Matching	
Curvature Matching	

Dual Object Combine

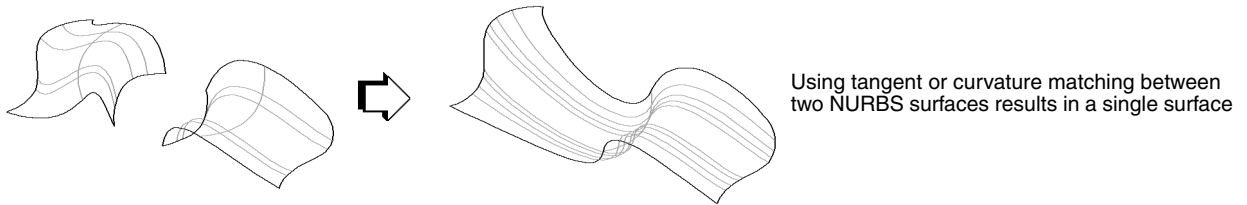
The **Dual Object Combine** mode trims or extends to combine two objects into a single object at their endpoints or intersections. Only open objects, such as lines and NURBS curves and surfaces, can be connected.



To combine two objects:

- 1. Click the **Connect/Combine** tool from the Basic palette, and select **Dual Object Combine** from the Tool bar.
- 2. Click on the first, and then the second, object to combine.  
The two objects are trimmed or extended if necessary and combined into one object.





## Composing and Decomposing Objects and Surfaces

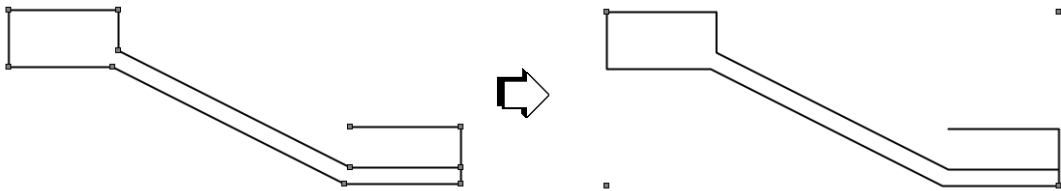
### Composing Objects and Surfaces

The **Compose** command can combine NURBS surfaces, 2D lines, arcs, open polygons, NURBS curves, NURBS arcs, and open 3D polygons into a single object. The endpoints of each object must be touching to use this command. Objects that are not touching are ignored.

Adjacent NURBS surfaces, which may have been split by the **Split** tool (see “Splitting Objects and NURBS Surfaces” on page 275), can be composed into a single NURBS surface with this command.

To compose adjacent objects or NURBS surfaces:

1. Select the objects or NURBS surfaces to be composed.
2. Select **Modify > Compose**. The objects are combined to create a single object or NURBS surface.



If there are multiple objects touching at the same endpoint, the two objects closest in stacking order are combined.

### Decomposing Objects and Surfaces

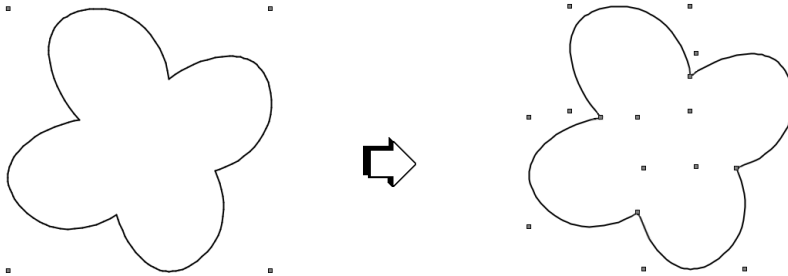
The **Decompose** command can decompose NURBS surfaces, 2D polygons, 2D polylines, 3D NURBS curves created with the **Compose** command, and open 3D polygons.

Occasionally, surface creation methods like the **Create Surface from Curves** command can create a surface with internal discontinuities. Many of the 3D Power Pack tools and commands are not designed to work with these types of surfaces. The **Decompose** command can separate the surface into NURBS surfaces without discontinuities.

To decompose a NURBS surface or object into individual segments:

1. Select the NURBS surface or object to be decomposed.
2. Select **Modify > Decompose**.

The NURBS surface is separated into individual surfaces, or the object is separated into individual segments.



## Locking and Unlocking Objects

### Locking Objects

Objects in a drawing can be protected with the **Lock** command so that they cannot be accidentally moved, deleted, or edited. A locked object must be unlocked before any changes can be made to it.

To lock an object:

1. Select the object or objects to lock.
2. Select **Modify > Lock**, or select **Lock** from the object context menu.

The Object Info palette indicates that the object is locked. Depending on the selection highlighting setting in VectorWorks preferences, the handles and/or highlighting also change to indicate that the object is now locked (see “Selection Indicators” on page 29).

### Unlocking Objects

Unlock an object or group of objects that was previously locked with the **Unlock** command. Unlocked objects can be copied, moved, deleted, or edited.

To unlock objects:

1. Select the object or objects to be unlocked.
2. Select **Modify > Unlock**, or select **Unlock** from the object context menu.

The Object Info palette no longer indicates that the object is locked. Depending on the selection highlighting setting in VectorWorks preferences, the handles and/or highlighting also change to indicate that the object is now unlocked (see “Selection Indicators” on page 29).

## Aligning Objects to Grid

The **Align to Grid** command aligns 2D and 3D objects to the snap grid, placing the upper-left corner of each object at its closest grid point. The **Align to Grid** command can be used to realign objects to the snap grid when the grid's settings have changed. It also aligns objects to the grid if they were either created with the **Snap to Grid Constraint** tool turned off or were moved off the grid after they were created.

To align an object to a grid:

1. Select the object or objects to align.
2. Select **Modify > Align > Align to Grid**.

VectorWorks aligns the object(s), placing the upper-left corner of each object at its closest grid point.

## Rotating Objects

VectorWorks provides a variety of ways to rotate 2D and 3D objects. Use the **Rotate** tool to rotate an object directly using the mouse. Use the various **Rotate** commands to rotate the object around the current location, by choosing a preset rotation, or by entering custom rotation information in a dialog box.

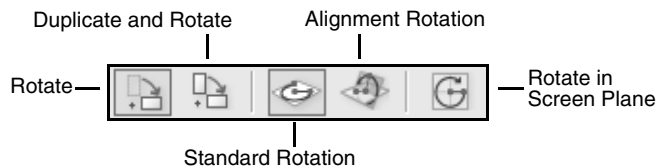
Certain objects, such as rectangles, rounded rectangles, ovals, bitmaps, and PICT images, can be rotated by holding the Shift key down while rotating with the rotate cursor of the **2D Selection** tool.

## Rotate Tool

The **Rotate** tool can rotate 2D and 3D objects in the drawing. However, if both 2D and 3D objects are selected, only the 2D objects are rotated.

When a 2D object is selected, the **Rotate** tool has no options in the Tool bar. Double-clicking the tool opens the Rotate Object dialog box as described in "2D Custom Rotation" on page 392.

When a 3D object is selected, the **Rotate** tool has five rotation options in the Tool bar.



Mode	Description
Rotate	Rotates the selected object
Duplicate and Rotate	Creates a duplicate object and rotates it
Standard Rotation	Rotates the object about a defined axis
Alignment Rotation	Rotates the object by aligning it with another object
Rotate in Screen Plane	<p>In conjunction with the other options, rotates the object parallel to the computer screen plane, rather than the working plane</p> <p><b>Rotate in Screen Plane</b> cannot be used with wall objects. Also, the option has no effect when the drawing is in a view parallel to the screen plane, such as Top or Front.</p>

## 2D Standard Rotation



To rotate a 2D object:

1. Select the 2D object(s) to rotate.
2. Click the **Rotate** tool from the Basic palette.
3. Click to create a fulcrum line (a temporary handle to rotate the object).
4. Click to end the fulcrum line.
5. Move the cursor to rotate the object.  
A preview object displays.
6. Click to set the rotation.

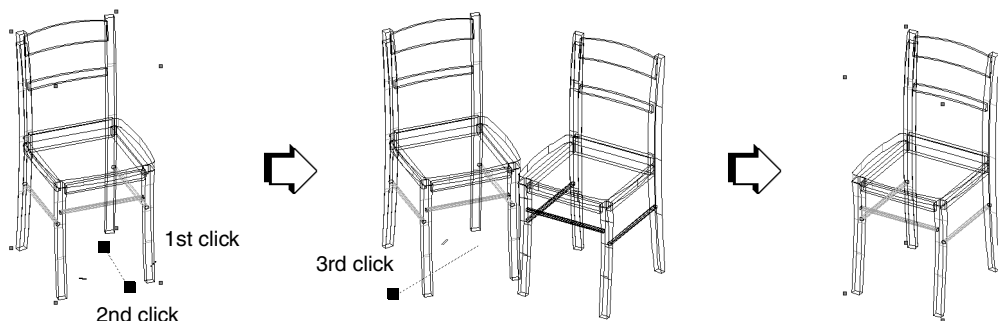
## 3D Standard Rotation



To rotate a 3D object around a specified axis:

1. Select the 3D object to rotate.
2. Click the **Rotate** tool from the Basic palette.
3. Select **Rotate** or **Duplicate and Rotate** from the Tool bar, depending on whether the original or a duplicate object is to be rotated.
4. Select **Standard Rotation** from the Tool bar.
5. By default, the rotation plane is parallel to the working plane. If desired, select **Rotate in Screen Plane** from the Tool bar to rotate in a plane parallel to the computer screen plane.
6. Click to create a fulcrum line (a temporary handle to rotate the object).
7. Click to end the fulcrum line.
8. Move the cursor to rotate the object to the desired new position.
9. Click to set the rotation.

The original object or its duplicate is rotated to the new position.



Rotating a chair using the **Rotate** and **Standard Rotation** options

## 3D Rotation by Alignment



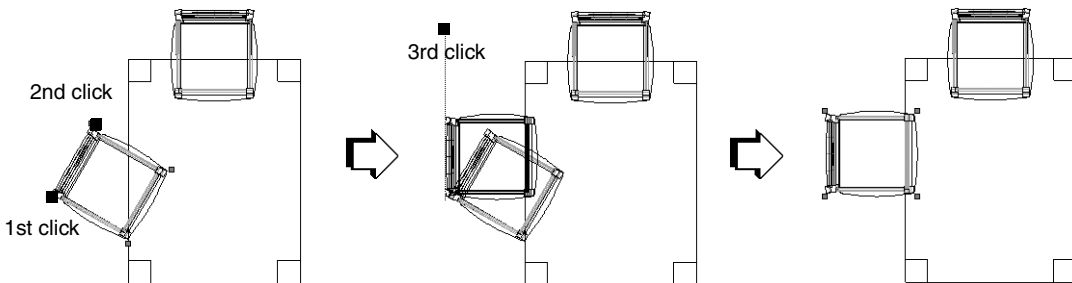
To rotate a 3D object by aligning it with another object:

1. Select the 3D object to rotate.
2. Select the **Rotate** tool from the Basic palette.
3. Select **Rotate** or **Duplicate and Rotate** from the Tool bar, depending on whether the original or a duplicate object is to be rotated.
4. Select **Alignment Rotation** from the Tool bar.
5. By default, the rotation plane is parallel to the working plane. If desired, select **Rotate in Screen Plane** from the Tool bar to rotate in a plane parallel to the computer screen plane.
6. Click to set the first point on the selected object.
7. Click to set the second point on the selected object.

This defines the edge of the object that will be rotated by alignment and creates a fulcrum line.

8. Click the desired point to align the object with.

The original object or its duplicate is rotated to the new position.



## Preset Rotation Angles

The rotate commands provide a number of ways to rotate 2D and 3D objects in a drawing without changing their base location in the drawing. Select one of the preset rotation angles, or specify a custom rotation angle.

To rotate at a specified angle:

1. Select the object(s) to rotate.
2. Select **Modify > Rotate**, and then the pre-set rotation. Alternatively, select **Rotate** from the object context menu.

Parameter	Description
Rotate Left 90°	Rotates the selected object counter-clockwise 90°
Rotate Right 90°	Rotates the selected object clockwise 90°
Flip Horizontal	Flips the selected object about its center
Flip Vertical	Flips the selected object vertically about its center

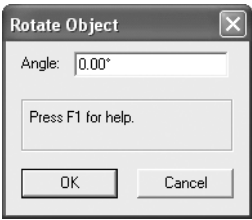
## 2D Custom Rotation

The center of rotation for this command is limited to the center of the object’s bounding box.

To rotate at custom angles in 2D:

- 1. Select the object or objects to rotate.
- 2. Select **Modify > Rotate > Rotate**.

The Rotate Object dialog box opens.



- 3. Enter the rotation angle.  
*The precision of the values that can be entered (degrees, minutes, and/or seconds) depends on the Units setting.*
- 4. Click **OK**.

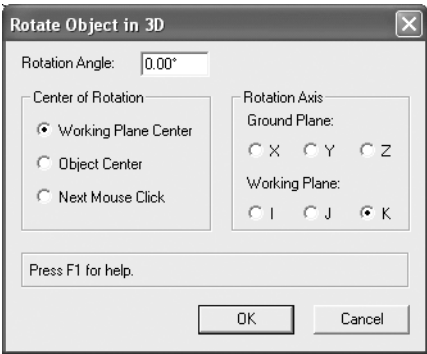
## 3D Custom Rotation

The precision of the rotation values that can be entered (degrees, minutes, and/or seconds) depends on the Units setting.

To rotate at custom angles in 3D:

- 1. Select the 3D object or objects to rotate.
- 2. Select **Modify > Rotate > Rotate 3D**.

The Rotate Object in 3D dialog box opens. Specify the rotation parameters.



Parameter	Description
Rotation Angle	Enter the angle of rotation
Center of Rotation	Specify the desired center of rotation

Parameter	Description
Working Plane Center	Rotates using the center of the working plane
Object Center	Rotates about the center of the selected object
Next Mouse Click	Rotates around the next mouse click in the drawing window
Rotation Axis	Select whether the rotation axis will be based on the <b>Ground Plane</b> or the <b>Working Plane</b> , and about which axis point

3. Click **OK**.

Unrotating 3D Objects

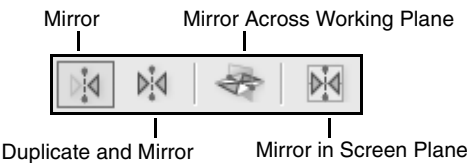
The **Unrotate 3D Objects** command returns any 3D object that has its own coordinate system to its upright position. Use the command to rotate symbols, extrudes, multiple extrudes, and sweeps so that they align with the world coordinate system. This command helps re-orient the drawing after rotating an object.

To unrotate a 3D object:

- 1. Select the 3D object or objects to unrotate.
- 2. Select **Modify > Unrotate 3D Objects**.

Mirroring Objects

The **Mirror** tool can mirror 2D and 3D objects. However, if both 2D and 3D objects are selected, only the 2D objects are mirrored. Depending on which types of objects are selected, there are four modes.



Mode	Description
Mirror	Mirrors the selected object about an axis line. For 3D objects, the mirrored object is on the same plane as the original object (parallel to the working plane) unless <b>Mirror in Screen Plane</b> is selected.
Duplicate and Mirror	Creates a duplicate of the selected object and then mirrors the duplicate about an axis line. For 3D objects, the mirrored object is on the same plane as the original object (parallel to the working plane) unless <b>Mirror in Screen Plane</b> is selected.
Mirror Across Working Plane (3D objects only)	Mirrors the selected object to the other side of the working plane
Mirror in Screen Plane (3D objects only)	Mirrors the selected object about an axis line, in the screen plane  Mirror in Screen Plane cannot be used with wall objects. Also, this option has no effect when Mirror Across Working Plane is used, or when the drawing is in a view parallel to the screen plane, such as Top or Front.

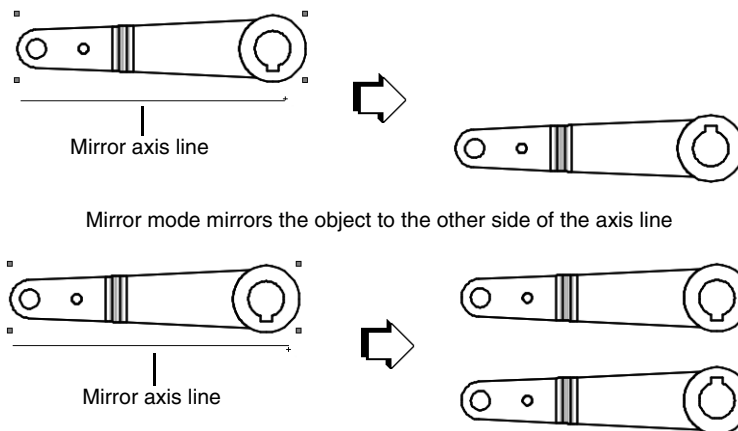
## Mirroring a 2D Object



To mirror a 2D object:

1. Select the object to mirror.
2. Click the **Mirror** tool from the Basic palette.
3. Select **Mirror** or **Duplicate and Mirror** from the Tool bar, depending on whether the original object is to remain in place.
4. Click and drag to create an axis line. Click to finish the line.

The object or its duplicate is mirrored on the opposite side of the axis line.



Duplicate and Mirror mode creates a mirror duplicate of the object

## Mirroring a 3D Object Using an Axis Line



To mirror a 3D object using an axis line:

1. Select the 3D object to mirror.
2. Click the **Mirror** tool from the Basic palette, and then select **Mirror** or **Duplicate and Mirror** from the Tool bar, depending on whether the original object is to remain in place.
3. By default, the mirrored object is placed on the same plane as the original object (parallel to the working plane). If desired, select **Mirror in Screen Plane** from the Tool bar to place the mirrored object in a plane parallel to the computer screen plane.
4. Click and drag to create an axis line. Click to finish the line.

The object or its duplicate is mirrored to the opposite side of the axis line.



## Mirroring a 3D Object Across the Working Plane



To mirror a 3D object across the working plane:

1. Select the 3D object to mirror.
2. Click the **Mirror** tool from the Basic palette, and then select **Mirror** or **Duplicate and Mirror** from the Tool bar, depending on whether the original object is to remain in place.
3. Select **Mirror Across Working Plane** mode.

The object or its duplicate is mirrored to the opposite side of the working plane. There is no need to create an axis line.

## Converting Objects

VectorWorks objects can be converted in several ways.

### Convert to Lines

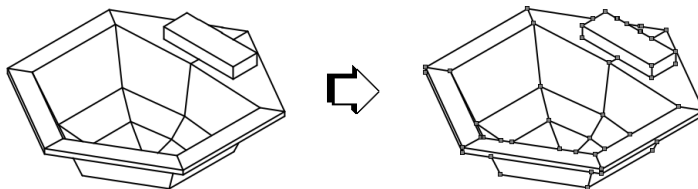
The **Convert to Lines** command changes a single object into the series of 2D lines needed to create it. For example, a 2D rectangle is converted into four lines. Both 2D and 3D objects can be converted into lines.

Circles and ovals can also be converted into numerous line segments. However, especially when converting circles, the accuracy of the line segments depends on the **2D conversion res** (resolution) setting chosen in the VectorWorks Preferences dialog box.

To convert an object to lines:

1. Select the object to convert.
2. Select **Modify > Convert > Convert to Lines**.
3. If the object can be rendered, select the wireframe, hidden line, or dashed hidden line rendering conversion option.
4. Click **OK**.

The object is converted into lines and each segment can be manipulated.



### Convert Copy to Lines

The **Convert Copy to Lines** command works like the **Convert to Lines** command except that it first makes a copy of the object and then converts the copy into line segments. The original object remains intact.

To convert a copy of a 2D or 3D object to lines:

1. Select the object to convert.

2. Select **Modify > Convert > Convert Copy to Lines**.
3. If the object can be rendered, select the wireframe, hidden line, or dashed hidden line rendering conversion option.
4. Click **OK**.

A copy of the object is converted into lines and each segment can be manipulated.

## Convert to Polygons

The **Convert to Polygons** command changes any object with a surface into the 2D polygon or series of polygons needed to create it.

Circles and ovals can also be converted. However, especially when converting circles, the accuracy of the polygons depends on the **2D conversion res** (resolution) setting chosen in the VectorWorks Preferences dialog box.

When most closed 3D geometry is converted to 2D polygons with the hidden line rendering option, back-facing polygons are discarded.

To convert a 2D or 3D object to polygons:

1. Select the object to convert.
2. Select **Modify > Convert > Convert to Polygons**.
3. If the object can be rendered, select either the wireframe or hidden line rendering conversion option.
4. Click **OK**.

The object is converted to a group of polygons. To select an individual polygon, first select **Modify > Ungroup**.

## Convert Copy to Polygons

The **Convert Copy to Polygons** command works like the **Convert to Polygons** command, except that it first makes a copy of the object and then converts the copy into 2D polygons. The original object remains intact.

To convert a copy of a 2D or 3D object to polygons:

1. Select the object to convert.
2. Select **Modify > Convert > Convert Copy to Polygons**.
3. If the object can be rendered, select either the wireframe or hidden line rendering conversion option.
4. Click **OK**.

A copy of the object is converted to a group of polygons. To select an individual polygon, first select **Modify > Ungroup**.

## Convert to 3D Polygons

The **Convert to 3D Polys** command converts any 2D line or surface object, including polylines, polygons, circles, ovals, and rectangles, into a 3D polygon. Once converted, the new polygon contains a Z dimension, assigning it a place in 3D space. It can be rotated and manipulated with 3D tools. The new polygon will not, however, have a thickness.

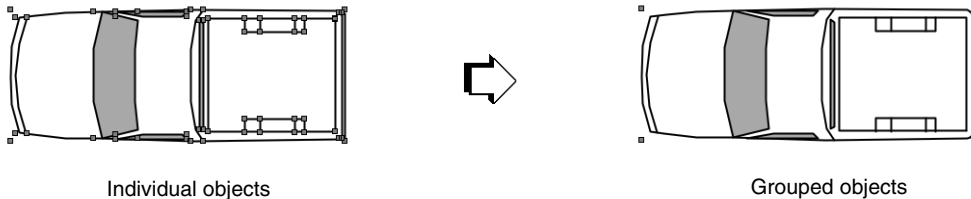
When converting two or more objects simultaneously, VectorWorks assigns the objects to a group when converting them to polygons.

To convert a 2D object to 3D polygons:

1. Select the 2D object or objects to convert.
2. Select **Modify > Convert > Convert to 3D Polys.**

## Grouping Objects

The **Group** command groups two or more individual objects (including text and symbols) together. The group of objects is then treated as a single object. For example, grouped objects can be moved to a different layer in one move. In addition, this command can group two or more groups of objects into a single group.



To group objects:

1. Select the objects (or groups) to be grouped.
2. Select **Modify > Group.**

The objects are grouped into one object, as indicated by the handles, and the group is placed in the active class.

Use the View bar's left arrow to exit a group and return to the previous view. This can save time when working with 3D objects.

## Editing a Group

The **Edit Group** command edits objects that constitute the group. Double-clicking a group, or selecting **Edit** from the context menu, also edits the group.

This command also edits a group of objects that is nested inside another group; each time the **Edit Group** command is selected, VectorWorks moves one level deeper into the group. In addition, this command allows edits to hybrid objects, symbols, roofs, sweeps, extrudes and multiple extrudes, plug-in objects, custom objects, and floors. Even though these objects are created without using the **Group** command, VectorWorks treats them as a group because they are defined by the objects they contain. For example, an extrude is defined by the 2D object it contains, which is its container object. A sweep is defined by its profile object. If one of these objects has been moved or rotated, its 2D container object is displayed at its original location for editing. When editing, the view is centered on the component(s).

**Edit Group** does not work on walls.

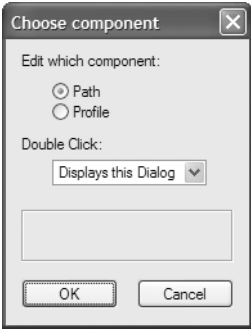
When editing a group, the default is to hide all other objects in the drawing. However, showing all objects in the drawing is also possible, although only the grouped objects can be edited. To show all the objects, select **Show other objects while in group** in the VectorWorks preferences. This allows the **Edit Group** command to use other objects for snapping. When editing nested groups, only the first container group shows other drawing objects.

To edit a group of objects:

1. Select the group to edit.
2. Select **Modify > Edit Group.**

Alternatively, edit the group by selecting **Edit** from the context menu, or by double-clicking on the group. Edit the path or profile of a plug-in object directly by selecting **Edit Path** or **Edit Profile** from the context menu.

- 3. If the group consists of a path or profile object, the Choose Component dialog box opens. Only one component of a path or profile object can be edited at one time. Select the component to edit and click **OK**.



Parameter	Description
Path/Profile	Edits the path or profile component
Double-click	Sets the future behavior when double-clicking on a plug-in object. Select whether to display the Choose Component dialog box, or directly edit the path or profile component.

- 4. The Edit Group window opens, containing the group or component to be edited. VectorWorks automatically hides objects other than those in the selected group. A colored border around the drawing window indicates that you are in an editing mode. The **Exit Group** command becomes available from the **Modify** menu, and the **Exit Group** button is visible in the top right corner of the drawing window.

Depending on the type of object edited, the button may display other “Exit” text, such as **Exit Sweep Profile** for sweeps, **Exit Extrude** for extruded objects, etc.

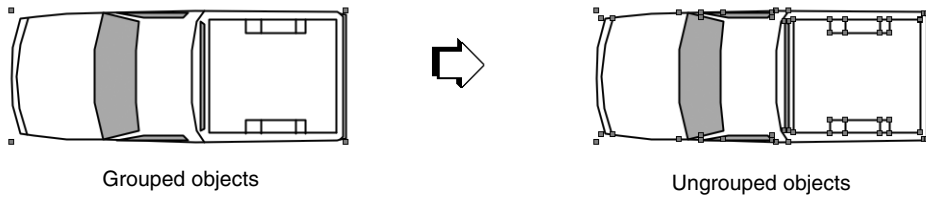
- 5. Make the changes to the objects, components, or container objects in the group. (Switch easily between components from the context menu.)
- 6. Click **Exit Group** to return to the main drawing area.

Alternatively, when editing a nested group, the button takes you back one group.

When a symbol is selected, the **Edit Group** command becomes the **Edit Symbol** command. When on a sheet layer, the **Edit Group** command becomes the **Edit Viewport** command.

## Ungrouping

The **Ungroup** command ungroups objects or groups that were previously combined with the **Group** command. Nested groups must be ungrouped one at a time.



To ungroup a group of objects:

1. Select the group to ungroup.
2. Select **Modify > Ungroup**. Alternatively, select **Ungroup** from the object context menu.

The objects are ungrouped, still retaining their individual attributes and information.

If a plug-in object is ungrouped, it loses its plug-in functionality. Confirm that high-level objects should be ungrouped.

## Returning to Top Level

The **Top Level** command is used when editing groups of objects that are nested. Exit all of the groups being edited, and return to the main drawing area in a single step.

Select **Modify > Top Level**.

VectorWorks automatically exits all groups being edited and returns to the main drawing area.

## Compressing Images

The bitmap images and image resources in a VectorWorks file can be compressed with the JPEG compression method, to save file space. JPEG compression can significantly reduce bitmap image file size, but can result in the loss of fine detail for some images.

The compression method and file size for a selected image display in the Object Info palette. Images that are already compressed by the JPEG compression method remain unchanged.

A selected bitmap file displays "Bitmap" as the object type at the top of the Object Info palette. A bitmap file may already have had PNG compression applied at import; the **Compress Images** command changes its compression format to JPEG.

## Compressing Selected Bitmap Images

To compress selected bitmap images:

1. Select the bitmaps to be compressed.
2. Select **Tools > Compress Images**.

The Compress Images dialog box opens.



3. Select **Apply JPEG Compression to Selected Bitmap Objects**. Click **OK** to compress the selected images.

## Compressing All Bitmap Images and/or Image Resources

The JPEG compression method can be applied to all bitmap images in the file. For the best possible reduction in file size, images that have been imported as resources (shown as image resources in the Resource Browser) can also be compressed by the JPEG compression method.

To compress all bitmap images and/or image resources:

1. Select **Tools > Compress Images**.

The Compress Images dialog box opens.



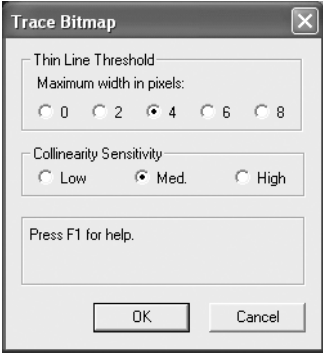
2. Select **Apply JPEG Compression to All**. Choose whether to apply the JPEG compression to all bitmap images in the drawing, image resources, or both. Click **OK** to compress the images.

## Tracing Bitmaps

The **Trace Bitmap** command traces bitmap objects and picture objects (images which have been imported with the **PICT as Picture** command). It creates a group of vector lines from the image.

To trace a bitmap or picture object:

1. Select the image to trace.
2. Select **Modify > Trace Bitmap**.
3. Enter the desired criteria in the Trace Bitmap dialog box.



Parameter	Description
Maximum width in pixels	Specify the maximum number of pixels to be recognized as a single line; pixel counts above the selected value are traced
Collinearity Sensitivity	Select a value to define the segment size and accuracy of the trace

4. Click **OK**.

The time it takes VectorWorks to trace the image can vary from seconds to hours. The tracing time required is determined by the image size, as well as the line threshold and collinearity sensitivity settings selected.



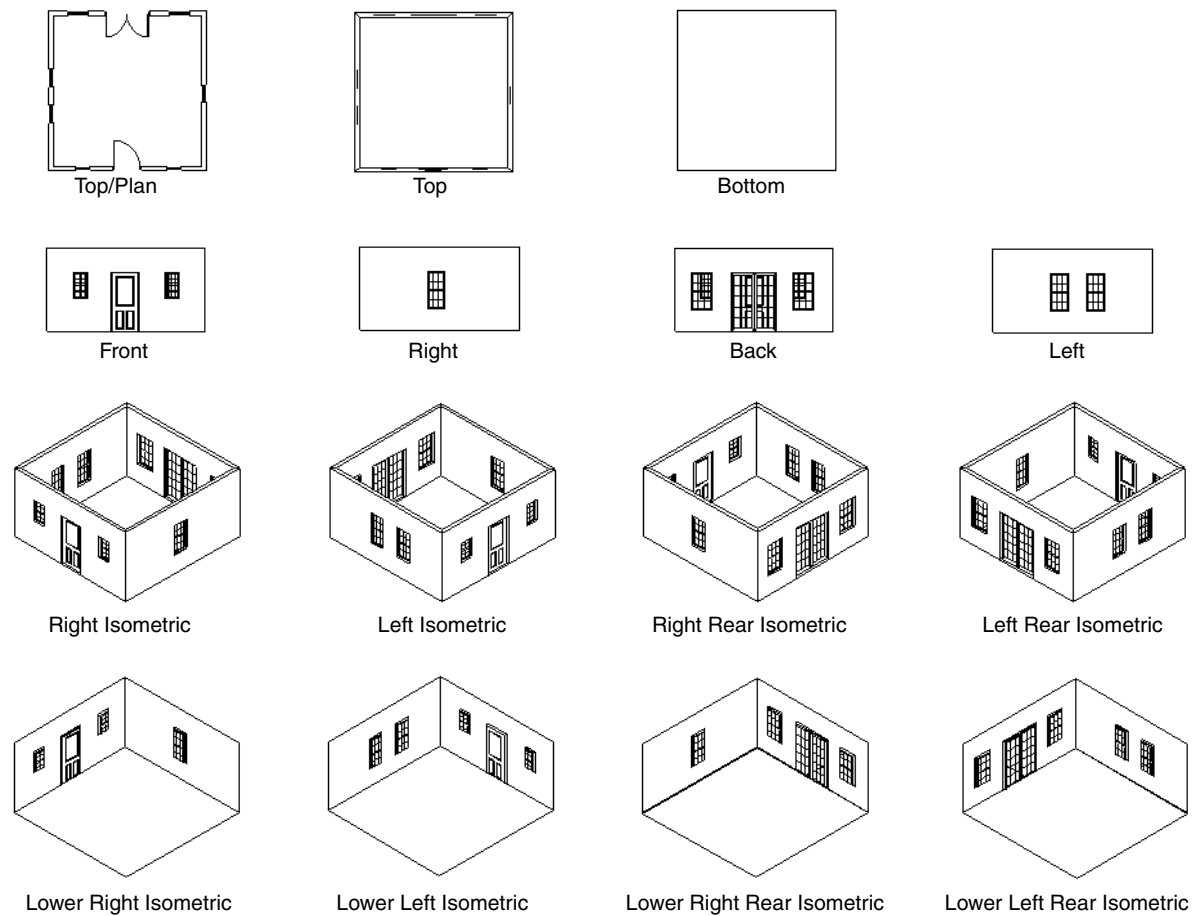


VectorWorks has many tools and features that change the drawing view. For example, change the orientation from a top view to a left isometric view, or interactively “fly over” or “walk through” a 3D model. Several rendering options are also available. These show 3D models with additional realistic details, such as hidden lines, colors, and lighting.

## Using Standard Views

The items under the **View > Standard Views** sub-menu change the representation and the orientation of the drawing area. VectorWorks has 15 view options, which can be divided into four basic categories:

Category	Description
2D View	Select the <b>Top/Plan</b> command to view the drawing in 2D; use this for elevations, annotations, title blocks, and other 2D illustrations
3D Elevations	Use the <b>Top</b> , <b>Front</b> , <b>Right</b> , <b>Bottom</b> , <b>Back</b> , and <b>Left</b> commands to view 3D elevations
3D Representations Above the Ground Plane	Use the <b>Right Isometric</b> , <b>Left Isometric</b> , <b>Right Rear Isometric</b> , and <b>Left Rear Isometric</b> commands to view 3D representations above the ground plane
3D Representations Below the Ground Plane	Use the <b>Lower Right Isometric</b> , <b>Lower Left Isometric</b> , <b>Lower Right Rear Isometric</b> , and <b>Lower Left Rear Isometric</b> commands to view 3D representations below the ground plane



To change among the different views:

Select **View > Standard Views**, and then select a view.

The view changes and a check mark displays in front of the active view in the **Current View/Standard Views** list.

The reference for the view, whether working plane or ground plane, may depend on the selection in the **Working Planes palette** (see “Working Plane View and Modes” on page 557).

To switch views rapidly, use shortcuts on the numeric keypad.

Keypad Number	View
0	Top/Plan
1	Left Isometric
2	Front
3	Right Isometric
4	Left

Keypad Number	View
5	Top
6	Right
7	Left Rear Isometric
8	Rear
9	Right Rear Isometric

The View bar also provides quick access to the standard view commands. Click the Current View and select a standard view from the list that displays. If the view is something other than a standard view, “Custom View” displays as the current view.



Current View/Standard Views list

## Projection

The projection commands alter the way VectorWorks displays the 3D geometry of the drawing on a 2D screen. In addition to the standard 2D Plan projection, VectorWorks has six 3D projection modes.

To switch projection modes:

Select **View > Projection**, and then select a projection.

Projection Mode	Description
2D Plan	Matches the projection for a normal 2D drawing; use this view to draw 2D objects
Orthogonal	Displays an undistorted 3D projection of the drawing—objects display at their exact size regardless of their distance from the ground plane
Perspective	Adds distortion to the drawing so that objects that are farther away appear smaller than objects that are closer, as if the drawing were projected on an imaginary cropped plane, set at a certain distance. The Perspective mode closely approximates how the 3D model will display in the real world.
Oblique Cavalier (30° or 45°)	The Cavalier modes show an undistorted front view along with depth (also known as full-depth axonometric projections). The lines along the Z axis (which show the depth of an object) are represented in true length. This distorts the overall image of the object and makes it appear deeper. These modes make precise measurements possible, either from a printout of the drawing or from the screen image.
Oblique Cabinet (30° or 45°)	The Oblique Cabinet modes (also known as half-depth axonometric projections) are similar to Oblique Cavalier. However, the depth lines are shortened by 50%. This distorts the actual length of these lines, but represents a more natural view of the object. These modes can still be used to take measurements of vectors perpendicular to the projection plan (along the Z axis) from a printed drawing, but the results must be multiplied by two to obtain the actual dimension.

OpenGL and RenderWorks do not support the Oblique projections. To render Oblique projections, use one of the Polygon render modes, or use Hidden Line mode.

## Perspective

The perspective commands change the amount of distortion used to display the drawing, which gives the impression of 3D perspective. Select from normal, narrow, or wide perspectives, or create a custom perspective.

Perspective	Description
Set Perspective	Set a custom perspective numerically
Narrow Perspective	Similar to a telephoto lens
Normal Perspective	Similar to a portrait lens
Wide Perspective	Similar to a wide angle or fisheye lens

To select a perspective:

Select **View > Perspective**, and then select the perspective.

To set a custom perspective value, select **Set Perspective**. The Set Perspective dialog box opens. Type the custom perspective value in the **Perspective** field, and then click **OK**. The lower the value, the wider the angle of perspective.

## Simulating Movement

Several tools simulate movement over and through the drawing.

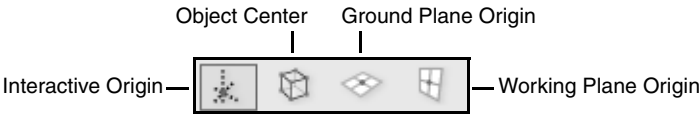
When you use these tools, the model may display in wireframe mode even if a render mode is set. When the movement stops, VectorWorks renders the new view of the model. Additionally, for a highly complex drawing, VectorWorks temporarily removes some of the detail to speed up the movement. When the movement stops, the detail returns.

These tools have certain Tool bar buttons that are true modes, and others that act as command buttons. When some of these tools are in use, the Data bar provides display-only information to help orient the view.

## Flyover

The **Flyover** tool simulates movement over and around a real-world model.

To control the movements of the **Flyover** tool, drag the mouse around a selected center of rotation. The Tool bar buttons set the center of rotation.

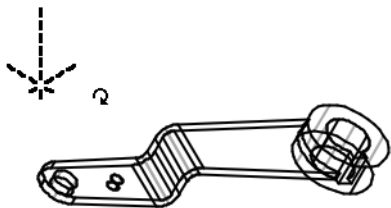


Mode	Description
Interactive Origin	Sets the center of rotation with a mouse click
Object Center	Sets the center of rotation to the center of the selected objects; if no objects are selected, sets the center of rotation to the center of the visible objects
Ground Plane Origin	Sets the center of rotation to the center of the ground plane
Working Plane Origin	Sets the center of rotation to the origin of the current working plane



To fly over a drawing:

1. Click the **Flyover** tool from the View/Draw, 3D Modeling, or Visualization tool set.
2. Select the mode from the Tool bar.
3. In Interactive Origin mode, click to specify the center of rotation for the flyover movement.
4. The center of rotation is indicated by dashed axis lines.



To fly over the drawing, click on the drawing and drag in the direction of movement while you hold the mouse button. To stop the movement, release the mouse button. Alternatively, use shortcuts on the keyboard to fly over the drawing.

Mouse Movement	Shortcut Keys	Description
Move left or right		Turns left or right about the selected center of rotation
Move up or down		Moves up or down about the selected center of rotation
Move in toward center	Alt + move right (Win) or Option + move right (Mac)	Moves the view toward the center of rotation (in Perspective projection)
Move outward from center	Alt + move left (Win) or Option + move left (Mac)	Moves the view outward from the center of rotation (in perspective projection)
Move down toward ground plane	Alt + move up (Win) or Option + move up (Mac)	Moves down toward the ground plane (in perspective or orthogonal projection)
Move up from ground plane	Alt + move down (Win) or Option + move down (Mac)	Moves up from the ground plane (in perspective or orthogonal projection)

Mouse Movement	Shortcut Keys	Description
	Shift key	Constrains the rotation to the global Z axis, or to the K axis of the active working plane (when <b>Working Plane Mode</b> is enabled in the Working Planes palette)
	Ctrl key (Win) or Command key (Mac)	Draws selected objects in full detail, and hides deselected objects (so that the redraws are faster)

Activating the Flyover Tool Temporarily

While another tool is active, press and hold the mouse wheel button and the Ctrl key (Windows) or Control key (Mac) simultaneously to activate the **Flyover** tool. Orient the view as desired, and release the mouse. The previous tool becomes active again automatically.

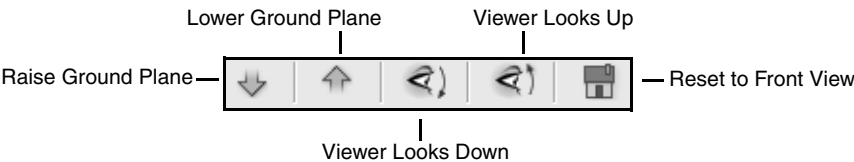
This feature will not work properly if the wheel button is assigned a custom function in the mouse setup. For example, if the wheel button is set to perform a delete when clicked, a wheel click in VectorWorks deletes rather than activates the flyover tool. (The specific setting required for this feature depends on the type of mouse being used.)

Walkthrough

The **Walkthrough** tool simulates movement through a 3D model.

The tool operates in perspective projection. To control the movements of the **Walkthrough** tool, move the mouse or click one of the first four mode buttons. The buttons perform precise, incremental walkthrough movements in the direction specified.

Click **Reset to Front View** mode to return to a front view of the model, on the same level as the ground plane.



To conduct a walkthrough of a model:

- 1. Click the **Walkthrough** tool from the Visualization tool set.
- 2. Click on the drawing and drag while you hold the mouse button to perform the walkthrough. Imagine the drawing area divided into four quadrants. With the mouse button pressed, move forward, backward, left, and right by dragging the mouse in these directions. The place where the four quadrants meet is the “still area” — move the mouse there to slow or stop the walkthrough movement. The farther away from the still area the mouse moves, the faster the movement. To stop the movement, release the mouse button.

Alternatively, use shortcuts on the keyboard to walk through the drawing.

Mode	Mouse Movement/Key	Description
	Move left or right	Turns left or right from the viewer’s location about the Z axis
	Move up or down	Moves forward or backward in the world XY plane

Mode	Mouse Movement/Key	Description
Raise Ground Plane	Alt + move down (Win) or Option + move down (Mac)	Raises the viewpoint height
Lower Ground Plane	Alt + move up (Win) or Option + move up (Mac)	Lowers the viewpoint height
Viewer Looks Down	Alt + move left (Win) or Option + move left (Mac)	Lowers the viewpoint angle
Viewer Looks Up	Alt + move right (Win) or Option + move right (Mac)	Raises the viewpoint angle
Reset to Front View		Sets the drawing to a front view of the model, on the same level as the ground plane
	Ctrl key (Windows) or Command key (Macintosh)	Draws selected objects in full detail, and hides deselected objects (so that the redraws are faster)

When the **Walkthrough** tool is in use, the Data bar displays the following information to help orient the view.

Data Bar	Description
Yaw	Displays the angle (0 – 360 degrees) between the walking direction and the positive Y axis, to describe the direction of movement in the ground plane. A yaw of 90 degrees indicates movement in the direction of the positive X axis. A yaw of 180 degrees indicates movement in the direction of the negative Y axis.
Pitch	Displays the viewpoint’s viewing angle. A value of 0 degrees indicates that the viewer is looking straight ahead; a value of 45 degrees indicates that the viewer is looking up at an angle 45 degrees from horizontal.
Viewer X/Y/Z	Displays the position of the viewer relative to the ground plane

## Translate View

The **Translate View** tool provides another way to look at a 3D model in orthogonal or perspective projections. To control the movements of the **Translate View** tool, move the mouse or click one of the mode buttons. The buttons perform precise, incremental movements in the direction specified.



To translate a view:

1. Click the **Translate View** tool from the Visualization tool set.
2. Click on the drawing and drag while you hold the mouse button to translate the drawing from side to side or up and down. To stop the movement, release the mouse button. Alternatively, click the mode buttons or use shortcuts on the keyboard to translate the view.



Mode	Mouse Movement/Key	Description
	Move left or right	Moves along screen X axis
	Move up or down	Moves along screen Y axis
Move Picture Closer	Alt (Win)/Option (Mac) + move right or down	Moves the drawing closer (in perspective projection)
Move Picture Away	Alt (Win)/Option (Mac) + move left or up	Moves the drawing farther away (in perspective projection)
	Ctrl key (Windows) or Command key (Macintosh)	Draws selected objects in full detail, and hides deselected objects (so that the redraws are faster)

When the **Translate View** tool is in use, the Data bar displays the following information to help orient the view.

Data Bar	Description
Viewer X/Y/Z	Displays the position of the viewer relative to the ground plane
L/R	Displays the movement to the left and right of an imaginary axis perpendicular to the screen
U/D	Displays the movement up and down from an imaginary axis perpendicular to the screens
I/O	Displays the movement in and out of the drawing along an imaginary axis perpendicular to the screen

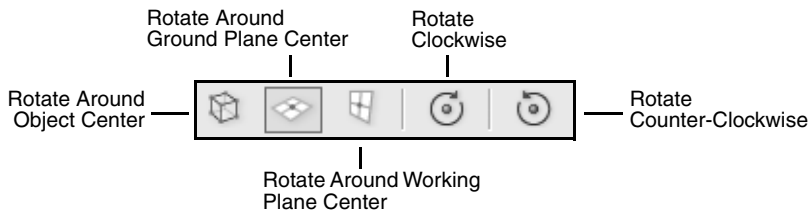
## Rotating the 3D View

To rotate the 3D view, either use the **Rotate View** tool, or specify rotation values with the **Rotate 3D View** command.

### Rotating with the Mouse

The **Rotate View** tool rotates the view clockwise or counter-clockwise in 3D.

To control the movements of the **Rotate View** tool, drag the mouse or click one of the mode buttons. The first three Tool bar buttons set the center of rotation. The last two modes perform precise, incremental rotation movements in the direction specified.



To rotate the 3D view:

1. Click the **Rotate View** tool from the Visualization tool set.
2. Select the mode from the Tool bar.



Mode	Description
Rotate Around Object Center	Uses the center of selected objects as the rotation center
Rotate Around Ground Plane Center	Uses the center of the ground plane as the rotation center
Rotate Around Working Plane Center	Uses the origin of the current working plane as the rotation center

- To rotate the view, click on the drawing and drag while holding the mouse button. Move the cursor to rotate the view in the direction of the mouse movement. Release the mouse to stop the rotation. Alternatively, use the two Tool bar buttons.

Mode	Mouse Movement/Key	Description
	Move left or right	Rotates about the screen Y axis (or the screen Z axis if the mouse is at the perimeter of the drawing)
	Move up or down	Rotates about the screen Y axis (or the screen Z axis if the mouse is at the perimeter of the drawing)
Rotate Clockwise		Each click rotates the view in a clockwise direction about the selected center of rotation
Rotate Counter-Clockwise		Each click rotates the view in a counter-clockwise direction about the selected center of rotation
	Ctrl key (Windows) or Command key (Macintosh)	Draws selected objects in full detail, and hides deselected objects (so that the redraws are faster)

When the **Rotate View** tool is in use, the Data bar displays the following information to help orient the view.

Data Bar	Description
Azimuth	Displays the ground plane angle (in degrees) between the positive X axis and the direction from the selected center of rotation to the viewer
Elevation	Displays the angle (in degrees) between the selected center of rotation and the plane which is parallel to the ground plane and passes through the view origin
Roll	Displays (in degrees) the amount of rotation about the selected rotation center

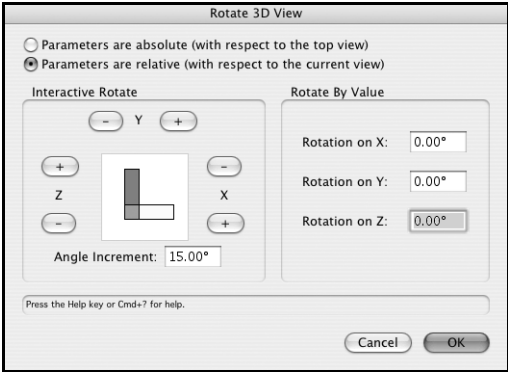
## Rotating Precisely

The **Rotate 3D View** command provides a precise way to rotate the 3D view. Enter rotation values directly, or rotate the view in increments. A preview displays the rotation movements before the actual view is rotated.

To rotate the 3D view:

- Select **View > Rotate 3D View**.

The Rotate 3D View dialog box opens.



Parameter	Description
Parameters are absolute	Starts the view rotation from a top (absolute) view
Parameters are relative	Starts the view rotation from the current view
Interactive Rotation	
+ , - X/Y/Z buttons	The plus and minus buttons for each axis rotate the view by the increment specified
Angle Increment	Specifies the rotation increment (in degrees) for the interactive rotation buttons
Rotation by Value	
Rotation on X/Y/Z	Specifies the rotation value (in degrees, minutes, and seconds) for the X, Y, and/or Z axes

2. Specify the rotation criteria, and then click **OK** to rotate the 3D view as specified.

## Using a SpaceNavigator Mouse

VectorWorks supports both the standard and personal editions of the 3Dconnexion Inc. SpaceNavigator™ mouse. The SpaceNavigator driver must be installed; see [www.3dconnexion.com/support/](http://www.3dconnexion.com/support/).

SpaceNavigator movement affects the current view in VectorWorks; when cycling through movement modes with the SpaceNavigator’s left button, the VectorWorks Message bar displays a notice.

The effects of the SpaceNavigator tool on the VectorWorks view depend on the current view and projection, as well as the tool mode.

For best results while navigating, render the drawing with OpenGL rendering.

VectorWorks View or Projection	SpaceNavigator Result
Top/Plan	Any SpaceNavigator manipulation switches the view to Top
Isometric, Orthogonal	Like the <b>Flyover</b> tool, the SpaceNavigator supports spinning and tilting motions

VectorWorks View or Projection	SpaceNavigator Result
Perspective	<div>Cycle through the SpaceNavigator modes for various types of navigation.</div> <ul style="list-style-type: none"><li>• The first mode functions like the <b>Flyover</b> tool, with spinning and tilting motions.</li><li>• The second mode functions like the <b>Walkthrough</b> tool, allowing movement on a plane parallel to the Ground plane with spinning to the left or right.</li><li>• The third mode imposes no constraints, supporting all axes of motion. This mode is the most flexible, but can be challenging to control; decreasing axis sensitivity from the SpaceNavigator control panel is recommended (press the right Navigator button).</li></ul>

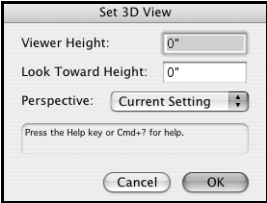
Setting a 3D View

The **Set 3D View** command sets a precise 3D view at a specified viewing angle, height, and perspective. Normally, the command is executed from 2D Top/Plan view; however, the command can also set a 3D view from any of VectorWorks’ 3D projection modes.

To set a 3D view:

1. Select **View > Set 3D View**.
2. Click and draw a line to indicate the view direction; the line starting point indicates the viewer position and the line end point indicates the point the viewer is looking towards (look toward point).

The Set 3D View dialog box opens.



3. Specify the 3D view criteria.

Parameter	Description
Viewer Height	Specifies the height of the viewer at the start point of the drawn line
Look Toward Height	Specifies the height of the view destination at the end point of the drawn line
Perspective	Select the desired perspective, or use the current setting to keep the perspective unchanged

4. Click **OK**. The 3D view is adjusted as specified.

## Setting a Camera View in RenderWorks

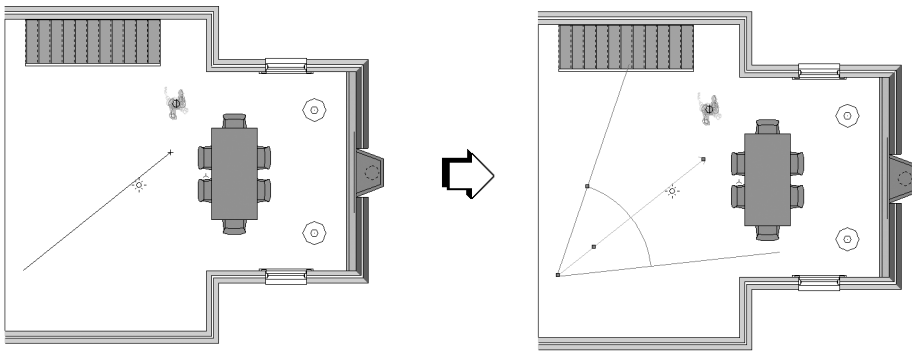
RenderWorks contains a method of setting a camera view with the **RenderWorks Camera** tool. Specific attributes, such as camera focal length, field of view, height, and aspect ratio can be set.



To insert a RenderWorks camera:

1. Select the **RenderWorks Camera** tool from the Visualization tool set (RenderWorks required).
2. Click in the design layer to specify the camera location. Click again to indicate the camera look-to point.

If this is the first time a camera object has been inserted in this session, the RenderWorks Camera Object Properties dialog box opens. Click **OK**.



3. Click **Display Camera View** in the Object Info palette, or simply double-click on the camera, to switch to the 3D camera view. To return to Top/Plan view, click **Top/Plan View** in the Object Info palette.



4. The camera properties can be edited in the Object Info palette.

Parameter	Description
Camera Height	Sets the camera height; at placement, the camera is set to a default height of 1500 mm or 5'0". If a Z value is also specified for the camera object, the total camera height is the sum of the Z height and the <b>Camera Height</b> .
Look To Height	Sets the height of the camera look-to point; at placement, the look-to height is set to a default height of 1500 mm or 5'0". If a Z value is also specified for the camera object, the total look-to height is the sum of the Z height and the <b>Look To Height</b> .
Top/Plan View	Switches to a Top/Plan view of the 2D camera
Display Camera View	Switches to display the 3D camera view (double-clicking on the camera in a 2D view also switches to camera view)
Fine Tune Camera View	Opens the Perspective View Controls dialog box, for making fine adjustments to the camera view controls (see "Adjusting the Camera View" on page 416)
Projection	Select Perspective or Orthogonal projection for the camera view; Perspective creates an adjustable clipping frame for the camera view, while Orthogonal is useful for an elevation view (for example, a skewed elevation view of a building which is not in a standard view). Available parameters depend on the selected projection.
Render Mode	Selects a render mode for the 3D camera view
Aspect Ratio	Sets the aspect ratio of the perspective clipping window; the clipping window can also be set to the page size or to a custom aspect ratio
Custom Aspect	When a custom <b>Aspect Ratio</b> is selected, enter the custom ratio
For Film Size of	Specifies the camera film size, and determines the focal length of the camera (has no effect on the camera view)
Focal Length is	Displays the camera focal length, based on film size
Field of View	Specifies the view angle; set to a default angle of 65 degrees. Use the control point to set the view angle on the 2D camera with the mouse.
For DPI of	Calculates the pixel size when exporting the camera view (has no effect on the camera view)
Pixel Size is	Displays the pixel size based on the DPI setting
Clip Frame Scale %	Scales the size of the clipping window frame
Left/Right Tilt Angle	Tilts the camera to the left or right, for more accurate perspective matching
Camera Name	Specifies a name for the camera, which can be displayed or hidden in 2D view; move the camera name text control point to adjust the position of the name

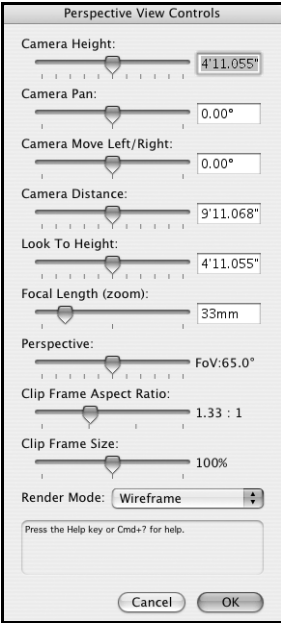
Parameter	Description
Camera Display	<p>Select a camera display mode; the camera name only displays in 2D</p> <ul style="list-style-type: none"><li>• None: Hides the camera in 2D and 3D views, and hides the camera name</li><li>• 2D: Displays the camera in 2D view, but hides the camera name, and hides the camera in a 3D view</li><li>• 3D: Displays the camera’s perspective clipping window bounding box in 2D view, displays the camera in 3D view, and hides the camera name</li><li>• 2D + 3D: Shows the camera in 2D and 3D views, but hides the camera name</li><li>• 2D + Name: Shows the camera and camera name in 2D view, but hides the camera in 3D views</li><li>• 3D + Name: Shows the camera in 3D view, shows the camera name in 2D view, but hides the camera in 2D view (displays a locus instead)</li><li>• 2D + 3D + Name: Shows the camera and camera name in 2D view, and shows the camera in 3D views</li></ul> <p>The 3D camera view displays the bounding box of the camera view, the view line, and the look-to end point. Displaying a camera in a 3D view allows it to be easily selected during design development, and it can be hidden later for final presentation</p>
Auto Update 3D View	<p>When selected, automatically updates the 3D camera view with every parameter change; for complex models, deselect when making several parameter changes, and then either re-select <b>Auto Update 3D View</b> or click <b>Display Camera View</b> to update the camera view with any parameter changes</p>

Adjusting the Camera View

The camera view settings can be fine tuned in real-time, and the display attributes specified.

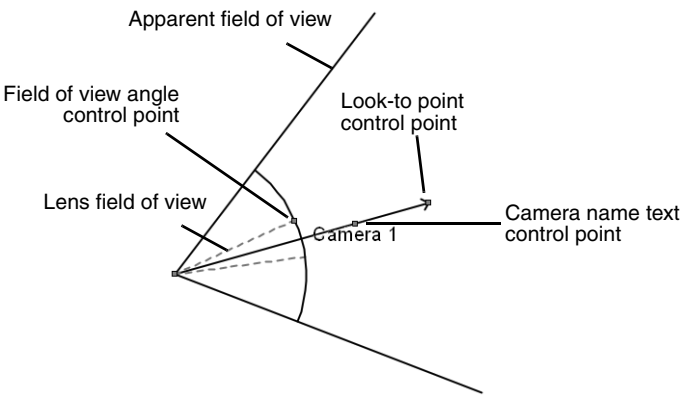
To adjust the camera view:

1. Click **Fine Tune Camera View** from the Object Info palette of a selected camera object.  
The Perspective View Controls dialog box opens. Either use the sliders or enter values to adjust the camera settings; changes are reflected automatically in the drawing.  
*For **Camera Height**, **Look To Height**, and **Camera Distance**, the slider range is proportional to the displayed value. To expand the slider range, enter a larger value.*



Parameter	Description
Camera Height	Moves the camera vertically
Camera Pan	Pans the camera, rotating it about its axis within a +/- 20 degree range, as if it were on a tripod
Camera Move Left/Right	Rotates the camera about the look-to point, within a +/- 20 degree range
Camera Distance	Moves the camera towards or away from the look-to point
Look To Height	Sets the height of the look-to point, which effectively tilts the camera vertically
Focal Length (zoom)	Acts like a zoom lens; sets the lens focal length, from 10 to 200 mm and changes the field of view angle
Perspective	Increases or decreases the perspective effect, making the perspective lines vanish more or less steeply about the look-to point; works most effectively when the look-to point is at the center of the scene or object being viewed
Clip Frame Aspect Ratio	Sets the aspect of the perspective clipping window; use in conjunction with the <b>Clip Frame Size</b> to obtain the desired window size
Clip Frame Size	Sets the scale of the perspective clipping window; use in conjunction with the <b>Clip Frame Aspect Ratio</b> to obtain the desired window size
Render Mode	Selects a render mode for the 3D camera view

2. A camera object can be copied to insert additional camera views. In addition, the 2D camera display attributes can be set by fill and pen foreground and background colors in the Attributes palette. Control points adjust the field of view angle, the look-to point, and the camera name location.



Fill/Pen Color Attribute	Parameter
Fill foreground	Sets the field of view angle color when the camera height is higher than the look-to height
Fill background	Sets the text color for the camera name
Pen foreground	Sets the color of the view line connecting the camera to the look-to point, as well as the color of the 3D camera representation
Pen background	Sets the color of the angle of view lines

The divergence between the apparent field of view angle and the lens field of view angle increases as the difference between the camera and look-to heights increases. When the camera and look-to heights are equal, the lens field of view angle line (dashed gray line by default) is not visible.

## Fit to Objects

The **Fit to Objects** command provides an easy way to zoom in and out of a drawing. There are two options: fit the window around all the objects in the drawing, or fit the window around a particular object or set of objects.

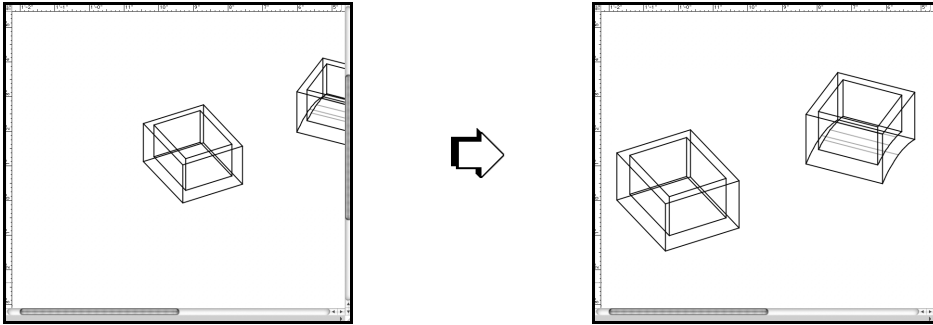


To fit the drawing window around all visible objects in the drawing:

1. Ensure that the current layer contains the object(s) to view, and that no objects are selected.
2. Select **View > Zoom > Fit to Objects**. Alternatively, click the **Fit to Objects** button on the View bar.

VectorWorks zooms in or out so that all the objects in the drawing display in the drawing area.

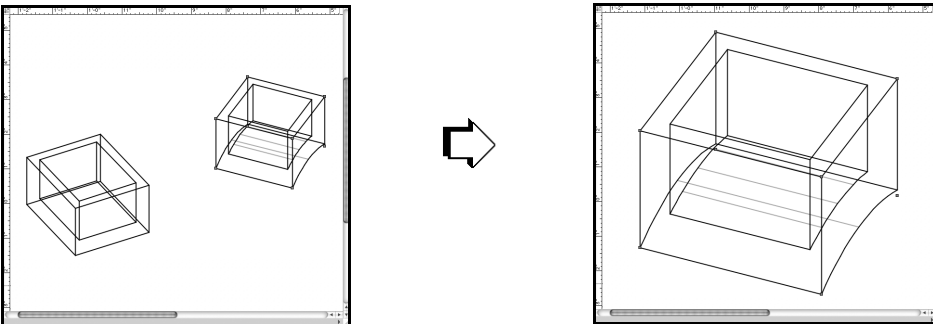




To fit the view to a particular object or set of objects:

1. Ensure that the current layer contains the object(s) to view.
2. Select the object or objects to view.
3. Select **View > Zoom > Fit to Objects**. Alternatively, click the **Fit to Objects** button on the View bar.

VectorWorks zooms in to display only the selected object(s) in the drawing area.



## Fit to Page Area

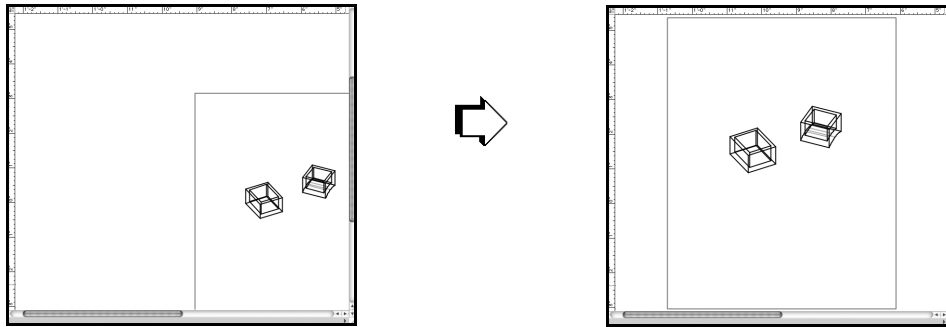
The **Fit to Page Area** command displays the entire print area in the drawing window. For a single page drawing, this command displays the entire page. For a drawing with two or more pages, all of the pages display at one time.



To fit the print area in the window:

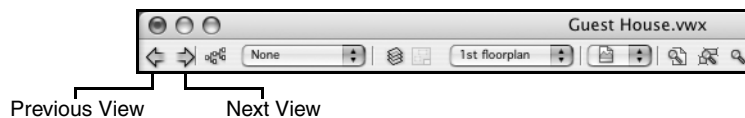
Select **View > Zoom > Fit to Page Area**. Alternatively, click the **Fit to Page Area** button on the View bar.

VectorWorks zooms in or out to display all pages in the print area.



## Viewing History

VectorWorks automatically records a history of the last ten changes in drawing view, including projection, perspective and zoom changes. Click the **Previous View** and **Next View** buttons on the View bar to move through the change history stack.



On a Windows system with a five-button mouse, buttons 4 and 5 on the mouse (which invoke the Back and Forward commands in web browsers) invoke Previous View and Next View, respectively.

## Adding Light

Once one or more light sources have been added to the drawing, it can be rendered to mimic the effect of light on the drawing surfaces.

Default lighting is automatically added to a drawing for basic visibility of rendered objects. The default lighting is fixed to the “camera” so that it always lights an object appropriately. However, rendering a complex scene usually requires the addition of light sources.

Light added to a VectorWorks drawing can be ambient or diffused. Ambient light affects all surfaces equally. Diffused lighting affects surfaces differently depending on the angle of the light source and position of the surfaces.

## Ambient Light and Sunlight

### Setting Lighting Options

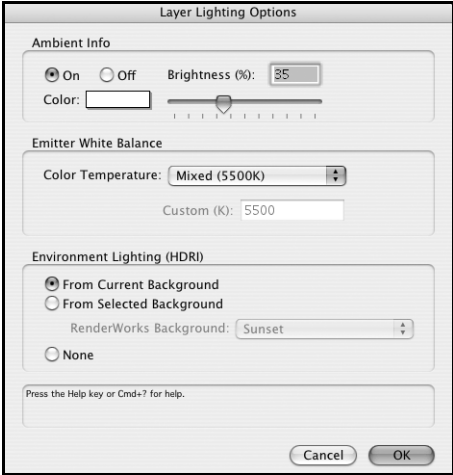
The **Set Layer Lighting Options** command specifies the ambient light brightness and default color for the current layer. By default, the ambient light parameters are set to **On**, with a **Color** of white, and a **Brightness** of 35%. When RenderWorks is installed, this command also sets the white balance for any light sources with a color temperature, and specifies environment background lighting parameters when a RenderWorks HDRI background resource has been added to the drawing (see “Creating HDRI Backgrounds” on page 658).

The ambient light of a selected viewport can be edited by clicking **Lighting Options** from the Object Info palette (see “Viewport Parameters” on page 614).

To set ambient light:

- 1. Switch to the layer where the desired ambient light settings are to be set.
- 2. Select **View > Lighting > Set Layer Lighting Options**.

The Layer Lighting Options dialog box opens. Set the ambient light for the layer. The white balance setting can be adjusted for light sources in the layer with a color temperature specified (RenderWorks required). For a chart of common color temperature ranges, see “Correlated Color Temperature” on page 732.



Parameter	Description
Ambient Info	
On/Off	Activates or deactivates the ambient light settings for the layer
Brightness	Specifies the ambient light brightness; enter a percentage or drag the slider bar
Color	Specifies a default color associated with the ambient light; click the color box to select the color
Emitter White Balance (RenderWorks required)	
Color Temperature	Select a color temperature that will be balanced to appear white. Lower temperatures, which might otherwise have an orange cast, or higher temperatures, which might otherwise appear with a blue tint, are adjusted to appear white. Select <b>Custom</b> to specify a temperature to be white balanced.
Custom (K)	If a Custom <b>Color Temperature</b> is specified, enter the temperature in Kelvin
Environment Lighting (HDRI) (RenderWorks required)	When an HDRI layer background has been selected for the layer or viewport, specifies how to control its lighting contribution to the rendering (see “Creating HDRI Backgrounds” on page 658)
From Current Background	Uses the image environment background set for the layer as both a background and a light source

Parameter	Description
From Selected Background	Lights the model with the colors from the HDRI background selected here
None	Uses the image environment background set for the layer or viewport as a background only. The background does not contribute to lighting.

3. Click **OK**.

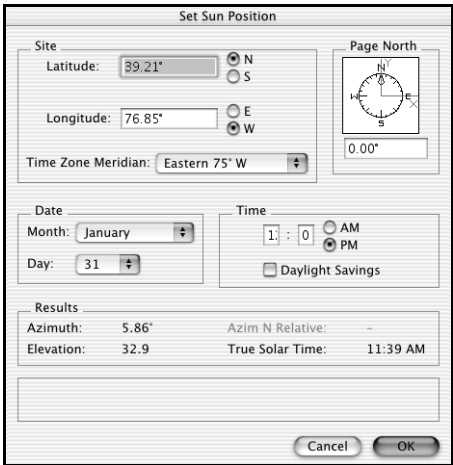
Adding Sunlight

Sunlight in VectorWorks is created by projecting parallel rays from a directional light.

To set the sun position:

- 1. Select **View > Lighting > Set Sun Position**.

The Set Sun Position dialog box opens. Enter the sun position information.



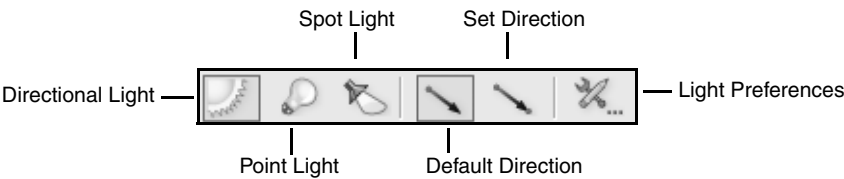
Parameter	Description
Site	Specifies the site's latitude and longitude
Time Zone Meridian	Specifies the site's time zone; one hour of difference is equal to 15° of longitude
Page North	Normally, the drawing is oriented to page north (true north, not magnetic north), and no compensation is required; if the drawing was not created with this orientation, specify an angular offset in degrees from page north
Date	Specifies the time of year
Time	Specifies the time of day
Daylight Savings	Select if Daylight Saving time is in effect
Results	Based on the settings made, displays the <b>Azimuth</b> (South at zero degrees, without Page North rotation), <b>Azimuth N. Relative</b> (North at zero degrees, without Page North rotation), <b>Elevation</b> (degrees above the horizon), and <b>True Solar Time</b> (takes into account daylight savings time, site longitude and time zone, and the earth's orbit and tilt)

- 2. Click **OK** and verify the results. If a directional light was selected before choosing the **Set Sun Position** command, the command modifies the angles of light to the new azimuth and elevation. If no light was selected, the tool inserts a new directional light at the specified sun position.




A shadow analysis can be performed for a site by inserting several light sources with identical parameters except for time of day. RenderWorks must be installed to conduct a shadow analysis.

## Adding Light Sources

The **Light** tool places light sources in the drawing. Select the type of light and specify the light preferences from the Tool bar.



When RenderWorks is installed, additional parameters and light source types are available. These additions are described in this section and in “Advanced RenderWorks Lighting” on page 679.

Mode	Description
Directional Light 	Projects light with parallel rays, like the sun
Point Light 	Radiates light in all directions, like a bare light bulb
Spot Light 	Projects light in a specific direction, aimed at a specific object, like a flashlight or conventional spotlight
Default Direction	For directional lights, click to specify the light position
Set Direction	For directional lights, click to set the light direction, and then click to specify the light position
Light Preferences	Sets the preferred light parameters

## Adding a Light Source

Adding a light source to a drawing hides the default lighting scheme that is automatically present for basic rendering purposes.



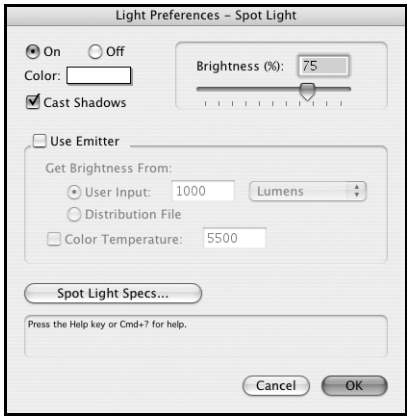
To add a light source:

1. Click the **Light** tool from the Visualization tool set.

From the Tool bar, select the type of light source to insert (directional light, point light, or spot light). If inserting a directional light, select the light placement method (Default Direction or Set Direction).

- 2. Click the **Light Preferences** Tool bar button to specify the light source preferences for this session. Depending on the light source selected, different parameters are available. In addition, certain parameters are only available when RenderWorks is installed.

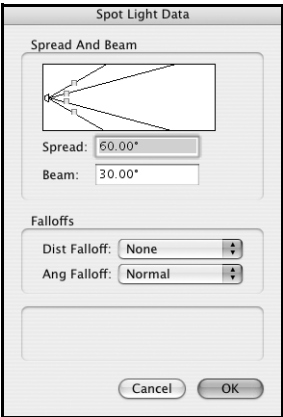
The Light Preferences dialog box opens.



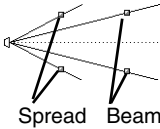
Parameter	Description
On/Off	Shows or hides the light produced by the light source
Color	Specifies a color associated with the light source; click the color box to select the color. This parameter is not available if <b>Use Emitter</b> is selected and a <b>Color Temperature</b> is specified (RenderWorks required).
Cast Shadows (RenderWorks required)	Select to create shadows
Brightness	Specifies the light source brightness; enter a percentage or drag the slider bar. A value over 100% can be entered. This parameter is not available if <b>Use Emitter</b> is selected (RenderWorks required).
<b>Use Emitter</b> (RenderWorks required)	For accuracy, specifies the light's actual brightness and color temperature; leave deselected to use the light as a simple light source
Get Brightness From (RenderWorks required)	Specifies the luminous quantity of a light
User Input (RenderWorks required)	Specifies the brightness as an accurate number in Lux, Lumens, Footcandles, or Candelas; the units vary depending on the light source
Distribution File (RenderWorks required)	Does not apply to directional, point, or spot lights (see "Advanced RenderWorks Lighting" on page 679)

Parameter	Description
Color Temperature (RenderWorks required)	<p>Specifies the light color temperature in Kelvin. This refers to an ideal black body emitter, glowing “red hot” or “white hot.” A lower temperature generates an orange color; the hotter the temperature, the closer to white the color of the light is.</p> <p>Specifying this parameter is optional. If not specified, the default temperature is 0, meaning that the final emission color for the light is entirely controlled by the selection in <b>Color</b>.</p> <p>When the temperature is specified, <b>Color</b> cannot be changed. The final emission color is set by the <b>Color Temperature</b>.</p> <p>Color temperature settings can be white-balanced on a per-layer basis; see “Setting Lighting Options” on page 420.</p>
Directional, Spot, or Point Light Specs	Click to set additional specifications for the light source

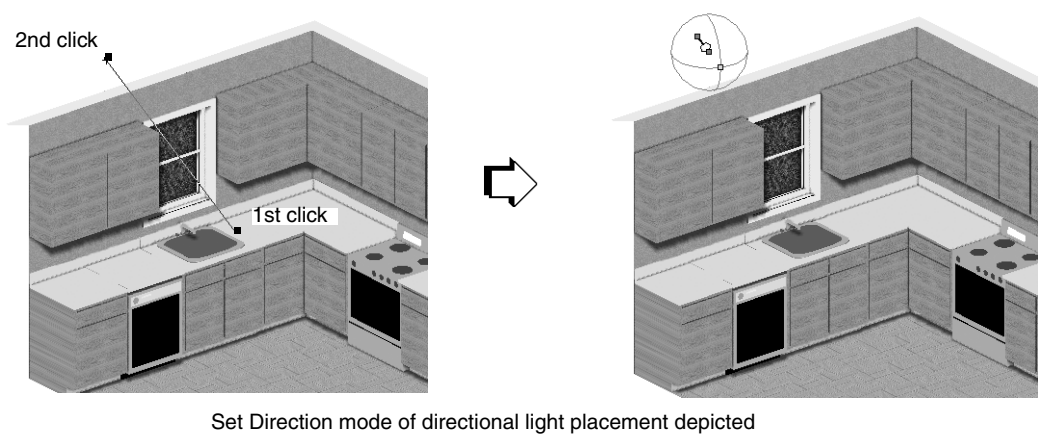
3. Click **Directional Light Specs**, **Spot Light Specs**, or **Point Light Specs**, for the selected light source type, to specify additional parameters.



Parameter	Description
Directional Light	
Direction	Specifies the light’s direction by either specifying the light angle or vector
Angle	Sets the light’s angle by azimuth and elevation. The azimuth angle is set based on an angle of 0 degrees at the negative Y axis, and is positive in a counter-clockwise direction; the elevation angle is the angle above (positive) or below (negative) the horizon.
Vector	Indicates the direction of the light by specifying the coordinates of its X, Y, and Z delta vectors
Point Light	
Dist Falloff	Select the distance falloff function (rate of intensity change while moving along the beam away from the light source)

Parameter	Description
Spot Lights	
Spread/Beam diagram	Drag the handles on the diagram to set the spot light <b>Spread</b> and <b>Beam</b> angles, or enter the values in the fields below the diagram 
Spread	Specifies the spread angle of the spot light (light cone's maximum angle)
Beam	Specifies the beam angle of the spot light (cone of light that does not change intensity up to the spread angle, after which the angle falloff determines its intensity)
Falloffs	Specify the distance and angle falloff function
Dist Falloff	Select the distance falloff function (rate of intensity change while moving along the beam away from the light source)
Ang Falloff	Select the angle falloff function (specifies the rate of intensity change between the beam and the spread)

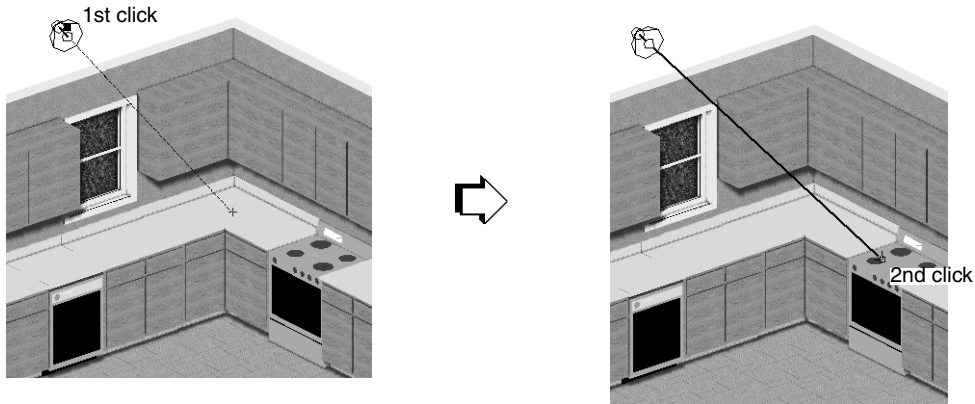
- 4. Click **OK** to return to the Light Preferences dialog box. Click **OK** to return to the drawing.
  - 5. Click to place a light object with the parameters specified in the Light Preferences dialog box.
- If placing a directional light, click to specify the light position in Default Direction mode. In Set Direction mode, click once to specify the light target or direction, and then click a second time to specify the light position.



If placing a spot light, click to place the light, and then drag to specify the light direction and target. The spot light can be aimed at any object. Click again to set the spot light. The target Z height can be adjusted precisely with the **Look To Height** parameter of the Object Info palette.

The spot light target handle and projection line only display when the spot light is selected. Use the **2D/3D Selection** tools to move the light. The target handle aims the spot light and can be adjusted with the **3D Selection** tool once the spot light has been created. Use the **3D Reshape** tool to move the target handle constrained about an axis selected in the Tool bar.





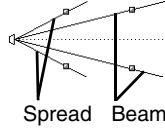

## Light Source Properties



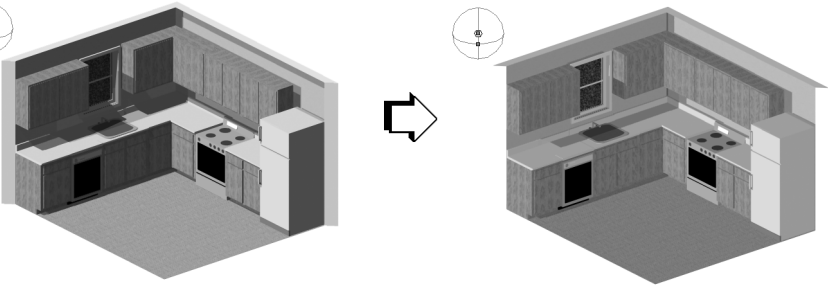

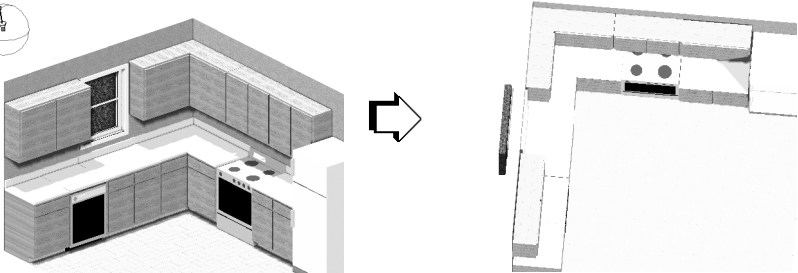
Light source parameters are displayed and can be modified in the Object Info palette. The parameters available depend on the type of light source.

Some of the parameters are only available when RenderWorks is installed; see “Advanced RenderWorks Lighting” on page 679 for information on the light types available in RenderWorks.

Parameter	Description
Kind	Indicates the type of light source; change to a different type by selecting a different kind from the displayed list  A custom, area, or line light requires RenderWorks.
On/Off	Shows or hides the light produced by the light source; this setting can also be accessed from the light context menu
Auto Update	Automatically renders the drawing when rendering-related parameters change
Update	When <b>Auto Update</b> is deselected, click to render the drawing when rendering-related parameters change
Cast Shadows (RenderWorks required)	Select to create shadows
Lit Fog (RenderWorks required)	Creates a special volumetric lighting effect for the light source when used in combination with the Lit Fog RenderWorks background weather effect (see “Creating Weather Effects” on page 660)
Use Emitter (RenderWorks required)	For accuracy, specifies the light’s actual brightness and color temperature; leave deselected to use the light as a simple light source. Required for a custom, area, or line light.
Brightness	Specifies the light source brightness; enter a percentage or drag the slider bar. A value over 100% can be entered. This parameter is not available for custom, area, and line lights, or if <b>Use Emitter</b> is selected (RenderWorks required).

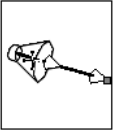
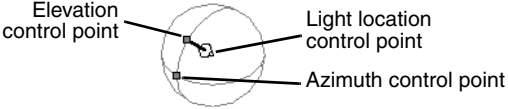

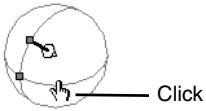
Parameter	Description
Brightness From (RenderWorks required)	Specifies the location of the light intensity data for a custom, line, or area light (either user input or distribution file); the distribution file can be specified by clicking <b>Load Distribution</b>
Brightness Value (RenderWorks required)	Specifies the brightness as an accurate number
Brightness Unit (RenderWorks required)	Select Lux, Lumens, Footcandles, or Candelas for the unit of Brightness; the available units depend on the light type
Dimmer (RenderWorks required)	Dims the light source brightness (intensity); enter a percentage or drag the slider bar. Only the brightness of the light source is affected; the color temperature is not changed.
Light Rotation Angle (RenderWorks required)	Specifies the rotation angle of a custom light source around an axis connecting the light location to the light target; this angle defines the plane for the intensity distribution curve, and is displayed in red on the custom light object
Use Distribution File (RenderWorks required)	Specifies whether to use the attached emission profile data file for the area or line light intensity information; distribution data is required for a custom light
Distribution File (RenderWorks required)	Displays the distribution file name when a valid distribution file has been selected, or “None” if a valid distribution file has not been designated (click <b>Load Distribution</b> to specify a file)
Load Distribution (RenderWorks required)	For a custom, area, or line light, loads light emission profile data from a standard file. The brightness value is obtained using the integral of the raw emission data provided with the file. The file must be a text file with industry standard intensity distribution data in CIE, IESNA, CIBSE, or EULUMADAT format (.ies, .cib, .cie, and .ldt).
Color Temperature (RenderWorks required)	<p>Specifies the light color temperature in Kelvin. This refers to an ideal black body emitter, glowing “red hot” or “white hot.” A lower temperature generates an orange color; the hotter the temperature, the closer to white the color of the light is (see “Correlated Color Temperature” on page 732 for typical light source color temperature ranges).</p> <p>Specifying this parameter is optional. If not specified, the default temperature is 0, meaning that the final emission color for the light is entirely controlled by the selection in <b>Color</b>.</p> <p>When the temperature is specified, <b>Color</b> cannot be changed. The final emission color is set by the <b>Color Temperature</b>.</p> <p>Color temperature settings can be white-balanced on a per-layer basis; see “Setting Lighting Options” on page 420.</p>
Color	Specifies a color associated with the light source; click the color box to select the color. This parameter is not available if <b>Use Emitter</b> is selected and a <b>Color Temperature</b> is specified (RenderWorks required).

Parameter	Description
Color Filtering (RenderWorks required)	For area lights, filters the color of the light emanating from the area light object by the color or texture of its original geometry
Dist Fall	Indicates the distance falloff function for a point, spot, custom, area, or line light (specifies the rate of intensity change while moving along the beam away from the light source)
Quality (RenderWorks required)	For area and line lights, specifies the sampling quality of the light; select From Render Mode to use the setting specified in <b>Area/Line Light Quality</b> in the rendering options
Render Geometry (RenderWorks required)	For area and line lights, renders the light object geometry
Show Direction (RenderWorks required)	For area lights, shows the light direction indicators
Flip Direction (RenderWorks required)	For area lights, flips the direction of the light being emitted
Ang Fall	Select the angle falloff function (rate of intensity change between the beam and the spread)
Spread/Beam diagram	<p>Drag the handles on the diagram to set the spot light <b>Spread</b> and <b>Beam</b> angles, or enter the values in the fields below the diagram</p> 
Spread	Specifies the spread angle of the spot light (light cone's maximum angle)
Beam	Specifies the beam angle of the spot light (cone of light that does not change intensity up to the spread angle, after which the angle falloff determines its intensity)
X/Y/Z or I/J/K	Specifies the location of the light source in relation to the ground plane or working plane
Look To Height	For spot lights, sets the Z height above the ground plane of the spot light target handle
Azimuth	Indicates the azimuth for a directional light (South at zero degrees); enter new values or drag the slider bar to set
Elevation	Indicates the elevation (degrees above the horizon) for a directional light; enter new values or drag the slider bar to set
Pan/Tilt 	Click the top button to display the spot light or custom light beam pan and tilt angles; enter new values or drag the slider bar to set

Parameter	Description
$\pm X/\pm Y/\pm Z$ 	Click the bottom button to display the light beam direction in terms of its X, Y, and Z components
Set Light to View 	Sets the orientation of the directional, spot, or custom light to that of the current view; this function can also be accessed from the light context menu 
Set View to Light 	Sets the orientation of the current view to that of the directional, spot, or custom light; this function can also be accessed from the light context menu 

A symbol that contains a light object can be copied to reproduce identical lights. Change the light intensity for each symbol in the Object Info palette.

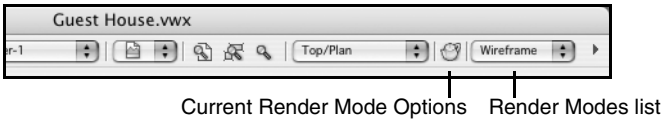
Once a light has been placed on the drawing, the **2D Selection** or **3D Selection** tool can be used to change its location, and, depending on the light type, beam parameters.

Light Type	Beam Parameter	Description
Point, Spot, Directional	Light location	<p>Click on the light with the move cursor and drag it to its new location</p>  <p>The spot light target handle is not locked to its target. The target handle location may need re-adjusting after moving the spot light.</p>
Spot, Directional	Orientation and view	<p>Select the light; in the Object Info palette, click <b>Set Light to View</b> to set the light orientation to the current view orientation, or click <b>Set View to Light</b> to set the orientation of the view to that of the light</p>
Directional	Azimuth and elevation direction	<p>Click on the azimuth or elevation control points to change the directional light parameters. Move the handles with the mouse, or enter the azimuth and elevation values in the Data bar.</p> 
Spot	Target direction	<p>Click on the handle with the <b>3D Selection</b> tool to change the spot light target direction; drag to the new target and click to set</p> 
Directional	Beam direction	<p>Click and drag with the hand cursor to change the beam direction</p> 

## Rendering with VectorWorks

The render modes in VectorWorks translate the drawing in various ways to create an image with additional realistic details. For example, a Hidden Line rendering is similar to the non-rendered (Wireframe) image, but it hides the portion of the objects that would not normally be visible. An OpenGL rendering also has hidden lines, and colors and shading; it also shows how the light sources interact with the object surfaces, and it can show any textures that were applied.

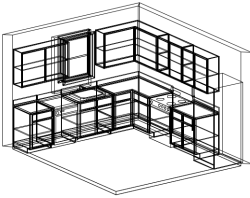
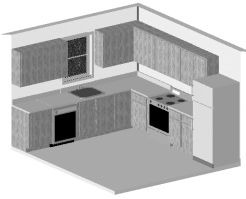
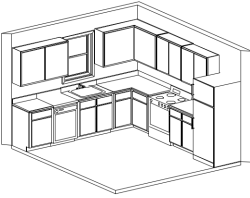
The View bar has a **Render Modes** list for quick access to the rendering commands. In addition, the **Current Render Mode Options** button opens the settings dialog box for the current render mode, if applicable.

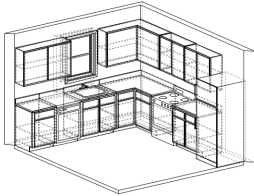
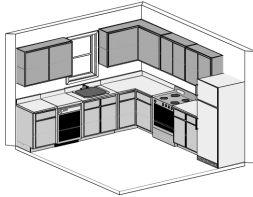
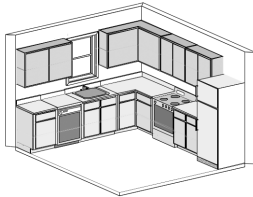
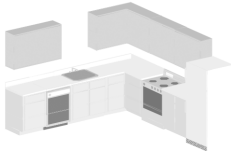
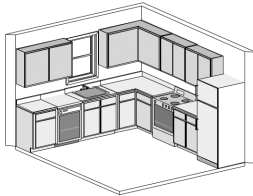


To select a render mode:

Select **View > Rendering**, and then select the desired render mode.

To cancel a render process before it is complete, press **Esc**.

Rendering Command	Description
Wireframe	Nothing is rendered 
OpenGL	Creates a good-quality, detailed rendering, with colors, shading, and textures (optional); see “OpenGL” on page 434 for details 
Hidden Line	Hides the edge lines of objects that are behind other objects, which gives a solid appearance 

Rendering Command	Description
Dashed Hidden Line	<p>Edge lines of objects that are behind other objects display as dashed lines</p> 
Unshaded Polygon	<p>Displays objects as solids, and displays attributes such as colors</p> 
Shaded Polygon	<p>An Unshaded Polygon rendering with shading added</p> 
Shaded Polygon - No Lines	<p>A Shaded Polygon rendering with no edge lines</p> 
Final Shaded Polygon	<p>A Hidden Line rendering on top of a Shaded Polygon - No Lines rendering; edges and curved surfaces are cleaner than those in a Shaded Polygon rendering</p> 

## OpenGL

Use the OpenGL render mode to create good-quality rendering previews that are fast and interactive. (For final-quality output, use RenderWorks; see “Rendering with RenderWorks” on page 679.)

The OpenGL mode performs lighting calculations based on polygons; this means that drawings with more polygons render more realistically. More advanced renderers, such as RenderWorks, calculate the lighting effects for each pixel. This method takes more time, but it produces higher-quality renderings.

VectorWorks has a default lighting scheme, so that a basic rendering does not require an added light source. However, the addition of a light source is usually necessary for a more realistic rendering (see “Adding Light Sources” on page 423). The addition of a light source automatically hides the default lighting scheme, so that the scene is not too bright. OpenGL renders up to eight lights in a drawing; additional lights have no effect.

To get the best performance from OpenGL, use a video card that supports hardware-accelerated OpenGL. There are significant compatibility issues with some cards; see [www.nemetschek.net](http://www.nemetschek.net) for a list of video cards that are compatible with VectorWorks.

VectorWorks 8 files that were rendered in QuickDraw 3D automatically render in OpenGL when they are converted to versions later than VectorWorks 8.

## OpenGL Render Options

Use the OpenGL options to control the level of detail in rendered images, which in turn affects the render speed (less detail renders faster). These settings apply only to the current drawing; they remain in effect in the current drawing until the settings are changed. The current OpenGL settings are saved when you create a template (see “Using Drawing Tablets” on page 78).

To set the OpenGL options:

1. Select **View > Rendering > OpenGL Options**.

The OpenGL Render Settings dialog box opens.



Parameter	Description
Detail	Specifies the level of detail for renderings; a low setting renders faster
Use Textures	Renders object textures; this provides better detail, but it takes longer to render
Use Anti-Aliasing	Filters the rendering and reduces pixellated edges; this option is unavailable if the graphics card does not support the feature



Parameter	Description
Use NURBS	Uses NURBS surfaces instead of polygonal approximation, for renderings with high quality, smooth curved surfaces; to smooth mesh objects, enable mesh smoothing in the document preferences (see “Display Preferences” on page 48)
Draw Edges	Renders objects with lines drawn around the edges, similar to the lines in the Hidden Line render mode
Use Shadows (RenderWorks required)	Objects in the drawing cast shadows on other objects (but not on the ground plane)
On Ground Only (RenderWorks required)	If <b>Use Shadows</b> is selected, select this option to have objects in the drawing cast shadows on a plane at the lowest point in the drawing — which is usually the ground plane — but not on other objects
Softness (RenderWorks required)	If <b>Use Shadows</b> is selected, select the level of softness for the shadow edges (a low setting uses less memory and renders faster)

2. Select the OpenGL render options, and click **OK** to change the settings for the file.

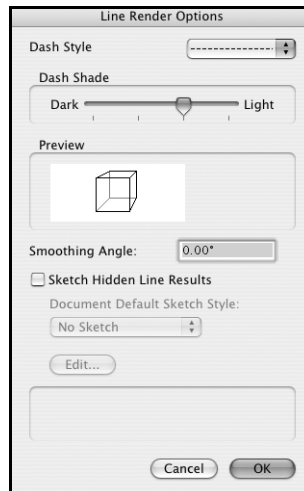
## Line Render Options

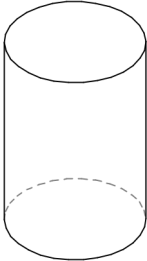

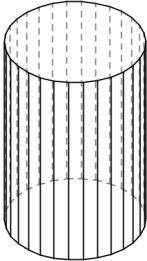
Use the line render options to control the style and shade of dashed lines for Dashed Hidden Line mode. Other options set the number of facet lines for the Hidden Line, Dashed Hidden Line, and Final Shaded Polygon modes. These settings apply only to the current drawing; they remain in effect in the current drawing until the settings are changed. The current line render settings are saved when you create a template (see “Using Drawing Tablets” on page 78).

To set line rendering options:

1. Select **View > Rendering > Line Render Options**.

The Line Render Options dialog box opens.



Parameter	Description
Dash Style	Select the dash style for hidden lines when the Dashed Hidden Line mode is selected
Dash Shade	Adjust the slider to select how hidden lines are shaded when the Dashed Hidden Line mode is selected
Preview	Displays a preview of the selected parameters
Smoothing Angle	<p>Sets the angle to reduce facet lines when the Hidden Line, Dashed Hidden Line, or Final Shaded Polygon mode is selected; if the value is greater than zero, facet lines will be removed between any two faces of an object that are within that angle of each other</p> <div></div> <p>A Dashed Hidden Line rendering with the <b>Smoothing Angle</b> set to 0</p> <p>A Dashed Hidden Line rendering with the <b>Smoothing Angle</b> set to 15</p>
Sketch Hidden Line Results (Design Series required)	Specifies whether to apply sketch effects to lines when the Hidden Line, Dashed Hidden Line, or Final Shaded Polygon mode is selected; see “Sketch Rendering” on page 584 in the VectorWorks Design Series User’s Guide
Document Default Sketch Style (Design Series required)	Sets the default sketch style for lines when the Hidden Line, Dashed Hidden Line, or Final Shaded Polygon mode is selected; see “Setting the Default Sketch Style” on page 584 in the VectorWorks Design Series User’s Guide. Click <b>Edit</b> to open the Sketch Style Editor dialog box for additional sketch style modification.

2. Select the line render options, and click **OK** to change the settings for the file.

# Dimensioning and Annotating

VectorWorks provides automated tools for dimensioning, measuring distance, and annotating drawings.

## Dimensioning

Use VectorWorks' dimensioning tools to measure distances, angles, 2D and 3D object dimensions, and also add dimensioning lines with the measurements to the drawing.

VectorWorks uses the dimension standard set in document preferences when creating new dimensions (see "Dimension Preferences" on page 49). The preferences can specify any of the built-in dimension standards, or a custom standard specifically created for the drawing.

## Using Custom Dimension Standards

Custom dimension standards can be created in the current file or imported from another drawing file.

### Creating a Custom Dimension Standard

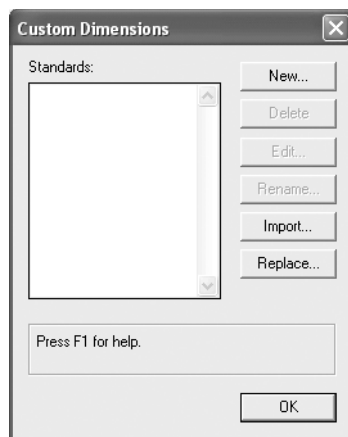
To create a custom dimension standard:

1. Select **File > Document Settings > Document Preferences**.

The Document Preferences dialog box opens.

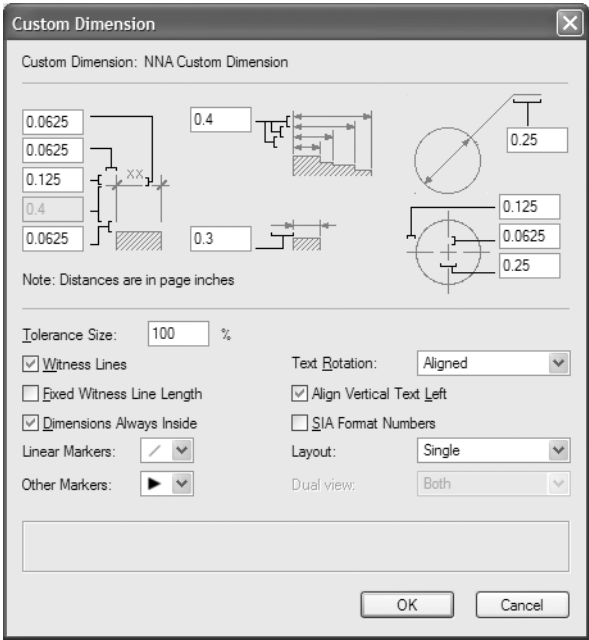
2. Click the Dimensions tab.
3. Click **Custom**.

The Custom Dimensions dialog box opens.



4. Click **New**.
5. Enter a name for this dimension standard and click **OK**.
6. Select the new dimension from the Standards list and click **Edit**.

The Custom Dimension dialog box opens. Enter the desired values for the display of dimensions, and then click **OK**.



Parameter	Description
Dimension line distances	Specifies the dimension line distances for linear, radial, and ordinate dimensions
Note: Distances are in	Displays the drawing units currently in use for the file
Tolerance Size	Sets the size of the tolerance in relation to the dimension text
Witness Lines	Applies witness lines to dimensions; when deselected, witness lines are hidden
Fixed Witness Line Length	Allows the setting of a fixed length for witness lines
Dimensions Always Inside	Sets dimension values to always display between the witness lines
Linear Markers	Select the marker attributes for use with linear dimension markers (see “Setting Default Marker Types” on page 60).
Other Markers	Select the marker attributes for use with other dimension markers (see “Setting Default Marker Types” on page 60).
Text Rotation	Sets how text is handled when a dimension is rotated; text can be horizontal, aligned, or horizontal/vertical
Align Vertical Text Left	When a dimension is placed vertically, keeps the text to the left of the dimension line
SIA Format Numbers	Sets all numbers to use the SIA format; not available when a dual layout is selected
Layout	Sets whether dimensions display as single values, dual - side by side, or dual - stacked
Dual view	If a dual layout is selected, specify whether both dimensions are shown, primary only, or secondary only

7. Select the new standard from the Dimension Standards list, and then click **OK**.

## Editing a Custom Dimension Standard

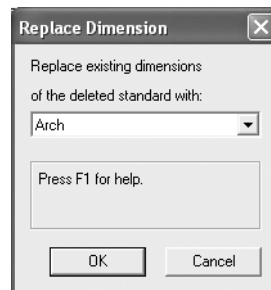
To edit a custom dimension standard:

1. Select **File > Document Settings > Document Preferences**.  
The Document Preferences dialog box opens.
2. Click the Dimensions tab.
3. Click **Custom**.  
The Custom Dimensions dialog box opens; select the custom standard to edit.
4. Click **Edit**.  
The Custom Dimension dialog box opens.
5. Enter desired edits and click **OK**.

## Deleting a Custom Dimension Standard

To delete a custom dimension standard:

1. Select **File > Document Settings > Document Preferences**.  
The Document Preferences dialog box opens.
2. Click the Dimensions tab.
3. Click **Custom**.  
The Custom Dimensions dialog box opens; select the custom standard to delete.
4. Click **Delete**.  
The Replace Dimension dialog box opens.



5. Select a new standard to use for existing dimensions in the drawing file, and then click **OK**.

## Renaming a Custom Dimension Standard

To rename a custom dimension standard:

1. Select **File > Document Settings > Document Preferences**.  
The Document Preferences dialog box opens.
2. Click the Dimensions tab.
3. Click **Custom**.

The Custom Dimensions dialog box opens; select the custom standard to rename.

4. Click **Rename**.

The Assign Name dialog box opens.

5. Enter a new name for this dimension standard and click **OK**.

## Importing a Custom Dimension Standard

To import a custom dimension standard:

1. Select **File > Document Settings > Document Preferences**.

The Document Preferences dialog box opens.

2. Click the Dimensions tab.

3. Click **Custom**.

The Custom Dimensions dialog box opens.

4. Click **Import**.

The standard Open dialog box displays.

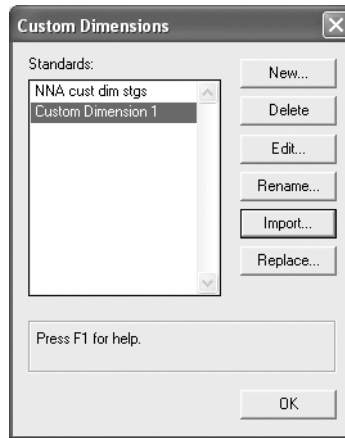
5. Select the file from which the dimension standard will be imported and click **Open**.

The Select Item dialog box opens.



6. Select the dimension standard to import and click **OK**.

The imported dimension displays in the Custom Dimensions dialog box for the current drawing file.



## Replacing a Dimension Standard

Replace any default or custom dimension standard with another default or custom dimension standard.

To replace a dimension standard:

1. Select **File > Document Settings > Document Preferences**.

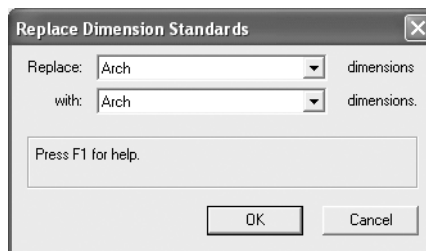
The Document Preferences dialog box opens.

2. Click the Dimensions tab.
3. Click **Custom**.

The Custom Dimensions dialog box opens; select the standard to replace.

4. Click **Replace**.

The Replace Dimension Standards dialog box opens.

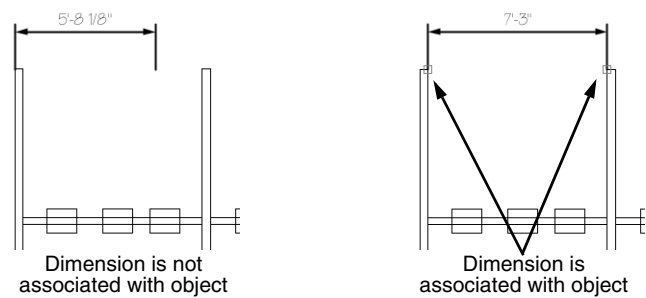


5. Select the dimension standard to be replaced in the **Replace** list and select the desired dimension standard in the **with** list. Click **OK**.

The new dimension standard replaces dimensions created with the previous standards, and is used for any newly dimensioned objects.

## Associative Dimensioning

In document preferences, the **Associate dimensions** field is selected by default, allowing dimensions to be associated with objects, including walls and wall components. The dimension must be applied between two vertex points for the dimension to be associated.



Appearing on the drawing as a parametric constraint, the association of a dimension can be deleted through the Edit Constraints dialog box (**Modify > Edit Constraints**); if the dimension is resized, the association is lost. This is also true if the dimension is relocated, but not the object to which it is associated.

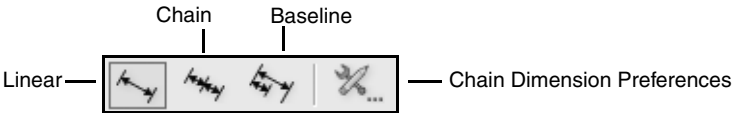
Associative dimensions can exist across layers of the same scale. To apply an associative dimension across layers, Layer Options must be set to **Show/Snap/Modify Others** and both layers must be in a **Top/Plan** standard view. Associative dimensions can be created on viewports in annotation edit mode (see “Creating Annotations for Sheet Layer Viewports” on page 621).

Dimensions can be auto-associated; see “Dimension Preferences” on page 49.

If associative dimensioning is not used, dimensions cannot be associated with objects after they are placed (except for chain dimensions).  
Changing the length of a linear associative dimension in the Object Info palette breaks the association of a dimension. When using associative dimensions across layers, changing the scale of a layer breaks the association.

## Unconstrained-Line Dimensioning

The **Unconstrained Dimension** tool can draw dimension lines at any angle. Along with measuring and dimensioning an object, use this tool to calculate the distance between two or more points in the drawing area.



Mode	Description
Linear	Creates a dimension line with a single measurement
Chain	Creates a continuous chain of dimension lines
Baseline	Creates a series of connected dimension lines, starting from an initial base point
Chain Dimension Preferences	For Chain mode, specifies whether dimensions are created as a single chain object, or as individual dimension objects

The linear dimension text can be moved along the dimension line. See “Modifying Dimensions” on page 454.



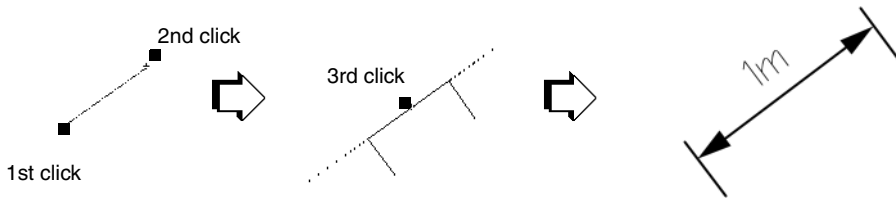
## Unconstrained Linear Dimension

The Unconstrained Linear mode creates a dimension line with a single measurement.



To create a dimension line with a single measurement:

1. Click the **Unconstrained Dimension** tool from the Dims/Notes tool set, and select **Unconstrained Linear** mode.
2. Click to set the measurement start point.
3. Click to end the measurement.
4. Move the cursor away from the object and click to place the dimension line.  
This specifies how far the dimension line is offset from the measured object.
5. Double-click to exit the dimensioning tool.



## Unconstrained Chain Dimension

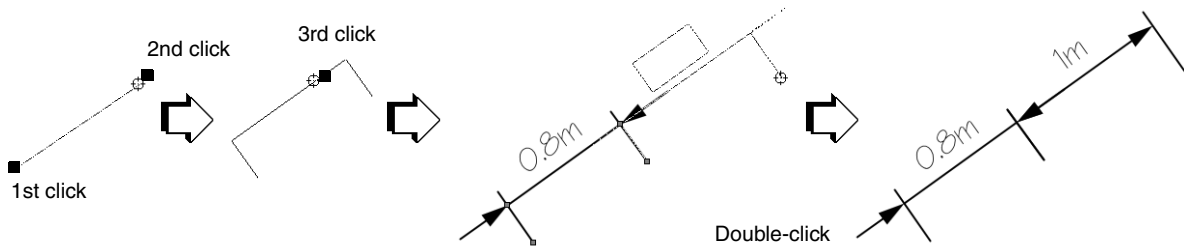
Unconstrained Chain mode creates a series of connected dimension lines, with each line segment displaying its specific measurements. Use the Chain Dimension preferences option on the Tool bar to set whether to create multiple dimension objects or a single chain object.

When dimensions are part of a chain object, they can all be moved at once, and their attributes and properties can be changed as a group. The properties of dimensions in a chain object also can be edited individually. When dimensions in the chain are modified, the other dimensions adjust automatically. See “Modifying Dimensions” on page 454 for more information about editing chain objects.



To create a chain of connected dimension lines:

1. Click the **Unconstrained Dimension** tool from the Dims/Notes tool set, and select **Unconstrained Chain** mode.
2. Select Chain Dimension Preferences from the Tool bar.
3. Select either to **Use Chain Dimension Objects** or to **Use Individual Dimensions**, and click **OK**.
4. Click to set the measurement start point.
5. Click to end the measurement of the first segment.
6. Move the cursor away from the line and click to place the dimension line.  
This specifies where to draw the dimension line and place the measurements.
7. Move the cursor to the end of the next segment and click to set its endpoint.
8. Continue setting segments.
9. Double-click to end the chain.



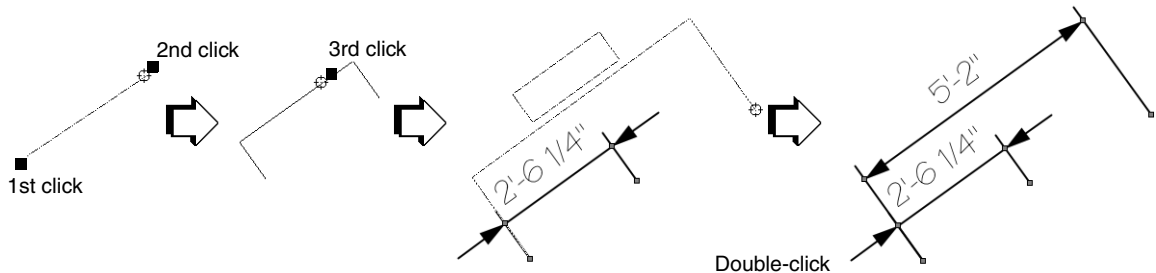
## Unconstrained Baseline Dimension

Unconstrained Baseline mode creates a series of connected dimension lines, with each line segment measuring the distance from the initial starting point (the base point).



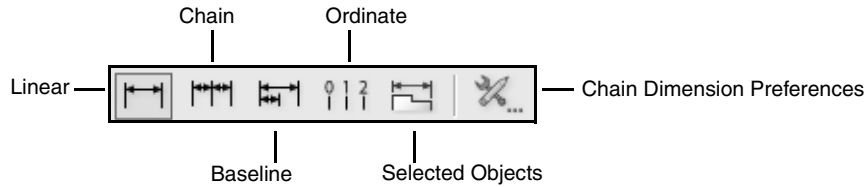
To create a series of baseline dimension lines:

1. Click the **Unconstrained Dimension** tool from the Dims/Notes tool set, and select **Unconstrained Baseline** mode.
2. Click to set the measurement start point.
3. Click to end the measurement of the first segment.
4. Move the cursor away from the line and click to place the dimension line.  
This specifies where to draw the dimension line and place the measurements.
5. Move the cursor to the end of the next segment and click to set its endpoint.
6. Continue setting segments.
7. Double-click to end the baseline.



## Constrained-Line Dimensioning

The **Constrained-Line Dimensioning** tool draws dimension lines that are constrained horizontally or vertically. Along with measuring and dimensioning an object, use this tool to calculate the horizontal or vertical distance between two or more points in the drawing.



Mode	Description
Linear	Creates a constrained dimension line with a single measurement
Chain	Creates a continuous chain of constrained dimension lines
Baseline	Creates a series of connected constrained dimension lines, starting from an initial base point
Ordinate	Creates a series of constrained ordinate dimensions, starting from an initial base point
Selected Objects	Creates a constrained dimension line for the greatest span of a selected object or group of objects
Chain Dimension Preferences	For Chain mode, specifies whether dimensions are created as a single chain object, or as individual dimension objects

The dimension text can be moved along the dimension line. See “Modifying Dimensions” on page 454.

## Constrained Linear Dimension

The Constrained Linear mode creates a constrained dimension line with a single measurement.

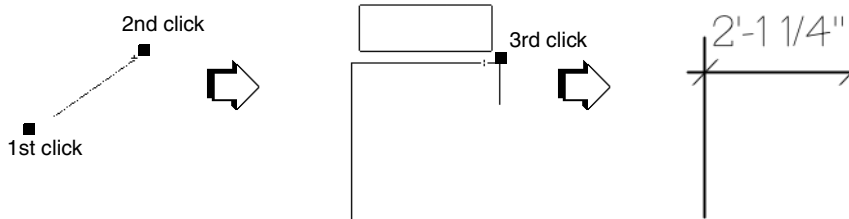


To create a constrained dimension line with a single measurement:

1. Click the **Constrained-Line Dimensioning** tool from the Dims/Notes tool set, and select **Constrained Linear** mode.
2. Click to set the measurement start point.
3. Click to set the end of the measurement.
4. Move the cursor away from the object.

This specifies how far the dimension line is offset from the measured object. The dimension preview snaps to a horizontal or vertical orientation.

5. Click to place the dimension line.
6. Double-click to exit the dimensioning tool.



## Constrained Chain Dimension

The Constrained Chain mode creates a series of constrained, connected dimension lines, with each line segment displaying its specific measurements. Use the Chain Dimension preferences option on the Tool bar to set whether to create multiple dimension objects or a single chain object.

When dimensions are part of a chain object, they can all be moved at once, and their attributes and properties can be changed as a group. The properties of dimensions in a chain object also can be edited individually. When dimensions in the chain are modified, the other dimensions adjust automatically. See “Modifying Dimensions” on page 454 for more information about editing chain objects.

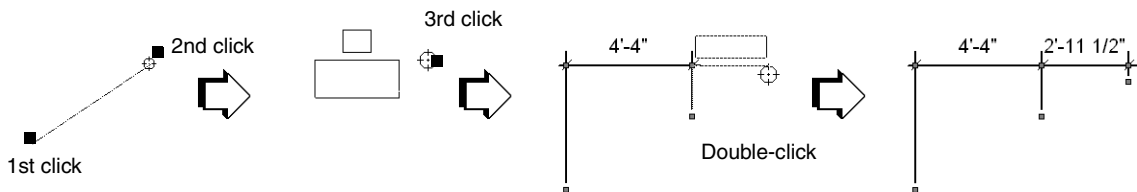


To create a chain of constrained connected dimension lines:

1. Click the **Constrained-Line Dimensioning** tool from the Dims/Notes tool set, and select **Constrained Chain** mode.
2. Select Chain Dimension Preferences from the Tool bar.
3. Select either to **Use Chain Dimension Objects** or to **Use Individual Dimensions**, and click **OK**.
4. Click to set the measurement start point.
5. Click to set the end of the first measurement.
6. Move the cursor away from the object.

This specifies how far the dimension line is offset from the measured object. The dimension preview snaps to a horizontal or vertical orientation.

7. Click to place the first dimension line.
8. Move the cursor to the end of the next segment and click to set its endpoint.
9. Continue setting segments.
10. Double-click to end the chain.



## Constrained Baseline Dimension

Constrained Baseline modes create a series of constrained, connected dimension lines, with each line segment measuring the distance from the initial starting point (the base point).



To create a series of constrained baseline dimension lines:

1. Click the **Constrained-Line Dimensioning** tool from the Dims/Notes tool set, and select **Constrained Baseline** mode.
2. Click to set the measurement start point.
3. Click to set the end of the first measurement.

4. Move the cursor away from the object.

This specifies how far the dimension line is offset from the measured object. The dimension preview snaps to a horizontal or vertical orientation.

5. Click to place the first dimension line.
6. Move the cursor to the end of the next segment and click to set its endpoint.
7. Continue setting segments.
8. Double-click to end the baseline.

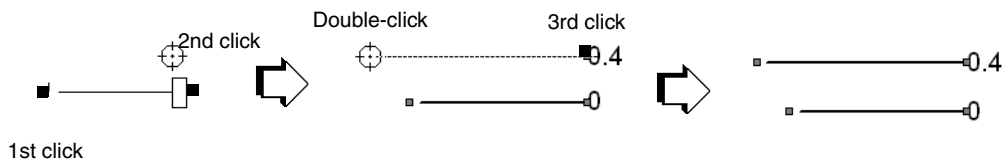
## Ordinate Dimensions

The Ordinate mode measures and dimensions a series of either horizontal or vertical distances from one fixed point.



To draw ordinate dimensions:

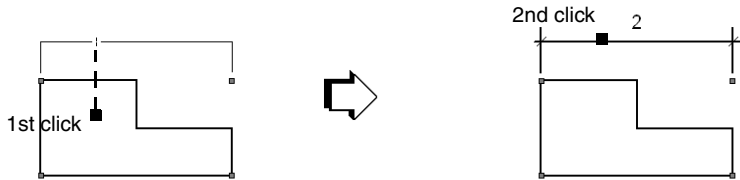
1. Click the **Constrained-Line Dimensioning** tool from the Dims/Notes tool set, and select **Ordinate** mode.
2. Click to set the measurement start point; the first segment is always considered the fixed point and is labeled 0.
3. Click to set the length of the first segment.
4. Move the cursor horizontally or vertically to create ordinate measurements from the initial segment.
5. Click to set the next segment's distance from the first segment. Move to draw the next segment and click to set.
6. Continue creating segments.
7. Double-click to exit the dimensioning tool.



## Selected Object Dimensions

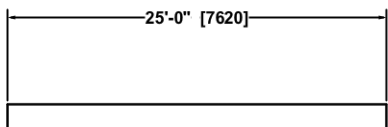
The Selected Object mode measures and dimensions the horizontal or vertical span of any 2D or 3D object, or the edge-to-edge span of several objects or a group of objects. In all cases, the tool measures the greatest span. Horizontal Dimension lines can be drawn inside, above, or below an object or group of objects. Vertical dimension lines can be drawn inside, to the right, or to the left of an object or group of objects.

1. Select the object or objects to dimension.
2. Click the **Constrained-Line Dimensioning** tool from the Dims/Notes tool set, and select **Selected Objects** mode.
3. Click near the object or group of objects to be dimensioned.
4. Move the cursor in the desired direction where the dimension should be created. A preview dimension displays, constrained in either the horizontal or vertical direction.
5. Click to set the position of the dimension line.

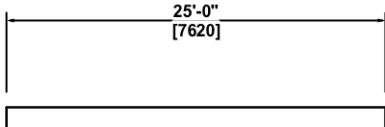


## Dual Dimensioning

Dual dimensioning displays two sets of values, such as inches and millimeters, within a single dimension. These values have independent unit settings and attributes. Dual dimensions can be displayed side by side or stacked.



Side-by-side dual dimension



Stacked dual dimension

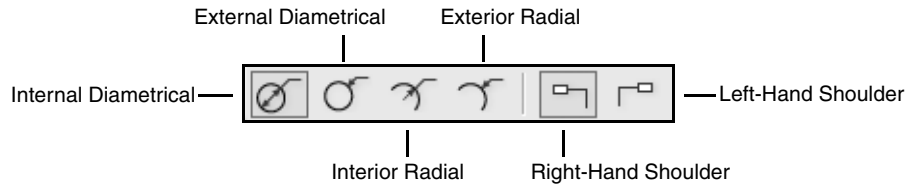
Control the units for each dimension through **File > Document Settings > Units**. The primary dimension uses the **Units** set on the General Display tab of the Units dialog box (see “Units” on page 53). By switching to the Dimension Objects (Primary) tab, change the primary dimension’s **Rounding Style** to be different from that of the General Display. The settings on the Dimension Objects (Secondary) tab provide full control of the unit of measurement, unit marks, rounding, and decimal formatting used for the secondary dimension.

Once a dual dimension is placed on the drawing, adjust the individual attributes for both the primary and secondary dimension from the Object Info palette. The **Dual View** and **Prim/Sec** attributes apply to dual dimensions (see “Modifying Dimensions” on page 454).

## Radial Dimensioning

The **Radial Dimension** tool measures and marks either radius or diameter dimensions for arcs and circles. This tool does not work on ovals, or objects with rounded corners.

The **Radial Dimension** tool can place the dimension lines and measurements either inside or outside of the circle/arc.



Mode	Description
Internal Diametrical	Measures and dimensions the diameter of a circle or arc, placing the dimension inside the object
External Diametrical	Measures and dimensions the diameter of a circle or arc, placing the dimension outside the object

Mode	Description
Interior Radial	Measures and dimensions the radius of a circle or arc, placing the dimension inside the object
Exterior Radial	Measures and dimensions the radius of a circle or arc, placing the dimension outside the object
Right-Hand Shoulder	Places an exterior diametrical or radial dimension measurement to the right of the dimension line
Left-Hand Shoulder	Places an exterior diametrical or radial dimension measurement to the left of the dimension line

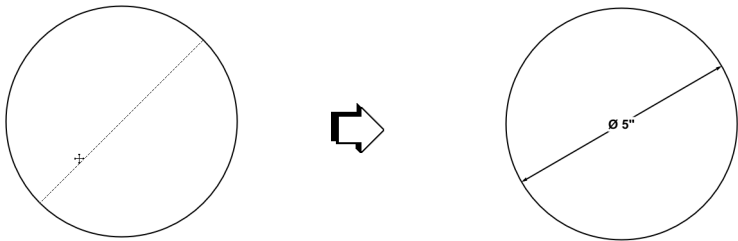
Diametrical Dimensioning Inside Circle/Arc

The Internal Diametrical Dimension mode measures and dimensions the diameter of a circle or arc, and places the dimension inside the object.



To dimension the diameter of a circle or arc:

- 1. Click the **Radial Dimension** tool from the Dims/Notes tool set, and select **Internal Diametrical Dimension** mode.
- 2. Click on or within the arc or circle to dimension.
- 3. Move the cursor to preview the dimension line location.
- 4. Click to place the dimension.



Diametrical Dimensioning Outside Circle/Arc

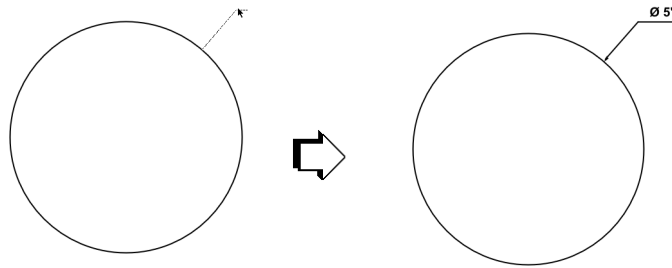
The External Diametrical Dimension mode measures and dimensions the diameter of a circle or arc, and places the dimension outside the object.



To dimension the diameter of a circle or arc:

- 1. Click the **Radial Dimension** tool from the Dims/Notes tool set, and select **External Diametrical Dimension** mode.
- 2. Specify the side of the dimension line to place the measurements.  
To place them to the right of the line, click **Right-Hand Shoulder** mode button.  
To place them to the left of the line, click the **Left-Hand Shoulder** mode button.
- 3. Click on or within the arc or circle to dimension.

4. Move the cursor to preview the dimension line location.
5. Click to place the dimension.



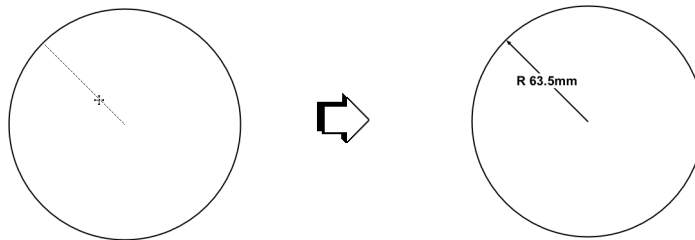
### Radial Dimensioning Inside Circle/Arc

The Interior Radial Dimension mode measures and dimensions the radius of a circle or arc, and places the dimension inside the object.



To dimension the radius of a circle or arc:

1. Click the **Radial Dimension** tool from the Dims/Notes tool set, and select **Interior Radial Dimension** mode.
2. Click on or within the arc or circle to dimension.
3. Move the cursor to preview the dimension line location.
4. Click to place the dimension.



### Radial Dimensioning Outside Circle/Arc

The Exterior Radial Dimension mode measures and dimensions the radius of a circle or arc, and places the dimension outside the object.

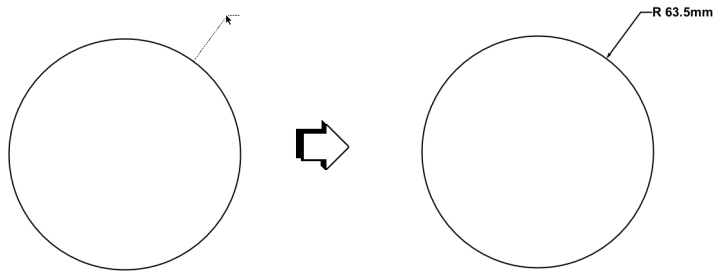


To dimension the radius of a circle or arc:

1. Click the **Radial Dimension** tool from the Dims/Notes tool set, and select **Exterior Radial Dimension** mode.
2. Specify the side of the dimension line to place the measurements.  
To place them to the right of the line, click the **Right-Hand Shoulder** mode button. To place them to the left of the line, click the **Left-Hand Shoulder** mode button.
3. Click on or within the arc or circle to dimension.



4. Move the cursor to preview the dimension line location.
5. Click to place the dimension.



## Marking 2D Object Centers

The **Center Mark** tool divides a circle, oval, rectangle, or rounded rectangle into quarters, marking the exact center of the 2D object. In addition, it can place a center mark on any or all of the corners of a rounded rectangle.

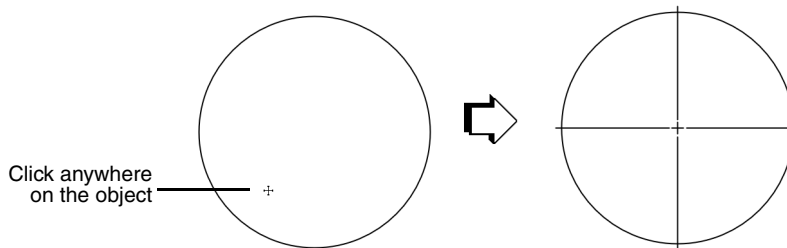
### Marking the Center of 2D Objects



To mark the center of a circle, oval, rectangle, or rounded rectangle:

1. Click the **Center Mark** tool from the Dims/Notes tool set.
2. Click on the 2D object to mark.

The center is marked by the intersection of two lines.



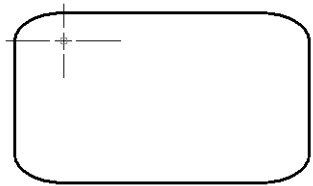
### Marking the Center of a Rounded Rectangle Corner



To place a center mark in the corners of a rounded rectangle:

1. Click the **Center Mark** tool from the Dims/Notes tool set.
2. While pressing Option (Macintosh) or Alt (Windows), move the cursor over the rounded rectangle corner to mark.
3. Click to place the center mark.

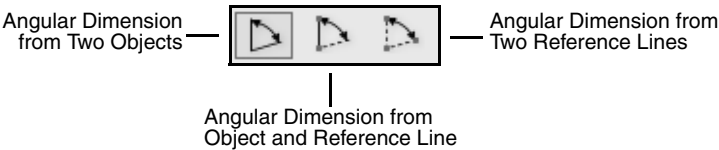
The center is marked by the intersection of two lines.



## Angular Dimensioning

The **Angular Dimension** tool measures and dimensions angles. Dimension the angle between two objects, between two sides of a single object, between a single object and a reference line, or between two reference lines.

This tool works with all 2D objects with linear sides, including round and rotated rectangles, lines, polylines, and polygons. It does not, however, work with circles, ovals, or arcs. In addition, it cannot dimension between parallel lines.



A grouped object must be ungrouped before angular dimensions can be obtained.

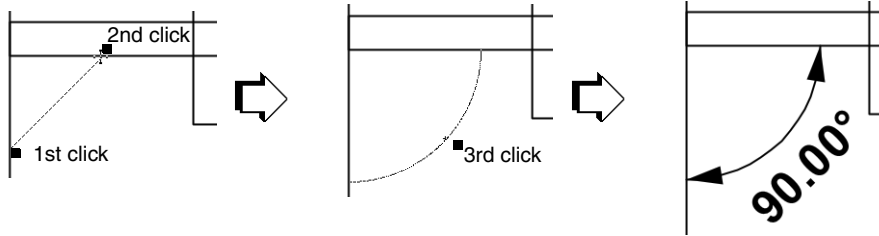
Mode	Description
Angular Dimension from Two Objects	Dimensions the angle between two object sides or faces
Angular Dimension from Object and Reference Line	Dimensions the angle between an object and a reference line
Angular Dimension from Two Reference Lines	Dimensions the angle between two reference lines

### Angle Between Two Objects (Sides or Faces)



To dimension the angle between the sides or faces of two objects:

- Click the **Angular Dimension** tool from the Dims/Notes tool set, and select **Angular Dimension from Two Objects** mode.
- Click the side or face of the first object.  
A preview line displays.
- Click the side or face of the second object.  
An angular dimension preview displays.  
To select a different angle—for example, spanning the opposite direction—move the cursor until the preview displays the desired angle.
- Click a third time to define the radius of the dimension.

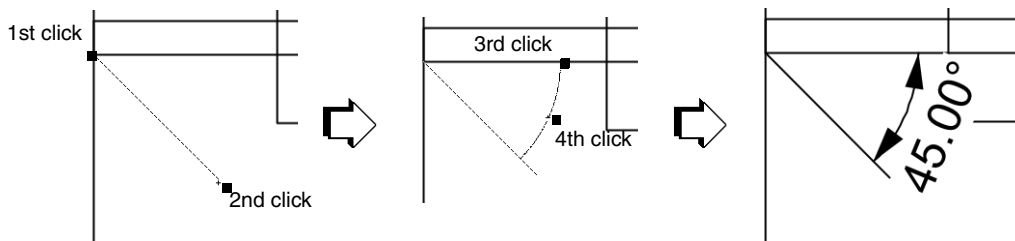


## Angle Between One Reference Line and an Object



To dimension an angle between one reference line and an object:

1. Click the **Angular Dimension** tool from the Dims/Notes tool set, and select **Angular Dimension from Object and Reference Line** mode.
2. Click to set the start of the reference line.  
A reference line preview displays.
3. Click again to set the end of the reference line.  
The cursor changes to a pointing hand.
4. Click on the side of the object (and, therefore, angle) to dimension.  
An angular dimension preview displays.  
To select a different angle—for example, spanning the opposite direction—move the cursor until the preview displays the desired angle.
5. When the preview displays the desired angle, click again to draw the reference line and to define the angle of the dimension.



## Angle Between Two Reference Lines



To dimension an angle between two references lines:

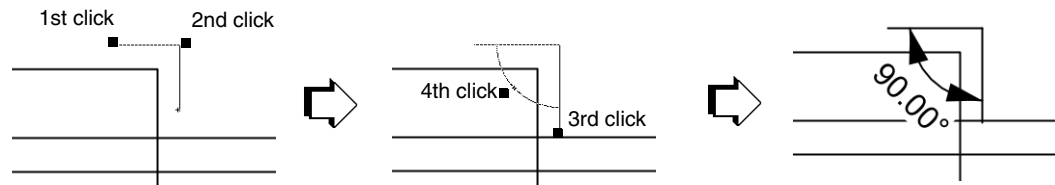
1. Click the **Angular Dimension** tool from the Dims/Notes tool set, and select **Angular Dimension from Two Reference Lines** mode.
2. Click to set the start of the first reference line.  
A reference preview line displays.

- 3. Click again to set the end of the first reference line.
- 4. A second reference line preview displays.
- 5. Click a third time to set the end of the second reference line.

An angular dimension preview displays.

To select a different angle—for example, spanning the opposite direction—move the cursor until the preview displays the desired angle.

- 6. When the preview displays the desired angle, click again to define the angle of the dimension.



## Modifying Dimensions

Modify dimensions by manipulating them with the **2D Selection** and **2D Reshape** tools, or by adjusting dimension parameters in the Object Info palette or Properties dialog box. For chain dimension objects, use commands on the object context menu to add, delete, and edit individual dimensions within the chain.

A line, arc, or circle can be changed to a dimension (linear, angular, or radial) by selecting the dimension line style from the Attributes palette. See “Line Style Attributes” on page 232.

Adjoining dimensions can be changed into a single chain dimension object by selecting them, and then selecting **Modify > Compose**. Similarly, a chain object can be changed into multiple dimensions by selecting the chain and then selecting **Modify > Decompose**.

## Editing Dimensions with the Mouse

Action	Description
Change the length of the dimension and/or the length of a witness line	To change the dimension length, click on the endpoint of a witness line with the <b>2D Selection</b> tool and drag it parallel to the dimension line; in chain dimension objects, the size of any adjoining dimension is adjusted automatically. To change the length of a witness line, drag its endpoint toward or away from the dimension line.
Change the length of all witness lines simultaneously	Click on the dimension line (but not on a witness line connection) with the <b>2D Selection</b> tool and drag it until the witness lines are the desired length
Change the position of the text	Click-drag the text to the desired location with the <b>2D Selection</b> tool. For linear dimensions, press and hold the Shift key while dragging the text to the desired location to prevent altering the witness line length.
Move the entire dimension	With the <b>2D Selection</b> tool, click on a witness line (but not on an endpoint) or on one of the two control points at each end of the dimension line, and drag the entire dimension to a new location

Action	Description
Modify several dimension lines, end points, or witness lines at once	With the <b>2D Reshape</b> or <b>2D Selection</b> tool, select the dimension(s) or control point(s) to modify. Then, use the <b>2D Reshape</b> tool to draw a marquee around the control points to modify. The control points move when the marquee moves, while control points outside of the marquee remain fixed.

## Editing Dimension Properties

Edit the properties of a selected dimension in the Object Info palette.

- These properties can also be accessed by right-clicking the dimension and selecting the **Properties** command from the object context menu.
- To format the dimension text, select **Format Text** from the context menu.
- For chain dimension objects, the edits are applied to all dimensions within the chain. To edit the properties of individual dimensions within a chain, use the **Edit Dimension** command from the context menu instead.

Different parameters are available depending on what type of dimension is being edited.

Parameter	Description
Dim Std	Selects the dimension standard type; this selection determines which fields display in the Object Info palette or Properties dialog box.
Witness	For linear dimensions, this sets whether the witness line displays on both ends of the dimension line, only the start, only the end, or not at all. For chain dimension objects, this sets whether all or none of the witness lines display.
Length	For linear and baseline dimensions, and for individual dimensions within a chain, this sets the length of the dimension. Changing this value breaks the relationship of associative dimensions.
Offset	Sets the length of the witness lines
Text Off	Sets the dimension text offset from the dimension line
Text Rot	Sets the orientation of the dimension text to the dimension line
Auto Position Text	Automatically aligns the dimension text to the center of the dimension line; deselect to allow manual control of the text location
Flip Text	Mirrors the dimension text to the opposite side of the dimension line. This parameter is not available for chain dimension objects or individual dimensions within a chain.
Arrows Inside	Sets whether arrows display inside witness lines or are flipped outside
Leader to Left	Switches the radial dimension leader from the right to the left side of the object
Dual View	Selects which dimensions to display, when a dual-dimension standard is selected. This parameter is not available for chain dimension objects.
Prim/Sec	Toggles between settings for primary and secondary dimensions, when a dual-dimension standard is selected. This parameter is not available for chain dimension objects.

Parameter	Description
Interior Arc	Sets the angular dimension inside the witness lines; deselect to move the dimension outside of the witness lines at the opposite angle
Prec	Sets the dimension precision with up to eight digits of accuracy
Box Text	Places a box around the dimension
Show Dim Value	Shows or hides the dimension
Leader	Enter text to display before the dimension
Trailer	Enter text to display after the dimension
Tol	When a single-dimension standard is selected, sets whether a dimension displays a single, double, limited, or no tolerance value
Top/Bottom/Display as Typed	When a tolerance display is selected, sets the tolerance values and how they display

## Editing Chain Dimensions

If a witness line within a chain dimension object is added, moved, or deleted, the dimension measurements in the chain adjust automatically.

Action	Description
Add a dimension	Right-click anywhere on the dimension object, and select <b>Add Dimension</b> from the context menu. Click with the bull’s-eye cursor to set the endpoint of the new witness line. Alternatively, create a new individual dimension within the lines of a dimension in an existing chain object, and VectorWorks adds the new dimension to the chain automatically.
Delete a dimension	Right-click on the dimension line of the dimension to be deleted, and select <b>Delete Dimension</b> from the context menu.
Delete a witness line	Right-click on the witness line to be deleted, and select <b>Delete Witness Line</b> from the context menu.
Edit an individual dimension’s properties	Right-click on the dimension to be edited, and select <b>Edit Dimension</b> from the context menu. Edit parameters in the Object Properties dialog box as desired and click <b>OK</b> (see “Editing Dimension Properties” on page 455). To apply properties edits to all dimensions in the chain, use the <b>Properties</b> command or the Object Info palette instead.
Format Text	Right-click on the dimension to be edited, and select <b>Format Text</b> from the context menu

## Measuring Distance

Distance can be measured in VectorWorks without actually being recorded. This can be useful for placing objects or for reference.

### Measuring in Units

The **Tape Measure** tool measures the distance between two or more points in the drawing area, and temporarily displays the length in the Data bar. The tool shows the measurement between one click and the next, and it also keeps track of the cumulative length from the very first click.

Measurements display in the Data bar until the mouse is double-clicked. Note the measurements before the display clears.

3D objects must be in orthogonal projection and front or side view to be measured with the **Tape Measure** tool.



To measure a distance:

- 1. Click the **Tape Measure** tool from the Dims/Notes tool set.
- 2. Click where the first measurement is to start.
- 3. Move the cursor along the distance to measure.

The Data bar displays two measurements:

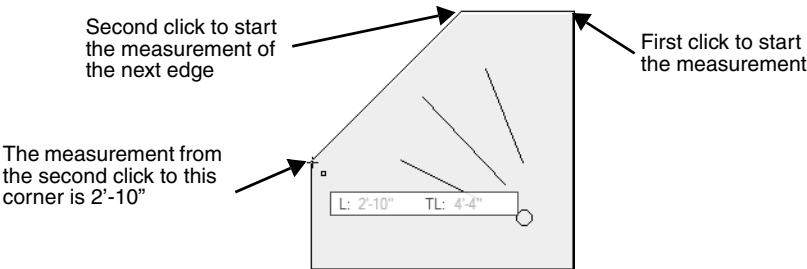
Data Bar	Measurement
L	Length (distance) from the previous point
TL	Total length (cumulative measure) from the starting point

- 4. To continue measuring in a different direction or area, click to set the next starting point.

The L measurement changes to zero.

- 5. Move the cursor to measure the next distance.

The Data bar reflects the length from the previous point and the total cumulative length.



- 6. When the measurements are complete, note the total length.
- 7. Double-click to end the measurements.

## Measuring in Degrees

The **Protractor** tool measures angles in the drawing, and temporarily displays the degrees measurement in the Data bar. There are two modes for the tool.



Mode	Description
Angle from Two Segments	Calculates the angle between two objects or object sides that are linear — rectangles (including rounded and rotated), lines, polylines, and polygons. This mode cannot, however, measure circles, ovals, or arcs. In addition, it cannot measure between parallel lines
Angle from Three Points	Measures an angle between three points in the drawing area

### Angles Between Objects or Object Sides



To measure the angles between objects or object sides:

1. Click the **Protractor** tool from the Dims/Notes tool set, and select **Angle from Two Segments** mode.
2. Move the selection arrow over the first side of the angle to measure.
3. Click to select the side, and then move the cursor to the other angle side.  
The angle displays in the Data bar.
4. Note the angle, and then click to end the measurement.

### Angles Between Three Points



To measure angles between three points:

1. Click the **Protractor** tool from the Dims/Notes tool set, and select **Angle From Three Points** mode.
2. Click to set the first point.
3. Click to set the second point.
4. Move the cursor to the third angle point.  
The angle displays in the Data bar.
5. Note the angle, and then click to end the measurement.

## Adding a Drawing Border

The **Drawing Border** tool places a pre-formatted drawing border along the edges of the drawing area, set to the drawing size. Standard size pages have a matching standard drawing border. A custom size border can easily be specified, and drawing borders and title blocks can be customized to meet office requirements.



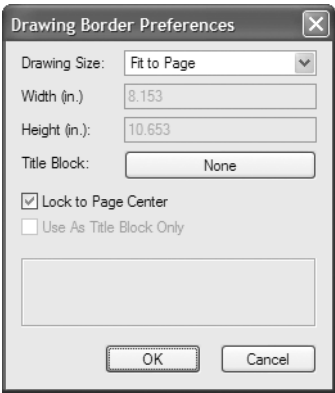
The **Update Plug-in Objects** command may need to be run on files containing drawing borders that were created in an earlier version of VectorWorks. This command converts the drawing borders to the latest format; see “Migrating from Previous Versions” on page 5. Additional drawing border capabilities are available in the VectorWorks Design Series. See “Creating Drawing Borders” on page 491 in the VectorWorks Design Series User’s Guide.



To place a drawing border:

- 1. Make the design or sheet layer active. Drawing borders are inserted in Top/Plan view on design layers.
- 2. Click the **Drawing Border** tool from the Dims/Notes tool set.
- 3. Click **Preferences** from the Tool bar to set the default drawing border parameters.

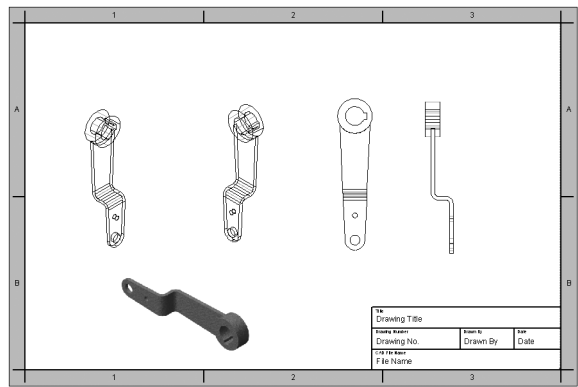
The Drawing Border Preferences dialog box opens.



Parameter	Description
Drawing Size	Select a standard size and format for the drawing border, or select Fit to Page to set the drawing border to the page dimensions (see “Page Setup” on page 74). Select Custom to use custom drawing border dimensions, and specify the <b>Width</b> and <b>Height</b> dimensions.
Title Block	Opens the Import Title Block dialog box, for selecting a title block symbol to insert (see “Adding a Title Block” on page 463), or select None for no title block
Lock to Page Center	Locks the drawing border center position to the page center; deselect to position the drawing border manually. If the plan has been rotated (Design Series required), select <b>Lock to Page Center</b> to position the drawing border correctly when in a non-rotated view.
Use As Title Block Only	When a title block has been selected, displays only the title block and hides all other drawing border elements

- 4. Click once in the drawing to set the drawing border insertion point, and then click again to set the drawing border orientation.
- 5. The drawing border is placed on the drawing.

The drawing border can be re-sized and re-scaled after placement, attributes can be changed, and title blocks and revision histories can be added.



## Drawing Border Properties

The drawing border properties can be edited in the Object Info palette.

Parameter	Description
Lock to Page Center	Locks the drawing border center position to the page center; deselect to position the drawing border manually. If the plan has been rotated (Design Series required), select <b>Lock to Page Center</b> to position the drawing border correctly when in a non-rotated view.
Size	Select a standard size and format for the drawing border, or select Fit to Page to set the drawing border to the page dimensions. Select Custom to use custom drawing border dimensions, and click <b>Border Settings</b> to specify the dimensions.
Orientation	Select Portrait or Landscape orientation
Horizontal Dimension	Displays the drawing border horizontal dimensions
Vertical Dimension	Displays the drawing border vertical dimensions
Border Settings	Opens the Drawing Border Settings dialog box, for specifying further properties (see “Specifying Additional Drawing Border Settings” on page 462)
Title Block	Opens the Import Title Block dialog box, for selecting a title block symbol to insert (see “Adding a Title Block” on page 463). This setting can also be accessed from the drawing border context menu.
Current Title Block	When a title block has been inserted, displays the title block symbol name
Use As Title Block Only	When a title block has been selected, displays only the title block and hides all other drawing border elements
Title Block Position	Specifies the title block location relative to the drawing border
Title Blk Scale Factor	If the title block is too large or small at normal scale (scale factor 1), scales the title block size, including text. A value below 1 makes the title block smaller, while a value above 1 makes the title block larger; text is automatically scaled along with the title block geometry.

Parameter	Description
Title Blk Margin	Adds a horizontal, vertical, or block margin to the title block
Use Revision Block (Design Series required)	Adds a revision history block to the drawing border
Show Revision Zone	Adds a revision zone column to the revision block, for specifying the location of the revision
Use Tolerance Block (Design Series required)	For ASME title blocks, adds a tolerance block area to the title block
Use Projection Block (Design Series required)	For ASME title blocks, adds a projection block area to the title block; specify First Angle or Third Angle in <b>Projection</b>
Show Grids	Displays grid text and lines in the drawing border margin; this setting can also be accessed from the drawing border context menu
Show Grid Lines	Displays grid lines on the drawing
Fold Marks	Select the fold mark measurements when adding fold marks to the drawing border. The first measurement specifies the drawing fold width and the second measurement indicates the margin fold width. Select Custom to specify custom fold mark distances. Fold marks are designed for use with ISO drawings.
Margin Width	When custom fold marks are selected, enter the margin fold width
Folded Width	When custom fold marks are selected, enter the drawing fold width
Folded Height	When custom fold marks are selected, enter the drawing fold height
Hide Border	When the drawing border includes a title block, hides the drawing border and displays only the title block (this allows a different drawing border to be used with that title block, if desired)
Fill Border	Fills the area between the outer and inner border lines with a fill selected from the Attributes palette
Add Parts List (Design Series required)	Adds a parts list to an ASME title block, when a parts list worksheet has been created
Edit Title Block	Opens the Edit Title Block dialog box, for specifying or changing the title block information
Edit Revision Data (Design Series required)	Opens the Edit Revision Data dialog box, for specifying revision information and format (see "Editing Revision Block Data" on page 493 in the VectorWorks Design Series User's Guide)
Edit Issue Data (Design Series required)	Opens the Edit Issue Data dialog box, for specifying issue data on US Arch title blocks (see "Editing Issue Data" on page 495 in the VectorWorks Design Series User's Guide)

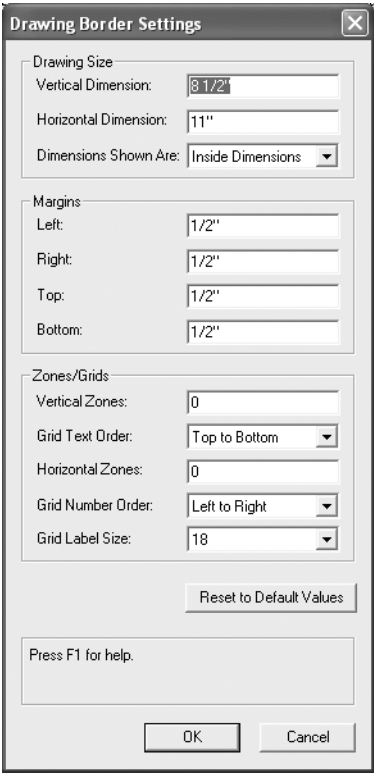
## Specifying Additional Drawing Border Settings

Additional drawing border settings are available from the Object Info palette.

To specify additional drawing border settings:

1. Select the drawing border.
2. In the Object Info palette, click **Border Settings**. Alternatively, double-click on the drawing border.

The Drawing Border Settings dialog box opens.



Parameter	Description
Drawing Size	Specifies the drawing border size
Vertical/Horizontal Dimension	Specifies the drawing border vertical/horizontal dimensions; initially, these are based on the <b>Size</b> selected in the Object Info palette, but the dimensions can be edited. This parameter is not available when the <b>Size</b> is Fit to Page.
Dimensions Shown Are	Applies the dimensions to either the outer or inner border dimensions
Margins	Specifies the drawing border margin widths
Zones/Grids	
Vertical Zones	Specifies the number of vertical zones to include

Parameter	Description
Grid Text Order	Indicates whether vertical grid text starts at the top or bottom of the border
Horizontal Zones	Specifies the number of horizontal zones to include
Grid Number Order	Indicates whether horizontal grid numbers start at the left or right of the border
Grid Label Size	Specifies the text size for both grid text and numbers
Reset to Default Values	Restores the default drawing border settings

3. Click **OK** to set the drawing border parameters.

### Adding a Title Block

A title block containing drawing information can be added to the drawing border. Title blocks are saved as symbols with text linked to a record.

A title block can be the only part of the drawing border that displays, by selecting **Use As Title Block Only** in the drawing border preferences or the Object Info palette.

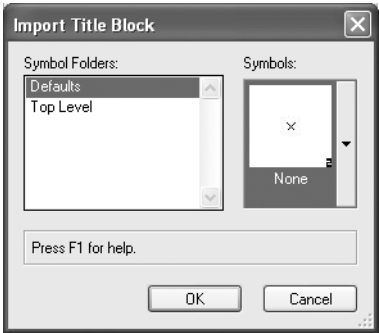
Additional title block capabilities are described in “Creating Drawing Borders” on page 491 in the VectorWorks Design Series User’s Guide.

To add a title block to the drawing border:

- 1. Select the drawing border.
- 2. In the Object Info palette, click **Title Block**.

Right-click on the drawing border and select **Title Block** from the context menu.

The Import Title Block dialog box opens.



Parameter	Description
Symbol Folders	Specifies the location of the drawing border symbols
Symbols	Provides a graphical list of available drawing border symbols

- 3. Select a title block symbol from the selected symbol folder. The Defaults folder contains the default title block resources; see “VectorWorks Fundamentals Default Resources” on page 141. The title blocks listed under Top Level are title block symbols that exist in the current file.

To remove a title block, select **None**.

4. Click **OK** to add the selected title block symbol to the drawing border. The title block is scaled to match the current layer scale if necessary.
- When a drawing border is inserted into a drawing, the Drawing Border Components symbol folder is automatically created and displays in the Resource Browser. Title block symbols added to the drawing border are automatically placed in that folder.

## Creating a Custom Title Block

A custom title block, containing company-specific graphics, information, and data fields, can be easily created and then inserted into a drawing border.

To create a custom title block:

1. In a new file with a scale of 1:1, create the elements of the title block, including lines, rectangles, graphics, and text.

UDI		UDI, Inc. 10 Anywhere Street Anytown, USA	
TITLE  Drawing Title			
DRAWN BY  Name		REVISION  No	DATE  Date

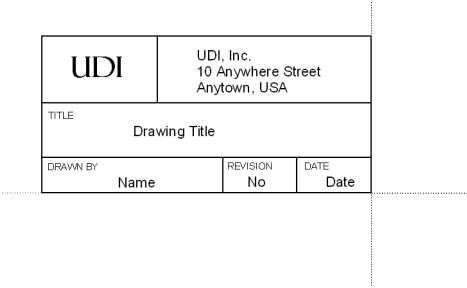
The title block pen style, pen color, line style, line thickness, and text attributes can inherit the drawing border attributes, or be fixed at creation.

Parameters are inherited from the drawing border by specifying the associated class style for the element in the Attributes palette at the time of title block creation. Different settings can be combined so that some parameters are inherited from the drawing border, while others are set from the Attributes palette at the time of title block creation. For example, if a line should use the same color as the drawing border, but have a dashed line style with a thickness of 1.00 mm, when creating the line, set the line's Pen color to "Color By Class," its Line Style to dashed, and its Line Thickness to 1.00 mm.

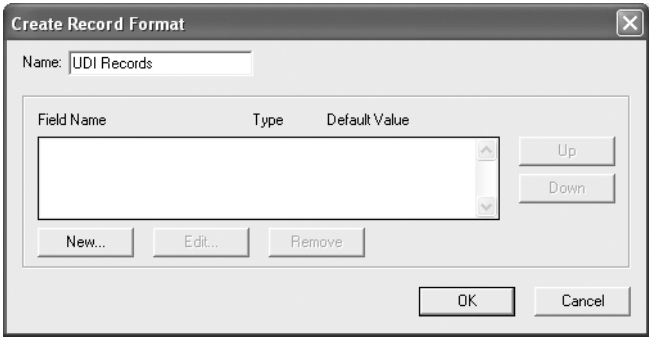
Title Block Parameter	Attribute Palette Setting	Result
Geometry		
Pen Style	Class Style Solid, Pattern, or Dash style chosen	Same as drawing border  As specified in the Attributes palette when the title block geometry was created
Pen Color	Class Color Solid color chosen	Same as drawing border  As specified in the Attributes palette when the title block geometry was created
Line Style/Thickness	Class Thickness Line style and thickness chosen	Same as drawing border  As specified in the Attributes palette when the title block geometry was created

Title Block Parameter	Attribute Palette Setting	Result
Text		
Pen Style	Class Style	Uses text attributes (font, size, and style) from drawing border
	Solid	Uses text attributes that were set when the title block text was created
Pen Color	Class Color	Same as drawing border
	Solid color chosen	As specified in the Attributes palette when the title block text was created

- 2. Select all the title block elements, and then select **Modify > Create Symbol**.
- 3. Provide a name for the new title block, and then click **OK** to create the title block symbol.  
*If symbol folders are present, the Move dialog box opens. Specify the Defaults location for the symbol.*
- 4. In the Resource Browser, select the new custom title block symbol. Select **Edit** from the Resources menu.  
The Edit Symbol dialog box opens.
- 5. Select the 2D Component to edit.
- 6. In the Edit Symbol window, ensure that the bottom right corner of the symbol is at the (0,0) origin position. This places the title block at the correct location in the drawing border.



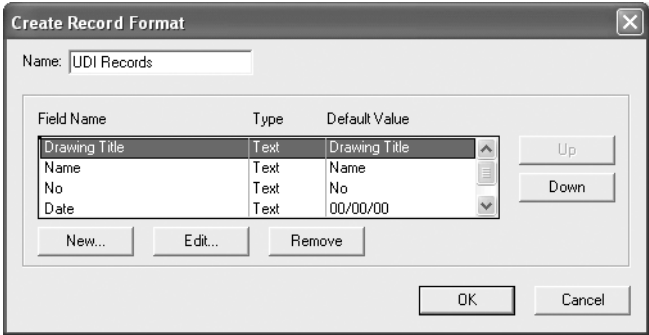
- 7. Click **Exit Symbol**, located at the top right of the Edit Symbol window, to return to the drawing.
- 8. From the Resources menu of the Resource Browser, select **New Resource**, and then select **Record Format**.  
The Create Record Format dialog box opens. Enter a name for the new record format.



- 9. Click **New** to add a field to the record format.  
The Edit Field dialog box opens.



- 10. The field names of the record format correspond to titles and associated editable fields in the Edit Title Block dialog box. Create a text field that corresponds to one of the editable text fields of the title block.
- 11. Click **OK**.
- 12. Create all the necessary title block fields.



To create a multi-line field, append a pound sign (#) to the field name, as in Drawing Title#

To work with the Issue Manager (Design Series required), field names must be prefixed with a **P\_** for project fields (fields with the same value on all title blocks in the file) and an **S\_** for sheet fields (fields with a different value on any title blocks). The prefixes also cause the Edit Title Block dialog box to be separated into project and sheet tabs.

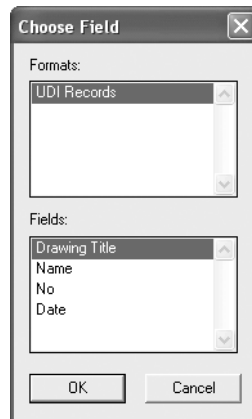
- 13. Click **OK**.
- 14. In the Resource Browser, select the new custom title block symbol created earlier. Select **Attach** from the Resources menu.

The Attach Record dialog box opens.

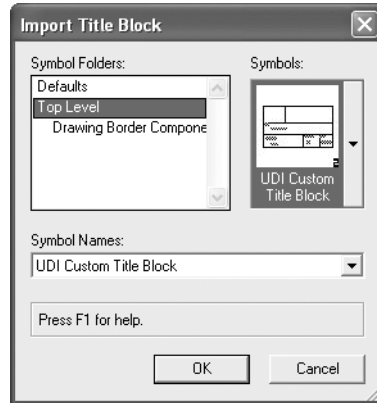




15. Select the custom record format to attach to the symbol, and click **OK**.
16. In the Resource Browser, select the new custom title block symbol. Select **Edit** from the Resources menu.  
The Edit Symbol dialog box opens.
17. Select the 2D Component to edit.
18. Select the first editable text string, such as Drawing Title.
19. Select **Modify > Link Text to Record**.  
The Choose Field dialog box opens.



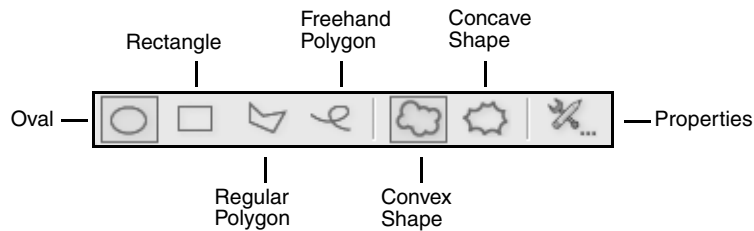
20. Select the custom record format from the **Formats** list, and then select the appropriate record field to link to from the **Fields** list.
21. Click **OK** to return to the Edit Symbol window. Repeat for all editable text fields, linking them to the correct record field.
22. Click **Exit Symbol** at the top right of the drawing window to return to the drawing.
23. To be available to the **Drawing Border** tool, either the file must be saved in the Libraries\Defaults\Drawing Border - Title Block folder, or the custom symbol and its associated record format must be imported into the Custom Title Blocks.vwx file, located in the same default resources folder.
24. To place the custom title block, click **Title Block** from the Object Info palette of a selected drawing border, and select the custom title block symbol.



## Creating Revision Clouds

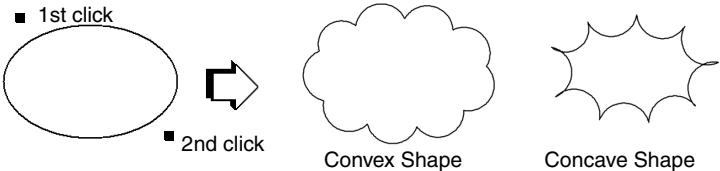
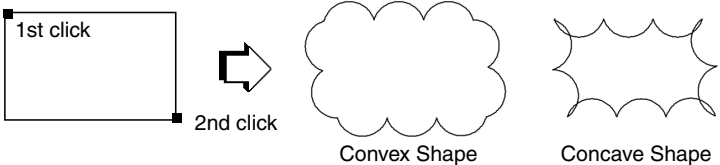
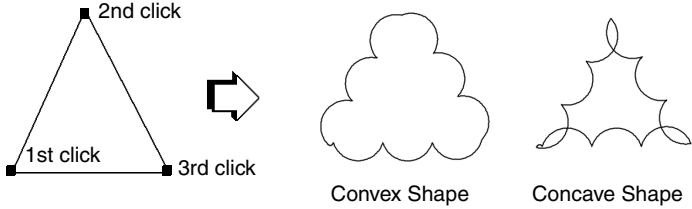
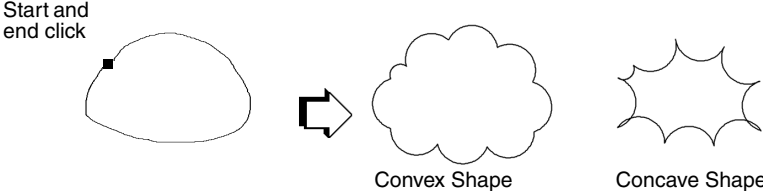
Use the **Revision Cloud** tool to identify a section of a drawing that has changed. Insert a revision cloud in an area of the drawing, or around an entire portion of the drawing, if appropriate.

For the Design Series, revision clouds can also be created by first drawing a polyline and then selecting the **Objects from Polyline** command (see “Creating Objects from Polylines” on page 599 in the VectorWorks Design Series User’s Guide).



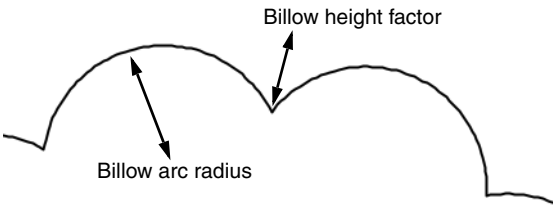
To create a revision cloud:

1. Click the **Revision Cloud** tool from the Dims/Notes tool set.
2. Click the **Revision Cloud Properties** Tool bar button to define the revision cloud properties. The properties can also be set after placement, from the Object Info palette. Click **OK**.
3. Select the revision cloud mode and select to draw the cloud with either a convex or concave shape. The convex shape draws billows outward from the preview image or from the specified vertices. The concave shape draws billows inward from the preview image or from the specified vertices.

Mode	Description
Oval	<p>Inserts the revision cloud around the perimeter of a preview oval. Click to set the start point, move the cursor in the desired direction, and click to set the end point. To constrain the oval to a circle, press and hold the Shift key while drawing.</p> 
Rectangle	<p>Inserts the revision cloud around the perimeter of the preview rectangle. Click to set the start point, move the cursor in the desired direction, and click to set the end point. To constrain the rectangle to a square, press and hold the Shift key while drawing.</p> 
Regular Polygon	<p>Inserts the revision cloud around the perimeter of the specified vertices. Click to set the start point (first vertex), click at the desired location for each subsequent vertex, and either click at the starting vertex to close the polygon or double-click at the final vertex to create an open polygon. If the polygon is open, VectorWorks completes the cloud based on the outline.</p> 
Freehand Polygon	<p>Inserts the revision cloud around the perimeter of the specified vertices. Click to set the start point and click-drag to draw the freehand polygon. If the polygon is open, VectorWorks completes the cloud based on the outline.</p> 

- Click to draw the revision cloud according to the specified mode.

The revision cloud properties can be edited from the Object Info palette.



Parameter	Description
Minimum Billow Radius	Sets the minimum radius of each arc in the revision cloud
Maximum Billow Radius	Sets the maximum radius of each arc in the revision cloud
Billow Hgt. Factor (0.1-1.0)	Sets the height of the billow
Billow Type	Select convex or concave
Polyline Parameters	Edits the revision cloud polyline; see “Reshaping Objects” on page 259

# Creating Floors, Walls, and Roofs

VectorWorks provides a variety of specialized tools and commands for creating floors, walls, and roofs.

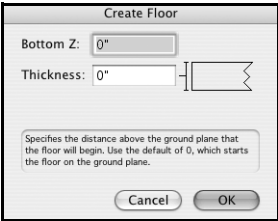
## Creating Floors

The **Floor** command can be used to create not only floors, but also decks, patios, stages, platforms, and lofts. The command converts any 2D drawing object into a hybrid (2D/3D) object of any shape and thickness. The source object must be flat and must also be parallel to the ground plane.

To create a floor:

1. Select **View > Standard Views > Top/Plan**.  
While this command can be used in a 3D projection mode, the precise X and Y placement is much harder to determine.
2. Select the 2D or flat hybrid object(s) to turn into a floor.
3. Select **Model > AEC > Floor**.

The Create Floor dialog box opens.



Parameter	Description
Bottom Z	Specifies the distance above the ground plane that the floor will begin (the Bottom Z height). In most cases, use the default of 0, which starts the floor on the ground plane.
Thickness	Sets the floor thickness

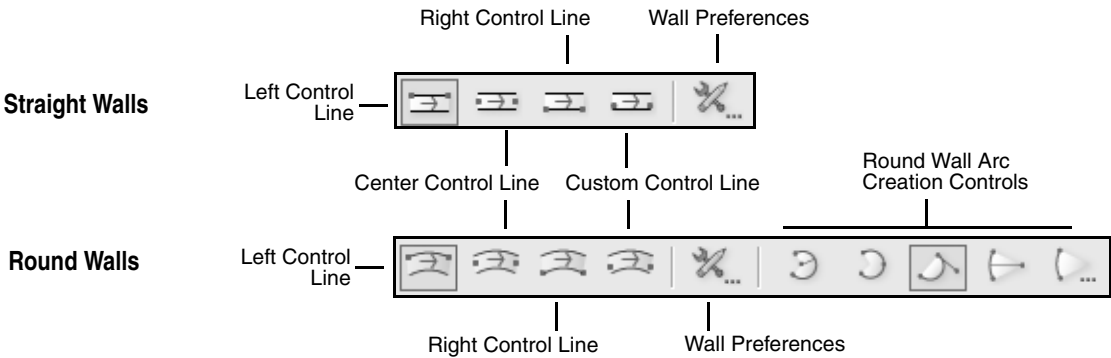
4. Click **OK**, and then change to a 3D projection mode to see the floor.

## Creating Walls

VectorWorks provides the flexibility to draw both straight and round walls and to join those walls to other walls. VectorWorks treats each wall section as a separate object. Either automatically join walls together when drawing them, or join them after drawing by using one of the joining options. Other wall options include the ability to add component lines and fills to walls, cap and trim them, and insert symbols (such as doors and windows) into them. You can also add and delete peaks in a wall, if the elevation changes from one end of the wall to the other.

[Additional wall capabilities are available in VectorWorks Architect, and are cross-referenced to the appropriate section in the VectorWorks Design Series User’s Guide where applicable.](#)

VectorWorks provides four ways to position the wall in relation to the control line. These modes are activated by the four buttons on the Tool bar.

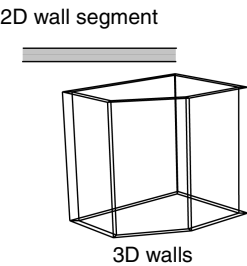


Mode	Description
Left Control Line	Walls are drawn along their left sides
Center Control Line	Walls are drawn from the center
Right Control Line	Walls are drawn along their right sides
Custom Control Line	Walls are drawn from an offset point specified in wall preferences; most effective when drawing walls containing components
Wall Preferences	Sets the physical parameters of the wall; see “Drawing Straight Walls” on page 472
Arc Creation Controls	Select the arc creation method to use when drawing round walls; for more information on arc creation modes, see “Creating Arcs” on page 206

See “Wall Direction” on page 479 for details on how the starting point and direction in which the wall is drawn determines the wall’s interior and exterior sides.

## Drawing Straight Walls

The **Wall** tool creates a hybrid wall object, simultaneously adding both a 2D and a 3D version of the wall to the drawing. Walls can be drawn in Top/Plan or in a 3D view.



Create walls by drawing them with the mouse, or by using a mouse-Data bar combination (see “Using the 2D Data Bar” on page 183 or “Using the 3D Data Bar” on page 291). The following directions assume that the walls are drawn with the mouse.

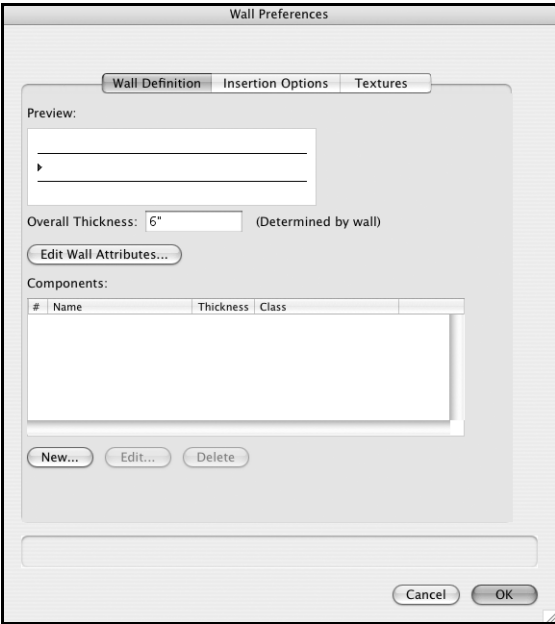


To create straight walls:

- 1. Select the **Wall** tool from the Walls tool set.
- 2. Click the desired **Offset** mode button (see “Creating Walls” on page 471).
- 3. Click the **Wall Preferences** mode button.

The Wall Preferences dialog box opens. This dialog box can be accessed any time afterward to modify wall settings. Walls can also be drawn first, and then the parameters can be set later from the Object Info palette.

Additional wall capabilities are available in VectorWorks Architect, and are cross-referenced to the appropriate section in the VectorWorks Design Series User’s Guide where applicable.



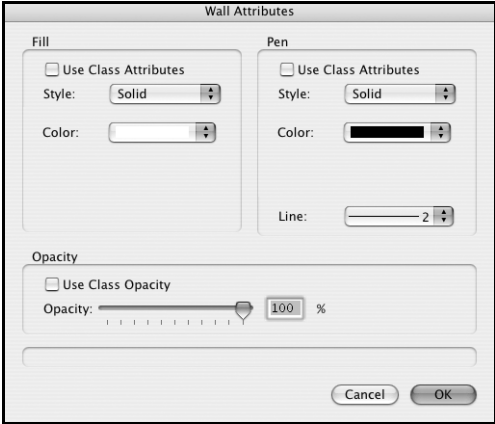
Parameter	Description
Wall Style (VectorWorks Architect required)	In VectorWorks Fundamentals, all walls are un-styled. For information on wall styles, see “Creating Walls in Architect” on page 55 in the VectorWorks Design Series User’s Guide.
Save Preferences as Wall Style (VectorWorks Architect required)	See “Creating Walls in Architect” on page 55 in the VectorWorks Design Series User’s Guide
Preview	Displays a preview of the wall structure, including any defined components; the preview wall is drawn from left to right, so the “top” of the preview, by default, indicates the left part of the wall as it will be drawn (see “Wall Direction” on page 479). The arrow shows the wall direction.

Parameter	Description
Overall Thickness	Displays the thickness of the wall. If a wall contains no components, enter the wall thickness.  The thickness of a wall with components is defined by the sum of the component thicknesses. When components have been defined, this parameter becomes read-only.
Edit Wall Attributes	Opens the Wall Attributes dialog box, to specify the wall fill and pen settings
Components	Lists the components that form the structure of the wall, in order from left to right as displayed in the preview. To change the order of a component, click and drag within the # column.
New	Click to define the components of the wall; see “Creating Wall Components” on page 480 for information on creating components
Edit	Opens the Component Attributes dialog box to edit the selected component’s thickness and attributes (you can also double-click on a component to open the Component Attributes dialog box)
Delete	Deletes the selected wall component; the wall thickness is adjusted accordingly

4. Click **Edit Wall Attributes** to specify the wall attributes.

The Wall Attributes dialog box opens. The wall attributes of an un-styled wall are initially set to the parameters displayed in the Attributes palette. If they are changed here, the Attributes palette reflects the changed attributes of the selected wall (after exiting the Wall Preferences dialog box).

Fill, pen, and opacity can be set by class rather than by the attributes in the Wall Attributes dialog box. If the wall class is changed later, the wall changes to use the attributes of the new class. Wall attributes cannot be overridden on a per-instance basis; if a wall style uses class attributes, all walls of that style must use class attributes. However, walls of the same wall style can be placed in different classes.

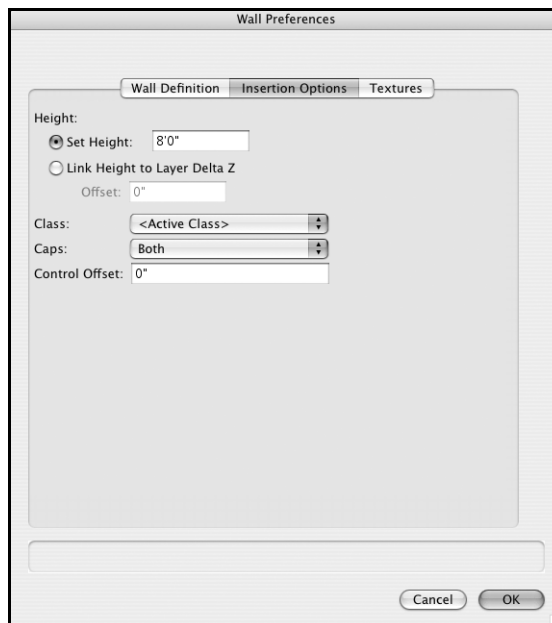


Parameter	Description
Fill	
Use Class Attributes	Sets wall fill attributes by class rather than by the parameters in the Wall Attributes dialog box



Parameter	Description
Style	Specify the wall fill attributes, or select None for no fill. Selected hatch, gradient, or image fills, if not already present in the file, are imported and added to the Resource Browser (default resources are automatically imported into the current file at the point of use and display in the Resource Browser). See “VectorWorks Fundamentals Default Resources” on page 141 and “Fill Attributes” on page 230.
Pen	
Use Class Attributes	Sets pen attributes by class rather than by the parameters in the Wall Attributes dialog box
Style	Specify the wall pen attributes, or select None for no pen. See “Pen Attributes” on page 231.
Line	When a pen style has been selected, specify the line thickness and style; see “Line Style Attributes” on page 232
Opacity	
Use Class Opacity	Sets wall opacity by class rather than by the parameters in the Wall Attributes dialog box
Opacity	Specifies the transparency of the wall; drag the slider to the left to increase the transparency, or enter a percentage directly in the box to the right of the slider

- Click **OK** to return to the Wall Preferences dialog box. If components are to be added to the wall, click **New** to define each component (see “Creating Wall Components” on page 480). The **Overall Thickness** is then defined by the thickness of the wall components.
- Click the Insertion Options tab to set the wall insertion options.



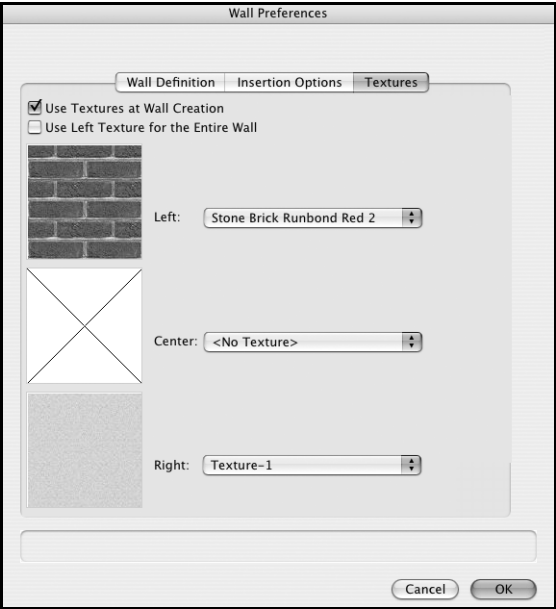
Parameter	Description
Height	
Set Height	Sets the default wall height value; walls are drawn with this height, which can be edited later in the Object Info palette
Link Height to Layer Delta Z	Sets the default wall height to the value specified for the design layer's <b>Delta Z</b> value (see "Setting Design Layer Properties" on page 87)  The association between wall height and the layer's <b>Delta Z</b> value can be broken after wall creation, by deselecting <b>Link Wall Height to Layer +/- Z</b> from the Object Info palette.
Offset	Adds to or subtracts from the height of the design layer's <b>Delta Z</b> value
Class	Specifies the default class for the walls
Caps	Select whether a wall segment is capped at the start point, the end point, both ends, or has no caps at all
Control Offset	If using the <b>Custom Control Line</b> wall mode, enter the offset value for the control line (see "Creating Walls" on page 471)

VectorWorks Architect is required to display the Data Fields tab. See "Creating Walls in Architect" on page 55 in the VectorWorks Design Series User's Guide.

7. Click the Textures tab to set the wall textures (RenderWorks required).

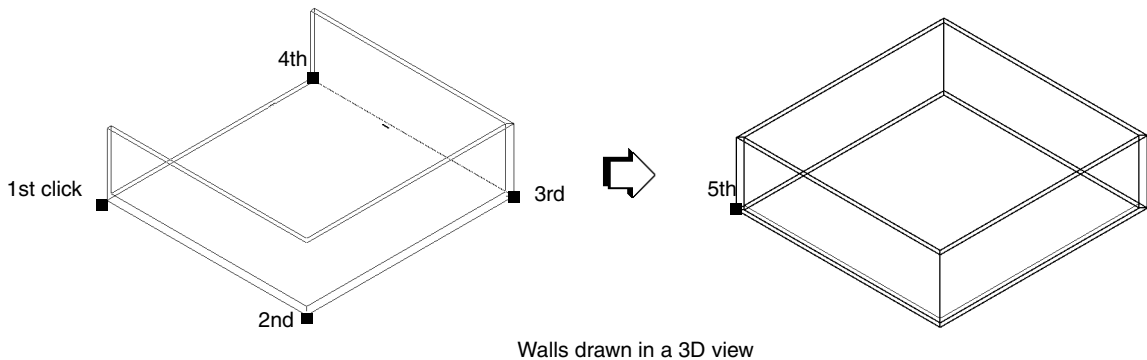
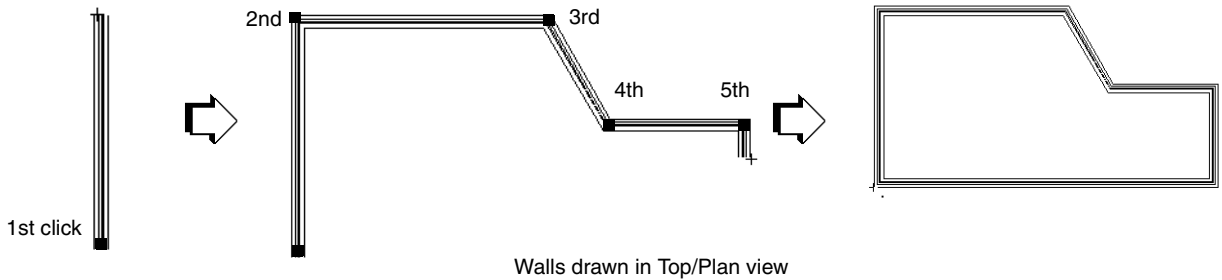
Select from the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141). Alternatively, select Class Texture to use the texture defined by the wall's class. Any walls with that wall style use class textures for that part of the wall (unless overridden). Class Texture can also be chosen for a selected wall in the Render tab of the Object Info palette.

Textures can also be set from the Render tab of the Object Info palette. Textures applied from the Object Info palette override the textures set in the Textures tab. Textures from the Textures tab override the class textures, when **Use Textures at Wall Creation** is selected.



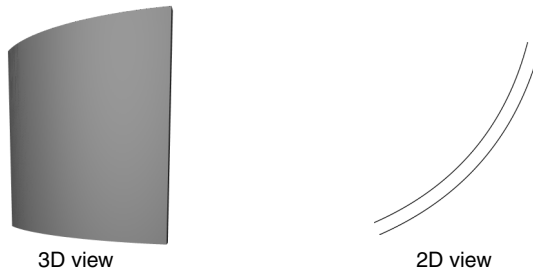
Parameter	Description
Use Textures at Wall Creation	Applies the textures to the walls as they are drawn
Use Left Texture for the Entire Wall	Applies the texture selected in <b>Left</b> to the center and right parts of the wall (see “Wall Direction” on page 479 for information on wall sections)
Left	Specifies the texture for the left section of the wall
Center	Specifies the texture for the center and ends of the wall
Right	Specifies the texture for the right section of the wall

8. Click **OK** when the wall preferences have been set.
9. Click at the starting point of the first wall section.
10. Click to end the first wall section.  
To continue creating walls, click at the end of each additional wall section.
11. Double-click to finish the wall if the start point and end point are not at the same location; otherwise, click at the starting location (a SmartCursor cue displays) to finish the wall.



## Drawing Round Walls

Round, hybrid walls can be created and joined to straight walls. The **Round Wall** tool is essentially a combination of the **Wall** tool and **Arc** tool functions. It creates a round wall with the same features and elements as straight walls. Walls can be drawn in Top/Plan or in a 3D view.



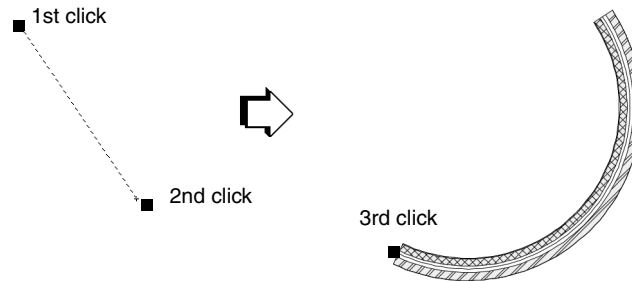
Round walls preferences include all of the same parameters as straight walls.



To create round walls:

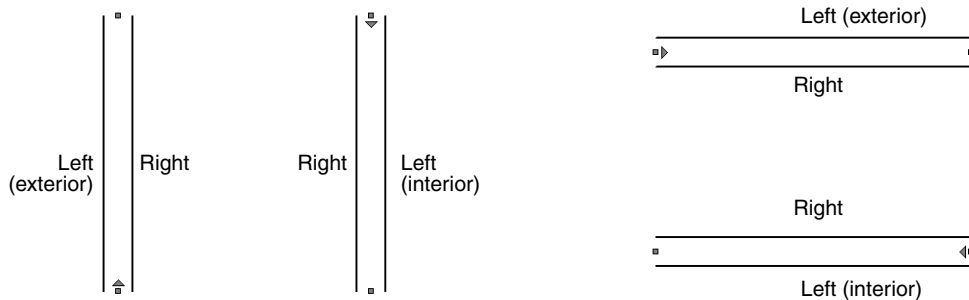
1. Click the **Round Wall** tool from the Walls tool set.
2. Click the desired **Offset** mode button (see “Creating Walls” on page 471).
3. Click the Wall Preferences mode button (the preferences are described in “Drawing Straight Walls” on page 472).

4. Click **OK** when the round wall preferences have been set.
5. Click to set the center point of the wall arc.
6. Click the mouse to begin drawing the wall, or use the Data bar to enter an angle. For more information on arc creation modes, see “Creating Arcs” on page 206.
7. Click to end the wall.



## Wall Direction

The starting point and direction the wall is drawn determines a wall’s “sides.” The center of a wall is always the same, but the left and right sides depend on the drawing direction. For example, when drawing a wall in a clockwise direction, the left side is always the exterior side; in a counterclockwise direction, it becomes the interior.

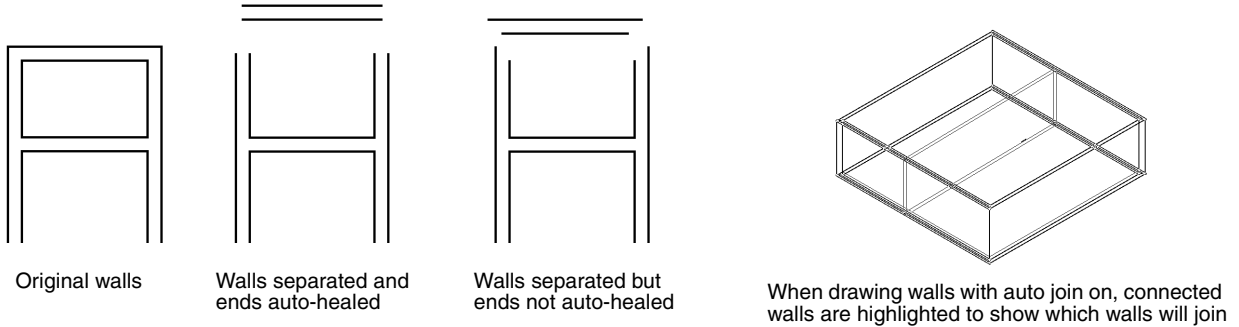


In Top/Plan view, arrows indicate the current wall direction

Wall direction can be reversed by clicking **Reverse Sides** from the Object Info palette.

## Automatically Joining Walls

The VectorWorks preferences item, **Auto join walls**, automatically joins walls at corners and intersections, and automatically heals the mitered ends of walls when they are separated from one another. For T joins, the break in the side of the wall is healed. Walls can be in either 2D or 3D view.



To set the **Auto join walls** preference:

1. Select **Tools > Options > VectorWorks Preferences** (see “Edit Preferences” on page 39).
2. On the Edit tab, select **Auto join walls**.
3. Click **OK**.

## Creating Wall Components

Wall components define the sections that make up a wall. For example, to indicate that a wall is made up of studs, inner drywall, outer sheathing, and then a siding material, define a component for each of these items to illustrate their location.

The overall thickness of a wall is equal to the sum of its components. Component fill and line style are only displayed in Top/Plan view (except for section viewports in the Design Series).

Use the **Eyedropper** tool to copy wall component settings from one wall to another (see “Transferring Attributes” on page 234).

[Additional wall capabilities are available in VectorWorks Architect.](#)

Wall components can be defined prior to drawing the wall in Wall Preferences mode, or after drawing the wall, from the Object Info palette.

[Wall components can also be edited from Wall Preferences mode. Editing a component from wall preferences does not affect existing walls.](#)

## Defining Components for New Walls

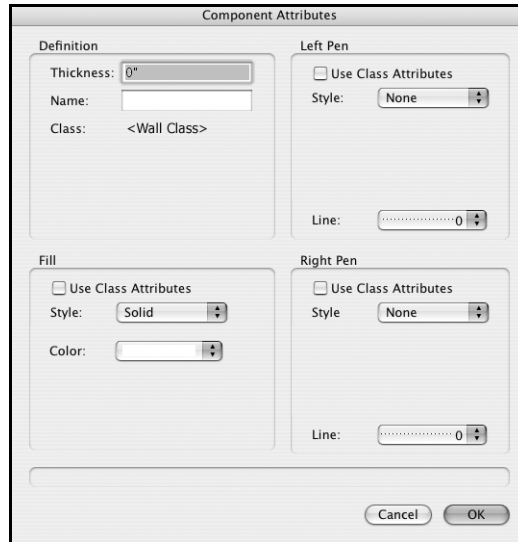
To define a wall component prior to drawing the wall:

1. Select the **Wall** tool or **Round Wall** tool from the Walls tool set, and then click **Wall Preferences** from the Tool bar.

The Wall Preferences dialog box opens.

2. On the Wall Definition tab, click **New**.

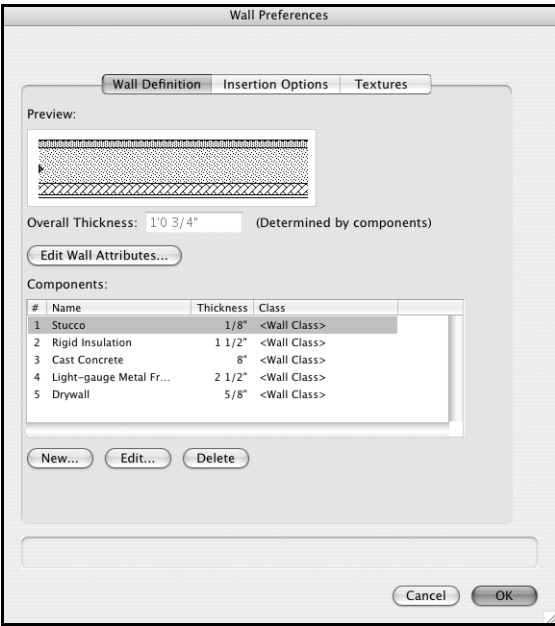
The Component Attributes dialog box opens. Specify the component thickness, name, and parameters.



Parameter	Description
Definition	
Thickness	Specifies the component's thickness; the thickness of a wall is the sum of its components. A component must have a thickness greater than 0.
Name	Provide a name for the component, which displays in the <b>Components</b> list in the Wall Preferences dialog box
Class	Displays the component class; this setting can be changed in VectorWorks Architect (see "Creating Walls in Architect" on page 55 in the VectorWorks Design Series User's Guide). VectorWorks Fundamentals can display classes set in Architect. <Wall Class> indicates that the component assumes the same class setting as that of the wall.
Fill	
Use Class Attributes	Sets component fill attributes by class rather than by the parameters in the Component Attributes dialog box. If the component class is changed later, the component changes to use the attributes of the new class.
Style	Specify the wall fill attributes, or select None for no fill. Selected hatch, gradient, or image fills, if not already present in the file, are imported and added to the Resource Browser (default resources are automatically imported into the current file at the point of use and display in the Resource Browser). See "VectorWorks Fundamentals Default Resources" on page 141 and "Fill Attributes" on page 230.
Left Pen/Right Pen	Class attributes can be used for the left and right pen parameters. Otherwise, select a style, line thickness, and dash style for the left and right sides of the component; see "Line Style Attributes" on page 232  <a href="#">Component lines are no longer shared between components as they were in Version 12.</a>

- Click **OK** to create the component and return to the Wall Preferences dialog box.

The wall's **Overall Thickness** value changes to be determined by its components. As components are defined, they display in the preview. Click and drag a component in the # column to change its order.



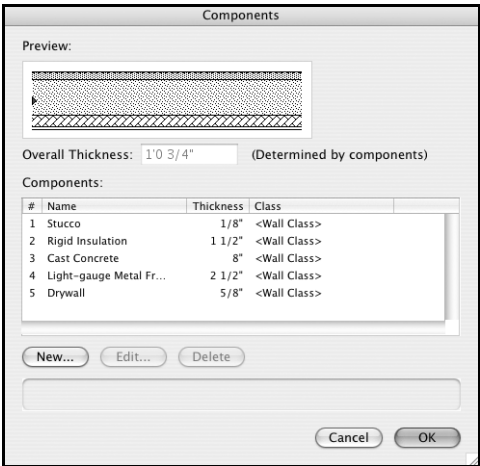
- 4. Click **OK**.

### Defining Components for Existing Walls

To define or edit wall components for an existing wall:

- 1. Select the wall(s).
- 2. From the Object Info palette, click **Components**.

The Components dialog box opens.





Parameter	Description
Preview	Displays a preview of the wall structure, including the defined components; the preview wall is drawn from left to right, so the “top” of the preview, by default, indicates the left part of the wall as it will be drawn. The arrow shows the wall direction.
Overall Thickness	The thickness of a wall with components is defined by the sum of the component thicknesses
Components	Lists the components that form the structure of the wall, in order from left to right as displayed in the preview. To change the order of a component, click and drag within the # column.
New	Click to define the components of the wall as described previously in this section
Edit	Opens the Component Attributes dialog box to edit the selected component’s thickness and attributes (you can also double-click on a component to open the Component Attributes dialog box)
Delete	Deletes the selected wall component; the wall thickness is adjusted accordingly

3. Click **New** or **Edit**, and define or edit the components as described previously.
4. Click **OK** to return to the Components dialog box.
5. Click **OK**. The new component definition is applied to the selected wall(s).

## Creating Walls from a Polygon

Another way of obtaining walls is to create them from a polygon.

To create walls from a polygon:

1. Draw or select the polygon to become the basis for the walls.
2. Select **Modify > Create Walls from Polygon**.

The Create Walls from Poly dialog box opens. Select the desired wall parameters.

Create Walls from Poly

Wall position relative to edge of poly

☒ Center

☐ Inside

☐ Outside

Use existing wall style

☒ Yes

☐ No

Use existing wall thickness

☒ Yes

☐ No

Thickness: 1/8"

Use existing wall height

☒ Yes

☐ No

Height: 0"

Assign to class:

None

☐ Delete Source Poly

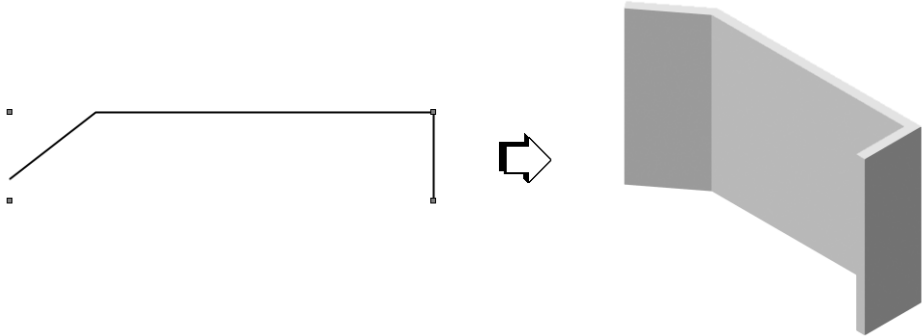
Cancel

OK

Parameter	Description
Wall position relative to edge of poly	Specifies whether the wall position should be centered on the polygon, inside the polygon, or outside the polygon
Use existing wall style	Specifies whether to create the walls using the existing wall style
Use existing wall thickness	Specifies whether to create the walls using the existing wall thickness or specify a new <b>Thickness</b> value
Use existing wall height	Specifies whether to create the walls using the existing wall height or specify a new <b>Height</b> value
Assign to class	Select the class into which the walls should be placed
Delete Source Poly	Deletes the source polygon after the walls are created

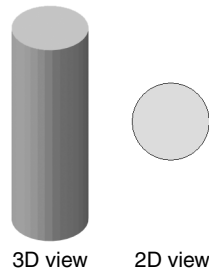
3. Click **OK**.

VectorWorks creates the wall(s) based on the original polygon and the specified parameters.



## Creating Pillars

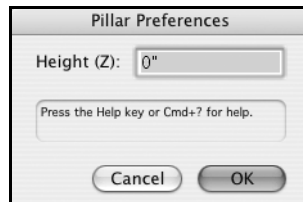
The **Pillar** command converts any closed 2D shape—rectangle, circle, oval, or polygon—into a pillar. In addition, use it on open 2D shapes, such as lines and polylines, to create a flat, screen-like object. These objects include such things as movie screens, room dividers, and moving walls. Once created, a pillar can be joined to a wall. Create pillars in 2D Top/Plan view.



To create a pillar:

1. Select **View > Standard Views > Top/Plan**.
2. Click on the 2D object to convert.
3. Select **Model > AEC > Pillar**.

The Pillar Preferences dialog box opens.

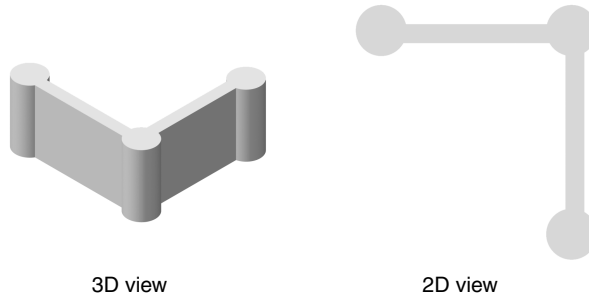


4. Enter a pillar height.
5. Click **OK**.

To view the new pillar, change to a 3D projection mode.

## Joining Pillars and Walls

Walls and pillars can be joined together. Any number of walls can connect to the pillar as long as space exists on the pillar.



To join a pillar to a wall:

1. Click on the pillar.
2. Draw the walls.

If the Auto-join feature is enabled, then the walls automatically connect to the pillar.

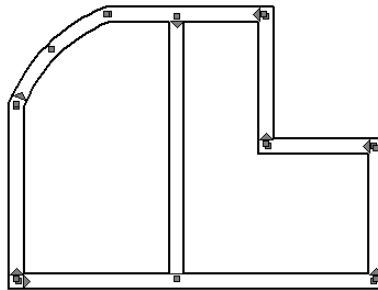
If the Auto-join feature is disabled, then click the **Wall Join** tool from the Walls tool set and join the walls to the pillar.

## Creating a Polygon or Polyline from Walls

VectorWorks can create a polygon or polyline based on either the gross area or net area of walls. This is useful for calculating the area of a room, for example, or for using color to differentiate among rooms.

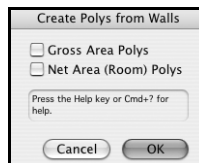
To create a polygon or polyline based on the perimeter of the walls:

1. Select the walls to use for the polygon or polyline. Multiple walls can be selected to create several polygons or polylines at the same time.



2. Select **Modify > Create Polys from Walls**.

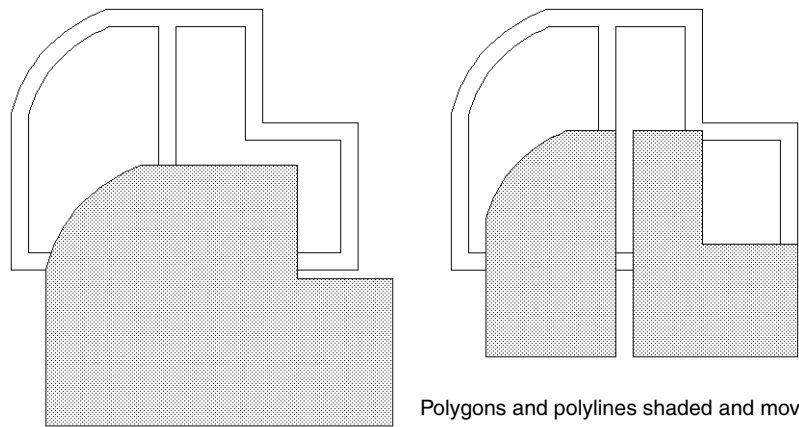
The Create Polys from Walls dialog box opens.



Parameter	Description
Gross Area Polys	Creates a polygon or polyline from the exterior perimeter of the selected walls
Net Area (Room) Polys	Creates a polygon or polyline from the interior perimeter of the selected walls

3. Click **OK**.

VectorWorks automatically creates the polygon or polyline, leaving the original walls unchanged.



## Editing Walls

Wall parameters can be edited from the Object Info palette. Vertices can be added, deleted, or moved, and walls can be reshaped. In addition, wall breaks can be removed, walls can be joined in a variety of conformations, and symbols can be added to the walls.

## Wall Properties

The properties of selected straight or round walls and their components can be edited in the Object Info palette. Change the wall attributes from the Attributes palette.

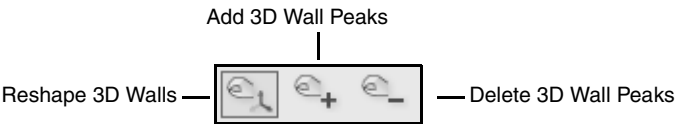
Parameter	Description
Style	In VectorWorks Fundamentals, all walls are un-styled. VectorWorks Architect is required to select other wall styles; see “Creating Walls in Architect” on page 55 in the VectorWorks Design Series User’s Guide.
+/- Z	Sets the default wall height value
Link Wall Height to Layer +/- Z	Sets the default wall height to the value specified for the design layer’s <b>Delta Z</b> value (see “Setting Design Layer Properties” on page 87)  Deselecting this option breaks the association between wall height and the layer’s <b>Delta Z</b> value.
Offset	Adds to or subtracts from the height of the design layer’s <b>Delta Z</b> value

Parameter	Description
Bot Z	Sets the location of the bottom of the wall above or below the layer’s Z value
Thick	Displays the overall thickness of the wall; the thickness of a wall without components is determined by the wall attributes. The thickness of a wall with components is defined by the sum of the component thicknesses.
Visible Thickness	Displays the wall thickness, while accounting for component visibility settings. Invisible components on the interior and exterior of the wall cause the wall to appear thinner than its actual length, for display purposes.
Caps	Select whether a wall segment is capped at the start point, the end point, both ends, or has no caps at all
Type	When the wall is capped, specifies flat or round caps
Components	Edits the wall components (see “Creating Wall Components” on page 480)
Reverse Sides	Reverses the direction of the wall sections (see “Wall Direction” on page 479)

Reshaping Walls

Use the **3D Reshape** tool to edit the elevation of walls, add vertices to create peaks in a wall, and delete vertices that have been added. Use the **2D Selection** or **3D Selection** tool to change the wall length. Symbols remain where placed when a wall is reshaped.

Three modes are available when both the **3D Reshape** tool and a wall is selected.



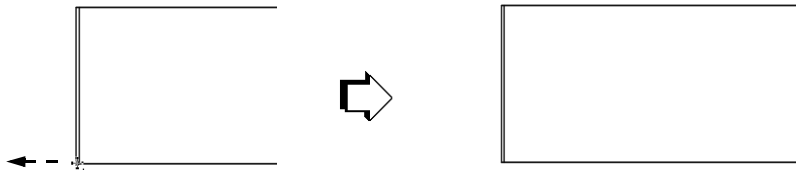
Mode	Description
Reshape 3D Walls	Adjusts the position of a selected wall vertex
Add 3D Wall Peaks	Adds a vertex to a wall for reshaping purposes
Delete 3D Wall Peaks	Deletes a wall vertex

Changing Wall Length



To change a wall’s length:

1. Select the wall to reshape.
2. In Top/Plan, click the **2D Selection** tool, or in a 3D view, click the **3D Selection** tool from the Basic palette.
3. Position the cursor over an end selection handle, and click.  
In a 3D view, the handles are at the base of the wall.
4. Move the mouse to lengthen or shorten the wall.
5. Click when the wall is at the desired length.



With the **3D Selection** tool, drag the handle at the base of the wall to lengthen or shorten the wall (Front view depicted)

## Changing Wall Elevation

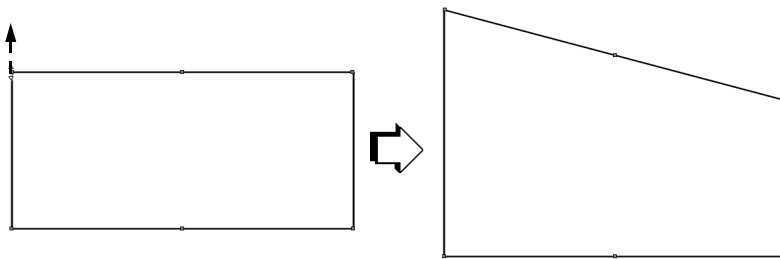


To change the elevation of a wall:

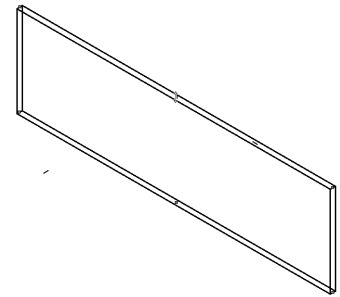
1. Select the wall to reshape.
2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Reshape 3D Walls** mode.
3. Position the cursor over one of the handles on the ends or top/bottom middle of the wall, and click.

When the cursor is over a selection handle, the standard arrow cursor changes into a double-headed, unfilled arrow.

4. Move the mouse to adjust the wall.
5. Click at the desired location.



With the 3D Reshape cursor, drag a top corner point to reshape the top of the wall (Front view depicted)



In an isometric view, drag the handle in the middle of the wall (top or bottom) to change the height

## Adding a Vertex to Walls



To add a vertex to a wall:

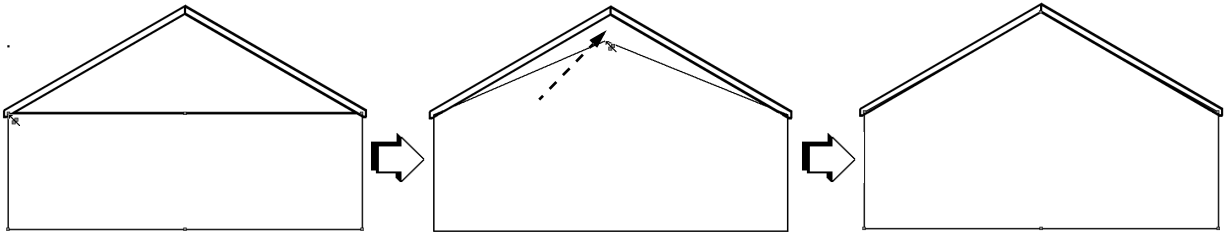
1. Select the wall that requires a peak (vertex).
2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Add 3D Wall Peaks** mode.
3. Position the cursor over an end point on one of the corners or an existing vertex, and click.

When the cursor is over an end point, the standard arrow cursor changes into a single-headed, filled arrow with shaded boxes on either side of the shaft.

4. Move the mouse to add a vertex to the top or bottom of the wall.

A vertex can be moved to any location along the same wall as long as the location does not pass another existing vertex.

5. Click when the vertex is at the desired location.



With the Add Peak cursor, click-click an end point to add a peak  
(Front view depicted)

The top of the wall is now flush with  
the bottom of the roof

To reshape a curved wall to match a planar surface, use the **Subtract Solids** or **Intersect Solids** command with an object that matches the plane of the roof.

## Deleting a Wall Vertex



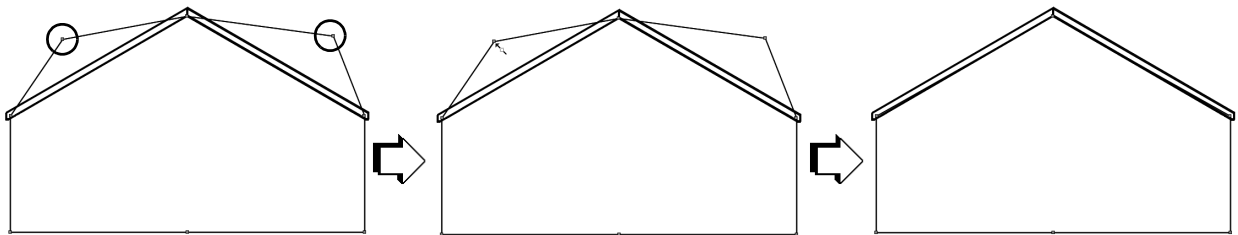
To delete a control point:

1. Select the wall with the peak (vertex) to be deleted.
2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Delete 3D Wall Peaks** mode.
3. Position the cursor over the vertex to delete.

When the cursor is over a vertex, the standard arrow cursor changes into a single-headed, filled arrow with a hollow diamond in the shaft.

4. Click on the vertex.

The vertex is removed and the wall is reshaped to the remaining vertices.



Wall with two unnecessary vertices  
(Front view depicted)

With the Delete Peak cursor, click a  
vertex to delete it

Wall with two vertices  
removed

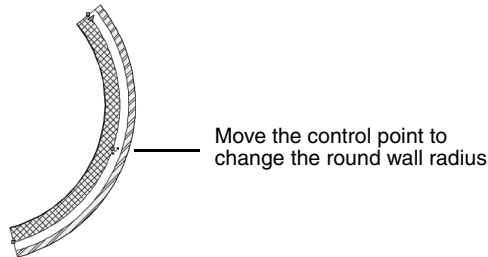


## Changing Round Wall Radius



To change the radius of a round wall:

1. Select the round wall to edit.
2. Click the **2D Selection** tool from the Basic palette.
3. Position the cursor over the center control point, and click.
4. Move the mouse to change the radius, and click to set the end point.



Flip the round wall arc by dragging toward, and through, the arc center.

## Removing Wall Breaks

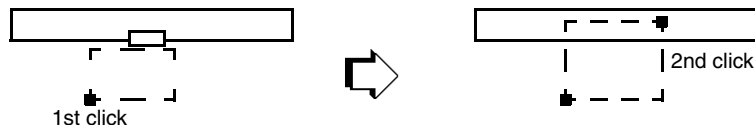
The **Remove Wall Breaks** tool cleans up any wall breaks or gaps that were created during editing. For example, when creating a new wall that joins an existing wall, if the new wall is later deleted, a break in the remaining wall displays at the joint. The **Remove Wall Breaks** tool can remove the break and any end caps.



To remove wall breaks:

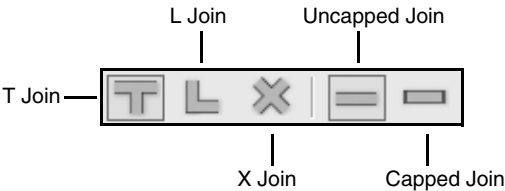
1. Click the **Remove Wall Breaks** tool from the Walls tool set, or right-click on the wall and select **Remove Break** from the context menu.
2. Click and drag to create a marquee box around the wall break or end cap to remove.

The wall break or end cap is automatically removed.



## Joining Walls

The **Wall Join** tool joins straight or curved wall segments, not already connected using the **Auto join walls** preference. (See “Automatically Joining Walls” on page 479 for information on **Auto join walls**.) There are three modes for joining walls and two end cap modes.



Mode	Description
T Join	Extends or shortens one wall segment until it intersects with a second wall segment; creates Y joins by joining the first selected wall to two sections of an existing L join
L Join	Joins the closest ends of two walls to create a corner
X Join	Joins two wall segments at the point where they intersect
Uncapped Join	Applies an uncapped join to wall join operations
Capped Join	Applies a capped join to wall join operations

Right-click on a wall and select **Join** from the context menu to temporarily activate this tool.

T and Y Wall Joins

The T Join mode is used to create both T wall joins and Y wall joins.

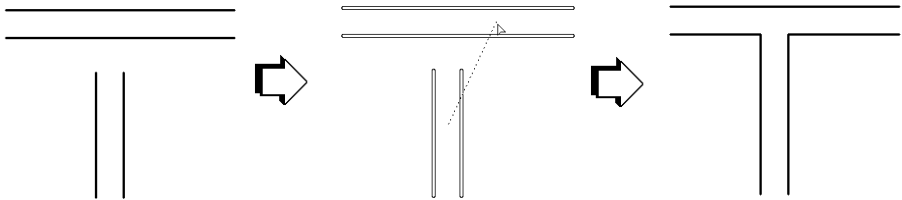
T Wall Joins

The T Join mode extends or shortens the first wall segment until it intersects with a second wall segment. As only the first wall is extended, this mode will not create corner type joins. (For those, use the L wall join mode. See “L Wall Joins” on page 493 for more information.)

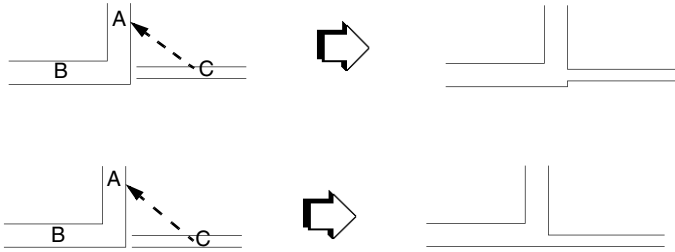


To join walls with the T Join mode:

- 1. Click the **Wall Join** tool from the Walls tool set, or right-click on the wall and select **Join** from the context menu.
- 2. Click **T Join** from the Tool bar.
- 3. Select the wall segment to join.
- 4. Select the second wall segment to join.



When trying to create a T join to an existing corner, join the wall segment to the perpendicular corner segment. This creates a clean join between the walls.



In both cases, wall A and B are already corner joined; wall C is joined to wall A

## Y Wall Joins

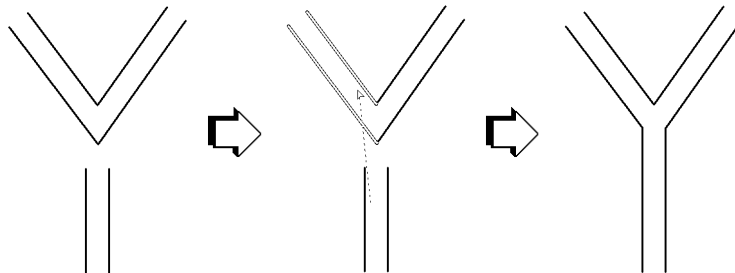
Y wall joins are not automatically created when using the **Auto join walls** preference. (See “Setting VectorWorks Preferences” on page 39 for information on **Auto join walls**.) Instead, the T Join mode is used to create Y wall joins.



To create a Y wall join between three wall segments:

1. Click the **Wall Join** tool from the Walls tool set, or right-click on the wall and select **Join** from the context menu.
2. Click **T Join** from the Tool bar.
3. Select the wall segment to join.
4. Select one of the two wall segments to join.

The wall segments are joined.



## L Wall Joins

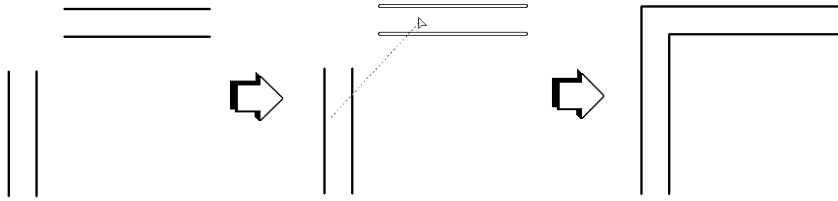
The L Join mode joins the closest ends of two walls to create a corner. Both wall lengths are extended or shortened, as necessary, until they meet cleanly.



To join walls with the L Join mode:

1. Click the **Wall Join** tool from the Walls tool set, or right-click on the wall and select **Join** from the context menu.
2. Click **L Join** from the Tool bar.
3. Select the first wall segment to join.
4. Select the second wall segment to join.

The wall lengths are resized, as necessary.



## X Wall Joins

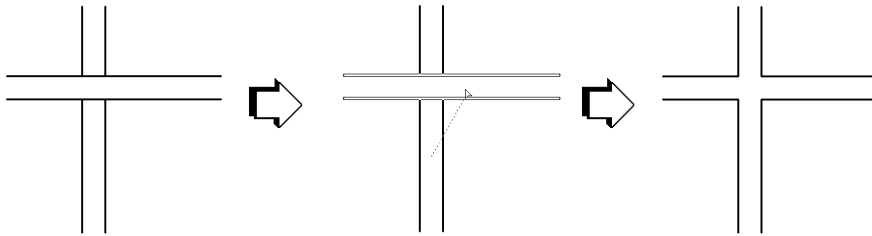
The X Join mode joins two wall segments at the point where they intersect.



To join walls with the X Join mode:

1. Click the **Wall Join** tool from the Walls tool set, or right-click on the wall and select **Join** from the context menu.
2. Click **X Join** from the Tool bar.
3. Select the first wall segment to join.
4. Select the second wall segment to join.

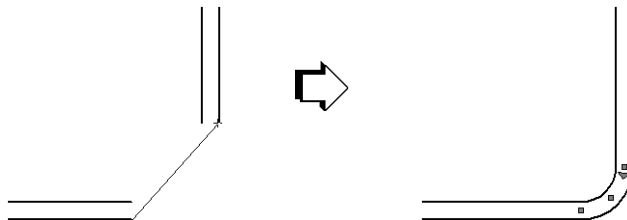
The first wall is split about the second wall to create the join.



The two wall segments must already intersect in order to use this mode, as neither segment's length is altered.

## Joining Walls with the Fillet Tool

The **Fillet** tool, located on the Basic palette, joins two wall segments by creating a round wall between them. See "Creating Fillets and Chamfers" on page 279.



## Symbols Within a Wall

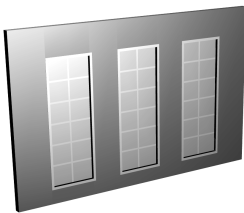
Once the walls have been created, symbols such as windows and doors can be added to them in either 2D or a 3D view. For information on symbol wall insertion options and changing symbol properties, see "Creating New Symbols" on page 156 and "Editing Symbols" on page 164.

Often, the same type of symbol is added repeatedly to the walls; this is accomplished with the **Duplicate Symbol in Wall** tool. Once the symbols have been placed in a wall, move them in the wall with the selection tools.

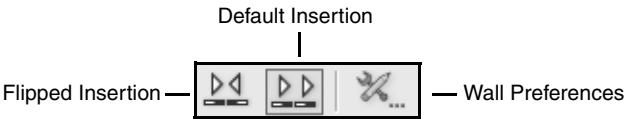
Placing Duplicate Symbols in Walls

Use the **Duplicate Symbol in Wall** tool to easily place multiple copies of a symbol in a wall, such as doors or windows in an office building or electrical outlets along a wall.

Another method of moving and duplicating symbols within walls is with the **Move by Points** tool; see “Moving Objects by Clicking” on page 369.)



Select a mode from the Tool bar.

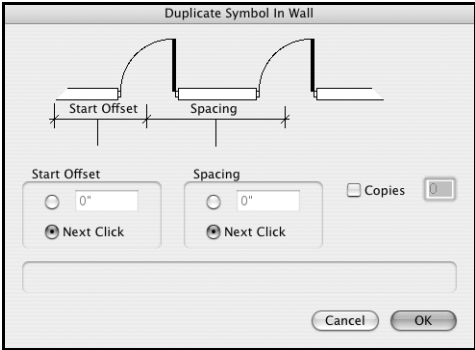


Mode	Description
Flipped Insertion	Flips the symbol during placement (for example, changes the direction that a door opens)
Default Insertion	Places the symbol using the orientation at creation
Wall Preferences	Specifies symbol placement information



To place duplicate symbols in a wall:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Click the desired symbol from the list.
3. Select **Make Active** from the **Resources** menu.  
Activate a symbol already placed in the drawing with the **Symbol Pick Up** mode of the **2D Symbol Insertion** tool (see “Symbol Pick Up Mode” on page 162).
4. Click the **Duplicate Symbol in Wall** tool from the Walls tool set.
5. Select the placement mode from the Tool bar.  
This sets the symbol orientation. To place the symbol using the orientation in which it was created, click the **Default Insertion** mode button. To flip the symbol when it is placed, click the **Flipped Insertion** mode button.
6. Click **Wall Preferences** from the Tool bar.  
The Duplicate Symbol In Wall dialog box opens. Indicate how to place the symbols.



Parameter	Description
Start Offset	To set the first symbol position with the mouse, select <b>Next Click</b> ; to set the first symbol position by a specified distance from a wall end, select the button next to the text box and enter a distance from the wall end
Spacing	To place successive symbols by mouse click, select <b>Next Click</b> ; to place successive symbols a specified distance apart, select the button next to the text box and enter a distance between symbols
Copies	If selected, enter the specific number of symbol copies to insert into the wall

- 7. Click **OK**.
- 8. Click on the wall to indicate where the first symbol should be inserted. A preview of the symbols are shown along the wall to aid in placement. If inserting the first symbol by an offset value, click anywhere on the wall and the first symbol preview displays at the proper offset distance.
- 9. If spacing symbols by the next mouse click, move the mouse along the wall to set the spacing between symbols, and click again to insert the duplicate symbols. If spacing symbols by a specified distance, click again to insert the duplicate symbols. If a number of copies was specified, that number of symbols is automatically inserted.

Move the mouse to the opposite side of the wall to flip the symbol direction.

Dragging and Dropping Symbols in Walls

To insert a 2D, 3D, or hybrid symbol in a wall by dragging it from the Resource Browser:

- 1. Click the symbol in the Resource Browser and drag it to the desired location in the wall.  
The symbol cannot be rotated during insertion, since the **2D Symbol Insertion** tool (or **3D Symbol Insertion** tool) is not automatically activated. When a symbol is dropped onto a wall or round wall, VectorWorks inserts the symbol into the object using the default flip value. (If this is not desirable, make the symbol active and it is inserted with the appropriate insertion tool.)
- 2. If necessary, edit the symbol parameters in the Object Info palette.

Moving Symbols in Walls

The **2D Selection** tool moves symbols within walls. (Another method of moving and duplicating symbols within walls is with the **Move by Points** tool; see “Moving Objects by Clicking” on page 369.)

Several symbols can be selected and moved at once. When multiple symbols are selected, their common parameters can be changed in the Object Info palette.

Symbols within walls and symbols outside of walls cannot be selected at the same time.

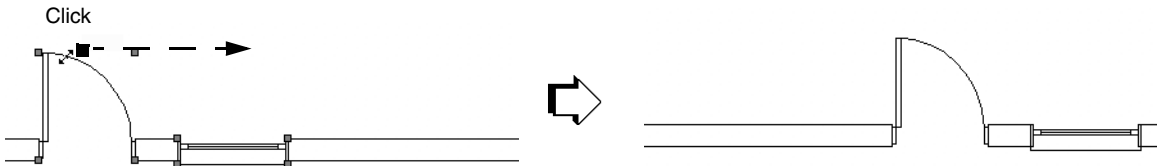


To move one or more symbols within a wall:

- 1. Switch to **Top/Plan** view.  
Symbols in a wall can only be moved in 2D view.
- 2. Click the **2D Selection** tool from the Basic palette.  
Toggle Wall Insertion mode on or off, depending on the desired result.

Action	Description
Select one or more symbols inserted in a wall, with <b>Wall Insertion</b> mode on	Inserted symbols can be dragged out of the wall (and into another wall if desired).
Select one or more symbols not inserted in a wall, with <b>Wall Insertion</b> mode on	Selected symbols can be inserted into a wall by dragging them over the wall.
Select one or more symbols inserted in a wall, with <b>Wall Insertion</b> mode off	The symbols are moved within the wall. When one of the objects in the selection reaches the end of the wall, none of the objects can be moved further in that direction.

- 3. Select the symbol or symbols.
- 4. Position the cursor near the symbol to be moved. When the resize cursor displays, drag the symbol(s).



## Creating Roof Faces

VectorWorks offers two ways to create a roof for a structure:

- The **Roof Face** command converts any closed 2D object into a roof face object.
- The **Create Roof** command creates a roof by selecting the object(s) that the roof will be based upon (including walls, polygons and polylines). See “Creating Roof Objects” on page 500.

Use the **Roof Face** command to create hybrid (2D/3D) roof structures from simple 2D objects. This is an easy way to create a slab or flat roof, by converting any closed 2D object into a roof face object.

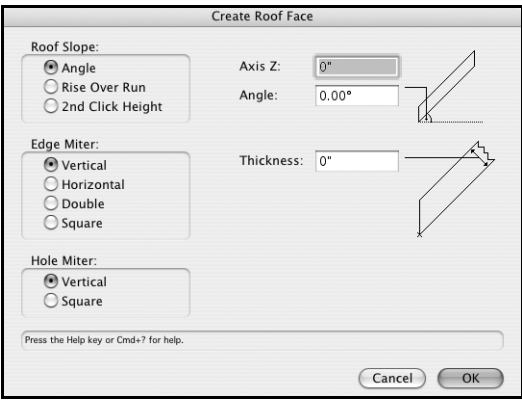
For example, use this command to create a uniquely shaped roof, such as a gable roof over a round structure. The roof can be created in the same design layer as the wall structure, or in a different layer. Create a viewport to view the walls and roof together.

While this command can create a hip or gable roof, it is easier to create these types of roofs with the **Create Roof** command.

To create a roof face:

1. Draw the 2D object that is the basis for the roof.  
Any enclosed 2D object can be used, such as enclosed arcs, polylines, rectangles, circles, and ovals.
2. Select the 2D object.
3. Select **Model > AEC > Roof Face**.

The Create Roof Face dialog box opens. Specify the roof slope creation method, edge and hole miter options, and roof parameters.

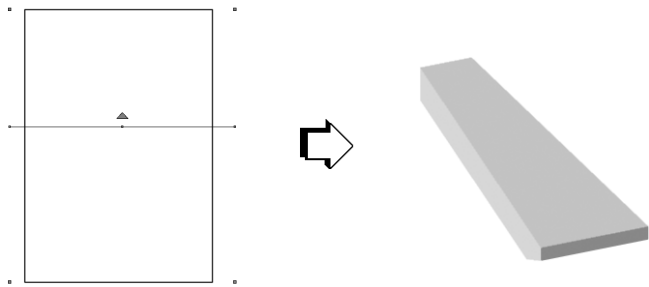


Parameter	Description
Roof Slope	Indicates the roof slope creation method and criteria
Angle	Creates a roof slope based on an angle; specify the <b>Angle</b>
Rise over Run	Creates a roof slope based on rise over run values; specify the <b>Rise</b> and <b>Run</b> . The rise is the distance along the Y axis the roof rises above the Z height, and run is the distance along the X axis for the roof to reach that height.
2nd Click Height	Creates a roof slope based on a mouse click position (this option only available in Top/Plan view). Enter the <b>Height</b> for the second mouse click.
Edge Miter	Indicates the miter type for the roof edge
Vertical	Creates the roof edge perpendicular to the ground plane
Horizontal	Creates the roof edge parallel to the ground plane
Double	Creates the roof edge with a horizontal and vertical miter; specify the <b>Horizontal</b> and <b>Vertical</b> lengths
Square	Creates the lower edge of the roof face perpendicular to the roof surface, regardless of the roof angle
Hole Miter	Specifies cut-out miter options
Vertical	Cut-out edges are perpendicular to the ground plane
Square	Cut-out edges are perpendicular to the roof surface
Axis Z	Sets the roof height



Parameter	Description
Angle	For angled roof slopes, indicates the roof slope angle
Rise/Run	For rise over run roof slopes, specifies the rise and run values
Height	Indicates the height of the second mouse click when the roof slope is specified with that option
Thickness	Specifies the roof thickness
Vertical/Horizontal	For double miters, specifies the horizontal and vertical miter lengths

- Click **OK**.
- Click-drag the mouse across the 2D object to draw a line defining the roof axis; click again to complete the line. A black arrow displays on one side of the line, indicating which side of the object will be the high side of the roof.
- Point the mouse to the side of the roof that will be highest, and then click again. The roof axis line displays selection handles, and the arrow pointing to the high side of the roof turns blue, indicating that the roof face is complete.



## Reshaping Roof Faces

Once a roof face has been created, there are several ways to edit it:

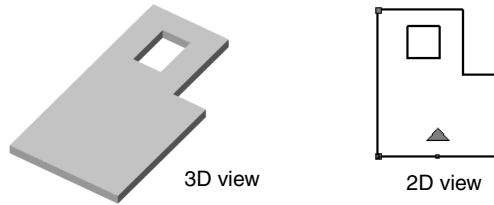
- Edit the roof face parameters (such as the angle or eave type) in the Object Info palette.
- Change the roof’s basic 2D object shape using the **Edit Group** command. (Be careful not to use the **Ungroup** command, as this permanently changes the roof face back into the original 2D object.) Use the **Exit Group** command to complete the change.
- Move the roof face axis using the **2D Selection** tool in Top/Plan view.
- Change the roof face angle using the **3D Reshape** tool (best in Front or Back view).

The roof angle must be between 0° and 85° to be changed by the **3D Reshape** tool.

## Creating Cut-outs in a Roof Face

Use the **Clip Surface** command to add a cut-out to a roof face. A cut-out, for example, can be used to add a hole for a chimney that overlaps two or more faces of the roof.

This procedure creates a cutout in a roof face created with the **Roof Face** command (see “Creating Roof Faces” on page 497).



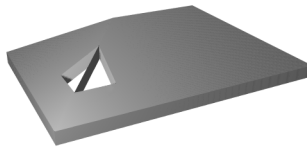
The edges of the cut-out are mitered according to the selections made in the Create Roof dialog box during the creation of the roof face.

To add a cut-out to a roof face:

1. Select the roof face.
2. Create an object with the dimensions for the cut-out and place it where the cut-out will be located.
3. Select both objects.
4. Select **Modify > Clip Surface**.

This creates the cut-out in the roof face, leaving behind the object used to make the cut-out.

5. Select the object used to make the cut-out and delete it.



## Dragging and Dropping Symbols in a Roof Face

To insert a 2D, 3D, or hybrid symbol in a roof face by dragging it from the Resource Browser:

1. Click the symbol in the Resource Browser and drag it to the desired location in the roof face.

The symbol cannot be rotated during insertion, since the **2D Symbol Insertion** tool (or **3D Symbol Insertion** tool) is not automatically activated. When a symbol is dropped onto a roof face, VectorWorks inserts the symbol into the object using the default flip value. (If this is not desirable, make the symbol active and it is inserted with the appropriate insertion tool.)

2. If necessary, edit the symbol parameters in the Object Info palette.

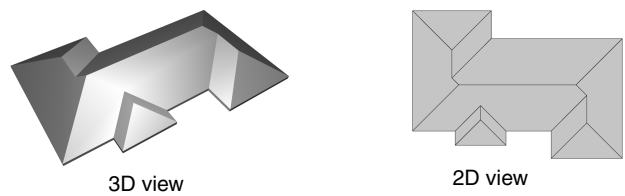
## Creating Roof Objects

VectorWorks offers two ways to create a roof for a structure:

- The **Create Roof** command creates a roof by selecting the object(s) that the roof will be based upon (including walls, polygons, polylines, and arcs).
- The **Roof Face** command converts any closed 2D object into a roof face object. See “Creating Roof Faces” on page 497.

The **Create Roof** command creates a roof object with multiple faces based on specified parameters. A great variety of roof types can be created by this method, and they can include roof elements such as gables and skylights. Once the

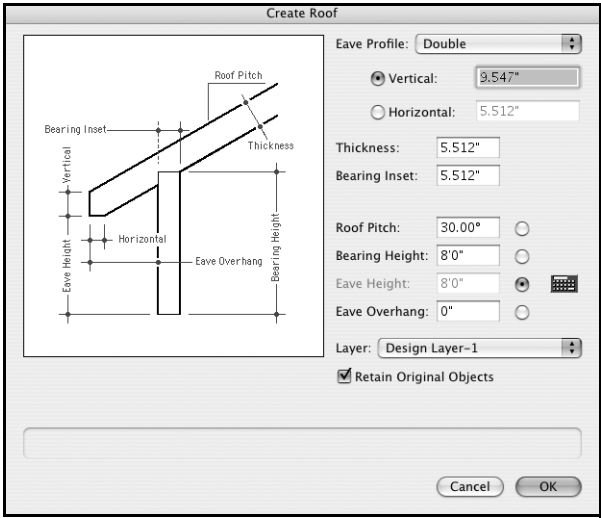
walls of a structure are complete, select the walls that the roof will be based upon, and specify the roof parameters. Alternatively, select a polygon or polyline as the basis for the roof.



To create a roof object:

1. Select the walls, polygon, or polyline that the roof will be based upon.  
Shift-click to select multiple walls. If the building has an attachment, such as a garage, that will have a different roof structure, then select only the desired walls.
2. Select **Model > AEC > Create Roof**.

The Create Roof dialog box opens. Enter the desired criteria to create the roof object. The parameters are illustrated in the roof diagram. Certain default parameters are suggested based on the selected roof parameters.



Parameter	Description
Eave Profile	Select the roof edge appearance <ul style="list-style-type: none"><li>• Square: angled fascia, soffit edges</li><li>• Vertical: vertical fascia, angled soffit edges</li><li>• Horizontal: no fascia, horizontal soffit edges</li><li>• Double: vertical fascia, horizontal soffit edges</li></ul>
Vertical	Specifies the vertical length for a double miter eave
Horizontal	Specifies the horizontal length for a double miter eave
Thickness	Specifies the roof thickness

Parameter	Description
Bearing Inset	Specifies how far the bearing wall cuts into the roof
Roof Pitch	Specifies the roof pitch as an angle or rise:run ratio; click <b>Calculate</b> for an automatic calculation based on bearing height, eave height, and eave overhang
Bearing Height	Specifies the height of the rafter plate or top plate above the wall layer Z height where the roof will be supported; click <b>Calculate</b> for an automatic calculation based on roof pitch, eave height, and eave overhang
Eave Height	Specifies the height of the lowest portion of the roof; click <b>Calculate</b> for an automatic calculation based on roof pitch, bearing height, and eave overhang
Eave Overhang	Specifies the distance that the roof extends beyond the bearing wall; click <b>Calculate</b> for an automatic calculation based on roof pitch, bearing height, and eave height
Layer	By default, the roof is created in the active design layer. To create the roof in a different layer, select an existing layer from the list, or select <b>New Layer</b> to create a new layer.
Retain Original Objects	Retains the source object(s) that formed the basis of the roof

3. Click **OK**.

VectorWorks creates a hip roof over the selected object(s) using the criteria set in the Create Roof dialog box.

## Editing Roof Objects

Once a roof object has been created, there are multiple ways to edit it:

- Edit the roof object parameters (such as the thickness or eave type) in the Object Info palette.
- Change roof edge shapes (such as hip or gable) using the **2D Selection** or **3D Selection** tool.
- Reshape the roof object using the **2D Reshape** or **3D Reshape** tool in Top/Plan view.

## Editing Basic Roof Object Parameters

Change the basic parameters that were set when the roof object was created using the Object Info palette.

To change roof object settings:

1. Select the roof.
2. From the Object Info palette, change basic parameters as necessary.

Parameter	Description
Bearing Inset	Specifies how far the bearing wall cuts into the roof
Thickness	Specifies the roof thickness (normally, this is the perpendicular thickness; when a roof has different slopes, the vertical thickness can be specified)
Applies To	When a roof has different slopes, the vertical thickness can be specified to avoid incorrect roof intersections. Select <b>Vertical Thickness</b> and enter the <b>Thickness</b> value
Gable Thickness	When gable walls exist, specifies the gable wall thickness

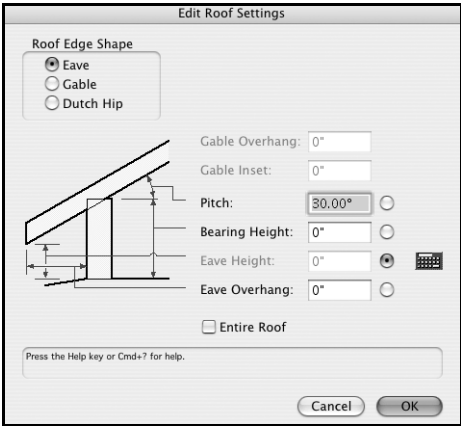
Parameter	Description
Eaves	Specify the eave type
Vertical	For Double Miter types, enter the vertical length of the eave
Create Gable End Walls	Select to create wall sections at gable ends

### Changing the Roof Edge Shape

By default, VectorWorks creates a hip roof with eave edges all around. Specific roof edges can be changed to a gable or Dutch hip shape.

To change the roof edge shape:

1. Select the roof with the **2D Selection** tool.  
Selection handles display for the roof.
2. Click on the selection handle of the edge to be edited.  
The Edit Roof Settings dialog box opens.
3. Change the roof parameters and select **Entire Roof** to apply the edits to all sections of the roof. If **Entire Roof** is not selected, the edits apply to the edge of the roof that was clicked.



Parameter	Description
Roof Edge Shape	Select the basic shape of this roof edge: Eave, Gable, or Dutch Hip. By default, VectorWorks creates a hip roof, which has an “Eave” edge on all sides.  When this setting is changed, the available parameters and roof diagram reflect the selected roof edge shape.
Gable Overhang (Dutch Hip only)	Specifies how the gable wall on top of the Dutch hip face will be cut; enter zero for a flat gable wall, or enter the number of inches the gable wall will be inset from the gable roof edge
Gable Inset (Dutch Hip only)	Specifies how far the gable wall on top of the Dutch hip face will be from the edge of the hip face

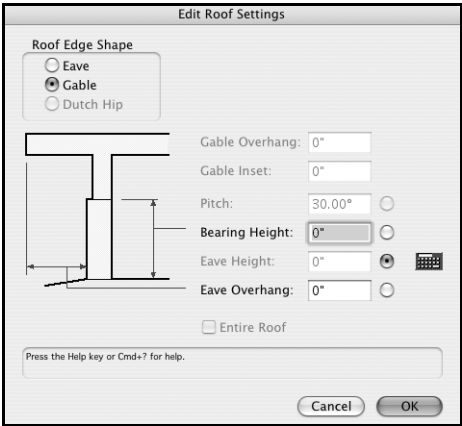
Parameter	Description
Pitch (Eave and Dutch Hip only)	Specifies the roof pitch as an angle or rise:run ratio; click the calculator for an automatic calculation based on bearing height, eave height, and eave overhang
Bearing Height	Specifies the height of the rafter plate or top plate above the wall layer Z height where the roof will be supported; click the calculator for an automatic calculation based on pitch, eave height, and eave overhang
Eave Height	Specifies the height of the bottom-most portion of the roof; click the calculator for an automatic calculation based on pitch, bearing height, and eave overhang
Eave Overhang	Specifies the distance that the roof extends beyond the bearing wall, click the calculator for an automatic calculation based on pitch, bearing height, and eave height
Entire Roof (Eave and Dutch Hip only)	Select this option to apply the edited roof parameters to all available roof sections

4. Click **OK** to change the roof edge settings.

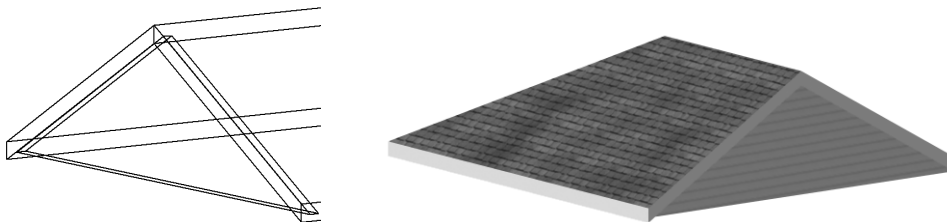
Changing a Hip Roof to a Gable Roof

To change a hip roof into a gable roof:

- 1. Select the roof with the **2D Selection** tool.  
Selection handles display for the roof.
- 2. Click on the selection handle of the face to change into a gable wall.  
The Edit Roof Settings dialog box opens.
- 3. Select the **Gable** option.  
A diagram and parameters for a gable edge display.



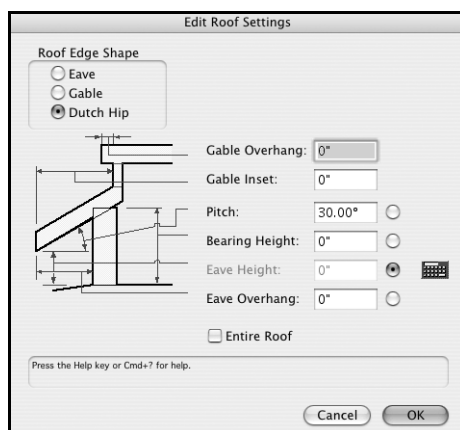
4. Change the parameters as described in “Changing the Roof Edge Shape” on page 503, and click **OK**.  
A triangular wall is placed when the gable roof is created.



## Changing a Hip Roof to a Dutch Hip Roof

To change a hip roof into a Dutch hip roof:

1. Select the roof with the **2D Selection** tool.  
Selection handles display for the roof.
2. Click on the selection handle of the face to change into a Dutch hip face.  
The Edit Roof Settings dialog box opens.
3. Select the **Dutch Hip** option.  
A diagram and parameters for a Dutch hip edge display.



4. Specify a **Gable Inset** value to create the Dutch hip face, and change other settings as described in “Changing the Roof Edge Shape” on page 503.
5. Click **OK**.
6. Select **Entire Roof** to apply the edits to all appropriate sections of the roof.

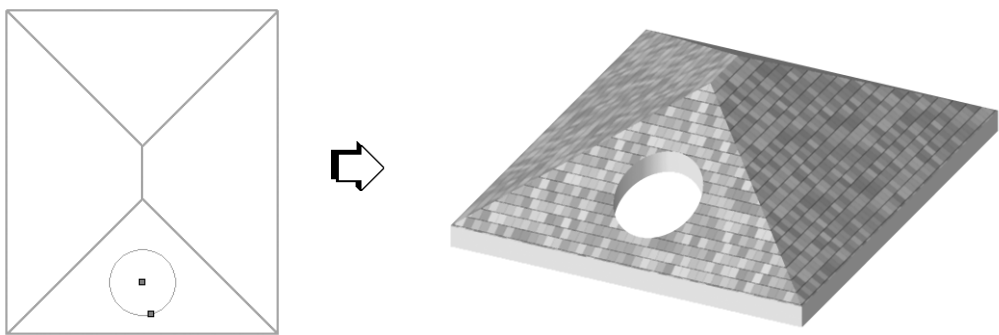


## Creating Cut-outs in a Roof Object

Cutting a hole in a roof object is easily accomplished by editing the roof object group and drawing the cut-out shape.

To create a cut-out in a roof object:

1. Select the roof object.
2. Select **Modify > Edit Group**.
3. In the Edit Group window, draw a 2D object (rectangle, circle, oval, polygon, polyline, or arc) over the roof.
4. Click **Exit Group** at the top right of the window.
5. The shape is cut out of the roof.

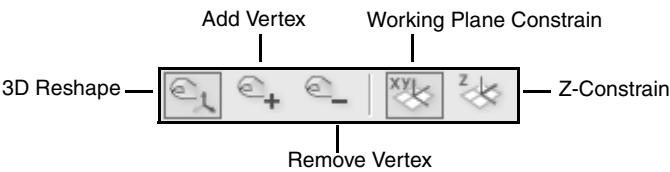


## Reshaping Roof Objects

A roof object can be reshaped in a 2D or 3D view with the **3D Reshape** tool. The roof edge, roof ridge, and roof slope can be changed.

In Top/Plan view, the **2D Reshape** tool can be used for basic roof shape editing. However, only the **3D Reshape** tool, in any view, can edit the roof edge and roof ridge location.

Five modes are available when both the **3D Reshape** tool and a roof object is selected.



Mode	Description
3D Reshape	Adjusts the position of a selected roof vertex, constrained horizontally or vertically in combination with the Z-Constrain and Working Plane Constrain modes
Add Vertex	Adds a peak (vertex) to a roof
Remove Vertex	Deletes a roof peak (vertex)
Working Plane Constrain	In 3D Reshape mode, reshapes the roof object horizontally, constrained along the X and/or Y axes



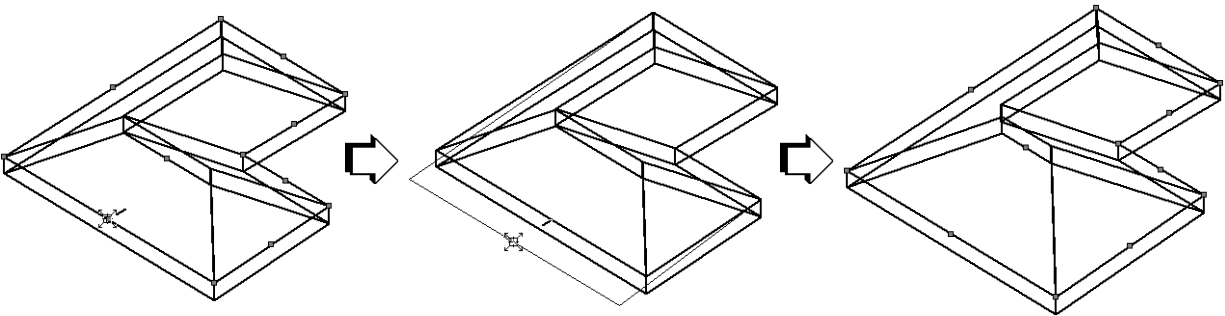
Mode	Description
Z-Constrain	In 3D Reshape mode, reshapes the roof object along the Z axis to change the height of a roof ridge or eave

Reshaping the Roof Along the X and Y Axis



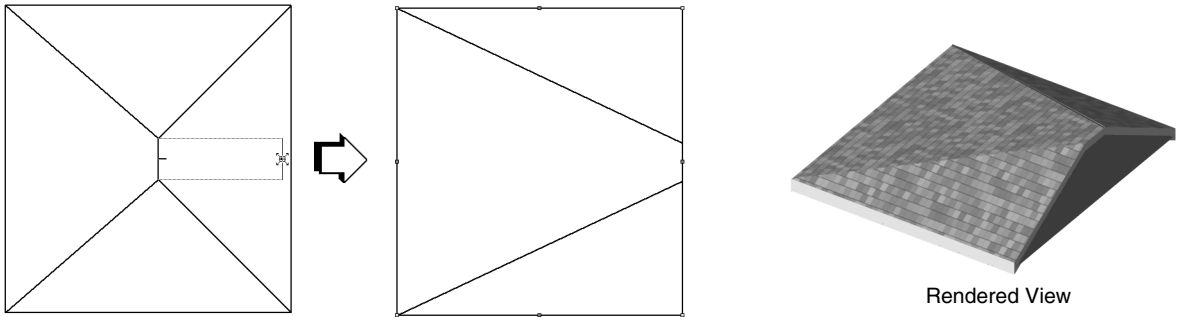
To reshape the roof horizontally:

- 1. Select the roof object.
- 2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Working Plane Constrain** mode.
- 3. Position the cursor over a roof handle.  
When the cursor is over a handle, the standard arrow cursor changes into an unfilled, four-way arrow.
- 4. Click-drag the handle to change the roof handle location, or enter specific X and Y distance values in the Data bar.



The roof edge, ridge, or eave handle location can be changed. The handle movement is constrained along the X or Y axis (the ground plane); the height of the roof element cannot be changed in this mode.

Change the slope of a roof face by moving the ridge handle. If the reshape results in a roof slope that approaches or exceeds 90 degrees, you are prompted to create a gable wall if desired.



- 5. Click when the handle is at the desired location.

## Reshaping the Roof Along the Z Axis

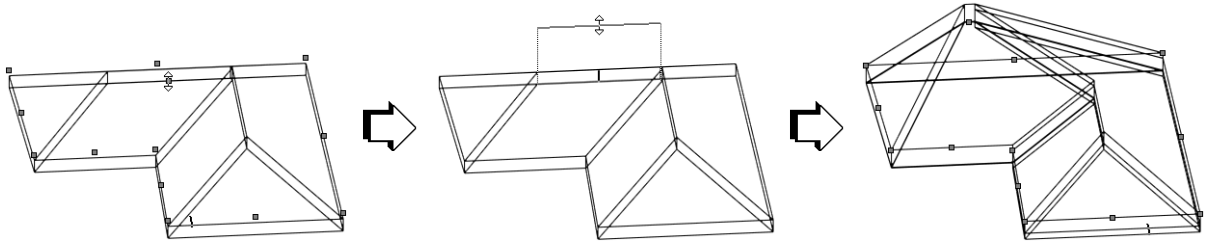


To change the height of a roof ridge or eave:

1. Select the roof object.
2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Z-Constrain** mode.
3. Position the cursor over a roof ridge or eave handle.

When the cursor is over a handle, the standard arrow cursor changes into two-way hollow arrow.

4. Click-drag the handle to change the roof handle location, or enter the specific Z axis distance in the Data bar.



The roof ridge or eave handle location can be changed. The handle movement is constrained along the Z axis (vertically); only the height of the roof element can be changed in this mode.

5. Click when the handle is at the desired location.

## Adding a Roof Vertex



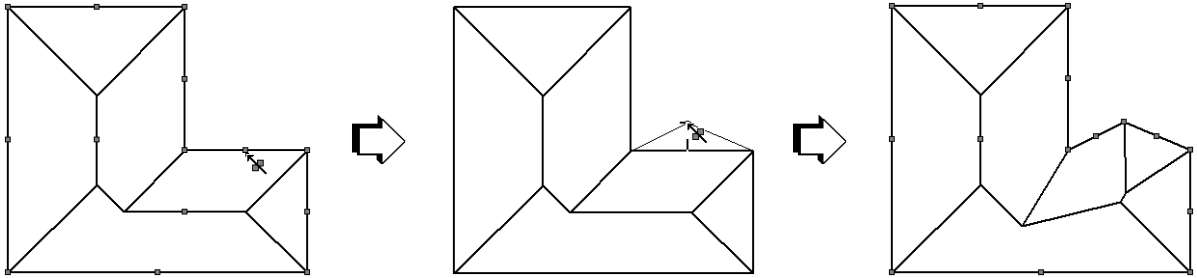
To add a vertex to a roof:

1. Select the roof for adding the vertex.
2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Add Vertex** mode.
3. Position the cursor over one of the edge or eave handles.

The standard arrow cursor changes into a single-headed, filled arrow with shaded boxes on either side of the shaft.

4. Click-drag the mouse to add a vertex to the roof edge or eave.
5. Click when the vertex is at the desired location.

The roof is automatically reshaped to accommodate the new vertex.



## Deleting a Roof Vertex



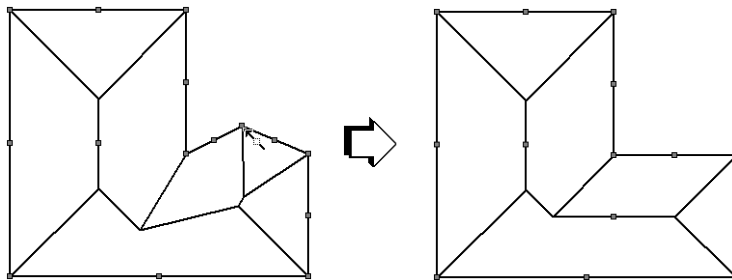
To delete a vertex from a roof:

1. Select the roof with the vertex to be deleted.
2. Click the **3D Reshape** tool from the 3D Modeling tool set, and select **Remove Vertex** mode.
3. Position the cursor over the eave vertex to delete.

The standard arrow cursor changes into a single-headed, filled arrow with a hollow diamond in the shaft.

4. Click the vertex.

The vertex is removed and the roof is reshaped to the remaining vertices.



## Adding Roof Elements

Once a roof object has been created, roof elements, such as dormer windows and skylights, can be added.

### Creating Dormer Windows



VectorWorks can create a wide variety of dormer windows in roofs. There are five styles to select from: trapezium, gable, shed, hip, and bat; each gable type has unique parameters. The Edit Roof Element dialog box, used to create and edit the dormers, changes according to the style of dormer chosen.

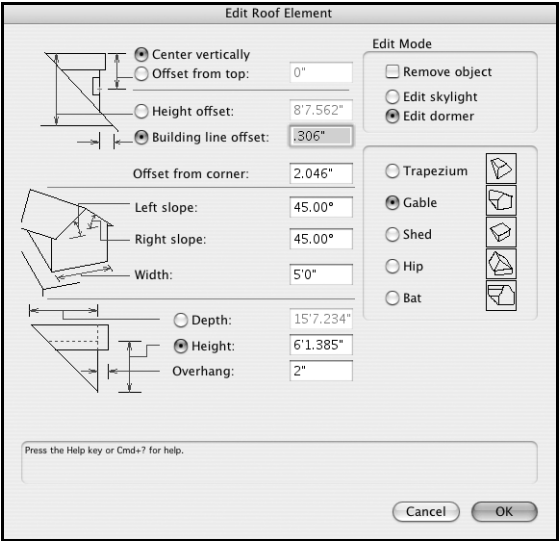
*Dormer walls are always drawn in a clockwise direction for easy texture application.*

To create a gable dormer window in a roof object:

- 1. Select **View > Standard Views > Top/Plan**.
  - 2. Select **Window > Palettes > Resource Browser**.
  - 3. Select a window symbol.
- The window must be a symbol, not a plug-in object.
- 4. Select **Make Active** from the **Resources** menu. The **3D Symbol Insertion** tool is automatically activated from the 3D Modeling tool set.
  - 5. Click to place the symbol in the roof object.

The roof must be a roof object with a fill, and not simply a roof face.

The Edit Roof Element dialog box opens.



Dormer styles

- 6. Click **Edit Dormer**.
- 7. Select the dormer style.

The parameters automatically change according to the selected dormer style, with values for placing the dormer at the location specified with the mouse click.

Parameter	Dormer Style	Description
Center vertically	All	Places the center of the window symbol in the center of the available vertical space in the front face of the dormer; the normal insertion point is not used
Offset from top	All	Locates the top of the window symbol a set distance from the top of the dormer face; the normal insertion point is not used

Parameter	Dormer Style	Description
Height offset	All	Indicates the vertical distance from the top of the point of engagement with the roof, or where the roof and the dormer meet, to the bearing point, which is usually along the top of the bearing wall
Building line offset	All	Specifies the distance from the building outline to the plan center of the window symbol
Offset from corner	All	Sets the distance from the corner of the roof to the center of the dormer; the roof corner that the measurement is taken from is always to the left of the dormer when facing it
Top width	Trapezium, Bat	Determines the width of the top roof and sets the front face's trapezoid shape; the front face is always symmetrical when using this option
Right slope	Trapezium, Gable, Hip	Determines the angle of the right edge of the front face; the front face can be asymmetrical when using this option
Left slope	Trapezium, Gable, Hip	Specifies the angle of the left edge of the front face. Along with the <b>Right Slope</b> , this dimension determines the top width of the front face. <b>Right Slope</b> must be selected for this option to be available.
Bottom width	Trapezium, Gable, Bat	Sets the width of the bottom edge of the front face; works in conjunction with either the <b>Top Width</b> or the <b>Left and Right Slope</b> entries and is required
Slope	Trapezium, Shed, Bat	Indicates the angle of the pitch of the top dormer roof as measured from a horizontal line
Width	Gable, Shed, Hip	Horizontal distance of the front face of the dormer
Front Slope	Hip	Indicates the angle of the pitch of the front face of the dormer roof as measured from a vertical line
Height	All	Specifies the elevation height of the front face of the dormer; determines the plan depth of the dormer
Top width	Bat	Indicates the width of the top of the roof as measured along the front face of the dormer
Bottom Height	Bat	Distance from the bottom of the dormer to the beginning of the compound curves of the roof as measured along the front face of the dormer
Depth	All	Sets the plan distance from the point of engagement with the roof to the front face of the dormer; determines the elevation height of the front face of the dormer
Overhang	Gable, Shed, Hip	Amount of roof extension past the dormer's front roof face
Control Point	Bat	Point where the two curves of the roof meet. This option controls the location of that point from the side edge of the dormer as measured along the roof. The location of this point determines the depth of the curves that make up the roofline.

8. Click **OK**.

The gable dormer with window is created and placed according to the parameters specified. A hole is automatically created in the roof where the dormer walls exist.

## Editing Dormer Windows

Once created, the dormer window parameters can be edited.

To edit a dormer window:

1. Select the dormer.

Selection handles display around the roof and at the location of each dormer.

2. Position the cursor over the selection handle for the dormer and click.

The Edit Roof Element dialog box opens.

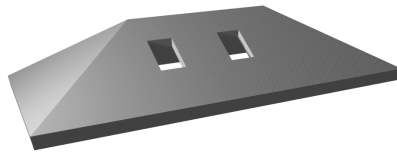
3. Select **Edit Dormer** and change the desired parameters as described in “Editing Dormer Windows” on page 512.

To remove the dormer completely, select **Remove Object**.

4. Click **OK**.

The drawing area displays the specified changes for the selected dormer.

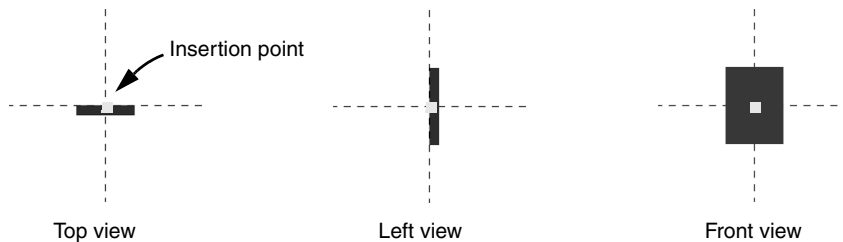
## Creating Skylights



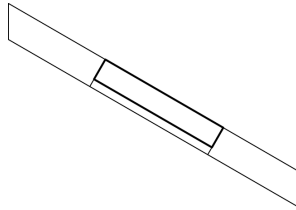
A similar process to creating dormer windows is used to place a full skylight, complete with a window symbol, in the roof.

A cut-out can also be created through this process, but it is easier to create a cut-out by following the procedures described in “Creating Cut-outs in a Roof Object” on page 506.

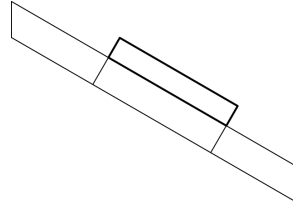
A 3D-only window symbol is required for creating a skylight. An existing hybrid symbol can be converted to a 3D symbol by editing the symbol and deleting the 2D component. When creating skylight symbols, set the insertion point of the symbol at the back and center of the symbol.



The insertion point of the symbol determines whether a skylight will be flush or surface-mounted.



Square miter flush-mounted



Square miter surface-mounted

## Inserting a Skylight

To insert a skylight:

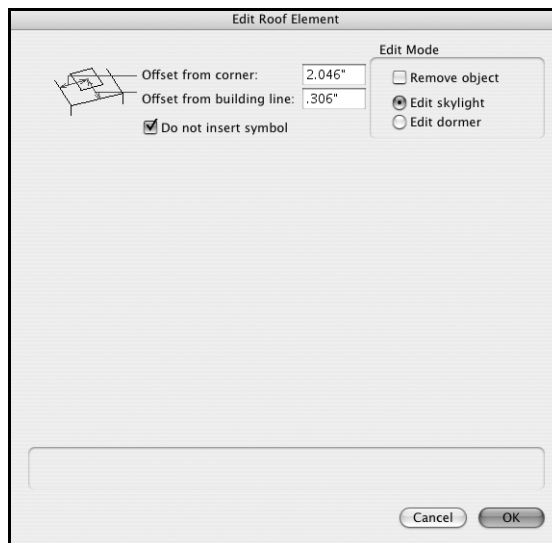
1. Select **Window > Palettes > Resource Browser**.
2. Select a 3D window symbol to use in the skylight. Hybrid and 2D window symbols will not work for skylights, though hybrid symbols can be used to create a cut-out.
3. Select **Make Active** from the **Resources** menu. The **3D Symbol Insertion** tool is automatically activated from the 3D Modeling tool set.
4. Click to place the symbol in the desired location in the roof.

The roof must be a roof object, and not a roof face.

The Edit Roof Element dialog box opens.

5. Click **Edit Skylight**.

The skylight parameters are displayed.



Parameter	Description
Offset from corner	Specifies the distance from the edge of the roof to the center of the skylight symbol
Offset from building line	Sets the distance from the edge of the building to the center of the skylight symbol
Do not insert symbol	Select to use create a cut-out in the roof without inserting the window symbol
Remove object	Deletes the skylight from the roof
Edit dormer	Accesses the dormer parameters instead of the skylight parameters

6. Click **OK** to create the skylight (or cut-out).

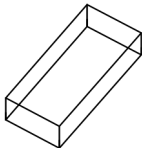
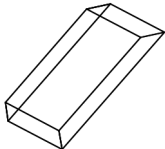
**Editing Skylights**

Skylights and cut-outs are edited and deleted in the same manner as dormers.

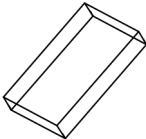
To edit a skylight:

1. Select the skylight.  
A selection handle displays at the skylight location.
2. Position the cursor over the selection handle for the skylight and click.  
The Edit Roof Element dialog box opens, with the skylight parameters displayed.
3. Edit the parameters as described in “Inserting a Skylight” on page 513.  
To remove the skylight completely, select **Remove object**.
4. Click **OK**.  
The drawing area displays the specified changes for the selected skylight.

The skylight miter parameters can be changed from the Object Info palette.

Skylight Miter	Description
Vertical	Cuts the roof vertically at both the top and bottom of the skylight 
Splayed	Cuts the roof horizontally at the top of the skylight, and vertically at the bottom 



Skylight Miter	Description
Square Cut	<p>Cuts the roof perpendicular to the roof at both the top and bottom of the skylight</p> 



# Importing and Exporting Files

VectorWorks has the ability to import and export to a variety of file formats. Your work may require you to import drawings from colleagues that use previous versions of VectorWorks or other programs. You may also have to export your drawings for those colleagues. VectorWorks' import and export functionality provides the means to incorporate VectorWorks files with other program's files, including other CAD programs, worksheet, and word processing programs.

## Importing Files

The **Import** command imports files from a number of different file formats. This command opens drawings produced in other software programs in VectorWorks, where the drawing objects and data can then be manipulated. The original file remains unchanged.

To import a file:

1. Select **File > Import**.
2. Select the import option to use.
3. Select a file from the Open dialog box.
4. Click **Open**.

[Special considerations apply for DXF/DWG files. See "DXF/DWG File Import" on page 537.](#)

Import Format	Description
DXF/DWG	<p>DWG and DXF files are produced by other CAD programs (such as AutoCAD). To avoid unexpected formatting problems with DXF/DWG, import into a blank document. VectorWorks can import DWG/DXF files from version 2007/2008 format or lower.</p> <p>DXF and DWG files can be imported as VectorWorks symbols, using the default import settings and the active layer's scale. When importing as a symbol, paperspace objects are ignored. The symbol's name is automatically assigned based on the original file name, without the .dxf or .dwg extension.</p> <p>See "DXF/DWG File Import" on page 537 for more information.</p>
Single DXF/DWG File	Imports a single DXF/DWG file at a time, instead of in a batch
EPSF	Encapsulated PostScript Files (EPSF) are produced by many graphics and desktop-publishing programs. EPSFs are typically high-resolution files.
Image File	Image files, including GIF, JPG, TIF, BMP, and others, can be imported. See "Importing an Image File" on page 518 for more information.
PICT	PICT files were first produced by MacDraw and other object-oriented drawing programs. PICT is also the native format of the Macintosh clipboard. PICT files imported into VectorWorks can be more than a single object, allowing image editing. Images imported with this command automatically have PNG compression applied.
PICT as Picture	PICT as Picture files are imported as a single graphic object. The following operations cannot be performed on this type of import: <b>Trim</b> tool, <b>Clip</b> tool, and <b>Shear</b> tool. Picture images retain picture comments when imported into VectorWorks.

Import Format	Description
Metafile	Graphics files in the Metafile format can be imported from virtually any program, including AutoCAD and word processing programs. There are two versions of Metafiles: standard (pre-Windows 95) and enhanced. VectorWorks supports the enhanced version. Images imported with this command automatically have PNG compression applied.
Metafile as Picture	Metafile as Picture files are imported as a single graphic object; the trim, clip, and shear operations cannot be used on this type of import
Worksheet	VectorWorks can import a variety of worksheet formats, including text, comma-delimited, CSV, DIF, and SLK. A worksheet must be open to receive the import. (To import a VectorWorks worksheet into the current drawing, use the Resource Browser.)
VectorScript	Imports a series of VectorScript commands into a VectorWorks file
IGES (3D only)	During IGES import, points are imported as a group of 3D loci, NURBS curves are imported as a group of NURBS curves, NURBS surfaces are imported as a group of NURBS surfaces, closed solids are imported as a group of imported solids, and open solids are imported as a group of NURBS surfaces. If there is only one element in the IGES file, it is imported as a single element rather than grouped. Imported solids cannot be ungrouped or edited through the <b>Edit Group</b> command; they can be used in solid operations.
SAT (3D only)	Imports ACIS/SAT 3D solids as NURBS-based VectorWorks solids

## Importing an Image File

Images are compressed when they are imported into a VectorWorks file, to reduce the file size.

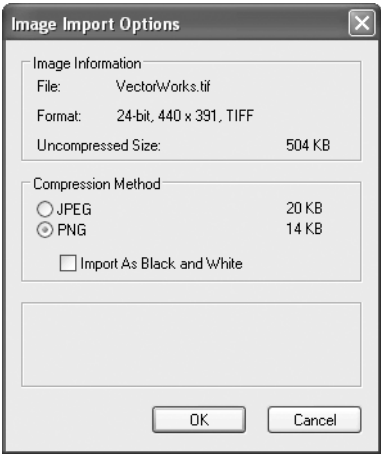
To import an image file:

1. Select **File > Import > Import Image File**, and then select the image file to import.
2. The Image Import Options dialog box opens. Specify the options for the imported image.

Information about the image file is displayed at the top. The compression method that produces the smallest file size is selected by default. Select the method that will give the best balance between compression and detail display. The file size for each type of compression is displayed to help with the selection.

If the selected option results in a file size larger than the uncompressed size, the image is imported uncompressed.

If VectorWorks Design Series is installed, an option to reference the imported image displays on the dialog box. See “Referencing Imported Images” on page 695 in the VectorWorks Design Series User’s Guide for details.



Compression Method	Description
JPEG	Provides a high amount of compression, resulting in the smallest VectorWorks file size. However, fine detail may be obscured. JPEG compression is most suitable for photographic images.
PNG	Provides a moderate amount of compression, while preserving image details; select <b>Import as Black and White</b> to import as a 1-bit monochrome image in PNG format

3. Click **OK** to import the image. The Object Info palette displays the image information.
- The **Trim**, **Clip**, and **Shear** tools cannot be used on an imported image.
- Images imported into the file that are not already in JPEG format can be compressed by JPEG with the **Compress Images** command. See “Compressing Images” on page 399.

## Exporting Files

The **Export** command exports VectorWorks files into several different file formats, including previous versions of VectorWorks. The exported files can then be imported into another software program. VectorWorks exports to a new file, leaving the original file intact.

To export a file:

1. Select **File > Export**.
2. Select the export file format.  
Specify the export options, along with the file name and destination.
3. Click **Save**.

Special considerations apply for exports to DXF/DWG format. See “DXF/DWG File Export” on page 528.

Export Format	Description
DXF/DWG	DWG and DXF files can be read by other CAD programs (such as AutoCAD). In addition, they can be printed by service bureaus and opened in rendering programs. The VectorWorks translator exports DWG/DXF files for AutoCAD versions 2007/2008, 2004/2005/2006, 14/LT98/LT97, and 13/LT95. Exporting to version 12 and above is recommended to preserve the maximum file integrity (use the latest version possible for best results). See “DXF/DWG File Export” on page 528 for more information.
Database	Saves all records of a particular format as a file that can be used in a database program, such as FileMaker Pro and Microsoft Access. VectorWorks provides a variety of formats to select from when exporting records as a database, including comma-delimited, tab-delimited, merge, DIF, and SYLK.
EPix/Piranesi (RenderWorks required)	Creates an ePix (Extended Pixel) file; see “EPix Export” on page 714 for more information
EPSF	EPSF (Encapsulated PostScript Format) files can be read by many graphics and desktop-publishing programs. The VectorWorks translator exports EPSF files in Illustrator 88 format. EPSFs contain all drawing elements except color bitmaps. VectorWorks exports these files with high resolution and full accuracy. Specify the EPS Preview Options for the TIFF preview when saving the file.
Image File	Exports the file as an image file in formats like JPG, Photoshop, BMP, and others. The image can then be imported into other applications or used in web pages. See “Exporting an Image File” on page 521.
Export PDF (Quartz Only)	This command is available on the Macintosh when <b>Quartz Imaging</b> is enabled (see “Display Preferences” on page 41). It exports the current file to a PDF document in the specified location.  Design Series users on both Macintosh and Windows have additional PDF options. See “PDF Interoperability” on page 653 in the VectorWorks Design Series User’s Guide.
Export PICT	This command is available on the Macintosh when <b>Quartz Imaging</b> is disabled (see “Display Preferences” on page 41). It exports a vector image of the current file in the specified location.
Metafile	Exports graphics files in Metafile format for inclusion in virtually any Windows program, including AutoCAD and word processing programs. There are two versions of Metafiles: standard (pre-Windows 95) and enhanced. VectorWorks supports the enhanced version.
QuickTime VR Object (RenderWorks required)	Creates a QuickTime Virtual Reality object file; see “QuickTime VR Object Export” on page 716 for more information
QuickTime VR Panorama (RenderWorks required)	Creates a QuickTime Virtual Reality panorama file; see “QuickTime VR Panorama Export” on page 718 for more information
VectorScript	Writes out the current file as a series of VectorScript commands. These commands can then be used as part of a VectorScript script or as a guide for learning.

Export Format	Description
Worksheet	Worksheet files can be read by spreadsheet programs, such as Microsoft Excel, as well as by some word processing programs. Export all rows or only selected rows of a worksheet. Because many of these programs have different format requirements, VectorWorks provides a variety of formats to select from when exporting files as a worksheet, including comma-delimited, tab-delimited, merge, DIF, and SYLK. Using the tab-delimited format, for example, creates a file that can be opened as a table in Microsoft Word.
IGES (3D only)	This command exports 3D curves, surfaces, and solids to IGES format (see “Exporting in IGES Format (3D only)” on page 524)
SAT (3D only)	Creates an SAT file for exporting ACIS 3D solids. The <b>Export Solids as Trimmed Surfaces</b> option exports a solid as several different ACIS “bodies” (for example, a cube exports as six ACIS bodies). If this option is deselected, a solid is exported as a single body.
Export Simple VectorScript (3D Only)	Creates an exported VectorScript designed to be easy to import into programs like Strata Software products
Export Stereo Lithography (3D Only)	Exports all visible 3D surfaces and solids in the current layer into an STL-formatted file (see “Exporting in Stereo Lithography Format” on page 524)
VectorWorks 9, 10, and 11	Saves a copy of the file in a format that can be opened and manipulated in an older version of VectorWorks. See “Exporting to Previous VectorWorks Versions” on page 525.

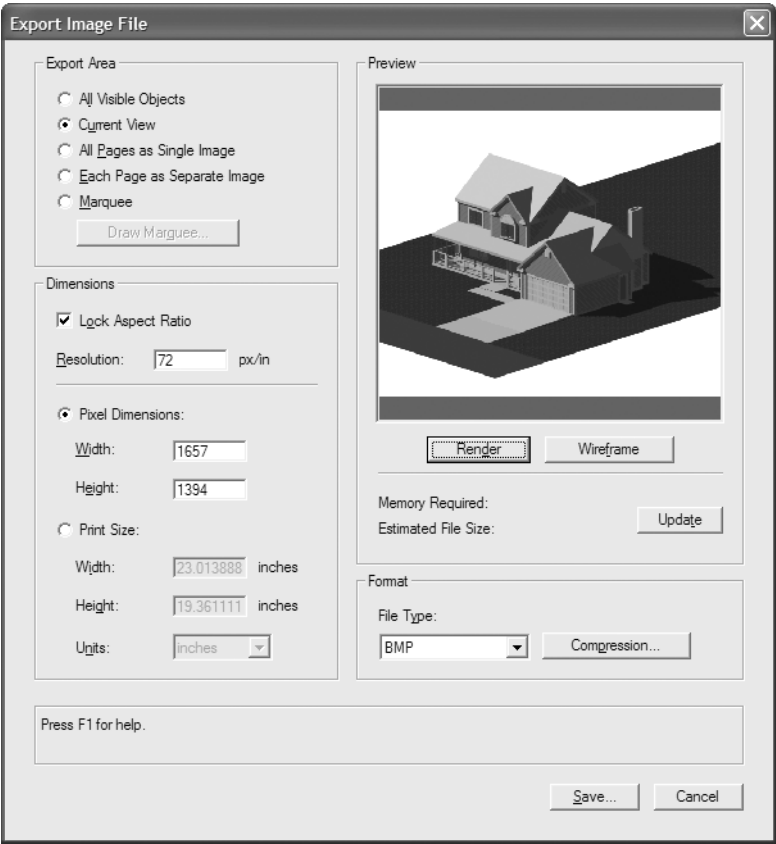
## Exporting an Image File

The **Export Image File** command exports a rendered drawing to a variety of file formats: BMP, JPG, PCT, PNG, PNT, PSD, QTI, SGI, TGA, or TIF. Different portions of the image can be selected for export.

To export an image file:

1. Select **File > Export > Export Image File**.

The Export Image File dialog box opens. Select the export options, and then click **Render** or **Wireframe** to display the exported image preview.



Parameter	Description
<b>Export Area</b>	
All Visible Objects	Exports an image that includes all visible objects (objects do not have to be currently on screen to be considered visible)
Current View	Exports an image that is exactly as it displays on the current screen
All Pages as Single Image	Saves all pages in the print area as one image. By default, the image dimensions are set to match the print area specifications in the Page Setup dialog box. The image dimensions can be changed, but must remain proportional to the print area aspect ratio.
Each Page as Separate Image	Saves each page in the print area as separate images. By default, the image dimensions are set to match the page size specifications in the Page Setup dialog box. The image dimensions can be changed, but must remain proportional to the page size aspect ratio.



Parameter	Description
Marquee	Exports an image within a user-created marquee. Select this option and then click <b>Draw Marquee</b> to temporarily close the dialog box. Click and drag to specify the area for export; the marquee dimensions are displayed on the Data bar. Click to set the export area and return to the Export Image File dialog box. The <b>Pixel Dimensions</b> of the image are automatically set to the marquee dimensions.
<b>Dimensions</b>	
Lock Aspect Ratio	Select to maintain the image aspect ratio when specifying dimensions
Resolution	Specifies the printed image resolution in pixels over inches
Pixel Dimensions	
Width/Height	Specifies the exported image dimensions; if <b>Lock Aspect Ratio</b> is selected, changes to one dimension will update the other to maintain the aspect ratio
Print Size	
Width/Height	Specifies the printed image dimensions in the selected <b>Unit</b> ; if <b>Lock Aspect Ratio</b> is selected, changes to one dimension will update the other to maintain the aspect ratio
Units	Select a unit to apply to the <b>Print Size</b> parameters
Preview	Displays a rendered or wireframe preview according to the current settings
Render	Updates the preview with a rendered view using the currently set rendering option
Wireframe	Updates the preview with a wireframe view
Memory Required/Estimated File Size	Estimates the amount of memory required for the export and the approximate file size of the exported file, based on the current settings
Update	Updates the estimated memory and file size requirements
Format	
File Type	Select the file format for the exported image, and indicate specific compression settings, if any
Compression	Specifies compression settings according to the selected <b>File Type</b>

QuickTime offers great flexibility when specifying compression settings for the various file types. Consult QuickTime documentation for information on these settings.

2. Click **Save**.

In the dialog box which opens, provide a name for the file; VectorWorks adds the file extension according to the file format selected. If the **Each Page as a Separate Image** was selected for export, VectorWorks automatically appends an incremental number to each file name.

3. Click **Save**.

A new file is created without changing the original drawing file. This new file can then be opened in other applications or imported into another software program.

## Exporting in IGES Format (3D only)

The **Export IGES (3D only)** command exports 3D curves, surfaces and solids from VectorWorks into IGES format (version 5.3). Closed solids are exported as solids, while open solids are exported as a collection of surfaces.

Objects that are exported to an .igs file from VectorWorks include:

- 3D loci
- CSG solids (add/subtract/intersect/section)
- Groups
- Shells
- Symbols
- 3D polygons
- Extrudes and multiple extrudes
- NURBS curves and surfaces
- Solids (sphere/cone/hemisphere)
- Chamfers
- Fillets
- Parametric objects
- Sweeps

To export a file to the IGES format:

1. Select **File > Export > Export IGES (3D only)**.

The Export Options dialog box opens.



2. Select **Export Solid as Trimmed Surfaces** to export a solid as several different “bodies” (for example, a cube exports as six bodies); otherwise, a solid is exported as a single body.
3. Click **OK**.
4. Specify the file name and destination.
5. Click **Save**.

Export Item	Export Result
NURBS curve	IGES Entity Type 126
NURBS surface	IGES Entity Type 128
Trimmed NURBS surface	IGES Entity Type 144
Closed solid	IGES Entity Type 186

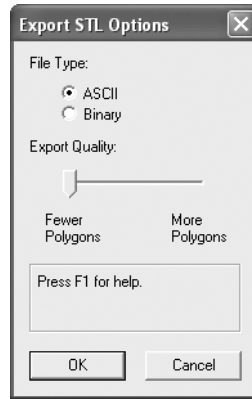
## Exporting in Stereo Lithography Format

The **Export Stereo Lithography (3D Only)** command exports all visible 3D surfaces and solids in the current layer into an STL-formatted file. Once exported, this file can be used for rapid prototyping purposes or imported into other CAD packages.

To export a file in the Stereo Lithography format:

1. Select **File > Export > Export Stereo Lithography (3D Only)**.

The Export STL Options dialog box opens.



2. Select **ASCII** or **Binary** for the file type. Using the slider control, adjust the coarseness of the polygonal representation for the export quality.
3. Click **OK**.
4. Specify the file name and destination, and then click **Save**.

## Exporting to Previous VectorWorks Versions

VectorWorks files from the current version can be exported to previous versions of VectorWorks. Consider the following limitations when exporting to previous versions of VectorWorks.

### Coordinate Limits

If the range of layer scales, symbol sizes, object sizes, or object locations is too great, not all the objects can be exported. If this occurs, you will be prompted to delete some objects. To minimize the chance of this problem occurring, select **Tools > Purge Unused Objects** before attempting to export. In addition, locate objects that are far away from the page by selecting **View > Zoom > Fit to Objects** (or by clicking the **Fit to Objects** button on the View bar), and deleting them.

### 3D Power Pack Compatibility

Geometry created with the 3D Power Pack is supported in VectorWorks 9.5.1 and later, including versions of VectorWorks 9.5.1 without the Power Pack module installed.

All 3D Power Pack operations, with the exception of blends, shells, and section solids, are supported in previous releases of VectorWorks 9. Objects with blended edges, shells, and section solids are deleted in versions of VectorWorks prior to 9.5.1.

3D Power Pack geometry is not supported in versions of VectorWorks prior to version 9.

## DXF and DWG File Formats

DXF and DWG are two common file formats used to exchange information between different CAD and drawing programs. DXF is a semi-public standard promoted and controlled by Autodesk, Inc. DWG is a proprietary, closed format used by Autodesk for its products. DXF and DWG files contain almost identical information, and both store all

of the same objects. Recent versions of AutoCAD have bugs when reading some DXF files, such as losing links to images, so DWG is usually a safer choice in that case. As of this writing, the most recent DXF/DWG version is version 2007/2008. VectorWorks imports and exports versions 2.5 through 2007/2008. Export to versions earlier than 12 is not recommended; maximum file integrity cannot be maintained, because too much information is lost during the translation.

## VectorWorks 2008 Improvements

The following changes to the DXF/DWG translation procedure have been added:

- Worksheet images can now be exported to DXF in a single step, without exporting a separate sheet and importing it into the DXF/DWG drawing. All cell formatting is now preserved, including: text font, size, style, color, and position inside the cell; cell border line style, thickness, and color; cell fills.
- A custom prefix can be assigned to imported DXF layers for easy identification in VectorWorks layer and class lists.

## Information Lost in Translation

Importing from and exporting to DXF/DWG is not the same as saving or opening a VectorWorks file. It is a translation from one way of doing things to another; consequently, information can get lost in the translation. Following are some items that DXF/DWG handles differently. These can introduce unwanted effects in the translated file.

Item	Description
Units	Version 2000 DXF/DWG and later supports the concept of true units, so the file’s unit settings can be imported (if it includes units). Previous versions of DXF/DWG do not support units, and some version 2000 and later files may be unitless. There is no way for VectorWorks to tell whether these unitless drawings were made in meters, feet and inches, or microns. Communicate with the person providing the file to determine this information. Unitless DXF/DWG files do have five “units” settings (such as “Architectural” and “Engineering”) which are used to guess the original units, but the guess may need to be adjusted.
Line Weights	VectorWorks allows line weights and colors to be specified independently. AutoCAD has recently gained the ability to do so, but most AutoCAD users still use colors to map to line weights. Version 14 and earlier DXF/DWG files do not support true line weights at all. If you choose to export with line weights mapped to colors, then original object colors will be lost.

Item	Description
Colors and Fills	<p>VectorWorks is more graphically rich than DXF/DWG can currently support. In all cases, VectorWorks chooses the closest possible translation given the limitations inherent in DXF/DWG. The default version in the export dialog box will always give the best results possible, assuming the recipient's software can read all of the information.</p> <p>DXF/DWG versions prior to 2004 have a fixed color palette (which changes slightly depending on whether the background is black or white) and all objects have just one solid color associated with them. Objects such as circles in DXF have no fill color (just a line color). A few objects can have a fill color, but they have no separate line color.</p> <p>DXF/DWG version 14 and above supports a "solid hatch," which is a separate object that can be associated with objects such as circles to make them look like they have a color fill. These hatches cannot be the same color as the background color (such as a white rectangle on a white background to mask objects underneath). Since these solid hatches can be associative, VectorWorks can import them and set the associated object's fill color instead of having two separate objects for frame and fill.</p> <p>DXF/DWG version 2000 supports "wipeout" entities, which are essentially polygonal images filled with the background color. Some AutoCAD users may not want to receive files with wipeouts. DXF/DWG export includes an option to exclude solid fills (which includes both wipeouts and solid hatches). Since wipeouts can only be polygons and are not associative, if a white circle on a white background is exported and then re-imported into VectorWorks, the result is an unfilled circle and a polygon with a white fill and no pen inside the circle. The smoothness of the polygon (number of facets) depends on the 2D conversion resolution preference when it was exported.</p> <p>Objects with pattern fills, image fills, or gradients export as a plain solid color.</p>
Layers and Classes	<p>Each VectorWorks design layer is similar to a DXF/DWG model space. A VectorWorks drawing can have many design layers visible at the same time, with different scales and views for each design layer, but only one model space is allowed in a DXF/DWG file. Therefore, VectorWorks has to merge the multiple design layers, and some information can be lost. The drawing should generally look and print the same after the export, but independent layer scales, object coordinates, and invisible objects can be lost.</p>
Groups and Symbols	<p>VectorWorks uses symbols, which are objects that can be inserted multiple times without greatly increasing the file size, and which need only one edit to update all copies. It also has groups, which are objects that are grouped together and act as one object. The DXF/DWG equivalent of a VectorWorks symbol is called a "block." The closest DXF/DWG equivalent to a VectorWorks group is an "anonymous block," which is like a symbol without a name. Anonymous blocks cannot be edited easily in AutoCAD, however, so VectorWorks no longer exports anonymous blocks. Instead, if the plug-in object or group has a name assigned in the Data tab of the Object Info palette, then that name is used; otherwise a name is generated automatically.</p>
Attributes and Linked Text	<p>DXF/DWG does not have database records that correspond to VectorWorks record formats. It does have objects called attribute definitions ("attdefs") which, when placed in blocks/symbols, behave somewhat like linked text in VectorWorks. The correspondence is very loose and as a result translation of these objects is not always smooth. DXF/DWG block attributes are created for things exporting as blocks (symbols, groups, plug-in objects, or layer links) that have record formats attached. Because only DXF/DWG blocks can have attributes attached, the record format information is not exported for other object types, such as lines or circles.</p>

Item	Description
Names	When exporting to DXF/DWG version 2000 and later, the characters in layer and block names will not change. Accurate translation of lower case text, spaces and other Unicode characters is supported (except for the following illegal characters, which are converted during export: < > " ' , / \ : ? *   = ). Export to previous versions converts all name characters to uppercase; all spaces and special characters are converted to underscores. DXF/DWG attribute tag names cannot have spaces in any version; any spaces found in record field names are converted to an underscore.
Styled Multiline text	Multiline formatted text includes various sized fonts that are bold, underlined, or italicized, and that wrap to the next line. This type of text is supported for DXF/DWG versions 13 and up. For earlier versions, wrapped text is split into separate lines.
Layer Transfer Mode / Transparency	DXF/DWG does not support layer transfer modes or transparency, so use only paint transfer mode (100 percent opaque under Quartz and GDI+ imaging)
Dimensions	<p>VectorWorks and AutoCAD handle dimensions, units, and dimension standards very differently. Dimensions exported to DXF/DWG look exactly the same when opened in AutoCAD, but they may change appearance slightly if edited. VectorWorks also creates appropriate dimension styles for all dimension standards that are used in the file, so even if the recipient modifies the dimensions or creates new ones, they should not look significantly different.</p> <p>During import, the file's current units and dimension standard may be used, so imported dimensions may look slightly different. All common dimension styles should transfer flawlessly, but ensure that the VectorWorks file is set up with the correct units, angular units, dimension standard, and design layer page size before import. When doing a batch import of multiple files, choose an appropriate template file that has the appropriate settings.</p> <p>If unsure what the source file is using, use the import option to import the dimensions as groups, preserving the original look. It is recommended to import once as groups to evaluate the settings requirements, and then again as dimensions in a new file with the appropriate settings. If markers look too small or too large, the layer scale and page size may need to be adjusted.</p>

## DXF/DWG File Export

Consider the following points when exporting from VectorWorks to DXF/DWG.

Item	Export Notes
Linked Text	Linked text in symbols export as block attributes.
Symbols, Plug-ins, Layer Links, and Groups	Symbols, plug-ins, layer links, and groups export as blocks. Exported blocks are given a generic name such as "Group-2" unless they were named in the Data tab of the Object Info palette.
Line Weights	By default, line weights are converted to the closest DXF line weight. If the color mapping option is used, mapping information is entered during export and written to a .ctb file.

Item	Export Notes
Fills, Patterns, Gradients, and Hatches	Solid fills, patterns, image fills, and gradients export as DXF objects with associated solid hatch or unassociative wipeout. Wipeouts are only available in version 2000 and later. Hatches export as associative hatches to AutoCAD version 14 and higher, or as anonymous blocks to AutoCAD version 13 and lower.
Raster Images	Raster images export to the same folder that the drawing and any hatch pattern files are exported to. They export as JPEG files, with an image object in the DXF/DWG file that stores the name of the JPEG file and the insertion point. Images are only supported in AutoCAD versions 14 and higher.
Solids and NURBS Surfaces	Solids and NURBS surfaces typically export as ACIS objects. The following objects cannot be exported as ACIS objects: meshes (which export as DXF meshes), 3D polygons (which export as 3D polygons, or as triangles if filled), NURBS curves (which export as DXF splines), and walls (which export as triangulated 3D polys in 3D views, and as lines and arcs in 2D views).
Design Layers, Sheet Layers, and Viewports	<ul style="list-style-type: none"> <li>• VectorWorks design layer objects export as DXF model space entities. If only design layers (no sheet layers) are exported, individual design layers' scales and views are exported to model space as one scale and view.</li> <li>• VectorWorks sheet layers export as DXF paper space layouts, with normal viewports exported directly and section viewports exported as blocks. Annotations become paper space objects on top of the viewports. AutoCAD requires all paper space objects to be either above or below the viewports, but not both, so any objects or annotations that appear below the viewports in VectorWorks will appear above the viewports in AutoCAD. Therefore, avoid putting anything underneath viewports in VectorWorks.</li> <li>• If sheet layers are exported, all design layers referenced from viewports on the sheet layers are exported to model space in top view without scaling, and viewports are created in paper space layouts to show the various views and scales. Sheets should generally look and print as expected (though without rendering modes set due to some AutoCAD bugs), but the single model space may have many overlapping objects and may not be as usable.</li> <li>• Since AutoCAD has only one model space, and it does not have hybrid 2D/3D objects, it is sometimes necessary for VectorWorks to export the design layers as one or more blocks with special DXF layer names to control the block visibility. For example, a design layer called "Foundation" might export as blocks named "Foundation (2D)" and "Foundation (3D)," with associated DXF layers named "_Foundation (2D)" and "_Foundation (3D)." The blocks will be inserted in model space and assigned to those DXF layers. Viewports that should hide either the 2D or 3D objects will freeze or thaw the appropriate DXF layer.</li> </ul> <p>When exporting sheet layers, VectorWorks optimizes the translation for preserving the look of the sheets, at the cost of possibly adding some complexity and decreasing the ease of editing items in model space. To minimize the complexity, export sheets with unrelated design layers to separate files, or limit the drawing to one VectorWorks design layer.</p>

## Preparing to Export

The following procedures are recommended to help ensure a satisfactory translation.

1. Export behaves differently based on whether design layers or sheet layers are selected for export. If one or more sheets are selected, a paper space layout is exported for each sheet with the sheet objects; any design layers visible in viewports are exported to model space. (Sheets that do not share design layers should usually be exported to separate files.) Other sheet layers and unreferenced design layers are omitted from export. If only design layers are selected, then all visible design layers are exported to model space and all sheet layers are omitted.
2. AutoCAD does not have multiple model spaces. If the sheet layer being exported has multiple viewports at different scales, the model space may have overlapping objects from the design layers, and the scale will be set to 1:1 instead of the expected design layer scale(s). To avoid this problem, set the scale the same for all design layers, and make sure that no objects overlap. Then, adjust the viewport scales as desired.
3. Do not export design layers in perspective, as they will not be in perspective in the DXF/DWG file. Instead, create a sheet layer with a viewport set to perspective view.
4. For DXF/DWG versions earlier than 14, object fills will not export. To better approximate the appearance of the exported file for these versions, remove all fills in a copy of the file before export. This will help identify lines under solid fills that need to be deleted or trimmed when the solid fill is removed.

DXF/DWG versions 14 and later support associative boundary hatches, or “bhatches.” Therefore, fills, solid fills, and hatches can be exported as follows.

VectorWorks	DXF/DWG
Associative hatch definitions	bhatch definition; hatch pattern files (.pat) are exported along with the DXF/DWG file
Hatches with multiple colors or with background fill	Multiple bhatch definitions
Filled polygons with three or four sides, with the fill color different from the background color	“Solid” entities
Objects with a solid fill (color different from background color) or hatch	Object with associated bhatch
Objects with solid fill (color same as background color)	<ul style="list-style-type: none"><li>• Wipeout entity (AC2000 and later)</li><li>• No fill (AC14 and earlier)</li><li>• Light gray bhatch (AC14)</li></ul>
Filled polylines with holes	Multiple objects and associated bhatch definition with island detection

5. Set the class and layer visibility appropriately. If invisible VectorWorks layers are exported as DXF/DWG layers, objects in invisible classes will not be exported, and vice versa. To preview what will be exported, set classes to “show/snap/modify others” and layers to “show others.”
6. DXF/DWG does not support hybrid objects. If only design layers are being exported, set the view for each design layer so the appropriate 2D or 3D components are exported. From Plan view, the 2D component of a hybrid symbol is exported; from Top view or any 3D view, the 3D component is exported. To preserve the 3D object coordinates, use Top view to export all 3D design layers (or use viewports to show other views, and export the sheets containing those viewports).



7. Symbols, plug-in objects, groups, and layer links export as named blocks in DXF/DWG.

The name that these items receive depends on the view that is in effect upon export. As an example, the symbol “Widget” would receive the following names, depending on the view:

Symbol Type and View	Exported Block Name
Hybrid symbol in Plan view	Widget (2D)
Hybrid symbol in 3D view	Widget (3D)
Non-hybrid symbol	Widget

The assigned layer link depends on whether **Project 2D** was selected for the layer link.

Layer Link Option	Exported Block Name
Layer link in plan view with <b>Project 2D</b> option selected	Layer-1 (2D)
All other layer links	Layer-1 (3D)

To check the item names, re-import an exported file into VectorWorks.

- 8. Check the drawing with both black and white backgrounds. If the VectorWorks file has a white background and uses a dark (but not black) color to draw objects, then others who look at the exported file with a black background may not be able to see the objects.
- 9. Set the 2D and 3D conversion resolutions (in VectorWorks preferences) to a low value if file size is a concern. Higher resolutions result in larger exported file sizes. Lower resolutions decrease file sizes, but can result in blockiness, especially when exporting to earlier versions of DXF/DWG.

**DXF/DWG Export Procedure**

- 1. Select **File > Export > Export DXF/DWG**.

In the alert dialog box that displays, click **OK** to confirm that you want to continue. The DXF DWG Export Options dialog box opens.

- 2. Select the appropriate export options, and click **OK** to export the file.

The DXF/DWG export dialog box options are described in “DXF/DWG Export Options” on page 532. During export, a progress bar displays, along with the number of objects processed.

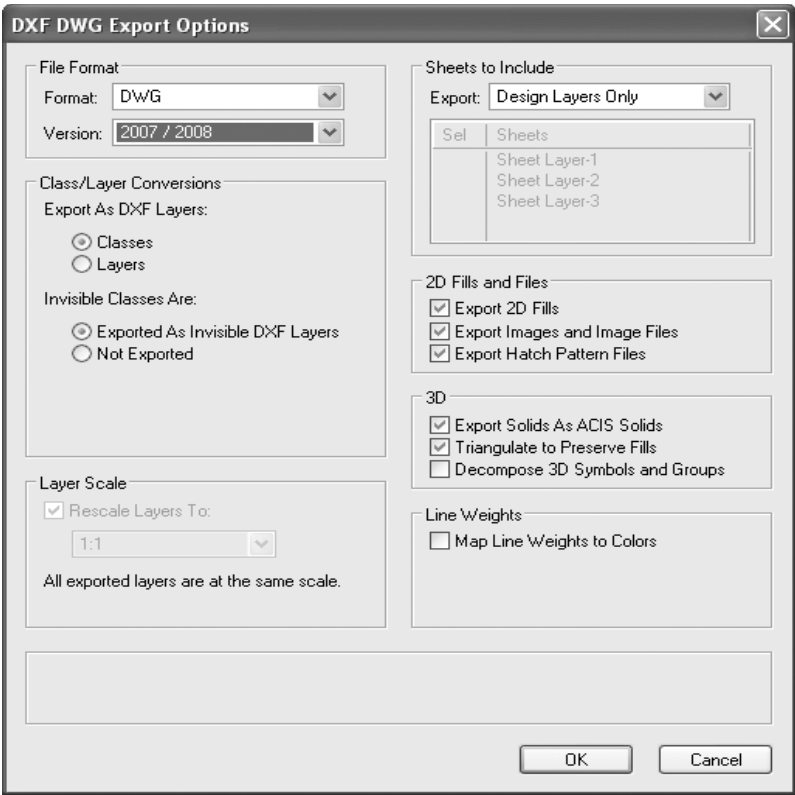
- 3. It is frequently helpful to view the translated file in a third-party software program to ensure that the translation process did not introduce unwanted effects. After export, leave the file open and import the exported file back into VectorWorks or into another software package. Compare the two versions, noting any problems. For example, the loss of object fills in earlier versions of DXF/DWG can cause unwanted lines to display. Correct these problems in a copy of the VectorWorks file and export the file again.

Do not change the .dxf or .dwg file extension or other software packages will not be able to read the file. Do not export as binary DXF unless certain that the recipient will be able to read this format.

AutoCAD users may report that circles and other objects look like blocky polygons. They can improve the appearance of the drawing by zooming in and using either the “regenall” or “regen” command, or by increasing the VIEWRES value.

## DXF/DWG Export Options

The DXF DWG Export Options dialog box contains a variety of options to help retain the file integrity in the DXF/DWG format.

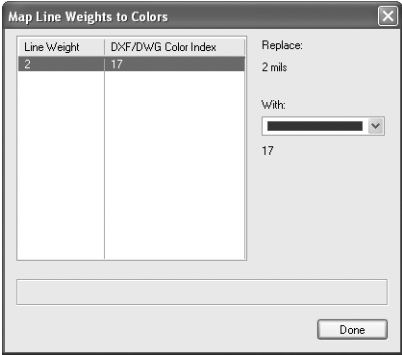


Parameter	Description
File Format	
Format	<p>Choose from three exported file formats: DXF as plain text, DXF as a binary encoding, and DWG.</p> <p>One of the main differences between these formats is file size. Although individual files can vary, an uncompressed text DXF file is generally larger than an uncompressed DWG file. However, the file size can be significantly reduced by using a compression utility. A compressed text DXF file is normally smaller than a compressed DWG file. Binary DXF file sizes generally fall between the two for both compressed and uncompressed files.</p> <p>In addition to file size, consider the formats that other applications can support. Before exporting to binary DXF or to DWG, ensure that the receiving party's software can read those formats. Since binary and text DXF both use the same .dxf extension, if the DXF file cannot be opened, it may be mistakenly considered corrupted. When in doubt, export as text DXF, which is universally supported.</p> <p>Recent versions of AutoCAD have bugs when reading some DXF files, such as losing links to images, so DWG is usually a safer choice in that situation.</p> <p>DXB is a simpler file format used by some third-party applications that do not support the full DXF or DWG file format. It is not the same as binary DXF; do not use .dxb as the extension for binary DXF files. VectorWorks does not support DXB.</p>
Version	<p>For best results, export to the highest version supported by the recipient's software, or the default export version, whichever is lower. The latest versions of DXF/DWG have features more similar to VectorWorks and may provide a better translation, but not all software packages can read the latest versions. When in doubt, export as DXF and version 12, which has widespread industry support.</p> <p>Other options on the dialog box can change or become unavailable depending on the version selected.</p>
Class/Layer Conversions	
Export as DXF Layers	<p>This option is available if the <b>Export</b> option is set to Design Layers Only.</p> <p>Since VectorWorks classes correspond most closely to DXF/DWG layers, normally, the <b>Classes</b> option is recommended. There is no direct equivalent for VectorWorks layers in DXF/DWG. A single VectorWorks design layer is similar to DXF "model space."</p> <p>This is most important for the import of groups and symbols. In VectorWorks, the objects in groups and symbols can belong to different classes, but they must be on the same layer. In a DXF/DWG file, the entities equivalent to VectorWorks' symbols and groups (known as "blocks") can be on different DXF/DWG layers.</p> <p>Layers normally do not export relative to the Z value shown in the Design Layers tab of the Organization dialog box.</p>

Parameter	Description
Invisible Classes are	<p>While VectorWorks organizes drawings by class and by layer, the DXF/DWG file format only has layers. The following description assumes that, as recommended, classes are selected for export as layers. (If instead VectorWorks layers are selected for export as DXF/DWG layers, equivalent options are presented for the layers.)</p> <p>Select whether to export invisible classes. If <b>Exported As Invisible DXF Layers</b> is selected, objects that are in invisible classes in the VectorWorks file are exported, and can be seen by making the DXF/DWG layer visible. This is the recommended option. However, if invisible classes contain private information or if the size of the exported file needs to be reduced, select <b>Not Exported</b> to delete these invisible objects.</p> <p>If invisible classes are exported as DXF layers, objects on invisible VectorWorks layers are not exported. To export these items, first make the layers visible, and then select the <b>Export</b> command.</p>
Layer Scale	
Rescale Layers To	<p>When the <b>Export</b> option is set to Design Layers Only, paper space is not used; all items are placed in model space. Model space must be at one scale; DXF/DWG files do not have different layer scales. If the layers to be exported are at various scales, the option to rescale them to a common scale before export becomes available. By default, the most frequently used layer scale will be used.</p> <p>Choosing the best scale for export is important. Select <b>Rescale Layers To</b> and click the common scale to use from the displayed list.</p> <p>Symbols on rescaled layers are exported as scaled blocks in the DXF/DWG file.</p> <p>When sheets are selected for export, all design layers export to model space at effectively a 1:1 scale, and viewports take care of showing the objects at other scales.</p>
Sheets to Include	
Export	<p>The options on this list change depending on the contents of the file being exported and on which export <b>Version</b> is selected.</p> <p>Select the items to export from the list. If Design Layers Only is selected, either classes or design layers can be exported as DXF layers.</p> <p>If one of the sheet options is selected, the selected sheet layers are exported as paper space layouts; also, design layers used in viewports are exported to model space. While multiple sheets can be exported to the same file, note that unrelated sheets usually should be exported to different files.</p>
Sheets	If Selected Sheets is selected as the <b>Export</b> option, select the sheets to export from the displayed list.
2D Fills and Files	
Export 2D Fills	Select this option to export solid fills as wipeouts (DXF/DWG versions 2000 and later) or solid hatches (DXF/DWG version 14 and later). A VectorWorks hatch with multiple levels and colors generates multiple hatch pattern definitions. See “Preparing to Export” on page 530 for more information on the conversion.
Export Images and Image Files	Select this option to export image objects and image files. This option is only enabled for DXF/DWG versions 2000 or higher.

Parameter	Description
Export Hatch Pattern Files	When a drawing has hatches, select this option to create additional hatch pattern (.pat) files in a specified folder. The hatch pattern files, and the DXF/DWG exported file and any support files, such as .jpg images, are placed in this folder. AutoCAD requires the hatch pattern files to retain the hatch associativity and to add hatches to additional objects with the same hatch pattern. When <b>Export Hatch Pattern Files</b> is deselected, AutoCAD displays the hatch but cannot edit it.
3D	
Export Solids as ACIS Solids	<p>Select this option to export most VectorWorks solids and NURBS surfaces as ACIS objects. Deselect this option to export solids as polygonal faces (if the target software package cannot read ACIS solids, for example).</p> <p>Walls, round walls, roof and floor slabs, filled 3D polygons, meshes, and NURBS curves cannot be exported as ACIS solids.</p>
Triangulate to Preserve Fills	<p>Some software packages, such as AutoCAD, are not capable of rendering exported 3D surfaces that have more than three or four vertices per face. Select this option to break up such faces into a set of triangles that can be properly rendered. The algorithm used works best on planar or nearly-planar surfaces, such as the top of an extruded circle.</p> <p>Even if <b>Export Solids as ACIS Solids</b> is selected, this option may be used to handle 3D objects that cannot be exported as ACIS solids.</p> <p>When in doubt, select this option (this increases the exported file size and the time necessary to export it, and may result in unwanted lines in some cases)</p>
Decompose 3D Symbols and Groups	Some software packages cannot handle exported groups and symbols. If a problem occurs, select <b>Decompose 3D Objects</b> to convert symbols and groups to ungrouped objects. Do not select this option unless it is absolutely necessary.
Line Weights	
Map Line Weights to Colors	<p>The traditional method of specifying line weights in a DXF/DWG file is to use a unique line color for each line weight. The thickness corresponding to each color is then specified at plotting or printing time. Newer DXF/DWG versions support true line weights, but most AutoCAD users are likely to be using colors nevertheless.</p> <p>Because DXF/DWG version 2000 and later supports limited true line weights, by default the <b>Map Line Weights to Colors</b> option is deselected and VectorWorks line weights are converted to the closest possible weight value automatically. Line weights with a value of zero are not exported.</p>

Parameter	Description																																																				
	<table><tr><th>VW Line Weight (mm)</th><th>DXF Line Weight (mm)</th><th>VW Line Weight (mm)</th><th>DXF Line Weight (mm)</th></tr><tr><td>0</td><td>Deleted</td><td>0.52 - 0.56</td><td>0.53</td></tr><tr><td>0.01 - 0.07</td><td>0.05</td><td>0.57 - 0.65</td><td>0.60</td></tr><tr><td>0.08 - 0.11</td><td>0.09</td><td>0.66 - 0.75</td><td>0.70</td></tr><tr><td>0.12 - 0.14</td><td>0.13</td><td>0.76 - 0.85</td><td>0.80</td></tr><tr><td>0.15 - 0.16</td><td>0.15</td><td>0.86 - 0.95</td><td>0.90</td></tr><tr><td>0.17 - 0.19</td><td>0.18</td><td>0.96 - 1.03</td><td>1.00</td></tr><tr><td>0.20 - 0.22</td><td>0.20</td><td>1.04 - 1.13</td><td>1.06</td></tr><tr><td>0.23 - 0.27</td><td>0.25</td><td>1.14 - 1.30</td><td>1.20</td></tr><tr><td>0.28 - 0.32</td><td>0.30</td><td>1.31 - 1.49</td><td>1.40</td></tr><tr><td>0.33 - 0.37</td><td>0.35</td><td>1.50 - 1.75</td><td>1.58</td></tr><tr><td>0.38 - 0.45</td><td>0.40</td><td>1.76 - 2.05</td><td>2.00</td></tr><tr><td>0.46 - 0.51</td><td>0.50</td><td>2.06 - 6.48</td><td>2.11</td></tr></table> <p>Select this option to convert line weights to colors. Then during the export process, a list of line weights in the file displays. Specify the color to map to each of these line weights. To select a different color for a selected line weight, click the color box and select a color from the displayed options.</p> <p>For version 2000 and later, this option creates a .ctb file for each exported DXF/DWG file (named after the original .vwx file) containing color mapping information. The exported DXF/DWG file stores the name of the .ctb file in it. The AutoCAD user must put this in the support path, as AutoCAD does not read the .ctb file when it is simply included in the same folder as the DXF/DWG file.</p> <p>To avoid having a color table files for each exported file, use a single .ctb file for each unique set of mappings, and delete the others. When an exported file is opened in AutoCAD, edit the page setup and choose an appropriate color table file.</p>	VW Line Weight (mm)	DXF Line Weight (mm)	VW Line Weight (mm)	DXF Line Weight (mm)	0	Deleted	0.52 - 0.56	0.53	0.01 - 0.07	0.05	0.57 - 0.65	0.60	0.08 - 0.11	0.09	0.66 - 0.75	0.70	0.12 - 0.14	0.13	0.76 - 0.85	0.80	0.15 - 0.16	0.15	0.86 - 0.95	0.90	0.17 - 0.19	0.18	0.96 - 1.03	1.00	0.20 - 0.22	0.20	1.04 - 1.13	1.06	0.23 - 0.27	0.25	1.14 - 1.30	1.20	0.28 - 0.32	0.30	1.31 - 1.49	1.40	0.33 - 0.37	0.35	1.50 - 1.75	1.58	0.38 - 0.45	0.40	1.76 - 2.05	2.00	0.46 - 0.51	0.50	2.06 - 6.48	2.11
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0.46 - 0.51	0.50	2.06 - 6.48	2.11																																																		

Parameter	Description
	<p>For earlier DXF/DWG versions, converting line weights to colors is recommended, and <b>Map Line Weights to Colors</b> should be selected. When re-importing the file, use the reverse process to convert the colors back to line weights.</p> <div></div>

Items Which Cannot Export to DXF/DWG

Certain VectorWorks items have no equivalent in DXF/DWG and therefore cannot be exported. Other items could be exported, but inadequate support in AutoCAD makes it inadvisable to do so. A few objects (such as worksheets) could in theory be exported to something useful, but VectorWorks currently lacks support for doing so.

The following list includes items that do not export to DXF/DWG, for various reasons.

- Textures
  - Rendered views
  - Image props
  - Lights
  - EPS or vector PICTs in some cases
  - “Graying” of layers and classes
  - Individual layer scales
- Record format information attached to arbitrary objects
  - RenderWorks background images
  - Oblique cavalier and oblique cabinet projections
  - Object names attached to arbitrary objects
  - Layer transfer modes other than **Paint**
  - Design layers with perspective views
  - Depending on the export options, either layers or classes

DXF/DWG File Import

Consider the following points when importing from DXF/DWG to VectorWorks.

Item	Import Notes
Line Weights	If no .ctb file is present and true line weights are present, then the line weights import exactly. If no .ctb file is present and no true line weights are present, values will have to be entered manually. The values in the dialog can be initialized by first importing a file that does have an associated .ctb file. This creates a hidden record that stores the mapping information. A template file could be created after doing such an import, to save the values for future use.

Item	Import Notes
Text	<ul style="list-style-type: none"><li>• Text is sometimes unlinked from symbols when imported to preserve the original look. Options are provided for preserving the links instead.</li><li>• Some text styles are not supported; text is deleted from 3D symbols when imported.</li></ul>
Model Space Entities	Model space entities are imported as design layer objects.
Paper Space and Viewports	Each paper space layout creates a VW sheet layer when imported. DXF viewports are imported as VW viewports, with the same scale, view, and projection.
Points	Points are imported as symbols or as loci, depending on the file and the import options chosen.
Multilines	Multilines are imported as grouped lines. An option is provided to import them as walls.
bhatches, Images, and Wipeouts	<ul style="list-style-type: none"><li>• bhatch definitions are imported as hatch definitions.</li><li>• A single object associative bhatch with no islands is imported as an equivalent object with a solid or hatch fill.</li><li>• A multi-object, non-associative bhatch or associative bhatch is imported as an object with zero line weight and solid or hatch fill.</li><li>• A bhatch with islands is imported as one or more polylines with holes, with solid or hatch fill.</li><li>• Images referenced by the DXF/DWG file are imported as VectorWorks images.</li><li>• A wipeout is imported as a polygon with a solid fill that is the same color as the background.</li></ul>

Preparing to Import

VectorWorks imports versions 2.5 through 2007/2008 of DWG and text and binary DXF. Before import, the following steps are recommended to enhance the likelihood of a satisfactory translation:

1. Read “Information Lost in Translation” on page 526 for more information about the differences between DXF/DWG and VectorWorks.
2. It is not necessary to explode the entire drawing in AutoCAD before importing. If a file is not importing correctly, try exploding individual problem objects before import.
3. If possible, communicate with the file originator. Determine the intended units, page size, and scale of the file, along with the intended color-to-line weight mapping, if any.

DXF/DWG Import Procedure

Multiple, single, or an entire folder of DXF/DWG files can be imported. The imported files can create new VectorWorks files, create new symbols, or be imported into the current file. The results of the import process are summarized in a log file.

A master file’s external reference files (“xrefs”) are automatically bound during import. When a single DXF/DWG master file is imported, VectorWorks displays an alert if any xrefs are missing, along with the names of the missing files. (No alert appears when multiple files are imported.)

Verify that the best possible options were selected for import by checking the imported file. If the import was not successful, try again with different options.

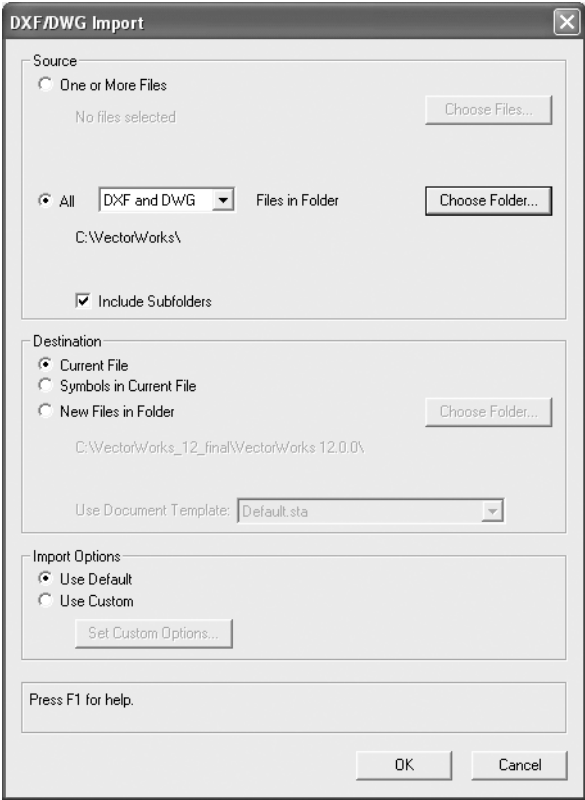


Importing DXF/DWG Files

For maximum flexibility when importing several DXF/DWG files, use the **Import DXF/DWG** command.

To import DXF/DWG files:

- 1. Create a blank file and set the drawing size, or open an empty template that already has the correct drawing size.  
*Importing into a drawing that is not blank can produce unexpected results and is not recommended. If more than one file is being imported into the current file with the **Import DXF/DWG** command, ensure that the files are very similar.*
- 2. Select **File > Import > Import DXF/DWG**.  
The DXF/DWG Import dialog box opens.



Parameter	Description
Source	
One or More Files	Imports only one file or only certain files within a folder. Click <b>Choose Files</b> and choose one or more DXF/DWG files to import. The number of files selected and their location is displayed.
All ___ Files in Folder	Imports all files of the selected type (DXF only, DWG only, or DXF and DWG) from a specified folder. Click <b>Choose Folder</b> and choose the source folder.

Parameter	Description
Include Subfolders	If <b>All Files in Folder</b> is selected, includes all files of the selected type in all sub-folders.
Destination	
Current File	Imports the selected file(s) into the current file. If several files are selected, a new layer is created for each imported model space.
Symbols in Current File	Imports the selected file(s) into the current file. Each file creates a separate symbol. This is convenient when importing part catalogs, for example. Paper space is not imported.
New Files in Folder	Converts the selected file(s) into new, separate VectorWorks files in the selected folder. Click <b>Choose Folder</b> to choose the location. This is the best option when converting many files.
Use Document Template	If <b>New Files in Folder</b> is selected, select a template to use for each new file, or select Blank Document. The template can be useful for specifying the page size to use for model space objects (which can also affect dash scales and conversion of polyline widths). It also allows specification of a dimension standard, default color to line weight mappings, and in some cases, units.
Import Options	
Use Default	Applies the default DXF/DWG import options to the imported files; see “DXF/DWG Import Options” on page 541.
Use Custom	Sets custom options for the file import; click Set Custom Options to open the DXF DWG Import Options dialog box (see “DXF/DWG Import Options” on page 541). If several files will be imported, it is recommended that <b>Units Setting In File</b> be set to Determine Automatically.

3. Click **OK** to import the file(s).

The progress of the import is displayed for each imported file during import. The final results of the import process are shown in the DXF/DWG Import Results dialog box.



4. Click **Details** to open the results log file. The log text file, named DXF\_DWF Import Log, is placed in the specified destination folder if it exists, or in the VectorWorks application folder. New log information is appended to any existing log file.

## Importing a Single DXF/DWG File

To import a single DXF or DWG file:

1. Create a blank file and set the drawing size, or open an empty template that already has the correct drawing size.

Importing into a drawing that is not blank can produce unexpected results and is not recommended. This includes overwriting of dash styles and class attributes for existing objects in the drawing. Workgroup referencing may give better results in these cases.

2. Select **File > Import > Import Single DXF/DWG File**.

The Import DXF/DWG Files dialog box opens. Select the file to import; the progress of the initial import is displayed.

3. During the import, the DXF DWG Import Options dialog box opens.

Select appropriate import options as described in “DXF/DWG Import Options” on page 541.

4. Click **OK** to finish importing the file. A progress bar displays, along with the number of objects processed and free memory available.
5. Check the imported file.

## DXF/DWG Import Options

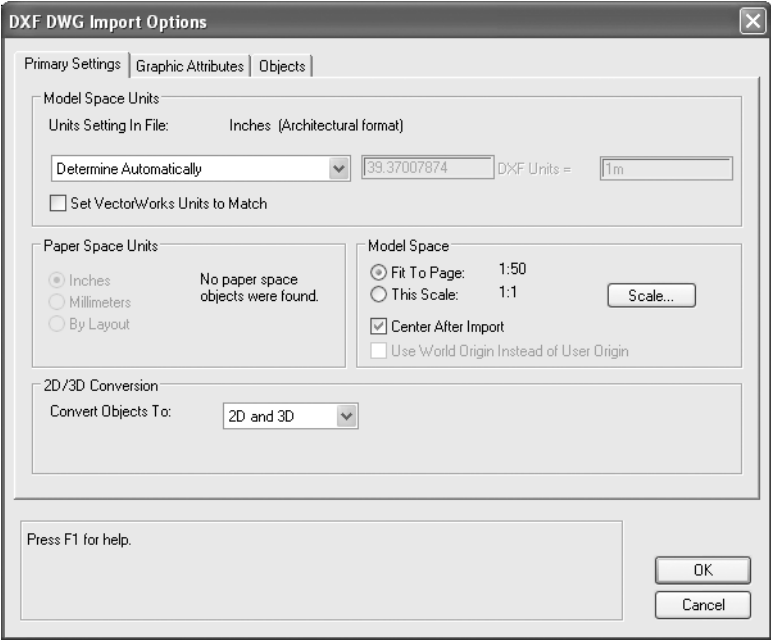
The DXF DWG Import Options dialog box provides all the necessary options to import a DXF/DWG file with the maximum file integrity.

The first tab, Primary Settings, contains important basic settings. The Graphic Attributes and Objects tabs contain settings for advanced users to customize the import process.

Options that do not apply to the current file import appear dimmed, and an explanation displays next to the option. For example, if no paper space objects are contained in the DXF/DWG file to be imported, the Paper Space Units options is dimmed, and the message “No paper space objects were found” displays.

### Primary Settings Tab

The options on the Primary Settings tab establish the basic import options.



Parameter	Description
Model Space Units	Version 2000 and later DXF/DWG files support true units. When importing a file with true units, VectorWorks determines and sets the units automatically. If the DXF or DWG file does not contain true units information, VectorWorks tries to guess the units setting; however, it may still require adjusting (see “Setting Units Manually” on page 544).
Units Setting In File	<p>VectorWorks tries to determine the imported file’s unit settings, and displays the information to the right of <b>Units Setting in File</b>, along with the unit format (such as Architectural), and the scaling factor that will be assumed (such as 1 <b>DXF Units</b> = 1”).</p> <ul style="list-style-type: none"><li>• To use the displayed unit settings in the VectorWorks file, select <b>Determine Automatically</b> from the list, and also select <b>Set VectorWorks Units to Match</b>.</li><li>• To use another unit type (such as Centimeters), select it from the list, and also select <b>Set VectorWorks Units to Match</b>.</li><li>• To use a custom unit type, or to change the defaulted scaling factor, select <b>Custom</b> from the list, and then specify the units in the text boxes. Enter the unitless DXF/DWG number in the first box, and a number with units in the second box. (For example, 15 DXF Units = 1” in the VectorWorks drawing.) The units displayed in the second box are the same as the current VectorWorks document settings, but other units can be entered as long as the appropriate units suffix is included, such as 3 cm. Also select <b>Set VectorWorks Units to Match</b>.</li><li>• To use the units currently set in the VectorWorks file, select <b>Use VectorWorks Document Units</b>. VectorWorks assumes that 1 DXF unit = 1 current document unit when importing objects.</li></ul>

Parameter	Description
Set VectorWorks Units to Match	Changes the VectorWorks document units and units format to match the DXF/DWG file being imported; the physical sizes of imported objects will not be affected. This option is disabled when Use VectorWorks Document Units is selected from the <b>Units Setting In File</b> list.
Paper Space Units	Select the paper space units for converting paper space objects. Version 2000 and later DXF/DWG files can have multiple paper space layouts, with each layout having its own units setting; if that is the case, select <b>By Layout</b> (this option is not available for earlier versions of DXF/DWG).
Model Space	Once the units have been determined, specify the scale for VectorWorks to display the imported file.  Choosing the model space scale is important. The scale affects the dash length scaling and the conversion of polylines with widths (world-space line weights) to VectorWorks line weights. If the scale or drawing size are set incorrectly, some polylines may seem to have the wrong line weight and some dashes may be too long or too short.
Fit to Page	VectorWorks estimates a scale based on the bounds of all of the objects in model space; the scale fits those objects on the page. Select this option to use the estimated value.
This Scale	To import at a different scale, set the scale manually. Click <b>Scale</b> to open the standard Layer Scale dialog box, and select the desired scale. ( <b>All Layers</b> and <b>Scale Text</b> do not apply to DXF/DWG files.) Click <b>OK</b> to return to the Primary Settings tab, and the selected scale displays.
Center After Import	Select this option to center imported objects on the page in the VectorWorks document. The origin is moved so that the most recent import has correct coordinates. In other words, if all the imported objects are shifted to be centered on the page, then the user origin shifts by the same amount. Only objects from the current import are moved though, so previously imported objects do not get centered and thus are no longer at the same location relative to the user origin.  Deselect this option to position imported objects according to either the user origin currently set in the VectorWorks document, or the internal world origin (a constant), depending on the <b>Use World Origin Instead of User Origin</b> setting. Deselecting <b>Center After Import</b> keeps origins aligned for multiple file imports. Note that some imported objects may display off of the page if <b>Center After Import</b> is not selected.
Use World Origin Instead of User Origin	If <b>Center After Import</b> is not selected, select this option to position imported objects in VectorWorks according to the world origin (a constant value in all VectorWorks documents).  Deselect this option to position imported objects according to the user origin currently set in the VectorWorks document.

Parameter	Description
2D/3D Conversion	<p>DXF/DWG files are 3D in nature. From the <b>Convert Objects To</b> list, specify whether objects should be imported as 3D, 2D, or a mixture of 2D and 3D. Generally, select the 2D and 3D option, which converts objects that appear to be 2D (planar objects parallel to or in the ground plane) to VectorWorks 2D objects. The remaining objects are imported as 3D.</p> <p>Because VectorWorks does not have 3D text, selecting 2D and 3D can cause text in 3D symbols to be deleted. In addition, objects parallel to the ground plane that have a thickness are imported as 3D even though the originator of the file may not have intended for them to be 3D. If problems occur, import all objects as 2D by selecting All 2D. A warning displays if selecting this option will distort any objects, such as 3D symbols with 3D rotation.</p> <p>If the file contains only a 3D model, select the All 3D option. Otherwise, parts of a large object composed of several entities could be converted to 2D.</p> <p>Occasionally, none of the choices is appropriate for all the objects. In this case, select the option that best converts most of the objects.</p>

Sometimes DXF/DWG drawings are split up into pieces and saved as separate files, such as different areas of a large city map. When multiple files like this are imported into one file, they need to have their coordinates aligned, and their layer scale set the same. The recommended workflow is to import the first file with the default **Fit to Page** scale, and with **Center After Import** turned on. For subsequent files, manually set the scale to the same scale defaulted for the first file, and turn off the centering option.

The Primary Settings tab covers the basic requirements for importing a DXF/DWG file. If the results are not satisfactory, explore the options on the Graphic Attributes and Objects tabs.

Setting Units Manually

If objects seem to be the wrong physical size after import, ensure that the units chosen are correct. (**Model Space Scale** only affects the display, but **Units Setting in File** affects the actual measured size of the objects.) DXF/DWG files do not always have the true units set, and sometimes have incorrect units set.

VectorWorks guesses the units based on the information available, and indicates what it found in the dynamic text at the top of the pane. If the guess is wrong, set the units manually.

If you do not know the correct units, but you know the true length of one of the objects in the drawing, determine the true units as follows.

Import the file and choose Custom units, setting the edit boxes to something like 1 **DXF Units** = 1". After import, measure the size of the object that you know the true length of. Close the document and redo the import, but this time set the units to Custom with these values in the edit boxes: (measured length) **DXF Units** = (true length). For example, if the true length is 1", but the measured length is 2.54", enter 2.54 **DXF Units** = 1". (Do not include units in the first box, and if in feet and inches mode, just use the total measured length in inches.)

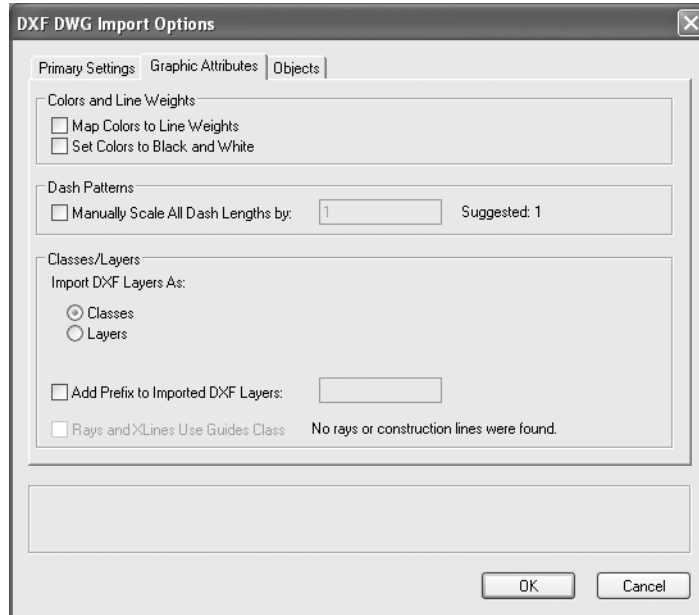
If VectorWorks finds an exact match for that ratio, it will change the Custom choice to the correct units. (In the example above, it changes it to Centimeters.) If the measurements and the ratio are not exact (for example, 2.539 instead of 2.54), manually adjust it to a standard ratio. Common ratios have values such as 1, 12, 2.54, and powers of 10. Examples: 1/12, 12/10, 2.54/0.01, etc.

If you do not know any true lengths, but the document contains dimension objects that show lengths, follow the steps just described with the following change: Select **Convert Dimensions to Groups** (see "Objects Tab" on page 547), import, and use the value in the imported dimension object as the true length.

Normally VectorWorks leaves the document units setting unchanged after an import. If a DXF/DWG file is set to meters, but the VectorWorks document is set to feet and inches, then a dimension object that shows 1 meter in the original file will show as 3'3.37" in the imported file. If you want the imported drawing to be the same as the original, select the **Set VectorWorks Units to Match** option. You can also import with the option to convert dimensions to groups (see "Objects Tab" on page 547) if you want the document to stay in the current units, but you want the dimensions to look the same as in the original.

## Graphic Attributes Tab

The Graphic Attributes tab contains settings for advanced users to customize the import process.



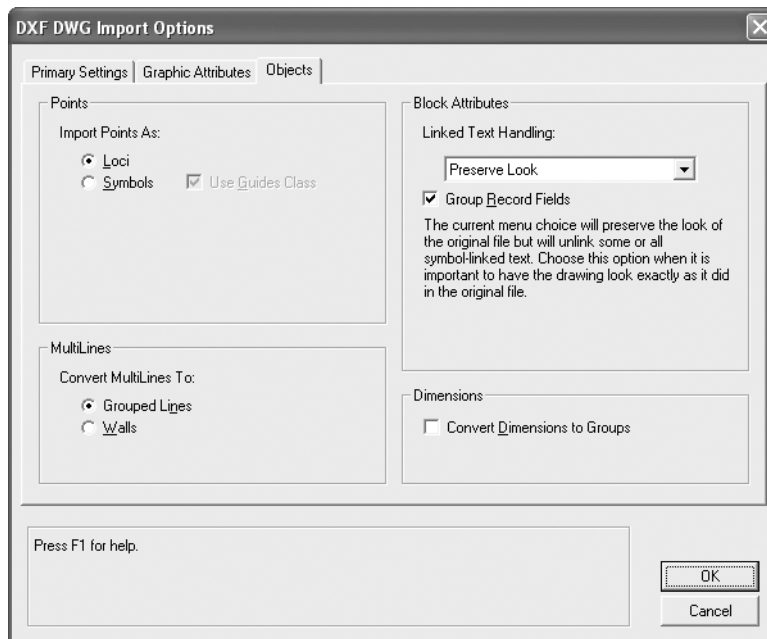
Parameter	Description
Color and Line Weights	<p>Most DXF/DWG files do not use true line weights, although that is starting to change. Color is traditionally used to indicate line weights. There are some standards that specify mappings between colors and line weights, but those standards are often ignored. VectorWorks automatically chooses the standard mappings when exporting, if the document does not already have a hidden record left over from a previous export or import that specifies the mappings. When importing, VectorWorks does not choose the standard mappings, but rather defaults to a reasonable line weight for all colors, implicitly alerting the user that they should determine the true mappings that are desired.</p> <p>If desired, specify mappings by selecting <b>Map Colors to Line Weights</b>. Select the desired color mapping during the import process; if necessary, communicate with the file originator to determine the correct line weights.</p> <p>The colored lines can be changed to black (or white if the background is black). Select <b>Set Colors to Black and White</b>. Note that most DXF/DWG files are created with a black background, and the colors may not show up well on a white background.</p> <p>Version 2000 and later uses .ctb files to store color mapping information, but it also supports line weights, so these options may or may not be needed.</p> <ul style="list-style-type: none"> <li>• If no .ctb file is detected during import, and true line weights are present, <b>Map Colors to Line Weights</b> is deselected automatically, and the line weights import exactly.</li> <li>• If no .ctb file is detected, and true line weights are not present, <b>Map Colors to Line Weights</b> is selected automatically. A dialog box displays to allow manual mapping (by default, all colors are mapped to the same line weight, or to the last mapping used during the current session).</li> <li>• If a .ctb file is detected, <b>Map Colors to Line Weights</b> is selected automatically, and VectorWorks reads the file to determine how colors should map to line weights. A dialog box displays to allow manual mapping (values are pre-set by the mapping file; duplicate mappings are indicated by italics).</li> </ul>
Dash Patterns	<p>In some files, dash lengths may import at an inappropriate scale. Change the dash length scale by selecting <b>Manually Scale All Dash Lengths by</b> and entering a scale value. A suggested scale value is displayed. The scaling does not affect line thickness. VectorWorks converts any dash patterns that are extremely small to solid lines to avoid unacceptable slowdowns during file display and printing.</p>



Parameter	Description
Classes/Layers	<p>DXF/DWG layers correspond more closely to classes in VectorWorks than they do to VectorWorks layers. Normally, import DXF/DWG layers as VectorWorks classes.</p> <p>There is no equivalent to VectorWorks layers in a DXF/DWG file. When DXF/DWG layers are mapped to VectorWorks layers, a warning displays if some of the objects in symbols or groups would leave their original layers and take on the layer of the symbol or group. For simple files without blocks, or files with objects inside the block that are set to “by block” attributes, importing layers as VectorWorks layers should pose no problems.</p> <p>To group imported DXF layers in VectorWorks class and layer lists for easy identification, select <b>Add Prefix to Imported DXF Layers</b>. Enter the custom prefix to use in the field to the right of the checkbox. If <b>Import DXF Layers As Classes</b> is selected, the prefix and a hyphen is added to the beginning of the class name when imported into VectorWorks. Similarly, If <b>Import DXF Layers As Layers</b> is selected, the prefix and a hyphen is added to the beginning of the layer name when imported into VectorWorks.</p> <p>Rays and Xlines (or construction lines) are DXF/DWG objects that are similar to VectorWorks guides. A ray starts at a point and goes off to infinity, while a construction line is anchored at a point and goes off to infinity in both directions. Select <b>Rays and XLines use Guides Class</b> to convert Rays and Construction Lines into lines in the Guides class, which are of finite length.</p>

## Objects Tab

The Objects tab contains settings for advanced users to customize the import process. In particular, decisions about preserving object visibility and record field links are available.



Parameter	Description
Points	DXF/DWG Points act either like the locus in VectorWorks (a drawing aid that is not printed), or like a symbol that is visible and can be printed. Select whether to import points as <b>Loci</b> or as <b>Symbols</b> . The default behavior is to import as symbols if the point style has specified a real world size (that is, it is zoom invariant and always prints the same), or as loci if the point style is specified as a percentage of the pixel size of the drawing window (that is, it varies with the zoom level). Select <b>Use Guides Class</b> to import points as <b>Symbols</b> in the VectorWorks Guides Class; this allows them to be hidden. In VectorWorks, use the <b>Show/Hide Guides</b> commands to toggle their display.
Block Attributes	<p>“Attributes” in a DXF/DWG file are similar to linked text in VectorWorks. Select how to handle attribute conversion into VectorWorks symbol linked text. Regardless of the selection, record formats will be created based on the attributes found during import, and imported blocks with attributes will have record formats attached.</p> <p>Choose a <b>Linked Text Handling</b> method from the list. Depending on the file to be imported, not all options are available.</p>
Preserve Look and Links	<p>This option should be selected when available. The attributes will display as they did in the DXF/DWG file, and they will be converted to symbol linked text.</p> <p>If the file contains invisible attributes or attributes that override the attribute definitions, this option is not available.</p>
Preserve Look	This is the next best option. The attributes will look and print as they did in the DXF/DWG file, but some symbol text may become unlinked, if necessary, to preserve the look. Symbol record field updates are not reflected in unlinked text. With this option, an individual symbol could have a mixture of linked and unlinked text.
Preserve Visible Links	This option is available when the DXF/DWG file contains attributes marked as “invisible.” This type of attribute is converted in to a record format attached to a symbol, but is not converted to linked text. The look of the drawing should be preserved, but minor changes to visibility are possible. The advantage of this method is that linked text is preserved for all visible attributes.
Preserve All Links	The link between record fields and symbol text is preserved with this option. Any invisible attributes will become visible. The look of the DXF/DWG file may not be preserved, but the symbol text will not be unlinked.
Hide All	All attribute text is hidden upon import. The information is still attached to the object in record format, but it is not visible.
Group Record Fields	<p>Each block attribute imports as a record format field. Select <b>Group Record Fields</b> to group those fields into a single record format. VectorWorks groups sets of attributes into record formats if they have the same set of field names. For example, if two blocks (symbols) have attributes with field names of “color” and “part number,” both blocks are converted with the same record format. If one of the blocks has “color,” “part number,” and “price,” while the other only has two of those, then the blocks are converted with different record formats. When grouped, the record format name is created from the names of the first few fields in the record format.</p> <p>Deselect <b>Group Record Fields</b> to create one record format per field, with no grouping. Without grouping, the record format uses the same name as the record field.</p>

Parameter	Description
MultiLines	Multilines (or “mlines”) are similar in some ways to walls in VectorWorks, in that they can have breaks that are “healed” and can be connected to other multilines. There are several significant differences between multilines and walls, but an option is provided to import multilines as walls. Do not select this option unless all multilines in the DXF/DWG file are intended to be walls.  When importing multilines as walls, the wall heights may need to be adjusted. This can be done quickly by selecting <b>Tools &gt; Custom Selection</b> , selecting all walls, and changing their height in the Object Info palette.
Dimensions	Select <b>Convert Dimension to Groups</b> to preserve the look of the original dimensions by converting them into groups, rather than as recognized VectorWorks dimension objects.

Dimensions are imported using the file’s current unit and dimension standard settings. The **Convert Dimension to Groups** option is most helpful when the dimension standard used in the DXF/DWG file is unknown.

### DXF/DWG Items Which Cannot Import to VectorWorks

Certain DXF/DWG items have no equivalent in VectorWorks and cannot be imported. A few other objects theoretically could be imported, but VectorWorks does not currently support them.

- Named views
- Lights
- Tables
- Cropping block and images
- rtext
- User coordinate systems (UCS)
- SHX fonts
- Custom line styles and shape files
- Gradients
- DXF groups (named selection sets, not the same as VectorWorks groups)
- Textures
- Certain objects from industry-specific variations of AutoCAD, if those objects do not have proxy graphics saved in the file

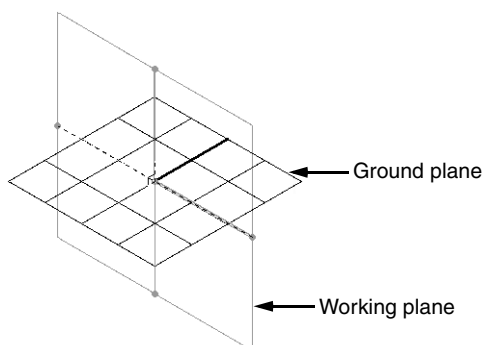


# Using Working Planes

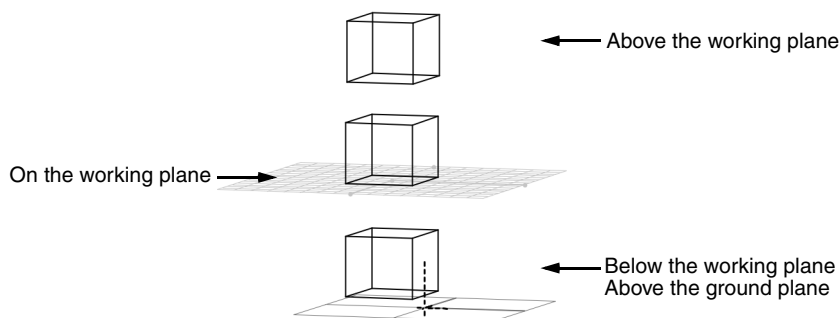
The working plane is an important concept in VectorWorks for working in 3D. This section covers all aspects of the working plane, including aligning, rotating, moving, and saving the working plane position.

## Understanding the Working Plane

Every VectorWorks drawing has a ground plane and a working plane. The ground plane provides a constant visual and logical reference and is fixed in relation to the objects in the drawing. In an architectural sense, the ground plane is like the ground level of a building. In most cases, architects use this plane as the basis for their drawings. Therefore, the location of VectorWorks' working plane defaults to that of the ground plane. However, in other disciplines, or in certain circumstances, the orientation of the working plane needs to change. The working plane can be moved, aligned to different objects or surfaces, and rotated, unlike the ground plane, which remains constant at the internal drawing center.



Every object created in VectorWorks is placed in relation to the ground plane, whether it is placed directly on that plane or placed above or below it. The working plane helps to easily create and position objects in 3D space. It allows you to draw while in an isometric view and position objects exactly where they are needed. When changing the location of the working plane, the ground plane remains displayed, providing a constant frame of reference while adjusting the working plane.

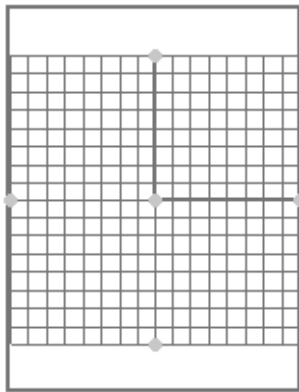


For example, for a drawing of a complex machine, with numerous gears, cams, rollers, and other parts that intersect on multiple planes, the working plane can be changed to different locations and angles in relation to the ground plane. Creating or locating objects according to the working plane allows highly accurate positioning of the objects in 3D space.

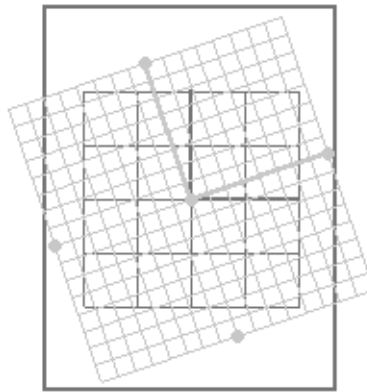
In addition, some tools require a vector or plane. The 3D viewing tools can use the working plane to define their center and/or axis of rotation, while the **Mirror** tool mirrors the selected 3D objects across the working plane. The location of 3D tools in 3D space is taken from the point on the working plane directly behind the pointer, or from a snap point if they are snapped to an object.

## Appearance of the Planes

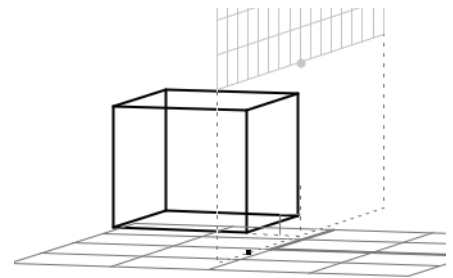
In any view other than Top/Plan, the ground plane is represented in gray. When the working plane and the ground plane are located in the same position, only the ground plane is shown. However, once the location of the working plane changes, it is represented on the screen as a pink grid. Dotted gray lines indicate the intersection of the ground and working planes.



Ground plane and working plane together in 3D View



Ground plane with working plane in different orientation



Dotted lines represent the intersection of the ground and working planes

If the grid lines are not visible, select **Show Grid Lines** in the Set Grid dialog box (see “Snap and Reference Grids” on page 55).

The working plane is displayed with five control points, or handles. These handles are used for rotating and repositioning the plane. The center handle is located at the plane origin, while the remaining four handles are at the center of each of the four edges of the plane. See “Moving and Rotating the Working Plane” on page 558 for more details.

Both the working plane and ground plane also include a darker, thicker set of lines representing the X and Y or I and J axes. These lines allow you to easily keep track of the location of the axes regardless of the orientation of the plane.

To label the axes, select **Show 3D axis labels** on the 3D tab of the VectorWorks Preferences dialog box.

## Setting the Working Plane Location

The **Set Working Plane** tool changes the position and angle of the working plane. Set the working plane to any location in 3D space in order to accurately place objects.

The **Set Working Plane** tool has two modes:



Mode	Description
Three Points	Defines the working plane by three, 3D points, or according to the surface of a rendered object
Planar Face	Aligns the working plane to a selected planar face

## Setting the Working Plane with Three Points

Two methods are available for defining the working plane in Three Points mode. The first method allows the position and angle of the working plane to be set by defining the origin and axes of the new working plane location. The second method sets the position and angle of the working plane according to a rendered object's surface.

### Setting the Working Plane

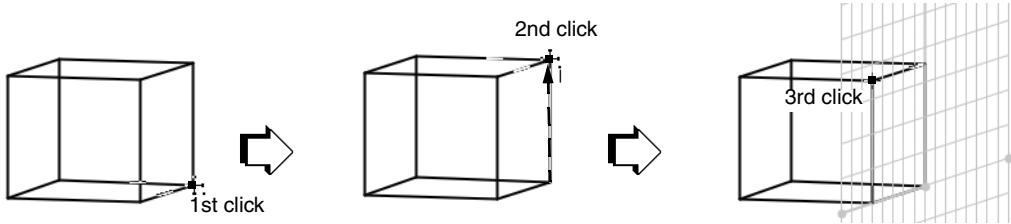
Work in wireframe mode to save time.



To set the working plane with three points:

1. Select a view other than Top/Plan.
2. Click the **Set Working Plane** tool from the 3D Modeling tool set, and then select **Three Points** from the Tool bar.
3. Click to set the first point.  
This becomes the center of the working plane.
4. Click to set the second point.  
This corresponds to the working plane I axis.
5. Select the third point.

Once the third point is defined, VectorWorks automatically sets the working plane to intersect all three points.



### Setting the Working Plane to a Rendered Object's Surface

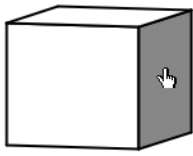
The working plane can be defined according to the surface of a rendered object.



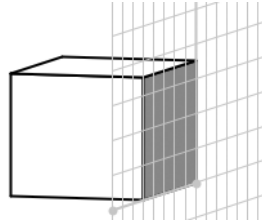
To set the working plane to a rendered object's surface:

1. Select a view other than Top/Plan and a rendering mode for the drawing.  
Select a rendering mode of Unshaded Polygon, Shaded Polygon, Shaded Polygon No Lines, or Final Shaded Polygon.
2. Click the **Set Working Plane** tool from the 3D Modeling tool set, and then select **Three Points** from the Tool bar.  
The cursor changes to a pointing hand when over the surface of a rendered object.

- Click on the surface to use for defining the working plane location.



Click the rendered surface to use for aligning the working plane



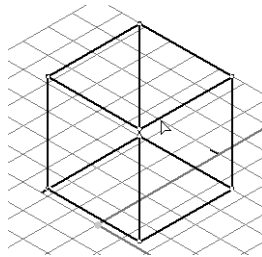
The working plane position is set to the selected surface.

## Setting the Working Plane to a Planar Face

Planar Face mode is particularly useful when aligning the working plane to the top of an object without sharp corners (like a cylinder); instead of clicking in three places, only the planar face of the object needs to be selected.

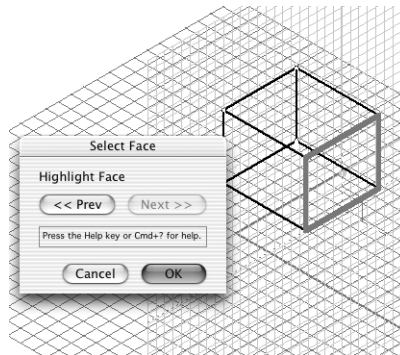
To set the working plane to a planar face:

- Select a view other than Top/Plan.
- Click the **Set Working Plane** tool from the 3D Modeling tool set, and then select **Planar Face** from the Tool bar.



- If more than one face is available for selection, the Select Face dialog box opens. Click the arrows until the desired face is highlighted, and then click **OK**.

The working plane is aligned to the selected face.





## Aligning Objects to the Working Plane

One way to align objects precisely in 3D space is to align them to the working plane.

### Setting Objects to the Working Plane with Three Points



To align an object to the working plane with three points:

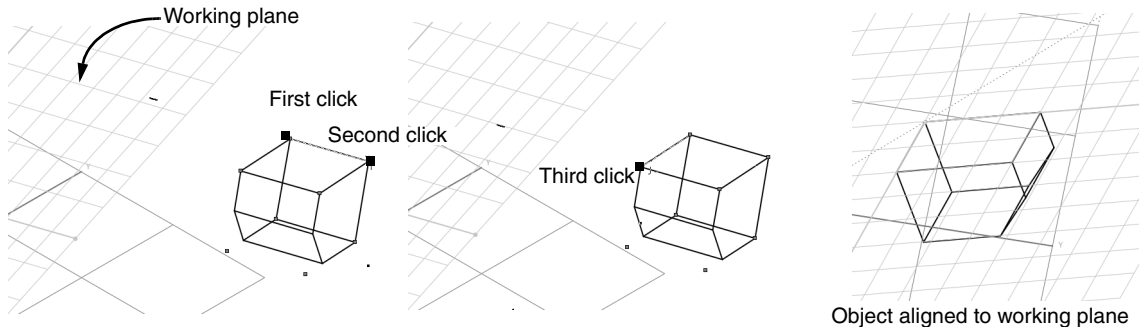
1. Select a view other than Top/Plan.
2. Set the working plane location as desired. Select the object to align to the working plane.
3. Click the **Align Plane** tool from the 3D Modeling tool set.
4. Click a location on the object to align with the origin of the working plane.
5. Click a second point on the object to define the X axis.

The line between the first and second points defines the X axis.

6. Click a third point on the object to define the Y axis.

The line between the first and third points defines the Y axis.

The object aligns itself to the working plane as defined by these points. If the surface was mistakenly aligned to the wrong side of the working plane, use the **Mirror** tool to flip the object to the opposite side of the working plane.



### Setting a Rendered Object's Surface to the Working Plane

A rendered object can be aligned to the working plane.



To align a rendered object to the working plane:

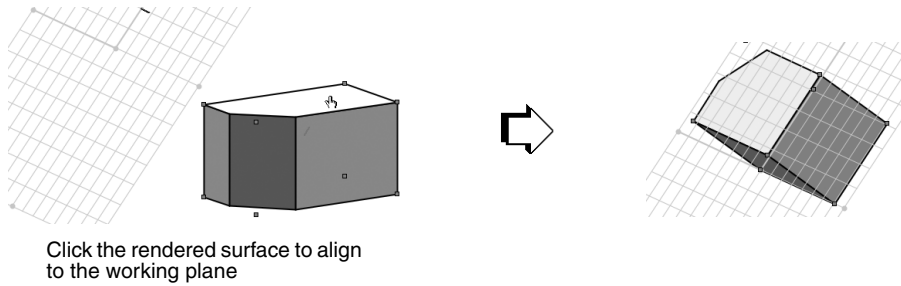
1. Select a view other than Top/Plan and a rendering mode for the drawing.

The projection must be other than 2D Plan, with a rendering mode of Unshaded Polygon, Shaded Polygon, Shaded Polygon No Lines, or Final Shaded Polygon.

2. Click the **Align Plane** tool from the 3D Modeling tool set.

The cursor changes to a pointing hand when over the surface of a rendered object.

3. Click on the surface to align to the working plane.



The object's selected surface is aligned to the working plane.

## The Working Planes Palette

The Working Planes palette displays working plane positions that have been set and saved while working on a drawing. From this palette, switch between working plane positions, name and save working plane positions, and select the working plane display mode. Combine these features with the **Set Working Plane** tool and the **Align Plane** tool to accurately control the placement and alignment of objects in 3D space.

### Accessing Existing Working Plane Positions

Initially, when the working plane position has not yet been changed, the only position saved in the Working Planes palette is that of the ground plane location. Once the position of the working plane has been changed, there are two ways to access existing working plane positions.

#### Accessing Working Plane Positions from the Current Drawing Session

To access unsaved working plane positions:

1. Select **Window > Palettes > Working Planes**.

The Working Planes palette opens.

2. Click the left and right arrow buttons to cycle through the last ten unsaved positions from the current drawing session. These positions are not permanently saved with the drawing.

Once it has been named, a working plane position can no longer be accessed with the left and right arrows.

### Saving and Accessing Working Plane Positions

The working plane position can be permanently saved with the drawing and accessed later from the Working Planes palette. Once named, the plane position is no longer included in the list of the working planes accessed by the left and right arrows on the Working Planes palette.

To permanently save a working plane position:

1. Select **Window > Palettes > Working Planes**.

The Working Planes palette opens.

2. Select the working plane position to save.

The left and right arrows cycle the drawing area through the most recent working plane positions.

3. Click **Add**.

The Assign Name dialog box opens.

4. Enter a name for the working plane position.
5. Click **OK**. Saved working plane positions are displayed in alphabetical order in the palette. To access a saved working plane position, double-click its name in the Working Planes palette.



## Deleting and Renaming Working Plane Positions

With the exception of the ground plane position, any named working plane position in the drawing can be deleted or renamed. The ground plane position is the default, common to all drawings, and it cannot be deleted or renamed. Planes are listed in alphabetical order under the ground plane.

To delete a working plane position:




1. Select **Window > Palettes > Working Planes**.  
The Working Planes palette opens.
2. Select the desired working plane from the list.
3. Click **Delete**. The working plane is removed from the list.

To rename a working plane position:

1. Select **Window > Palettes > Working Planes**.  
The Working Planes palette opens.
2. Select the desired working plane from the list.
3. Click **Rename**.  
The Assign Name dialog box opens.
4. Enter a new, unique name for the working plane.
5. Click **OK**. The working plane is renamed.

## Working Plane View and Modes

The three buttons at the bottom of the working planes palette control how the working plane is viewed and how it interacts with certain tools and commands.

Button	Description
Look At Working Plane 	Changes the view to be perpendicular to the working plane; similar to the <b>Top</b> view under the <b>View</b> menu in that you are looking straight at the working plane
Ground Plane Mode 	Sets the ground plane as the reference for tools such as the <b>Flyover</b> tool, <b>Walkthrough</b> tool, and other viewing tools; used with the <b>Flyover</b> tool's rotation center mode
Working Plane Mode 	Sets the working plane as the reference for tools such as the <b>Flyover</b> tool, <b>Walkthrough</b> tool, and other viewing tools; used with the <b>Flyover</b> tool's rotation center mode

## Moving and Rotating the Working Plane

Moving and rotating the working plane can be performed either by using the handles on the plane or by menu commands. Moving the handles with the mouse is a quick method, but not as accurate. The commands allow exact values to be specified.

When making changes to the working plane position, select **Show 3D axis labels** on the 3D tab of the VectorWorks Preferences dialog box.

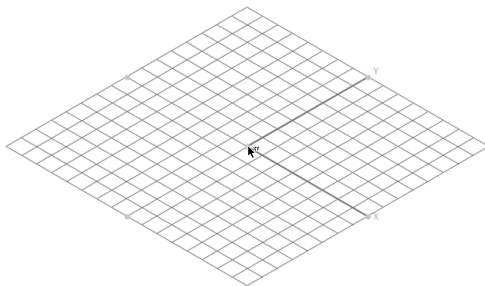
### Moving the Working Plane by Dragging

Move the working plane by dragging its center handle along the I, J, K or X, Y, Z axes.

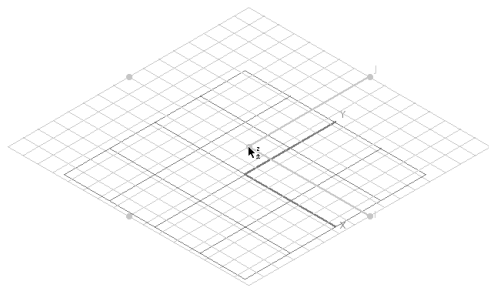


To move the working plane by dragging:

1. Switch to a 3D view.  
A view other than Top/Plan is required to move the working plane.
2. Click the **3D Selection** tool from the Basic palette.
3. Place the cursor near the center handle to move the plane in I, J space, or directly over the center handle to move the plane in X, Y space, as indicated by the small letters next to the cursor.  
Pressing the Alt key (Windows) or Option key (Macintosh) with the cursor near the center handle moves the origin along the K axis or the Z axis, as indicated by the small letter next to the cursor.
4. Click to begin moving the plane.
5. Click to place the plane in the desired location.



Cursor placed at center handle of the working plane



With the Alt/ Option key held down, the working plane moves up along the Z axis

### Moving the Working Plane Precisely

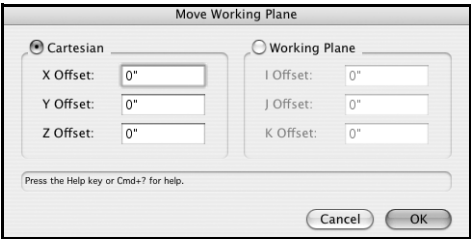
To move the working plane with the **Move Working Plane** command:

1. Switch to a view other than Top/Plan.

The working plane cannot be moved in Top/Plan view.

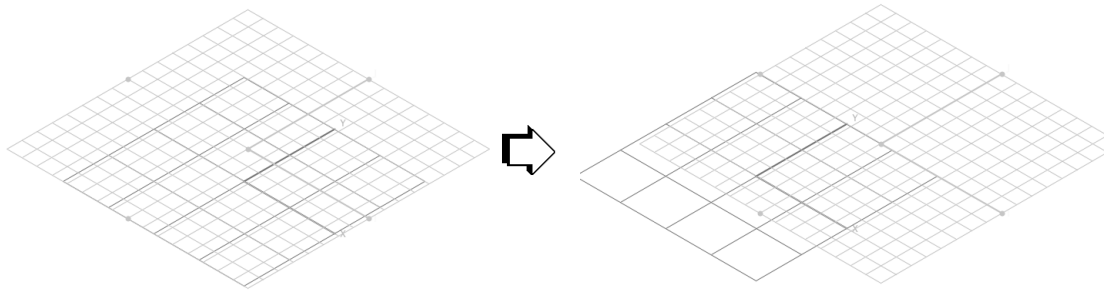
2. Select **View > Move Working Plane**.

The Move Working Plane dialog box opens. If moving along the X, Y, Z axes, the working plane is moved in relation to ground plane. If moving along the I, J, K axes, the working plane is moved in relation to itself. Specify the desired offset; values can be positive or negative.



3. Click **OK**.

The working plane moves according to the values entered.



## Rotating the Working Plane by Dragging

To rotate the working plane by dragging its handles:

1. Switch to a view other than Top/Plan.

The working plane cannot be rotated in Top/Plan view.

2. Click the **3D Selection** tool from the Basic palette.

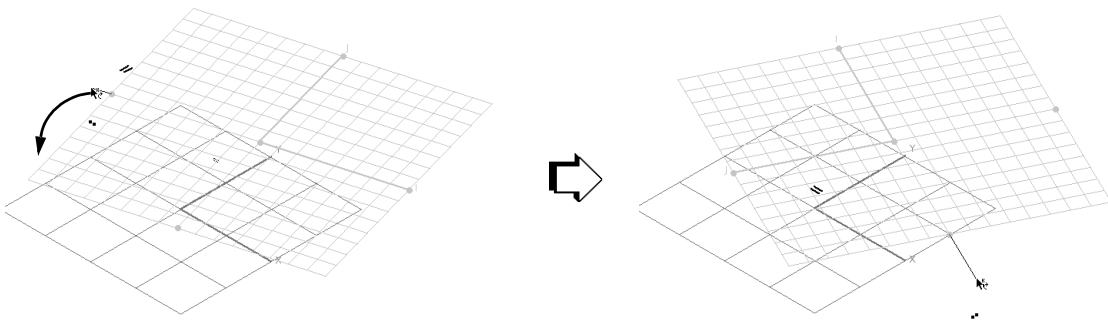
3. Position the cursor near the desired handle.

Placing the cursor near one of the outside handles will rotate the plane about the K, J or I, J axis, indicated by a small letter and a rotation arrow next to the cursor.

4. Click to begin rotating the plane.

The working plane snaps to standard preset angles (30, 45, 60, and 90 degrees) as it rotates close to them.

5. Click to place the plane in the desired location.



Move the control point in the desired direction  
to move the working plane

## Rotating the Working Plane Precisely

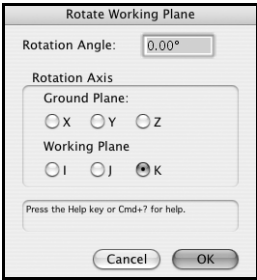
The **Rotate Working Plane** command provides the most precise way to rotate the working plane. Specify degrees, minutes, and seconds to rotate the plane.

The rotation value display (degrees, minutes, and/or seconds) depends on the Units setting. See “Units” on page 53 for more information on setting the units.

To rotate the working plane with the **Rotate Working Plane** command:

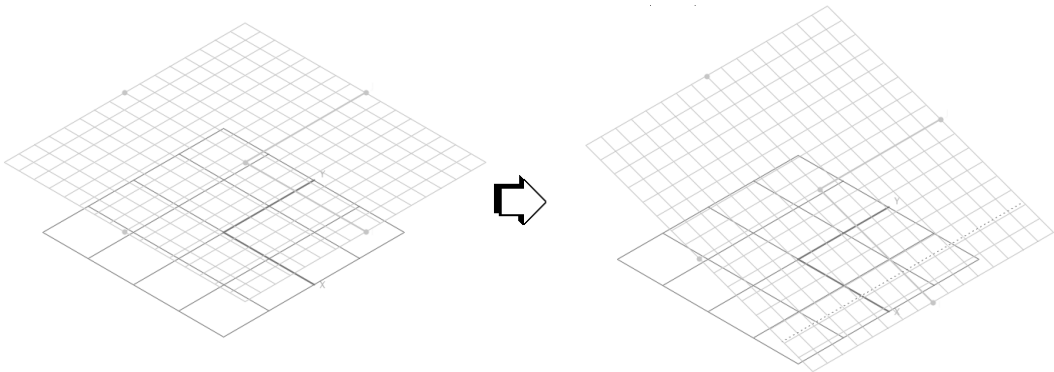
- 1. Switch to a view other than Top/Plan.  
The working plane cannot be rotated in Top/Plan view.

- 2. Select **View > Rotate Working Plane**.  
The Rotate Working Plane dialog box opens.



Parameter	Description
Rotation Angle	Specifies the rotation angle value
Rotation Axis	Select X, Y, or Z for rotating about the ground plane axis, or I, J, or K for rotating about the working plane axis

- 3. Click **OK**.



Working plane rotated 20 degrees about the J axis





# Worksheets

VectorWorks' worksheet functions complement its drawing functionality, making it a complete package for the entire work process. From the information present in the file, worksheets can be created to track data, create cost and material lists, perform calculations, and more. Information in worksheets can be created and edited without leaving the VectorWorks file; eliminating the need for a separate program and reducing the number of files per project.

Worksheets in VectorWorks include both database and spreadsheet functionality. Data can be obtained from the drawing, and then calculations can be performed on that data.

The image shows two overlapping worksheet windows from VectorWorks. The 'room.schedule' window displays a table with columns A, B, and C. The data includes room numbers (1.1 to 1.12), room names (STAIR, MEETING, WOMEN, MEN, LUGGAGE, VESTIBUL, CONCEI, RECEPT, STORAGE), and room types (1, 106, 107, 108, 109, 110, 111a, 112). The 'Unit Type Totals' window displays a table with columns A, B, C, D, and E. The data includes unit types (TYPE A, TYPE A1, TYPE A2, TYPE A2/H, TYPE A3, TYPE A4, TYPE B, TYPE C, TYPE C1) and their corresponding counts for 'Number Units' and 'Number Rooms'.

	A	B	C	D	E
4			Number	Number	
5			Units	Rooms	
6	TYPE A	16	1		
7	TYPE A1	1	1		
8	TYPE A2	1	1		
9	TYPE A2/H	2	1		
10	TYPE A3	2	1		
11	TYPE A4	2	1		
12	TYPE B	1	1		
13	TYPE C	3	2		
14	TYPE C1	6	2		

Worksheets can be imported and exported, allowing data to be shared between worksheets, files, and other spreadsheet programs. A worksheet can also be added to a drawing and printed.

## Creating Worksheets

For complex drawings, it is best to create separate worksheets for each task rather than one large worksheet. Worksheets can be linked to share data, formulas, and calculations.

Worksheets can be created in several ways. A blank worksheet can be created through the Resource Browser, and then edited to display the desired information. The **Create Report** command uses information already present in the drawing to create a worksheet. Worksheets can also be imported from other VectorWorks files and other spreadsheet programs.

If the same set of objects are typically used in your drawings, you can create a template file with a worksheet that serves as a "master price list" listing all the objects and their costs. Then, to create materials lists and cost estimates for a new design, simply import or reference the worksheet in the new drawing file.

To create a blank worksheet:

1. Select **Window > Palettes > Resource Browser**.
2. From the Resources menu, select **New Resource** to display the New Resource menu.
3. Select **Worksheet**.

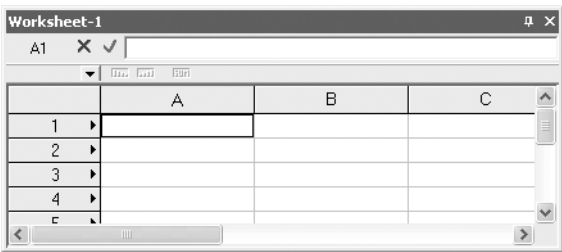
The Create Worksheet dialog box opens.



Parameter	Description
Name	Enter a worksheet name; it can be renamed later through the Resource Browser by selecting the worksheet and clicking <b>Rename</b> from the Resources menu
Rows / Columns	Enter the number of rows and columns for the worksheet; the number of rows and columns can be modified later

4. Click **OK**.

A new worksheet window opens.



See “Using Worksheets” on page 566 for information on how to use the worksheet.

The worksheet is saved with the file and is listed in the Resource Browser. It can also be accessed by selecting **Window > Worksheets**.

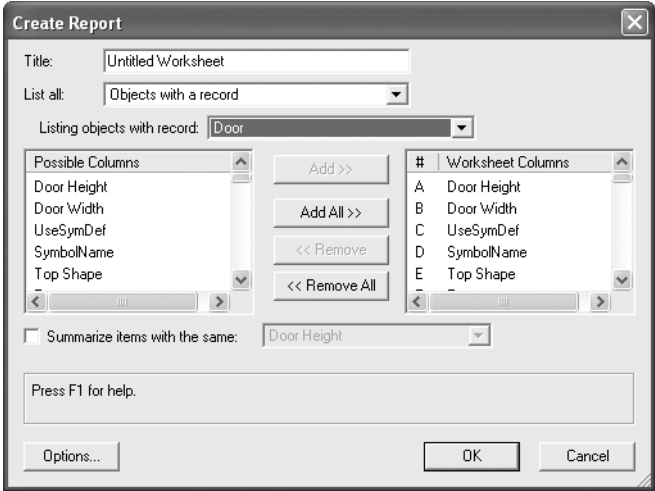
## Creating Reports

The **Create Report** command automatically creates a worksheet with database rows containing data from existing symbols or record formats.

To create a report from record formats or symbols:

1. Select **Tools > Reports > Create Report**.

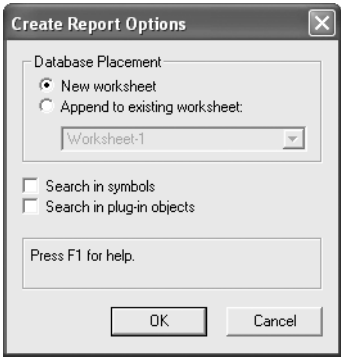
The Create Report dialog box opens. Specify the report criteria. Items in the **Worksheet Columns** list are listed in the order in which they will appear in the worksheet; to change the order, click in the # column and drag the item to the desired position in the list and worksheet.



Parameter	Description
Title	Assign a worksheet title
List all	Select to either list all objects with a record or list all symbols
List objects with record	If listing all objects with a record, select the record format to include
Possible Columns	Lists the columns that can be selected for inclusion in the worksheet
Worksheet Columns	Lists the columns selected for inclusion in the worksheet. Initially, all possible columns are placed in the <b>Worksheet Columns</b> list. Items that will be used as worksheet columns appear dimmed in the <b>Possible Columns</b> list.
Add / Add All	To add a column to the worksheet, select it in the <b>Possible Columns</b> list and click Add; click Add All to move all the columns to the <b>Worksheet Columns</b> list
Remove / Remove All	To remove an item from the worksheet, select it in the <b>Worksheet Columns</b> list and click <b>Remove</b> ; click <b>Remove All</b> to move all the columns to the <b>Possible Columns</b> list
Summarize items with the same	Summarizes symbols or record formats containing identical fields, rather than creating a new database row for each; select the field to summarize
Options	Specifies additional report options

2. Click **Options** to specify additional report criteria.

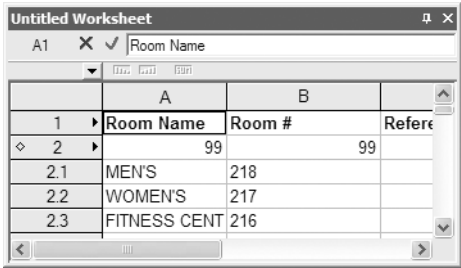
The Create Report Options dialog box opens.



Parameter	Description
New worksheet	Select to create a new worksheet
Append to existing worksheet	Select to append the information to a worksheet, and then select the target worksheet
Search in symbols	Select to search symbol instances for embedded records and symbols or include this information in the worksheet
Search in plug-in objects	Select to search plug-in object instances for embedded records or symbols and include this information in the worksheet

- 3. Click **OK** to return to the Create Report dialog box.
- 4. Click **OK** to create the worksheet.

The worksheet opens automatically and consists of the specified columns, and contains a sub-row for each object or symbol in the drawing. The first data row shows the total value for the column.



- 5. The worksheet is saved with the file and is listed in the Resource Browser.

## Using Worksheets

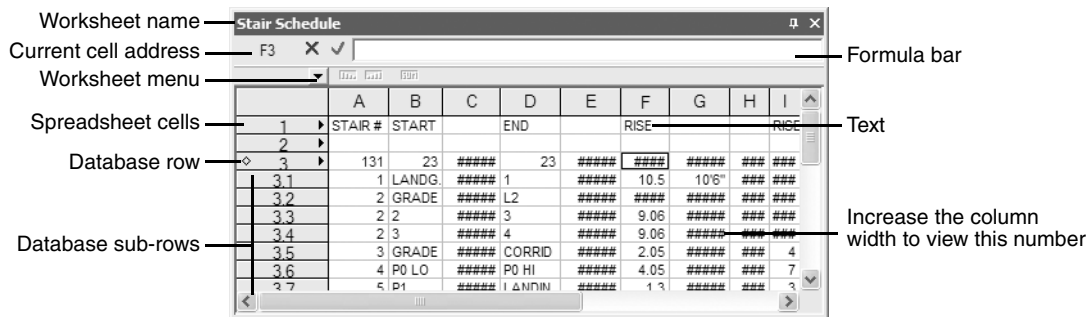
When worksheets exist in an open file, **Window > Worksheets** becomes available. All the worksheets present in the indicated file are listed, and can be opened by selecting them from the sub-menu. Worksheets with a check mark are currently open. Worksheets can also be opened from the Resource Browser by selecting the worksheet from the list and selecting **Open** from the **Resources** menu.

A worksheet opens in a separate window; it can be resized, moved, and closed. Worksheets contain a separate menu and command icons (see “Worksheet Commands” on page 569).

Because an open worksheet is in a separate window, it is not printed with the drawing. To include a worksheet as part of a drawing, select the worksheet in the Resource Browser and click **Worksheet on Drawing** from the Resources menu. When the worksheet is open, the worksheet on the drawing displays as an “X.” When the worksheet is closed, the updated worksheet displays on the drawing. Double-click the worksheet from the drawing to open it. See “Worksheets as Graphic Objects” on page 585.

The worksheet appearance can be specified with a variety of formatting options (see “Formatting Worksheet Cells” on page 572). The format is retained when the worksheet is included on the drawing. The appearance of the worksheet background (fill, pen, and line thickness) can also be modified from the Attributes palette.

In a VectorWorks worksheet, rows are numbered sequentially starting with 1, and columns are labeled alphabetically starting with A. The cell’s row number and column letter indicate the spreadsheet cell address (database sub-rows display a blank address). Cells can contain text, numbers, or formulas.



When an empty worksheet is first created, all rows contain spreadsheet cells. Once created, database rows are marked with a diamond shape next to the row number. The database header row contains the criteria, while the database sub-rows represent the objects that meet the specified criteria. For more information on spreadsheet cells and database rows, see “Worksheet Rows” on page 577.

## Moving Around in Worksheets

The following table describes the keys used to move around in the worksheet.

Keys	Description
Arrow (Up, Down, Right, Left)	Moves by one cell in the direction indicated
Tab	Moves right by one cell
Enter	Moves down by one cell
Shift+Tab	Moves left by one cell
Shift+Enter	Moves up by one cell

If more than one cell is selected, movement is restricted to the selected cells only.

## Selecting and Editing Worksheet Cells

Enter data in the currently selected cell with the worksheet Formula bar.

## Selecting Cells

To select cells:

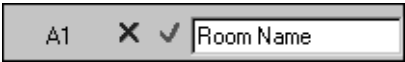
- **Select a single cell:** Click on the cell. The cell contents, for spreadsheet rows and database header rows, are displayed in the worksheet Formula bar.
- **Select a range of cells:** Click-drag across a range of cells to select them, or click in one corner and Shift-click in the opposite corner.
- **Select an entire column or row:** Click on the header cell. Click-drag across the header cells to select multiple rows or columns.
- **Select non-contiguous cells, rows, or columns:** Press and hold the Ctrl (Windows) or Command (Macintosh) key while clicking on each cell, row, or column to select.
- **Select the entire worksheet:** Click at the top left worksheet cell.

## Editing Cells

Spreadsheet cells can be edited. To edit a cell:

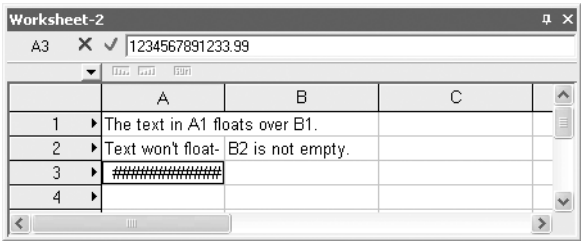
1. Select the cell.

The cell contents are displayed in the worksheet Formula bar.



2. Type directly in the Formula bar to enter text, numbers, or a formula.
3. To accept the edits and change the cell contents, click on the green check mark button. To cancel the edits, click on the red "X."
4. If necessary, adjust the width of the cell columns or cell rows by dragging the divider bar between the cell header columns or cell header rows. Alternatively, select the **Column Width** command from the Worksheet menu (see "Column Width" on page 570). Adjust the row height with the **Row Height** command from the Worksheet menu (see "Row Height" on page 570). Multiple rows or columns can be adjusted at one time.

Text that is longer than the width of a cell "floats" over empty adjacent cells. Numbers that exceed the cell width are displayed with # characters. Alternatively, text can be set to wrap (see "Formatting Worksheet Cells" on page 572).



## Cutting, Copying, and Pasting Cell Contents

The standard shortcut keys for Cut (Ctrl+X for Windows, Command+X for Macintosh), Copy (Ctrl+C for Windows, Command+C for Macintosh), and Paste (Ctrl+V for Windows, Command+V for Macintosh) can be used for worksheet editing.

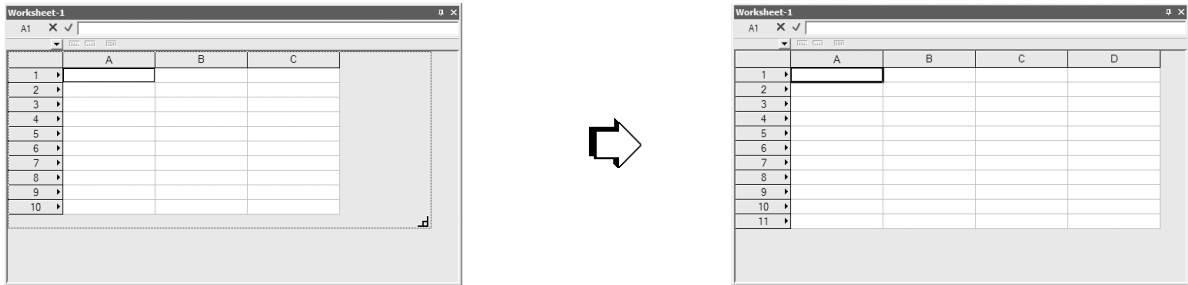
The same value or formula can be copied to a range of cells.

To copy cell contents to a range of cells:

1. Select the cell with the information to repeat and copy the cell by pressing Command+C (Macintosh) or Ctrl+C (Windows).
2. Select the destination cells for the information and paste by pressing Command+V (Macintosh) or Ctrl+V (Windows). The formula or value is repeated in each of the selected cells.

## Adding Rows and Columns

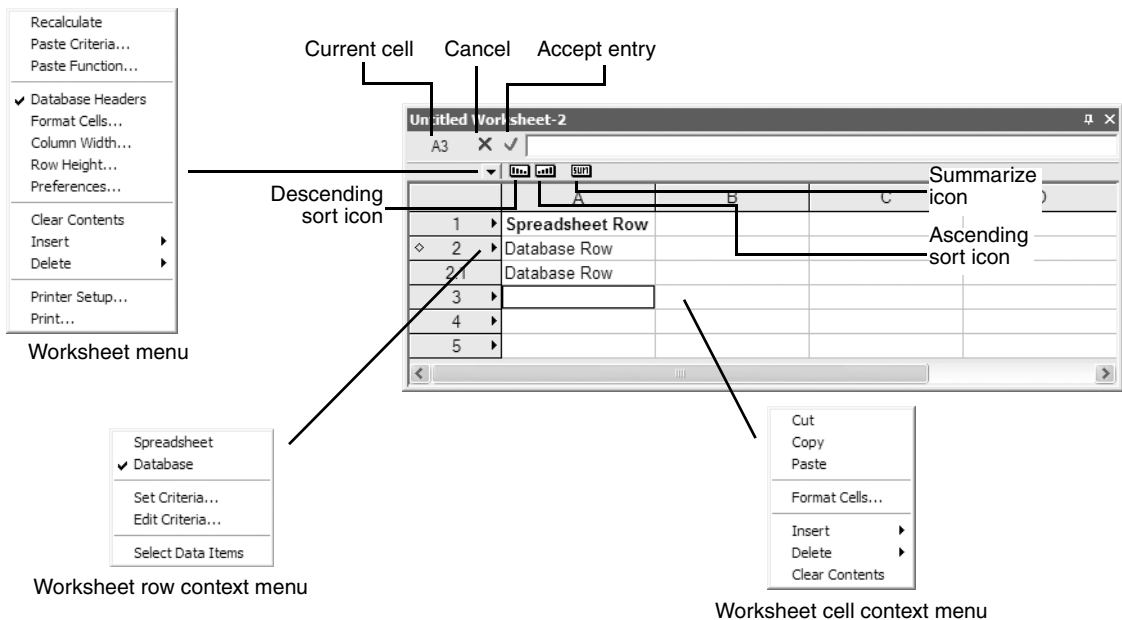
Rows and columns can be inserted with the Insert command on the worksheet menu (see “Worksheet Commands” on page 569). In addition, placing the cursor at the bottom right corner of the worksheet activates a special cursor which allows rows and/or columns to be added by dragging.




Hover the cursor over the bottom right corner of the worksheet to obtain the insert cursor; drag to add columns and/or rows

## Worksheet Commands




Specific worksheet commands are separate from the main window and are accessed through the Worksheet menu.



The worksheet commands and the buttons at the top of the worksheet are defined in the following table.

Worksheet Command	Description
Worksheet Menu Arrow 	Displays the commands and functions for the selected cell(s)
Recalculate	Recalculates all formulas in all worksheets, whether open or closed; this function can also be accessed from the worksheet image (on drawing) context menu
Paste Criteria	Displays the Criteria dialog box; select search criteria to insert in a formula
Paste Function	Displays the Select Function dialog box; select function to be inserted in the formula (see “Entering Formulas” on page 580)
Database Headers	Toggles between displaying and hiding all worksheet database header rows
Format Cells	Opens the Format Cells dialog box, for setting the format and appearance of selected cells (see “Formatting Worksheet Cells” on page 572)
Column Width	Displays the Column Width dialog box. Set the width value of selected cells in the specified units. Click <b>Standard Width</b> to use the default width. The width of multiple selected columns can be adjusted at one time.
Row Height	Opens the Row Height dialog box; set the row height to automatically fit the selected cell contents, or set a specific row height in the specified units. The height of multiple selected rows can be adjusted at one time.
Preferences	Displays the Worksheet Preferences dialog box. <b>Header</b> and <b>Footer</b> text fields and the <b>Margin</b> settings apply to printed worksheets only. Select <b>Show Grid</b> to display the worksheet gridlines. Select <b>Show Tabs</b> to print worksheet column and row headers. Select <b>Auto-recalc</b> to recalculate all worksheet arithmetic functions when cells are edited. Click <b>Font</b> to specify the worksheet default font and size.
Clear Contents	Deletes the contents of the selected cells
Insert	<p>Adds rows or columns to the worksheet. Select one or more rows or columns; the number selected determines the number inserted. Select <b>Insert &gt; Rows</b> to add rows above the selected rows. Select <b>Insert &gt; Columns</b> to add columns to the left of the selected columns.</p> <p>Use caution when inserting rows or columns. Depending on the type of cell references used in formulas, inserting rows or columns could change the values returned by a formula.</p>
Delete	<p>Deletes rows or columns from the worksheet. Select one or more rows or columns and select <b>Delete &gt; Rows</b> or <b>Delete &gt; Columns</b>.</p> <p>Use caution when deleting a row or column. Ensure that its cells are not part of a formula. Deleting cells that are part of a formula may change the values returned by the formula. Select <b>Edit &gt; Undo</b> to undo the action.</p>
Printer Setup	Displays the Printer Setup dialog box. This is the same as the standard Printer Setup dialog box; however, it only affects the printer information for the worksheet.
Print	Displays the Print dialog box, to print the current worksheet; this is the only way to print a worksheet from VectorWorks unless the worksheet is included as a part of the drawing



Worksheet Command	Description
Descending Sort Icon 	<p>Sorts the database sub-rows in a column in descending order. To apply, select the database row to sort. Click and drag the icon to the desired column header. A numbered icon displays next to the column heading letter. The number indicates the sort precedence for that column.</p> <p>To remove the sort, click and drag the icon away from the column header cell.</p>
Ascending Sort Icon 	<p>Sorts the database sub-rows in a column in ascending order. To apply, select the database row to sort. Click and drag the icon to the desired column header. A numbered icon displays next to the column heading letter. The number indicates the sort precedence for that column.</p> <p>To remove the sort, click and drag the icon away from the column header cell.</p>
Summarize Icon 	<p>Summarizes identical database items in the desired column. Click and drag the icon to place it over the desired column header. An icon is placed next to the column heading letter. Identical items in the columns sub-rows are grouped together in a single sub-row.</p> <p>To remove the summary, click and drag the icon away from the column header cell.</p>

Up to three sort icons and three summarize icons can be placed in the columns of a database row.

## Worksheet Cell Context Menu

A worksheet context menu is activated by right-clicking while on a cell.

Menu Item	Description
Cut	Removes the contents of selected cells, temporarily storing the contents in the clipboard
Copy	Copies the contents of selected cells to the clipboard, where they are temporarily stored; the original contents remain in the worksheet
Paste	Places cell contents stored in the clipboard into the current cell or range of cells
Format Cells	Opens the Format Cells dialog box, for setting the format and appearance of selected cells (see “Formatting Worksheet Cells” on page 572)
Insert	<p>Adds rows or columns to the worksheet. Select one or more rows or columns; the number selected determines the number inserted. Select <b>Insert &gt; Rows</b> to add rows above the selected rows. Select <b>Insert &gt; Columns</b> to add columns to the left of the selected columns.</p> <p>Use caution when inserting rows or columns. Depending on the type of cell references used in formulas, inserting rows or columns could change the values returned by a formula.</p>
Delete	<p>Deletes rows or columns from the worksheet. Select one or more rows or columns and select <b>Delete &gt; Rows</b> or <b>Delete &gt; Columns</b>.</p> <p>Use caution when deleting a row or column. Ensure that its cells are not part of a formula. Deleting cells that are part of a formula may change the values returned by the formula. Select <b>Edit &gt; Undo</b> to undo the action.</p>

Menu Item	Description
Clear Contents	Deletes the contents of the selected cells
Pick Value from List (Design Series required)	Edits record information in database rows when selecting fields from a list

Worksheet Row Context Menu

An additional worksheet context menu is activated by clicking and holding while on a row header cell.

Menu Item	Description
Spreadsheet	Converts a database header row into a spreadsheet cells, keeping intact any information in the header row. This deletes all sub-rows and the information contained within them. Has no effect on Spreadsheet cells.
Database	Converts a row of spreadsheet cells into a database header row and opens the Criteria dialog box. Has no effect on database rows.
Set Criteria	Opens the Criteria dialog box for setting the criteria used to generate the database sub-rows. Available only when a database header row is clicked.
Edit Criteria	Opens the Criteria dialog box for editing the current criteria used to generate the database sub-rows. Available only when a database header row is clicked.
Select Data Items	Selects all objects on the drawing that meet the criteria for the database row. Available only when a database header row is clicked.

Clicking and holding while on a database row activates the **Select Item** command from the context menu. Select this command to select an individual database object, and change the view to display the selected object (see “Selecting Database Objects” on page 578).

Formatting Worksheet Cells

The appearance of worksheet cells can be set by a variety of formatting options.

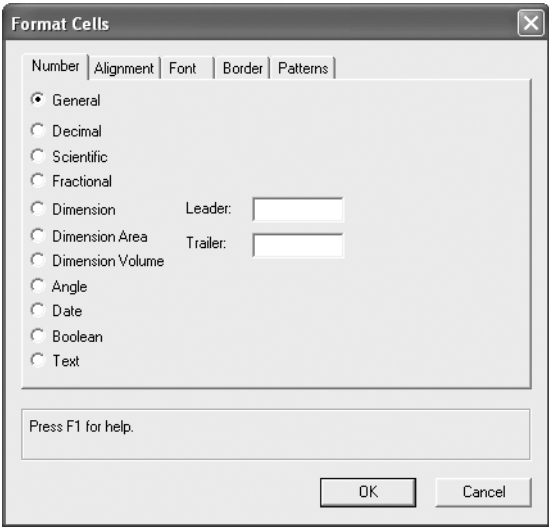
Formatting applied to a database header row applies to the associated database rows.

To format worksheet cells:

- 1. Select the cell(s) to format.
- 2. From the Worksheet menu, select **Format Cells**.

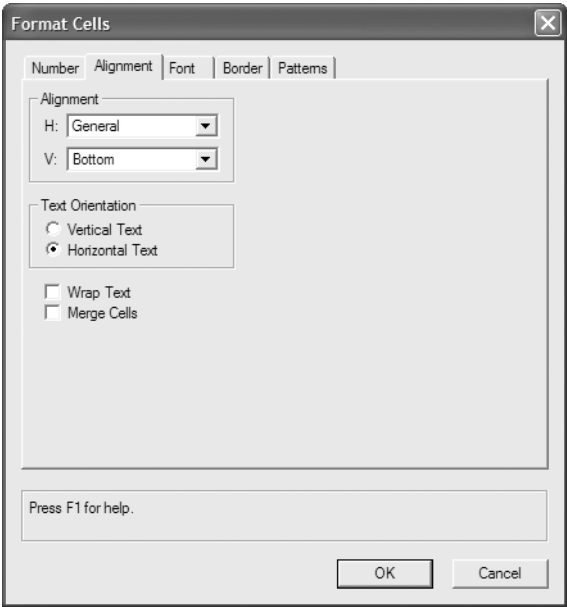
The Format Cells dialog box opens.

The Number tab sets the number format for the selected cells (see “Creating Record Formats” on page 170).



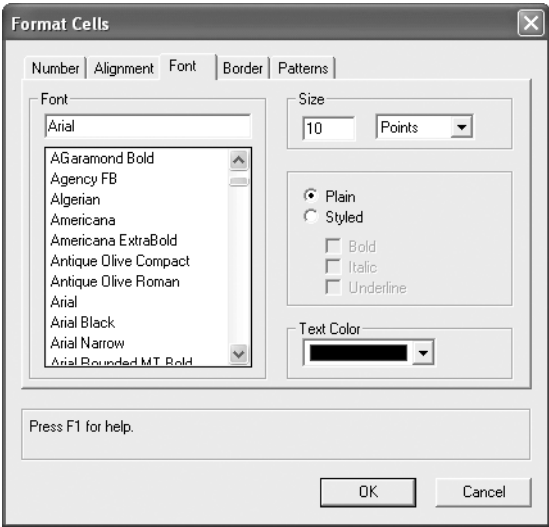
Parameter	Description
General	Specifies the default general format
Decimal	Uses decimal numbers; enter a value for the number of decimal places, and if desired, select to use commas as separators
Scientific	Uses scientific numbers; enter a value for the number of decimal places
Fractional	Uses fractional numbers; enter the rounding value for fractions
Dimension	Uses dimension numbers
Dimension Area	Uses dimension area format and displays the specified area units after the number
Dimension Volume	Uses dimension volume format and displays the specified volume units after the number
Angle	Determines the accuracy of angles and measurement system applied; measurement system is degrees, minutes, and seconds or decimal numbers up to eight decimal places
Date	Uses dates; select the desired date format from the list
Boolean	Select to use a data value of either True or False
Text	Select to enter a string of characters; the cell contents are treated as text, even if a number is in the string
Leader	Allows specified leader text to display before the cell value (except for Boolean and Text formats)
Trailer	Allows specified trailer text to display after the cell value (except for Boolean and Text formats)

3. Click the Alignment tab to specify text alignment options.



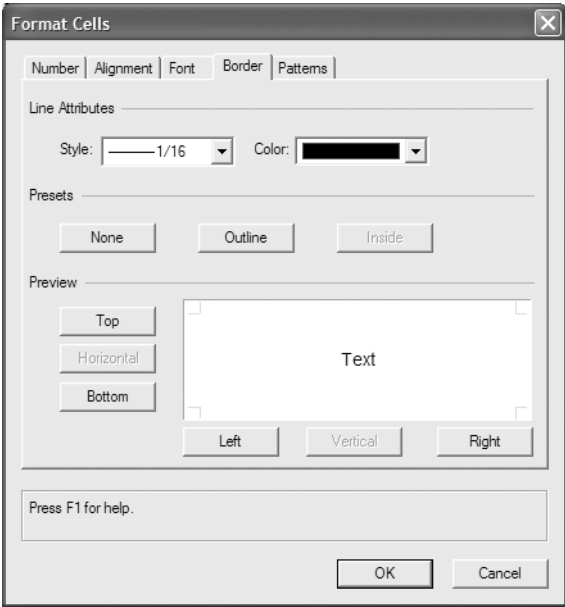
Parameter	Description
Alignment	Sets the alignment of text in relation to the cell border
Horizontal	Specifies horizontal text alignment; select General to align text strings on the left and numbers on the right
Vertical	Specifies vertical text alignment
Text Orientation	Sets the text orientation
Vertical Text	Orients text vertically
Horizontal Text	Orients text horizontally
Wrap Text	Select to wrap text that exceeds the cell width (automatically adjusting row height); deselect to allow text that is longer than the cell width to “float” over empty adjacent cells. If adjacent cells contain content, unwrapped text may appear truncated. Numbers that exceed the cell width are displayed with # characters.
Merge Cells	Merges a range of selected spreadsheet cells into one cell; cell and border formatting and text wrapping are applied to the cell group rather than to the individual cells. The cell contents and format of only the upper left cell in the group apply to the merged cells. Data and formatting in the other cells will be lost during the merge.  To split merged cells, select the merged cell group and then deselect <b>Merge Cells</b> .

4. Click the Font tab to specify the font, font size, style, and text color of text in selected cells. See “Formatting Text” on page 189.



5. Click the Border tab to set cell border formatting options.

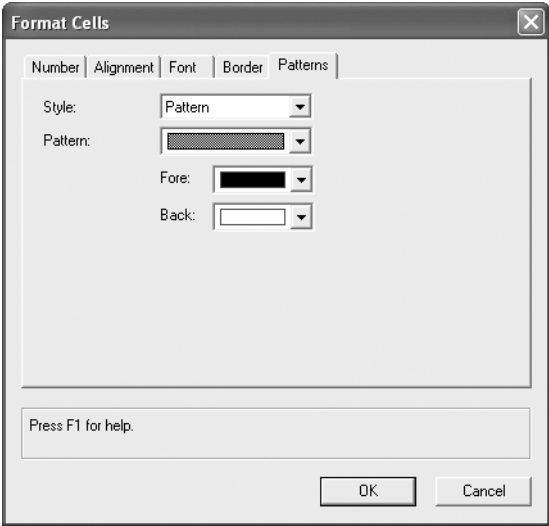
The current Line Attributes are applied to a border element as it is added. Select the attributes before clicking to add a border element.



Parameter	Description
Line Attributes	Sets the border line style, weight, and color. Select the formatting, and then click the border button to which the formatting applies.
Style	Selects the line style and thickness for the border element

Parameter	Description
Color	Selects the line color for the border element
Presets	Click a preset to automatically set border formatting options
None	Removes all border formatting
Outline	Adds a border only to the outside edges (top, bottom, left, and right) of the cell selection
Inside	Adds a border only to the inside (horizontal and vertical) edges of the cell selection
Preview	Adds border elements and previews the border appearance
Top	Adds a border to the top of the cell selection
Horizontal	When more than one cell is selected, adds a horizontal border between cells
Bottom	Adds a border to the bottom of the cell selection
Left	Adds border to the left edge of the cell selection
Vertical	When more than one cell is selected, adds a vertical border between cells
Right	Adds a border to the right edge of the cell selection

6. Click the Patterns tab to specify fill options for the selected cell(s).



Parameter	Description
Style	Select None to remove current cell fill options or to specify no fill; select Solid or Pattern to apply a solid fill color or pattern to the selected cell(s)
Color/Pattern	Select the fill color, or for the pattern style, choose the style and pattern foreground and background colors

7. Click **OK** to set the formatting for the selected cell(s). The worksheet formatting also applies to worksheets placed on a drawing.

Unit Type Totals

C5 = COUNTIFS(\$B:\$E,\$B:\$E,"<COUNT(\$B:\$E,unit mark) & (unit\_info reference=55)

	A	B	C	D	E
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

**Fancy Resort**  
**Unit Type Schedule**

	Number Units	Number Rooms
TYPE A	16	1
TYPE A1	1	1
TYPE A2	1	1
TYPE A2(HC)	2	1
TYPE A3	2	1
TYPE A4	2	1
TYPE B	1	1
TYPE C	3	2
TYPE C1	6	2
TYPE C3	1	2
TYPE D	2	2
TYPE D1	1	2
TYPE D2	1	2
TYPE D3	1	2
TYPE E LOWER	4	2
TYPE F	1	2
TYPE F1	1	2
TYPE G	3	3
TYPE H LOWER	2	3
Total	51	

## Worksheet Rows

Worksheets can obtain data from the drawing based on specified criteria, and then list the data and allow calculations to be performed on the data. Use a database row to specify the criteria for obtaining drawing data. See “Specifying the Worksheet Row Type” on page 578 to select the type of worksheet row. For information on entering data in spreadsheet cells and database rows, see “Entering Data” on page 579.

Untitled Worksheet

A1 X ✓ Room Name

	A	B	
1	Room Name	Room #	Refere
2	99	99	
2.1	MEN'S	218	
2.2	WOMEN'S	217	
2.3	FITNESS CENT	216	

## Spreadsheet Cells

Spreadsheet cells contain text, formulas, or numbers. Text helps to identify the purpose of a worksheet and labels the columns in a worksheet. Numbers represent drawing data or the results of a formula. Insert formulas to perform calculations based on drawing data; VectorWorks includes more than 30 built-in operation functions (see “Additional Worksheet Operations” on page 586).

## Database Rows

Worksheets with defined database rows display drawing object database information, which is represented by a database header row and its sub-rows. The sub-rows of a database row are tied to specific objects in the drawing. The database header row, identified by the diamond shape next to the row number, contains the criteria, while the database sub-rows beneath the header are generated for every object that meets the set criteria. Criteria and formulas specified in the database row determine what is displayed and calculated from the sub-rows. If no object meets the set criteria, no database sub-rows are created.

Many criteria combinations can be specified, including an object’s name, record information, line weight, fill pattern, layer, or class. For example, create a list of all the rooms in a resort, or list only the green wing-backed chairs from all the two-room suites that are scattered throughout the resort.

### Selecting Database Objects

Database objects that meet the criteria of the row can be selected from a worksheet.

To select database objects:

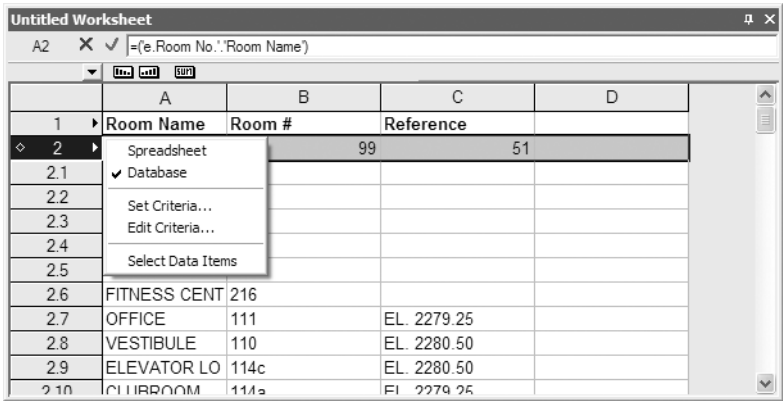
1. Either all database objects or a single database object can be selected.  
If selecting all database objects that meet database row criteria, right-click on the database header row to open the context menu.  
If selecting an individual database object, right-click on the specific database object to open the context menu.
2. From the context menu, select either **Select Data Items** or **Select Item**.  
All database objects which meet the header row, or the individual row object, are selected. If an individual object was selected with Select Item, the view changes to display the selected object.

### Specifying the Worksheet Row Type

The row pulldown menu specifies whether a worksheet row is a database row.

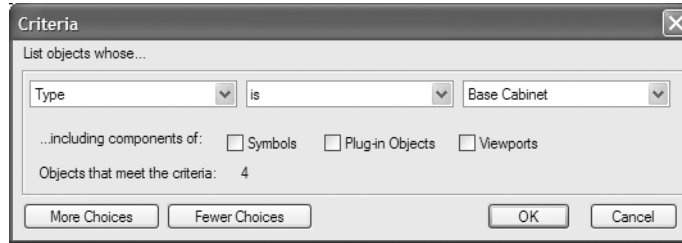
To define a database row:

1. Click and hold the mouse on the row to change.  
The worksheet row menu opens.



2. Select **Database**.  
The Criteria dialog box opens for the selection of criteria for the database header row.





More criteria can be specified by clicking **More Choices**; the number of objects that meet the criteria displays. Click **OK**. Database functionality is now enabled for the row; beneath it, the sub-rows list the objects that meet the criteria specified.

## Undefining a Database Row

To undefine a row as a database row:

1. Click and hold the mouse on the row to change.
2. Select **Spreadsheet**.

Undefining a database row removes the database row criteria and all sub-rows.

## Entering Data

Data entry in a worksheet depends on whether the data is entered into a spreadsheet cell or a database cell.

### Entering Data in Spreadsheet Cells

Two types of information can be entered into the spreadsheet cells of a worksheet: constant values and formulas. In addition, a cell can reference another cell in that worksheet or in another worksheet.

All information is entered in the worksheet Formula bar located at the top of the worksheet. Formulas can contain functions, which are detailed in “Additional Worksheet Operations” on page 586.

### Entering Constant Values

Constant values consist of numbers, spaces, non-numeric characters, or any combination of these. Constant values are not part of a formula or the result of a formula.

The formula phrase “=1”, or any number following an equal sign, is also considered a constant value.

When entering constant values, keep in mind:

- Constant values are treated as text except for some combinations of numeric and non-numeric characters, which may be interpreted as a number with a particular number format (see “Formatting Worksheet Cells” on page 572)
- Text is left-aligned unless the cell is formatted on the Alignment tab in the Format Cells dialog box (select **Format Cells** from the Worksheet menu)
- Numbers entered in cells are formatted as General; they can be changed to Dimension on the Number tab in the Format Cells dialog box (select **Format Cells** from the Worksheet menu)

Entering Formulas

Formulas are entered in a spreadsheet cell to analyze and perform operations on the data. A formula is entered in the worksheet Formula bar. Formulas can be applied to a single cell, or across a range of cells by selecting the cells and pasting the formula in the range. Formulas always begin with an equal sign (=) and consist of a combination of functions, cell references, or operators.

Formulas combine values with operators, such as a multiplication sign, to produce a new value (see “Operators” on page 591). Formulas must be entered in a specific manner. If the formula is not entered correctly, it produces an error and does not execute. Two common mistakes in syntax include forgetting to use pairs of parentheses, and omitting required commas when no argument is present.

Basic formula syntax is described in the following table.

Syntax	Explanation
Parentheses ( )	Enclose a parameter list
Square brackets [ ]	Enclose a record destination
Periods .	Separate record identifier and field identifier
Colons :	Separate path name levels
Single quotes '	Enclose a string constant
Dollar signs \$	Absolute reference designator
Double periods ..	Used to designate ranges

To keep VectorWorks from treating numbers entered as text in a cell as a number, enclose the number in single quotation marks, as in '40' or format the cell as **Text** on the Number tab of the Format Cells dialog box.

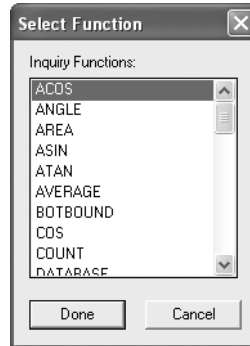
To manually enter a formula:

1. Select the cell, and then click in the worksheet Formula bar.
2. Enter an equal sign (=) and then enter the formula.  
A formula can consist of functions, operators, cell references, and values.
3. When the formula is complete, click the green check mark to validate the entry.  
To cancel an entry, click the red X button.
4. The formula executes as soon as the cell entry has been validated (**Auto-recalc** must be selected in the worksheet preferences; see “Preferences” on page 570).

Formulas can also be entered using the **Paste Function** and **Paste Criteria** commands.

To enter a formula using the **Paste Function** and **Paste Criteria** commands:

1. Select the cell, and then click in the worksheet Formula bar.
2. Enter an equal sign (=).
3. Select **Paste Function** from the Worksheet menu.  
The Select Function dialog box opens.

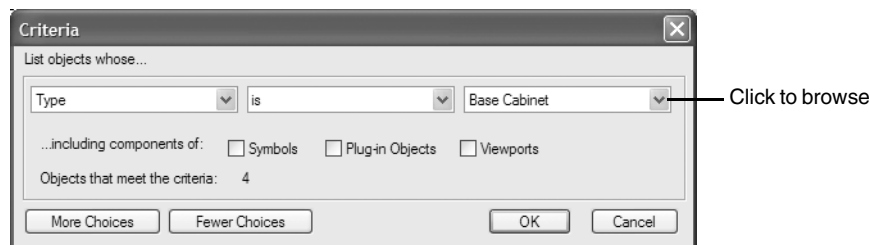


4. Select a function from the list, and then click **Done**. See “Worksheet Functions” on page 586 for more information on the functions.

The formula is placed in the worksheet Formula bar and the cursor is placed between the parentheses, awaiting criteria.

5. Select **Paste Criteria** from the Worksheet menu.

The Criteria dialog box opens.



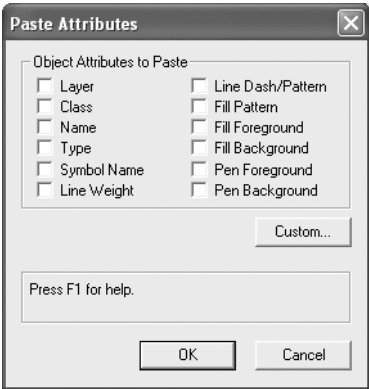
6. Set each of the three fields to the desired search criteria. Click **More Choices** to add additional search fields. Click **Fewer Choices** to remove added search fields.
7. Click **OK**.

8. When the formula is complete, click the green check mark to validate the entry.

To cancel the entry, click the red X button.

9. The formula executes as soon as the cell entry has been validated (**Auto-recalc** must be selected in the worksheet preferences; see “Preferences” on page 570).

If an object is selected when the **Paste Criteria** command is selected, the Paste Attributes dialog box opens.



Rather than selecting from search fields, the criteria are based on the selected object. Select the object attributes to include in the criteria search. To access the standard Criteria dialog box, click the **Custom** button.

Cell References

Cell references specify the location of one or more cells to use cell data or values in a formula. The cells can be referenced within the current worksheet (internal references), or from another worksheet (external references) within the same drawing.

External references must include the full path name to the other worksheet. The syntax for entering an external reference into a formula is:

Syntax	Example
worksheet name:cell address	=MyWorksheet:A1
worksheet name:range of addresses	=SUM(MyWorksheet:A1..A12)

If the name of the worksheet contains spaces, then the name must be enclosed with single quotes as in the following example: ='The Worksheet':A1

An external reference is updated by selecting **Recalculate** from the Worksheet menu.

Relative and Absolute Cell References

There are two forms of cell reference data used with cell addresses in a worksheet: relative and absolute. An absolute reference refers to a specific cell address, while a relative reference refers to a cell relative to the location of the cell containing the reference.

An absolute reference makes use of the special dollar sign (\$) character. The \$ character locks that part of the cell reference it precedes. There are three combinations when using the \$ character in an absolute reference.

Combination	Description
\$A1	Locks the specified column reference but leaves the row reference relative; the same column is always referred to, although the row can change
\$A\$1	Locks both the specified column and row references; regardless of where the formula is copied, it always refers to the original cell

Combination	Description
A\$1	Locks the specified row reference but leaves the column reference relative; the same row is always referred to, although the column can change

## Entering Data in Database Rows

Database rows are used to obtain record information attached to objects in a drawing (see “Database Rows” on page 577). Database rows are followed by the sub-rows corresponding to each object that meets the criteria specified in the header row.

The information in the sub-rows can list either object attributes or the data contained in database records. Database records are created in the Record Formats dialog box; these records can be assigned through the Data tab of the Object Info palette. See “Viewing and Editing Object Records” on page 175 for more information.

To enter data in database rows, specify the criteria as described in “Specifying the Worksheet Row Type” on page 578. To manually enter database row criteria, see “Retrieving Object and Record Information” on page 590.

## Worksheet Import/Export

Data from other software programs, such as Microsoft Excel and FileMaker Pro, can be imported into VectorWorks. In addition, VectorWorks worksheets can be exported for use in other spreadsheet, word processing, or database programs.

### Worksheet Import

Data from a wide variety of worksheet formats can be imported into a file, including worksheet data from other programs and worksheets from other VectorWorks files.

#### Importing Worksheet Data from Another Program

To import a worksheet into the current file, both the worksheet and its original file must be open. In addition, a blank worksheet must exist in the active drawing as a destination for the imported worksheet.

The worksheet formats that can be imported include comma delimited, tab delimited, merge, DIF, and SYLK. During import, the spreadsheet data is imported, but the formulas (logic) are not.

To import a worksheet into VectorWorks:

1. Create a new worksheet by selecting **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. From the Resources menu, select **New Resource** to display the New Resource menu.
3. Select **Worksheet**.  
The Create Worksheet dialog box opens.
4. Specify the same number of rows and columns that are present in the worksheet to be imported.
5. Select **File > Import > Import Worksheet**.
6. Select the worksheet file to be imported. The worksheet must be in one of the formats available on the **Files of type** list.
7. Click **Open**. The worksheet is imported into the open worksheet in VectorWorks.

## Importing Worksheets from Another VectorWorks file

To import a VectorWorks worksheet from another VectorWorks file:

1. Select **Window > Palettes > Resource Browser** to open the Resource Browser.
2. Locate the file containing the worksheet using the **Find** command in the **Resources** menu, or from a Favorites file. See “Accessing Existing Resources” on page 147 for more information.
3. Select the worksheet to import, and click **Import**. (Alternatively, drag the worksheet resource into the desired VectorWorks file to insert it as a drawing object; see “Worksheets as Graphic Objects” on page 585.)

The selected worksheet is imported into the current file.

## Importing a Table from Microsoft Word

The following procedure is an example of how to import a table from Microsoft Word into a VectorWorks worksheet.

To import a Word table into a worksheet:

1. In Word, select the entire table to be imported.
2. Select **Table > Convert > Table to Text**.  
The Convert Table to Text dialog box opens.
3. In the dialog box, click **Tabs** for the separation identifier.
4. Click **OK**.
5. Save the table.

If the file consists of only the table, select **File > Save As**. In the Save As dialog box that opens, select **Text Only** from the **Save as type** list, and click **OK**.

If the table is part of a larger file, copy the table to the Clipboard. Select **File > New**, and paste the table text into the new document. Save the file as a text file.

6. Return to VectorWorks and import the table as described in “Importing Worksheet Data from Another Program” on page 583.

## Worksheet Export

VectorWorks’ worksheet files can be exported and read by spreadsheet programs, such as Excel, as well as by some word processing programs. Because many of these programs have different format requirements, VectorWorks provides a selection of formats when exporting files as a worksheet. These include comma delimited, tab delimited, merge, DIF, and SYLK. Using the tab delimited format, for example, creates a file that can be opened as a table in Microsoft Word.

VectorWorks allows the export of all rows or only selected rows of a worksheet.

[Worksheets placed on the drawing cannot be exported to DXF/DWG.](#)

To export a worksheet from VectorWorks:

1. Select **File > Export > Export Worksheet**.
2. The Export Worksheet dialog box opens.



Select the format for the export, and whether to export all rows or only the selected rows. Click **OK** and specify the name and location of the exported worksheet.

3. Click **Save**. The specified worksheet rows are exported to the desired location in the set format.

## Worksheets as Graphic Objects

Worksheets can be included in a drawing as a graphic object. For example, a generated parts list for an object can be included in the drawing by placing the worksheet as an object. As with any graphic object, the worksheet can be moved to any location on the drawing. However, it cannot be resized or edited as an object. It can be opened and edited by opening its worksheet through the Resource Browser.

To include a worksheet as an object on a drawing:

1. Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

2. Select the desired worksheet.

The worksheet must be a part of the current drawing. If the worksheet is part of another drawing, first import it into the current drawing by selecting it from the Resource Browser and selecting **Import** from the **Resources** menu (see “Importing Worksheets from Another VectorWorks file” on page 584).

3. Select **Worksheet On Drawing** from the **Resources** menu.

The worksheet is now included in the drawing as a graphic object. It can be moved like any other graphic object and placed where desired. If the worksheet is currently open, the contents of the worksheet in the drawing are replaced with an X.

Alternatively, double-click the worksheet in the Resource Browser to place it in the drawing file, or select the worksheet in the Resource Browser and drag it to the desired location in the drawing file. Both methods automatically select **Worksheet on Drawing** and place the worksheet as a graphic object. When inserting a worksheet using the drag and drop method, the top left corner of the worksheet is placed at the point where the mouse is released over the drawing file.

To edit a worksheet included as a drawing object:

1. Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

2. Select the desired worksheet.

3. Select **Open** from the **Resources** menu.

- 4. The worksheet is opened and available for editing. The contents of the worksheet in the drawing are replaced with an X. Close the worksheet to display the worksheet contents in the drawing.

## Additional Worksheet Operations

### Worksheet Functions

Worksheet functions take a value or values, perform an action, and return a value or values. All functions that begin with a capital letter use search criteria. Lower case functions, known as worksheet functions, require a number value or a cell range. The argument for all trigonometry functions must be in radians. The following table alphabetically lists all of the worksheet functions available in VectorWorks.

Code	Returns	Example	Related Functions
acos(number)	The arccosine of a number. The arccosine is the angle whose cosine is number. The returned angle is given in radians in the range 0 to pi.  Number is the cosine of the angle, and must be from -1 to 1.	=acos(cos(x))	(cos) (pi)
Angle(criteria)	The angle of lines and walls, the span angle of arcs (in degrees), and the slope angle of slabs (in degrees)	=Angle(t=wall)	
Area(criteria)	The total area of 2D objects that meet the criteria	=Area(t=rect)	(Perim)
asin(number)	The arcsine of a number. The arcsine is the angle whose sine is number. The returned angle is given in radians in the range -pi/2 to pi/2. To express the arcsine in degrees use the rad2deg function (or multiply the result by 180/pi).  Number is the sine of the angle in question and must be from -1 to 1.	=asin(sin(x))	(pi) (sin)
atan(number)	The arctangent of a number. The arctangent is the angle whose tangent is number. The returned angle is given in radians in the range -pi/2 to pi/2. To express the arctangent in degrees, multiply the result by 180/pi().  Number is the tangent of the angle in question.	=atan(tan(x))	(pi) (tan)
average(number1, number2...)	The average (mean) of the arguments	=average (85, 70, 95)	(max) (min) (sum)



Code	Returns	Example	Related Functions
BotBound(criteria)	The minimum y coordinate of objects that meet the criteria	= BotBound(sec)	(LeftBound) (RightBound) (TopBound)
cos(number)	The cosine of a given angle.  Number is the angle in radians for which the cosine is calculated.	= cos(Deg2Rad(90))	(pi)
Count(criteria)	The number of objects that meet the specified criteria	= Count(sel)	
deg2rad(number)	Converts number from degrees to radians.  Number is the value in degrees to be converted to radians.	=deg2rad(45)	
exp(number)	e raised to the power of number. The constant e equals 2.71828182845904, the base of the natural logarithm.  Number is the exponent applied to the base e.	=exp(2)	(ln)
Height(criteria)	The delta y (height) of objects	=height(t=rect)	(Width)
if (logical_test, value_if_true, value_if_false)	Use value_if_true if logical_test is true, value_is_false if logical_test is false.  Use this function to conduct conditional tests on values and formulas and to branch based on the results of that test. The outcome of the test determines the value returned by the If function. The logical_test can be any value or expression that can be evaluated to true or false. Up to seven If statements can be nested as value_if_true, value_if_false arguments to construct elaborate formulas. Boolean statements within an if statement must be in parentheses. Text within an if statement should be enclosed within quotation marks.	=if((c7>100),100,c7) or =if((c7>100);100;c7) when commas are used as decimal separators by the operating system	
int(number)	Removes any fractional part of a number.  Number is the real number to be rounded to an integer.	=int(1.5)	(round)
IsFlipped(criteria)	Returns a value which is the total number of flipped objects which meet the criteria	=IsFlipped(t=rect)	

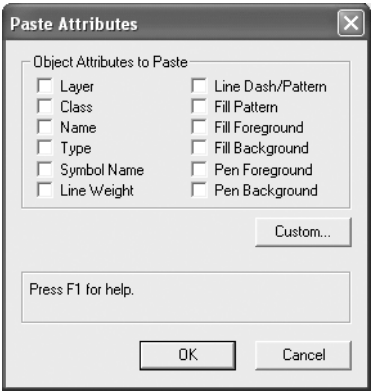
Code	Returns	Example	Related Functions
LeftBound(criteria)	The left side minimum x (left boundary) of the objects that meet the criteria	=LeftBound(n="obj")	(BotBound) (RightBound) (TopBound)
Length(criteria)	The length of lines or walls that meet the criteria	=Length(t=line)	
ln(number)	The natural logarithm (base e). Number is the positive real number for which the logarithm is calculated.	=ln(x)	(exp)
log(number)	The base 10 logarithm of a number. Number is the positive real number for which the logarithm is calculated.	=log(2)	(ln)
max(number1, number2,...)	The largest number in the list of arguments. Number is 1 – 14 numbers for which the maximum value is to be found.	=max (5,7,9)	(min)
min(number1, number2,...)	The smallest number in the list of arguments. Number is 1 – 14 numbers for which the minimum value is to be found.	=min(5,7,9)	(max)
Perim(criteria)	The perimeter of objects that meet the criteria	=Perim(sel)	
rad2deg(number)	Converts number from radians to degrees. Number is the value in radians to be converted to degrees.	=rad2deg (0.5235987)	
RightBound(criteria)	The right side minimum x (right boundary) of the objects that meet the criteria	=RightBound(sel)	(BotBound) (TopBound) (LeftBound)
round(number)	Rounds the specified number to the nearest whole number	=round(3.24259)	(int)
sin	The sine of a given angle	=sin(deg2rad(30))	(pi)
sqrt(number)	A positive square root. Number is the number for which the square root is calculated.	=sqrt(16)	
sum(number1, number2,...)	The sum of all numbers in the list of arguments. Number is 1 – 14 numbers for which the sum is calculated.	=sum(10,20,30)	(Average)

Code	Returns	Example	Related Functions
SurfaceArea(criteria)	Returns the sum of CalcSurfaceArea for each object that meets the criteria	=SurfaceArea (t=wall)	
tan(number)	The tangent of the given angle. Number is the angle in radians for which the tangent is calculated.	=tan(deg2rad(45))	(pi)
TopBound(criteria)	The maximum y (top boundary) of the objects that meet the criteria	=TopBound (n='root')	(BotBound) (LeftBound) (RightBound)
Volume(criteria)	Returns the sum of CalcVolume for each object that meets the criteria	=Volume(t=wall)	
WallArea_Gross (criteria)	Returns the 2D gross surface area of one wall face	=WallArea_Gross (t=wall)	WallArea_Net
WallArea_Net(criteria)	Returns the 2D gross surface area of one wall face, without door and window areas	=WallArea_Net (t=wall)	WallArea_Gross
WallAverageHeight (criteria)	Returns the average wall height of a wall, including wall peaks and different starting and ending heights	=WallAverageHeight (t=wall)	
WallStyleName(criteria)	Returns the name of a wall style	=WallStyleName (t=wall)	
WallThickness(criteria)	Returns the thickness of a wall	=WallThickness (t=wall)	
Width(criteria)	The delta x (width) of objects	=Width(n='box')	(Height)
XCenter(criteria)	The center of objects in the X direction	=XCenter (n='board')	(YCenter)
YCenter(criteria)	The center of objects in the Y direction	=YCenter (n='board')	(XCenter)

## Search Criteria

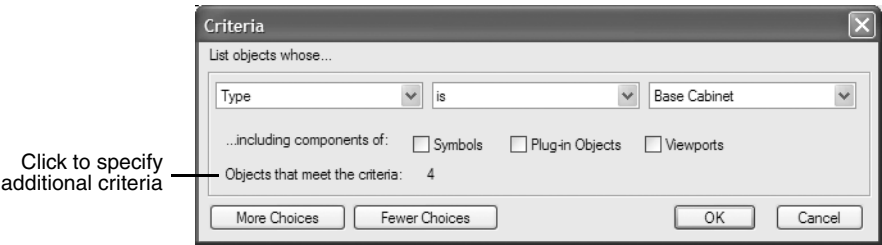
Search criteria are used within a function to limit that function to drawing objects that meet the criteria. For example, use search criteria to find doors of a specific size, walls of a certain color, or objects costing less than a certain amount.

Criteria are placed in a formula when by selecting the **Paste Criteria** command from the Worksheet menu. If an object is currently selected when choosing this command, the Paste Attributes dialog box opens. Select the object's attributes to include in the function, or click **Custom** to perform a database custom criteria selection.



Opens when an object is selected

If no objects are selected, the Database Criteria dialog box opens, to perform a database custom criteria selection.



Opens when no objects are selected

## Retrieving Object and Record Information

Once a database row is defined, each column can show attached record data and object attributes. Each sub-row cell displays the information requested while the total number of objects found is displayed in the database row. If the column returns numerical data, the sum is shown in the database row. Information found in each column can be sorted using the ascending, descending, and summarize buttons; see “Worksheet Commands” on page 569.

### Retrieving Object Attributes

To retrieve object information in a database row:

1. Click the database row cell where the formula will be entered.
2. In the worksheet Formula bar, enter an equal sign (=), and then enter the criteria to display (such as =(t=wall)).

The following search criteria codes can be manually entered. These same codes are placed in a formula, with proper parentheses and syntax, by the Database Criteria dialog box.

Criteria Name	Code	Criteria Name	Code
Arrowhead	ar	Class Name	c
Every Object	all	Fill Background	fb
Fill Foreground	ff	Fill Pattern	fp

Criteria Name	Code	Criteria Name	Code
Layer Name	l	Line Style	pp
Line Weight	lw	Object Name	n
Object Record	r	Object Type	t
Pen Background	pb	Pen Foreground	pf
Pen Pattern	pp	Selected Status	sel
Symbol Name	s	Visibility	v

3. Click the green check mark to validate the entry.

Retrieving Record Information

To retrieve record information in a database row:

- 1. Click the database header cell where the formula will be entered.
- 2. In the worksheet Formula bar, enter an equal sign (=) and then enter the record information to display. The syntax for retrieving record information is:

Syntax	Example
record name.field name	=Furniture.Type

A period (.) must separate the two names or the formula will not be executed.

If the name of the record format or field name contains spaces, then the name must be enclosed with single quotes such as in the following example: =Trees.'Growth Rate'

3. Click the green check mark to validate the entry.

Operators

VectorWorks uses the following operators. If the operator can be created with a special key combination, it is shown.

Arithmetic

Performs basic mathematical operations. These combine numeric values and produce numeric results.

Operator	Description
+	Addition
-	Subtraction
*	Multiplication
/	Division
^ or **	Exponentiation

Comparison

Compares two values and produces the logical value TRUE or FALSE.

Operator	Description
=	Equal
<> or ≠	Not equal
<	Less than
<= or ≤	Less than or equal to
>	Greater than
>= or ≥	Greater than or equal to

On the Macintosh, <> or ≠ can be specified by Option+ =, <= or ≤ by Option+ <, and >= or ≥ by Option+ >.

Cell Range Reference

Combines references to two cells into a single joint reference. The operator is .. or **Range**.

Special Words and Characters

The following special words and characters are reserved for use in formulas.

Operator	Description
(	Left parenthesis
)	Right parenthesis
,	Comma
;	Semicolon
:	Colon
TRUE	True
FALSE	False

VectorWorks provides several options for customizing the product environment to suit a wide range of individual design needs. One of the most important options is VectorScript, a lightweight Pascal-like programming language. Use VectorScript to do anything from creating simple tools that assist with the most tedious drafting tasks to developing sophisticated solutions that address the most demanding design needs.

While VectorScript provides a rich set of development tools for creating scripts from scratch, there are also several VectorWorks commands which allow scripts to be created without direct knowledge of the VectorScript language. The **Custom Selection**, **Custom Tool/Attribute**, and **Custom Modification** commands provide the ability to create useful scripts directly. (The **Custom Modification** command requires the Design Series; see “Creating Custom Modification Scripts” on page 21 in the VectorWorks Design Series User’s Guide.)

See the VectorScript Language Guide for an introduction to the VectorScript language. The VectorScript Language Guide is available in the help system, and as a PDF in [VectorWorks]\VWHelp\Additional Documentation.

In addition, the VectorScript Function Reference is a comprehensive command reference available online. It is located in VWHelp/VectorScript Reference/VSTFunctionReference.html

## Creating Custom Selection Scripts

Custom selection scripts allow objects in the current file to be selected or deselected according to user-specified criteria. The wide array of options in the command allows for very specific filtering and selection according to the defined selection requirements.

To create a custom selection script:

1. Select **Tools > Custom Selection**.

The Custom Selection dialog box opens.

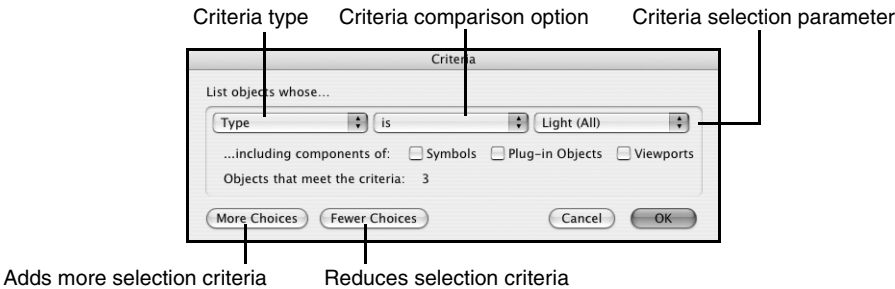


Parameter	Description
Select	Selects the objects matching the specified criteria without affecting the existing selection status of other objects
Select Only	Deselects all objects prior to performing the selection operation
Deselect	Deselects any objects matching the specified criteria without affecting the selection status of other objects in the file

Parameter	Description
Execute Immediately	Performs the specified selection operation immediately upon exiting the Custom Selection dialog box; the operation criteria is not saved for future use
Create Script	Saves the criteria and command options as a VectorScript that can be reused as needed

2. Click **Criteria** to specify the selection criteria for the operation.

The Criteria dialog box opens.



3. Choose the desired criteria options. The number of objects that meet the criteria displays.

Specify additional options by clicking **More Choices**. To remove the most recently added option, click **Fewer Choices**.

Specify whether to also include objects that are part of symbols, plug-in objects, or viewports.

4. Click **OK**.

If the **Execute Immediately** option was chosen, the selection operation is now performed. If the **Create Script** option was chosen, when prompted, name the VectorScript containing the selection operation commands. The script then displays in a script palette, and can be double-clicked to perform the selection operation.

## Creating Custom Tool/Attribute Scripts

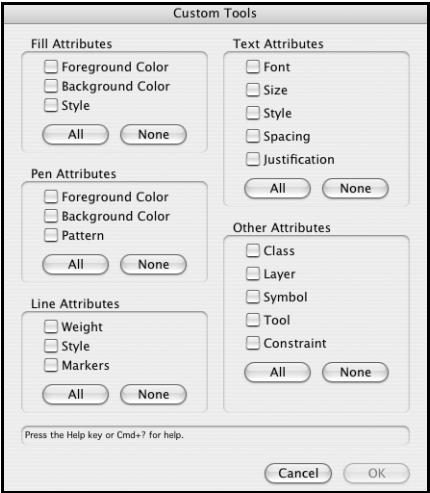
Custom tool/attribute scripts record the current attribute and file settings in a script format for later use. These custom settings can be combined with the active tool to allow a specific set of attributes, such as line style or pen color, to be reactivated for use with the tool. For example, a dashed line style and red pen foreground color can be saved with the line tool in a script for drawing red dashed lines.

To create a custom tool/attribute script:

1. Select **Tools > Custom Tool/Attribute**.

The Custom Tools dialog box opens.





2. Select which attributes should be saved in the script.
- The saved attributes are used when the script is executed and can be modified or reset as desired.

Parameter	Description
All	Selects all attributes in the group for saving to the script
None	Deselects all attributes in the group, clearing any selections that were already made
Fill Attributes	Saves fill foreground and background colors and styles
Pen Attributes	Saves pen foreground and background colors and styles
Line Attributes	Saves line weight (thickness) and style and the presence and size of markers
Text Attributes	Saves text attributes including font, size, style, spacing, and justification (alignment)
Other Attributes	Saves other attributes such as classes, layers, symbols, tools, and constraints

3. Click **OK**.
4. When prompted, name the VectorScript containing the saved settings.
- The script displays in a script palette, and can be double-clicked to execute.

## Creating VectorScripts

VectorWorks allows the creation of scripts which are saved as resources. The scripts, known as VectorScripts, can be used to store custom-written scripts for performing tasks within the file. VectorScripts, like other scripts created using VectorWorks’ automated script creation tools, are stored in script palettes contained within the file.

To create a VectorScript:

1. Select **Window > Palettes > Resource Browser**.
- The Resource Browser opens.

2. From the Resources menu, select **New Resource** to display the New Resource menu.
3. Select **VectorScript**.  
If no script palette exists, enter a name for a new script palette when prompted, and click **OK**.  
If multiple script palettes exist, but are not currently active, the Select Script Palette dialog box opens. Select the palette to add the script to and click **Add**.
4. Enter a name for the new VectorScript and click **OK**.
5. The VectorScript Editor opens to begin a script editing session.  
For information on creating scripts, see the VectorScript Language Guide, available in the help system, and the VectorScript Function Reference, which is a comprehensive command reference located in: VWHelp/VectorScript Reference/VFunctionReference.html
6. Click **OK** to save the script in the active script palette.

## Running VectorScripts

VectorScripts can be run in a variety of ways.

### Running VectorScripts from the Resource Browser

To run a VectorScript from the Resource Browser:

1. From the Resource Browser, select the palette containing the VectorScript to run.
2. From the context menu, select **Enter** to display the available VectorScripts in the palette.
3. Select the VectorScript, and from the context menu select **Run**. (Alternatively, double-click the VectorScript resource to run it or drag the VectorScript resource into the drawing area.)

### Running VectorScripts from the Script Palette

To run a VectorScript from a script palette:

1. Select **Window > Script Palettes** and select the VectorScript palette containing the desired VectorScript.  
*To open the palette from the Resource Browser, select **Window > Palettes > Resource Browser**, and then select the VectorScript palette containing the desired VectorScript. From the context menu, select **Open**.*
2. Double-click the VectorScript to run it.

### Running VectorScripts as Files

Some scripts may exist as text files only, if they were created outside VectorWorks in a separate text editor program. These scripts are not stored in the script palette as a resource.

1. Select the **Tools > Scripts > Run VectorScript**.  
The Choose VectorScript File dialog box opens.
2. Select the desired script and click **Open** to run the script.

## Managing VectorScripts

VectorScripts, like any other VectorWorks resource, can be edited, moved, copied, renamed, or deleted. VectorScripts also have the added ability of being encrypted to prevent editing.

For information on the VectorScript Editor, see “The VectorScript Editor” on page 105 in the VectorScript Language Guide. The VectorScript Language Guide is available in the help system, and as a PDF in [VectorWorks]\VWHelp\Additional Documentation.

## Editing VectorScripts

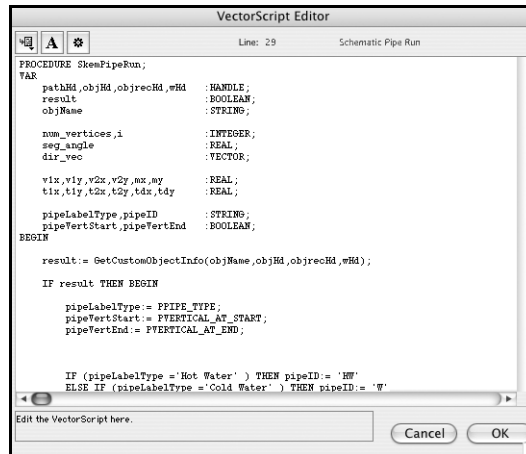
To edit a VectorScript:

1. Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

2. Select the script, and then select **Edit** from the **Resources** menu.

The VectorScript Editor dialog box opens.



3. When a script editing session is complete, click **OK** to save changes, or click **Cancel** to discard script changes.

Alternatively, VectorScripts can be edited directly from the script palette by Option-double-clicking the script name in the palette (Alt-double-click on Windows). The VectorScript Editor opens and the script can be edited.

## Renaming VectorScripts

To rename a VectorScript:

1. Select **Window > Palettes > Resource Browser**.

The Resource Browser opens.

2. Select the script to be edited, and then select **Rename** from the **Resources** menu.

The Assign Name dialog box opens.

3. Enter the new script name.

4. Click **OK**.

## Duplicating VectorScripts

To duplicate a VectorScript:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Select the script to be duplicated, and then select **Duplicate** from the **Resources** menu.  
The Assign Name dialog box opens.
3. Enter the name for the duplicated script, and then click **OK**.  
The duplicate script is created in the same palette as the original script.

## Deleting VectorScripts

To delete a VectorScript:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Select the script to be deleted, and select **Delete** from the **Resources** menu.
3. When prompted, click **OK** to delete the script.

## Importing VectorScripts

To import a script from another VectorWorks file:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Locate the file containing the script. Select the script to be imported, and then select **Import** from the **Resources** menu. (Alternatively, drag the VectorScript resource into the desired VectorWorks file.)  
The script is imported into the active script palette. If no palette is active, select the destination for the imported script, when prompted.

## Encrypting VectorScripts

A script can be encrypted and locked to prevent editing.

To encrypt a VectorScript:

1. Select **Tools > Scripts > Encrypt VectorScript**.  
The Choose VectorScript File dialog box opens.
2. Locate and select the script text file to encrypt.
3. Click **Open**.  
The Save Encrypted VectorScript Code Document dialog box opens.
4. Enter a new name for the script, and then select the location for saving the file.
5. Click **Save**.  
The script is saved in an encrypted format.

## Managing Script Palettes

Use the Resource Browser to manage script palettes as well as individual scripts.

### Opening a Script Palette

To open a script palette:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Select the script palette to be opened, and then select **Open** from the **Resources** menu.  
The script palette opens.

### Moving a Script to a New Palette

To move a script to a new palette using the Resource Browser:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Select the script palette containing the desired script, and then select **Open** from the **Resources** menu.  
The source script palette opens in the drawing.
3. Select the script palette where the script will be moved, and then select **Open** from the **Resources** menu.  
The destination script palette opens in the drawing.
4. Click on the script to move, and then press Command+X (Macintosh) or Ctrl+X (Windows). The script is removed from the palette and placed into the clipboard.
5. Click on the destination script palette, and then press Command+V (Macintosh) or Ctrl+V (Windows). The script is placed into the selected script palette.

Each script palette can also be opened from the **Window** menu.

### Importing a Script Palette

To import a script palette from another VectorWorks file:

1. Select **Window > Palettes > Resource Browser**.  
The Resource Browser opens.
2. Locate the script palette to be imported.  
For information on using the Resource Browser to locate resources in other VectorWorks files, see “Using the Resource Browser” on page 142.
3. Select the script palette to be imported, and then select **Import** from the **Resources** menu. (Alternatively, drag the script palette resource into the desired VectorWorks file.)  
The palette and any scripts it contains are imported into the active VectorWorks file.

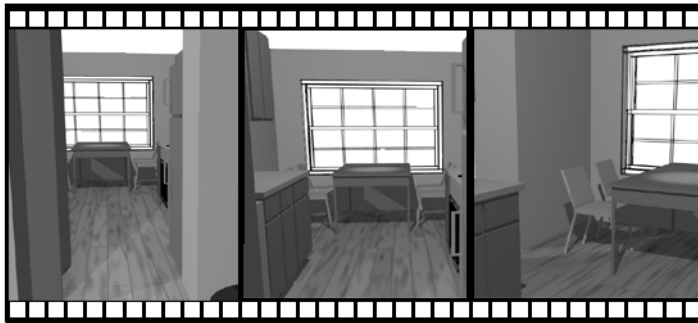


VectorWorks provides several ways to present a completed drawing. Guide your customer through an animated walkthrough of your design by creating a QuickTime movie. Present many croppable views of the drawing on a single layer with viewports. Finally, the layer link feature creates linked views of the design layers in the drawing.

## Animating Drawings with QuickTime

With QuickTime, animations can be created from a 3D VectorWorks drawing. QuickTime is a separate program available with VectorWorks. It includes Movie Player, for viewing several different file types.

QuickTime must be installed to view or create QuickTime movies. It is available on the VectorWorks CD.



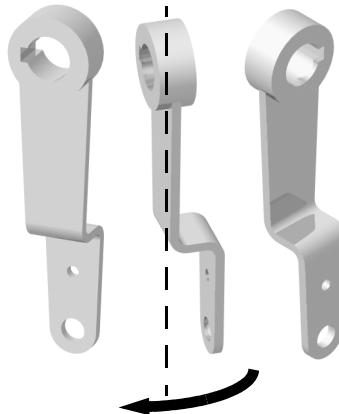
## Animating Drawings

Two types of animations can be created in VectorWorks—Orbit Point and Move Along Path. The Orbit Point animator rotates by a specified number of degrees around a 3D object or selected point in the drawing. The Move Along Path animator moves through the 3D drawing, following a specified path.

In Perspective view, only the portion of the model within the perspective frame (see “Perspective” on page 406) is visible in the animation.

### Creating Orbit Point Animations

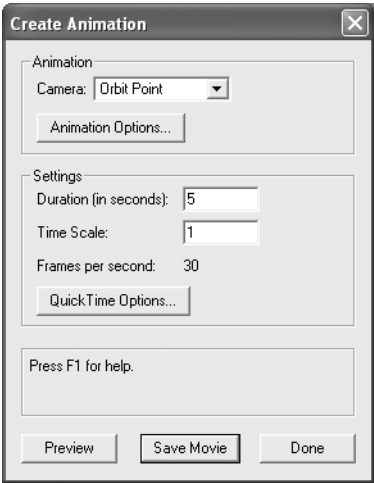
The Orbit Point animator creates an animation that moves in a circular path around a specific 3D object or point.



To create an orbit point animation:

1. Set up the drawing view.  
Select the desired views from the **View** menu — **Standard Views**, **Projection**, **Rendering**, and **Perspective**. In addition, use the **Zoom** tool to set the drawing magnification level. Ensure that only the layers and classes that should display in the animation are visible.
2. To specify an object or objects as the center of rotation, select the object or group of objects.
3. Select **Model > Create Animation**.

The Create Animation dialog box opens.



4. Set the **Camera** to **Orbit Point**.
5. Click **Animation Options**.

The Simple Orbit Options dialog box opens.



Parameter	Description
Ground plane	Specifies the center of the ground plane (0X, 0Y, 0Z) as the center of rotation for the animation
Working plane	Specifies the center of the working plane (0I, 0J, 0K) as the center of rotation for the animation



Parameter	Description
Selection	Specifies the center of the selected object(s) as the center of rotation for the animation
Rotation angle	Specifies the amount of rotation (in degrees) for the animation; for example, to complete an orbit around the selected center of animation, enter 360

- Click **OK** to return to the Create Animation dialog box.

The QuickTime frames per second (fps) value is displayed. VectorWorks uses default compression settings for QuickTime; these settings produce a good-quality animation without an excessive file size. However, the parameters can be modified by clicking on the **QuickTime Options** button.

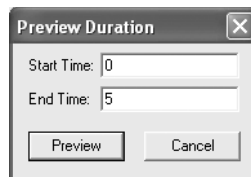
QuickTime is a complex program which offers great flexibility in selecting settings. Consult the online QuickTime Player help (available from the QuickTime Help menu) for more information about QuickTime parameters and compression settings.

- Specify the remaining parameter settings in the Create Animation dialog box.

Parameter	Description
Duration (Sec)	Sets the total length of time of the animation
Time Scale	Specifies the animation rate; a value between 0.1 and 0.99 creates a slow motion effect, while a value between 1.01 and 10.00 speeds up the animation. Leave the default value of 1.00 for a normal time scale.

- Click **Preview** to check the animation before saving it. Depending on the rendering setting, the preview may be shown in wireframe.

To preview only a selected portion of the animation, press Command (Macintosh) or Ctrl (Windows) when clicking **Preview**. The Preview Duration dialog box opens.



Specify the animation starting and ending time (in seconds) and click **Preview**.

To stop showing a preview, simultaneously press Command + Period (Macintosh) or Esc (Windows).

- When satisfied with the preview, click **Save Movie** to save the animation.

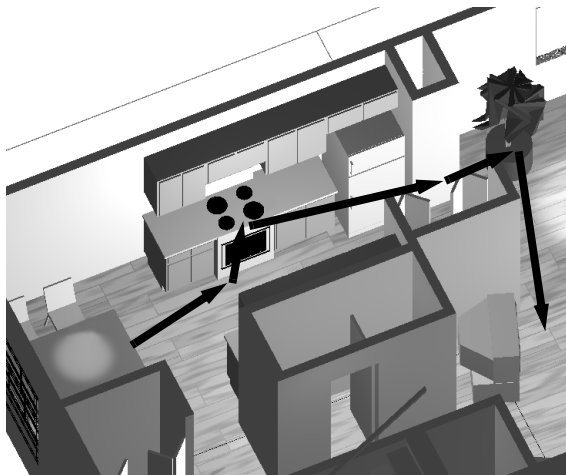
The Save As dialog box opens.

- Enter the name for the QuickTime Movie file and specify its location. Click **Save**. The progress of movie creation is displayed.

To see the completed animation, see “Viewing QuickTime Animations” on page 609.

## Creating Move Along Path Animations

The Move Along Path type of animation moves through a 3D drawing along a specified path. For example, create a walk-through presentation of a house.



To create an animation moving along a specified path:

1. Set up the drawing view.

Select the desired views from the **View** menu—**Standard Views**, **Rendering**, and **Perspective**.

The drawing **Projection** must be set to **Perspective**.

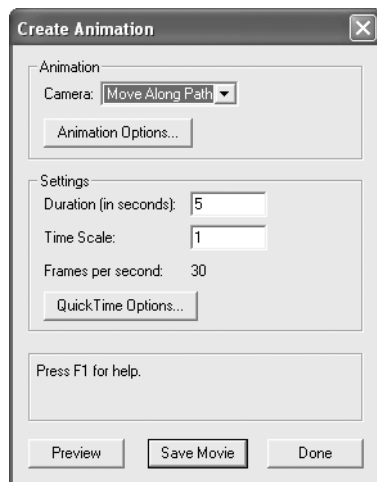
2. Save a view for each point along the path to use for creating the animation.

Use the **Walkthrough** and/or **Flyover** tools to change views. To save a view, select **View > Save View**. In the Save View dialog box that opens, enter the **View Name**, ensure that **Save Factors** is selected, and then click **OK** (see “Creating Saved Views” on page 104).

3. Select **Model > Create Animation**.

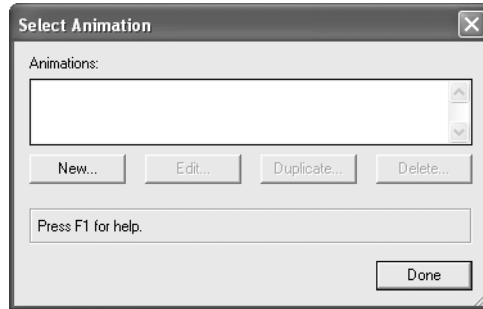
The Create Animation dialog box opens.

4. Set the **Camera** to **Move Along Path**.



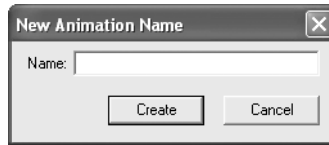
5. Click **Animation Options**.

The Select Animation dialog box opens.



6. Click **New**.

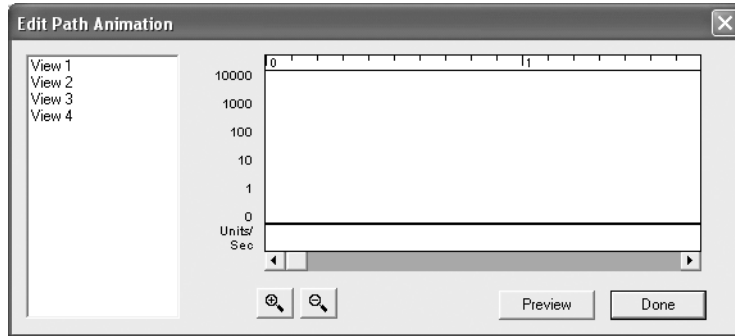
The New Animation Name dialog box opens.



Enter a name for this animation and then click **Create** to return to the Select Animation dialog box.

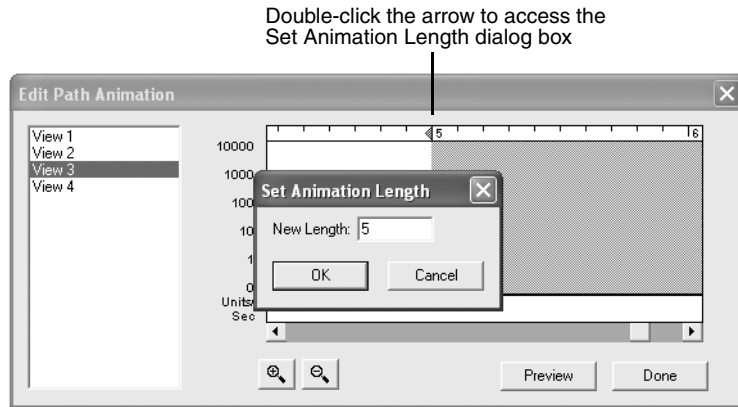
7. Select the name of the new animation and click **Edit**.

The Edit Path Animation dialog box opens.



The **Zoom In** and **Zoom Out** buttons under the graph change the magnification level of the animation graph.

A new path animation uses the default length from the setting in the main QuickTime options dialog box. To specify a different animation length, double-click the arrow to the far right of the timeline.



8. From the list of views on the left, drag the starting view name to the animation graph.

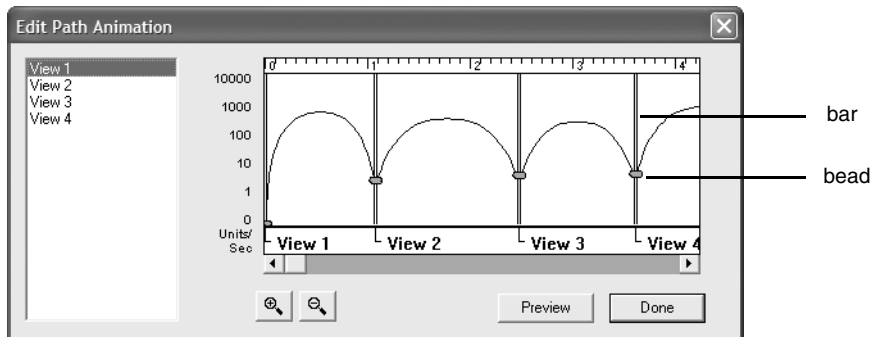
VectorWorks automatically places the first view at the graph's origin—0 seconds, 0 drawing units/second.

9. Select the next view to use and drag it to the animation graph.

A bar with a bead is added to the graph. Drag the bar and bead to change the animation settings (time elapsed between view changes and velocity of camera movement).

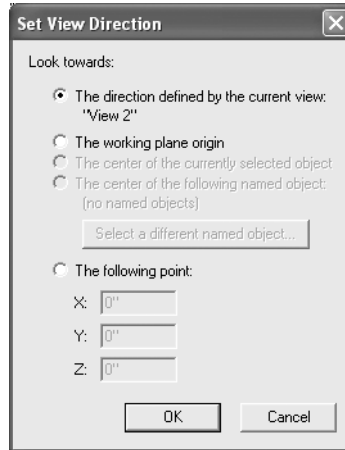
The distance between bars is the time in seconds that it takes to move from one view to the next.

Move the bead up and down to determine the slope of the line between bars. This slope indicates the velocity of the movement between views (the number of drawing units/second that the camera moves). In general, the slope should form a steady curve. An uneven curve will cause a choppy camera movement, speeding up and slowing down in a jolting manner. The slope cannot dip below the X axis—this would create a negative velocity.



10. To set a specific camera target, double-click on a bead.

The Set View Direction dialog box opens.

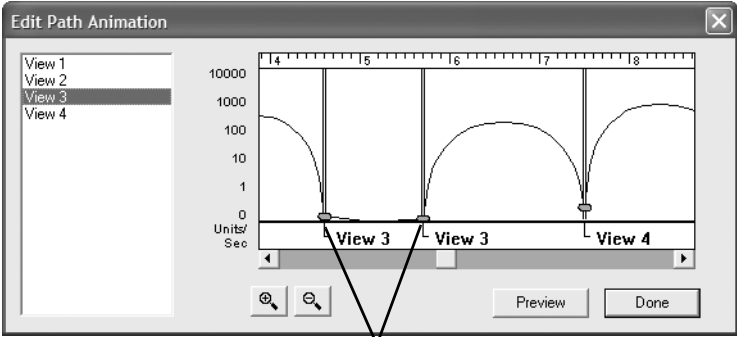


Parameter	Description
Look towards	Specifies what direction the view should look toward
Current view	Sets the view to the current bead's saved view
Working plane origin	Sets the view to the working plane origin
Center of currently selected object	Sets the view to the X, Y, Z center of the currently selected object(s) bounding box
Center of following named object	Sets the view to look at the center of a named 3D object. Click <b>Select a different named object</b> to open the Look At Named Object dialog box. Select the object to set the view toward (named objects in walls or layer links cannot be selected).
Following point	Sets the view to the specified X, Y, Z coordinates

11. Click **OK** to exit the **Set View Direction** dialog box.
12. Continue selecting views and dragging them onto the animation graph until the desired views have been included within the time allotment. To view a wireframe version of the animation, click **Preview**.

To add a pause to the animation, drag the same view twice into the animation graph so that the views are next to each other in sequence. The line between the views should be flat (no upward or downward slope). This creates a velocity of zero and, therefore, a pause in the animation.

Setting the view to different specified X, Y, Z coordinates for each of these frames, makes the camera appear to stop its forward motion and pan from one direction to another.



To create a pause, place the same view twice in the animation graph. Ensure that there is no slope between the repeated views.

13. Click **Done** to return to the Create Animation dialog box.

The QuickTime frames per second (fps) value is displayed. VectorWorks uses default Compression Settings for QuickTime; these settings produce a good-quality animation without an excessive file size. However, the parameters can be modified by clicking on the **QuickTime Options** button.

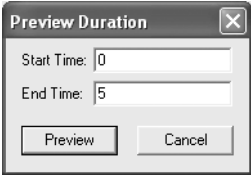
QuickTime is a complex program which offers great flexibility in selecting settings. Consult the online QuickTime Player help (available from the QuickTime Help menu) for more information about QuickTime parameters and compression settings.

14. Specify the remaining parameter settings in the Create Animation dialog box.

Parameter	Description
Duration (Sec)	Sets the total length of time of the animation
Time Scale	Specifies the animation rate; a value between 0.1 and 0.99 creates a slow motion effect, while a value between 1.01 and 10.00 speeds up the animation. Leave the default value of 1.00 for a normal time scale.

15. Click **Preview** to check the animation before saving it. Depending on the rendering setting, the preview may be shown in wireframe. Specify the animation starting and ending time (in seconds) and click **Preview**.

To preview only a selected portion of the animation, press Command (Macintosh) or Ctrl (Windows) when clicking **Preview**. The Preview Duration dialog box opens.



To stop showing a preview, simultaneously press Command + Period (Macintosh) or Esc (Windows).

16. When satisfied with the preview, click **Save Movie** to save the animation.

The Save As dialog box opens.

17. Enter the name for the QuickTime movie file and specify its location. Click **Save**. The movie creation progress displays.

To see the completed animation, see “Viewing QuickTime Animations” on page 609.

## Adding Text or Title Screens to Animations

Unless text is specifically converted into a 3D object (using the **TrueType to Polyline** command), VectorWorks and QuickTime view text as 2D. This means text in a drawing exported as a QuickTime movie remains motionless, not moving with the other 3D objects. This principle is also true for any graphic images placed in the drawing.

VectorWorks can be used to create an animated title screen as a separate QuickTime movie, using an Orbit Point animation to move the 2D text. (The Move Along Path animator requires 3D perspective projection.) Then, within the QuickTime program, link the two files together to create one movie.

*When creating a title screen animation, ensure that the title movie uses the same QuickTime frame rate setting as the linked animation movie.*

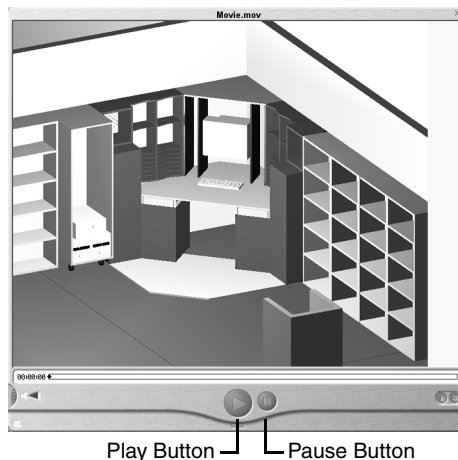
## Viewing QuickTime Animations

Macintosh-generated or Windows-generated movies can be viewed on either platform.



To view existing movies:

1. Double-click the file name or **QuickTime Movie** icon for the desired movie. Alternatively, open the QuickTime application and select the file from the **Open** menu.
2. Click the **Play** button to play the movie.



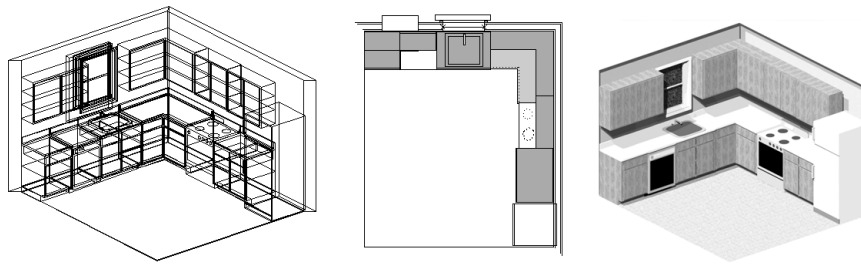
## Presenting Drawings with Sheet Layer Viewports

VectorWorks “viewport” objects allow the creation of views from several directions, complete with details, annotations, dimensions, and title blocks. Viewports can show other parts of the active document, or even portions of other documents.

Viewports can display entire as well as cropped views of a drawing, with specified layer and class visibility settings, projection, render mode, and orientation parameters. If the drawing changes, the viewports can be easily updated to reflect the changes.

In both VectorWorks Fundamentals and VectorWorks Design Series, you can create one or more viewports on a sheet layer, and each viewport can show one or more design layers from this document. Additionally, VectorWorks Design Series allows you to create one or more viewports on a design layer, and the design layers shown in the viewports can be either from this document, or referenced from another document. For details about design layer viewports, see “Presenting Drawings with Design Layer Viewports” on page 616 in the VectorWorks Design Series User’s Guide.

A sheet layer can contain many viewports. Sheet layers retain their own print settings, including print area, resolution, and printer setup parameters. For more information on sheet layers, see “Managing Layers” on page 84.



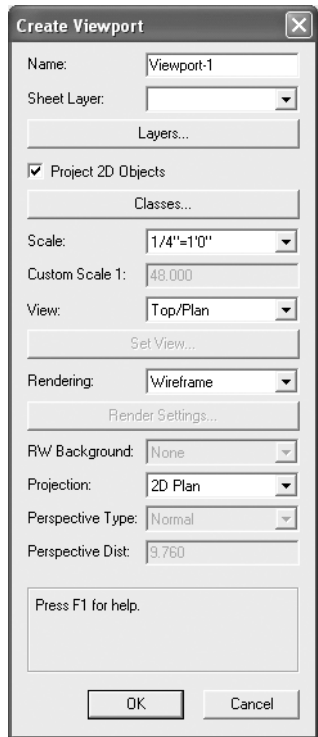
## Creating a Sheet Layer Viewport from a Design Layer

A sheet layer viewport can be created from an active design layer.

To create a viewport from a design layer:

1. Select **View > Create Viewport**.
2. The Create Viewport dialog box opens. The viewport parameters are initially set to be the same as those of the design layer that is currently active. Viewport parameters can be set at creation, or after the viewport has been created.





Parameter	Description
Name	Specifies the viewport name
Sheet Layer	Select the sheet layer where the viewport will be created, or select New Sheet Layer to create a sheet layer. If there are no sheet layers present and a new one is not created now, you will be prompted to create a sheet layer after clicking <b>OK</b> .
Layers	Specifies which design layers will be visible in the viewport; see “Changing the Layer Properties of Sheet Layer Viewports” on page 623
Project 2D Objects	Select to display 2D objects in a viewport with a view other than Top/Plan
Classes	Specifies which classes will be visible in the viewport; see “Changing the Class Properties of Sheet Layer Viewports” on page 625
Scale	Specifies the viewport scale relative to the page; select a scale or choose Custom and enter the scale value in <b>Custom Scale</b>
Custom Scale	When a custom scale is selected, enter the scale value
View	Specifies the orientation of the design layers displayed in the viewport; select a cardinal view or choose Custom and then click <b>Set View</b> to specify the view
Set View	When a custom view is selected, click <b>Set View</b> to open the 3D Rotation dialog box for the entry of custom view parameters (see “Rotating Precisely” on page 411 for more information)

Parameter	Description
Rendering	Specifies the render mode for the viewport; RenderWorks is required for RenderWorks render modes. Open GL, Hidden Line, Dashed Hidden Line, Final Shaded Polygon, Artistic RenderWorks, Custom Radiosity, and Custom RenderWorks enable the <b>Render Settings</b> button for specifying rendering parameters (for the Design Series, the Sketch render mode also enables the <b>Render Settings</b> button).
Render Settings	Certain render modes require parameters to be set; click to specify (see “Line Render Options” on page 435 for Hidden Line Render settings, “Rendering with VectorWorks” on page 431 for OpenGL and shaded polygon settings, “Artistic RenderWorks Options” on page 700 for Artistic RenderWorks settings, “Custom RenderWorks Options” on page 689 for Custom RenderWorks settings, and “Radiosity” on page 692 for information on rendering with radiosity)
RW Background (RenderWorks required)	Select a RenderWorks background from either the default resources or the current file’s resources to use as a background for the viewport; see “VectorWorks Fundamentals Default Resources” on page 141
Projection	Select the projection type for the viewport (see “Projection” on page 405)
Perspective Type	For Perspective projection, select the type of perspective, or choose Custom and specify the perspective distance
Perspective Dist	For custom perspectives, enter the perspective distance

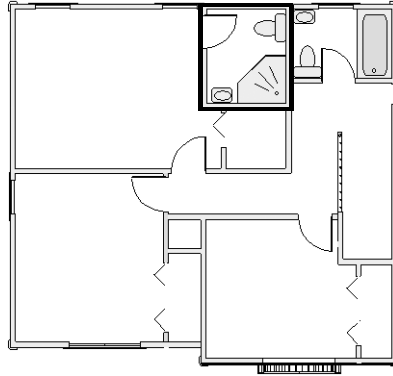
3. Click **OK**.
4. If a sheet layer does not already exist in the file, the New Sheet Layer dialog box opens automatically to create one. Click **OK**.
- The viewport is created on the designated sheet layer, and the sheet layer becomes active.



## Creating a Sheet Layer Viewport by Cropping

To create a detail viewport either from a design layer or from an existing uncropped viewport on a sheet layer:

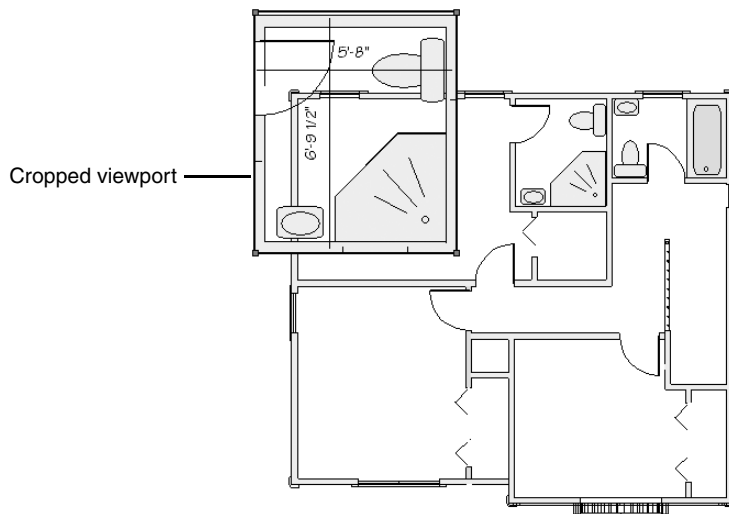
1. Make active the existing design layer or sheet layer that will display in the viewport.
2. Create a 2D object (such as a rectangle, circle, oval, polyline, polygon etc.). The 2D object must define an area; for example, a 2D line cannot be used. Position the 2D object on the design layer or existing uncropped viewport to delimit the area to be included in the new viewport. The fill of a viewport cropping object is always None; however, the pen style can be set from the Attributes palette.



3. If the cropped viewport is being created from a design layer, select the 2D object. If the cropped viewport is being created from a sheet layer, select both the 2D object and the uncropped viewport.
4. Select **View > Create Viewport**.
5. An alert dialog box asks whether the object should be used as the viewport's crop. Select **Yes** (or **Yes Always** to always use a selected 2D object as a crop object when creating viewports).
6. The Create Viewport dialog box opens. Name the viewport and select the sheet layer to place it on. The remaining viewport parameters are initially set to be the same as the design layer properties (for design layers) or selected viewport (for sheet layers). Change the parameters as needed (see "Creating a Sheet Layer Viewport from a Design Layer" on page 610).
7. Click **OK**.

The viewport, cropped by the selected 2D object, is created on the specified sheet layer.

To hide the crop object, edit the viewport's crop (see "Cropping Sheet Layer Viewports" on page 618) and set the object's Pen Style to **None**. Alternatively, change the class of the crop object to invisible.




## Properties of Sheet Layer Viewports

### Viewport Parameters

Once it has been created, the properties of the sheet layer viewport can be edited in the Object Info palette.

Viewports have a fill and pen style of None.

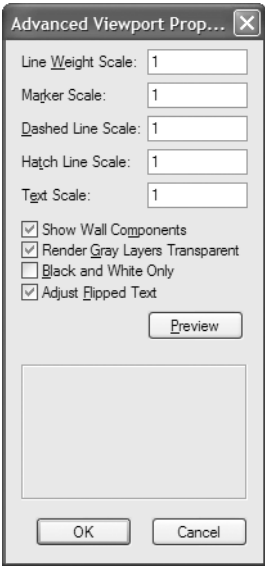
Parameter	Description
Object Position Locator 	Specifies the point on the viewport's bounding box that is to be positioned by the X and Y values; click on a different location to change the point
X / Y	Specifies the absolute position of the viewport's bounding box along the X axis and Y axis, based on the point specified in the object position locator
Rotation	Sets the viewport rotation; if the viewport was created from a rotated plan view (Design Series required), this parameter can be used to reset the viewport to the world coordinate system
Crop	Indicates whether the selected viewport has been cropped (see "Cropping Sheet Layer Viewports" on page 618)
Update	Click to update the viewport to reflect any changes that have occurred since the viewport was created or last updated (see "Status of a Sheet Layer Viewport" on page 617)
Layers	Specifies which design layers are visible in the viewport and allows changes to some of the layer properties in the viewport; see "Changing the Layer Properties of Sheet Layer Viewports" on page 623
Project 2D Objects	Select to display 2D objects in a viewport with a view other than Top/Plan
Classes	Specifies which classes are visible in the viewport and allows changes to some of the class properties in the viewport, including changes to the properties for crop and annotation objects. Class visibilities can be overridden for a selected viewport; see "Changing the Class Properties of Sheet Layer Viewports" on page 625.
Scale	Specifies the viewport scale relative to the page; select a scale or choose Custom and enter the scale value in <b>Custom Scale</b>
Custom Scale	When a custom scale is selected, enter the scale value
View	Specifies the orientation of the design layer shown in the viewport; select a cardinal view or choose Custom and specify the view by clicking <b>Set View</b>
Set View	When a custom view is selected, click <b>Set View</b> to open the 3D Rotation dialog box for the entry of custom view parameters (see "Rotating Precisely" on page 411 for more information)

Parameter	Description
Background/Foreground Render	Specifies the render mode(s) for the viewport. Select a background mode and specify the settings, if any. For a composite effect, also select an optional foreground mode and specify any settings (Wireframe, Sketch, Hidden Line, or Dashed Hidden Line are the only render modes available for foreground rendering).  RenderWorks is required for certain render modes. OpenGL, Hidden Line, Dashed Hidden Line, Final Shaded Polygon, Artistic RenderWorks, Custom Radiosity, and Custom RenderWorks enable the render settings to be specified.
Render Settings	Certain render modes require parameters to be set; click to specify (see “Line Render Options” on page 435 for Hidden Line Render settings, “Rendering with VectorWorks” on page 431 for OpenGL and shaded polygon settings, “Artistic RenderWorks Options” on page 700 for Artistic RenderWorks settings, “Custom RenderWorks Options” on page 689 for Custom RenderWorks settings, and “Radiosity” on page 692 for information on rendering with radiosity)
RW Background (RenderWorks required)	Select a RenderWorks background from either the default resources or the current file’s resources to use as a background for the viewport; see “VectorWorks Fundamentals Default Resources” on page 141
Projection	Select the projection type for the viewport (see “Projection” on page 405)
Perspective Type	For Perspective projection, select the type of perspective, or choose Custom and specify the perspective distance
Perspective Dist	For custom perspectives, enter the perspective distance
Lighting Options	Click to change the ambient light parameters described in “Setting Lighting Options” on page 420.  By default, a viewport’s ambient light is set according to the ambient light settings of the first visible design layer in the viewport. If there are no visible layers, then the ambient light is set to on, with a color of white and a brightness of 35% (similar to the default ambient lighting for a design layer).
Advanced Properties	Opens the Advanced Viewport Properties dialog box; see “Advanced Sheet Layer Viewport Properties” on page 615

## Advanced Sheet Layer Viewport Properties

To access additional viewport parameters, click **Advanced Properties** from the Object Info palette of a selected viewport.

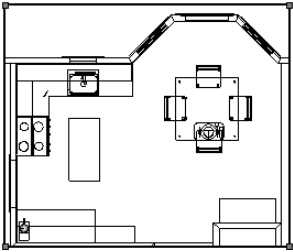
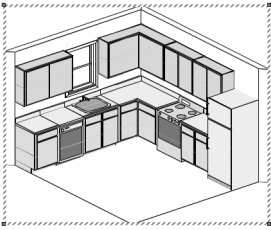
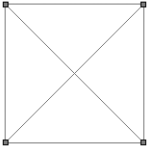
The Advanced Viewport Properties dialog box opens. These settings affect the viewport display only, and do not change the original design layer(s).



Parameter	Description
Line Weight Scale	Enter a value larger than 1.0 to increase the viewport line weights, or a value below 1.0 (but larger than 0) to decrease the line weights
Marker Scale	Enter a value larger than 1.0 to increase the viewport marker size, or a value below 1.0 (but larger than 0) to decrease the marker size
Dashed Line Scale	Enter a value larger than 1.0 to increase the length and spacing of viewport dash segments, or a value below 1.0 (but larger than 0) to decrease the length and spacing of dashed line segments
Hatch Line Scale	Enter a value larger than 1.0 to increase the spacing between viewport hatch lines, or a value below 1.0 (but larger than 0) to decrease the spacing between hatch lines
Text Scale	Enter a value larger than 1.0 to increase the text size in viewports, or a value below 1.0 (but larger than 0) to decrease the text size; only associated viewport text is affected
Show Wall Components	Displays or hides wall components in Top/Plan view, regardless of the document preferences wall component display setting (see “Display Preferences” on page 48)
Render Gray Layers Transparent	Design layers with a visibility set to “Gray” are rendered as transparent, similar to the transparent effect achieved with the <b>Stack Layers</b> command in the Design Series (see “Stacking Layers” on page 645 in the VectorWorks Design Series User’s Guide)
Black and white only	Changes all colors in the viewport to black or white; this is useful for displaying two viewport copies on the same sheet layer, with one in color and the other in black and white. However, if the document preferences display setting is black and white, viewports will also display as black and white.
Adjust Flipped Text	Re-orients rotated and flipped text in the viewport so that it is always readable (regardless of the VectorWorks flipped text preference; see “Display Preferences” on page 41)
Preview	Displays the viewport with a preview of the advanced settings

## Status of a Sheet Layer Viewport

The status of a sheet layer viewport is indicated visually.

Viewport Status	Description
Normal	<p>A normal, up-to-date viewport displays with rectangular handles when selected</p> 
Out of date	<p>When the objects in a viewport have changed since the viewport was created or last updated, the viewport becomes out of date. An out-of-date viewport is displayed with a red and white outline.</p> 
Empty	<p>A viewport is displayed as a red "X" when the associated design layer contains no objects or the objects are hidden, or when the associated design layer is set to "invisible"</p> 

## Modifying Sheet Layer Viewports

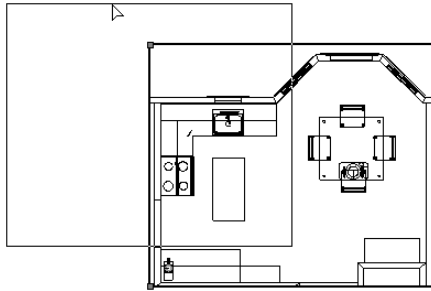
There are several ways to modify sheet layer viewports; their appearance can be completely different from the original design layers, for presentation purposes.

- Modify the settings for the viewport in the Object Info palette.
- Modify the viewport with various 2D and 3D tools and commands.
- Crop the viewport.
- Edit the design layer(s) that display in the viewport.
- Add annotations and dimensions to the viewport.
- Change the properties of the viewport's layers and classes.

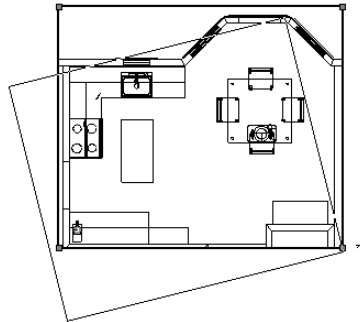
## Moving and Editing Sheet Layer Viewports

A sheet layer viewport can be edited like most 2D objects. For information on 2D tools and commands, see “Editing 2D Objects” on page 255. 3D tools cannot be used on sheet layers. However, a 3D object can be copied from a design layer and pasted on a sheet layer. A design layer viewport (Design Series required) cannot be pasted on a sheet layer.

- Use the **Cut**, **Copy**, and **Paste** commands to copy or paste a viewport on its original sheet layer or another sheet layer. Use the **2D Selection** tool to drag a viewport to a new position (or edit the X- and Y-axis positions in the Object Info palette). Press the Delete key to delete a selected viewport.



- Use the **Move**, **Rotate**, and **Mirror** commands and the **Rotate** and **Mirror** tools to move, rotate, or mirror a viewport. The viewport can be split by the **Split** tool (in Split by Line mode), and clipped with the **Clip** tool.



- Use the **Scale Objects** command to scale a viewport. Any crop objects in the viewport are also scaled, as are annotations and dimensions. Viewport text, however, is not scaled unless **Scale Text** is selected in the Scale Objects dialog box.
- Use the **Modify > Lock** and **Modify > Unlock** commands to lock and unlock viewports.
- Use 2D drawing tools on sheet layers to create borders, title blocks, and so on.

## Cropping Sheet Layer Viewports

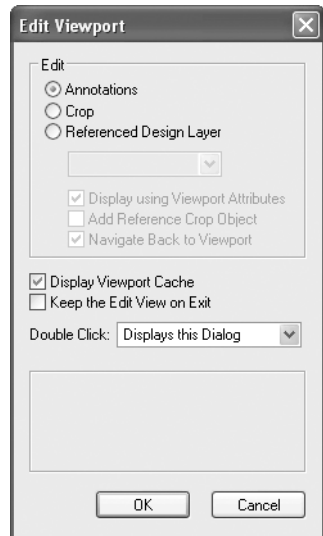
A viewport can be cropped on its sheet layer, to display only a portion of the viewport.

To crop a viewport:

1. Click on the viewport with the **2D Selection** tool to select it.
2. Select **Modify > Edit Viewport**. Alternatively, right-click (Windows) or Ctrl-click (Macintosh) on a viewport, and select **Edit** from the context menu.

The Edit Viewport dialog box opens.

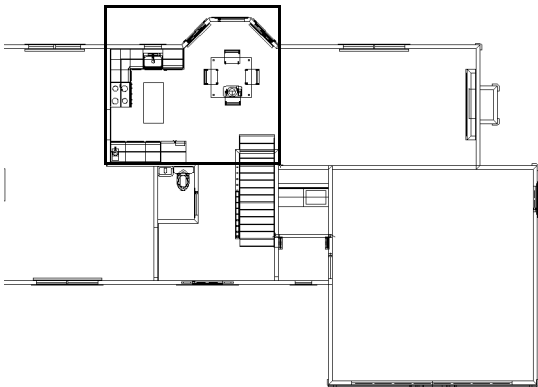




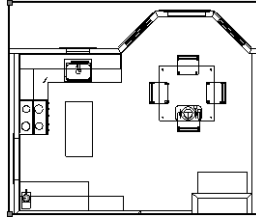
Parameter	Description
Annotations	Creates or edits viewport annotations and dimensions (see “Creating Annotations for Sheet Layer Viewports” on page 621)
Crop	Creates or edits a cropped viewport
Referenced Design Layer	Navigates to the selected design layer to edit objects contained in the viewport (see “Editing a Design Layer Displayed in a Sheet Layer Viewport” on page 621)
Display using Viewport Attributes	Retains the viewport view parameters and layer and class visibilities when you navigate to the design layer; if the <b>Navigate Back to Viewport</b> option is also selected, the file’s layer and class visibilities return to their original status when you exit the design layer
Add Reference Crop Object	When a viewport has been cropped and this option is selected, displays the crop on the design layer so that edits can be made to the design layer while knowing the position of the crop object
Navigate Back to Viewport	Temporarily adds a <b>Return to Viewport</b> button to the design layer that returns you to the viewport when the edit to the design layer is complete (similar to an Edit Group operation)
Display Viewport Cache	If the viewport is currently in a render mode other than Wireframe, select <b>Display Viewport Cache</b> to display a cache image of the rendered viewport during editing; deselect to display a Wireframe view of the viewport
Keep the Edit View on Exit	When you return to the viewport after an edit, this setting maintains any view changes (zoom and view location) made during edits to the viewport annotation or the crop object. Deselect this option to return to the original viewport view settings after editing.

Parameter	Description
Double Click	Sets the future behavior when a viewport is double-clicked, eliminating the display of this dialog box if desired (it can still be accessed by selecting <b>Modify &gt; Edit Viewport</b> , or by selecting <b>Edit</b> from a viewport's context menu). If the Edits the Design Layer option is selected, a double-click activates the design layer of the double-clicked object. If the object does not belong to a design layer, the Edit Viewport dialog box opens to select a design layer to edit.

3. Click **Crop**, and then click **OK** to enter Edit Crop mode.
- Alternatively, right-click (Windows) or Ctrl-click (Macintosh) on a viewport and select **Edit Crop** from the context menu.
- A colored border around the drawing window indicates that you are in an editing mode. The **Exit Viewport** command becomes available from the **Modify** menu, and the **Exit Viewport Crop** button is visible in the top right corner of the drawing window.
4. Create a 2D object (such as a rectangle, circle, oval, polyline, or polygon). The 2D object must define an area; for example, a 2D line cannot be used. Position the 2D object to delimit the new viewport display area. The fill of a viewport cropping object is always None; however, the pen style can be set from the Attributes palette while in Edit Crop mode. Set the pen style to None to make the crop object invisible.
- To view other objects while in Edit Crop mode, select the **Show other objects while in groups** VectorWorks preference (see “Display Preferences” on page 41).
- Adjust the view as necessary using the **Flyover** tool (see “Flyover” on page 406).
- The bounding box of the crop object is also the perspective clip rectangle, if the viewport is in Perspective projection. Reshaping the crop object changes the perspective clip rectangle as well.



5. Click **Exit Viewport Crop** to return to the sheet layer.



6. The cropped viewport displays In the Object Info palette, the crop status change to **Yes**.
7. To change, replace, or delete the crop object, select the viewport and then select **Modify > Edit Viewport** to re-enter Edit Crop mode.

Visibility changes made from the **Classes** tab of the **Organization** dialog box (**Tools > Organization**) do not affect the visibility of the crop object. To change the class visibility of a crop object, click **Classes** from the viewport Object Info palette, and make the changes in the **Viewport Class Properties** dialog box (see “Changing the Class Properties of Sheet Layer Viewports” on page 625).

## Editing a Design Layer Displayed in a Sheet Layer Viewport

To edit a design layer that is displayed in a sheet layer viewport:

1. Select the viewport.
2. Select **Modify > Edit Viewport**. The Edit Viewport dialog box opens (see “Cropping Sheet Layer Viewports” on page 618 for a description of the dialog box parameters).

Alternatively, right-click (Windows) or Ctrl-click (Macintosh) on a viewport and select **Edit Design Layer** from the context menu to activate the design layer of the right-clicked object (if the right-clicked object does not belong to a design layer, the Edit Viewport dialog box opens).

Click **Design Layer** and select the design layer to edit from the list. Select **Display using Viewport Attributes** to view the design layer with the viewport attributes (orientation, projection, render mode, and layer and class visibilities). A rendered viewport displays the original design layer with the viewport’s render mode; however, the design layer’s render mode options for that mode are used.

If the original design layer has different “Z” heights and **Display using Viewport Attributes** is selected, the layer options are set to **Active Only**.

Select **Add Reference Crop Object** to view the crop object on the design layer during editing. However, because the crop object is added to the design layer, it could become visible in other viewports that reference that area of the design layer.

Select **Navigate Back to Viewport** to easily return to the viewport when you are finished with the design layer edits. A colored border around the drawing window indicates that you are in an editing mode. The **Return to Viewport** button is visible in the top right corner of the drawing window.

3. Click **OK** to make the selected design layer the active layer.

## Creating Annotations for Sheet Layer Viewports

Use the Edit Annotation mode to add annotations and dimensions in viewports, and to edit those annotations and dimensions later on.

To view other objects on the sheet layer while editing a viewport, select the **Show other objects while in groups** preference on the **Display** tab of **VectorWorks** preferences.

To add annotations, including dimensions, to a viewport:

1. With the viewport's sheet layer active, select the viewport by clicking on it with the **2D Selection** tool.
2. Select **Modify > Edit Viewport**. The Edit Viewport dialog box opens (see "Cropping Sheet Layer Viewports" on page 618 for a description of the dialog box parameters).
3. Click **Annotations** and then click **OK** to enter Edit Annotation mode. Alternatively, right-click (Windows) or Ctrl-click (Macintosh) on a viewport and select **Edit Annotations** from the context menu.

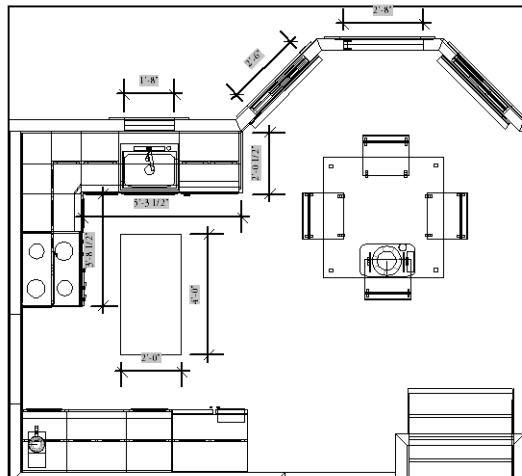
A colored border around the drawing window indicates that you are in an editing mode. The **Exit Viewport** command becomes available from the **Modify** menu, and the **Exit Viewport Annotation** button is visible in the top right corner of the drawing window.

4. Use the various dimension tools from the Dims/Notes tool set to add dimensions to the viewport (see "Dimensioning" on page 437). The dimension tools snap to the objects in the viewport as if you were dimensioning the design layer. When the viewport is in Top/Plan view, associative dimensions can be applied to 2D objects—including walls—on the design layer. The dimensions are automatically updated if the design layer object changes.

Text, callouts, and other annotations, as well as 2D objects, can be added to the viewport. The Design Series contains additional annotation objects.

The stacking order of selected annotations can be changed with the **Modify > Send** commands. To add graphical annotations to a viewport rendered with Hidden Line, use the **2D Polygon** tool Polygon from Boundary modes (see "2D Polygon Tool" on page 221).

Annotations are in viewport scale, not sheet layer scale.



5. Click **Exit Viewport Annotation** to exit Edit Annotation mode and return to the sheet layer.
6. To change, replace, or delete the viewport annotations, select the viewport and then select **Modify > Edit Viewport** to re-enter Edit Annotation mode.

Visibility changes made from the Classes tab of the Organization dialog box (**Tools > Organization**) do not affect the visibility of the crop object. To change the class visibility of a crop object, click **Classes** from the viewport Object Info palette, and make the changes in the Viewport Class Properties dialog box (see "Changing the Class Properties of Sheet Layer Viewports" on page 625).

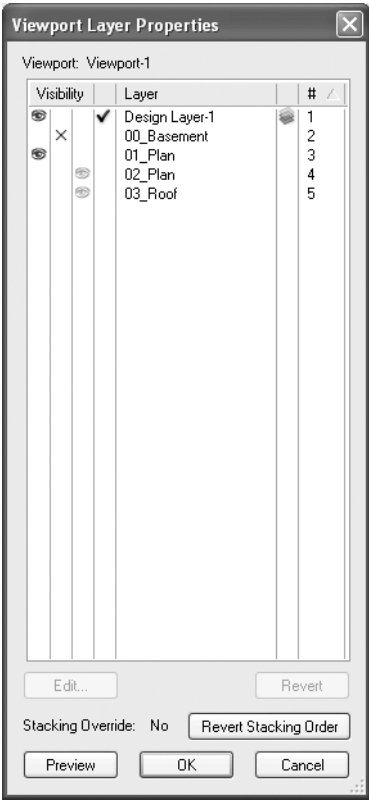
## Changing the Layer Properties of Sheet Layer Viewports

The viewport's layer visibility, opacity, stacking order, and colors can be changed from the sheet layer. Other viewports, as well as the design layer properties, are not affected. The viewport attributes can be tailored as desired for presentation; several copies of the same viewport can appear completely different.

To change the viewport layer properties:

1. Select the viewport.
2. From the Object Info palette, click **Layers**.

The Viewport Layer Properties dialog box opens.



Parameter	Description
Layer list	Lists the viewport layers and their visibility, edited status, layer color use status, and stacking order. Click the triangle in the heading of an active column to toggle between ascending and descending sort order based on that column parameter.
Visibility	Click in a layer visibility column to change the class visibility for this viewport. <ul style="list-style-type: none"><li>• Visible (displays objects in this layer)</li><li>• Invisible (hides objects in this layer)</li><li>• Gray (displays objects in this layer as dimmed)</li><li>• Check mark (indicates layers with overrides)</li></ul>

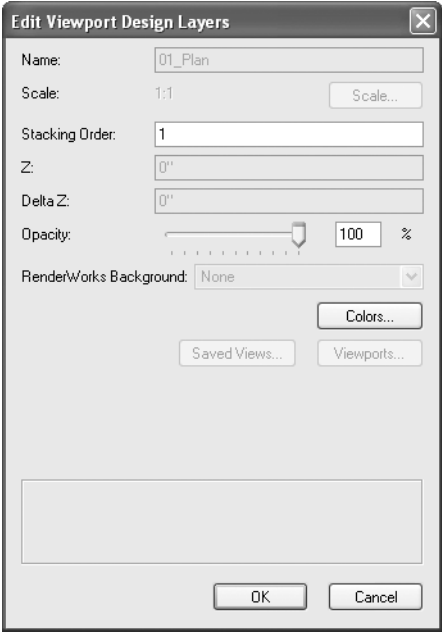
Parameter	Description
Use Layer Colors	Click to apply the viewport layer colors set in the Edit Viewport Design Layers dialog box (click <b>Edit</b> to set the colors, as described in the next step), overriding the design layer colors. This setting is independent of the Use layer colors document preference.
#	Displays the layer stacking order; drag a layer within the # column to change its stacking order
Edit	Opens the Edit Viewport Design Layers dialog box, to override the properties of the selected layer
Revert	Returns the viewport layer properties to their status upon opening the dialog box
Stacking Override	Indicates whether the layer stacking order in the viewport is different from the design layer stacking order. Click <b>Revert Stacking Order</b> to return to the original design layer stacking order.
Preview	Click to preview the layer property settings in the selected viewport

3. To override the layer properties (for viewport display), select one or more viewport layers and click **Edit**.

Alternatively, double-click on a viewport layer to edit it.

The Edit Viewport Design Layers dialog box opens.

Displays when the VectorWorks  
preference for Quartz imaging  
(Macintosh) or GDI+ imaging  
(Windows) is enabled



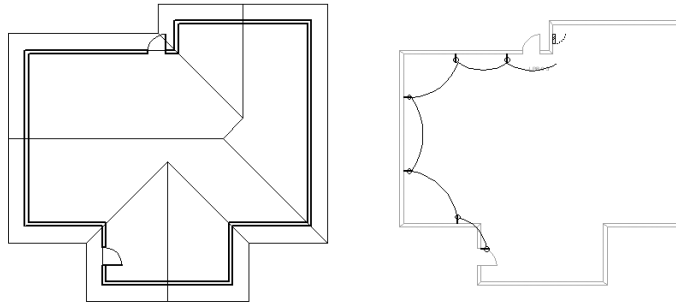
4. The same parameters apply when you create a design layer (see “Setting Design Layer Properties” on page 87); for viewport layers, only the stacking order, transfer mode or opacity, and colors can be edited. These edits apply to the current viewport only, though they can be transferred to other viewports with the **Eyedropper** tool.

The viewport layer colors can be controlled separately from the design layer colors, for flexible presentation output. Click **Colors** to override the fill and pen colors for the selected viewport layer. To see the effects of the color override, **Use Layer Colors** must be selected in the Viewport Layer Properties dialog box for the selected viewport. This is similar to the way that **Use Layer Colors** must be selected in Document Properties to see the layer color settings for a design layer, as described in “Setting the Design Layer Color” on page 92.

5. Click **OK** to return to the Viewport Layer Properties dialog box.  
Click **Preview** to evaluate the results of the property changes.
6. Click **OK** to return to the sheet layer.

## Changing the Class Properties of Sheet Layer Viewports

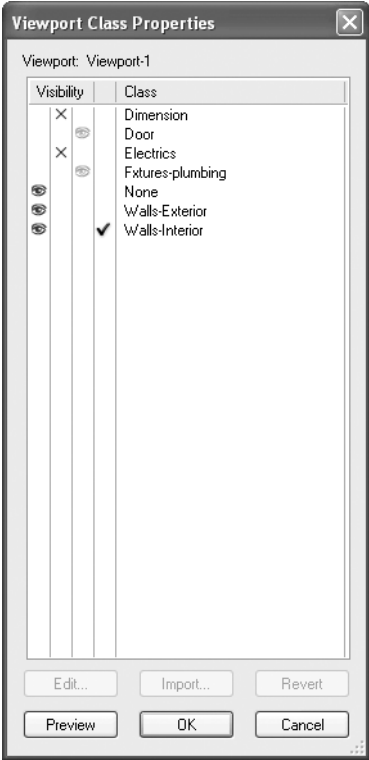
The class visibilities and attributes of a selected viewport can be changed from the sheet layer. This does not change the class properties or the class visibility for the original design layers or for other viewports. The viewport attributes can be tailored as desired for presentation; several copies of the same viewport can appear completely different.



To override viewport class properties:

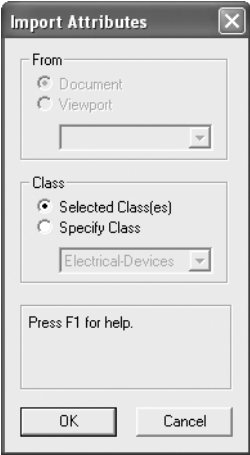
1. Select the viewport.
2. From the Object Info palette, click **Classes**.

The Viewport Class Properties dialog box opens. Change class visibilities and/or make class attribute overrides for the selected viewport.



Parameter	Description
Class list	<p>Lists the viewport classes and their visibility and edited status; click in a class visibility column to change the class visibility for this viewport. Click the triangle in an active column to toggle between ascending and descending sort order based on that column parameter.</p> <ul style="list-style-type: none"> <li>• Visible (displays objects in this class)</li> <li>• Invisible (hides objects in this class)</li> <li>• Gray (displays objects in this class as dimmed)</li> <li>• Check mark (indicates classes with overrides)</li> </ul>
Edit	<p>Opens the Edit Class(es) dialog box, to make overrides to the selected class that only apply to the current viewport (see “Setting Class Properties” on page 98)</p>



Parameter	Description
Import	<p>Opens the Import Attributes dialog box, to import the class attribute settings from the file. The attributes can be imported for the classes selected in the Viewport Class Properties dialog box, from corresponding classes, or from a specified class in the file.</p> <div></div> <p>Click <b>OK</b> to import the class attributes into the selected viewport. (The <b>Eyedropper</b> tool can also transfer class override attributes between viewports.)</p>
Revert	Sets the selected class back to its original document attributes, undoing any class overrides
Preview	Click to preview the class visibility and attribute settings in the selected viewport

3. Click **OK** to apply the class visibility and attribute changes to the selected viewport.

## Updating Sheet Layer Viewports

Changes that affect the appearance of a viewport are automatically updated for a wireframe viewport. However, if changes occur that require the viewport to be rendered again, the viewport will be displayed as an out-of-date viewport with a red and white striped border (see “Status of a Sheet Layer Viewport” on page 617).

If a sheet layer with an out-of-date viewport is printed, a message prompts you to either print the viewport as an out-of-date viewport or update the viewport(s) on the sheet layer before printing.

## Updating Selected Viewports

To update selected viewports:

1. Select the viewport(s).
2. On the Object Info palette, click **Update**. Alternatively, select **View > Update Selected Viewports**.
3. The selected viewports are updated.

## Updating All Viewports

To update all the viewports in the file:

1. Select **View > Update All Viewports**.

2. All viewports on all sheet layers are updated.

An update to multiple rendered viewports may require a significant amount of time. In particular, rendering with radiosity should be performed as a last step in the presentation process.

## Cutting Sections

VectorWorks' cutting section tools define a section line through a 3D model, placing the cut section on a new layer and leaving the original model intact.

The **Cut 2D Section** command creates a cross-section, or 2D contour, on the cutting plane. The contour is created by the intersection of the model with an infinite plane passing through the section line. Only the elements that actually intersect the section line are shown.

The **Cut 3D Section** command creates a section with all the 3D geometry that remains on the indicated side of the infinite plane passing through the section line. The elements that intersect the section line, as well as the 3D geometry that exists beyond the line, are shown.

Place a 2D section, along with a bold line, on top of a 3D section, to show the cutting plane with the section behind it.

## Cutting 3D Sections

The **Cut 3D Section** command cuts a 3D section, or slice, through a 3D model while leaving the model intact. The slice is placed on a new design layer.

To cut a 3D section from a 3D model:

1. Select the 3D model to section.
2. Select **Model > Cut 3D Section**.

The cursor changes to cross-hairs.

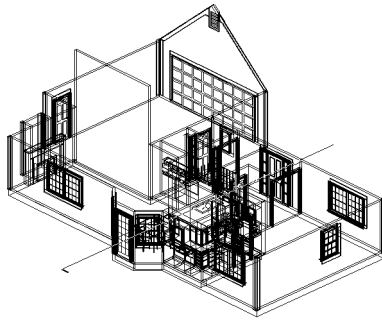
3. Click to set the start of the section. Draw a line across the object to define the section, and then click to set the end of the section.

When cutting a section while the drawing is in a Plan projection, the cutting plane (and the cut edge of the object) is perpendicular to the ground plane.

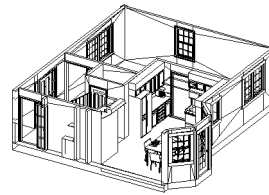
When cutting a section while in a 3D projection, the cutting plane is perpendicular to the working plane.

4. Click on one side of the line to indicate the portion of the model to keep.

VectorWorks automatically creates a new design layer and places the cut 3D section on it. The original layer remains intact. The new 3D section behaves like any other VectorWorks 3D object.



Select the object(s) and select **Model > Cut 3D Section**; set the section line and click on either side of it to specify the section to keep



The 3D section (rotated and rendered) is created on a new design layer; the original object(s) are left intact

Dimensions and text are 2D objects; therefore, they do not rotate with the cut 3D section.

## Cutting 2D Sections

The **Cut 2D Section** command cuts a 2D section, or a slice, from a 3D model without affecting the model. The slice is then placed on a new design layer. For example, to show the profile or a 2D cutaway section of an object in a mechanical 3D drawing, use this command to create the cutaway section in 2D quickly and easily, without affecting the original object.

To cut a 2D section from a 3D model:

1. Select the 3D model to section.
2. Select **Model > Cut 2D Section**.

The cursor changes to cross-hairs.

3. Click to set the start of the section. Draw a line across the object to define the section, and then click to set the end of the section.

When cutting a section while the drawing is in a Plan projection, the cutting plane (and the cut edge of the object) is perpendicular to the ground plane.

When cutting a section while in a 3D projection, the cutting plane is perpendicular to the working plane.

4. Click on one side of the line to indicate the portion of the model to keep.

VectorWorks automatically creates a new design layer and places the cut 2D section on it. The original layer remains intact.

## Layer Linking

### Creating Layer Links

Layers created in VectorWorks are independent of each other. Each design layer has its own scale, view, and render status. In VectorWorks Fundamentals, however, a layer link can be created that combines the geometry of several design layers, including workgroup-referenced layers, onto a single design layer. The linked objects on this design layer display in the same view and scale, and share the same render status. This can then be used to give an accurate

depiction of how objects in each layer work together. For example, the various floors of a building can be drawn on separate layers and then linked together into a new layer to form an entire building.

*In VectorWorks Fundamentals, consider using viewports instead of layer links, as they provide a better and easier way to present drawings.*

*In the VectorWorks Design Series, layer links are being superseded by design layer viewports. Layer links cannot be created, but for backward compatibility, existing layer links can still be viewed and edited. See “Presenting Drawings with Design Layer Viewports” on page 616 in the VectorWorks Design Series User’s Guide.*

The layer link is created on a new design layer that contains links to the existing design layers of the drawing. 3D objects on selected layers are automatically linked; 2D objects can be projected onto the layer link. Once the layer link is created, updates to the design layers are automatically reflected on the linked layer when a screen redraw occurs. However, this updating occurs only in one direction; any new objects or details added to the linked layer will not appear in any other layers. Linked objects cannot be edited on the linked layer; they must be edited on their source layer.

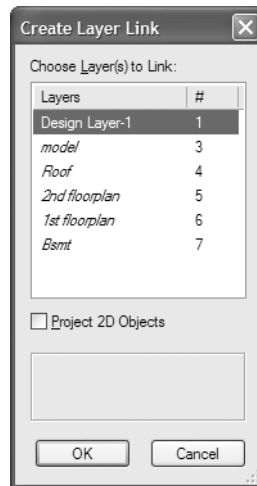
To create a layer link:

1. Create a new layer, and then make it the active layer.

This layer shows objects on all linked layers and any changes made to them.

2. Select **View > Create Layer Link**.

The Create Layer Link dialog box opens; the layer being linked to (the currently active layer) is not listed. Workgroup-referenced layers display in italics.



3. Select the design layers to be linked from the list of existing layers. Sheet layers are not displayed.
4. Select **Project 2D Objects** to display any 2D objects in a view other than Top/Plan.

*To project 2D objects after a layer link has been created, select and then unlock the layer link object. Select **Project 2-D Objects** in the Object Info palette.*

5. Click **OK**.

Linked layers are locked objects. To unlock a linked layer, select **Modify > Unlock**; double-click on an item in the layer link (or select **Edit Design Layer** from the context menu) to return to its source layer and edit it.

## Cropping Layer Links

Layer link objects can be cropped in a similar manner to viewports (see “Cropping Sheet Layer Viewports” on page 618). When cropped, only a portion of the layer link displays; increase the scale of the layer to create a detailed view. Layer links with workgroup-referenced layers can also be cropped.

To view other objects while cropping layer links, select the **Show other objects while in groups** VectorWorks preference (see “Display Preferences” on page 41).

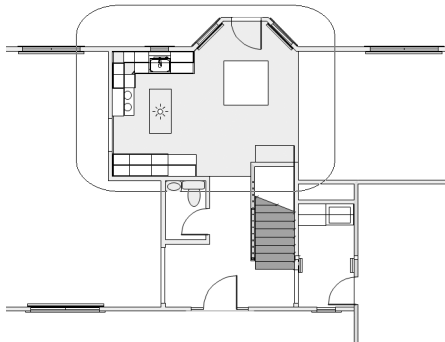
To crop a layer link:

1. Select an existing layer link.
2. Unlock the layer link by selecting **Modify > Unlock**.
3. Click **Edit Crop** from the Object Info palette to enter the Layer Link Crop mode. Alternatively, select **Edit Crop** from the layer link context menu.

A colored border around the drawing window indicates that you are in an editing mode. The **Exit Layer Link** command becomes available from the **Modify** menu, and the **Exit Layer Link Crop** button displays in the top right corner of the drawing window.

4. Create a 2D object (such as a rectangle, rounded rectangle, arc, circle, oval, polyline, or polygon). The 2D object must define an area; a 2D line, for example, cannot be used. Position the 2D object to delimit the new crop display area. The fill of a cropping object is always None; however, the pen style can be set from the Attributes palette while in Edit Crop mode. Set the pen style to None (or the crop object class to invisible) to make the crop object invisible.

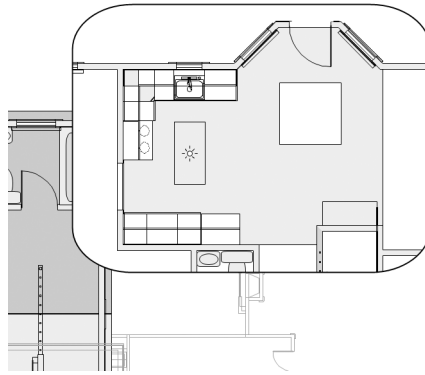
Use the **Flyover** tool to adjust the view as necessary (see “Flyover” on page 406).



5. Click **Exit Layer Link Crop**, or select **Modify > Exit Layer Link** to return to the drawing.

The cropped layer link is displayed. In the Object Info palette, the crop status has changed to **Yes**.

By increasing the scale of the layer with the layer link, and making other layers visible, a floor plan can be displayed (original design layer) along with a detailed view of the floor plan (zoomed in, cropped layer link).



6. To change, replace, or delete the layer link crop, select the cropped layer link and then select **Edit Crop** from the Object Info palette to re-enter crop mode. Click **Exit Layer Link Crop**, or select **Modify > Exit Layer Link** to return to the drawing.

The entire layer link is displayed if a viewport of a cropped layer link is created.

## Converting Layer Links

In the VectorWorks Design Series, layer links are being superseded by design layer viewports. Because VectorWorks Fundamentals users cannot create design layer viewports, and Design Series users cannot create layer links, it occasionally may be necessary to convert a layer link into a viewport, or to convert a design layer viewport into a layer link.

- To convert a layer link into a design layer viewport, first unlock the layer link. Right-click (Windows) or Ctrl-click (Macintosh) on the layer link and then select **Convert to Viewport** from the context menu.
- To convert a design layer viewport into a layer link, select the viewport and then select **Modify > Decompose**. The Object Info palette changes to indicate that the object is now a group. Select **Modify > Ungroup** to create a layer link.

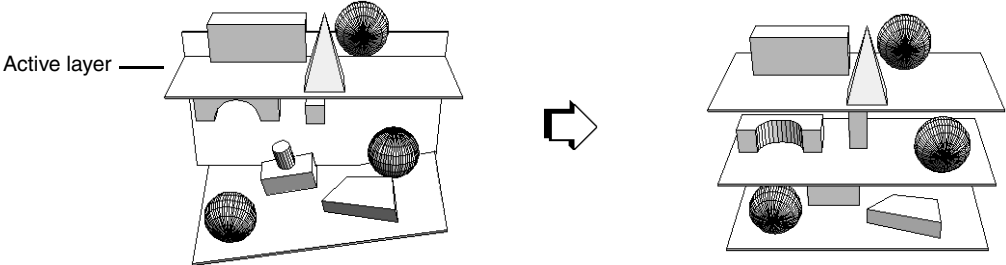
## Aligning Layer Views

The **Align Layer Views** command provides a one-step method to change all design layers in the drawing file so that they have identical Standard View and Projection modes. VectorWorks matches all design layers, regardless of visibility, to the active layer's Standard View and Projection modes.

To align design layer views:

1. Select **View**, and then set the **Standard Views** and **Projection** modes for the active layer.
2. Select **View > Align Layer Views**.

VectorWorks changes the Standard Views and Projection modes for all of the design layers in the drawing file.







# Creating and Mapping Textures

## RenderWorks Commands and Tools

When RenderWorks is installed, additional rendering commands, light source parameters, options, and two tools are present in the workspace. The Rendering commands, tools and options are integrated throughout the program in the following locations:

Item	Description
<b>Render Bitmap</b> tool	Renders a selected area with a specified rendering mode, creating a bitmap object
<b>RenderWorks Camera</b> tool	Creates a camera view based on specific parameters
<b>Attribute Mapping</b> tool	Adds the ability to move, rotate, and resize a texture on a 3D object surface
Object Info palette	Maps textures onto object surfaces using the options on the Render tab
Visualization palette	Accesses lights and cameras for quick editing, selection, and management
Resource Browser	Creates new textures and background resources, imports resources, and edits textures and backgrounds; drag a texture to an object to apply it
Rendering modes	Fast RenderWorks, Fast RenderWorks with Shadows, Fast Radiosity, Final Quality RenderWorks, Final Quality Radiosity, Custom RenderWorks, Custom Radiosity, and Artistic RenderWorks
Batch Rendering	Sets up batch rendering options and executes batch rendering
Additional light sources and parameters	Adds area lights, line lights, and custom lights, and adds accurate lighting parameters to point, directional and spot lights
<b>Edit Class(es)</b> dialog box	Specifies texture information for classes
<b>Edit Layers</b> dialog box	Specifies background resource to apply to a layer
<b>Purge Unused Objects</b> command	Purges unused textures from a drawing file
<b>Create Image Prop</b> command	Creates image props from image files
<b>Convert to Area Light</b> command	Creates an area light
<b>Convert to Line Light</b> command	Creates a linear light
Export EPix/Piranesi	Creates an EPix (epx) file
Export High Dynamic Range Image (HDRI)	Creates an Open EXR or HDR file
Export QT VR Object	Creates a QuickTime Virtual Reality Object file
Export QT VR Panorama	Creates a QuickTime Virtual Reality Panorama file

## Textures and Shaders

In RenderWorks, textures are applied to objects to make them appear more realistic. Textures are composed of components called shaders. There are four shader types: color, reflectivity, transparency, and bump; each shader

makes an independent contribution to the overall texture appearance. When creating or editing textures, the shader components are combined or excluded to achieve the desired texture effect.

In addition to using textures, realistic models can be enhanced with the use of backgrounds, weather effects, and the use of image files as props.

Four shaders contribute to a texture definition. Combining and adjusting these components causes a texture to appear as an image, colored, bumpy, shiny, and/or transparent. The following table defines the shader types:

Shader	Function
Color	Defines surface color; this can be a plain, uniform color, or a complex pattern like wood or marble
Reflectivity	Defines amount of light reflected by surface; it is dependent on surface texture properties and any light sources
Transparency	Defines surface transparency or opacity
Bump	Defines surface irregularities which give the texture a bumpy appearance

Shaders are divided into three categories: image-based shaders, wrapped shaders, and solid shaders.

Image-based Shaders

Image-based shaders are created from an image file imported into VectorWorks. These shaders are then mapped to the surface of an object.

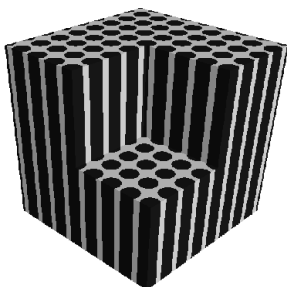
Wrapped Shaders

Wrapped shaders are 2D patterns projected onto a 3D object surface. These shaders are noted with an asterisk after the shader name.

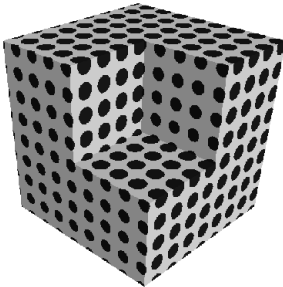
Solid Shaders

Solid shaders are 3D patterns applied to a 3D object surface. When a shape is changed or portions of the object cut away, the algorithm recalculates and portrays the object appropriately.

The following example shows the difference between a solid and a wrapped shader. In the solid shader, 3D spheres are used to make the polka dots; the shape of the dots remain circular even though portions of the object have been cut away. The wrapped polka shader uses 2D circles to make the polka dots; the shader reacts to the surface of the object, and the dots appear distorted where the object has been cut away.



Wrapped shader



Solid shader

## Creating Textures

Textures are created and displayed in the Resource Browser and are saved with the file (default resources are automatically imported into the file at the point of use, and display in the Resource Browser); see “VectorWorks Fundamentals Default Resources” on page 141 and “Using the Resource Browser” on page 142. Textures are created by defining the shaders that make up the texture.

Apply textures to an object from the Resource Browser or from the Render tab of the Object Info palette. See “Applying and Mapping Textures” on page 661 for more information.

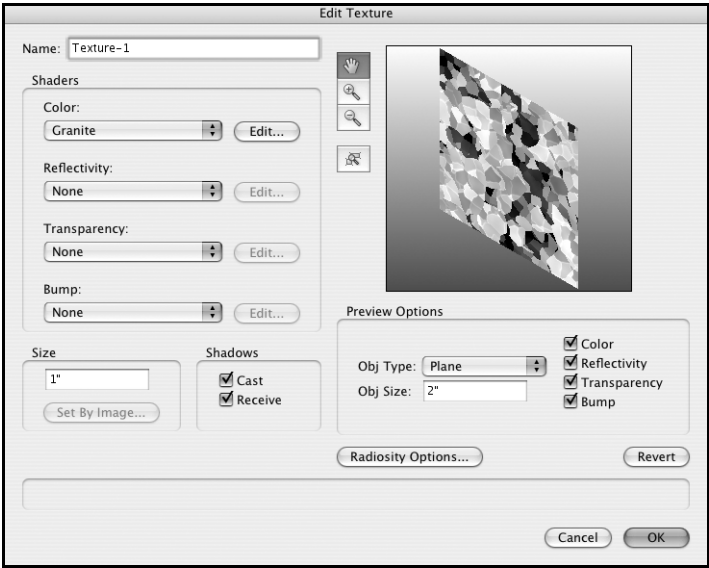
A library of texture resources is also provided in [VectorWorks]\Libraries\Textures.

### Creating a New Texture

To create a texture resource:

- 1. Select **Window > Palettes > Resource Browser** to open the Resource Browser.
- 2. From the Resources list, select **New Resource** to display the New Resource menu.
- 3. Select **RenderWorks Texture**.

The Edit Texture dialog box opens. Specify the shader parameters. Shader types and properties are described in “RenderWorks Shader Definitions” on page 733.



Parameter	Description
Name	Specifies the name of the texture resource
Shaders	Wrapped shaders are marked with an asterisk (*); the Edit Mapping properties (see “Applying and Mapping Object Textures” on page 663) affect these types of shaders.

Parameter	Description
Color	Select a color shader from the list, or choose Object Attribute to apply the object's fill color attribute. Image-based shaders require the selection of an image file (see "Creating Image-based Shaders" on page 639). After selecting the shader, click <b>Edit</b> to edit the shader properties.
Reflectivity	Select a reflectivity shader from the list (or select None to exclude this type of shader from the texture). Image-based shaders require the selection of an image file (see "Creating Image-based Shaders" on page 639). After selecting the shader, click <b>Edit</b> to edit the shader properties.
Transparency	Select a transparency shader from the list (or select None to exclude this type of shader from the texture). Image-based shaders require the selection of an image file (see "Creating Image-based Shaders" on page 639). Mask-based transparency shaders create a transparent mask from an image based on specified settings. After selecting the shader, click <b>Edit</b> to edit the shader properties.
Bump	Select a bump shader from the list (or select None to exclude this type of shader from the texture). Image-based shaders require the selection of an image file (see "Creating Image-based Shaders" on page 639). After selecting the shader, click <b>Edit</b> to edit the shader properties.
Size	Sets the real-world size for each repetition of the texture
Set By Image	For image-based textures, opens the Set Image Size dialog box, to set the texture size using the image (see "Setting the Texture Size by Image" on page 639)
Shadows	
Cast	Allows objects with this texture to cast shadows (for ray-traced shadows)
Receive	Allows objects with this texture to receive shadows (for ray-traced shadows)
Preview Options	The Preview window displays the effects of shader and size selections on a preview object
Preview Controls	Adjusts the preview position and magnification. Click <b>Pan</b> and drag the preview to the desired location. Click <b>Zoom In</b> or <b>Zoom Out</b> and then click and drag to create a marquee; this zooms in or out on a particular section of the preview. Click <b>Fit</b> to fit the preview to the window (according to <b>Obj Size</b> ).
Obj Type	Select the type of preview object from the list; for procedural (non image-based) shaders, the <b>Flat</b> object type is automatically used to create a preview for OpenGL rendering to approximate the look of the solid shader
Obj Size	Specifies the preview object size
Shader Checkboxes	Select to preview the associated shader; deselect to exclude the shader component from the texture preview
Radiosity Options	Opens the Radiosity Texture Options dialog box; specify if this texture should always participate in radiosity calculations (receive only or receive and emit light) when rendering with custom radiosity. ( <b>Allow Texture Override</b> must also be selected in the Radiosity Optimizations dialog box. See "Setting Custom Radiosity Options" on page 694.) Object overrides supersede texture overrides.
Revert	Returns the texture parameters to the original settings, undoing any changes

- Click **OK** to create a texture with the name and properties specified in the Edit Texture dialog box. The texture displays in the Resource Browser and is saved with the file.

The texture preview in the Resource Browser uses the **Flat** preview object at twice the texture size for ease of identification.

If modeling a glass object (simple and accurate glass reflectivity shader) with a 3D polygon or other sheet-like 3D object, duplicate and offset the 3D polygon by a small amount so that rays are traced through the glass with both an entering and exiting surface.

## Setting the Texture Size by Image

For image-based shaders, the real-world size of each texture repetition can be set based on a segment of the image.

To set the size of an image texture based on the image:

- Select the image to use for the texture, as described in “Creating Image-based Shaders” on page 639.
- In the Edit Texture dialog box, click **Set By Image**. If several image-based shaders are used, select the shader with the desired image in the Choose Image dialog box.

The Set Image Size dialog box opens. Red handles flash briefly to indicate the location of the line segment.



- Specify the image length to use for sizing the texture by dragging the line segment into position, and then dragging the ends of the line segment. If necessary, use the mouse scroll wheel to zoom into and out of the image, or click and hold the mouse wheel button to pan.

When the line is indicating the desired real-world length, specify the real-world size for the line segment in **Feature Size**.

- Click **OK** to exit the Set Image Size dialog box and update the **Size** value.

## Creating Image-based Shaders

Image-based shaders are created from image files imported into VectorWorks. Like wrapped shaders, an image-based shader is applied to the surface of an object. See “Applying and Mapping Object Textures” on page 663 for more information. Different settings are then required depending on the type of shader to be used with the image.

Shader	Image Type
Color	<ul style="list-style-type: none"><li>• Filtered Image</li><li>• Image Color</li></ul>
Reflectivity	<ul style="list-style-type: none"><li>• Image Reflectivity</li></ul>
Transparency	<ul style="list-style-type: none"><li>• Image Transparency</li><li>• Mask Transparency</li></ul>
Bump	<ul style="list-style-type: none"><li>• Image Bump</li></ul>

Multiple image shaders can be combined to create a realistic texture. For example, import a brick image with mortar joins, and then add an image bump to the brick. In addition, image-based shaders can be combined with non image-based shader types for a variety of effects.

Most image-based textures are automatically compressed when imported into VectorWorks. Imported JPEG files retain the original JPEG data; all other image files are compressed using lossless PNG format.

The Artistic RenderWorks Color Wash style cannot be used with image-based textures.

Selecting the Image for Import

To import an image for use as an image-based shader:

1. Create a graphics file to be imported as a shader. In a graphics program, save the image in a format that VectorWorks can import:
  - BMP
  - JPG
  - PCT
  - PNG
  - PNT
  - PSD
  - QTI
  - SGI
  - TIF
  - TGA
2. Create a new texture as described in “Creating a New Texture” on page 637. From any of the four shader component lists, select one of the image shader types.
3. If a resource with an image is already present in the file, the Choose Image dialog box opens.



Parameter	Description
Import an Image File	Imports a new image; click <b>OK</b> and proceed to Step 4.
Reuse an Image from Another Resource	Reuses a previously imported image; select the resource that contains the image. Click <b>OK</b> and proceed to Step 5.

4. Select the desired image file in the Open (Windows) or Import QuickTime Image Document (Macintosh) dialog box. Click **Open**.

5. The next dialog box that opens depends on the type of shader. Refer to the section that applies to the shader.

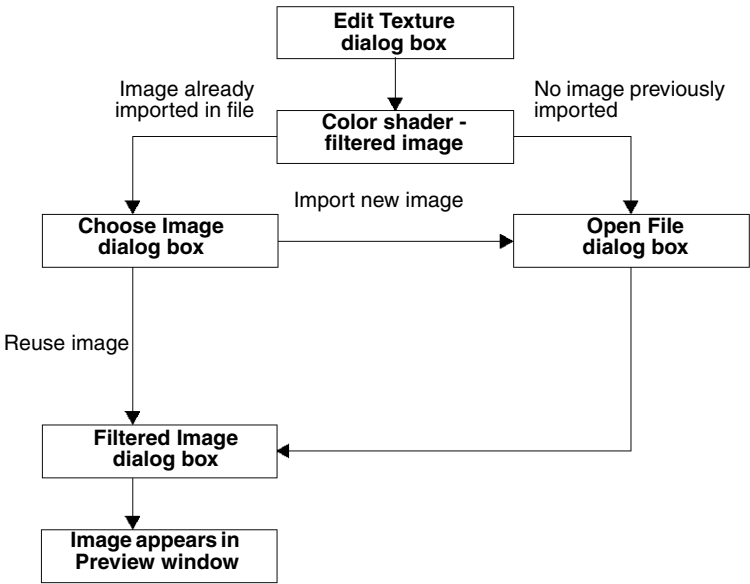
Shader	Section
Color	“Importing Images for Color Shaders” on page 641
Reflectivity	“Importing Images for Reflectivity Shaders” on page 643
Transparency	“Importing Images for Transparency Shaders” on page 645
Bump	“Importing Images for Bump Shaders” on page 648

Importing Images for Color Shaders

Color shaders can use images for image color and filtered image. The image color shader displays the image as-is. The filtered image shader allows an image to be tinted with a specified color.

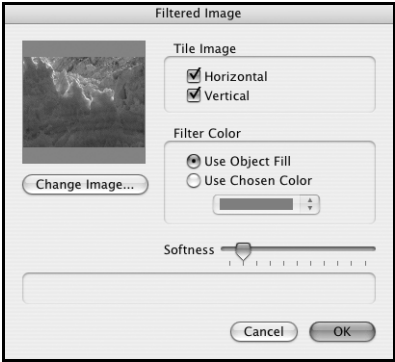
Filtered Image Color Shader

The process of selecting a filtered image color shader is illustrated by the following flow chart.



To import a filtered image color shader:

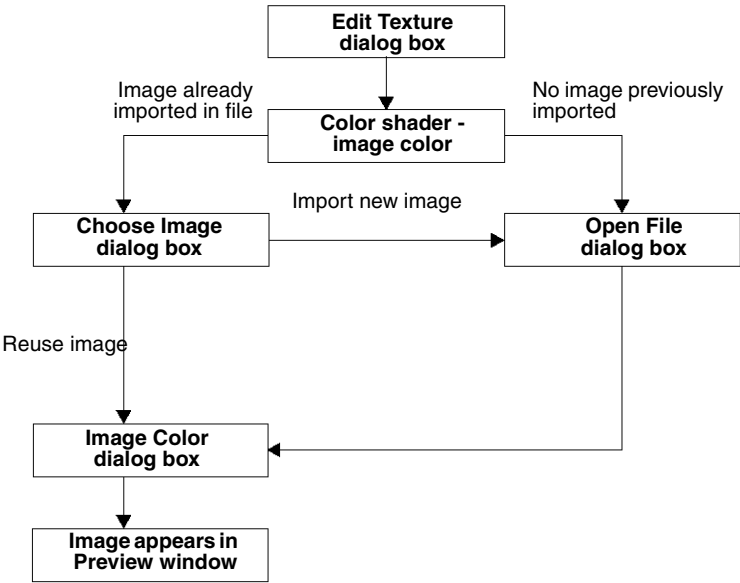
1. Select and import the image as described in “Selecting the Image for Import” on page 640.  
The Filtered Image dialog box opens.
2. Specify the image-based shader properties and click **OK** to import the image and preview the texture.



Parameter	Description
Image preview	Edits to the image are displayed in the image preview
Change Image	Selects a different image for import
Tile Image	Repeats the image in the horizontal, vertical, or horizontal and vertical directions; deselect for no tiling
Filter Color	Selects a color filter for the image; leave the default selection of <b>Use Object Fill</b> for no change or click the color box to choose a filter color for the image
Softness	Drag the slider to the right to increase image blurring when rendered in Final Quality or Custom RenderWorks (with anti-aliasing on)

Color Image Shader

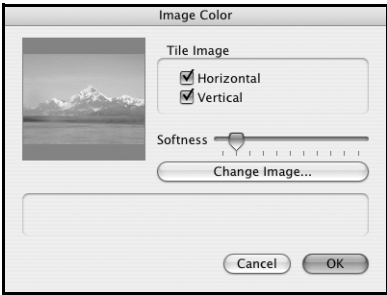
The process of selecting a color image shader is illustrated by the following flow chart.





To import a color image shader:

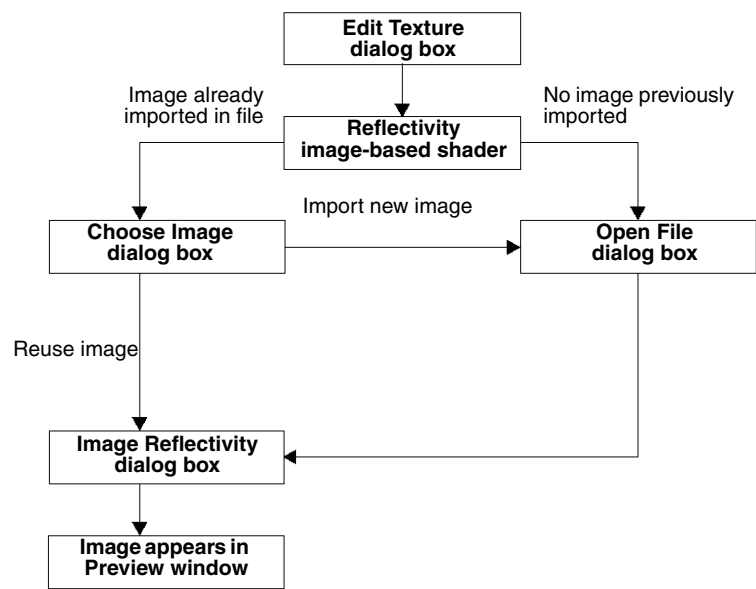
- 1. Select and import the image as described in “Selecting the Image for Import” on page 640.  
The Image Color dialog box opens.
- 2. Specify the image-based shader properties and click **OK** to import the image and preview the texture.



Parameter	Description
Image preview	Edits to the image are displayed in the image preview
Change Image	Selects a different image for import
Tile Image	Repeats the image in the horizontal, vertical, or horizontal and vertical directions; deselect for no tiling
Softness	Drag the slider to the right to increase image blurring when rendered in Final Quality or Custom RenderWorks (with anti-aliasing on)

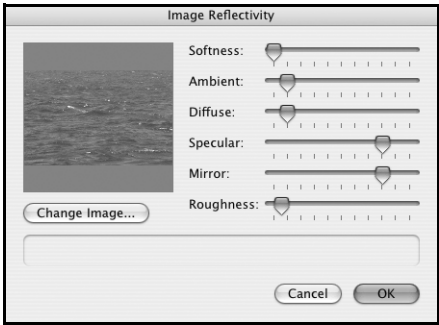
Importing Images for Reflectivity Shaders

The process of selecting a reflectivity shader is illustrated by the following flow chart.



To import a reflectivity image-based shader:

1. Select and import the image as described in “Selecting the Image for Import” on page 640.  
The Image Reflectivity dialog box opens.
2. Specify the image-based shader properties and click **OK** to import the image and preview the texture.



Parameter	Description
Image preview	Edits to the image are displayed in the image preview
Change Image	Selects a different image for import
Softness	Drag the slider to the right to increase image blurring when rendered in Final Quality or Custom RenderWorks (with anti-aliasing on)
Ambient	Drag the slider to the right to increase the effect of the ambient lighting on the texture brightness
Diffuse	Drag the slider to the right to increase the effect of directional light on the texture

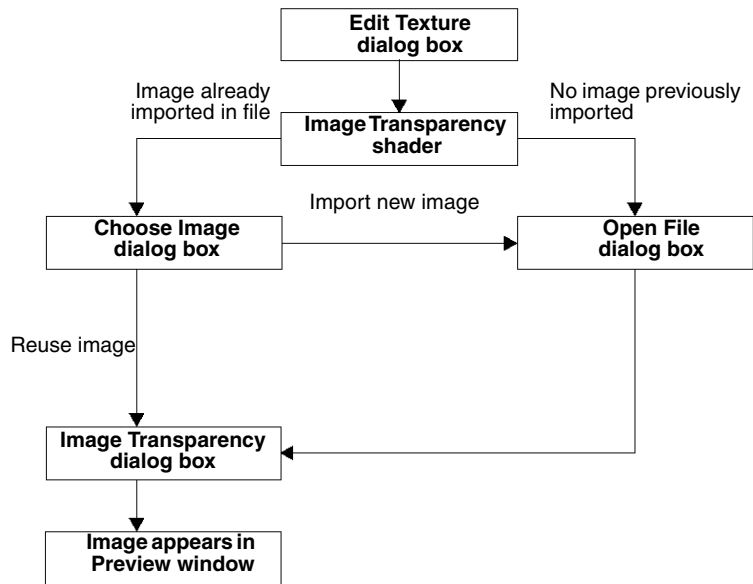
Parameter	Description
Specular	Drag the slider to the right to increase the effect of directional highlights on the texture
Mirror	Drag the slider to the right to increase the number of reflections on the texture
Roughness	Drag the slider to the right to increase the width of highlights on the texture

### Importing Images for Transparency Shaders

Transparency shaders can be created from images or image masks.

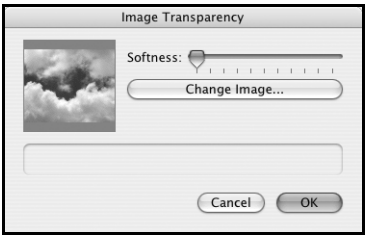
#### Image Transparency

The process of selecting an image transparency shader is illustrated by the following flow chart.



To import an image transparency shader:

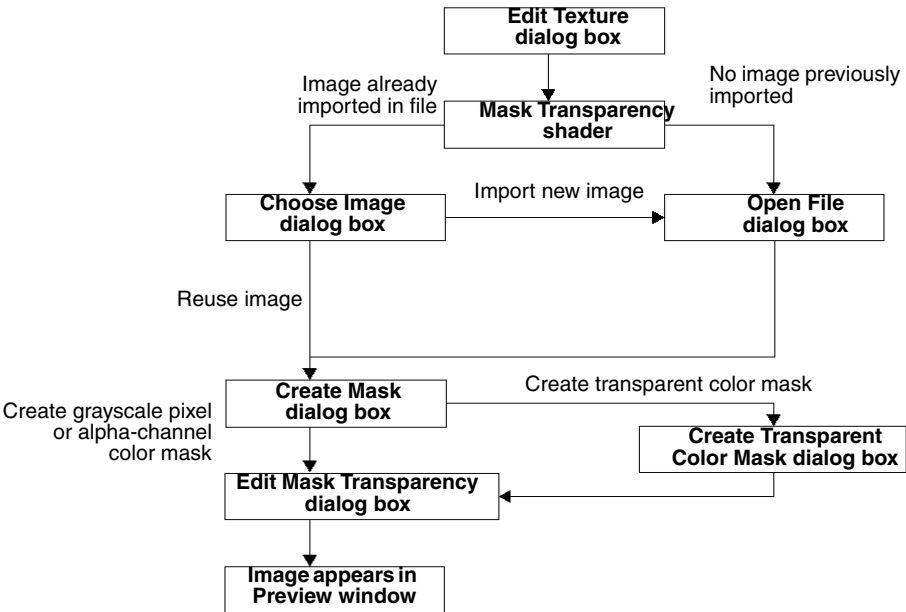
1. Select and import the image as described in “Selecting the Image for Import” on page 640.  
The Image Transparency dialog box opens.
2. Specify the image-based shader properties and click **OK** to import the image and preview the texture.



Parameter	Description
Image preview	Edits to the image are displayed in the image preview
Change Image	Selects a different image for import
Softness	Drag the slider to the right to increase image blurring when rendered in Final Quality or Custom RenderWorks (with anti-aliasing on)

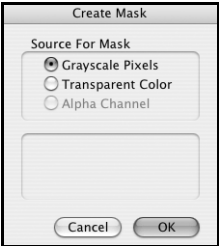
Mask Transparency

The process of selecting a mask transparency shader is illustrated by the following flow chart.



To create a mask transparency image-based shader:

- 1. Once the image has been selected and imported, specify the mask properties in the Create Mask dialog box.

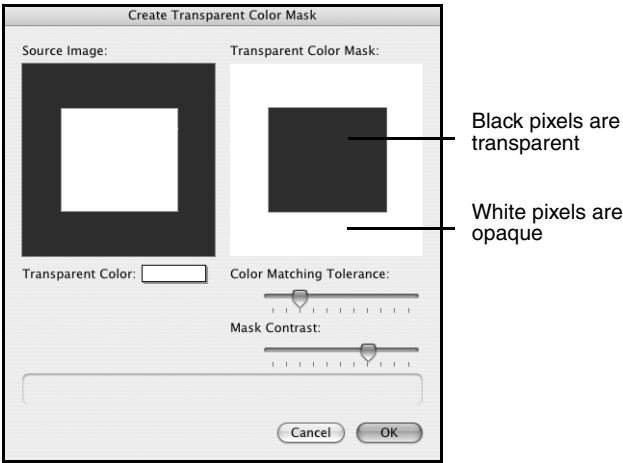


Parameter	Description
Grayscale Pixels	Creates a mask from the image's pixel brightness values; brighter pixels are more opaque
Transparent Color	Creates a mask with a selected transparent color and mask parameters
Alpha Channel	Uses the alpha channel of a source image as the mask (image must contain valid alpha channel information)

For Grayscale Pixel and Alpha Channel masks, click **OK**. Proceed to Step 3.

2. If **Transparent Color** was selected, the Create Transparent Color Mask dialog box opens. Select the mask properties and click **OK**.

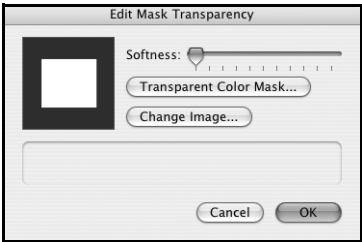
The source image must be more than eight-bit color to create a transparent color mask.



Parameter	Description
Source Image	Displays the imported image. Select the transparent color by clicking a color in the image; the resulting mask is displayed in the Transparent Color Mask preview. If necessary, use the mouse scroll wheel to zoom into and out of the image, or click and hold the mouse wheel button to pan.
Transparent Color	Displays the current transparent color. Instead of clicking on the source image to designate the transparent color, the color can be selected by clicking the color box.
Transparent Color Mask	Displays a preview of the mask based on the current transparent color selection and settings
Color Matching Tolerance	Adjusts the transparency tolerance; drag the slider to the right to increase the tolerance level. This allows a wider range of pixels similar to the transparent color to be considered transparent.
Mask Contrast	Adjusts the mask edge contrast; increase the contrast sharpness by dragging the slider to the right. Soften the contrast by dragging the slider to the left.

Images with a monochrome background are easiest to use when creating a mask transparency.

3. The Edit Mask Transparency dialog box opens.

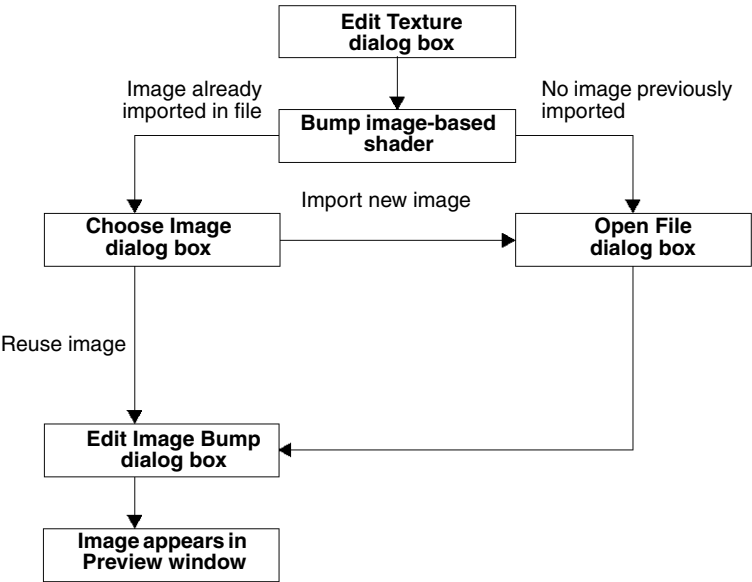


Parameter	Description
Softness	Drag the slider to the right to increase image blurring when rendered in Final Quality or Custom RenderWorks (with anti-aliasing on)
Transparent Color Mask	Selects the transparent color mask settings
Change Image	Selects a different image for import

4. Specify the mask transparency parameters and click **OK**. The imported mask transparency is previewed in the Edit Texture dialog box.

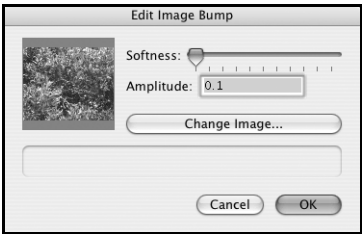
### Importing Images for Bump Shaders

The process of selecting a bump shader is illustrated by the following flow chart.



To import a bump image-based shader:

1. Select and import the image as described in “Selecting the Image for Import” on page 640.  
The Edit Image Bump dialog box opens.
2. Specify the image-based shader properties and click **OK** to import the image and preview the texture.



Parameter	Description
Image preview	Edits to the image are displayed in the image preview
Change Image	Selects a different image for import
Softness	Drag the slider to the right to increase image blurring when rendered in Final Quality or Custom RenderWorks (with anti-aliasing on)
Amplitude	Enter a value to adjust the apparent bump height; a higher value creates a bumpier appearance (Range: 0 – 1)

When using the monochromatic textures provided with VectorWorks, the **Softness** and **Amplitude** parameters may require careful adjustment depending on the viewing distance from the model.

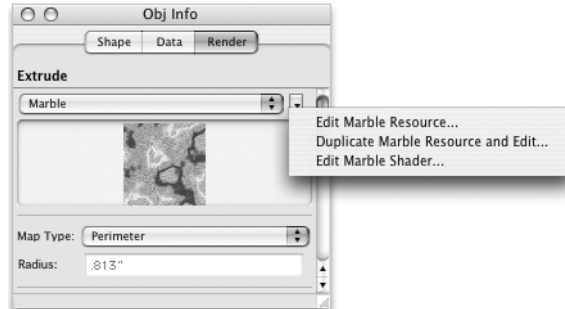
## Editing Textures and Shaders

All textures, whether created by you, selected from default resources, or imported from the resources included with VectorWorks, can be edited by changing the parameters of the shaders that make up the texture. This editing can be done from the Object Info palette, with the changes to the texture reflected immediately in the selected object. Alternatively, the texture can be edited from the Resource Browser.

A library of texture resources is provided in [VectorWorks]\Libraries\Textures.

### Editing Textures and Shaders of Selected Objects

The textures and shaders of a selected object can be edited directly through the **Texture** menu on the Render tab of the Object Info palette. The **Texture** menu allows the textures and shaders that make up the textures to be edited, with changes displayed immediately in the drawing.



To avoid making unwanted permanent changes to a texture resource that is used by several objects, select **Duplicate (Texture Name) Resource and Edit** and work on a copy of the texture resource instead of the original. Changes made to a copy of the texture only apply to the current selection.

## Editing the Texture Resource

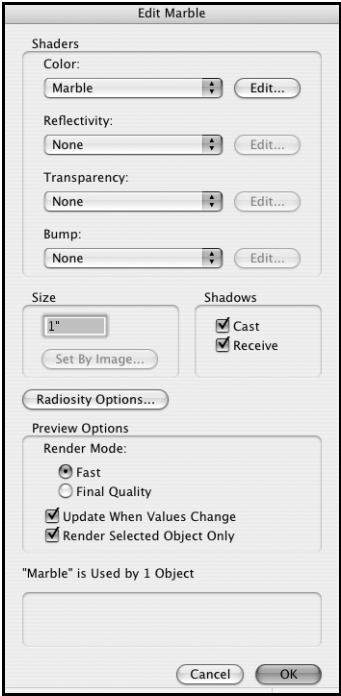
To edit the texture resource of a selection:

1. Select the desired textured object(s).
2. On the Render tab of the Object Info palette, click the arrow next to the texture name to open the **Texture** menu.
3. Select **Edit (Texture Name) Resource** to edit the current texture, or select **Duplicate (Texture Name) Resource and Edit** to make a copy of the resource for editing.

The Edit (Texture Name) dialog box opens, and a preview window is created around the selected object.

The parameters are the same as those used to create the texture; any changes are reflected directly in the drawing.





Parameter	Description
Shaders	Select a different or additional shader, or edit the shader parameters, as described in “Creating Textures” on page 637
Size	Sets the real-world size for each repetition of the texture
Set By Image	<p>For image-based shaders, click to set the real-world size in relation to a segment of the image (if several image-based shaders are used, select the shader in the Choose Image dialog box first). In the Set Image Size dialog box, specify the texture length to use for sizing by dragging the ends of the line segment. Then, specify the real-world size for the line segment in <b>Feature Size</b>. Click <b>OK</b> to exit the Set Image Size dialog box and update the <b>Size</b> value.</p> <p>The size should reflect the file setup. For example, if the layer scale is 1/4” and feet and inches are being used, the size should be in feet, not inches.</p>
Shadows	
Cast	Allows objects with this texture to cast shadows (for rendering modes that display shadows)
Receive	Allows objects with this texture to receive shadows (for rendering modes that display shadows)

Parameter	Description
Radiosity Options	Opens the Radiosity Texture Options dialog box; specify if this texture should always participate in radiosity calculations when rendering with custom radiosity. If the texture should receive light but not emit it, select <b>Receive Light</b> , or if the texture should both receive and emit light, select <b>Receive Light</b> and then also <b>Emit Light</b> . A texture override must also be selected under <b>Allow Special Overrides</b> in the Radiosity Optimizations dialog box. See “Setting Custom Radiosity Options” on page 694. Object overrides supersede texture overrides.
Preview Options	
Render Mode	Select a rendering mode for the preview window; this does not change the drawing rendering mode
Update When Values Change	Select to render the preview with the selected <b>Render Mode</b> as parameters change; if deselected, the drawing is not updated until the dialog box is closed
Render Selected Object Only	Select to render only the selected object as parameters change; deselect to render objects within the preview window as parameters change
(Texture Name) is Used by	Indicates the number of objects in the file with the current texture applied

Editing the Shader

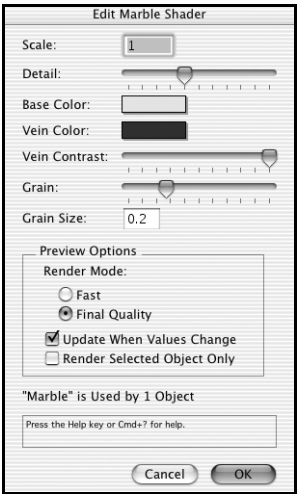
If only the shader parameters require editing, they can be accessed quickly from the **Texture** menu rather than editing the texture first.

To edit one of the shaders that makes up the texture of a selection:

- 1. Select the desired textured object(s).
- 2. On the Render tab of the Object Info palette, click the arrow next to the texture name to open the **Texture** menu.
- 3. Select **Edit (Shader Name) Shader** to directly edit one of the shaders that makes up the applied texture.

The Edit (Shader Name) Shader dialog box opens, and a preview window is created around the selected object.

The parameters are the same as those used to create the shader; any changes are reflected directly in the drawing.



Parameter	Description
Shader Properties	See “Shader Properties” on page 737 for a comprehensive list of shaders and shader properties.
Preview Options	
Render Mode	Select a rendering mode for the preview window; this does not change the drawing rendering mode
Update When Values Change	Select to render the preview with the selected <b>Render Mode</b> as parameters change; if deselected, the drawing is not updated until the dialog box is closed
Render Selected Object Only	Select to render only the selected object only as parameters change; deselect to render objects within the preview window as parameters change
(Texture Name) is Used by	Indicates the number of objects in the file with the current texture applied

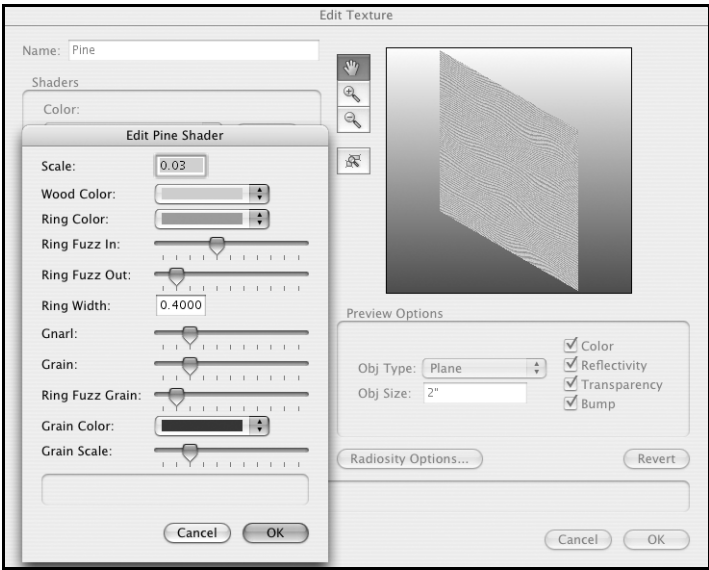
## Editing Textures and Shaders Through the Resource Browser

A texture and its shader properties can be edited from the Resource Browser. The texture does not have to be applied to any objects to be edited in this way; changes are displayed in a preview window rather than directly in the drawing.

To edit a texture resource, including its shaders, from the Resource Browser:

1. From the **Resource Browser**, select the texture to be changed, and then select **Edit** from the Resources menu.

The Edit Texture dialog box opens.



2. Click **Edit** to edit the shader. The dialog box that opens depends on the shader. Descriptions of all the possible parameters are presented in alphabetical order in “Shader Properties” on page 737.
3. Edit the texture properties as described in “Creating Textures” on page 637. The texture can also be renamed.

The changes are displayed in the preview window.

4. Click **OK** to exit the Edit Texture dialog box.

## Creating Image Prop Objects

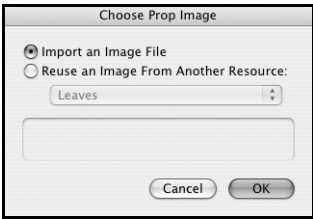
RenderWorks allows the insertions of “prop” objects made from imported images, such as trees, people, signs, and cars, to make a model look more realistic. An image prop must be in one of the formats listed in “Selecting the Image for Import” on page 640.

Most image-based textures are automatically compressed when imported into VectorWorks. Imported JPEG files retain the original JPEG data; all other image files are compressed using lossless PNG format.

An image imported for use as a prop is saved as a texture resource. A library of image prop resources is provided in [VectorWorks]\Libraries\Image Props.

To add an image prop:

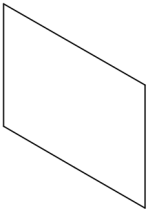
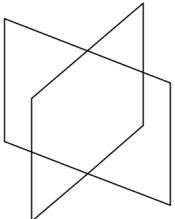
1. Select **Model > Create Image Prop**.
2. If a resource with an image is already present in the file, the Choose Prop Image dialog box opens.



Parameter	Description
Import an Image File	Imports a new image; click <b>OK</b> and proceed to Step 3.
Reuse an Image from Another Resource	Reuses a previously imported image; select the resource that contains the image. Click <b>OK</b> and proceed to Step 4.

3. Select the desired image file in the Open (Windows) or Import QuickTime Image Document (Macintosh) dialog box. Click **Open**.
4. The Image Prop Options dialog box opens. Specify the parameters for the image prop.



Parameter	Description
Name	Specify a name for the image prop (used for the texture and symbol name)
Dimensions	Specifies the image prop's height and width values
Lock Aspect Ratio	Maintains the image's aspect ratio when selected; editing one dimension automatically changes the other
Mask Options	
No Mask	Specifies that no image masking is to be used for the imported image
Use Mask	Specifies that image masking is to be used; click <b>Create Mask</b> to specify the mask image and properties as described in "Mask Transparency" on page 646. When rendering with <b>Custom RenderWorks</b> , set the <b>Recursion Level</b> appropriately (see "Custom RenderWorks Options" on page 689). If the recursion level is set too low, transparent objects, including overlapping image props, may appear opaque. In general, set the recursion level to twice the number of overlapping objects; if there are two overlapping image props, for example, set the recursion level to four.
Crossed Planes	Creates the illusion of object fullness by creating two image planes at a 90 degree angle to each other <div><div>Crossed planes deselected</div><div></div><div><div>Crossed planes selected</div><div></div></div></div>
Constant Reflectivity	Excludes the prop from the effects of light objects placed in the drawing; this is useful for images that already contain shadowed areas

Parameter	Description
Create Plug-In Object	Creates a plug-in object out of the prop; this allows the prop to be resized and automatically rotated
Auto Rotate to Viewer	Adjusts the plug-in object so that it is always rendered facing the viewer  In a radiosity rendering, auto-rotate is not possible because the model geometry within a completed radiosity solution is fixed
Create Symbol	Creates a symbol from the image prop; the image prop name is automatically assigned as the symbol name. Generating the image prop as a symbol allows the image prop to be easily re-inserted in the drawing.

Select **Auto Rotate to Viewer** for crossed plane images, so that the crossed planes cannot be detected.

5. Click **OK** to create the image prop.

The image prop symbol parameters can be edited in the Object Info palette. In the Resource Browser, the image prop is listed as a symbol/plugin object, if selected at creation. In addition, a texture is created for use by the image prop. Both the texture and, if created, the symbol/plugin object, are assigned the name provided in the Image Prop Options dialog box.



## Creating Layer Backgrounds

With RenderWorks, backgrounds can be added to create a more realistic drawing. Backgrounds, such as clouds, a color or color gradient, or an imported image or panorama, are applied on a per-layer basis. In addition, special weather effects can add to the layer the illusion of snow, fog, ground fog, or shafts of light in fog.



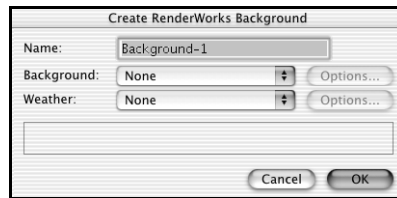
RenderWorks backgrounds are resources that are created and displayed in the Resource Browser and are saved with the file (default resources are automatically imported into the file at the point of use, and display in the Resource Browser); see “VectorWorks Fundamentals Default Resources” on page 141.

## Creating a Background

To create a background:

1. Select **Window > Palettes > Resource Browser** to open the Resource Browser.
2. From the Resources menu, select **New Resource** to display the New Resource menu.
3. Select **RenderWorks Background**.

The Create RenderWorks Background dialog box opens.



4. Enter the name of the new background and select the type of background to create. Click **Options** to set specific background parameters.

Parameter	Description
None	Select this option when creating a weather effect without an additional background
Clouds	Specifies a sky background with a background color and clouds
Scale	Specifies the cloud scale (1 – 10); enter a larger value for larger cloud sizes
Background Color	Select a background color for the sky
Cloud Color	Select a cloud color
Detail	Specifies the level of cloud resolution; drag the slider to the right to specify a greater level of detail (requires longer rendering times)
One Color	Specifies a background with one color; click <b>Options</b> to select the color
Two Color	Specifies a background with two colors which blend to form a gradient; click <b>Options</b> to select the colors
Top Color	Select the color for the start of the color gradient at the top of the page
Bottom Color	Select the color for the end of the color gradient at the bottom of the page
Image	Uses a specified image for the background (see “Creating Image Backgrounds” on page 658)
Image Environment (HDRI)	Uses a panoramic High Dynamic Range Image (HDRI) file for the background (see “Creating HDRI Backgrounds” on page 658)

OpenGL render mode only displays One Color, Two Color, and Image backgrounds.

5. Click **OK** from the Create RenderWorks Background dialog box to create the background resource.

The new background resource is listed in the Resource Browser. It is available in the Edit Design Layers dialog box (see “Applying RenderWorks Backgrounds” on page 676 for information).

A RenderWorks background can be quickly edited by pressing **Ctrl** (Windows) or **Option** (Macintosh) and double-clicking on the resource in the Resource Browser.

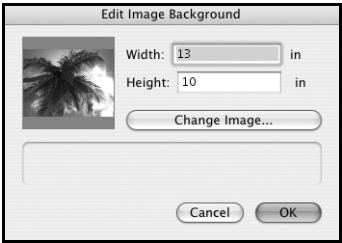
### Creating Image Backgrounds

To be used for a background, an image must be in one of the formats listed in “Selecting the Image for Import” on page 640.

1. If an image background is specified, select a new image or an image from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141).

The Edit Image Background dialog box opens; specify the image height and width (centered on the page). An image used as a background of this type, as opposed to the HDRI background, remains fixed to the page and does not change according to the 3D view.

An image can also be reused from another image-based resource if one exists in the file. In the Choose Image dialog box, select **Reuse an Image from Another Resource** and specify the resource. The Edit Image Background dialog box opens to allow editing of image parameters (see “Selecting the Image for Import” on page 640 for more information).



Parameter	Description
Width	Sets the width of the image in page units (inches or millimeters); width edits also automatically change the height, to maintain the image aspect ratio
Height	Sets the height of the image in page units (inches or millimeters); height edits also automatically change the width, to maintain the image aspect ratio
Change Image	Selects a different image for import

2. Click **OK** to use the image in the background.

### Creating HDRI Backgrounds

When an HDRI background is imported, it behaves as if an infinitely large, textured, sphere or cube was centered on the model. The virtual sphere or cube is so large that view position changes do not affect its display. However, view orientation changes do affect which part of the image is shown in the background; this provides a true 3D sense to the model.

By default, an image environment background renders as both a background and a light source. However, it is possible to use one HDRI background resource as an environment background, and another for environment lighting; see “Setting Lighting Options” on page 420.

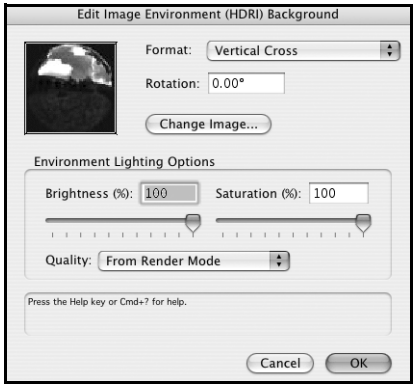


Purpose of HDRI Background Resource	Creation Method
Use an HDRI background resource as both environment background and environment lighting	Create an HDRI background resource and apply it to the layer. By default, the Layer Lighting Options is set to use the lighting from the current background.
Use an HDRI background as environment background only	Create an HDRI background resource and apply it to the layer. In the Layer Lighting Options dialog box, specify <b>None</b> for Environment Lighting.
Use an HDRI background resource as environment lighting only	Create an HDRI background resource, but do not apply it to the layer. In the Layer Lighting Options dialog box, select <b>From Selected Background</b> and specify the resource.
Use one HDRI background resource as an environment background and a different background resource for environment lighting	Create the first HDRI background resource and apply it to the layer (environment background). Create the second background resource but do not apply it to the layer. Instead, in the Layer Lighting Options dialog box, select <b>From Selected Background</b> and specify the second resource (environment lighting).

HDRI backgrounds render best in Perspective projection. In Orthogonal projection, HDRI backgrounds are suitable for lighting and reflections, but appear as a single background color because of the narrow field of view. For maximum speed and quality, select **Use Final Gather** when rendering an HDRI background with Custom RenderWorks. One bounce of indirect lighting is generated with HDRI lighting.

- 1. Select the image file to use. Acceptable formats include .exr (Open EXR) and .hdr.

The Edit Image Environment (HDRI) Background dialog box opens.



Parameter	Description
Preview	Displays a preview of the selected image
Format	The appropriate map type format for the image is automatically determined, and normally does not need to be changed. To choose a different map type format for the image, select it from the list (Vertical Cross for a cross image, Panorama for a Mercator projection, and Angular for a spherical image).

Parameter	Description
Rotation	Rotates the image about the Z axis, changing the light orientation and visible portion of the image ( <i>range</i> : -180 to 180 degrees)
Change Image	Imports a different image to use as the HDRI background
Brightness (%)	Specifies the brightness for environment lighting; enter a percentage or drag the slider to change the brightness. A value over 100% can be entered.
Saturation (%)	Specifies the color saturation for environment lighting; enter a percentage or drag the slider to change the saturation. A value over 100% can be entered.
Quality	Specifies the sampling value of the rendered image; higher-quality sampling results in better image resolution, but longer rendering times. Select From Render Mode to use the <b>Sampling Quality</b> specified in the render options (Custom RenderWorks Options or Custom Radiosity Options, see “Custom RenderWorks Options” on page 689 or “Setting Custom Radiosity Options” on page 694).

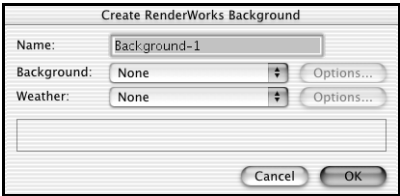
- 2. Click **OK** to use the image as an environment background resource.

Creating Weather Effects

To create a weather effect:

- 1. Select **Window > Palettes > Resource Browser** to open the Resource Browser.
- 2. From the Resources menu, select **New Resource** to display the New Resource menu.
- 3. Select **RenderWorks Background**.

The Create RenderWorks Background dialog box opens.



- 4. Enter the name of the new background and select the type of weather to create. Click **Options** to set specific parameters.

Parameter	Description
Fog	Creates a simulation of fog over the layer
Color	Select the fog color
Distance	Specifies the distance to maximum fog density; use a lower distance to increase the effect of the fog
Max. Density	Drag the slider to the right to increase the fog density
Ground Fog	Creates a simulation of ground fog over the layer
Color	Select the fog color

Parameter	Description
Height	Specifies the height of the ground fog
Distance	Specifies the distance to maximum fog density; use a lower distance to increase the effect of the fog
Max. Density	Drag the slider to the right to increase the fog density
Snow	Creates the illusion of falling snow on the layer
Color	Select the snow color
Amount	Drag the slider to the right for larger and more numerous snowflakes
Max. Density	Drag the slider to the right to decrease the distance between snowflakes
Near Scale	Increases or decreases the size of closer snowflakes
Far Scale	Increases or decreases the size of farther snowflakes
Lit Fog	Creates volumetric lighting effects, such as a shaft or cone of scattered light in fog, haze, or smoke. A light object must be inserted in the drawing, and <b>Lit Fog</b> must be selected in the Object Info palette for the light source object
Color	Select the fog (haze) color
Max. Density	Specifies the fog density; enter a larger value to increase the density of the effect
Receive Shadows	Allows the effect to be blocked by solid objects, creating shadows; for example, when blocking a shaft of light by a table, so that light does not display under the table <a href="#">Use Shadows must also be selected in the rendering options.</a>
Type	Select a method for creating the fog from a list of computational methods
Quality	Select the quality of the lit fog effect; a higher quality effect requires more rendering time
Density Variation	Allows the volumetric lighting effect to vary in density, which creates a realistic smoky or hazy effect, but takes longer to render
Variation Level	Drag the slider to the right to increase the fog variation
Variation Contrast	Drag the slider to the right to increase the fog contrast

- Click **OK** from the Create RenderWorks Background dialog box to create the weather effect resource.

The new resource is listed as a RenderWorks Background in the Resource Browser. It is available in the Layers dialog box (see “Applying RenderWorks Backgrounds” on page 676 for more information).

[Backgrounds and weather effects can be used together.](#)

[Textures and backgrounds that are not used in the drawing file should be purged to reduce file size. See “Purging Unused Objects” on page 373.](#)

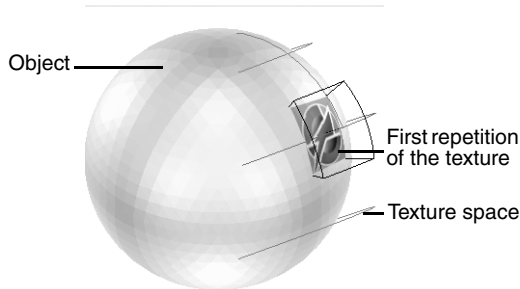
## Applying and Mapping Textures

Once a texture resource has been created, it can be applied to the surface of an object. A texture can be applied to a selected object or to objects assigned to a class. The mapping parameters specify how the texture is applied to the object; different objects require different mapping types. Finally, a RenderWorks background can be applied to add impact and realism to the design.

## Texture Projection and Orientation

### Mapping Types

A sphere, cylinder, plane, perimeter, or roof mapping type is used to control how a texture is projected onto different types of objects. To further adjust mapping, VectorWorks uses a visual control, or texture space, to represent the projected texture. This texture space can be modified by changing its rotation, horizontal and vertical offset, or scale. The texture space orientation can also be adjusted.

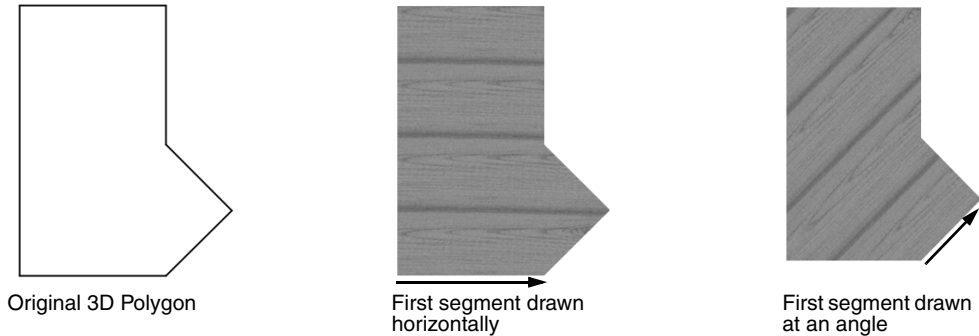


The available mapping types vary based on the object type being mapped:

Object Type	Mapping Types Available
Columns	Plane, Sphere, Cylinder
Extrudes	Plane, Sphere, Cylinder, Perimeter
Meshes	Plane, Sphere, Cylinder
Roofs	Roof
Slabs (Floors)	Plane, Sphere, Cylinder
Solid Primitives (Sphere, Hemisphere, Cone)	Plane, Sphere, Cylinder
CSG solids, Extrude Along Path, and Tapered Extrude	Plane, Sphere, Cylinder, Perimeter
Sweeps	Plane, Sphere, Cylinder, Perimeter
Walls	Plane, Sphere, Cylinder

### Textures and Drawing Direction

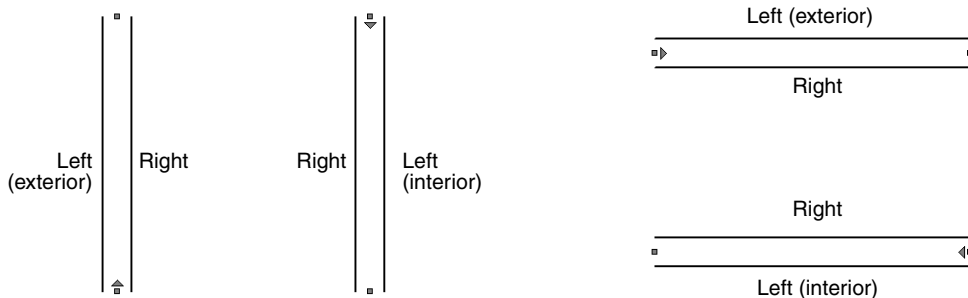
Textures are applied to 3D polygons and walls based on the direction the object was drawn. For 3D polygons, the texture is applied parallel to the first segment.



## Wall Texture Orientation

The starting point and direction the wall is drawn affects how a texture is applied. Textures are applied to a wall's left side, right side, and center. The center of a wall is always the same, but the left and right sides change based on drawing direction. When drawing a wall in a clockwise direction, the left side is the exterior side; however, drawing the wall in a counterclockwise direction makes the left side the interior side.

A texture applied to the center of the wall is visible at the ends of the wall.



In Top/Plan view, arrows indicate the current wall direction

If the texture(s) is incorrectly applied to a wall, with the wall selected, click **Reverse Sides** on the Shape tab of the Object Info palette. This flips the direction of the wall, switching the texture(s) to the opposite side(s).

## Applying and Mapping Object Textures

Mapping specifies how a texture is applied to an object. By adjusting texture mapping, various visual effects can be achieved.

2D objects cannot have a texture applied. Objects which cannot be textured display as a “Non-textureable Object” on the Render tab of the Object Info palette.

When applying a texture to a selected, textureable object, basic mapping parameters can be assigned to the texture through the Object Info palette. The result of these parameter changes is visible immediately in the drawing, as the selected object is re-rendered. However, for greater control, advanced mapping is necessary to specify how the texture displays on the object.

## Applying Textures with Basic Mapping

To apply a texture with basic mapping to one or more objects:

1. Create or import a texture resource as described in “Creating Textures” on page 637.
2. Select the object(s) to texture. If more than one object is selected, only the texture resource can be selected. Mapping parameters can only be set for individually selected objects.
3. Click the Render tab on the Object Info palette.
4. Select the desired **Texture** from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141), and then set the texture parameters, which apply only to the selected object. Because Object Info palette changes apply only to the selected object, one texture can be applied with different parameters to many objects.

The basic mapping parameters display in the Object Info palette; click **Mapping** to access advanced mapping items as described in “Applying Textures with Advanced Mapping” on page 665.

Parameter	Description
Part	For roofs and walls, select the portion of the roof (top, dormer) or wall (right, center, left) where the mapping should be edited, or select All to edit all parts of the wall or roof
Texture list	Select the texture to apply from either the default resources or the current file’s resources
Texture menu	Click the arrow next to the texture list to open the <b>Texture</b> menu. The texture resource or shader used to create the resource can be edited from here as described in “Editing Textures and Shaders of Selected Objects” on page 649. Before editing, the resource can be copied in order to preserve the original resource parameters.
Map Type	Select the map type; see “Mapping Types” on page 662
Radius	For sphere and cylinder maps, sets the texture radius; the default radius is the same as the 3D object radius. Increasing this value reduces the size of the texture on the object.
Flip Horizontally	Flips the texture horizontally, along the vertical axis
Flip Vertically	Flips the texture vertically, along the horizontal axis
Repeat Horizontally	Repeats the texture in a horizontal direction
Repeat Vertically	Repeats the texture in a vertical direction
Start Cap	Applies the texture to the bottom or starting surface of extrudes and sweeps
End Cap	Applies the texture to the top or ending surface of extrudes and sweeps
Scale	Determines the texture size when projected onto the object. For example, entering a scale factor of two doubles the size of the texture projection. Either enter a scale value or use the slider to change the scale.
Offset H/V	Sets the start location of the texture horizontally and vertically
Rotation	Sets the angle of texture rotation. Either enter a rotation value from 0 to 360 degrees or use the slider to change the rotation angle.
Update	Updates the drawing display
Mapping	Opens the Edit Mapping dialog box, with advanced mapping parameters; see “Applying Textures with Advanced Mapping” on page 665

Parameter	Description
Override Radiosity	Specifies that the selected object should be always participate in radiosity calculations (receive only or receive and emit) when rendering with custom radiosity. (An Obj Info override must also be selected under <b>Allow Special Overrides</b> in the Radiosity Optimizations dialog box. See “Setting Custom Radiosity Options” on page 694.) Object overrides supersede texture overrides.
Emit Light	When override settings are enabled, the object will receive and emit light when rendering with custom radiosity ( <b>Receive Light</b> is always also selected)
Receive Light	When override settings are enabled, the object will receive light when rendering with custom radiosity

The texture can also be applied to objects from the Resource Browser; click the texture and drag it to the desired object. Alternatively, select the desired object(s), double-click on the texture to apply, or select the texture and click **Apply** from the context menu. However, when a texture is applied in this way, mapping options cannot be accessed directly. Click on the **Render** tab of the Object Info palette to edit the texture mapping.

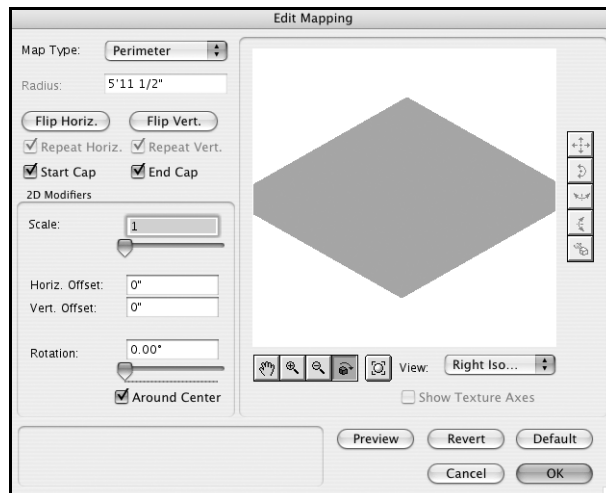
5. The texture is applied to the selected object(s).

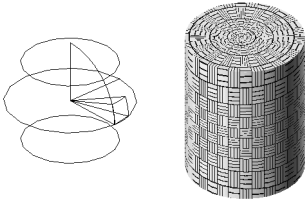
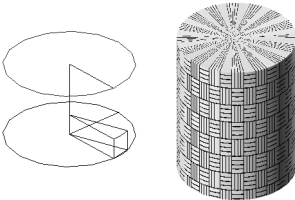

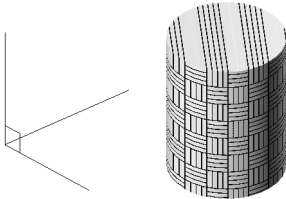

## Applying Textures with Advanced Mapping

To apply a texture and edit the advanced mapping:

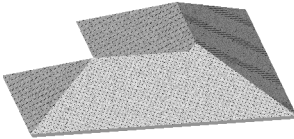
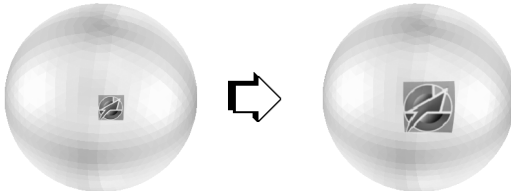
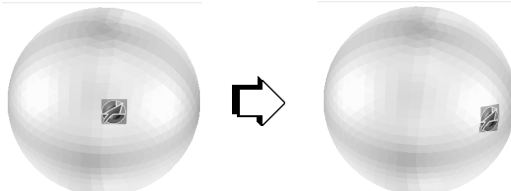
1. Create or import a texture resource as described in “Creating Textures” on page 637.
2. Select the object to texture.
3. Click the **Render** tab on the Object Info palette.
4. Select the desired **Texture** from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141). The basic texture parameters can be set from the Object Info palette; see “Applying Textures with Basic Mapping” on page 664.
5. Click **Mapping**. (**Mapping** is unavailable if multiple objects are selected.)

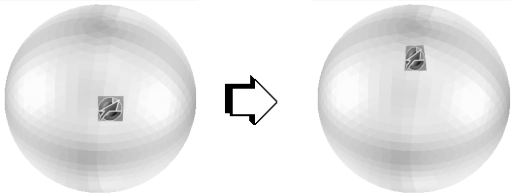
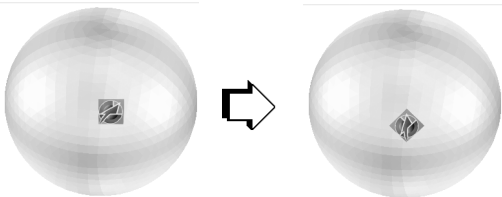






The Edit Mapping dialog box opens.







Parameter	Description
Map Type	Select how the texture is applied to the 3D object
Sphere	Projects each vertex of the object to the surface of a sphere 
Cylinder	Projects each vertex of the object to the surface of a cylinder 
Sphere and Cylinder maps have seams which are more apparent when using wrapped and image-based shaders 	
Plane	Projects each 3D vertex of an object onto a plane which determines the texture space (u, v) for that vertex 
Perimeter	Available for extrudes, tapered extrudes, extrude along path objects, sweeps, and CSG solids, this option wraps the texture around the perimeter of the objects 



Parameter	Description
Roof	<p>Only available for roof objects, this option wraps the texture across the perimeter of the roof object</p> 
Radius	<p>For sphere and cylinder maps, sets the texture radius; the default radius is the same as the 3D object radius. Increasing this value reduces the size of the texture on the object.</p>
Flip Horiz.	Flips the texture horizontally, along the vertical axis
Flip Vert.	Flips the texture vertically, along the horizontal axis
Repeat Horiz.	Repeats the texture in a horizontal direction
Repeat Vert.	Repeats the texture in a vertical direction
Start Cap	Applies the texture to the bottom or starting surface of extrudes and sweeps
End Cap	Applies the texture to the top or ending surface of extrudes and sweeps
2D Modifiers	Available for 3D objects using wrapped shaders. See “Textures and Shaders” on page 635 for more information.
Scale	<p>Determines the texture size when projected onto the object. For example, entering a scale factor of two doubles the size of the texture projection.</p> <p>Either enter a scale value or use the slider to change the scale.</p> 
Horiz. Offset	<p>Sets start location of the texture horizontally</p> 

Parameter	Description
Vert. Offset	Sets start location of the texture vertically 
Rotation	Sets the angle of texture rotation. When Around Center is selected, the texture rotates about its center; when deselected, the texture rotates about its lower left corner. Either enter a rotation value from 0 to 360 degrees or use the slider to change the rotation angle. 
Mapping Editors	Adjusts the texture space on the preview image
Move Texture 	Moves the texture on the object surface; click Ctrl (Windows) or Command (Macintosh) to move the texture space origin on the current viewing plane
Rotate Texture 	Rotates the texture axes about the texture center; click Ctrl (Windows) or Command (Macintosh) to twist the texture axes on the current viewing plane
Rotate Texture Horizontally 	Rotates the texture horizontally relative to the current view
Rotate Texture Vertically 	Rotates the texture vertically relative to the current view
Align Texture 	Aligns the texture to the object face that is clicked
Viewing Options	Changes the view of the preview image
Pan 	Moves the image displayed


Parameter	Description
Zoom In 	Magnifies the image; create a marquee to select the portion of the image to preview
Zoom Out 	Reduces the image magnification; create a marquee to select the portion of the image to preview
Rotate Camera 	Like the <b>Flyover</b> tool, rotates the view about the image
Fit Preview 	Fits the object into the preview window; this is convenient if the preview object has been moved far from the center of the preview window
View	Select a view for the preview image, align the image with the X, Y, or Z axis, or select <b>Custom View</b> and use the <b>Rotate</b> tool in the preview window to obtain the desired view
Show Texture Axes	Select to display the texture space axes in the preview; deselect to hide the axes
Preview	Creates a rendered preview of the image using Fast RenderWorks mode
Revert	Cancels any changes that have been made since the dialog box was opened, and returns the mapping parameters to their original status
Default	Defaults to the mapping settings appropriate for this type of object

6. Click **OK** to save changes.

## Direct Texture Mapping

The **Attribute Mapping** tool edits texture mapping parameters directly in the drawing window. This tool applies to textures created with wrapped color shaders or mask transparency shaders. The texture mapping type must be other than **Perimeter** for this tool.

When working in 2D, the **Attribute Mapping** tool edits image and gradient fills. “Editing Gradient and Image Fills” on page 250.

 To edit texture mapping directly in the drawing window:

1. Select a textured, 3D object.
2. Click the **Attribute Mapping** tool from the Visualization tool set. Depending on the textured object and texture type, up to three modes are available.

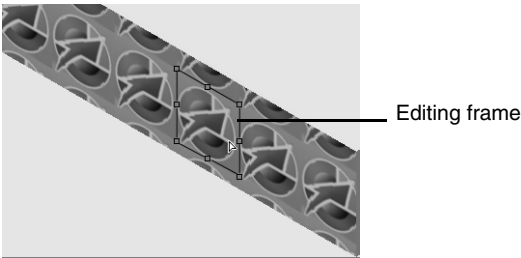


Mode	Description
Non-Repeating Mode	For repeating textures, displays a single repetition of the texture for easier texture editing
Original Repeat Mode	For repeating textures, restores the repeating pattern of the texture
Select Part Mode	For textured objects with more than one textureable part, such as walls and roofs, allows a different part of the object to be selected for texture editing

3. For a wall or roof, which may have different textures applied to different parts of the wall or roof, the Select Texture Part dialog box opens. Select the portion of the object to edit, and click **OK**.



4. An editing frame is placed over the first repetition of the texture.



Use the editing frame to set the texture position and to rotate or resize the texture. For easier direct mapping of a repeating texture, click **Non-Repeating** mode to see a single repetition of the texture. After editing the texture mapping, click **Original Repeat** mode to return to the original pattern and see the effect.

Action	Description
To edit the texture location	Click inside the editing frame and drag the texture to the desired location on the object surface
To resize the texture	Click on a corner handle at the corner of the editing frame, and drag to set the editing object to a new scale. To resize the texture evenly about its center, press the Ctrl key (Windows) or Command key (Macintosh) while resizing. Click to set.
To rotate the texture	Click on a side handle of the editing frame (the rotate cursor displays) and drag the handle to the new rotation angle. Click to set. Press the Ctrl key (Windows) or Command key (Macintosh) while rotating to rotate about the texture center.

5. To edit a different part of a roof or wall, click **Select Part** mode. In the Select Texture Part dialog box, select a different portion of the roof or wall to edit.

## Applying Textures to Symbols, Walls, and Roofs

While textures can be applied to individual objects as described in “Applying Textures with Basic Mapping” on page 664, applying textures to an object’s class or classes may be more efficient. Texture resources can be assigned to a class, which in turn can be applied to objects during creation.

Walls and roofs have their own class texture assignments.

Textures cannot be assigned to individual symbols directly through the Object Info palette. Textures must be applied to the separate components of the symbol. This can be done using the **Edit Symbol** command or by assigning textures to the classes that make up the symbol; complex objects can contain more than one class. Texture changes affect all instances of that symbol.

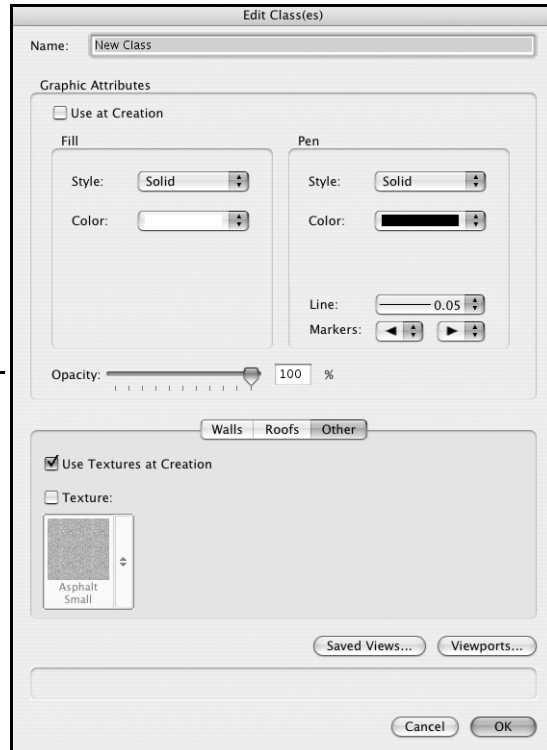
### Applying Object Textures by Class

Object textures can be set by class.

To apply a texture by class:

1. Select **Tools > Organization** to open the Organization dialog box.
2. Select the **Details** view option, and then select the Classes tab.
3. Select an existing class or create a new class (see “Creating Classes” on page 96).
4. With the class selected, click **Edit** to open the Edit Class(es) dialog box.
5. The texture properties of the class are set by the tabs on the right. Click the Other tab.

Displays when Quartz (Macintosh)  
or GDI+ (Windows) imaging  
VectorWorks preference is enabled



6. Select the desired **Texture** from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141). Select **Use Textures At Creation** to apply the texture to objects as they are created.
7. Click **OK** to exit the Edit Class(es) dialog box.  
The class displays on the Classes tab of the Organization dialog box.
8. If the object has not yet been drawn, click the blank area to the left of the **Class Name** to make the class active.  
If the object already exists, apply the class to it.
9. Click **OK** to exit the Organization dialog box.
10. Create the desired object(s). Objects are created with the specified texture for that class.

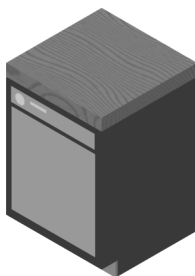
## Applying Textures to Symbols

Textures can be applied to the components that make up the symbol, or to the classes used by the symbol components.

### Applying Textures to Symbol Components

To apply texture(s) to the symbol components:

1. Select the symbol to edit.
2. Select **Modify > Edit Symbol**.  
The Edit Symbol window opens; see "Editing Symbol Definitions" on page 166 for more information on the Edit Symbol window.
3. Select the first component that requires a texture.
4. Click the Render tab on the Object Info palette.
5. Select the desired **Texture** from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141), and then edit the mapping parameters as described in "Applying and Mapping Object Textures" on page 663.
6. Repeat for each component of the symbol.
7. Select **Modify > Exit Symbol** once all changes have been applied.  
The new settings are applied to all instances of the symbol.



### Applying Textures to Symbol Component Classes

To apply textures to the symbol component classes:

1. Select **Tools > Organization** to open the Organization dialog box.

2. From the Classes tab, select one of the symbol classes to edit.
3. Click **Edit** to open the Edit Class(es) dialog box.
4. From the Other tab, select the desired **Texture** from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141). Select **Use Textures At Creation** to apply the texture at creation.
5. Click **OK** to return to the Organization dialog box.
6. Repeat steps 2 – 5 until all classes have an assigned texture.
7. Click **OK** to exit the Organization dialog box. The new settings are applied.

Some symbols in the Design Series use style classes; see "Using Style Classes" on page 124 in the VectorWorks Design Series User's Guide for more information.

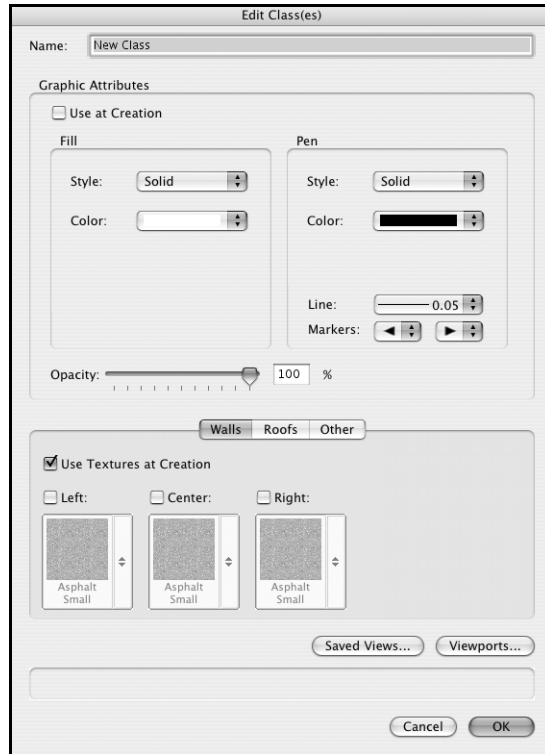
## Applying Wall Textures

Walls can be assigned a texture individually with the Object Info palette, or, more efficiently, through an assigned class.

To apply a texture to a wall(s) by class:

1. Select **Tools > Organization** to open the Organization dialog box.
2. Select the **Details** view option, and then select the Classes tab.
3. Create a class for wall objects (see "Creating Classes" on page 96).
4. With the new class selected, click **Edit** to open the Edit Class(es) dialog box.
5. Click the Walls tab.

Displays when Quartz (Macintosh)  
or GDI+ (Windows) imaging  
VectorWorks preference is enabled



6. Select the desired **Right**, **Center**, and **Left** wall surface texture from either the default resources or the current file's resources (see "VectorWorks Fundamentals Default Resources" on page 141). Select **Use Textures At Creation** to apply the texture at wall creation. See "Texture Projection and Orientation" on page 662 to understand how textures are applied to wall faces.
7. Click **OK** to exit the Edit Class(es) dialog box.

The new walls class displays on the Classes tab of the Organization dialog box.

8. Click the blank area to the left of the **Class Name** to make the new class active.
9. Click **OK** to exit the Organization dialog box.
10. Create the wall(s); see "Creating Walls" on page 471.

The walls are created with the specified texture for that class. Existing wall(s) can be assigned the texture through the Object Info palette. Select the part of the wall to texture from the **Part** list and then Class Texture from the texture list on the Render tab.

## Applying Roof Textures

Textures can be added to roof objects, dormers, and gable ends, either through the Render tab Object Info palette, or through an assigned class.

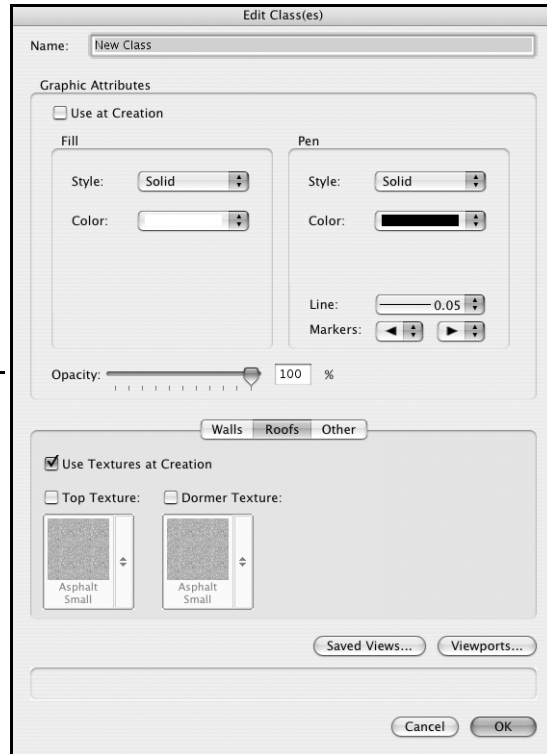
Use the **Roof** map type to map textures to roofs. RenderWorks automatically rotates a texture for each individual roof face in a VectorWorks roof object.



To apply a texture to a roof object by class:

1. Select **Tools > Organization** to open the Organization dialog box.
2. Select the **Details** view option, and then select the Classes tab.
3. Create a new class for roof objects (see “Creating Classes” on page 96).
4. With the new class selected, click **Edit** to open the Edit Class(es) dialog box.
5. Click the Roofs tab.

Displays when Quartz (Macintosh)  
or GDI+ (Windows) imaging  
VectorWorks preference is enabled



6. Assign a **Top Texture**, and if being used, a **Dormer Texture** from either the default resources or the current file's resources (see “VectorWorks Fundamentals Default Resources” on page 141). Select **Use Textures At Creation** to apply the texture at creation.
7. Click **OK** to exit the Edit Class(es) dialog box. The class displays on the Classes tab of the Organization dialog box.
8. Click the blank area to the left of the **Class Name** to make the new class active.
9. Click **OK** to exit the Organization dialog box.
10. Create a roof with the **AEC > Create Roof** command (see “Creating Roof Objects” on page 500).

The roof is created with the specified texture for that class. Existing roofs can be assigned the texture through the Object Info palette. Select the part of the roof to texture from the **Part** list and then Class Texture from the texture list on the Render tab.

## Applying Textures to Roof Face Objects

Roof face objects are represented as planes and do not make use of the top and sides roof textures. Textures are applied like any other 3D object. See “Applying and Mapping Object Textures” on page 663 for more information.

## Applying RenderWorks Backgrounds

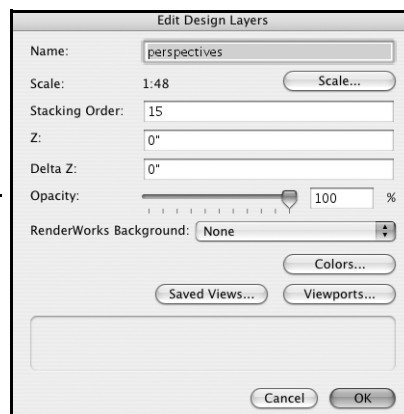
RenderWorks backgrounds, which include clouds, colors, images, and HDRI files, as well as weather effects like snow, fog, and volumetric lighting are resources saved with the file. They are applied to design layers on a per-layer basis. Backgrounds can also be applied to viewports by selecting the **RW Background** from the Object Info palette of a selected viewport.

A RenderWorks background can be quickly applied to the current design layer by double-clicking on the resource in the Resource Browser or by dragging it from the Resource Browser and dropping it into the current design layer.

To apply a RenderWorks background:

1. Create the background with the desired parameters (see “Creating Layer Backgrounds” on page 656 for information on creating RenderWorks backgrounds).
2. Select **Tools > Organization** to open the Organization dialog box.
3. From the Design Layers tab, select the design layer to receive the background.
4. Click **Edit** to open the Edit Design Layers dialog box.

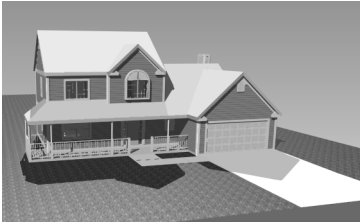
Displays when Quartz (Macintosh)  
or GDI+ (Windows) imaging  
VectorWorks preference is enabled



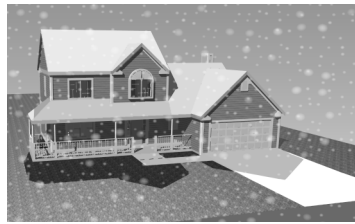
5. Select the **RenderWorks Background** for the layer from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141).
6. Click **OK** to exit the Edit Design Layers dialog box.
7. Click **OK** to exit the Organization dialog box.

When the drawing is rendered in a RenderWorks mode, the background displays. OpenGL can display One Color, Two Color, and Image backgrounds.

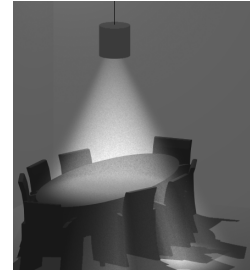
The Lit Fog weather effect requires a light source in the drawing with **Lit Fog** selected in the Object Info palette.



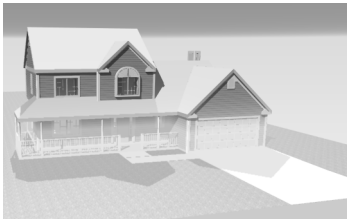
No weather effects



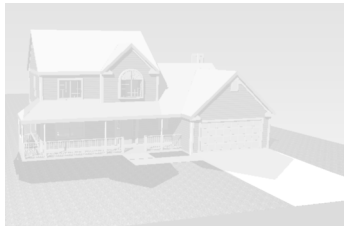
Snow weather effect



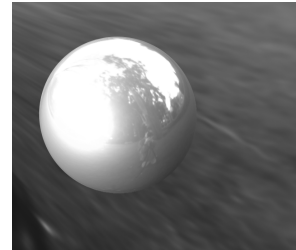
Lit fog weather effect



Ground fog weather effect



Fog weather effect

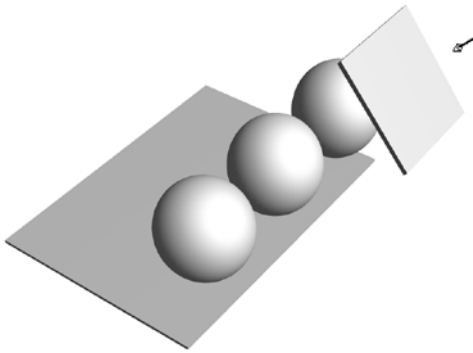


HDRI background

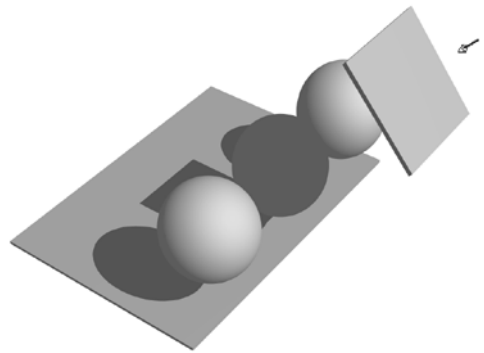


# Rendering with RenderWorks

The foundation VectorWorks program provides a quick, simple rendering solution using OpenGL (see “Rendering with VectorWorks” on page 431). OpenGL is good for fast, interactive rendering and medium-quality render previews, but it cannot create reflections. For final-quality output, use RenderWorks; it provides additional light sources, and it can cast shadows, create reflections, add indirect lighting effects (final gather rendering and radiosity), and produce much better rendering results through intensive lighting calculations. RenderWorks includes the Visualization palette for easily accessing all lights and cameras in the file. Another benefit of using RenderWorks is that an image can be rendered in any mode from a specified portion of the drawing.



OpenGL rendering performs vertex  
by vertex lighting calculations



RenderWorks rendering performs  
pixel by pixel lighting calculations

## Advanced RenderWorks Lighting

Default lighting is added by VectorWorks for the basic visibility of rendered objects. For a more realistic rendering, one or more light sources can be added to the drawing. The addition of a light source automatically hides the default lighting scheme, so that the scene is not overly bright.

The brightness and color of objects in shadow are affected by the layer's ambient light setting.



Scene rendered with light sources as well as ambient light

VectorWorks provides three light types: directional, point, and spot. With RenderWorks, additional parameters are provided for these light types, and additional light source types are included.

RenderWorks rendering modes must be used for the RenderWorks lighting options.

For information on the VectorWorks lighting types and parameters, see “Adding Light” on page 420.

Light Type	Description	Product
Directional	Projects light with parallel rays	VectorWorks and RenderWorks
Point	Radiates light in all directions	VectorWorks and RenderWorks
Spot	Projects light in a specific direction	VectorWorks and RenderWorks
Line	Emits light from a line	RenderWorks only
Area	Emits light from the surfaces of objects	RenderWorks only
Custom	Emits light based on a defined complex spatial distribution	RenderWorks only

## Inserting an Area or Linear Light

An area or linear light can be created from an existing object or line. Unlike the other light source types, which are emitted from a specific, concentrated source, area and linear lights emanate from an extended object. This is useful for creating diffused light sources with softer lighting, such as fluorescent lights, neon lights, windows, and skylights.

The color of area lights can be filtered by a texture, texture color, or the fill color of the original geometry. This feature can be used to create a wide variety of lighting effects, including skylights and stained glass windows.

The addition of multiple diffused light sources can add significantly to rendering time. For efficiency, replace a small area or line light with a point, spot, or directional light.

To create an area or linear light from an existing object or objects:

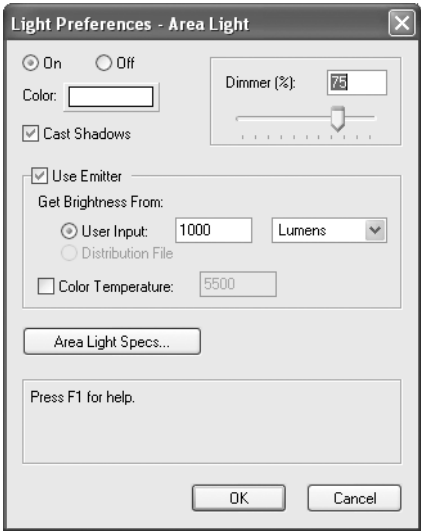
1. If creating an area light, select the object to convert to a light source; area light geometry should enclose a surface (a line or open polyline cannot be used, for example). Select a 2D line, closed 2D surface, or NURBS curve if creating a linear light.

Select more than one object to create several line or area lights at the same time.

Curved surfaces used for an area light require more rendering time than planar surfaces.

2. Select **Modify > Convert > Convert to Area Light** or **Modify > Convert > Convert to Line Light**.

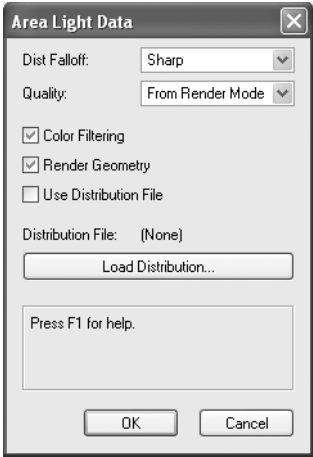
The Light Preferences dialog box opens; indicate the area or line light parameters. Specify light intensity by loading a distribution file or by manually entering a **Get Brightness From** value.



Parameter	Description
On/Off	Shows or hides the light produced by the light source
Color	Specifies a color associated with the light source; click the color box to select the color. This parameter is not available if a <b>Color Temperature</b> is specified.
Cast Shadows	Creates shadows
Dimmer	Dims the light source brightness (intensity); enter a percentage or drag the slider bar. Only the brightness of the light source is affected; the color temperature is not changed.
<b>Use Emitter</b>	An area or line light's actual brightness and color temperature must be specified, so this setting is not optional
Get Brightness From	Specifies the luminous quantity of the area or line light as a manually entered value or from a loaded distribution file
User Input	Manually specifies the luminous quantity of an area light as an accurate number; the units of a line light are always Lumens
Distribution File	Sets intensity distribution data with a standard file specified in <b>Area Light Specs</b> or <b>Line Light Specs</b> . The brightness value is obtained using the integral of the raw emission data provided with the file.

Parameter	Description
Color Temperature	<p>Specifies the light color temperature in Kelvin. This refers to an ideal black body emitter, glowing “red hot” or “white hot.” A lower temperature generates an orange color; the hotter the temperature, the closer to white the color of the light is (see “Correlated Color Temperature” on page 732 for typical light source color temperature ranges).</p> <p>Specifying this parameter is optional. If not specified, the default temperature is 0, meaning that the final emission color for the light is entirely controlled by the selection in <b>Color</b>.</p> <p>When the temperature is specified, <b>Color</b> cannot be changed. The final emission color is set by the <b>Color Temperature</b>.</p> <p>Color temperature settings can be white-balanced on a per-layer basis; see “Setting Lighting Options” on page 420.</p>
Area or Line Light Specs	Sets specific area or line light options and loads a distribution file

3. Click **Area Light Specs** or **Line Light Specs** to set additional parameters or load a distribution file.
- The Area Light Data or Line Light Data dialog box opens.

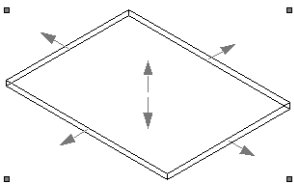


Parameter	Description
Dist Falloff	Select the distance falloff function (rate of intensity change while moving along the beam away from the light source)
Quality	Specifies the sampling quality of the light; select From Render Mode to use the setting specified in <b>Area/Line Light Quality</b> in the rendering options
Color Filtering (area light only)	Filters the color of the light emanating from the area light object by the fill color or texture of its original geometry
Render Geometry	Renders the light object geometry; deselect to hide the original geometry when rendering



Parameter	Description
Use Distribution File	Specifies whether to use the attached emission profile data file for the light intensity information
Distribution File	Displays the distribution file name when a valid distribution file has been selected, or "None" if a valid distribution file has not been designated (click <b>Load Distribution</b> to specify a file)
Load Distribution	Loads light emission profile data from a standard file. The brightness value is obtained using the integral of the raw emission data provided with the file. The file must be a text file with industry standard intensity distribution data in CIE, IESNA, CIBSE, or EULUMADAT format (.ies, .cib, .cie, and .ldt).

- 4. Click **OK** to return to the Light Preferences dialog box.
- 5. Click **OK**. The object or line is converted into a light. If more than one object was selected for conversion, the converted objects are grouped. The different directions of the light being emitted by an area light are indicated by arrows drawn on every surface.



Deselect **Show Direction** in the Object Info palette of a selected area light to hide the light direction indicators.

The light must be rendered with a RenderWorks rendering mode. When an area light is on and rendered, it has constant reflectivity and does not receive shadows; when it is off, it displays as a normal object.

### Editing an Area or Linear Light

The light parameters can be edited in the Object Info palette; see “Light Source Properties” on page 427.

An area light can be textured to create a variety of effects. From the Render tab of the Object Info palette, select a texture from either the default resources or the current file’s resources (see “VectorWorks Fundamentals Default Resources” on page 141). The color of the emitted light can be filtered by the texture color(s) or by the color of the original geometry, when **Color Filtering** is selected in the Object Info palette.

The area or linear light original geometry can be edited.

To edit the original light geometry:

- 1. Select the area or line light and then select **Modify > Edit Light**.  
The Edit Group window opens, and the original 3D object or a NURBS representation of a 2D object is displayed.
- 2. The object geometry can be edited with the **2D Reshape** or **3D Reshape** tool. In addition, the fill color of the original object can be changed to modify the color filtering properties of an area light.
- 3. Click **Exit Light** at the top right of the drawing window to return to the drawing.

## Inserting a Custom Light

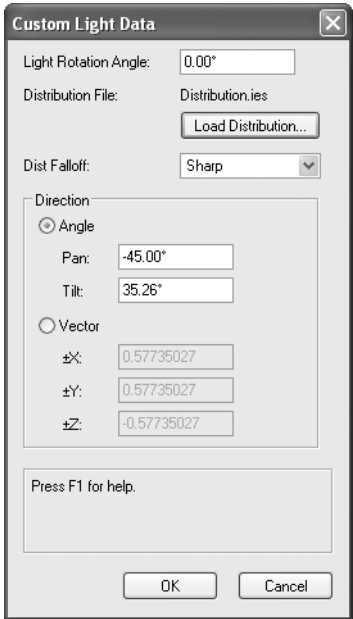
A custom light source’s emission distribution can be defined by a standard intensity distribution profile for accurate physical lighting.



To create a custom light:

1. Select the **Light** tool from the Visualization tool set, and then select **Custom Light** from the Tool bar.
2. Specify the custom light parameters by selecting **Light Preferences** from the Tool bar.

The Custom Light Data dialog box opens. Click **Load Distribution** and specify the location of the custom light distribution file, and then specify any additional custom light parameters.

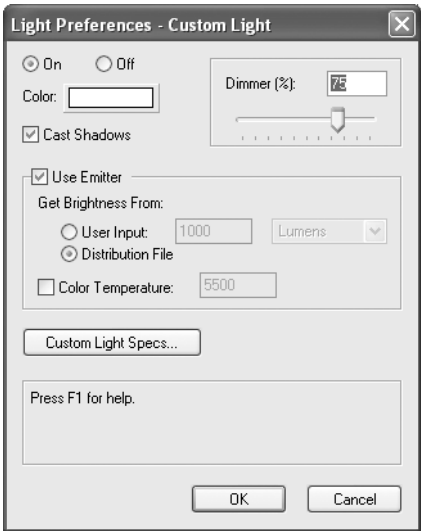


Parameter	Description
Light Rotation Angle	Specifies the rotation angle of the light source around an axis connecting the light location to the light target; this angle defines the reference plane for the intensity distribution curve
Distribution File	Displays the distribution file name when a valid distribution file has been selected, or “None” if a valid distribution file has not been designated (click <b>Load Distribution</b> to specify a file)
Load Distribution	Loads light emission profile data from a standard file. The brightness value is obtained using the integral of the raw emission data provided with the file. The file must be a text file with industry standard intensity distribution data in CIE, IESNA, CIBSE, or EULUMADAT format (.ies, .cib, .cie, and .ldt).
Dist Falloff	Select the distance falloff function (rate of intensity change while moving along the beam away from the light source)
Direction	Specifies the light’s direction by either specifying the light angle or vector

Parameter	Description
Angle	Sets the light's angle by pan and tilt. The pan angle is based on an angle of 0 degrees at the positive Y axis, and is positive in a counter-clockwise direction; the tilt angle is equal to 0 at the horizontal plane, positive when pointing below the plane, and negative when pointing above the plane.
Vector	Indicates the direction of the light by specifying the coordinates of its X, Y, and Z delta vectors

3. Click **OK**.

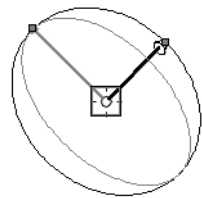
The Light Preferences - Custom Light dialog box opens. Specify additional custom light parameters. Emitter parameters are specified by the distribution file, and cannot be changed.



Parameter	Description
On/Off	Shows or hides the light produced by the light source
Color	Specifies a color associated with the light source; click the color box to select the color. This parameter is not available if a <b>Color Temperature</b> is specified.
Cast Shadows	Creates shadows
Dimmer	Dims the light source brightness (intensity); enter a percentage or drag the slider bar. Only the brightness of the light source is affected; the color temperature is not changed.
Use Emitter	A custom light's actual brightness and color temperature must be specified, so this setting is not optional
Get Brightness From	Specifies the luminous quantity of the area or line light as a manually entered value or from a loaded distribution file
User Input	Manually specifies the brightness in Lux or Lumens

Parameter	Description
Distribution File	Sets intensity distribution data with a standard file specified in <b>Custom Light Specs</b> . The brightness value is obtained using the integral of the raw emission data provided with the file.
Color Temperature	<p>Specifies the light color temperature in Kelvin. This refers to an ideal black body emitter, glowing “red hot” or “white hot.” A lower temperature generates an orange color; the hotter the temperature, the closer to white the color of the light is (see “Correlated Color Temperature” on page 732 for typical light source color temperature ranges).</p> <p>Specifying this parameter is optional. If not specified, the default temperature is 0, meaning that the final emission color for the light is entirely controlled by the selection in <b>Color</b>.</p> <p>When the temperature is specified, <b>Color</b> cannot be changed. The final emission color is set by the <b>Color Temperature</b>.</p> <p><a href="#">Color temperature settings can be white-balanced on a per-layer basis; see “Setting Lighting Options” on page 420.</a></p>
Custom Light Specs	Specifies additional custom light options and loads a distribution file

- 4. Click **OK** to return to the drawing.
- 5. Click in the drawing to insert the custom light.



The custom light object is represented by a pair of perpendicular arrow-head vectors and two perpendicular circles. The black vector points to the target location; its axis line (the light axis) connects the light source location to the target. The red vector starts at the light source location, pointing to a reference point on the “equator” of the polar intensity distribution. Also known as the “zero angle line,” it represents the origin for measuring the intensity on the light curve.

The two vectors form the black circle, and the red circle is perpendicular to it. The black circle represents the original plane where the light curves are located. The red circle constrains the movement of the zero angle line.

After a custom light has been placed, the light parameters can be edited in the Object Info palette; see “Light Source Properties” on page 427.

## RenderWorks Features for OpenGL

- If RenderWorks is installed, the OpenGL render mode has additional features that help you to preview and adjust a scene before it is rendered with RenderWorks.
- Turn on the **Draw Edges** feature to outline objects more clearly in the rendered drawing; these edges are similar to those in the Hidden Line render mode. (See “OpenGL Render Options” on page 434 for details.)

- Turn on the interactive **Use Shadows** feature to see how the shadows fall with different types of lighting. The shadows render much faster than they do with RenderWorks, which makes it easier to adjust the lights quickly. (See “OpenGL Render Options” on page 434 for details.)
- OpenGL can display three types of RenderWorks backgrounds: One Color, Two Color, and Image. It cannot display Cloud and HDRI backgrounds. (See “Creating Layer Backgrounds” on page 656 for details.)

## Preparing to Render

Once the drawing is complete or near completion, any textures have been applied, and the desired lighting has been added, consider the following before rendering.

### Adding 3D Polygons

Though not necessary, adding 3D polygons can provide receptors to catch and reflect light and shadows, increasing the ability to represent real-world lighting situations. For example, a large, horizontal 3D polygon can be placed below a 3D drawing to represent the ground or a floor. Placing several 3D polygons at various angles and locations in a drawing can provide reflective and transparent receptors for more natural-looking results.

### Adjusting the View

Select one of VectorWorks’ standard views (see “Using Standard Views” on page 403), and use the **Flyover**, **Walkthrough**, **Translate View**, or **Rotate View** tools to orient the drawing. Though the view can be adjusted after the drawing is rendered, it is faster to set the view while in wireframe mode.

## Rendering the Entire Drawing

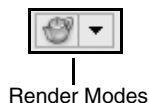
### RenderWorks Rendering Modes

RenderWorks offers several rendering modes, including custom rendering options, radiosity, and an artistic rendering option.

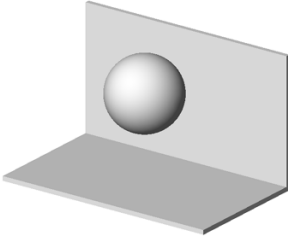
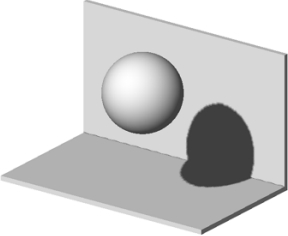
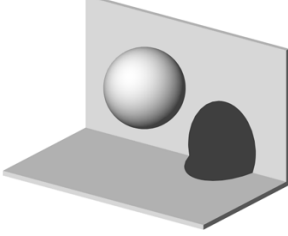
To render a drawing, select **View > Rendering** and the desired rendering mode. The rendering speed depends on the rendering option selected and the number and complexity of objects in the file.

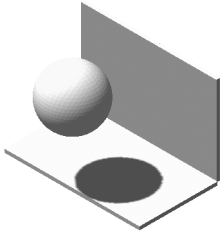
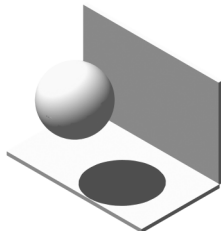
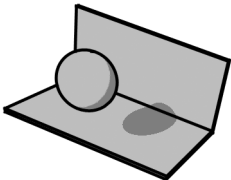
To cancel a rendering before it is complete, press the Esc key.

The **Current Render Mode** button on the View bar allows quick access to common rendering commands.



Save files in wireframe mode rather than in a rendered mode, so that files draw more quickly when opened. Rendered viewports are saved in a rendered state when **Save viewport cache** is selected in the Display tab of document preferences.

Rendering Mode	Description
Fast RenderWorks	<p>Renders without shadows, anti-aliasing, or ray tracing; low detail level</p> 
Fast RenderWorks with Shadows	<p>Renders with shadow-mapped shadows, but no anti-aliasing or ray tracing; low detail level</p> 
Final Quality RenderWorks	<p>Renders with reflections, refractions, ray-traced shadows, anti-aliasing, transparency, and a high level of detail</p> 
Custom RenderWorks	<p>Renders with parameters set by the user (see “Custom RenderWorks Options” on page 689)</p>

Rendering Mode	Description
Fast Radiosity	<p>Renders with fast RenderWorks parameters and includes basic radiosity settings, maximized for quick rendering</p> 
Final Quality Radiosity	<p>Renders with final quality RenderWorks parameters and includes radiosity and final gather rendering, maximized for quality</p>  <p>Complex drawings should be rendered with custom radiosity instead, to reduce rendering time while preserving quality.</p>
Custom Radiosity	<p>Renders with custom RenderWorks settings and radiosity parameters (see “Custom RenderWorks Options” on page 689 and “Setting Custom Radiosity Options” on page 694)</p>
Artistic RenderWorks	<p>Renders with multiple sketch styles for a hand-drawn look</p> 

### Custom RenderWorks Options

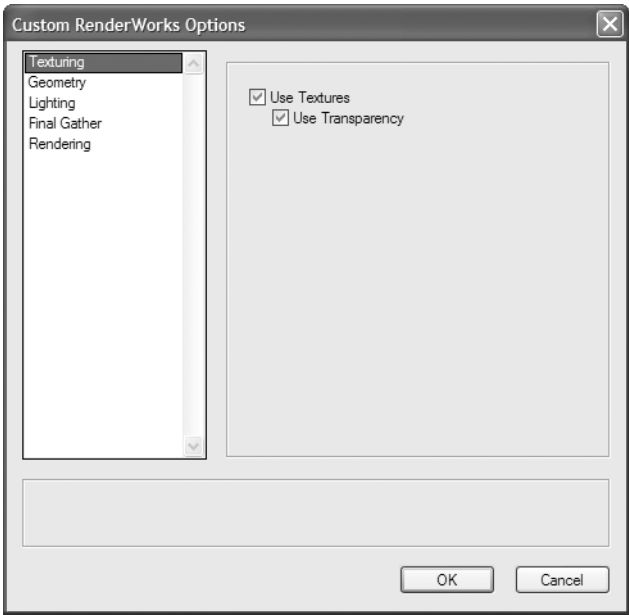
Custom render settings provide greater control over fine-quality rendering. These settings are used exclusively by the **Custom RenderWorks** rendering mode. Custom geometry settings override the **3D conversion res** setting on the 3D tab in VectorWorks preferences. These settings apply only to the current drawing and remain in effect in the current drawing until the settings are changed. In addition, the settings are saved when creating templates (see “Using Drawing Tablets” on page 78).

Custom RenderWorks includes final gather rendering, which offers superior indirect lighting calculations for a better, more detailed, end result. Scenes which are too complex to render with radiosity can still take advantage of indirect lighting effects by rendering them with Custom RenderWorks and final gather rendering.

To set Custom RenderWorks rendering options:

- 1. Select **View > Rendering > Custom RenderWorks Options**.

The Custom RenderWorks Options dialog box opens. Select a category from the list on the left to see the associated parameters on the right.



Parameter	Description
<b>Texturing</b>	
Use Textures	Applies the textures assigned to objects; deselect for faster rendering
Use Transparency	Select to render transparent textures and shadows where applicable; deselect for faster rendering without transparency
<b>Geometry</b>	
Curve Detail	Select Low, Medium, High, or Very High faceting and shadow resolution. Low produces an image with less detail and a faster rendering speed. Very High produces an accurate image but requires more time to render.
Use NURBS	Select to use NURBS surfaces during rendering, providing a higher quality rendering for curved surfaces; deselect for faster rendering. To smooth mesh objects, enable mesh smoothing in the document preferences (see “Display Preferences” on page 48).
<b>Lighting</b>	
Use Shadows	Select to render shadows, and select the type of shadow to create



Parameter	Description
Ray Traced Shadows	Select to create sharp-edged shadows. Ray tracing determines if each pixel is in shadow. Rendering times are longer due to this pixel-by-pixel sampling, but sharply defined shadows are created. The <b>Cast</b> and <b>Receive Shadows</b> option in the Edit Texture dialog box only works for ray traced shadows.
Transparent Shadows	When creating ray traced shadows, transparent shadows are an option; select to show the texture and color of the shadowing object in the shadow
Shadow Mapped Shadows	Select to create soft-edged shadows. Shadow mapping determines whether a pixel is in shadow by comparing the pixel position to a shadow map. Shadow maps are saved and require buffer memory (for example, a point light requires six shadow maps). Lower <b>Map Detail</b> levels produce softer shadows, render faster, and require less memory. Higher <b>Map Detail</b> levels require more memory and produce sharper shadow edges.
Sampling Quality	Select the level of detail for area, line light, and environment (HDRI background) geometry; higher detail provides better resolution, with texture detail and softer shadows, but requires more time to render
Lighting Options	Click <b>Layer Lighting Options</b> (from a design layer) or <b>Viewport Lighting Options</b> (from a viewport) to quickly access the associated lighting options dialog box. See “Setting Lighting Options” on page 420 for more information.
<b>Final Gather</b>	
Use Final Gather	Produces single-bounce indirect lighting effects
Detail Size	Controls the terminating resolution for light and shadow detail. Setting the size lower captures more indirect lighting details, resulting in a higher-quality image that also takes longer to render.
Accuracy	Affects the resolution of indirect lighting effects. Enter a value, or drag the slider to the right to increase the quality and smoothness, but also the render time.
Calculate Rough Specular Highlights	For reflectivity shaders, increases the number of traced specular rays, resulting in a more accurate specular highlight. The <b>Roughness</b> setting for reflectivity shaders (see “Importing Images for Reflectivity Shaders” on page 643) affects this parameter.
<b>Rendering</b>	
Use Anti-Aliasing	Select for smoother edges on objects and textures; deselect for faster rendering with rougher edges
Use Ray Tracing	Creates more realistic-looking reflective objects; rendering speeds will be affected, but improved quality will result.
Max Refractions	Increase the refraction level for drawings with transparent objects, including overlapping image props, so that they do not appear opaque. In general, set the refraction level to that of the number of overlapping objects; if there are four overlapping image props, for example, set the recursion level to four.
Max Reflections	Enter the number of levels of reflection among objects; a higher value slows rendering, but yields a more realistic image, especially for glass or mirrored objects

Parameter	Description
Auto-Adjust Exposure	Automatically adjusts the rendered image exposure for overly illuminated scenes (this is particularly useful for light types with intensity options specified)
Brightness	Adjusts the exposure brightness, if the automatic adjustment does not produce the desired result; enter a value or drag the slider to the right to increase the brightness (above 100%) or to the left to decrease the brightness (below 100%)

When testing a rendering, set the detail to low and turn textures and NURBS surfaces off. Lower rendering quality is offset by faster rendering times.

- 2. Click **OK** to set the Custom Render options.

## Radiosity

Although they are effective and relatively efficient, the ray-tracing calculations used in RenderWorks rendering modes cannot produce the full range of lighting effects seen in the real world. The most realistic, yet intensive, rendering effects require radiosity. By adding the indirect lighting and soft lighting effects of radiosity, a rendering can seem highly realistic.

Radiosity is a rendering technique that models light energy transfer between drawing geometry and materials. Radiosity treats each section of drawing geometry as both an absorber and emitter of light. Light energy starts from the light sources present in the drawing; the surfaces that the light illuminates then re-emit the light energy, with changes to the light quality producing softer shadows, color “bleeding” between differently-colored surfaces (because a colored surface re-emits colored light), and softer, diffused lighting. The light energy bounces around until it stops producing an effect.



The radiosity rendering method generates large mesh structures to resolve lighting details in the image. The parameters necessary to create a drawing with radiosity, combined, are called a “radiosity solution.” It is possible for the radiosity solution to require too much detail or such high amounts of mesh data that the rendering cannot take place over a reasonable time period. By balancing the need for sufficient detail in important parts of the image with the exclusion of excess data that is not as necessary, a good radiosity solution can be produced. In addition, the use of final gather rendering with radiosity can improve quality and shorten render times. RenderWorks provides the tools necessary to create the radiosity solution properly, for a high-quality rendering in the shortest possible amount of time.

Radiosity can be highly effective for “matte” drawings. It cannot produce indirect lighting effects for specular reflections, or for light distorted by glass.

Radiosity is available with three RenderWorks commands. For a quicker, lower-quality radiosity solution, select **View > Rendering > Fast Radiosity**. For a high-quality, but slower, radiosity solution, select **View > Rendering > Final Quality Radiosity**. Finally, for complex drawings, **Custom Radiosity** rendering allows the radiosity solution to be controlled by setting up and testing the radiosity solution manually.

## Radiosity Workflow

It can take some time to come up with an effective radiosity solution for a drawing. In addition, the rendering process itself can require significant amounts of time. Therefore, certain steps are recommended in order to achieve the best radiosity rendering.

1. The drawing should be as close to completion as possible. Modifications to the drawing geometry, materials, or lighting will cause the radiosity solution to be deleted, requiring the solution to be regenerated at the next render.

Radiosity solutions for design layers are not saved with the file. For viewports, individual radiosity solutions for each render mode that supports radiosity are stored with the file, if the **Save viewport cache** option is selected on the **Display** tab of document preferences.

2. For a preliminary view of the radiosity solution, select **View > Rendering > Fast Radiosity**. If the drawing is not too complex, then select **View > Rendering > Final Quality Radiosity**. The automatic radiosity solution and final gather rendering clean-up provided may be exactly what is required for the final presentation of a drawing.

A rendering made with final quality radiosity may take a considerable amount of time. For a complex model, optimizing the radiosity settings first and then rendering with custom radiosity is recommended.

3. For a custom radiosity solution, first specify the custom RenderWorks parameters by selecting **View > Rendering > Custom Radiosity Options**, and make custom settings for the categories in the Custom Radiosity Options dialog box (see “Custom RenderWorks Options” on page 689). Selecting **Use Final Gather** is recommended, for clean-up of triangular artifacts and light and shadow leaks, and for the indirect lighting of objects which are excluded from the radiosity solution. Like radiosity, final gather rendering creates indirect lighting effects, but from a single light bounce rather than the multiple light energy transfers of radiosity. A combination of “coarse” radiosity and “fine” final gather rendering settings can produce efficient, high-quality rendering effects.
4. With a specific setting, objects and textures can override the radiosity parameters, so that they always participate in a custom radiosity rendering (this allows radiosity settings to be set to exclude many other objects, without eliminating these specific textures and/or objects, saving unnecessary calculation time). For maximum efficiency, exclude all but the largest or most important objects from the radiosity rendering, and set the final gather rendering to handle the indirect lighting effects of the remaining objects.

Textures and objects can specifically only receive light, or both receive and emit light. Specify these overrides before attempting the radiosity rendering. For these types of textures, click **Radiosity Options** in the Edit Texture dialog box, and then select **Override Radiosity Settings**. To allow certain objects to override the radiosity settings, select **Override Radiosity** on the Render pane in the Object Info palette. An object can override its texture settings; if a texture does not have an override, but the object does, the override applies.

5. To optimize the radiosity solution, select **View > Rendering > Custom Radiosity Options**, and then click the Radiosity Options category in the Custom Radiosity Options dialog box. These parameters are described in “Setting Custom Radiosity Options” on page 694.
  - Click **Optimizations** to limit the radiosity bounds, if possible; for example, if only one area of a large model is illuminated, the rest of the model can be excluded from the radiosity calculations.
  - Select **Allow Special Overrides** to include specially-marked textures and objects regardless of the radiosity settings.
  - Click **Show Color-Coded Preview** in the Radiosity Options category of the Custom Radiosity Options dialog box, to preview the drawing while setting the sliders to their optimal positions. Insignificant geometry should be optimized out of the solution, until the preview displays that the final results will have the desired detail sizes.

6. Test the radiosity solution by setting a **Time Limit** and **Energy** percentage, and then press **Start**. During solution generation, a rendered preview of only the indirect lighting is shown in the drawing window, and solution statistics are displayed. Press the Esc key to further refine the solution, and then press **Resume** to continue it. Once the preview displays an acceptable solution, press **Accept**.
7. Render the customized radiosity solution for final presentation by selecting **View > Rendering > Custom Radiosity**.

To stop the generation of a radiosity rendering, press the Esc key, or Command-period (Macintosh), Ctrl-period (Windows), and a dialog box opens, asking whether to continue, delete, or accept the current solution.

A radiosity solution is view-independent. The view can be changed, or the **Flyover**, **Pan**, and **Zoom** tools used, for example, and the current solution is used to re-render the drawing. However, changes to the drawing geometry, textures, fill colors, materials, or lighting cause the solution to be deleted.

## Setting Custom Radiosity Options

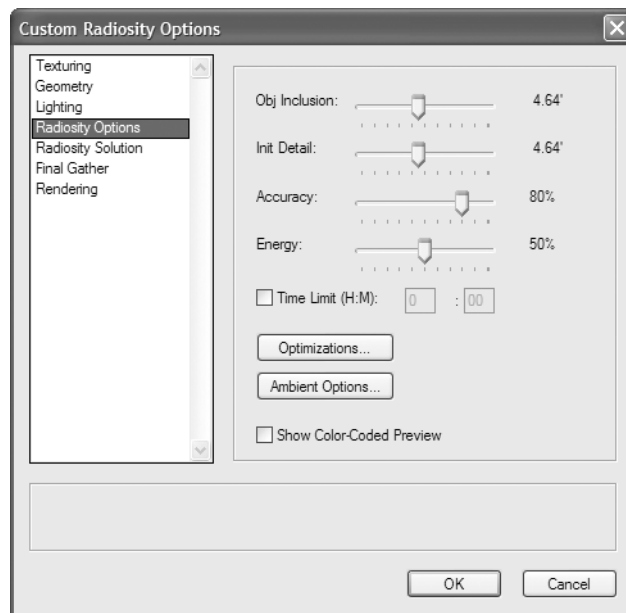
Setting the radiosity options for custom radiosity rendering provides a high level of control over the radiosity solution. The radiosity solution can be tested, stopped, changed, and resumed in order to determine the best parameters for rendering in a reasonable amount of time.

To set custom radiosity options:

1. Select **View > Rendering > Custom Radiosity Options**.
2. The Custom Radiosity Options dialog box opens. Select a category from the list on the left to see the associated parameters on the right.

The Texturing, Geometry, Lighting, Final Gather, and Rendering categories contain parameters described in “Custom RenderWorks Options” on page 689. The parameters set in these categories are identical to the custom RenderWorks settings, but apply to the custom radiosity rendering.

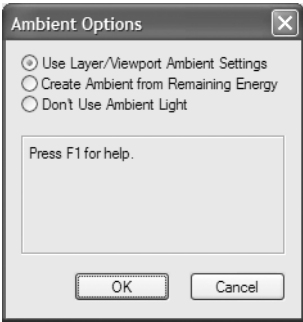
3. Click the Radiosity Options category to specify the custom radiosity settings.



Parameter	Description
Obj Inclusion	Controls the number of objects participating in the radiosity solution; objects below this size receive light energy, but do not emit it. Drag the slider to the right to increase the number of objects included. For maximum efficiency, set the size high enough to include only the largest and most significant objects, and enable final gather rendering to handle the smaller objects.
Init Detail	Controls the size of the emitting surfaces and the starting size of the receiving surfaces; drag the slider to the right to decrease the triangle (mesh) size
Accuracy	Controls the tendency for the mesh to approach the terminating resolution for light and shadow details; increasing this parameter affects the resolution of indirect shadows. In addition, it affects the accuracy of the light transport from surface to surface. Drag the slider to the right to increase the accuracy percentage.
Energy	Sets the amount of indirect light energy for the radiosity solution; when this level is attained, the solution is complete. Drag the slider to the right to further refine an existing solution.
Time Limit	Specifies a time limit in hours and minutes for terminating the radiosity solution. The solution terminates when either the time limit is reached or the desired <b>Energy</b> limit has been achieved (whichever comes first).
Optimizations	Specifies further control over which surfaces participate in the radiosity solution
Ambient Options	Specifies the ambient lighting setting; ambient lighting can have a significant effect on a radiosity rendering
Show Color-Coded Preview	<p>Provides a visual indication of the detail sizes and optimizations applied to the current scene, to quickly be able to eliminate insignificant geometry from the solution. The preview is color-coded to denote object inclusion, bounding volume limit, and initial detail values.</p> <ul style="list-style-type: none"> <li>• Red: Obj Inclusion (shows objects receiving but not emitting light)</li> <li>• Yellow: Init Detail</li> <li>• Black: Objects that are not included in the radiosity solution and are neither emitting nor receiving light, because they are outside the bounding volume (specified in <b>Optimizations</b>), or have overrides applied to them</li> <li>• Grayscale: Objects that are both receiving and emitting light energy are shown in a grayscale relative to their size</li> </ul>

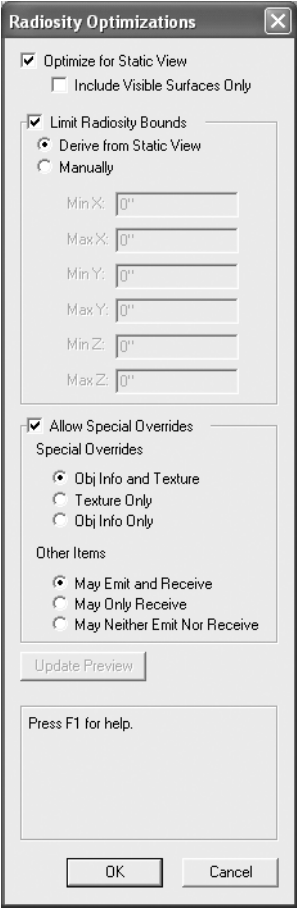
4. To control the ambient light options, click **Ambient Options**.

The Ambient Options dialog box opens. Normally, ambient lighting should be turned off for a radiosity rendering, to avoid overlighting.



Parameter	Description
Use Layer/Viewport Ambient Settings	Uses the ambient lighting setting specified in the Layer Lighting Options dialog box ( <b>View &gt; Lighting &gt; Set Layer Lighting Options</b> ) or in the Viewport Lighting Options dialog box (click <b>Lighting Options</b> from the Object Info palette Shape tab of a selected viewport)
Create Ambient from Remaining Energy	Converges the solution to the percentage specified in <b>Energy</b> and then applies the remaining light energy to all the objects as ambient light energy (can cause a scene to become overly bright if a significant amount of light energy remains)
Don't Use Ambient Light	Turns off ambient lighting for the radiosity rendering, which is recommended when emphasizing indirect lighting effects

5. To control which surfaces participate in the radiosity solution, click **Optimizations**. Before the solution is generated, visibility information is gathered to exclude insignificant objects from the solution, either because they are not visible, or they are not participating in the indirect lighting scheme. If textures and/or objects have radiosity overrides, enable the overrides.



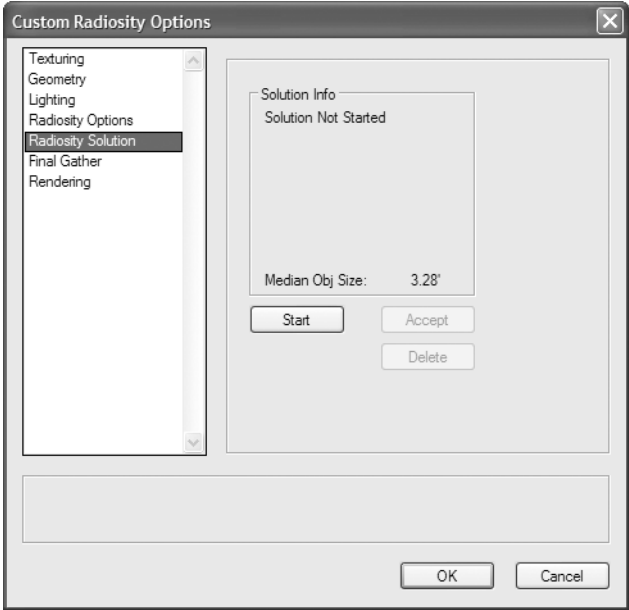
Parameter	Description
Optimize for Static View	Enables optimization options for rendering a static view with radiosity (deselect if planning to change views or create a movie from the rendering)
Include Visible Surfaces Only	Only visible surfaces participate in receiving and emitting indirect light; use overrides to include specific non-visible objects in the rendering
Limit Radiosity Bounds	Limits the radiosity solution to a 3D bounding volume (for example, the rest of a building may not need to participate in the rendering, when only one room is of interest)
Derive from Static View	Automatically determines the radiosity bounds using visibility data of objects in the current view gathered for static view optimization; includes objects behind the viewer
Manually	Specifies manual coordinates for the bounding volume. The bounding volume is previewed with dotted lines; objects outside the bounding volume are shown in black. Specify the minimum and maximum X, Y, and Z coordinates to determine the bounding volume.

Parameter	Description
<b>Allow Special Overrides</b>	Allows specific objects to participate in emitting or receiving indirect lighting during radiosity processing
Special Overrides	Sets the participation of objects with radiosity overrides set in the Object Info palette and textures with overrides set in the Edit Texture dialog box
Obj Info and Texture	Enables the override options in both the Edit Texture dialog box and the Render tab of the Object Info palette to allow objects and textures with overrides to emit or receive indirect lighting during radiosity processing, regardless of the custom radiosity parameters
Texture Only	Enables the <b>Override Radiosity Settings</b> option in the Edit Texture dialog box to allow objects with that texture applied to emit or receive indirect lighting during radiosity processing, regardless of the custom radiosity parameters
Obj Info Only	Enables the <b>Override Radiosity</b> option on the Render tab of the Object Info palette to allow specific objects to emit or receive indirect lighting during radiosity processing, regardless of the custom radiosity parameters
Other Items	Sets the emit/receive properties of objects and textures without overrides <a href="#">Emitting surfaces are processed from brightest to darkest</a>
May Emit and Receive	Allows objects and textures without overrides to possibly receive and re-emit light energy, depending on the radiosity settings
May Only Receive	Allows objects and textures without overrides to possibly receive light energy, depending on the radiosity settings, but not re-emit it
May Neither Emit Nor Receive	Allows objects without overrides to neither emit nor receive light energy, excluding them from participating in the radiosity solution. These objects and textures are rendered only by direct lighting.
Update Preview	Updates the color-coded preview ( <b>Show Color-Coded Preview</b> must be selected in the Radiosity Options category of the Custom Radiosity Options dialog box)

- Click the Radiosity Solution category to generate the solution.

The radiosity settings are used for a rendering with radiosity when **View > Rendering > Custom Radiosity** is selected. However, the radiosity solution can be generated from the Custom Radiosity Options dialog box first, if desired, in order to refine a solution until it is acceptable. By using the color-coded preview and the Solution Info controls (**Start/Resume**, **Accept**, **Delete**, and the Esc key), the radiosity solution can be refined until the best quality is achieved in the shortest amount of time.





Parameter	Description
Solution Info	<p>Displays statistics gathered from the current solution, while a solution is being generated and once it is complete</p> <ul style="list-style-type: none"><li>• <b>Energy</b>: displays the solution’s indirect light energy value; when this value reaches the <b>Energy</b> setting, the current solution has been produced.</li><li>• <b>Emitting</b>: shows the number of triangles emitting light energy</li><li>• <b>Receiving</b>: shows the number of triangles receiving light energy</li><li>• <b>Time Used</b>: displays the elapsed solution time</li><li>• <b>Time Remaining (Est.)</b>: displays an estimate of the remaining time until the <b>Energy</b> level has been reached and the solution is complete</li><li>• <b>Median Obj Size</b>: displays the median size of objects in the model, and sets the halfway position for the <b>Obj. Inclusion</b>, <b>Init Detail</b>, and <b>Small Detail</b> parameter sliders</li></ul>
Start/Resume	<p>Begins generating the radiosity solution, or proceeds with a paused solution if the <b>Energy</b> percentage has not been achieved.</p> <p>To pause the generation of a radiosity solution, press the Esc key, or Command-period (Macintosh), Ctrl-period (Windows).</p>
Accept	<p>When a solution exists, but the specified <b>Energy</b> value has not been reached, pressing <b>Accept</b> changes the <b>Energy</b> slider to the current solution’s energy value</p>
Delete	<p>Deletes a solution; press <b>Start</b> to restart the solution from the beginning</p>

Once a solution has been completed, the radiosity parameters cannot be changed. Click **Delete** if changes are desired, and then generate the solution again by pressing **Start**.

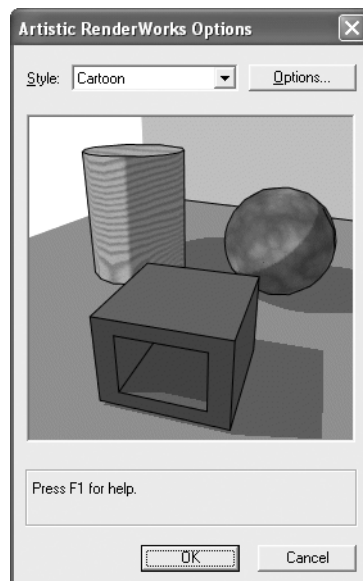
## Artistic RenderWorks Options

When selecting the Artistic RenderWorks mode, a variety of styles and options are available to create a hand-drawn or artistic look for a 3D drawing. These settings apply only to the current drawing and remain in effect in the current drawing until the settings are changed. In addition, the settings are saved when creating templates (see “Using Drawing Tablets” on page 78).

Artistic RenderWorks does not produce sketch rendering of 2D objects.

To set Artistic RenderWorks options:



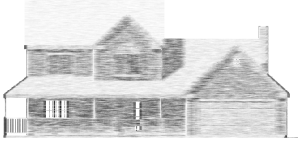
1. Select **View > Rendering > Artistic RenderWorks Options**.
2. The Artistic RenderWorks Options dialog box opens. A preview scene is shown in order to evaluate the effects of the different options.


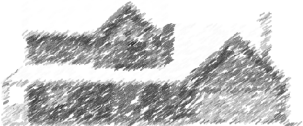





3. Select the **Style** from the list, and then click **Options** to set specific style parameters. The preview image displays the resulting effect.


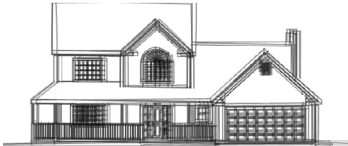
Certain Artistic RenderWorks styles use hidden line rendering. These styles may require longer rendering times for drawings with many facets (polygons). A style that does not use hidden line rendering is recommended for extremely complex drawings.



Many of the Artistic RenderWorks styles allow the layer's RenderWorks background to show through, if one has been defined and applied (see “Applying RenderWorks Backgrounds” on page 676).

Artistic RenderWorks Option	Description	Uses Hidden Line Rendering	Shows Background
Cartoon	Traces a border around edges of objects and combines simplified shading with drawn edges 	yes	no
Line Color	Specify the outline color by clicking the color box		
Line Width	Specifies the outline thickness		
Color Wash	Traces a border around the object edges, fades out color, and can provide a mottled appearance 	yes	no
Line Color	Specify the outline color by clicking the color box		
Line Width	Specifies the outline thickness		
Mottling	Adds lighter/darker areas, for a mottled appearance		
Wash	Fades colors for a washed-out appearance		
Contour	Uses directional lines to represent the image shapes 	no	yes
Line Length	Indicates the contour line length		
Line Density	Indicates the contour line density; higher density better defines the image shapes, while lower density allows more of the background to show through		
Line Color	If <b>Use Object Colors</b> is deselected, specify the contour line color by clicking the color box		
Use Object Colors	Draws contour lines using the image colors for each area of the image; deselect to use a single color		

Artistic RenderWorks Option	Description	Uses Hidden Line Rendering	Shows Background
Tapered Lines	Simulates a hand drawing of the image, with lines that taper 	yes	yes
Line Color	Specify the outline color by clicking the color box		
Line Width	Specifies the outline thickness		
Wobbliness	Indicates the amount of deviation from the intended outline		
Curliness	Increasing the slider adds waviness to the intended outline		
Tapering	Varies the outline thickness by tapering		
Hatch	Shades the image with hatch lines, all with the same angle 	no	yes
Line Color	If <b>Use Object Colors</b> is deselected, specify the hatch line color by clicking the color box		
Line Width	Indicates the hatch line thickness		
Wobbliness	Indicates the amount of deviation from a straight hatch line		
Line Length	Specifies the hatch line length		
Line Density	Sets the number of hatch lines; higher density better defines the image shapes, while lower density allows more of the background to show through		
Use Object Colors	Draws hatch lines using the image colors for each area of the image; deselect to use a single color		

Artistic RenderWorks Option	Description	Uses Hidden Line Rendering	Shows Background
Ink Print	Draws the image with a solid color and outlines the image with the background color 	yes	yes
Ink Color	Specifies the solid color		
Gap Width	Indicates the outline thickness		
Lines and Shadow	Traces a border around the edges of objects and displays shadows 	yes	yes
Line Color	Indicate the outline color by clicking the color box		
Line Width	Specifies the outline thickness		
Shadow Color	Indicate the color of any shadows by clicking the color box		
Mosaic	Displays the image as mosaic tiles 	no	yes
Gap Color	Specifies the color for the spaces between the tiles		
Gap Width	Sets the gap width between the tiles		
Tile Size	Indicates the size of the tiled sections		
Tile Shape	Sets the tiles' irregular appearance		
Gap Transparency	Specifies the transparency of the gap between the tiles; allows more or less of the background to show through		

Artistic RenderWorks Option	Description	Uses Hidden Line Rendering	Shows Background
Oil Painting	Provides the appearance of an oil painting 	no	yes
Mark Size	Specifies the brush stroke size		
Mark Count	Indicates the brush stroke number; more brush strokes better define the image shapes, while lower density allows more of the background to show through		
Mark Blend	Sets how well the brush strokes blend together		
Overlapping Lines	Simulates a hand-drawn pencil or marker drawing with multiple strokes of well-defined line(s) 	yes	yes
Line Color	Indicate the line color by clicking the color box		
Line Width	Specifies the thickness of the line(s)		
Line Count	Sets the number of lines drawn to define the drawing outline		
Wobbliness	Indicates the amount of deviation from the intended outline		
Curliness	Increasing the slider adds waviness to the intended outline		

Artistic RenderWorks Option	Description	Uses Hidden Line Rendering	Shows Background
Soft Lines	Simulates a hand-drawn pencil drawing with soft, smudged pencil line(s)  	yes	yes
Line Color	Indicate the line color by clicking the color box		
Line Width	Specifies the line thickness		
Blurriness	Increase the slider for a softer line		
Coverage	Specifies the amount of transparent areas (pencil skips) in the line		
Scale	Specifies the size of transparent areas in the line		
Stipple	Represents the drawing with irregular dots or short strokes of color  	no	no
Dot Color	If <b>Use Object Colors</b> is deselected, specify the color for the stipple dots by clicking the color box		
Dot Count	Specifies the number of stipple dots to use		
Use Object Colors	Draws stippling using the image colors for each area of the image; deselect to use a single color		

- Click **OK** to set the Artistic RenderWorks options.


## Rendering a Selected Area

The **Render Bitmap** tool creates a rendered bitmap image of a selected area and places it on top of the drawing. Manipulate this image similar to imported images.

Use this tool to preview a section of a drawing, or create a layout of several rendered views. It is also possible to render the entire drawing, creating an image that can be sent to a printer for preview or final quality output, or exported into a different image file format and saved.

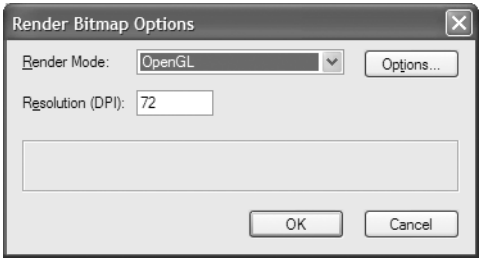
The **Render Bitmap** tool renders the image with the specified resolution and rendering mode. The bitmap created by the tool draws using the options selected on the Display tab in the document preferences (see “Setting Document Preferences” on page 48). Choose **Full Resolution**, **Reduced Resolution** or **Bounding Box**. The bounding box option displays as a gray rectangle bitmap image. Using this option saves re-drawing time when using the **Pan** tool or scroll bars.

The image created by the **Render Bitmap** tool is compressed by either the JPEG or PNG compression method, to reduce file size. The compression used depends on the **Default compression** selected on the Edit tab of VectorWorks preferences (see “Edit Preferences” on page 39).

 To render a specified area:

- 1. Select the **Render Bitmap** tool from the Visualization tool set.
- 2. Click the **Render Bitmap Preferences** Tool bar button.

The Render Bitmap Settings dialog box opens. Specify the rendering mode and any options.

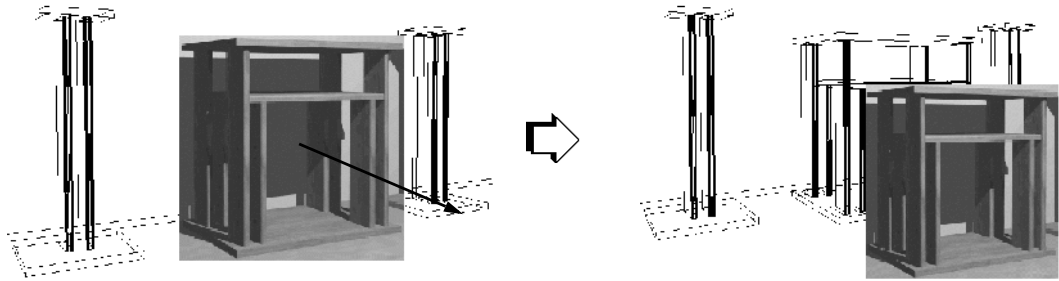


Parameter	Description
Render Mode	Select the rendering mode for the image; if the mode has additional settings, click <b>Options</b> to make any changes (changes are also made to the design layer settings)
Resolution (DPI)	Specify the resolution for the bitmap in dots per inch; lower resolution values reduce file size

- 3. Click **OK**.
- 4. Click and drag to create a marquee box around the desired area.

The area is rendered and a bitmap image of the rendered area is placed on top of the original area.

- 5. Move the new image to the desired location.



After rendering, the rendered bitmap image can be cut from VectorWorks and pasted into any image editing program for further manipulation.



## Batch Rendering

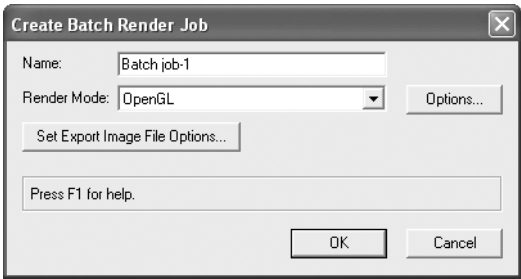
Batch rendering allows several images to be rendered while the computer is unattended. Each batch job retains its own view, rendering mode, resolution, and export settings.

### Creating Batch Rendering Jobs

The batch rendering job specifies the job name, rendering mode and options, and image dimensions and format, for the current drawing file.

To create a batch rendering job:

1. Establish the desired file view and level of magnification.  
The Export Image File settings determine the specific dimensions of the exported area and the visibility of objects (see “Exporting an Image File” on page 521).
2. Select **View > Rendering > Create Batch Render Job**.  
The Create Batch Render Job dialog box opens. Specify the rendering job parameters and click **OK**.



Parameter	Description
Name	Specifies the rendering job name for creating the batch
Render Mode	Select the rendering mode from the list
Options	For <b>OpenGL</b> and <b>Custom RenderWorks</b> rendering modes, the default file settings are in effect; to change the settings, click <b>Options</b> . These changes apply to the current job only.  For more information on OpenGL settings, see “Rendering with VectorWorks” on page 431. For Custom RenderWorks settings, see “Custom RenderWorks Options” on page 689.
Set Export Image File Options	Opens the Export Image File dialog box for specifying the rendered image file settings, including export area and format

The **Marquee** export area option in the Export Image File dialog box is not available for batch rendering jobs.

3. Create additional batch rendering jobs as required.  
Batch jobs can be renamed, edited, or deleted from the Start Batch Render dialog box.

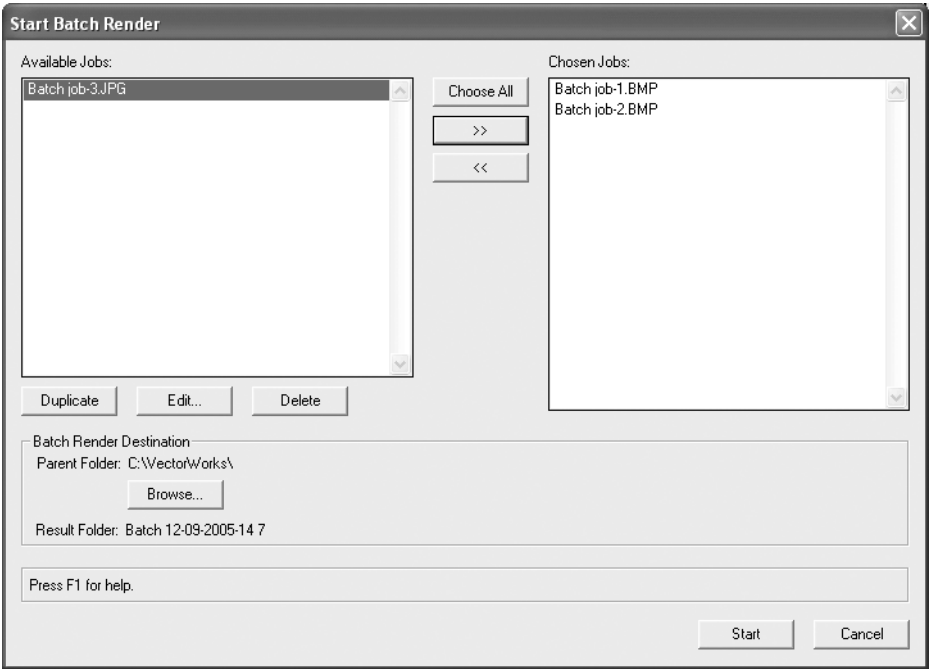
## Starting the Rendering Job Batch

Once rendering jobs have been created, specify their order and the rendered file location.

To specify the rendering job batch:

1. When it is time to begin the batch rendering process, select **View > Rendering > Start Batch Render**.

The Start Batch Render dialog box opens. Select the jobs to be rendered and specify the file location for the resulting rendered images.



Parameter	Description
Available Jobs	Lists the current batch render jobs in order of job creation; the jobs are displayed with the image file extension to be generated according to the job settings
Chosen Jobs	Lists the currently selected render jobs in order of execution; the most recently added job is placed at the end of the list
Choose All	Moves all <b>Available Jobs</b> to the <b>Chosen Jobs</b> list
>> button	Moves the selected job from the <b>Available Jobs</b> list to the end of the <b>Chosen Jobs</b> list
<< button	Moves the selected job from the <b>Chosen Jobs</b> list to the end of the <b>Available Jobs</b> list
Duplicate	Copies the selected available job and adds it to the end of the <b>Available Jobs</b> list; specify a new name for the job in the Assign Name dialog box
Edit	Opens the Edit Batch Render Job dialog box, for changing the parameters of the selected job
Delete	Removes the selected job from the list of available render jobs (no undo)

Parameter	Description
Browse (Windows)/ Choose (Macintosh)	Specifies the <b>Parent Folder</b> location, where all batch rendering resulting files will be located. By default, this is the application folder. The result sub-folder name is also displayed (this sub-folder is named according to the current date and time).

- Click **Start** to begin the batch rendering.  
The Batch Render Progress dialog box displays the status of the batch rendering. Press the Esc key to cancel the current job and proceed with the remaining batch jobs. Press **Cancel** to cancel all batch rendering jobs.
- As each job is rendered, the resulting file is placed in the Results Folder.

## Managing Lights and Cameras

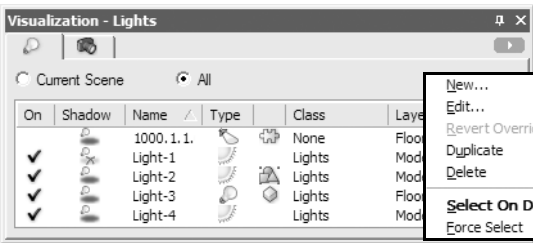
The Visualization palette provides fast and easy access to all lights and cameras in a VectorWorks file. Lights and cameras can be selected, edited, duplicated, created, and deleted. The palette also controls lighting overrides for selected sheet layer viewport(s), without modifying the lighting on the design layer or in another viewport.

Tasks that can be performed from the Visualization palette include:

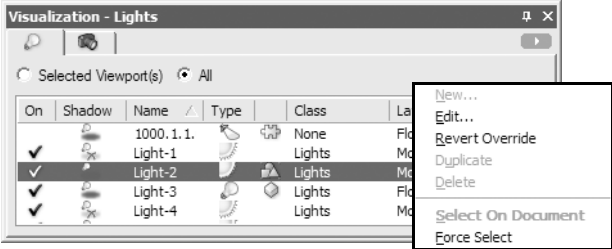
- Quickly locating any light in the file;
- Editing of any light or lights in the file, even lights that are inside a container object or on a different layer;
- Creating lighting overrides for sheet layer viewports;
- Managing light and camera objects, including creating, editing, deleting, duplicating, and sorting;
- Quickly switching to a camera’s established view.

To use the Visualization palette:

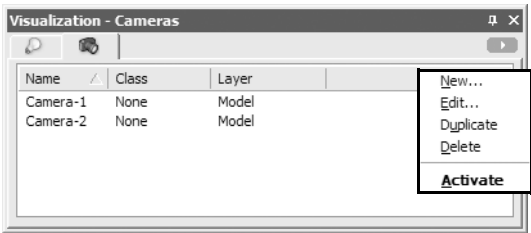
- Select **Windows > Palettes > Visualization**.  
The Visualization palette opens. The Visualization palette can remain open while working in the drawing.
- The Visualization palette contains two tabs: the Lights tab accesses lights, and the Cameras tab accesses cameras. The lights and cameras can be sorted by clicking in the header of any column.  
The Lights tab functions in two different modes depending on whether you are on a design layer or sheet layer. On a design layer, the palette lists either all the lights in the file, or just the lights that affect the current view. When on a sheet layer, the palette lists either all the lights in the file, or just the lights of selected viewports; edits to the selected viewport(s) affect the viewport lighting, creating an override, but this does not affect the associated design layer lighting.  
Depending on what action is being performed, different options are available in both the Visualization palette and the Visualization palette menu. Open the Visualization palette menu by clicking on the small triangle at the top right of the palette, or by accessing the context menu with a Ctrl-click (Macintosh) or right-click (Windows).











Design layer Visualization palette options







Sheet layer Visualization palette options



Visualization palette camera options

Parameter	Description
<b>Lights tab</b>	The Lights tab accesses the parameters of sheet layer viewports or all lights in the file
Current Scene	Displays only the lights which affect the current view (lights from the current layer and in visible classes)
Selected Viewport(s)	Displays only the lights which affect the currently selected sheet layer viewport(s); in this mode, lights can be edited to override the lighting of the selected viewports only. (Other Visualization palette light management commands are not available.) Select <b>Revert Override</b> to return the viewport to its original lighting.
All	Lists all the lights in the file
On	Click to toggle the light on or off; a check mark indicates that the light is on
Shadow	Click to toggle the ability of the lights to cast shadows on or off; a red “x” indicates that shadows are off
Override State	For lights in selected viewport(s), indicates whether the light has an override. <ul style="list-style-type: none"><li>• Uses design layer definition : the light parameters are the same in both the design layer and the viewport(s).</li><li>• Uses viewport override definition : the light parameters have been edited for the selected viewport(s), creating a viewport lighting override.</li></ul>
Name	Displays the name of the light (as shown on the Data tab of the Object Info palette)
Type	Indicates the type of light:  Directional  , Point  , Spot  , Custom  , Area  , or Line 

Parameter	Description
Light Parent	<p>Indicates whether the light is within a container object; if blank, the light is not part of another object.</p> <ul style="list-style-type: none"> <li>Group : indicates that the light is contained within a group.</li> <li>Symbol : indicates that the light is contained within a symbol; each instance is listed in the palette. Edits made directly from the Visualization palette, such as turning lights on and off, affect all symbol instances. (Selecting <b>Edit</b> from the Visualization palette menu, however, edits the symbol instance properties.)</li> <li>Plug-in Object : indicates that the light is contained in a plug-in object, such as a lighting device (Spotlight required)</li> <li>Layer Link : indicates that the light is contained within a layer link</li> </ul>
Class/Layer	Displays the light's class and layer
Menu commands	The Visualization palette menu commands manage and select light objects
New	Opens the Create Light dialog box, to create a directional, point, spot, or custom light on the current design layer; see "Adding Light Sources" on page 423
Edit	Opens the Properties dialog box, to edit the parameters of the currently selected light(s); when more than one light is selected, only common properties can be edited
Revert Override	Restores the original light parameters for the viewport(s), when the lights in selected sheet layer viewport(s) have been edited
Duplicate	Copies the currently selected light(s), placing the copy or copies on the same layer and in the same class as the original(s). Lights in symbols or plug-in objects cannot be duplicated.
Delete	Deletes the currently selected light(s). Lights in symbols or plug-in objects cannot be deleted.
Select On Document	<p>Selects the current light(s), and automatically centers the view on the light, or its container (alternatively, double-click on a light in the Visualization palette, if the light is in the active class or layer.) The light properties can then be edited in the Object Info palette or by clicking <b>Edit</b> from the Visualization palette menu. The selection and editing of multiple lights at once is supported.</p> <p><i>If the light is not in the active class or layer, use the <b>Force Select</b> command instead.</i></p> <p><i>The VectorWorks Display preference must be set to show lights.</i></p>
Force Select	If the light is in a different class or layer, activates the layer or class, and automatically centers the view on the light, or its container group or symbol. The light properties can then be edited in the Object Info palette or by clicking <b>Edit</b> from the Visualization palette menu. Multiple lights cannot be selected by this method.
<b>Cameras tab</b>	The Cameras tab accesses the parameters of the camera objects in the drawing
Name	Displays the name of the camera (as shown on the Data tab of the Object Info palette)
Class/Layer	Displays the camera's class and layer
Menu commands	The Visualization palette menu commands manage and select camera objects

Parameter	Description
New	Activates the <b>RenderWorks Camera</b> tool; click to place a camera object
Edit	Opens the Properties dialog box, to edit the parameters of the currently selected camera(s)
Duplicate	Copies the currently selected camera(s), placing the copy or copies on the same layer and in the same class as the original(s)
Delete	Delete(s) the currently selected camera(s)
Activate	Selects the current camera, and automatically changes the view to that of the camera (alternatively, double-click on a camera in the Visualization palette)

## Exporting a Rendered Drawing

All files rendered with RenderWorks can be exported. It is possible to export all or part of a drawing depending on the selected export format.

The image is re-rendered automatically before export.

## Exporting the Rendered Image

The **Export Image File** command exports a rendered drawing to a variety of image file formats. This command is described in detail in “Exporting Files” on page 519.

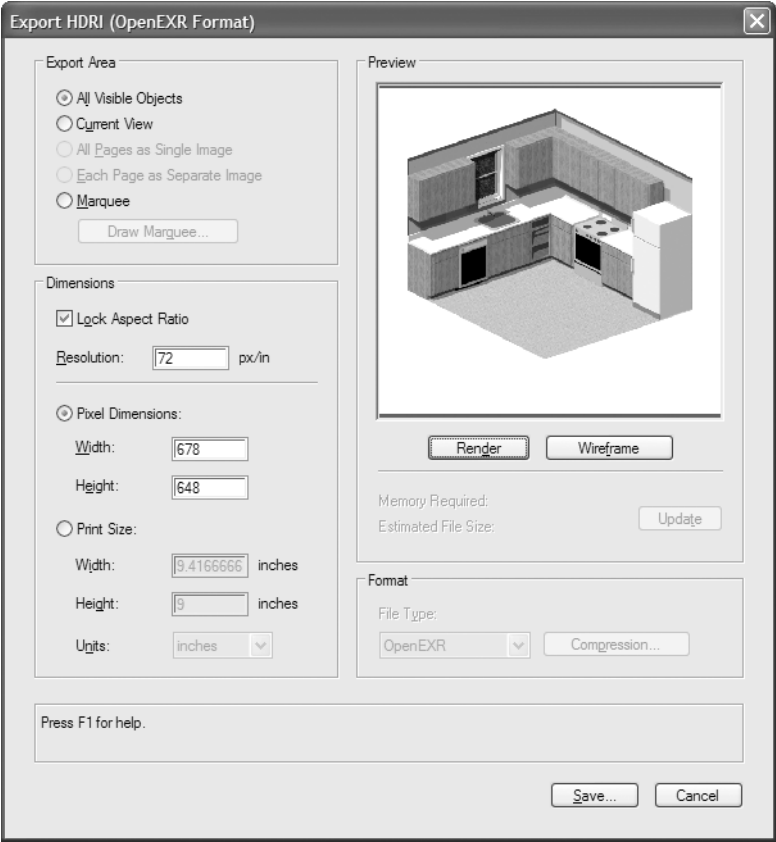
## High Dynamic Range Image (HDRI) Export

When RenderWorks is installed, the HDRI option is added to the list of export file choices. This command creates an OpenEXR file. This is a good choice for export when touching-up the image in an imaging program; the exported image is “lossless” and will not have quantization artifacts when color or exposure is further adjusted after export.

To export a file in HDRI format:

1. Select the RenderWorks rendering mode to use for the export, and render the image.
2. Select **File > Export > Export High Dynamic Range Image (HDRI)**.

The Export HDRI dialog box opens. Specify the dimensions and resolution for the exported image.



Parameter	Description
<b>Export Area</b>	
All Visible Objects	Exports an image that includes all visible objects (objects do not have to be currently on screen to be considered visible)
Current View	Exports an image that is exactly as it displays on the current screen
All Pages as Single Image	Not applicable for HDRI export
Each Page as Separate Image	Not applicable for HDRI export
Marquee	Exports the portion of the image specified with a marquee box. Select this option and then click <b>Draw Marquee</b> to temporarily close the dialog box. Click, and then drag to specify the area for export; the marquee dimensions are displayed on the Data bar. Click to set the export area and return to the Export Image File dialog box. The <b>Pixel Dimensions</b> of the image are automatically set to the marquee dimensions.
<b>Dimensions</b>	
Lock Aspect Ratio	Select to maintain the image aspect ratio when specifying dimensions

Parameter	Description
Resolution	Specifies the printed image resolution in pixels per inch
Pixel Dimensions	
Width/Height	Specifies the exported image dimensions; if <b>Lock Aspect Ratio</b> is selected, changes to one dimension will update the other to maintain the aspect ratio
Print Size	
Width/Height	Specifies the printed image dimensions in the selected <b>Unit</b> ; if <b>Lock Aspect Ratio</b> is selected, changes to one dimension will update the other to maintain the aspect ratio
Units	Select a unit to apply to the <b>Print Size</b> parameters
Preview	Displays a rendered or wireframe preview according to the current settings
Render	Updates the preview with a rendered view using the currently set rendering option
Wireframe	Updates the preview with a wireframe view
Memory Required/Estimated File Size	Not applicable for HDRI export
Update	Not applicable for HDRI export
Format	
File Type	Not applicable for HDRI export (always OpenEXR format)
Compression	Not applicable for HDRI export

3. Click **Save**.
- The Export OpenEXR File dialog box opens. Enter the name and location for saving the HDRI format file. Click **Save** to export the file. The file is created and saved in the location specified.

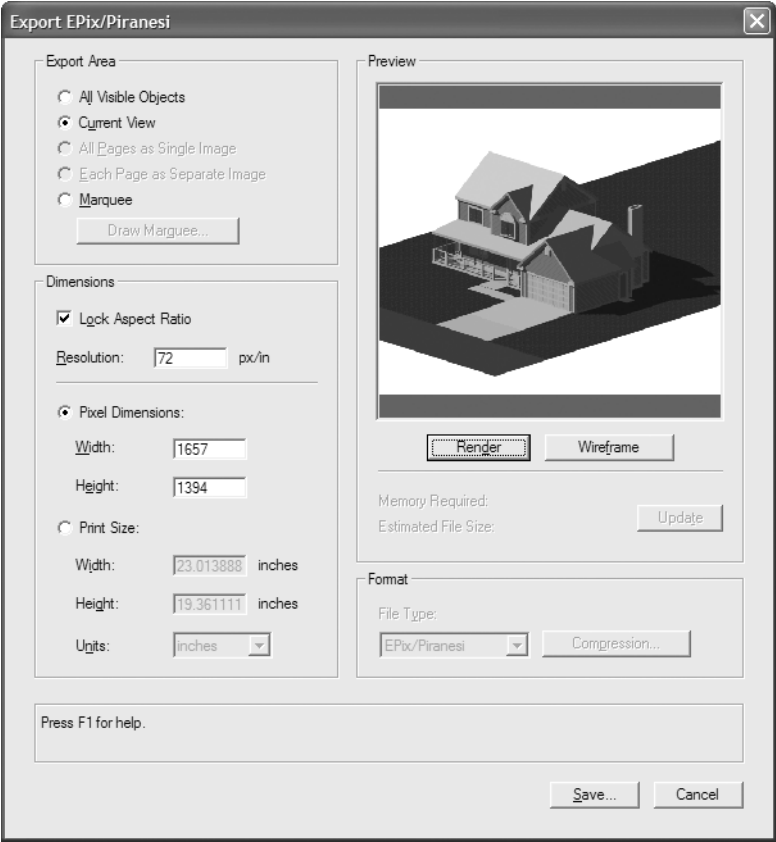
## EPix Export

When RenderWorks is installed, the EPix/Piranesi option is added to the list of export file choices. This command creates an ePix (Extended Pixel) file for use in the Piranesi software program.

To export as file type EPix:

1. Select **File > Export > Export EPix/Piranesi**.
- The Export EPix/Piranesi dialog box opens. Specify the dimensions and resolution for the exported image.





Parameter	Description
<b>Export Area</b>	
All Visible Objects	Exports an image that includes all visible objects (objects do not have to be currently on screen to be considered visible)
Current View	Exports an image that is exactly as it displays on the current screen
All Pages as Single Image	Not applicable for EPix/Piranesi export
Each Page as Separate Image	Not applicable for EPix/Piranesi export
Marquee	Exports the portion of the image specified with a marquee box. Select this option and then click <b>Draw Marquee</b> to temporarily close the dialog box. Click, and then drag to specify the area for export; the marquee dimensions are displayed on the Data bar. Click to set the export area and return to the Export Image File dialog box. The <b>Pixel Dimensions</b> of the image are automatically set to the marquee dimensions.
<b>Dimensions</b>	
Lock Aspect Ratio	Select to maintain the image aspect ratio when specifying dimensions

Parameter	Description
Resolution	Specifies the printed image resolution in pixels per inch
Pixel Dimensions	
Width/Height	Specifies the exported image dimensions; if <b>Lock Aspect Ratio</b> is selected, changes to one dimension will update the other to maintain the aspect ratio
Print Size	
Width/Height	Specifies the printed image dimensions in the selected <b>Unit</b> ; if <b>Lock Aspect Ratio</b> is selected, changes to one dimension will update the other to maintain the aspect ratio
Units	Select a unit to apply to the <b>Print Size</b> parameters
<b>Preview</b>	Displays a rendered or wireframe preview according to the current settings
Render	Updates the preview with a rendered view using the currently set rendering option
Wireframe	Updates the preview with a wireframe view
Memory Required/Estimated File Size	Not applicable for EPix/Piranesi export
Update	Not applicable for EPix/Piranesi export
<b>Format</b>	
File Type	Not applicable for EPix/Piranesi export; the file type is automatically set to .epx
Compression	Not applicable for EPix/Piranesi export

2. Click **Save**.

The Export Epix File dialog box opens. Enter the name and location for saving the .epx file. Click **Save** to export the file. The .epx file is created and saved in the location specified.

## QuickTime VR Object Export

When RenderWorks is installed, the QuickTime Virtual Reality object option is added to the list of export file choices. This command creates a QuickTime VR object file of the selected object, which can then be opened in QuickTime. The current rendering mode is used to create the movie. The size of the VectorWorks window determines the size of the final movie window.

QuickTime is a separate program available with VectorWorks. It includes Movie Player, for viewing several different file types.

[QuickTime must be installed to view or create QuickTime movies. It is available on the VectorWorks CD.](#)

To export an object as a QuickTime VR object:

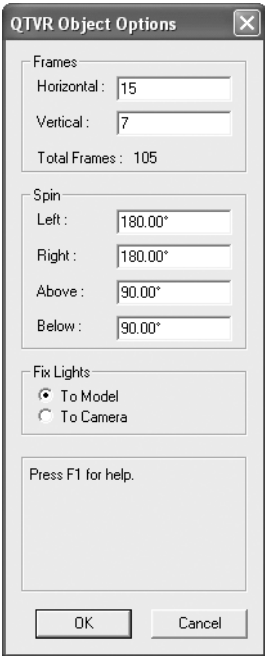
1. Render the drawing with a RenderWorks rendering mode.
2. Select the object to export.

[Due to a limitation of the LightWorks library, RenderWorks backgrounds cannot be exported.](#)

3. Select **File > Export > Export QuickTime VR Object**.

The QTVR Object Options dialog box opens.

4. Select the number of frames and spin options for creating the VR object file, and then click **OK**.



Parameter	Description
Frames	Specify how many frames to create in the file; more frames take longer, but increase the quality of the exported file. <b>Total Frames</b> displays how many frames will be created based on the horizontal and vertical frames specified.
Horizontal	Specifies the number of horizontal frames to create
Vertical	Specifies the number of vertical frames to create
Spin	Specify the angular sweep desired, relative to the front view of the object
Left	Indicates the left pan angle (0 to 180 degrees)
Right	Indicates the right pan angle (0 to 180 degrees)
Above	Indicates the angle above the horizon (0 to 90 degrees)
Below	Indicates the angle below the horizon (0 to 90 degrees)
Fix Lights	Specifies whether lights are fixed to the model or camera as the camera rotates
To Model	Fixes the lights to the model; the camera appears to rotate around the model and the lights remain stationary
To Camera	Fixes the lights around the camera; the model appears to rotate

5. Specify the .mov file name and location, and click **Save** to generate the QuickTime movie. For information on playing the QuickTime movie, see “Viewing QuickTime Animations” on page 609.

## QuickTime VR Panorama Export

When RenderWorks is installed, the QuickTime Virtual Reality Panorama option is added to the list of export file choices. This command creates a QuickTime VR panorama file of the drawing, which can then be opened in QuickTime. The current rendering mode is used to create the movie.

QuickTime is a separate program available with VectorWorks. It includes Movie Player, for viewing several different file types.

[QuickTime must be installed to view or create QuickTime movies. It is available on the VectorWorks CD.](#)

To export a drawing as a QuickTime panorama:

1. Render the drawing in **Perspective** projection with a RenderWorks rendering mode. The size of the perspective window affects the size of the panorama window; adjust the size of the perspective window by dragging the corner handles.

[Due to a limitation of the LightWorks library, RenderWorks backgrounds cannot be exported.](#)

2. Select **File > Export > Export QuickTime VR Panorama**.

The QTVR Panorama Options dialog box opens.



3. In the **Tilt Above/Below Horizon** field, specify the movie view tilt angle from the current view (a value of zero places the view at the horizon); then click **OK**.
4. Specify the .mov file name and location, and click **Save** to generate the QuickTime movie. For information on playing the QuickTime movie, see "Viewing QuickTime Animations" on page 609.

# Using the Workspace Editor

To create a custom VectorWorks workspace, you can edit the current workspace, edit a copy of the current workspace, or create a new workspace. Create multiple workspaces for different drawing needs, or customize a single workspace to your personal preferences.

Workspace customization options include:

- Add menus, tool palettes, tool sets, tools, and commands
- Remove unused menus, tool palettes, tool sets, tools, and commands
- Rearrange the order and the location of menus, palettes, tool sets, tools, and commands
- Add, modify, or delete the keyboard shortcuts for tools and commands
- Configure the context menus

VectorWorks also provides the ability to create customized plug-in tools, commands, and objects.

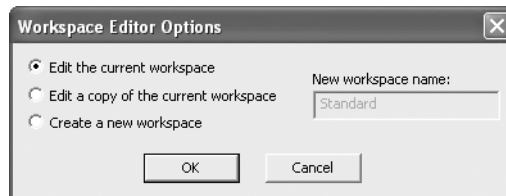
See “Using VectorScript Plug-ins” on page 83 in the VectorScript Language Guide. The VectorScript Language Guide is available in the help system, and as a PDF file in [VectorWorks]\VWHelp\Additional Documentation.

## Creating or Editing a Workspace

To create or edit a workspace:

1. Select **Tools > Workspaces > Workspace Editor**, or select **Customize** from a tool palette’s utility menu.

The Workspace Editor Options dialog box opens.

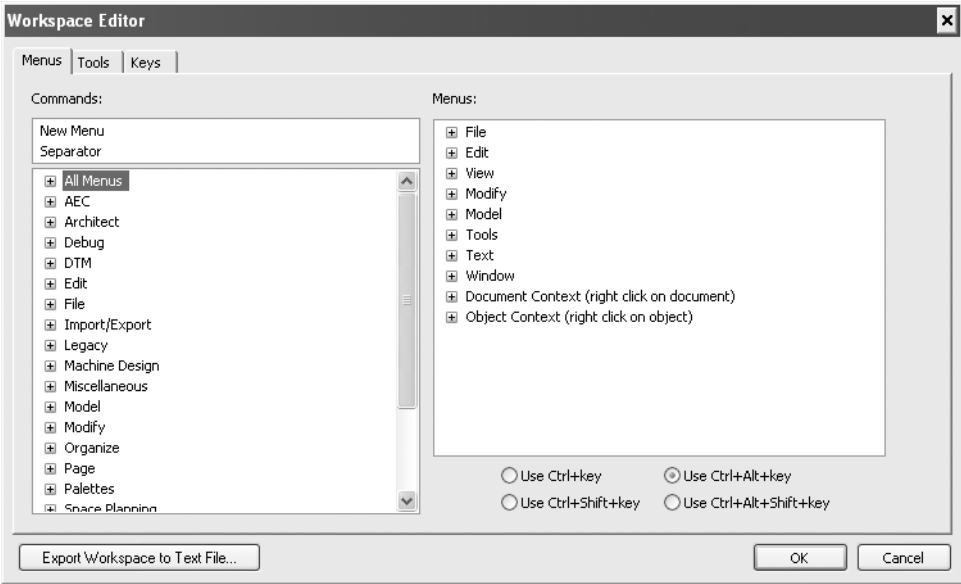


2. Select the workspace to edit.

Option	Description
Edit the current workspace	Changes the currently active workspace
Edit a copy of the current workspace	Creates an exact duplicate of the current workspace; this is the recommended option
Create a new workspace	Creates a new workspace where all tools and commands must be arranged (from scratch)

3. Enter a workspace name if this is either a new workspace or a copy of the current workspace.
4. Click **OK**.

The Workspace Editor dialog box opens.



5. Modify the menus, tools, or keyboard shortcuts as described in the following sections:
- “Modifying Menus and Commands” on page 720
  - “Modifying Tool Palettes and Tool Sets” on page 724
  - “Modifying Constraint and Mode Shortcuts” on page 727

Some shortcuts are reserved by VectorWorks or by the Windows or Macintosh operating system. The Workspace Editor does not prevent such shortcuts from being assigned to a palette or a tool. If this occurs, the Windows or Macintosh shortcut typically overrides the VectorWorks-assigned shortcut.

If a duplicate item is added to a menu, a palette, or a tool set, the item displays in both locations. Highlight the undesired occurrence of the tool or command and press the Delete key to remove it.

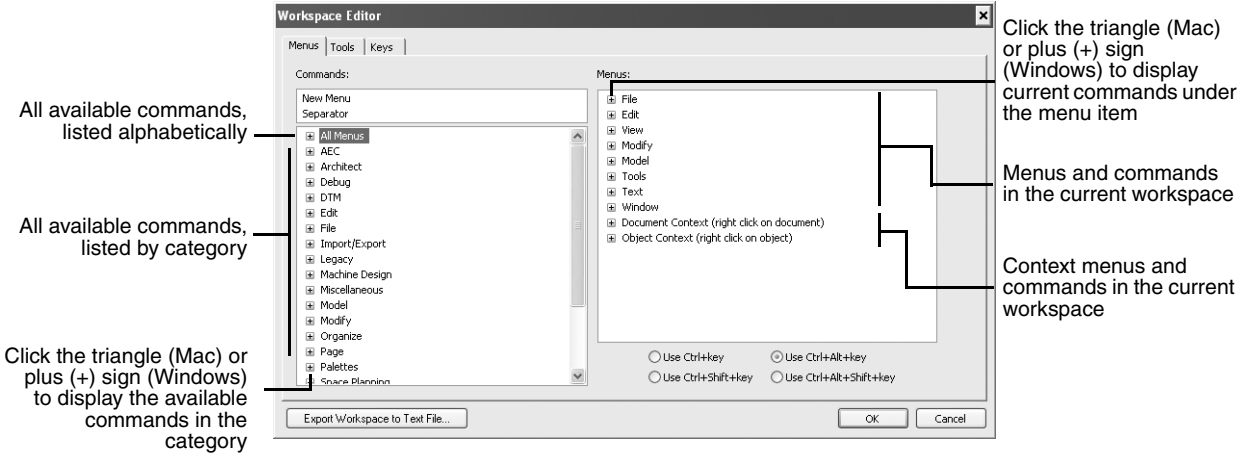
6. If desired, click **Export Workspace to Text File** to export a text file list of all menu items, tools, and keyboard shortcuts contained in the current workspace; when prompted, specify the file name and the location for the file and click **OK**. The text file also lists keys reserved by VectorWorks or the operating system, shortcuts that cannot be user modified, and shortcuts that can be modified from within the Workspace Editor.

## Modifying Menus and Commands

Modify menus and assign keyboard shortcuts to commands, as needed.

To add, modify, or delete a menu or a command:

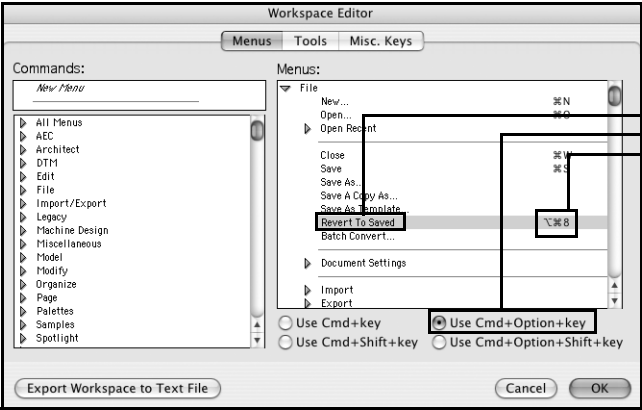
1. Access the Workspace Editor dialog box as described in “Creating or Editing a Workspace” on page 719.
2. Click the Menus tab. The left side of the dialog box displays all available commands, grouped by category. The right side of the dialog box displays the menus and commands currently assigned to the workspace. Modify the menus and commands as described in the following table.



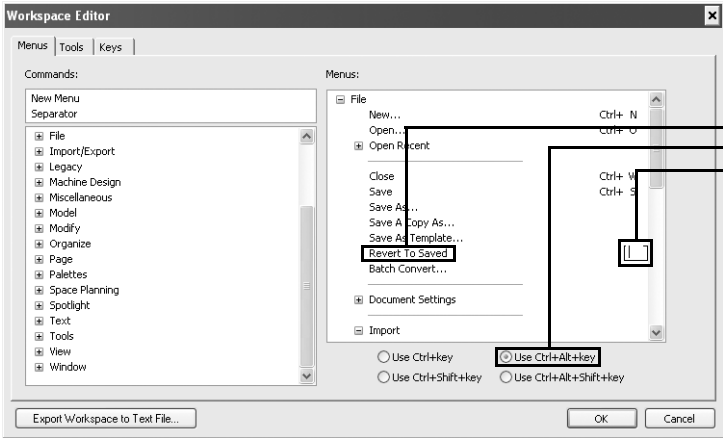
Option	Description
Add a new menu or submenu	Click-drag the <b>New Menu</b> command from the Commands list to the desired position in the Menus list; type the new menu name in place of <b>New Menu</b>
Add a command to a menu	Click the plus sign (Windows) or triangle (Macintosh) to expand the list of commands; click-drag the command from the Commands list to the desired position in the Menus list
Add a separator	Click-drag the <b>Separator</b> command (Windows) or separator line (Macintosh) from the Commands list to the desired position in the Menus list; a separator line displays
Move an item	Click-drag the item in the Menus list to the desired position
Delete an item	Select the item from the Menus list and press the Delete key, or drag the item outside of the Menus list display area (Windows); deleting an item will delete its stacked items unless they are moved from beneath that item first
Change a menu name	Select the menu from the Menus list and type the desired name; commands cannot be renamed

The Document Windows, Font, Tool Palettes, and Workspaces menu items are populated at run time. Therefore, they can only be placed as the last item in a list of sub-menu items.

3. If desired, assign the combination of keys to use as a shortcut to access a menu command.



- Macintosh
1. Select the command
  2. Select a shortcut key combination
  3. Press the desired key



- Windows
1. Select the command
  2. Select a shortcut key combination
  3. Click the screen and press the desired key

Shortcut Key Combination	Description
Macintosh	
Use Cmd + key	Assigns the combination of the Command key and another key to access this menu command
Use Cmd + Option + key	Assigns the combination of the Command key, Option key, and another key to access this menu command
Use Cmd + Shift + key	Assigns the combination of the Command key, Shift key, and another key to access this menu command
Use Cmd + Option + Shift + key	Assigns the combination of the Command key, Option key, Shift key, and another key to access this menu command
Windows	
Use Ctrl + key	Assigns the combination of the Ctrl key and another key to access this menu command



Shortcut Key Combination	Description
Use Ctrl + Alt + key	Assigns the combination of the Ctrl key, Alt key, and another key to access this menu command
Use Ctrl + Shift + key	Assigns the combination of the Ctrl key, Shift key, and another key to access this menu command
Use Ctrl + Alt + Shift + key	Assigns the combination of the Ctrl key, Alt key, Shift key, and another key to access this menu command

If a keyboard shortcut is already in use, the option to reassign the shortcut to the current menu command is presented. If the shortcut is reassigned, the original command no longer has a shortcut.

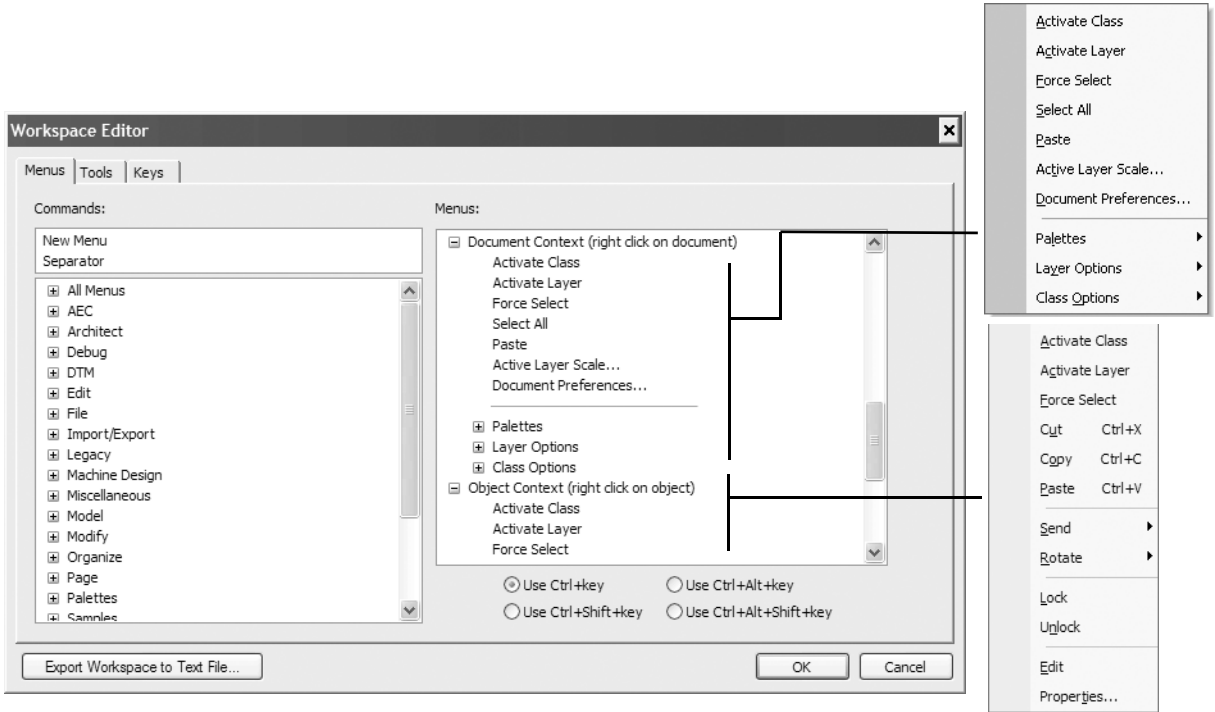
4. If necessary, modify or delete a keyboard shortcut.

Option	Description
Modify a keyboard shortcut	Select the shortcut from the Menus list; select a new shortcut key combination and/or enter a different key for the shortcut (if that key is reserved by VectorWorks or is already in use, a message displays)
Delete a keyboard shortcut	Select the shortcut key from the Menus list and press Delete or Backspace

5. Click **OK** to close the Workspace Editor dialog box.

Modifying Context Menus

Modify document context menus and object context menus in the same manner as described in “Modifying Menus and Commands” on page 720. These menus display when you click on an object or on the drawing area with a right-click (Windows) or Ctrl-click (Macintosh). The object context menus contain context-sensitive commands that pertain to the item that is currently selected in the drawing area.



## Modifying Tool Palettes and Tool Sets

Modify tool palettes and tool sets, and assign keyboard shortcuts to tools, as needed. Tools can only be added to tool sets, not to tool palettes.

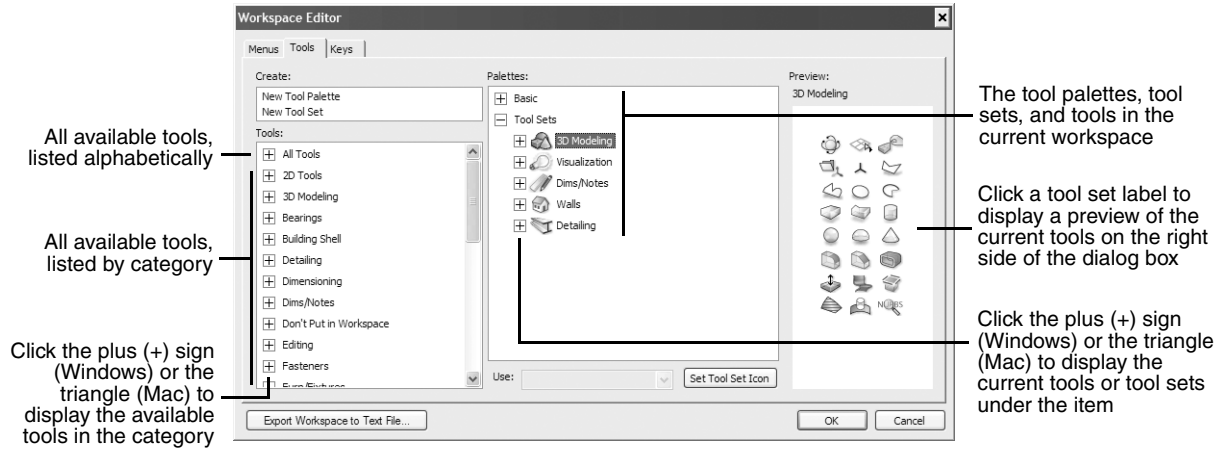
To provide more drawing space, stack the tools that have similar functionality.

To add, modify, or delete a tool palette or a tool set:

1. Access the Workspace Editor dialog box as described in “Creating or Editing a Workspace” on page 719.
2. Click the Tools tab. The left side of the dialog box displays all available tools, grouped by category. The right side of the dialog box displays the tool palettes, the tool sets, and the tools that are currently assigned to the workspace. Modify the tool palettes and the tool sets as described in the following table.

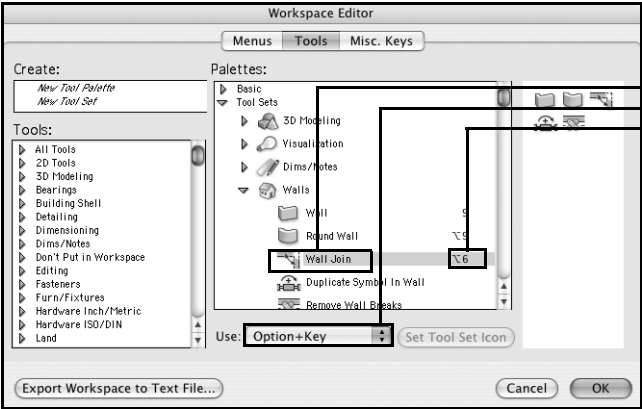
For the Basic palette, the edit tools and the tools for 2D and 3D object creation are listed in the View/Draw tool set.

The Don't Put in Workspace folder may display on the Tools tab. It contains plug-in objects that are inserted in the drawing by VectorWorks tools. Do not move the plug-in objects from this folder into the workspace, or VectorWorks will not be able to locate them.

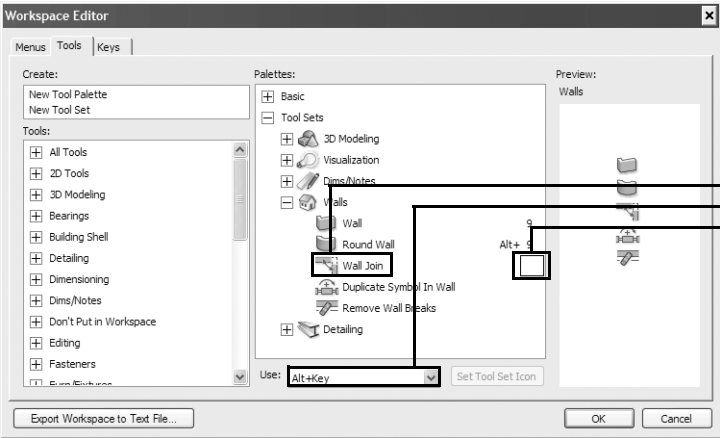


Option	Description
Add a new tool palette	Click-drag the <b>New Tool Palette</b> command from the Create list to the Palettes list; click the item's text label and type the new palette's name in place of <b>New Tool Palette</b>
Add a new tool set	Click-drag the <b>New Tool Set</b> command from the Create list to the Palettes list; click the item's text label and type the new tool set's name in place of <b>New Tool Set</b>
Change a tool set icon	To change the default icon for the tool set, select the tool set, click <b>Set Tool Set Icon</b> , and use the dialog that opens to select a 22 x 22 PNG image file to use
Add a tool or a tool category to a tool set	Click the plus sign (Windows) or triangle (Macintosh) to expand the list of tools; click-drag the tool (or the entire group of tools) from the Tools list to the desired position in the Palettes list
Move an item	Click-drag the item in the Palettes list to the desired position
Delete an item	Select the item in the Palettes list and press the Delete key, or (on Windows) drag the item outside of the Palettes list display area.  If you delete an item that has other items stacked beneath it, all of the stacked items are deleted along with the main item; to prevent this, move the stacked items to another location first.
Change the name of a tool palette or a tool set	Select the item from the Palettes list, click the item's text label, and type the desired name; tools cannot be renamed

3. If desired, assign or change the combination of keys to use as a shortcut to access a tool.



- Macintosh
1. Select the tool
  2. Select a shortcut key combination
  3. Press the desired key



- Windows
1. Select the tool
  2. Select a shortcut key combination
  3. Click the screen and press the desired key

Shortcut Key Combination	Description
Macintosh	
Use key	Assigns this key to access this tool
Use Option + key	Assigns the combination of the Option key and another key to access this tool
Use Shift + key	Assigns the combination of the Shift key and another key to access this tool
Use Option + Shift + key	Assigns the combination of the Option key, Shift key, and another key to access this tool
Windows	
Use key	Assigns this key to access this tool
Use Alt key	Assigns the combination of the Alt key and another key to access this tool
Use Shift + key	Assigns the combination of the Shift key and another key to access this tool
Use Alt + Shift + key	Assigns the combination of the Alt key, Shift key, and another key to access this tool

If a keyboard shortcut is already in use, the option to reassign the shortcut to the current tool is provided. If the shortcut is reassigned, the original tool no longer has a shortcut.

- 4. If necessary, modify or delete a keyboard shortcut.

Option	Description
Modify a keyboard shortcut	Select the shortcut from the Palettes list; select a new shortcut key combination and/or enter a different key for the shortcut (if that key is reserved by VectorWorks or is already in use, a message displays)
Delete a keyboard shortcut	Select the shortcut key from the Palettes list and press Delete or Backspace

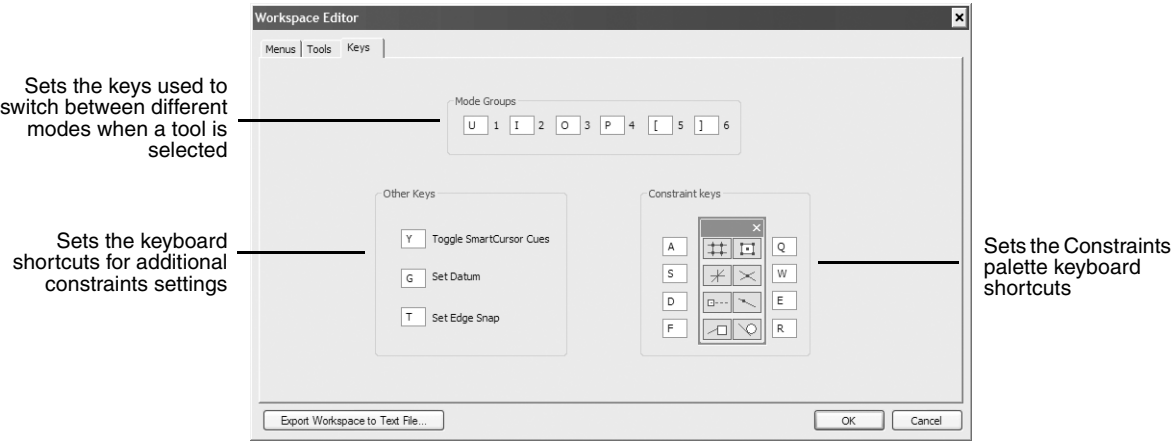
- 5. Click **OK** to close the Workspace Editor dialog box.

## Modifying Constraint and Mode Shortcuts

Modify the keyboard shortcuts for constraints and for modes, as needed.

To modify the shortcuts for constraints and modes:

- 1. Access the Workspace Editor dialog box as described in “Creating or Editing a Workspace” on page 719.
- 2. Click the Keys tab to display the keyboard shortcuts for the workspace currently in use. Assign or modify the keyboard shortcuts, as needed.



- 3. Click **OK** to close the Workspace Editor dialog box.

## Updating Custom Workspaces and Plug-in Objects

When a VectorWorks upgrade is installed, the standard workspaces and plug-in objects in the VectorWorks root folder (where the application is installed) are replaced.

Your custom workspaces and plug-ins (in your user folder) remain in place; see “User Folders Preferences” on page 46 in this guide for details about user folders. The first time the new version of VectorWorks is opened, it automatically converts the custom workspaces to the new format and saves a copy of the original workspaces in a Legacy Workspaces folder (in your user folder).

A backup copy of workspaces is automatically created at installation (see “Automatic Workspace Backup” on page xi).

For more information about where plug-in objects may be located, see “How Plug-ins Work” on page 84 in the VectorScript Language Guide. The VectorScript Language Guide is available in the help system, and as a PDF file in [VectorWorks]\VWHelp\Additional Documentation.

## Migrating Custom Workspaces

VectorWorks can automatically convert a custom workspace that was created in a previous version of VectorWorks. However, the custom workspace will not have any new or revised features from the latest release until it is migrated with the Workspace Editor. For details about the editor, see “Creating or Editing a Workspace” on page 719.

To enable the new functionality in the custom workspace, add the new tools and commands, and replace the tools and commands that have been updated.

Typically, you should also remove from the custom workspace the tools and commands that are no longer in the new version of VectorWorks. Some items may still be available under the Legacy heading in the Workspace Editor, even though they are no longer in the standard workspace. If so, you can use them in the custom workspace; however, their functionality is not guaranteed or supported. Only the items contained in the latest standard workspace are documented in the user’s guide and in the help system.

*If the custom workspace is from a version earlier than VectorWorks 12, start with the standard or classic workspace in the new version of VectorWorks and add customizations to that workspace; do not migrate the older custom workspace.*

To migrate a custom workspace to a new version of VectorWorks:

1. Review the list of workspace changes for this version in the [VectorWorks]/Workspaces folder. Decide which tools and commands need to be added, deleted, or updated in the custom workspace.
2. Place the custom workspace file in your [User]/Workspaces folder for the new version of VectorWorks.
3. Open VectorWorks, which automatically converts the workspace and places the original file in a Legacy Workspaces folder within your [User]/Workspaces folder.
4. Select **Tools > Workspaces > <<custom workspace>>** to access the custom workspace.
5. From the custom workspace, access the Workspace Editor.

The Workspace Editor Options dialog box displays. Select the option to edit a copy of the current workspace and specify a new name for the workspace.

6. Click the Menus tab to display the menus as they display in the workspace currently in use. Click the triangle (Macintosh) or the plus sign (Windows) next to an item to display an expanded list of menu commands.
7. On the right side of the Workspace Editor, highlight each obsolete command and press the Delete key.
8. On the left side of the Workspace Editor, highlight the new or replacement commands and drag them to the desired position on the right side of the Workspace Editor.
9. Click the Tools tab to display the tool palettes and tool sets as they display in the workspace currently in use. Click the triangle (Macintosh) or the plus sign (Windows) next to an item to display an expanded list of tool sets or tools.
10. On the right side of the Workspace Editor, highlight each obsolete tool and press the Delete key.
11. On the left side of the Workspace Editor, highlight the new or replacement tools and drag them to the desired position on the right side of the Workspace Editor.
12. Click **OK** to save the changes.

# Standards and Resources

## Object Libraries

The following object libraries are provided as standard VectorWorks or RenderWorks resources. A subset of these resources are also available by default at the point of use (see “VectorWorks Fundamentals Default Resources” on page 141).

Object Libraries	VW	RW
<b>Hatches</b>		
Hatches_ANSI.vwx	X	
Hatches_Cartographic.vwx	X	
Hatches_Default.vwx	X	
Hatches_Detail.vwx	X	
Hatches_Miscellaneous.vwx	X	
Hatches_Surface material.vwx	X	
Wall Hatches.vwx	X	
<b>Image Fills</b>		
Image Fills_Default.vwx	X	
Image Fills_Exterior Finishes.vwx	X	
Image Fills_Interior Finishes.vwx	X	
Image Fills_Metals Plastics Glass.vwx	X	
Image Fills_Nature.vwx	X	
Image Fills_StoneAndBrick.vwx	X	
<b>Image Props</b>		
Props-Hi-Res.vwx		X
Props-Lo-Res.vwx		X
<b>Object Sampler</b>		
Legacy Libraries	X	
HVAC_1_Line.vwx	X	
Map Symbols.vwx	X	
VectorWorks Basic	X	
EE Engineering.vwx	X	
EE Logic.vwx	X	
EE PC Board.vwx	X	
EE Schematics.vwx	X	
Office Cubicle Furniture.vwx	X	

Object Libraries	VW	RW
Office Equipment.vwx	X	
Office Furniture.vwx	X	
Process Equipt.vwx	X	
Process Piping.vwx	X	
Process Valves.vwx	X	
Residential Furniture.vwx	X	
Site Planning.vwx	X	
VectorWorks Architect Sampler.vwx	X	
VectorWorks Machine Design Sampler.vwx	X	
<b>Objects-Imperial</b>		
16_Electrical_Accurate Lamps.vwx		X
<b>Textures</b>		
Textures_Default.vwx		X
Textures_Exterior Finishes.vwx		X
Textures_Forbo Flooring-Artoleum.vwx (VectorWorks Architect required)		X
Textures_Forbo Flooring-Marmoleum.vwx (VectorWorks Architect required)		X
Textures_Interior Finishes.vwx		X
Textures_Metals Plastics Glass.vwx		X
Textures_Nature.vwx		X
Textures_StoneAndBrick.vwx		X
Textures_Wood.vwx		X
Textures_Wood-Arcitex.vwx (VectorWorks Architect required)		X

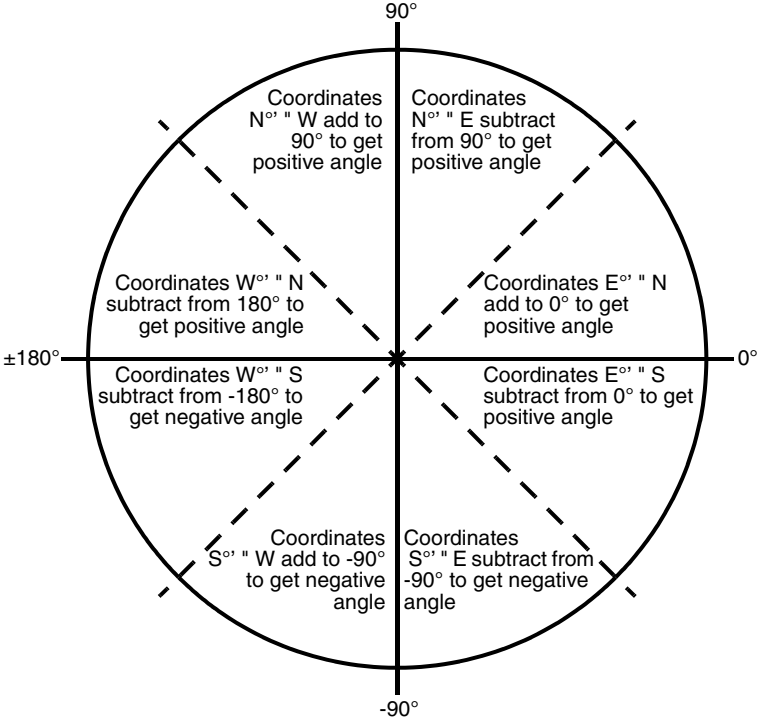
## VectorWorks Circle/Arc Conventions

Due East is 0°. Positive degrees run counter-clockwise and negative degrees run clockwise.

## Survey Bearings

The acute angle between the Meridian and a line measured from North to South, toward East and West gives a reading of less than 90°.





Architectural Scale

The following table provides the architectural scale conversion.

1" = 1' Fraction of inch equaling 1 foot	12 x 1/1 = 12 Inches/ foot multiplied by inverted fraction	1 : 12 Number to be typed into Paper Scale
1/2" = 1'	12 x 2/1 = 24	1 : 24
1/4" = 1'	12 x 4/1 = 48	1 : 48
3/4" = 1'	12 x 4/3 = 16	1 : 16
1/8" = 1'	12 x 8/1 = 96	1 : 96
3/8" = 1'	12 x 8/3 = 32	1 : 32
5/8" = 1'	12 x 8/5 = 19.2	1 : 19.2
7/8" = 1'	12 x 8/7 = 13.714...	1 : 13.7142857
1/16" = 1'	12 x 16/1 = 192	1 : 192
3/16" = 1'	12 x 16/3 = 64	1 : 64
5/16" = 1'	12 x 16/5 = 38.4	1 : 38.4
7/16" = 1'	12 x 16/7 = 27.428...	1 : 27.4285714
9/16" = 1'	12 x 16/9 = 21.333...	1 : 21.3333333

1" = 1' Fraction of inch equaling 1 foot	12 x 1/1 = 12 Inches/ foot multiplied by inverted fraction	1 : 12 Number to be typed into Paper Scale
11/16" = 1'	12 x 16/11 = 17.454...	1 : 17.4545454
13/16" = 1'	12 x 16/13 = 14.769...	1 : 14.7692307
15/16" = 1'	12 x 16/15 = 12.8	1 : 12.8
1/32" = 1'	12 x 32/1 = 384	1 : 384
3/32" = 1'	12 x 32/3 = 128	1 : 128
5/32" = 1'	12 x 32/5 = 76.8	1 : 76.8
7/32" = 1'	12 x 32/7 = 54.857	1 : 54.8571428
1/64" = 1'	12 x 64/1 = 768	1 : 768
3/64" = 1'	12 x 64/3 = 256	1 : 256

## Correlated Color Temperature

Color temperature is a simplified way to indicate the hue of a light source in degrees Kelvin (K). Lower color temperatures suggest more of a yellow-reddish color, while higher color temperatures tend to be more blue. The following chart can be used to approximate various light sources in a rendered scene.

Approximate Degrees K	Light Source Example
1500 - 1800	Candlelight
2800 - 3200	Indoor household tungsten light bulb
5000 - 5500	Sunny day at noon
6500 - 7000	Overcast sky
9000 - 12000	Blue sky

# RenderWorks Shader Definitions

RenderWorks textures are composed of four shaders: color, reflectivity, transparency, and bump. This appendix describes each shader type and provides a description of the fields obtained when editing shaders.

## Shader Types

### Color Shaders

Shader	Description
Object Attribute	Applies the object's fill color attribute
Filtered Image	Selects an imported image to be tinted with color and applied as a texture
Image Color	Selects an imported image to apply as a color texture
Blue Marble	Provides a blue marble appearance with the specified size and level of detail
Chrome Color	Creates simple chrome-like reflections, with the selected color and color ratio
Clouds	Provides a cloudy appearance, with the specified cloud and background color, as well as size and level of detail
Cubes	Creates a 3D lattice of cubes with alternating colors
Granite	Provides a granite-like pattern with mineral grains of various sizes and Granite Types: <ul style="list-style-type: none"><li>• Sierra: small grain size variation with universal mineral distribution</li><li>• Bianco: higher grain size variation with universal mineral distribution</li><li>• Diamond: combination of large, coarse grains and lesser amounts of fine-grained minerals</li><li>• Azalea: fine-grained granite with lesser amounts of large-grained minerals</li><li>• Auburn: very large grains with lesser amounts of uniformly distributed small grains</li></ul>
Marble	Creates a veined marble appearance of the specified color, size, and level of detail
Paving	Creates the appearance of paved slabs with mortar joints (for a rough tile or stone paving texture)
Plain Color	Specifies a plain, uniform color
Simple Wood	Creates a simple wood pattern with concentric rings of light and dark wood
Solid Polka	Creates a 3D lattice of spheres to form a polka-dot pattern
Turbulent	Mixes black with a specified color to create a random pattern
Checker Color	Provides a checker-board pattern of alternately-colored squares
Diagonal	Creates a diagonal stripe pattern of specific colors and sizes
Grid Color	Creates a grid pattern of the specified colors
Horizontal Stripe	Creates a horizontal stripe pattern of specific colors and sizes
Polka	Specifies a grid of circles to form a polka-dot pattern

Shader	Description
Vertical Stripe	Creates a vertical stripe pattern of specific colors and sizes
Birch, Cherry, Maple, Oak, Pine, and Wood	Provides a realistic wood appearance with pre-set parameters specific to the wood type
Birch Floor, Cherry Floor, Maple Floor, Oak Floor, Pine Floor, Wood Floor	Creates wooden flooring with a variety of patterns and parameters specific to the wood type and Replication Type: <ul style="list-style-type: none"><li>• Floorboards: simple floorboards</li><li>• Parquet: floorboards arranged in a geometric pattern (parquetry)</li><li>• Herringbone: floorboards arranged in a herringbone pattern</li><li>• Ladder: floorboards arranged in a ladder pattern</li></ul>
Brick	Creates a simple brick pattern, with bricks of a specified, uniform color
Brick Bonds	Creates bricks with a specified bonding pattern and appearance according to Bond Types: <ul style="list-style-type: none"><li>• Stretcher: standard alternating pattern</li><li>• Common: bricks in every fifth row are stacked crosswise against the other</li><li>• Flemish: alternating rows of normal and crosswise bricks</li><li>• English: bricks in every second row are stacked crosswise against the other</li><li>• Stack: bricks are stacked directly on top of each other</li><li>• Rowlock: alternating rows of normal and crosswise bricks, with the larger side of crosswise bricks visible</li></ul>
Roof Tiles	Creates a tiled pattern of specific shapes, sizes, and colors, simulating roof tiles as seen from the ground
Textured Brick	Creates a realistic textured brick pattern with very specific parameters
Draft Angle Evaluation	Evaluates surfaces for mold design by coloring problem areas
Geometric Curvature	Applies colors to denote curvature coefficients
Surface Evaluation	Shows surface curvature by placing the object in a striped cylinder

Reflectivity Shaders

Shader	Description
Image Reflectivity	Specifies an imported image to be used as the reflectivity shader (white is more reflective; black is less reflective)
Chrome Reflectivity	Creates a chrome-like effect for shiny or highly-polished surfaces
Constant	Creates reflectance with a constant color, unaffected by lights in the drawing
Glass, Accurate	Simulates glass surface finishes with reflection and transmission properties
Glass, Simple	Approximates glass surface finishes with reflection and refraction properties
Matte	Provides a dull matte appearance for surfaces like fabric and brick

Shader	Description
Metal, Accurate	Simulates metallic surface finishes with secondary mirrored views (includes refraction and absorption)
Metal, _____ (Aluminum through Tungsten)	Sets accurate metal reflectivity parameters automatically to simulate the specific type of metal selected
Metal, Simple	Simulates a shiny, metallic appearance with reflectance coefficients; suitable for metals like steel and brass
Mirror	Creates a mirror-like reflectance with secondary mirrored views
Multilayer Paint	Uses a base color, metallic layer and lacquer layer with specific properties for each, to simulate multi-layer paint surfaces
Phong	Approximates shiny or highly polished materials like ceramic or glass
Plastic	Simulates glossy materials such as plastic or varnished surfaces
Translucency	Simulates a non-reflective translucent surface lighted from behind
Translucent Plastic	Creates glossy reflectance with translucency, for shiny or highly polished translucent materials
Anisotropic, Brushed	Approximates a surface with parallel ridges, such as brushed metal
Anisotropic, Turned	Creates a surface with small concentric ridges
Anisotropic, Woven	Simulates woven material with a sheen, such as satin

## Transparency Shaders

Shader	Description
Image Transparency	Selects an imported image to apply, like a colored film, as a transparency texture
Mask Transparency	Selects a masked imported image to apply as a transparency texture (white is opaque; black is transparent)
Color Filter	Specifies a color to be applied as a transparency
Eroded	Creates the illusion of an eroded or worn surface
Plain Transparency	Provides plain, uniform transparency of a specified amount
Checker Transparency	Creates a checker-board pattern with squares of alternating transparency values
Grid Transparency	Creates a grid with opaque lines and transparent holes
Square	Provides a square region of transparency

## Bump Shaders

Shader	Description
From Color	Obtains the bump shader properties, such as height and location, based on the color shader information
Image Bump	Specifies an imported image to be used as the source of the bump map displacement
Birch, Cherry, Maple, Oak, Pine, Wood, Simple Wood <sup>1</sup>	Provides a realistic wood surface, with pre-set parameters specific to the wood type
Cast	Creates an irregular, metal-like rough surface, with specified displacements and indentations
Clouds <sup>1</sup>	Creates a cloud-patterned surface
Cubes <sup>1</sup>	Creates a 3D lattice of cubes with alternating heights
Granite <sup>1</sup>	Provides a granite-like surface with mineral grains of various sizes
Leather, Solid	Simulates the surface texture of leather
Marble <sup>1</sup>	Creates a veined marble surface
Paving <sup>1</sup>	Creates a paved surface, with rough tile or stone surfaces and mortar joints
Rough, Solid	Provides a rough, undulating metal-like surface with specified surface perturbations
Solid Polka <sup>1</sup>	Creates a 3D lattice of spheres with alternating heights
Turbulent <sup>1</sup>	Provides a random surface pattern
Birch Floor, Cherry Floor, Maple Floor, Oak Floor, Pine Floor, Wood Floor <sup>1</sup>	Creates a wooden flooring surface texture with a variety of patterns and parameters specific to the wood type and Replication Type
Brick <sup>1</sup>	Creates a simple brick pattern surface, with uniform bricks
Brick Bonds <sup>1</sup>	Creates a brick pattern surface according to the specific Bond Type
Checker Color <sup>1</sup>	Provides a checker-board pattern of alternate height squares
Diagonal <sup>1</sup>	Creates a diagonal stripe pattern of specific surface heights
Dimple	Specifies a grid of spheres which protrude above the surface, creating a regular dimpled appearance
Grid Color <sup>1</sup>	Creates a grid surface pattern of the specified heights
Horizontal Stripe <sup>1</sup>	Creates a horizontal stripe surface pattern of specific heights
Knurl	Creates a knurled indentation pattern
Leather, Wrapped	Simulates the surface texture of leather
Polka <sup>1</sup>	Specifies a grid of circles to form a polka-dot surface pattern
Roof Tiles <sup>1</sup>	Creates a tiled pattern of specific shapes, sizes, and heights, simulating roof tiles
Rough, Wrapped	Creates a rough, uneven cast-like metal finish, with specific roughness

Shader	Description
Textured Brick <sup>1</sup>	Creates a realistic brick surface pattern with very specific parameters
Tread Plate	Provides a regular tread-plate pattern with indentations that protrude above the surface
Vertical Stripe <sup>1</sup>	Creates a vertical stripe pattern of specific heights

<sup>1</sup> These bump shaders have a color shader equivalent.

## Shader Properties

The shader properties available during editing are presented in alphabetical order.

### Color Shader Properties

Shader Property	Description
Alt Brick Color Max/Min	Select the colors for complex brick shaders with a non-uniform brick color; each brick is textured by assigning it a variation of those colors. The Alt Brick Color pattern alternates with the Brick Color pattern to form variety in the rows
Amplitude	Drag the slider to the right to increase the amount of turbulence
Background Color	Select the color of the background for shaders that have a background
Bands	Specifies the number of divisions of color to display between the Min Cutoff Color and the Max. Cutoff Color for the Geometric Curvature shader, or the total number of bands around the cylinder for the Surface Evaluation Shader
Band Color	Select the color for the cylinder bands
Base Color	Underlying color which can be mixed with another color or have another color superimposed
Brick Color	Select the color of bricks for shaders with uniform brick color
Brick Color <number>	Select the colors for complex brick shaders with a non-uniform brick color; each brick has a base color randomly assigned based on the selections, and are textured by assigning them a variation of that color
Brick Color Max/Min	Select the colors for complex brick shaders with a non-uniform brick color; each brick is textured by assigning it a variation of those colors. The Brick Color pattern alternates with the Alt Brick Color pattern to form variety in the rows.
Brick Depth	The brick depth completes the dimensions of the brick, along with width and height, for complex brick shaders
Brick Width/Height	The brick size is specified by entering values for width and height
Cloud Color	Select the color of the clouds (usually a lighter color than the background color)
Color	Click to select the color

Shader Property	Description
Color <number> (granite)	Select the colors for the minerals of granite, numbered in order of decreasing average grain size. Color 4 represents the smallest sized grains, which are usually quartz; assign a darker color. Two of the colors can be set to the same value to represent granite with fewer distinct mineral colors.
Color <number> (roof tiles)	The color of each tile is selected randomly from the range specified by the tile color parameters; for uniform tile color, select the same color for both parameters
Color Noise	Drag the slider to the right to increase the intensity of random color variation areas
Color Noise Scale	Specify the size of random color variation areas (a value of one means the areas are comparable to the size of the largest grains)
Color Variation (granite)	Drag the slider to the right to increase the color variations among grains, fragments and base mineral color
Color Variation (roof tiles)	Drag the slider to the right to increase the random color variations within each tile
Color Variation Scale	Enter a color variation value to control how color variation will be distributed across roof tiles or paving slabs; values below one create a speckled effect, while values larger than one create patches of different colors (within the specific color range)
Contrast	Measures the contrast of transitions between dense and sparse areas. Range: 0.0 – 1.0.
Coverage	Determines the ratio of the area covered by the bands to the area displaying the base color; a value of zero displays only the base color, while a value of one displays only the band color
Cracks	Specify the visibility of grain cracks at the borders between fragments; higher values result in more visible cracks (Range: 0.0 – 1.0)
Curvature Type	Select the surface curvature type to display with false colors
Cylinder Axis	Specifies the location of the cylinder
Cylinder Radius	Specifies the size of the cylinder
Detail	Drag the slider to the right to increase the level of fine detail
Draft Angle	Specifies the angle (normally, 1) against which mold parts are designated as “pass,” “warning,” and “fail”
Edge Color	Select the color for the edge of roof tiles; select a darker color to simulate the effect of the tile edges in shadow
Edge Softness	Drag the slider to the right to increase the blurring at the edges of polka dot spheres
Even Color	Select one of the alternating colors in a pattern or lattice
Fail Color	Marks areas for which the mold cannot be removed because the angle to pull it out is incorrect; click to specify the color
Fragment Detail	Drag the slider to the right to increase the amount of granular deformation



Shader Property	Description
Fragment Size	Drag the slider to the right to decrease the number of mineral grains which are fragmented
Fragment Softness	Drag the slider to the right to increase the density and roughness of granular deformation
Fuzz	Drag the slider to the right to increase the amount of edge blurring
Gnarl	Drag the slider to the right to increase the random perturbation of tree rings, allowing “knots” to form
Grain	Drag the slider to the right to increase the amplitude of marble crystal grain (granularity) or intensity of wood grain
Graininess	Specifies the grainy nature of the paving
Grain Color	Select the color of wood grain, usually darker than base color to simulate the appearance of wood
Grain Scale (marble or paving)	Scale values above one make the marble crystals or paving flecks larger; values less than one make the pattern smaller
Grain Scale (wood)	Enter the grain size in relation to the ring size; this applies to random grain flecks, as well as ring fuzz grain (Range: 0.1 – 2.0)
Grid Color	Select the color of the grid lines for the grid shader
Grid Size	Enter the width and height of the grid lines
Groove Color	Select the color of the groove between floorboard sections
Groove Width	Specify the width of the groove between floorboard sections
Height	Height of the shader pattern
Max Cutoff	Indicates the maximum curvature value to be displayed with the specified color
Max Cutoff Color	Select the color to use for maximum curvature display
Min Angle	Controls the cylinder length by specifying the minimal value of the normal component along the cylinder axis in order for banding to be applied
Min Cutoff	Indicates the minimum curvature value to be displayed with the specified color
Min Cutoff Color	Select the color to use for minimum curvature display
Mix	Drag the slider to the right to increase the ratio of base color to reflection colors
Mortar Center Color	Specifies the color at the center of the mortar
Mortar Color	Select the color of the mortar for brick shaders
Mortar Color Variation	Drag the slider to the right to increase the color differences across the mortar
Mortar Color Variation Scale	Drag the slider to the right to increase the amount of color variation
Mortar Edge Color	Specifies the color at the edges of the mortar
Mortar Irregularity	Drag the slider to the right to make the mortar joints less straight

Shader Property	Description
Mortar Size	Size of mortar between bricks (uniform between rows and columns of bricks, or between paving tiles or slabs)
Noise	Drag the slider to the right to increase the uneven appearance of tree rings
Odd Color	Select one of the alternating colors in a pattern or lattice
Offset	Enter the joint offset amount between neighboring rows of wood floor sections ( <b>Floorboard</b> and <b>Ladder</b> replication types only)
Overhang Color	Marks areas for which the mold cannot be removed because the angle to pull it out is incorrect; click to specify the color
Pass Color	Marks areas for which the mold can be easily removed; click to specify the color
Pattern Scale	Enter the overall scaling factor for the wood pattern, determined by the radius difference of two adjacent rings (0.01 indicates that there are 100 rings per scaled unit length)
Plank Length/Width	Enter the length and width of floorboard sections
Plank Variation	Drag the slider to the right to increase the variation of brightness between floorboard planks
Radius	Values between zero and one define the radius of the polka dot spheres
Ring Color	Select the color to represent the darker-colored rings in the wood
Ring Fuzz Grain	Drag the slider to the right to increase the amplitude of perturbations at the edges of the tree rings
Ring Fuzz In/Out	Drag the slider to the right to increase the amount of blurring at the interior and exterior boundaries of the ring color and wood color
Ring Width	Enter the width of the tree rings relative to the tree's trunk (0 indicates no rings, while 1 indicates that the ring color is to be used for the entire trunk)
Rough Amplitude	Drag the slider to the right to increase the magnitude of roughness
Rough Scale	Drag the slider to the right to increase the smoothness around each brick
Scale	Scale values above one make the pattern larger; values less than one make the pattern smaller
Separation	Enter the distance between the centers of adjacent spheres
Shape Variation	Drag the slider to the right for more irregular paving shapes
Shape Smoothness	Drag the slider to the right for smoother paving shapes
Slab Size	Specifies the average size of the paving slabs or tiles
Spot Color	Select the color of the spheres for the polka dot shaders
Stripe Color	Select the color of the stripe for striped patterns
Strips	Number of rectangular floor planks arranged side by side to form the floor pattern
Tile Length/Width	Enter the tile top length and width

Shader Property	Description
Tile Thickness	Specify how thick the tile is and, therefore, how much of the tile edge is visible
Tolerance Angle	Specifies the tolerance angle for mold design calculations
Vein Color	Select the color of marbled veins
Vein Contrast	Drag the slider to the right to increase the contrast between the vein color and base color
Warning Color	Marks areas for which the mold can be removed, but with difficulty; click to specify the color
Width	Enter the width of the shader pattern
Wood Color	Select the color to represent the lighter-colored parts of the wood

## Reflectivity Shader Properties

Shader Property	Description
Absorption Red/Green/Blue	Drag the slider to the right to increase the absorption coefficients for red, blue, and green, respectively; default values correspond to silver
Ambient	Drag the slider to the right to increase the amount of ambient light reflected (the ambient light is set with the <b>Set Ambient Light</b> command)
Base Ambient	Specifies the ambient factor for the base layer
Base Diffuse	Specifies the diffuse factor for the base layer
Bias	The surface of the shader is represented by two sets of threads perpendicular to each other; the bias specifies the relative contribution of the two directions of threads. For even contribution from each direction, such as for cotton, use 0.5. A satin weave normally has a bias around 0.66. (Range: 0.0 – 1.0)
Chrome	Drag the slider to the right to increase the amount of chrome light reflected
Cylinder Distance	Drag the slider to the right to increase the distance between cylinders or scratches on the surface; cylinder distance varies from even, isotropic light reflection to maximum anisotropy (uneven reflection)
Diffuse	Drag the slider to the right to increase the amount of diffuse (directional) light reflected
Floor Height	Drag the slider to the right to increase the floor height across cylinders or surface scratches; floor height varies from no floor (more anisotropic with uneven light reflection) to a completely flat, isotropic surface with even reflection
Lacquer Mirror	Drag the slider to the right to increase the mirror factor for the lacquer
Lacquer Roughness	Drag the slider to the right to increase the lacquer roughness (sharpness of specular reflection highlights)
Lacquer Refraction	Drag the slider to the right to increase the refraction index of the lacquer
Lacquer Specular	Drag the slider to the right to increase the amount of specular highlights reflected for the lacquer

Shader Property	Description
Lacquer Transmission	Drag the slider to the right to increase the transmission factor for the lacquer; this filters the underlying color
Metallic Amplitude	Drag the slider to the right to increase the bumpiness of the metallic layer (similar to rough or cast amplitude bump shaders)
Metallic Detail	Drag the slider to the right to increase the amount of detail to use to represent the metallic bumps
Metallic Flakes	Select the type of metal to use for the bumps or flakes
Metallic Layer Factor	Drag the slider to the right to specify the amount that the metallic layer contributes to the overall shader appearance
Metallic Roughness	Drag the slider to the right to increase the reflection roughness of the metal bumps
Metallic Scale	Specifies the size of the metal bumps
Metallic Sharpness	Drag the slider to the right to increase the sharpness of the metal flakes
Mirror	Drag the slider to the right to increase the amount of light reflected in the mirror direction
Refraction	Drag the slider to the right to increase the refraction index for all wavelengths of light (the default refractive index corresponds to glass)
Refraction Red/Green/Blue	Enter the refraction indices for red, blue, and green, respectively; default values correspond to silver
Roughness	Drag the slider to the right to decrease the sharpness of the specular reflection highlights
Specular	Drag the slider to the right to increase the amount of specular highlights reflected
Specular Color	Select the color of specular highlights
Specular Exponent	Enter an exponent value to control the sharpness of the specular reflection highlights; higher exponent values (near ten) make the reflection appear sharper
Translucency	Drag the slider to the right to increase the degree of translucency (brightness of back-facing surfaces)
Transmission	Drag the slider to the right to increase the amount of light reflected from the transmission direction
Width/Height	Sets the horizontal and vertical frequency of the circular pattern of grooves

Transparency Shader Properties

Shader Property	Description
Color	Select a color to apply as a transparency
Coverage	Drag the slider to the right to decrease the degree of erosion

Shader Property	Description
Even Coverage	Drag the slider to the right to decrease the level of transparency; normally, this setting will be the opposite of the <b>Odd Coverage</b> setting
Fuzz	Drag the slider to the right to increase the amount of edge blurring
Grid Size	Specify the width and height of the grid lines
Height	Enter the height of the grid pattern
Horiz Fuzz	Drag the slider to the right to increase the amount of horizontal edge blurring
Horiz Min/Max	Specifies the left and right edges of the square, respectively, relative to the shader's origin
Inside Coverage	Drag the slider to the right to decrease the level of transparency inside the square; normally, this setting will be the opposite of the <b>Outside Coverage</b> setting
Odd Coverage	Drag the slider to the right to decrease the level of transparency; normally, this setting will be the opposite of the <b>Even Coverage</b> setting
Outside Coverage	Drag the slider to the right to decrease the level of transparency outside the square; normally, this setting will be the opposite of the <b>Inside Coverage</b> setting
Scale	Scale values above one make the pattern larger; values less than one make the pattern smaller
Transparency	Drag the slider to the right to increase the level of transparency
Vert Fuzz	Drag the slider to the right to increase the amount of vertical edge blurring
Vert Min/Max	Specifies the bottom and top edges of the square, respectively, relative to the shader's origin
Width	Enter the width of the grid pattern

## Bump Shader Properties

Shader Property	Description
Amplitude	Drag the slider to the right, or enter a value if an edit field is available, to increase the relative differences in height of the indentations
Blend	Drag the slider to the right to increase the amount of blend at the edges of the pattern
Brick Amplitude	Specifies the height of the bricks above or below the surface
Cast Amplitude	Drag the slider to the right, or enter a value if an edit field is available, to increase the amplitude of the surface displacements (bumps) which form the irregular casting pattern
Cell Amplitude	Drag the slider to the right to increase the height of each cell in the pattern
Center Blend	Drag the slider to the right to increase the size of the blend between the dimple sphere and the surface

Shader Property	Description
Center Depth	Enter the distance beneath the surface of dimple sphere centers; this value should be less than the <b>Radius</b> value
Cloud Amplitude	Specifies the height of the cloud regions above or below the surface
Cubes Amplitude	Specifies the difference in height between the cubes
Curve Amplitude	Drag the slider to the right to increase the number of curves in the edges of the cells in the pattern
Curve Detail	Drag the slider to the right to increase the level of fine detail in the grooves between the cells, providing a more creased appearance
Curve Frequency	Drag the slider to the right to increase the wiggly nature of the edges of the cells
Dent Amplitude	Drag the slider to the right, or enter a value if an edit field is available, to increase the amplitude of the indentations which form the irregular casting pattern
Dent Scale	Scale values above one make the indentations appear larger
Dent Threshold	Drag the slider to the right to increase the relative contributions made by the surface displacements and indentations
Detail	Drag the slider to the right to increase the level of fine detail
Fold Amplitude	Drag the slider to the right to increase the amplitude of the large-scale folds or wrinkles in the surface
Fold Detail	Drag the slider to the right to increase the level of fine detail for the large-scale wrinkles in the surface
Fold Frequency	Drag the slider to the right to increase the number of large-scale wrinkles in the surface
Graininess	Drag the slider to the right to increase the graininess of the paving
Grain Scale	Drag the slider to the right for larger grains
Grain Size	Scale values above one increase the size of the grains
Height	Sets the height of the fragments
Height Variation	Drag the slider to the right to increase the variation in height across the surface
Height Variation Scale	Drag the slider to the right to increase the size of the height variations
Height Noise	Drag the slider to the right to increase the variation in grain heights, making some grains taller than others
Height Noise Scale	Scale values above one increase the size of the grain height variations; values less than one decrease the size
Irregularity	Drag the slider to the right to increase the irregularity of each cell that makes up the pattern, or to the left to make the cells more square
Mortar Center Height	Specifies the height of the mortar joint centers above the surface
Mortar Edge Height	Specifies the height of the mortar edges above the surface
Mortar Height Variation	Drag the slider to the right to increase the variation in height across the surface

Shader Property	Description
Mortar Height Variation Scale	Drag the slider to the right to increase the size of the height variations
Mortar Irregularity	Drag the slider to the right to make the mortar joints less straight
Mortar Size	Specifies the size of the mortar joints between the paving slabs or tiles
Shape Smoothness	Drag the slider to the right for smoother paving shapes
Shape Variation	Drag the slider to the right to increase the irregularity of the paving shapes
Slab Size	Specifies the average size of the paving slabs or tiles
Radius	Values between zero and one define the radius of the dimple spheres
Radius (tread plate)	Enter the fractional radius of cylinders and spheres that make up the tread plate pattern; a lower value creates long, thin patterns (Range: 0.0 – 1.0)
Ring Amplitude	Specifies the height of the rings above or below the surface
Ring Height	Specifies the height of the wood rings above or below the surface
Rough Amplitude	Drag the slider to the right to increase the amplitude of the bumps in the surface
Rough Detail	Drag the slider to the right to increase the level of fine detail for the bumps in the surface
Rough Frequency	Drag the slider to the right to increase the number of bumps in the surface
Scale	Scale values above one make the pattern larger; values less than one make the pattern smaller
Separation	Enter the distance between the centers of adjacent dimple spheres
Sharpness	Drag the slider to the right to increase the abruptness of the transition between the peaks and troughs of the displacements
Smooth Min / Max	Drag the slider to the right to change the smoothness of the cell edges
Spot Amplitude	Specifies the height of the spots above or below the surface
Stripe Amplitude	Sets the height of the stripes above or below the surface
Vein Amplitude	Specifies the apparent height of the bumps
Wood Height	Specifies the height of the wood above or below the surface

## Frequently Asked Questions about Radiosity

Radiosity rendering is very different from other rendering modes, and requires a different workflow process to achieve a successful result.

### Q: What is radiosity?

A: Radiosity is one way for a computer to simulate the indirect lighting that occurs when lit surfaces transfer their energy to other surfaces. To calculate this lighting, all the surfaces in the model are converted into triangles and the brightest triangles are visited in turn. Light from each triangle is re-emitted to its neighbors, until some amount of energy has been accounted for, and then the radiosity solution is considered to be finished.

### Q: When should I use radiosity render modes?

A: You should use radiosity render modes when:

- The usual direct lighting and ambient light does not capture the lighting subtlety, contrasts, or color tones satisfactorily.
- One bounce of light is not enough, in a Custom RenderWorks rendering with final gather rendering enabled.
- There is a large contrast between the darkest and brightest parts of the model, or there are large color contrasts among the lit areas in the model.
- You are rendering interiors, where the light energy would eventually be dispersed to many surfaces.
- You are rendering exteriors, and you want to see “washes” of light from overhangs, patios, sidewalks, etc.

**Q: When should I not use radiosity render modes?**

A: You should not use radiosity render modes when:

- You can quickly produce satisfactory lighting by combining existing VectorWorks light objects, or easily “fake” the indirect lighting with fill lights.
- You can use area lights or a dome of directional lights to provide satisfactory soft lighting effects.
- There is not significant contrast between the brightest and darkest areas of the model, or there is not much color contrast between the lit surfaces in the model.
- Almost all of the light energy that falls on the model's surfaces will be lost into space and not hit neighboring surfaces when re-emitted.
- A satisfactory rendering can be achieved with Custom Renderworks including final gather rendering options.
- The geometry is so complex that an effective radiosity solution would take too long.

**Q: How do radiosity and ambient light relate?**

A: Ambient light is a catch-all phrase for the remaining light that is bouncing around in the model. Radiosity can be thought of as a way to correctly calculate and “localize” the ambient light. As more energy is accounted for in the radiosity solution, the (un-localized) ambient energy decreases until all the light energy has been localized. Radiosity can be used as a “fast” way to produce a more accurate ambient term, and apply some of the brightest light to specific regions of the model. Note that any ambient lighting set by the **Set Layer Lighting Options** command should be turned off for a radiosity rendering (set the ambient lighting control options by clicking **Ambient Options** from the Radiosity Options category of the Custom Radiosity Options dialog box).

**Q: Why is radiosity memory- and processor-intensive?**

A: Radiosity uses a lot of memory because all of the model's geometry must be duplicated and converted into triangles of a certain size, and assigned energy values. The more detailed geometry in a model, the more memory the radiosity processing will use and the more time will be required to re-emit light energy from each triangle to its neighbors. Also, the higher the render mode's detail settings, the more triangles are produced, resulting in larger memory requirements and more time to re-emit the light energy onto each triangle's neighbors. Doubling the number of surfaces in a model actually quadruples the time required for radiosity processing.

**Q: What is the difference between radiosity and final gather rendering?**

A: Both rendering processes create indirect lighting effects. However, final gather rendering is not affected by the model geometry, in that it does not duplicate the geometry and convert it into triangles with assigned energy values. Final gather rendering uses one bounce of light to create indirect lighting effects, while the light energy in a radiosity rendering is emitted and re-emitted until the solution is complete. Radiosity avoids some problems relating to noisy or speckled foregrounds in renderings, while final gather rendering avoids the triangulation artifacts seen in some radiosity images. Final gather rendering takes advantage of multi-threaded processors, while radiosity does not. For very complex models, final gather rendering enabled in Custom RenderWorks may provide a satisfactory rendering which would take too long to realistically achieve with radiosity alone.

The benefits of both types of indirect lighting effects can be achieved by combining them. For the most important (bright) objects in the model, use radiosity, and exclude the remaining objects from the solution. Final gather rendering can finish the indirect lighting effects.



**Q: How can I modify my model to render faster with radiosity?**

A: You can modify your model in these ways to help radiosity render faster:

1. Use the highest-level geometry you can to model your objects. It is much better to model an object as an extrude, sweep, boolean solid, or a NURBS surface than as a mesh. The worst way to model for a radiosity rendering is to create a detailed object as a set of small, individual 3D polygons.
2. Eliminate 3D details that are not going to be significant to the rendered image or the indirect lighting. For example, if you model a staircase's individual bolts and threaded screws, each of these will be contributing unnecessarily to the memory and time required for the radiosity solution. The **Median Obj Size** shown in the Custom Radiosity Options dialog box will have an unusually small value when the model consists of mostly tiny geometry.
3. Enable final gather rendering effects to handle the details excluded from the radiosity solution (select **Use Final Gather** in the Custom Radiosity Options dialog box).
4. Limit the size of large ground planes and landscape surfaces to the minimum size needed for the rendered image. Depending on the render mode's detail settings, the large surface area can produce millions of triangles that do not significantly light up the building because their energy is emitted mostly into space.
5. If geometry must be visible in the rendered image but will not contribute significantly to the indirect lighting, consider applying per-texture or per-object radiosity overrides to them to help the radiosity processor ignore them.

**Q: How do I control how much light is re-emitted from an object?**

A: The reflectivity shader controls how much light is re-emitted from a surface. To control this amount, apply a texture that uses a reflectivity shader, and adjust the reflectivity shader's Diffuse Factor. The default reflectivity shader when one is not assigned is Matte, whose Diffuse Factor is set to 100% by default.

In addition, use radiosity overrides. “Turn off” or “turn on” radiosity for specific objects or textures by using the override checkboxes shown in the Edit Texture dialog box and the Object Info palette's Render tab. For example, to render a ground plane with direct lighting but not include it in radiosity processing for efficiency, you can set the Radiosity Override checkboxes to not emit and not receive. This effectively removes the ground plane from radiosity processing. If a patch of grass needs to re-emit onto the side of a building, split the ground plane into a large one that does not emit or receive and a “skirt” around the building that does emit and receive.

Through the Radiosity Optimizations dialog box, model parameters can be set so that only certain objects re-emit indirect light, and all other objects either just receive indirect light or do not participate at all in the radiosity processing. One combination that can be produced is one where only the light on a floor is re-emitted onto the rest of the room, which becomes one bounce as in final gather rendering.

**Q: How do I efficiently render exteriors with radiosity?**

A: You can efficiently render exteriors with radiosity by:

1. Using Custom Radiosity render mode, select the **Include Visible Surfaces Only** checkbox in the Radiosity Optimizations dialog box. This means that only the visible building facade will be involved with radiosity processing. The objects and surfaces that are behind the facade will not be included in the radiosity processing.
2. Set large ground planes and tree image props to not emit or receive, using either Edit Texture or Object Info palette radiosity overrides.
3. Set the **Obj Inclusion** slider in the Custom Radiosity Options dialog box such that only the largest lit surfaces will emit (gray), and the smaller details like window mullions and door knobs will only receive (red).

4. If any surfaces are not visible that do produce significant indirect lighting (like flat roof surfaces that aren't visible in the current view), they can be forced to participate despite not being visible by setting either an Edit Texture or Object Info palette radiosity override to emit and receive.
5. Enable final gather rendering effects to handle the details excluded from the radiosity solution (select **Use Final Gather** in the Custom Radiosity Options dialog box).
6. In the Custom Radiosity Options dialog box, deselect the **Create Ambient from Remaining Energy** checkbox. This makes it possible to stop the radiosity processor sooner without having additional ambient lighting that makes the model overly bright or overly saturated with color.

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