3D Rendering and Animation Software

Version 9

User's Guide

Part No. ARP9-EN-0310

Welcome to ARC+ Render Pro

The ARC+ Render Pro application provides a complete rendering environment for architects, interior and exterior designers, landscape architects and furnishings designers. Using ARC+ Render Pro, you can produce photo-realistic images containing the colors, textures and transparencies of the planned materials that fit seamlessly into a photograph of the construction site. ARC+ Render Pro offers animation modules: the walk-through animation and the lighting animation. These modules enhance your 3D scenes with walk-through tours of rooms, down corridors and have special lighting effects to highlight buildings, interior design and much more.

Design by Mor Architects, rendering by Magoz Point Imaging

Overview of this Manual

1	*Getting Started*	Installing the ARC+ Render Pro software Working in the ARC+ Render Pro screens and commands
2	*Attributes*	Setting the colors, materials, and textures of objects Smoothing the surfaces of objects Using billboards to automatically rotate objects towards camera
3	*Cameras*	Setting the projection of the rendered image
4	*Lighting*	Creating colored and multisource lighting schemes Using point, spot, and distant light sources Using ambient light, background, and fog
5	*Rendering*	Producing photo-realistic rendered and ray-traced images Controlling the image type and quality Viewing rendered images
6	*Walk-through Animation*	Producing walk-through animated view of rendered scenes
7	*Lighting Animation*	Producing animated lighting view of rendered scenes
8	*Panorama*	Producing panoramic view of rendered scenes
9	*Objects Animation*	Producing objects animation
10	*Photo-realistic Objects*	Inserting photo-realistic objects

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About this Book

The *ARC+ Render Pro User's Guide* describes the optional ARC+ Render Pro module of ARC+. The book contains complete instructions for installing and using ARC+ Render Pro.

Before you read this book, you should have a basic familiarity with ARC+. If you are a new ARC+ user, you should read the chapters *Getting Started* and *Basic Tools* in the *ARC+ User's Guide.*

Using ARC+ Commands

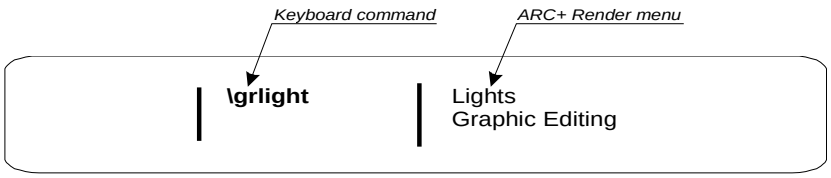
You can access the ARC+ Render Pro commands from the ARC+ Render Pro menu or by typing the command name. To display the ARC+ Render Pro menu, choose the ARC+ Render Pro option on the Tools menu of ARC+. To return to the regular ARC+ menu, choose ARC+ from the Tools menu.

This book presents the commands in the same format as other ARC+ documentation. For a complete explanation, see the *Preface* of the *ARC+ User's Guide*.

For example, to start the command for *Defining the Location and Type of Lights*. You can start the command in either of two ways:

- Using the ARC+ Render Pro menu: choose LIGHTS and then GRAPHIC EDITING.
- Using the keyboard: type \grlight on the ARC+ command line.

These possibilities are illustrated in the following standard format throughout this book:



Many of the ARC+ Render Pro commands operate in a special rendering mode, where the ARC+ command line is not displayed. While you are in the rendering mode, start each command from the menu alone.

In the rendering mode, there are many operations that you can perform using icons, toolbars, or popup menus. These options are explained in the relevant sections throughout this book.

Terminology

Throughout this manual the terms 'model' and 'scene' are used interchangeably. Both terms refer to the visual environment created with 3D objects, textures, materials and colors.

Cross References

Commands that are referenced are italicized, with the chapter number and name first, and the keyboard command name in parentheses. For example:

See *Chapter 4, Lighting, Defining the Location and Type of Lights* (\grlight).

Color Images

Some versions of this book contains grayscale images explaining how to use various features of the software. The images are displayed in color on the ARC+ Render Pro screen.

The illustrations of the screen and dialog boxes are not intended to be exact representations of any one computer. Depending on your computer system and the software release, the appearance may vary slightly from the illustrations in the book.

Additional Resources

The following resources help you get information on Graffiti products:

- ARC+ Render Pro Web site: *http://www.arcrender.com*
- ARC+ Render Pro documentation suggestions, errors, or questions: send email to *docs@arcrender.com*

1

Getting Started

This chapter provides a thorough overview of the ARC+ Render Pro application and operating instructions.

With ARC+ Render Pro, you can add to your model:

- Lighting and shadows, including multi-source and colored lighting schemes
- Realistic colors and textures for materials and background
- Transparent, reflective, shiny or dull surfaces
- Smoothing of curved surfaces
- Atmospheric conditions such as sky and fog
- Photo-realistic objects

You can select the ARC+ Render Pro commands from the pull-down menus at the top of your ARC+ screen, without leaving the ARC+ system.

Version Information

This book describes ARC+ Render Pro version 9, compatible with ARC+ version 13, 14, Progress or above.

Version information can be found under HELP > ABOUT.

IMPORTANT *If you edit a model using ARC+ Render Pro 9, do not attempt to open it in earlier version of ARC+ Render Pro. If you attempt to do so, the rendering files (*.GRB and *.GRT) may be damaged.*

Installing ARC+ Render Pro

In order to install and run ARC+ Render Pro:

- You must have a hardware (Hasp or NetHasp) lock with ARC+ Render Pro permission attached to your parallel port.
- Your display monitor must be set to at least 800 x 600 resolution and 256 or more colors.

If you don't have the stand-alone version of ARC+ Render Pro, you must have ARC+ installed on your system.

Other system requirements are the same as for ARC+. For details, see the *Getting started* chapter in the *ARC+ User's Guide.*

NOTE *If your hardware lock is not currently valid for ARC+ Render Pro, you can still install ARC+ Render Pro but you can't run the program. You are prompted to enter key codes when you enter ARC+ Render Pro following the installation. See Updating HASP Key Codes.*

Upgrading from a Previous Version of ARC+ Render

Before you upgrade, make a backup copy of any new textures that you added to ARC+ Render and any models or rendered images that you saved in the ARC+ Render directory. Save the backup in another directory location.

If you want to keep files in the old ARC+ Render directory, you can install the new version in a different directory. However, you cannot run the old version of the ARC+ Render program after you install the new version.

Installing ARC+ Render Pro from CD-ROM

1. Insert the ARC+ Render Pro CD-ROM in your computer. The setup program starts automatically.

NOTE *Alternatively, you can start the SETUP.EXE program by double-clicking in the Windows Explorer. The program is located in the RENDER \ DISK1 directory for your language on the CD-ROM (for example, D: \ ENGLISH \ RENDER \ DISK1 \ SETUP.EXE). Consult the redame file on the CD-ROM for latest information.*

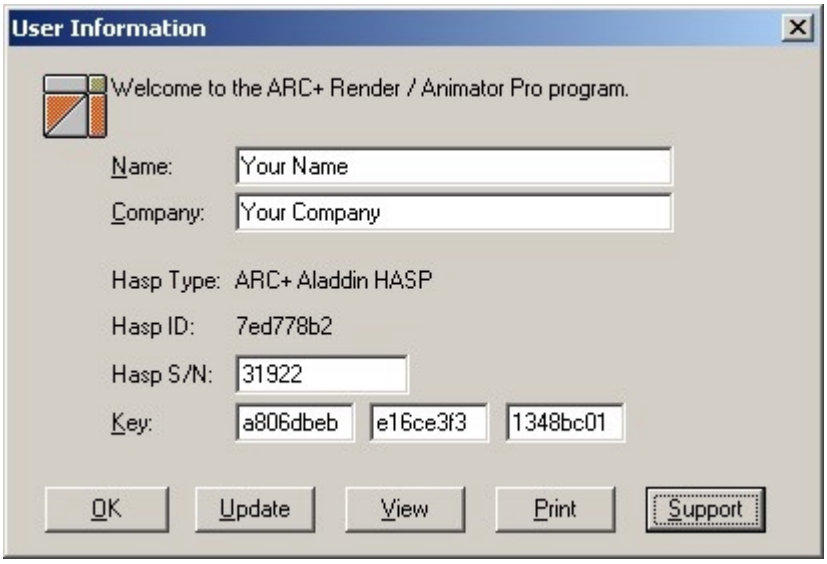
2. Select the language you want to install (English, French, Spanish, etc.).
3. Click the button to install ARC+ Render Pro.
4. Confirm the destination directory where ARC+ Render Pro is installed (by default C: \ PROGRAM FILES \ ARC RENDER), or click BROWSE to specify a different directory.
5. Confirm the folder name for ARC+ Render Pro on your Start menu (by default ARC+ RENDER PRO V9.0), or specify another name.
6. When the installation is complete, reboot your computer for the changes to take effect.

Installing ARC+ Render Pro from a Network Location

1. Connect to the network location where the administrator's version of ARC+ Render Pro is located.
2. In the Windows Explorer, double click the RENDER\DISK1\SETUP.EXE program.
3. Confirm the destination directory where ARC+ Render Pro is installed (by default C:\PROGRAM FILES\ARC RENDER), or click Browse to specify a different directory.
4. Confirm the folder name for ARC+ Render Pro on your Start menu (by default ARC+ RENDER PRO V9.0), or specify another name.
5. When the installation is complete, reboot your computer for the changes to take effect.

Updating HASP Key Codes and User Information

Make sure your hasp is connected, then start ARC+ Render Pro. Select HELP > USER INFORMATION to open the USER INFORMATION dialog box.

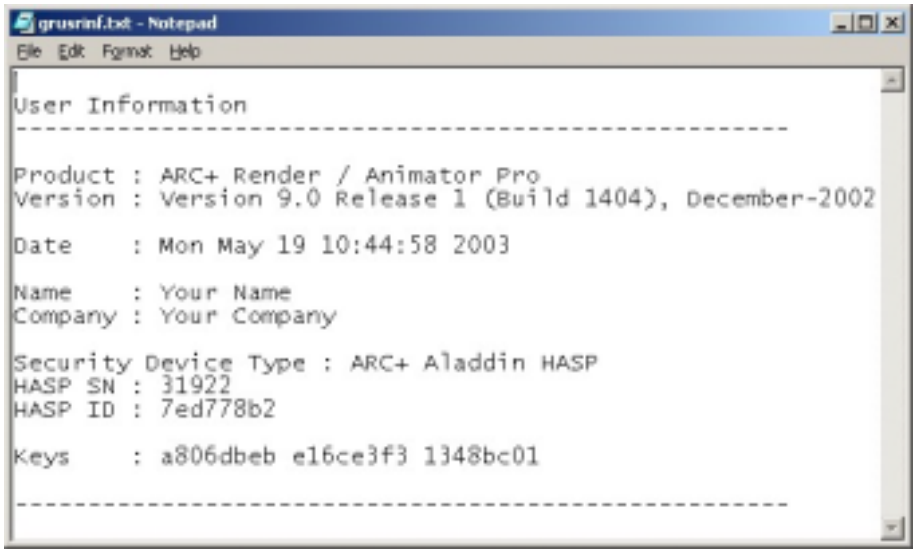


Key in the three key codes provided by your dealer (or four key codes for NetHasp).

Key in your HASP S/N code printed on a sticker on your HASP.

Click Update and then OK.

Click View to display the HASP information in Notepad.



Contact your dealer should you view any error messages. Current users should contact their dealer for update and key code information.

If no version of ARC+ Render Pro is installed on your computer and the HASP plug isn't key coded, the program will automatically launch the window for updating the key codes, similar to the above window.

Click SUPPORT to submit HASP information on the web.

Read the ARC+ Render Pro Readme File

Complementary or updated information about ARC+ Render Pro that was not available when this book was printed may be included in a README file on the CD-ROM. Read this file before you start working.

Setting the Windows Display Properties

ARC+ Render Pro can produce rendered images with many different file formats and color qualities. The highest quality uses 24 computer bits (0's and 1's) to represent each color, and is known by the names *24-bit color*, *true color*, and *RGB color*. An image produced with 24-bit color can contain up to 16.7 million shades of color.

You can use ARC+ Render Pro to produce a 24-bit image file, even if your computer is not set for a 24-bit display. If your computer is set to the Windows default of 256 colors (8-bit color), you may notice dots, lines, or patches in the color when you display the image on the screen. The faults are purely a display phenomenon. The file actually contains a smooth gradient of colors, and if you

reset your computer to 24-bit color, the same file displays as an accurate color image.

To set your computer to a 24-bit color display:

1. Click the right mouse button on an empty area of the Windows desktop.
2. From the popup menu, select PROPERTIES.
3. Select the SETTINGS tab.
4. Select one of the True Color options, for example TRUE COLOR (24 bit).
5. Click OK and if prompted, reboot your computer.

NOTE *The exact instructions may vary depending on your hardware type. If your hardware and resolution settings do not support true color, high color (16 bit) is also a good choice.*

Preparing an ARC+ Model for Rendering

Before you can render a model, you must create it or display it on the ARC+ screen. You may create it with any of the standard ARC+ three-dimensional building blocks:

- Polygons
- Simple solids (prisms)
- Complex solids
- Walls
- Placed objects containing any of the above entity types

ARC+ Render Pro displays these entities with true colors, textures, lighting, etc. in the final rendered image.

You may also include other types of entities in your model-lines, text, dimensions, help lines, hatching, and patterns. These entities are ignored by ARC+ Render Pro commands, however, and they are omitted from the final rendered image.

NOTE *You cannot render a two-dimensional projection of an ARC+ model created, for example, with the* Saving a 2D projection of a model *(*\save2d*) command (see* Files *in the* ARC+ User's Guide*). You can render a model that you imported from another program, e.g., as a DXF file, provided the model contains polygon and/or solid entities.*

Placed Objects

You may include placed objects in your model file. The component entities of a placed object are rendered in exactly the same way as other entities in your model.

ARC+ Render Pro modifies the source (library) file of the placed object slightly. It does this by storing the rendering attributes that you assign to entities in the placed object in the source file (see *Model and rendering files*). This may have undesirable consequences if you render another model containing the same placed object.

For example, create a model using a library coffee table as a placed object. If you give the tabletop a *mirror* material attribute, this information is stored in the library file. Unless you afterwards cancel the attribute, the table will have the same mirror finish when you render any other model that uses the same library file.

To prevent this, copy the library file to your working directory and place the *copy* in your model. Then, only the copy file is modified; the original library file remains unchanged.

NOTE *Optionally, you can tell ARC+ Render Pro to copy the library files when you apply the attributes. See* Model and rendering files *for more information.*

Openings (Negative Solids)

ARC+ uses *negative solids* to represent openings or voids in other entities, for example doorways or windows in walls (see *Polygons and solids* and *Openings* in the *ARC+ User's Guide*). You may include negative solids in your model: they are rendered as transparent areas, as you would expect.

If you wish to display a surface within an opening, for example a wooden door or reflections off a glass windowpane, then draw an ordinary, positive solid within the opening.

ARC+ Colors and Rendering Attributes

You can render a model using the following color options:

- You can use the standard ARC+ palette of fifteen colors and the internal ARC+ rendering attributes (color, texture, and transparency, see *Rendering* in the *ARC+ User's Guide*). To do this, prepare the model with the desired colors and attributes for each entity.
- You can obtain much better results by assigning colors and other attributes such as materials and textures in ARC+ Render. ARC+ Render allows you to assign over 16 million different rendering colors to your entities. The colors

and attributes that you assign in ARC+ Render *override* the standard ARC+ colors and the internal ARC+ rendering attributes.

- You can *color-code* the entities in your model with the standard ARC+ colors 1-15. For example, use color 1 for concrete, color 2 for wood, color 3 for glass, etc. During the rendering process you can construct a *color mapping table* that translates the standard ARC+ colors into combinations of ARC+ Render Pro colors, materials, and / or textures.
- You can *combine* these methods in a single rendering. For example, you can:
  - Render some entities in your model with their standard ARC+ colors and attributes
  - Assign special rendering colors and attributes to other entities
  - Color-code still other entities and render them with the color mapping table

See *Chapter 2, Attributes,* for full information on the treatment of colors and other attributes in rendering.

Displaying the Model

Before you render the model, display it on the ARC+ screen in the modeling mode. You may display the model in any convenient view-plan, elevation, axonometric, parallel, or perspective.

Starting ARC+ Render Pro

To start ARC+ Render Pro (if you don't have the stand-alone version), enter ARC+. On the Tools menu, select the ARC+ Render Pro option.

To return to the ARC+ menu, select ARC+ on the Tools menu.

NOTE *There is also a stand-alone version of ARC+ Render Pro, which you can enter without going through ARC+. For further information about upgrade, please contact your ARC+ Render dealer or ARC+ Render web site (www.arcrender.com).*

To start ARC+ Render Pro stand-alone version, you can use Windows Start menu, or start through ARC+.

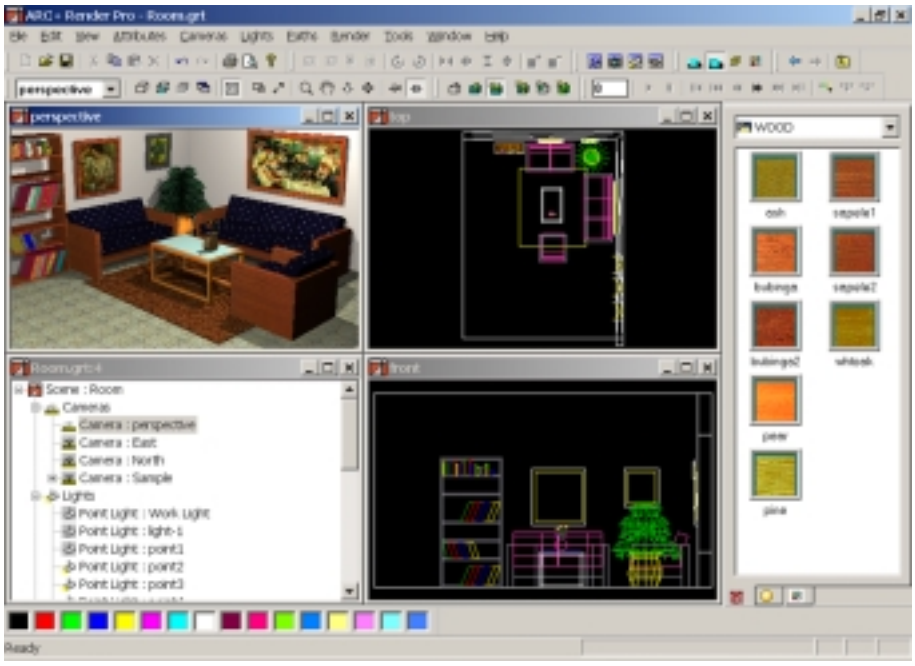
Entering ARC+ Render Pro Commands

The ARC+ Render Pro menu replaces the ARC+ menu in the display. You may select ARC+ Render Pro commands from the menu, or type the command names beginning with a backslash (like any other ARC+ commands) on the input line. Upon starting ARC+ Render Pro, the menu bar is displayed.

NOTE *Open and save file operations are available in the* FILE *menu of ARC+ Render Pro when running as stand-alone. When working under ARC+, Use* FILE *from the regular ARC+ menu to open and save files.*

The ARC+ Render Pro Screen

The ARC+ Render Pro main screen.



This screen contains a menu bar, Windows-standard tool bar, a viewing toolbar and a draw toolbar. The central part of the screen contains three work windows, showing different views of the model, and the scene tree view window (shown above - lower left). On the right side are the materials and textures toolbars. The bottom part of the screen contains the colors toolbar and the status bar. Like any Windows-standard screen, all components can be customized.

The Menu Bar

The menu bar is displayed on the top of the screen, under the program name and displayed file name.

Menu Options

The function of each command is described below:

FILE	General file level operations. When working under ARC+, you can: save bitmap, pack / unpack model, import textures, print files. When working in stand-alone mode, you can also: open and close an existing file, save files.
EDIT	File editing utilities: undo / redo, cut, copy, paste, delete, attach options, view log file, view properties of the selected object.
VIEW	Configure the appearance of the selected work window: WireFrame, Hidden Lines, Shaded, No Shading, Dynamic Rendering, Ray Tracing. It also enables refreshing the display and controlling the view options. Note that some of the view options can also be controlled from the draw toolbar.
ATTRIBUTES	Control the display in the scene tree window: all objects are displayed (dynamic editing), or only specific objects (color mapping, layer mapping, lights, cameras, clipboard).
CAMERAS	Control the viewpoints (cameras) of the rendered model. See *Chapter 3, Cameras*.
LIGHTS	Control the lighting of the rendered model. See *Chapter 4, Lighting*.
PATHS	Control the animation feature. See *Chapter 6, Animation*.

RENDER	Control the rendering of images, animation and panoramas. See *Chapter 5, Rendering, Chapter 6, Walk-through Animation*..
TOOLS	Control ARC+ Render Pro tools: show / hide scene tree view and status bar; customize toolbars, texture libraries, icon list; control ARC+ Render Pro options.
WINDOW	Control the arrangement of windows on the screen: new window, cascade, tile, arrange icons; see a list of the open windows; control configuration of the windows displayed on the screen.
HELP	Access help utilities; view information about the user, the software and the system resources.

The Standard Toolbar

You can use Windows standard toolbar to perform standard operations without having to select commands through the menu: generate a new file, open an existing file, save a file, cut, copy, paste, undo, redo, print, print preview and get information about ARC+ Render Pro.

The Viewing Toolbar

Windows Display Control

In the rendering mode, the model is graphically displayed in three different work windows. A specific angle of view for each of these windows can be selected from the pull-down view menu in the tool bar.

A view is added by adding a camera. See *Chapter 3, Cameras* for full information. The active window is named accordingly, and its name is added to the list.

View Control

You can adjust the view of the model within the active window by clicking the icons in the Viewing toolbar displayed below.

These icons are entirely independent of the view settings in the modeling mode. When you return to the modeling mode, your original view is restored.

The function of each viewing icon is described below:

ZOOM OPTIONS — From left to right: Zoom full - zoom the view to fill the window (including model and all objects). Zoom work area - only model view fills the window. Zoom object - zoom on selected object. Zoom all windows - toggles between zooming all windows and only active window.

TOGGLE PERSPECTIVE/PARALLEL — Toggles the view between the perspective and the parallel angles.

ZOOM BY RECTANGLE — Drag the mouse to define a rectangle around part of the model. The rectangle area fills the window.

PAN BY LINE — Drag the mouse to move the model in the window along the drawn line.

ZOOM DYNAMIC — Move the cursor upwards to zoom up, downwards to zoom down.

PAN DYNAMIC — Grab the model with the hand, and pan it in any direction.

WALK DYNAMIC — Move the cursor in any direction to advance in the model.

STUDY DYNAMIC — Move the cursor in any direction to rotate the model

STICKY MODE — Use sticky note in order to keep any of the above buttons pressed when you release the mouse button.

ANIMATION OPTIONS — From left to right: Number of key frames created. Play. Stop. Go to first frame. Go to previous key frame. Go to previous frame. Go to next frame. Go to next key frame. Go to last frame. Add key frame. Delete key frame. Make key frame.

LOOK EDITOR OPTIONS

Moves textures to create variations. From left to right: Move texture left. Move texture right. Move texture up. Move texture down. Rotate texture left. Rotate texture right. Decrease texture scale X. Increase texture scale X. Decrease texture scale Y. Increase texture scale Y. Increase blending. Decrease blending.

ATTACH OPTIONS

From left to right: Attach to entity. Attach to solid. Attach to layer. Attach to color.

VIEWING DISCRETE OPTIONS

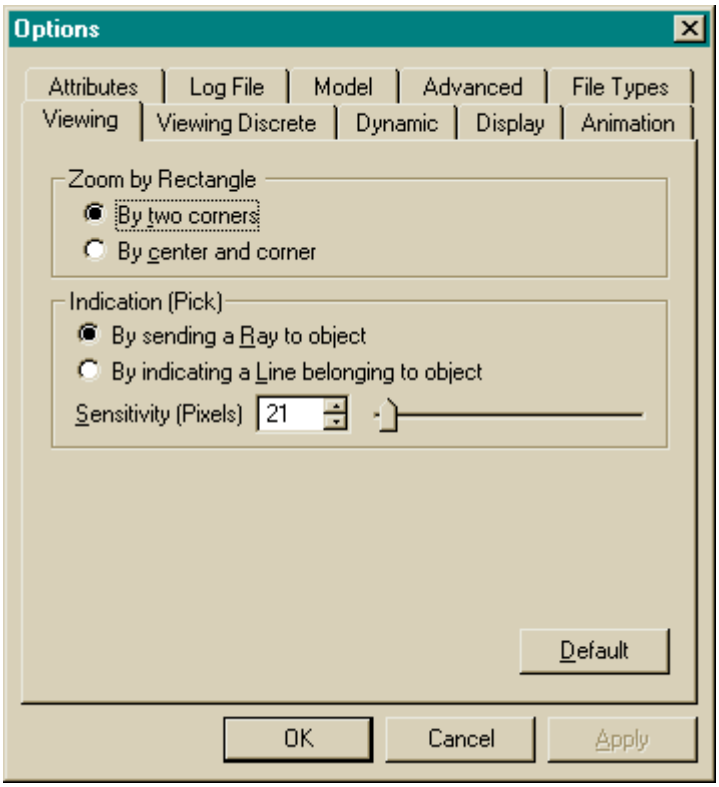
Viewing of a certain area. From left to right: Zoom in. Zoom out. Pan left. Pan right. Pan up. Pan down. Forward. Backward. Move observers eye position toward or away from the target location by a fixed distance: Rotate left. Rotate right. Rotate up. Rotate down.

Customizing the Viewing Icons

Customize the operation of the viewing icons using the following command:

Tools
Options
Viewing

From the command toolbar select TOOLS > OPTIONS and click the viewing discrete tab. The Options dialog box is opened. Options can be changed at any time. Your latest choices become the defaults for your next ARC+ session.



ZOOM BY RECTANGLE Controls the way in which the rectangle is drawn when using Zoom by Rectangle. (See above, View control).

BY TWO CORNERS The rectangle is drawn when dragging the mouse indicates the center of the rectangle and one corner.

BY CENTER AND CORNER The rectangle is drawn when dragging the mouse indicates two corners of the rectangle.

INDICATION (PICK) Controls the way an object is picked, indicated, when pointing to it with the mouse. This is most conspicuous in Wire Frame mode.

BY SENDING A RAY TO OBJECT A light ray is sent to indicate the object positioned where the mouse cursor stands.

BY SENDING A LINE BELONGING TO OBJECT The object is picked by tracing the line on which the mouse cursor stands.

SENSITIVITY PIXELS	Set the sensitivity levels corresponding to the object picked.

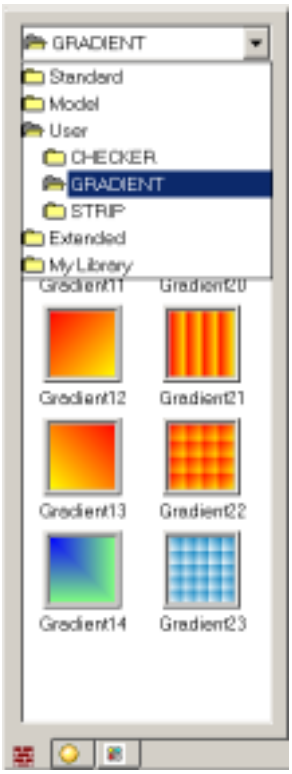
The Draw Toolbar

Control the display in the active window using the draw toolbar. This function can also be performed from the VIEW menu.

WIRE FRAME	View only the polygons forming the model (the default display).
NO SHADING	View the rendered model without shading effects.
DYNAMIC RENDERING	View rendered model with lighting and shadow effects, defined during dynamic rendering.
RAY TRACE WHOLE WINDOW	View model in highest quality rendering, including transparencies and reflections.
RAY TRACE BY RECTANGLE	Define a rectangle part of the model to view in the ray tracing mode.
RAY TRACE PUZZLE	View model in ray tracing mode, when the ray tracing process starts with an initial, low resolution display and evolves to the final result. (As opposed to default manner, displaying ray traced model “line by line”).

The Library bar

The library stores rendering attributes such as textures, materials and colors, which can be easily applied to selected surfaces in a model. Rendering attributes can be dragged-and-dropped directly from the library bar onto an object, or into an object's properties dialog-box. The attributes are discussed in *Chapter 2, Attributes*.



The library bar is arranged according to the rendering attributes types e.g. textures, materials, or colors.

Each library contains categories (folders and subfolders). The folders contain the rendering attributes i.e. textures, colors etc., arranged according to subjects. Double-clicking on a folder opens it and displays its content.

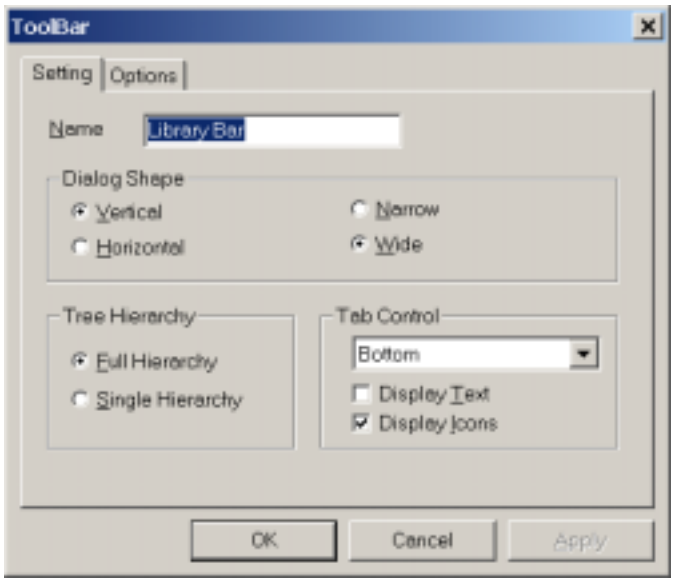
Customizing the Library bar

The Library bar can be customized in a number of ways: you can customize the library bar appearance and add or remove libraries.

Customizing the library-bar appearance

Right-click inside the library bar and select Options.

In the dialog box that opens you can adjust various library's bar appearance settings.



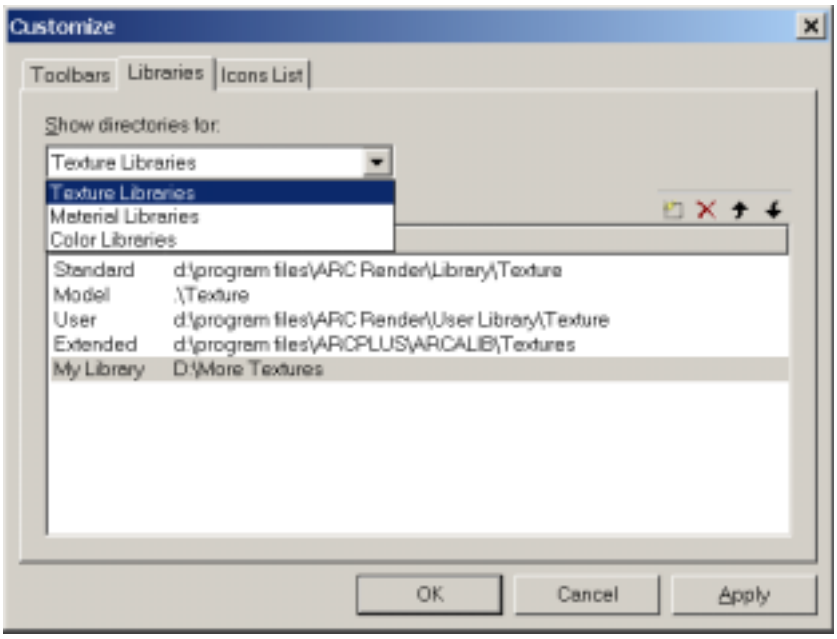
Under the Options tab in the options dialog-box, you can turn the appearance of all available folders on and off.

Click Apply to see the changes you made to the library appearance.

When you are done, click ok.

Customizing the list of libraries

To add or remove a library (Library is a collection of rendering attributes of the same type, i.e. textures, materials, colors - stored under folder on your disk or CD-ROM), Select Tools > Customize from the menu bar. In the dialog box that opens, click the Libraries tab.



Select a library type from the drop-down menu.

Use the icons on the right to add or remove a library. 

To add a new library, click on the icon. In the dialog box that opens, enter a name for the new library, and enter a path to the folder containing the new textures.

Delete a library from list. (select the required folder first)

NOTE: Standard library cannot be deleted from list

Move a library up the list (select the required folder first)

Move a library down the list (select the required folder first)

To specify a library as read-only, check the Read-only check box. Read-only libraries cannot be edited (see *Chapter 2, Attributes, Editing the library*).

File and Library Operations

When you render a model, the rendering attributes of model entities are stored together with the model in the model file. These attributes include:

- Rendering colors
- Materials
- Textures
- Smoothing

View, lighting and rendering options are stored in a special pair of *rendering files* (not stored in the regular model files). These have the same filename as your model and the .GRB and .GRT file extensions. When you open or save a model, the rendering files are opened or saved as well.

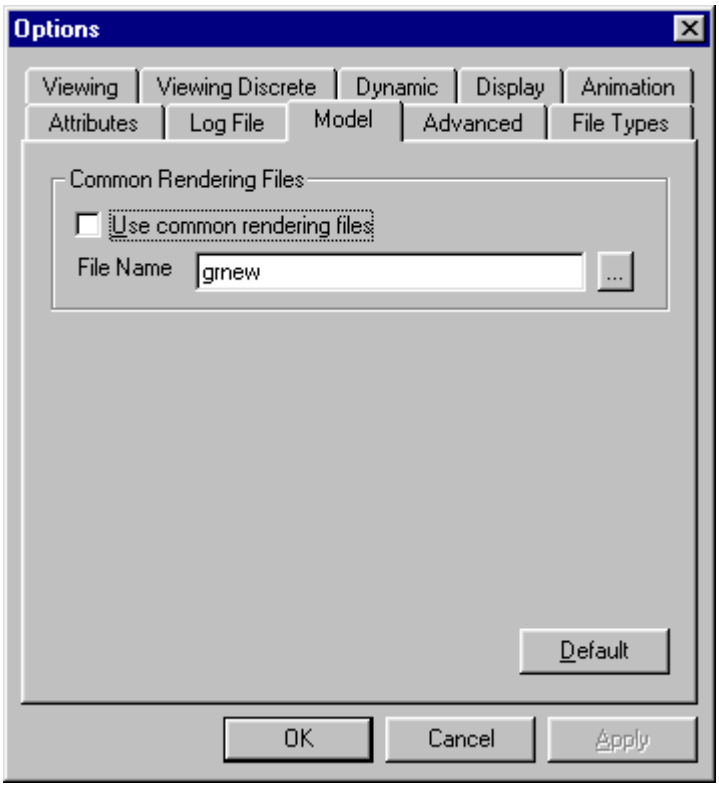
Using the same Rendering Files for all Models in a Directory

When you edit or create new material and texture definitions (see *Chapter 2, Attributes, Defining attributes*), the definitions are saved in the rendering files (*.GRB and *.GRT). In addition, the rendering files contain all your view, lighting, and rendering option settings.

You can transfer the material and texture definitions and other settings from one ARC+ model to another, by using the same rendering files for the models.

Tools
Options
Model

The OPTIONS dialog box is opened.



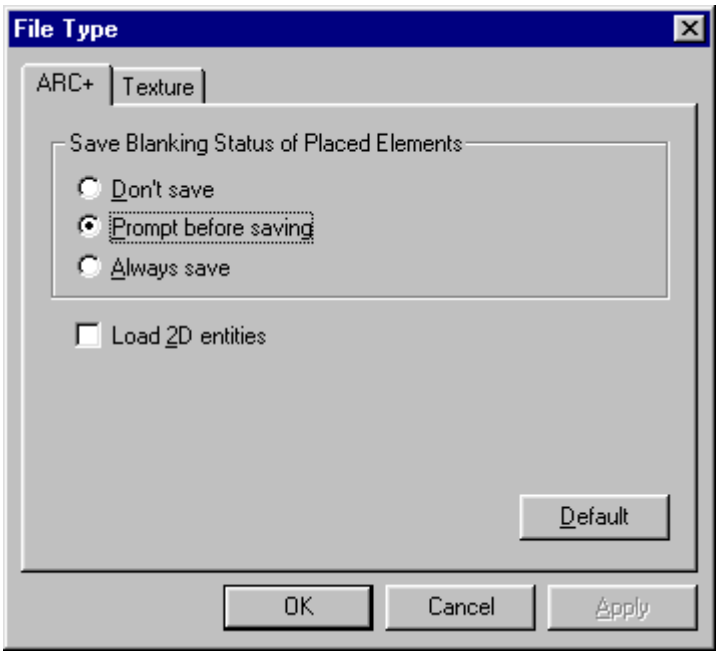
Select the USE COMMON RENDERING FILE option, and specify a filename (1-8 characters with no extension). When you open another model in the same directory, the definitions and settings are automatically available for use.

Saving Blanking of Placed Elements

If you blank or unblank placed elements within ARC+ Render Pro, you can select whether to preserve the blanking status when you leave the rendering mode (see *Modeling and rendering modes* later on in this chapter.). To save blanking status of placed elements select:

Tools
Options
File Types
Options

The FILE TYPE dialog box is opened.



You may select:

DON'T SAVE All your blanking settings are lost when you leave the rendering mode.

PROMPT BEFORE SAVING You are prompted whether to save or cancel the blanking status of each element when you leave the rendering mode.

ALWAYS SAVE The blanked or unblanked status of all placed elements is saved in the model files. The objects remain blanked or unblanked in both the modeling and rendering modes.

LOAD 2D ENTITIES Although 2D entities (lines and arcs) can be displayed on the ARC+ Render Pro editing screens, they cannot be rendered because they do not contain surfaces that reflect light. The 2D entities are not included in any rendered image. Check this option if you want to add them to the saved file.

NOTE *Like all other ARC+ editing, the blanked or unblanked status is saved in the permanent disk copy of your model only when you use the ARC+* \save *command.*

File Properties

The Properties dialog-box stores and displays various file details, such as the file's title, author's name, comments, summery, various statistical details, etc. Use file properties to store and display information about a file that will help identify and organize it. To open the file-properties dialog box, select File > Properties from the menu bar.

Packing

ARC+ Render Pro project contains the following files:

- Model files
- Placed files
- Library files
- Rendering files
- Custom texture and material files that don't exist on the destination system

ARC+ Render Pro automates the transfer of a project by allowing you to *pack* and *unpack* the complete set of project files. To prepare a project for transfer, select the pack command in the rendering mode:

File
Pack Model

ARC+ Render Pro identifies the required files and compresses them into a single file for easy transfer. You are prompted for a filename (with the extension .ZIP) and directory location to save the file.

On the destination computer, select the unpack command to decompress the files:

File
Unpack Model

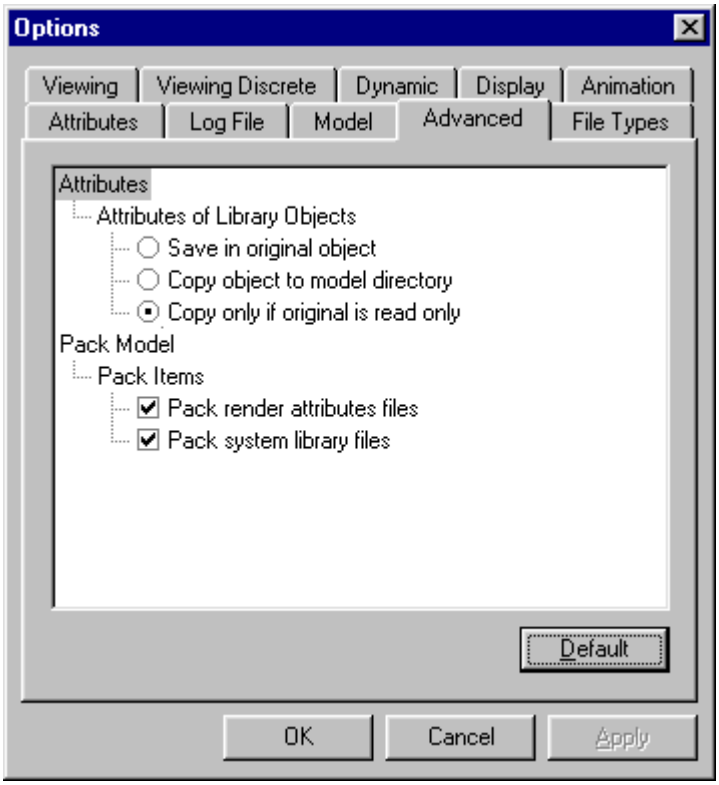
ARC+ Render Pro opens the .ZIP file and installs all the component files in the required locations. You are prompted for a directory to store the unpacked model.

Selecting the Files to Send

If you know that some of the required files already exist on the destination system, you can reduce the size of the pack file for a large project. To do this, select the following command:

Tools
Options

From the OPTIONS dialog box, select the ADVANCED tab.



In the dialog box, select the files that you need to send:

PACK RENDER ATTRIBUTES FILES Include custom texture and material definitions in the pack file.

PACK SYSTEM LIBRARY FILES Include files from the ARC+ system library.

Copying Library Objects

It is important to keep in mind that as you work in ARC+ Render Pro, you can assign rendering attributes to library objects that are placed in your model. When you save the model, ARC+ Render Pro saves the attributes as the new defaults in the *original* library model. If you later render another model

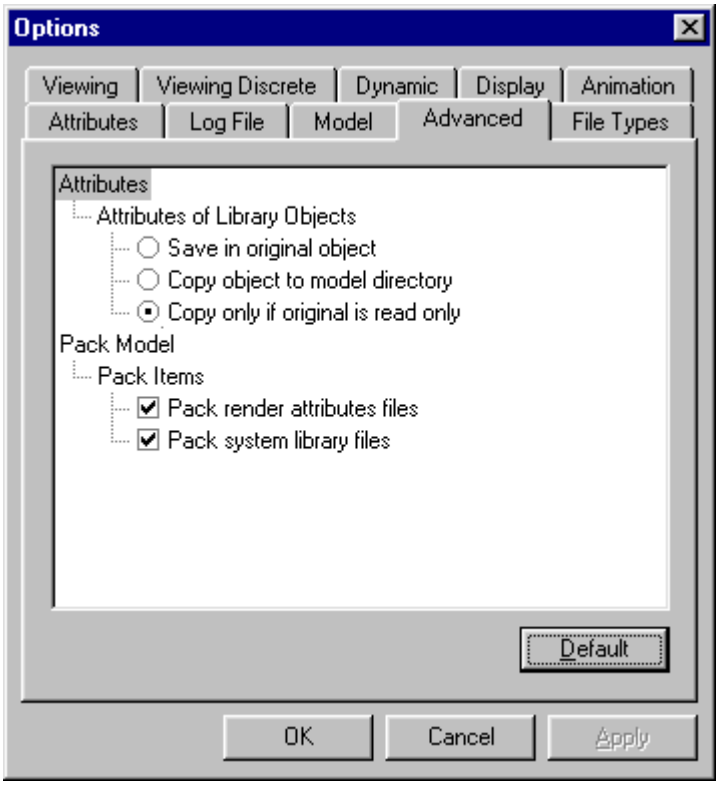
containing the same library object, it already contains these rendering attribute defaults.

This can be undesirable if you want to render different models with *different* attributes for library objects.

To change this, select:

	Tools Options

From the OPTIONS dialog box, select the ADVANCED tab.



SAVE IN ORIGINAL OBJECT — Save all attributes in the original library object.

COPY OBJECT TO MODEL DIRECTORY — Assign an attribute to a library object, ARC+ Render Pro prompts you to copy the object to the model directory. The attributes are saved with the copy and do not affect the original library version.

COPY ONLY IF ORIGINAL IS READ ONLY — If the original object is a read only file or in a read only directory, ARC+ Render Pro prompts you to copy the object to the model directory. For read / write objects, ARC+ Render Pro saves the attributes in the original file.

Customizing the Model Display

In the rendering mode, you can control the mode of view of the selected work window and customize the model display:

From the menu, select VIEW and select one of the following pull-down menu options:

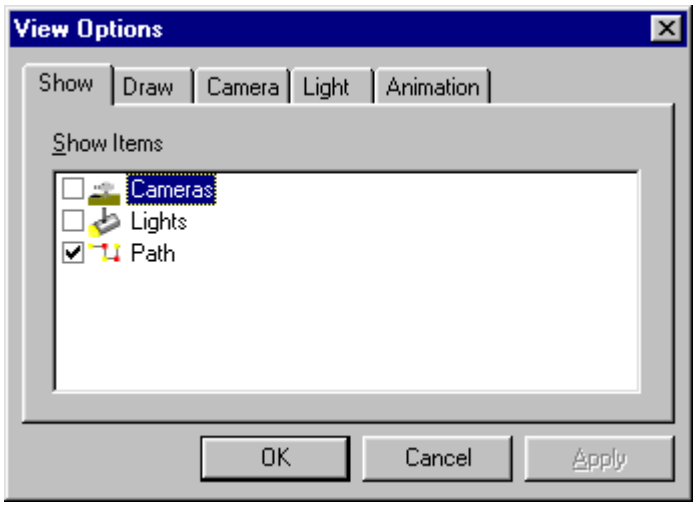
WIRE FRAME	View only the polygons forming the model (the default display).
HIDDEN LINES	View polygons forming the model, with hidden line removal.
SHADED	View flat textures, with shading effects. This option might result in faster display than flat rendering. It requires OpenGL or DirectX software (distributed with latest versions of Microsoft Windows operating systems).
NO SHADING	View the rendered model without shading effects. View the textures and colors applied to entities in the model, without the effect of the light sources; The model has uniform, white light.
DYNAMIC RENDERING	View rendered model with lighting and shadow effects, defined during dynamic rendering.
RAY TRACING	View highest rendering quality (including transparencies and reflections). Whole window, by rectangle, puzzle.
REFRESH	Re-draws the current work window.
OPTIONS	Control additional options.

NOTE *that some of these functions can also be performed from the draw toolbar.*

Control the view of the model in the selected work window by controlling the view options:

- ❑ Show cameras and lights
- ❑ Display the model in gray instead of color
- ❑ Simplify and speed up the model display
- ❑ Remove hidden lines from the display

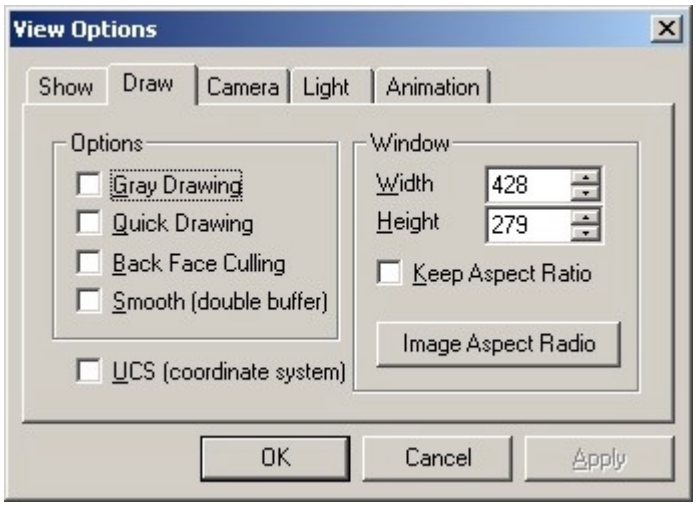
Use the dialog box to specify the default method of display. You can override your default settings at any time using the pop-up view menu (see *Windows and viewing icons* earlier in this chapter).



Select the element you want to display.

In the WIRE FRAME mode, you can define more options:

View
Options
Draw



GRAY DRAWING Use this option to simplify the display when you set the locations of objects such as light sources.

QUICK DRAWING — Simplify and speed up the display of a complex model by means of partial display: e.g., every third polygon, and every second line (see *Defining ARC+ Render Pro* Options).

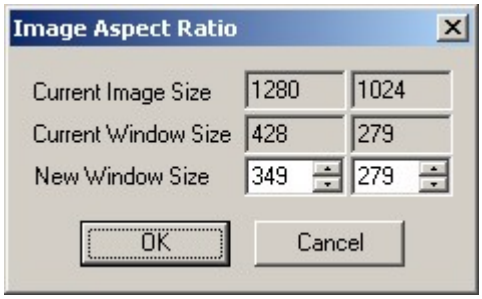
BACK FACE CULLING — Obtain a more realistic wireframe display. To speed up the display, hidden lines are only partially removed.

SMOOTH (DOUBLE BUFFER) — By default, ARC+ Render Pro starts to display a model while computations are in progress. If you select the USE DOUBLE BUFFER option, the changed model is displayed only when the computations are complete.

UCS (COORDINATE SYSTEM) — Adds a set of coordinates to the selected window.

WINDW SIZE — Set the window size (width and height of the window). To keep aspect ratio, check the KEEP ASPECT RATIO check box.

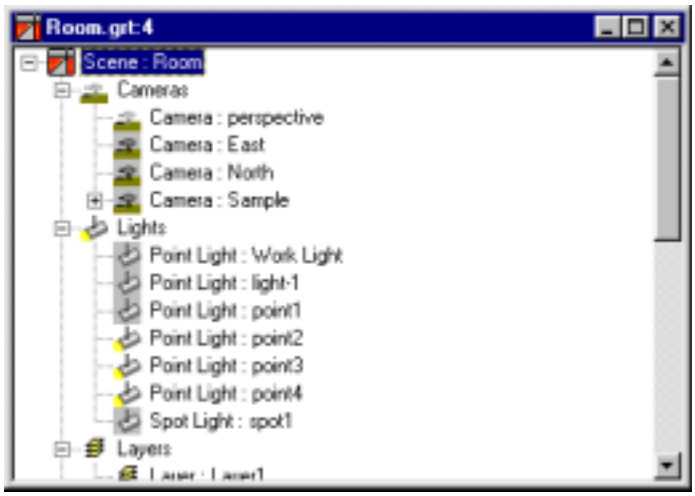
To automatically fit preview window size to image aspect ratio, click IMAGE ASPECT RATIO.



Customizing the Scene Tree

The scene tree presents the elements involved in the rendering process: Lights, cameras, layers, colors, solids and placed elements. Each element display can be expanded or collapsed, using Windows conventions (+ and -).

The types of the displayed elements are defined from the ATTRIBUTES menu, as follows:



DYNAMIC EDITING Display all element types.

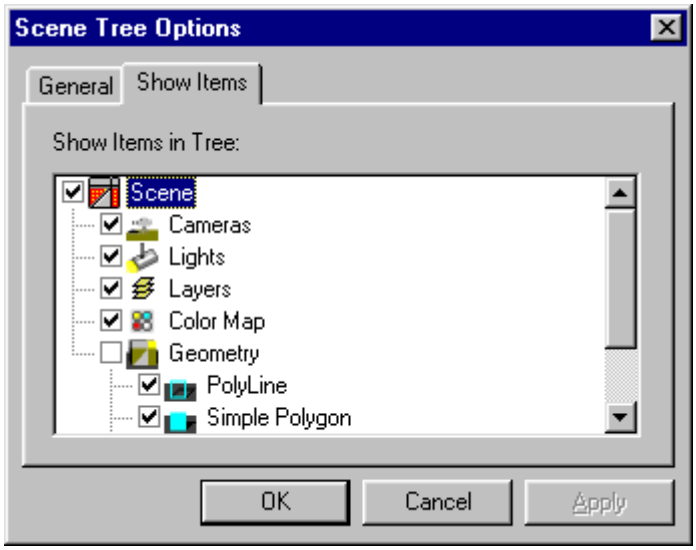
COLOR MAPPING Display only colors.

LAYER MAPPING Display only layers.

LIGHTS Display only lights.

CAMERAS Display only cameras.

Select VIEW > OPTIONS to customize the way the scene tree is displayed: the order and content of the elements. The SCENE TREE OPTIONS dialog box is opened.



Check the types of elements you wish to be visible on the scene tree. To determine the properties of the selected element, select the PROPERTIES tab.

The selected element properties dialog box is opened. Note that the dialog box differs according to the type of element (see *Chapters 3 through 5*).

Editing the Scene Tree and Adding Elements

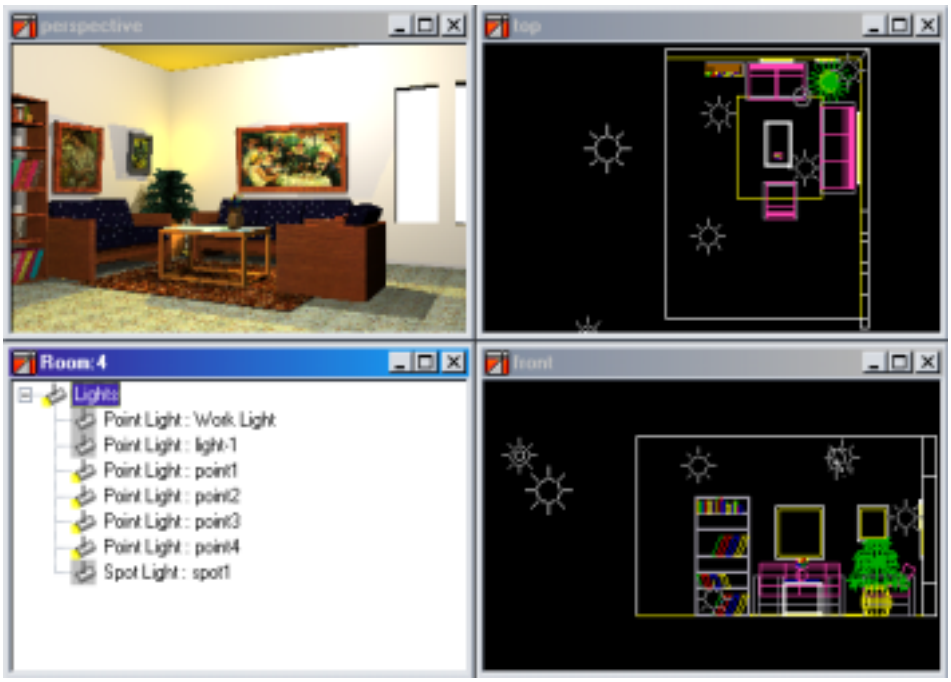
Elements (such as camera and lights) in the scene tree can be edited like any Windows application, using cut, copy, paste, delete and rename. Elements added to the scene tree are immediately displayed in all the other work windows. Right-click any scene tree element to display a pop-up menu. The pop-up menus vary according to element type (see *Chapters 3 through 5* for each element type).

Customizing the Workspace

The commands found under the layout View menu, move you among the various layouts available in Arc+ render Pro. When you choose one of the layouts, the appropriate set of elements is displayed. Their location in the scene is displayed in the top and front views on the right side of the perspective screen.

You can customize layouts by saving altered layouts or saving new ones.

In the example below, the lights layout is selected. Note that the location of the lights is marked in the top and front views on the right. If you select one of the lights in the list on the left, this light-element will be highlighted in the top and front views.



In this working mode you can edit each element as follows:

- Clicking on an element, either in the list on the left or in one of the scene-views on the right, will highlight this element and adjust the scene in the perspective screen accordingly
- Right-clicking on an element in the list, on the left-bottom side of the screen, will present you with a complete list of all the editing options available for this element
- Double-clicking on an element, either in the list on the left-bottom side or in one of the scene-view on the right, will display its properties dialog box
- Clicking on the element in either the top or front view on the right and holding down the mouse, you can drag an element to change its location

View Layouts

The available options in the layout popup menu under Views are:

Dynamic editing Displays a list of all available elements in an hierarchic tree which can be collapsed and expanded. These include cameras, lights, layers and colors. It

	does not show elements in the top or front views on the right
All other layouts	Display a layout of the corresponding elements (Color Mapping, Layer Mapping, Cameras, Lights, Camera Path, Light Path) and show corresponding elements in the top and front views on the right
Start	This layout is displayed when you open a model
Save Layout	Allows you to save the layout in its current configuration. You can save the layout under its present name, or create a new layout by typing a new name in the dialog box that opens when you choose 'Save Layout'
Define Layout	Allows you to copy, rename, delete, reset and set a layout as the current layout

Alternatively, you can also use the layouts toolbar to display the main layouts.

To display the layouts toolbar: 

Select Tools > Customize from the menu bar, click on the Toolbars tab and check the Layouts box.

Modeling and Rendering Modes

Keep in mind that you can perform many of the rendering operations within the modeling mode of ARC+. You can execute both ARC+ editing and ARC+ Render Pro commands, and you can *mix* the commands in any order that you prefer.

Alternatively, you can enter the *rendering mode* (ARC+ Render Pro), where you can combine many rendering commands in a single integrated operation. When you enter the rendering mode, the screen changes to a different layout, where the results of most rendering commands are immediately displayed.

The rendering commands are executed more rapidly and more conveniently in the rendering mode. Unless you want to mix ARC+ editing and rendering commands, it is recommended that you use the rendering mode for most rendering operations.

To Enter the Rendering Mode

To enter the rendering mode, select one of the following pull-down menu options:

\grdyned	Attributes Dynamic Editing
\grlight	Lights Graphic Editing
\greview	Cameras Graphic Editing
****	Paths Camera Path

In the rendering mode, select ARC+ Render Pro commands from the toolbar.

IMPORTANT *You cannot perform the following operations in the rendering mode:*

- *Entering ARC+ editing (nonrendering) commands*
- *Typing command names or parameters on the input line (there is no input line in the rendering mode)*

To perform any of the above operations, return to the modeling mode.

Returning to the Modeling Mode

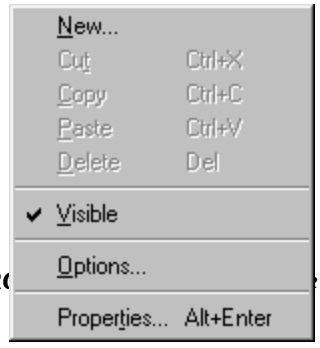
To leave the rendering mode and return to the normal ARC+ screen, select the following command from the pull-down menu:

	File Exit

Blanking Layers of ARC+ in the Rendering Mode

You can blank or unblank ARC+ layers without exiting the rendering mode.

Select the required layer from the SCENE TREE window and right-click the mouse. The following menu is opened.



Un-check VISIBLE.

NOTE *Your settings temporarily override any settings that you may have made using the* Blanking layers *(\lblnk) command before entering the rendering mode. Your previous layer settings are restored when you return to the modeling mode.*

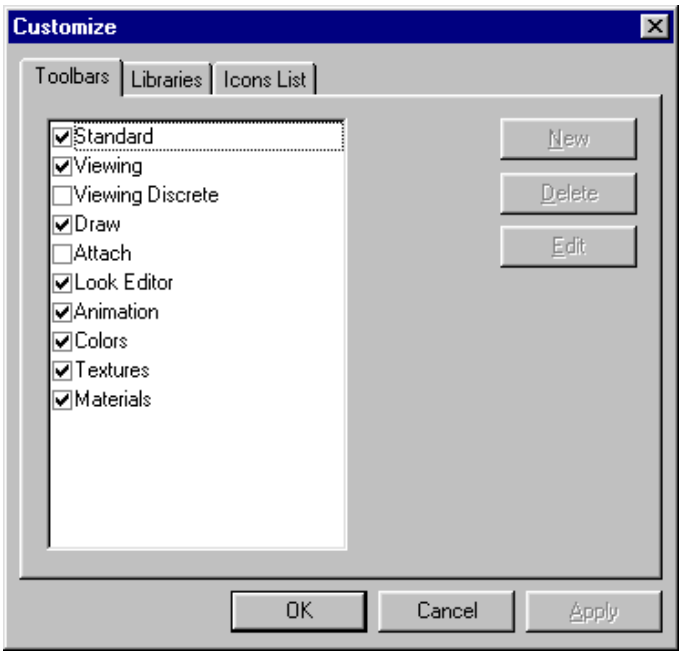
NOTE *To preserve the blank or unblanked status when you leave the rendering mode, see* Model and Rendering Files.

Customizing ARC+ Render Pro Screen

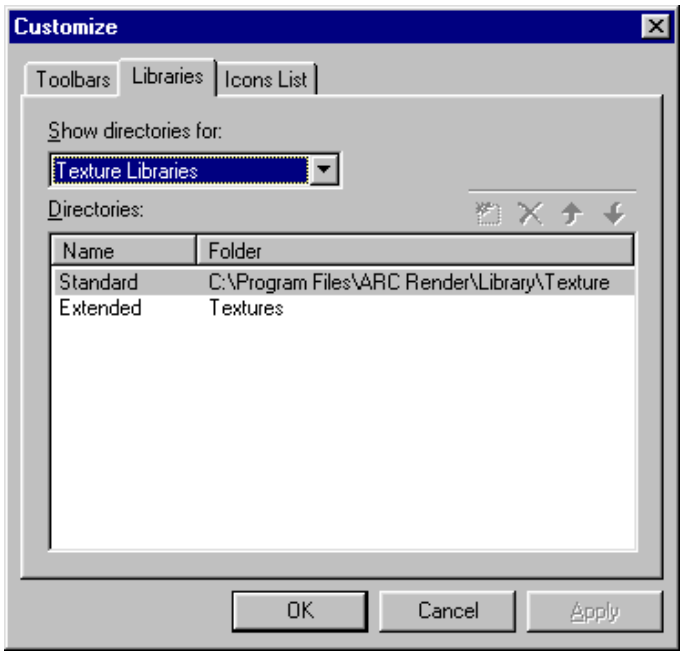
To customize your desktop and work environment to reflect your preferences:

Tools
Customize
Toolbars

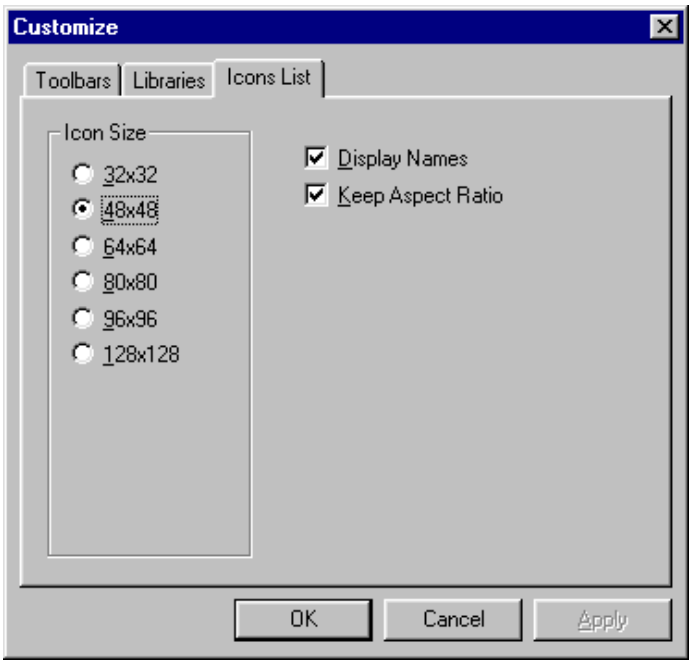
The CUSTOMIZE dialog box is displayed.



Check the toolbars you want displayed on the screen.



The Libraries tab enables you to customize the Texture and / or Model libraries you want displayed and specify their directory (path).



The Icons List tab enables you to select the size assigned to the displayed icons (specified in pixels), to display the icon's name and to specify whether or not to preserve the original aspect ratio.

Customizing the ARC+ Render Pro Window

You can configure the appearance of the rendering-mode screen by configuring the display of the view windows.

Windows

Select the following options:

NEW WINDOW A new, large view window is displayed in the middle of the screen, on top of all other windows.

CASCADE Four windows are arranged like a card pack. Click on a window in order to bring it forwards.

TILE Four windows are sharing the display area, side by side.

ARRANGE ICONS Arrange icons on screen.

Rendered Images

ARC+ Render Pro provides numerous options that control how rendering is performed. For an initial impression of the design, select a flat-shaded option that computes a clear image in just a few seconds. For the highest quality rendering, select a ray-traced image that displays high-quality effects.

The rendered image of a model is stored in an *image file* in the current directory of your hard disk. A variety of different image file formats are available, for example .TIF, .PCX, or .BMP. This enables you to transfer the image to other software systems, for example graphics or desktop publishing systems.

Typical Working Process

ARC+ in conjunction with ARC+ Render Pro, provides many options for creating and rendering your model. Each ARC+ user develops his or her own style of design, and it would be difficult to define a "normal" procedure for work.

What follows is an example of one possible procedure for rendering a model. The example does not include all of the possible ARC+ Render Pro commands and options. The order of commands can be altered, and you can mix rendering commands with ARC+ editing commands.

Menu Commands	Description	See Chapter and Section
Any ARC+ editing commands (on the main ARC+ menu)	Create or open an ARC+ model	*Getting started, Preparing the model*
	Display the ARC+ Render Pro menu	*Getting started, Entering ARC+ Render Pro commands*
Attributes Dynamic Editing	Enter the rendering mode and assign rendering colors, materials, and textures to the entities and background of your model	*Attributes, Assigning attributes to entities*
Attributes Lights Lights Ambient Light	Set the lighting scheme, for example 2-3 light sources plus ambient light	*Lighting*

Menu Commands	Description	See Chapter and Section
Cameras Graphic Editing	Set the rendering view	*Cameras, Setting the view in the rendering mode*
Render Image setting	Set the image file name, type, and size	*Rendering, Image file types*
Render Quality setting	Set the rendering quality options	*Rendering, Rendering Quality*
File Exit Rendering Mode	Return to the modeling mode	*Getting started, Modeling and rendering modes*
File Save	Save the model and rendering files	In the *ARC+ User's Guide*: *Files, Saving a file*
Render Render/Ray Tracing	Produce and display the rendered image	*Rendering, Producing the rendered image*

2

Attributes

This chapter defines rendering attributes and explains how to assign attribute values to entities using ARC+ Render Pro commands.

An ARC+ design model consists of three-dimensional components called *entities*. The surfaces of these entities are displayed in a rendering of the model. By assigning attributes to an entity, you instruct ARC+ Render Pro how to treat the surfaces of the entity in the rendering.

The attributes that you can assign are:

COLOR	Any of 16,777,216 distinct combinations of the red, green, and blue primary colors.
MATERIAL	A specified combination of properties representing how the entity interacts with light: transparency, diffuse (dull) or specular (shiny) reflection.
TEXTURE	Any of a large variety of realistic textures, such as wood, brick, paving, etc.
SMOOTHING	The degree to which sharp edges of a solid entity are smoothed in the rendered image.
BILLBOARD	The behavior that the element is automatically rotated towards the camera.

You can assign attributes in either the modeling or the rendering mode. If you work in the rendering mode, you can define a lighting scheme and background for your model while you assign the attributes, and you can immediately preview the effect of your assignments on the rendered image.

Defining Attributes

This section explains the meaning of rendering attributes and how to define attribute values using ARC+ Render Pro commands.

Colors

Specify colors using one of the methods described below.

RGB Colors

You specify colors using *RGB* definitions. RGB defines colors using the three primary color components (red, green and blue) which are the basis for a video image. A number from 0 to 255 defines how much of each component color is present in the RGB color. Some useful definitions appear in the table below.

Color	R (Red)	G (Green)	B (Blue)
Black	0	0	0
Red	255	0	0
Green	0	255	0
Blue	0	0	255
Cyan	0	255	255
Magenta	255	0	255
Yellow	255	255	0
White	255	255	255

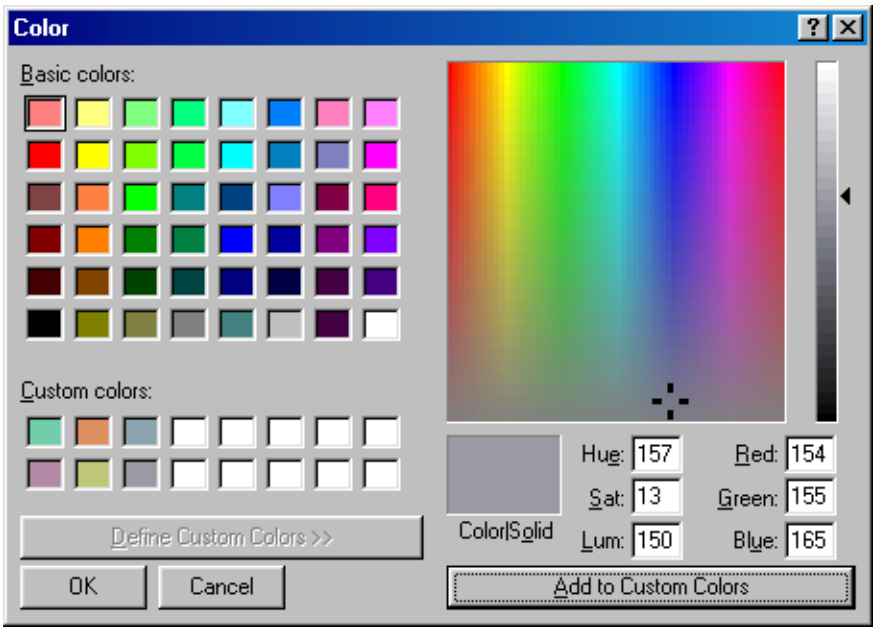
The RGB concept includes both the shade and the brightness of color. White, gray, and black, for example, can all be produced by adjusting the RGB component values. There is no need for a separate color brightness setting in the RGB system.

Using the Color Dialog Boxes

There are several ways to define a color in ARC+ Render Pro dialog boxes:

- Slide the RGB slide bars.
- If a color palette is displayed, click one of the palette entries. You may then modify the color by moving the slide bars.
- Make the RGB text areas active and type the desired amount of each primary color (0-255).

- Anywhere in ARC+ Render Pro where a color sample is displayed, you can double-click the sample to display the COLOR ATTRIBUTE dialog box. Select from the palette or use the slide bars to change the color as desired.



Other Color Systems

You can use several methods to specify colors in ARC+ Render Pro:

Color system	Explanation
RGB	Red Green Blue
HSL	Hue Saturation Luminance
Name	Name of color

The HSL colors are specified by numerical color coordinates, similar to RGB. In the Name system, colors are specified by names such as *gray*, *forest green*, or *goldenrod*.

To display a palette of colors in any of the dialog boxes, double-click in the sample colored area.

To name a color, right-click a color area or a color element in the scene tree and open the PROPERTIES dialog box.

NOTE *You may use the systems interchangeably and switch back and forth while working on the same model. The RGB and HSL alternatives produce an identical gamut of colors. The Name system is more limited, as you can produce many RGB or HSL colors that have no defined name.*

Naming a Color

In the attributes record of an entity, rendering colors are specified by name. The name is an ampersand symbol (&) followed by the RGB component values of the color. For example, the name *&255:255:255* refers to white and the name *&0:255:0* refers to green.

If you assign a rendering color in the modeling mode and you know the name of the color, you can type the name on the input line without using a dialog box.

NOTE *Use this naming system only in ARC+ Render Pro commands. In other (nonrendering) ARC+ commands, use the standard palette of fifteen colors which you specify by number (1-15).*

Default Color and Conflicts with Texture

If you assign no rendering color to an entity, then the entity is rendered with its ARC+ color from the standard 15-color ARC+ palette.

If you assign both a color attribute and a texture attribute to an entity, then the texture is used to form the rendered image and the color is ignored. To change the color of a texture, use the *Edit texture* command.

See *Combining attributes* later in this chapter for further information on these rules.

Editing a Color

Using the Edit Color dialog box, you can adjust or change the RGB color assigned to any entity.

Materials

In ARC+ Render Pro, a material attribute determines how light is treated when it strikes an entity's surface, which is important for determining shading characteristics, highlights, reflections, and transparency of the rendered image.

The material definition includes only optical properties, that is, those properties that affect the way you see the image. Other material properties such as mechanical strength, etc., are omitted from the material definition as they have no effect on the rendered image.

The optical properties of materials are fully exploited if you use the *ray tracing* method to form the rendered image (see *Chapter 5, Rendering*).

Characteristics of a few typical materials are given in the following table.

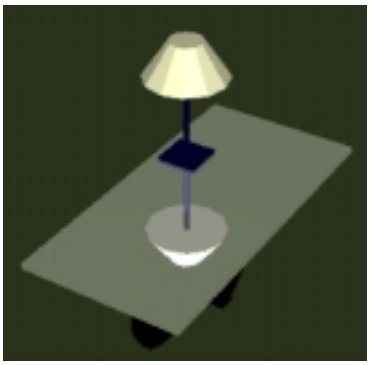
	Optical Properties	
Material	**In both rendering and ray tracing**	**Additional properties in ray tracing**
Aluminum	Medium shiny	No reflectance No transparency
Chalk	Dull	No reflectance No transparency
Glass	Shiny	Low reflectance High transparency
Mirror	Shiny	High reflectance No transparency
Plastic	Medium dull	No reflectance No transparency

You can edit the properties of a material to define new materials with properties that you desire.

Chalk table top

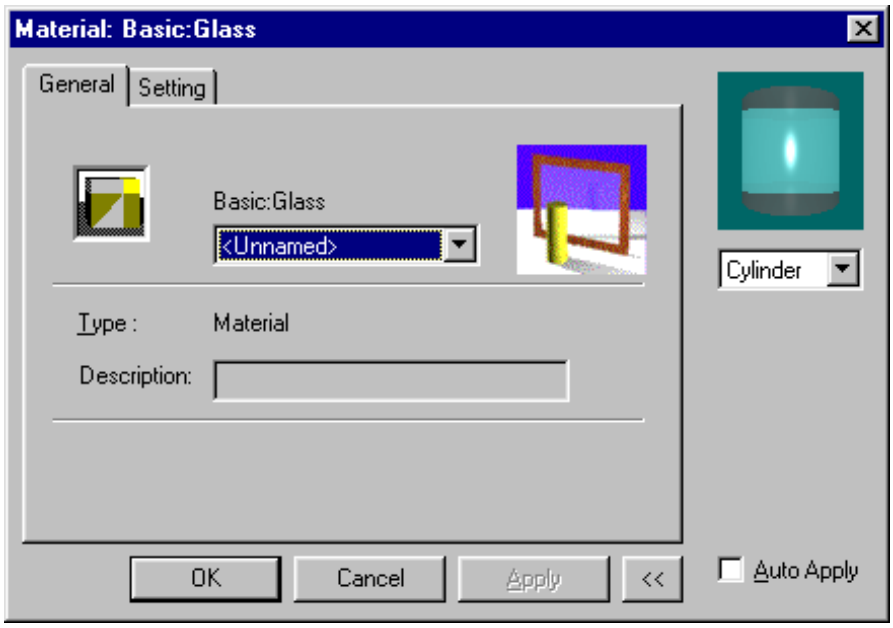
Glass table top

Mirror table top



Using the Material Dialog Boxes

Select a predefined material from a palette. If you edit and save a material definition, choose the icon of the original (unedited) material from the palette. Either double-click the icon or right-click the mouse and select PROPERTIES. A MATERIAL dialog box opens, consisting of two tabs: GENERAL, for naming the new material and SETTING, for editing its optical properties.



Naming a Material

In the attributes record of an entity, materials are specified by name selected from drop down menu. The predefined materials have simple names, such as *glass*. If you create a new material definition by editing a predefined material, you give it a subname, e.g., *glass:stained*, by typing in the DESCRIPTION text area.

If you know the name, you can specify a material in the modeling mode by typing on the input line without using a dialog box.

NOTE *Type the name using capital and small letters exactly as it appears in a dialog box or attributes record.*

Default Material

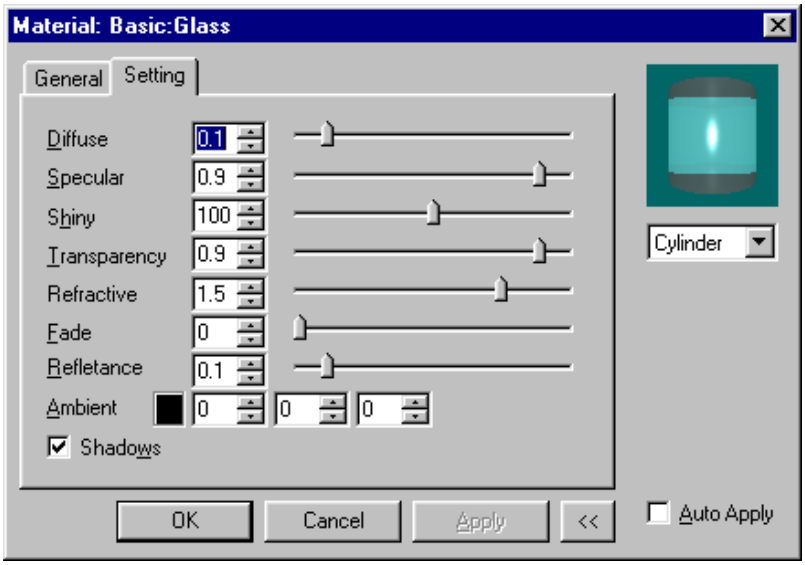
If you do not assign a material attribute to an entity, it is rendered using the default, a dull opaque material with no other special properties.

See *Combining Attributes* later in this chapter for further information on this subject.

Editing a Material

You can edit the optical properties defining the material of an entity (in effect defining a new material), using the SETTING tab in the MATERIAL dialog box.

The following parameters appear in the dialog box and are used in both the rendering and the ray-tracing methods:



DIFFUSE Light reflected from a surface of the material and scattered in all directions; dull reflection (range 0-1, default 1).

SPECULAR Light reflected from the material near the mirror direction; shiny reflection (0-1, default 0).

SHINY Angular distribution of specular reflection about the mirror direction; higher values give a narrower distribution and sharper highlights on the material.

TRANSPARENCY Fraction of light transmitted by a surface of this material onto other surfaces in the model (0-1, default 0). (Effective only in the Phong and Ray-tracing methods).

REFRACTIVE Ratio of the speed of light in vacuum to the speed of light in the material. This determines how a ray of light is bent when it passes through a transparent material such as glass, plastic, or water. The value is near 1.5 for most materials. (Effective only in the Phong and Ray-tracing methods).

FADE Decay of reflected or transmitted light intensity with distance from a surface of the material. A fade value of 0 means that the light intensity does not decrease

with distance. Larger values mean that the intensity decays more rapidly with distance (0-2, default 0). (Effective only in the Phong and Ray-tracing methods).

REFLECTANCE Fraction of light reflected by a surface of the material onto other surfaces in the model (0-1, default 0). (Effective only in the Phong and Ray-tracing methods).

AMBIENT Uniform, non-directional light of any RGB color illuminating the material. Use this parameter to ensure that surfaces of this material are not completely black in the rendered image (default 0).

SHADOWS The material casts shadows on surfaces behind it. For unusual lighting effects, you can turn off shadows for a material.

HINT *Materials with low diffuse reflection (e.g.,* mirror *or* glass*) tend to look dark in renderings produced with the flat or Gouraud shading options. If this is a problem, use the Phong or ray tracing shading option instead (*see *Chapter 5, Rendering, Shading options*).

Geometrical Characteristics

There are several differences in the behavior of materials when you apply them to a solid entity with different geometrical characteristics. To view the effect of applying a material to a three-dimensional solid, you can define the geometrical character of the solid.

From the pull-down menu in the properties dialog box select: CYLINDER, RECTANGLE, SPHERE or MATERIAL (two-dimensional). You can remove the GEOMETRICAL CHARACTERISTICS option from the dialog box by clicking the << button.

Textures

There are two types of textures in ARC+ Render Pro:

TWO-DIMENSIONAL A predefined pattern that is applied repeatedly to cover the surface of a polygon or solid entity.

THREE-DIMENSIONAL A computed pattern that is applied to the surface of a polygon entity or throughout the body of a solid entity.

There are several differences in the behavior of these textures when you apply them to a solid entity.

Thus, with two-dimensional textures, lines of the pattern (e.g., wood grain) may not be continuous or consistent at the edges of a solid entity. Three-dimensional textures fill the entire body of the solid, so lines are continuous and consistent at all edges.

You can apply a two-dimensional texture *nonglobally* onto each surface of a solid. Alternatively, you may apply it *globally* around all sides of a simple solid (prism). If you do this, the pattern is rescaled and wrapped around the sides of the solid. In the GLOBAL option, the texture is not applied to the top and bottom base polygons of the solid; you can apply the texture separately to the base polygons if you wish.

You may also apply a texture globally to a rotational solid (see *Polygons and solids, Creating a solid by rotating a polygon,* \rosol command, in the *ARC+ User's Guide*), provided the solid meets the following criteria:

- The upper and lower bases of the solid are perpendicular to the rotation axis.
- No other surfaces of the solid are perpendicular to the axis.
- The solid has a diameter that is greater than zero in all directions perpendicular to the axis.
- The solid was created by a rotation of 360°.

NOTE *If you try to apply a texture globally to a complex solid that does not meet these criteria, then it is applied nonglobally.*

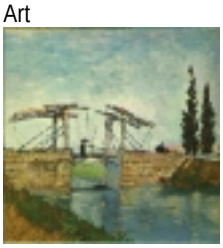
The GLOBAL and NONGLOBAL options are not relevant to three-dimensional textures.

Some of the available texture categories are listed below.

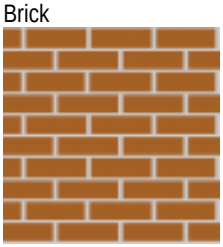
Texture Category	Typical Textures in Category
Art	Paintings and works of art
Brick	Brick and tile patterns
Carpet	Carpets and upholstery
Cloth	Fabrics and upholstery
Cork	Cork
Drinks	Soft-drink labels
Granite	Granite and stone
Marble	Marble
Paint	Rough painted surfaces
Parquet	Wood patterns
PVC	PVC flooring
Rug	Coarse rugs
Stone	Patterned stone and concrete
Wood	Wood materials

You can edit the properties of a texture to define new textures with patterns that you desire.

Art

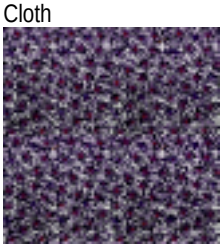


Brick



Carpet

Cloth

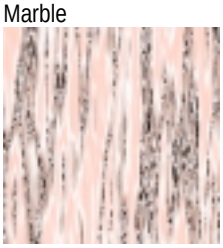


Cork

Drinks

Granite

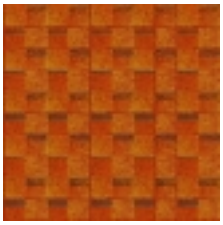
Marble



Paint

Parquet

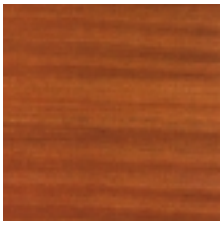
PVC



Rug

Stone

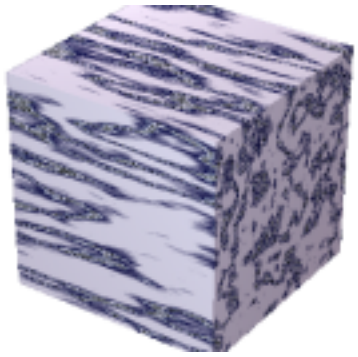
Wood



2D texture applied nonglobally

2D texture applied globally

3D texture



Using the Texture Dialog Boxes

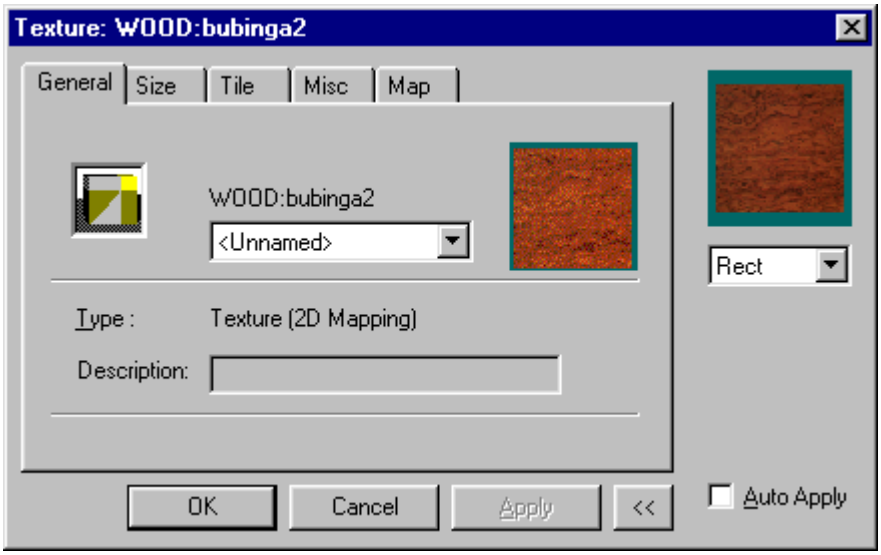
Select a texture from a palette.

Two-dimensional textures are displayed as patterned squares in the palette. The size of the square is one repeat unit of the texture pattern.

Three-dimensional textures are displayed as columns of marble, logs of wood, or other three-dimensional objects within a solid-color square. The size of the square is 1 x 1 meter, providing a visual guide for the scale of the texture.

If you edit and save a texture definition, choose the icon of the original (unedited) texture from the palette. The dialog boxes then provide either an additional scroll box or an EDIT icon by which you can choose your edited version.

To open the TEXTURE dialog box, select a texture from the palette. Either double-click it or right-click and select PROPERTIES. A dialog box with 4 tabs is opened.



Naming a Texture

In the attributes record of an entity, textures are specified by category and name, selected from drop down menu, for example *WOOD:budinga.* If you create a new texture definition by editing a predefined texture, you give the texture a subname, for example *WOOD:budinga:dark.*

If you know the category and name, you can specify a texture in the modeling mode by typing on the input line without using a dialog box.

NOTE *Type the category and name in capital and small letters exactly as it appears in a dialog box or attributes record.*

Default Texture and Conflicts with Color

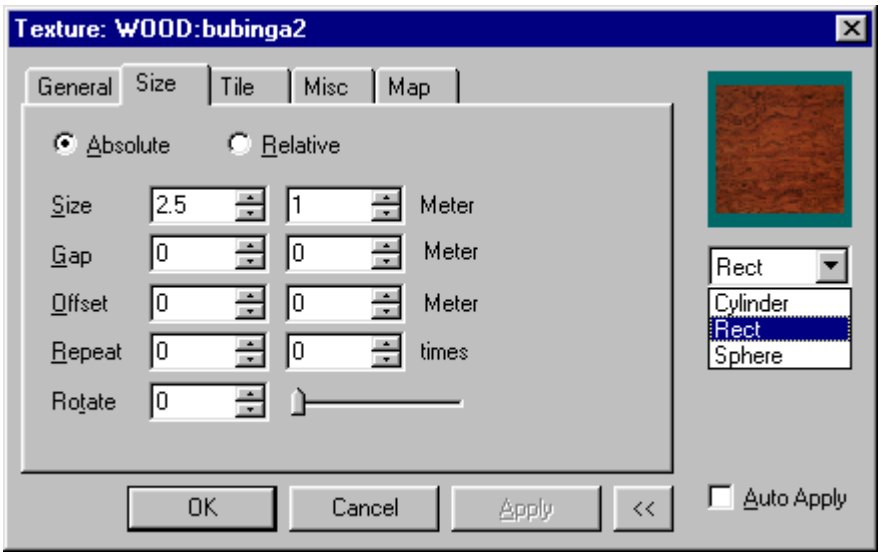
If you assign no texture to an entity, then the entity is rendered without texture.

If you assign both a color attribute and a texture attribute to an entity, then the texture is used to form the rendered image and the color is ignored.

See *Combining attributes later in this chapter* for further information on this subject.

Editing Texture Size and Orientation

You can edit the properties of a texture using the TEXTURE dialog box SIZE tab. The fields and options in this box vary depending on the type of texture you are editing.



For two-dimensional textures, you can change the scale or rotate the texture on the surface to which it is applied:

ABSOLUTE/RELATIVE — Select ABSOLUTE if you want to specify the other texture options (SIZE, GAP, and OFFSET) in your ARC+ working units (e.g., meters). Select RELATIVE if you prefer to specify the other options as a fraction or percentage of the polygon to which the texture is applied.

SIZE — Horizontal and vertical dimensions of the texture pattern unit (the unit that appears in a dialog box icon).

In the ABSOLUTE option, increasing the SIZE enlarges the texture. In the RELATIVE option, SIZE is the number of times that the texture pattern unit is repeated on the surface, i.e., increasing SIZE makes the texture unit smaller.

GAP Leaves a horizontal or vertical space between repetitions of the texture within the polygon.

OFFSET Displaces the starting point of the texture repeat pattern in a horizontal or vertical direction within the polygon.

If you select ABSOLUTE, specify OFFSET and GAP in your working unit (e.g., meters). If you select RELATIVE, specify OFFSET and GAP in percent of the texture unit dimensions.

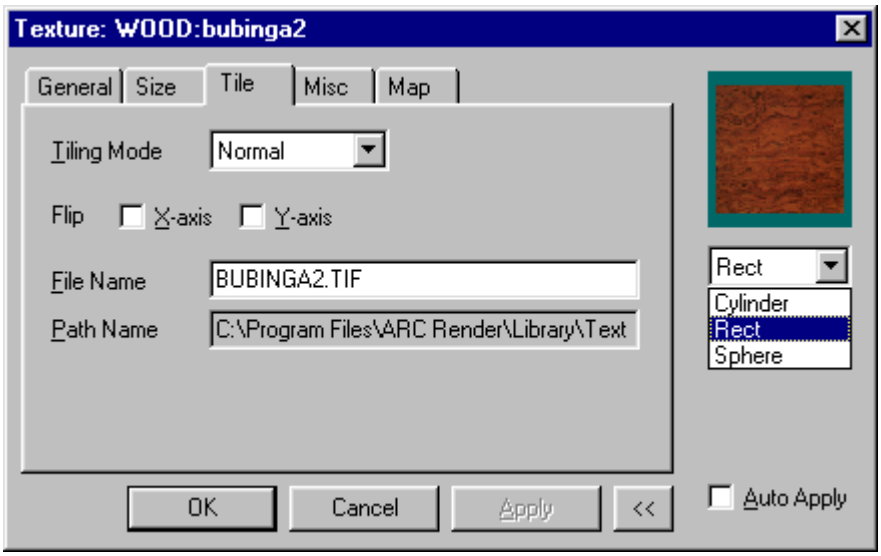
REPEAT Portion of the polygon surface that the texture covers in the horizontal and vertical directions. The default value of 0 means that the entire surface is covered. Specify nonzero values if you want to cover only part of the surface.

Specify repeat as the ABSOLUTE dimensions that you want to cover, e.g., 1 m horizontally x 2 m vertically, or as the RELATIVE number of times that the unit should be repeated, e.g., twice horizontally and three times vertically.

The REPEAT value is the *maximum* coverage of the surface. If you specify a REPEAT value that is larger than the entire surface (e.g., REPEAT = 10 m on a 2 m surface), then the entire surface is covered.

ROTATE Orientation angle of the texture on the surface (0-360°). With an angle of 0°, the first corner point of the pattern (bottom left of the dialog box icon) coincides with the first point that you defined when you created the polygon. The second corner point (top left of the icon) lies on the line between the first and second points of the polygon. With a rotation angle not equal to 0°, the pattern is rotated from this orientation.

To edit additional orientation properties of a texture use the TEXTURE dialog box TILE tab.



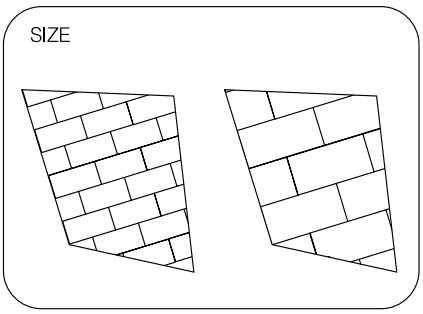
TILING MODE Determines how alternate texture units are oriented relative to one another throughout the polygon. Options are *normal* (all units oriented in the same direction), *mirror xy* (alternate units are flipped in both the horizontal and vertical directions), *mirror x* (flipped in the horizontal direction only), and *mirror y* (vertical direction only).

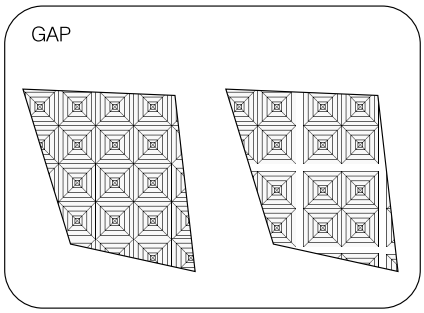
FLIP Reflects the texture pattern unit in the horizontal or vertical direction.

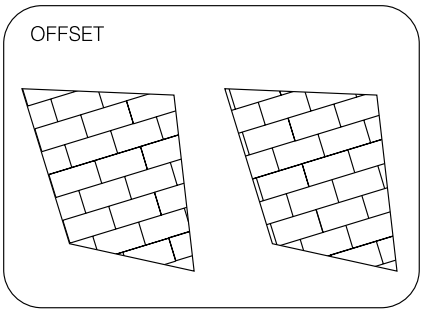
To edit the alignment property of a texture use the TEXTURE dialog box MISC tab.

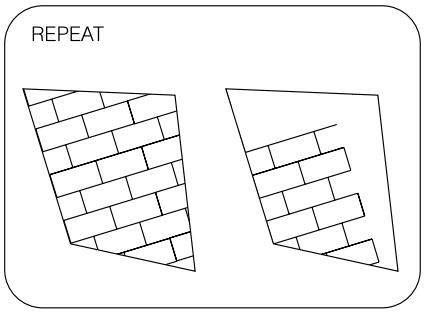
ALIGNMENT The direction in which the vertical dimension of the texture unit is placed. Options are *polygon* (i.e., the texture is placed parallel to the first side of the polygon), *x axis*, *y axis*, and *z°axis*. Choose *z axis*, for example, to ensure that a brick texture is placed parallel to the true vertical direction of your model.

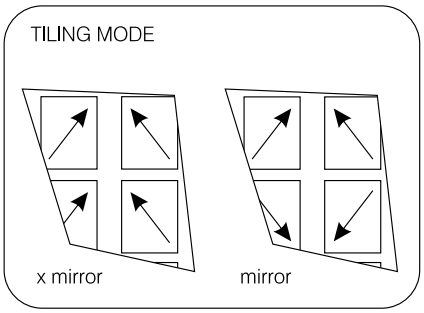
NOTE *The GAP, OFFSET, REPEAT, TILING MODE, FLIP, and ALIGNMENT options are effective for textures applied to polygons or applied nonglobally to solids.*

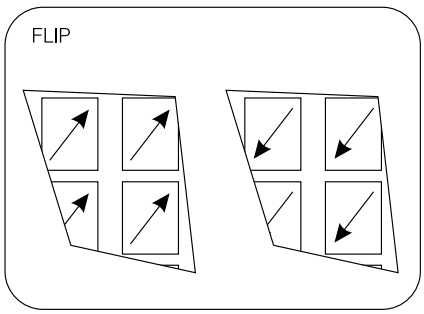

SIZE

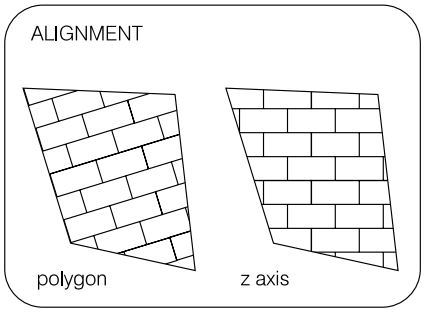

GAP

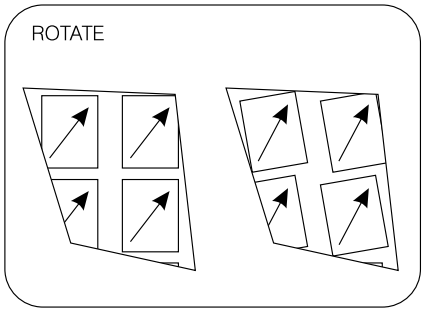

OFFSET


REPEAT


TILING MODE
x mirror
mirror


FLIP


ALIGNMENT
polygon
z axis

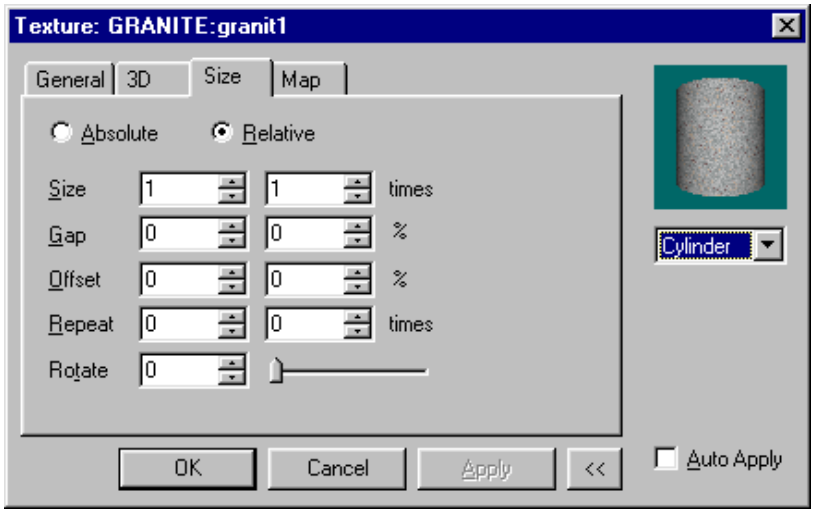

ROTATE

Editing Texture Colors

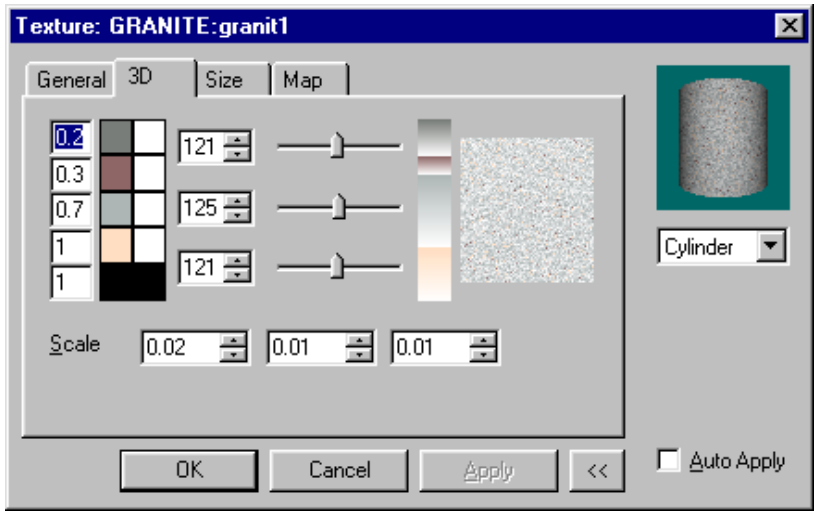
For two-dimensional textures that contain only two colors, you can edit:

COLORS Click either of the color squares to make it active and edit the color using the RGB slide bars.

For three-dimensional textures, you can edit both size and colors:



You can edit the properties of the texture using the TEXTURE dialog box SIZE tab, see *Editing Texture and Size Orientation*, earlier in this chapter.



You can edit color using the TEXTURE dialog box 3D tab.

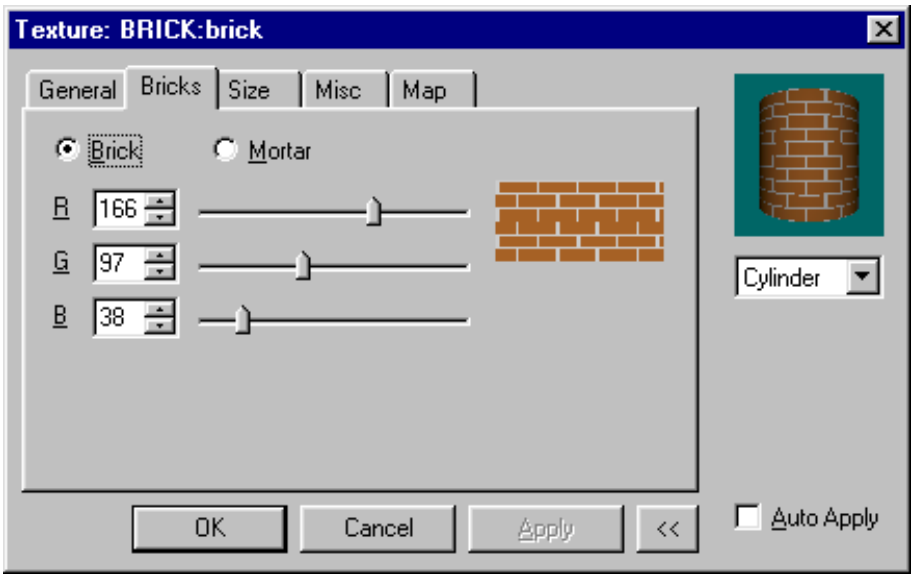
SCALE Density of the pattern in the xyz directions (lower values give denser patterns).

CONTOUR VALUES Numerical steps at which colors are defined. You may type any number between 0 and 1 on each line, using up to five successive lines. The numbers must be in *ascending* sequence. Changing the contour values changes the spacing of colors in the texture. Adding additional contour values introduces a larger variety of colors in the texture.

COLORS Five color values defined for each contour value. These colors, including a continuous range of colors between them, are displayed in the texture. To change the colors in the texture, click any of the color squares and adjust the RGB slide bars.

NOTE *For the mathematically inclined: A three-dimensional texture is computed as contour surfaces of a function* f (x,y,z)*, whose values range from 0 to 1. For specific contour values, you define colors in the dialog box. ARC+ Render Pro interpolates colors between the contour values that you define.*

Editing texture colors depends on the type of texture, and might vary for different types.



Bump Map Option-Roughening the Surface Appearance

You can apply a texture as a *bump map*, which is a roughness (embossed appearance, variation of surface orientation) that is applied to a surface. Select the MISC tab in the TEXTURE dialog box.

BUMP MAP DROP DOWN MENU

NO BUMP	Apply the texture smoothly. The texture hides any color that is applied to the same surface.
JUST BUMP	Apply the roughness effect to a surface, but not the colored texture from which it is derived. The roughness does not hide an underlying color, if you apply both the texture and a color to the surface, both show through.
TEXTURE + BUMP	Apply both the colored texture and the roughness effect. The texture hides any underlying color.

Transparency Map Option-Textures with Transparent Holes

You can apply a texture with *transparency map* that allow the background to show through. Common *transparency map* is *invisible black pixels.* A *black pixel* is defined as any point in the texture pattern unit that contains pure black color (RGB = 0 0 0). In effect, the black pixels are transparent holes or windows in the texture.

Check TRANSPARENCYMAP in the TEXTURE dialog box.

Transparency map options:

TRANSPARENCY CHANNEL Use transparency channel for transparency map. This option is effective when texture file have alpha channel. If alpha channel is not available in the current texture file, the comment “no alpha channel” is displayed next to this option.

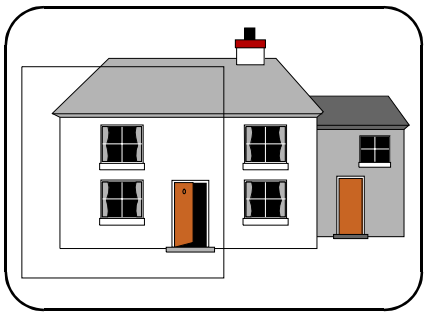
COLOR RANGE Use the parts of the texture image with color range as transparent areas. Default color range is black. When color range is black (*invisible black pixels*), use the black (RGB 0 0 0) parts of the texture image as transparent areas.

FILE Transparency map is available in external mask file.

To create a texture where INVISIBLE BLACK PIXELS is selected by default, see *Adding textures and texture categories*, later in this chapter. You can override the default by deselecting INVISIBLE BLACK PIXELS in the TEXTURE dialog box.

If the effect of the invisible black pixel doesn’t show in the rendered image, choose the ray tracing viewing method.

Bitmap of texture unit



Model containing rectangle

Rectangle filled with normal texture

Rectangle filled with invisible black pixel texture

Effect on Computation Time

Some three-dimensional textures take longer to draw on the screen than two-dimensional textures. The time for a rendering computation may be increased when a three-dimensional texture is employed.

Smoothing

You can assign the smoothing attribute to solid entities. Smoothing is performed by averaging the light characteristics on the surfaces adjoining at an edge.

Smoothing is effective, for example, to round the edges of a curved body that was approximated in ARC+ as a series of flat surfaces.

You *cannot smooth* a polygon entity or a single polygon on the surface of a solid.

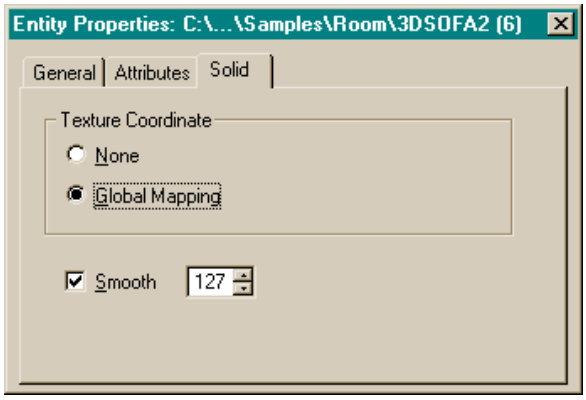
IMPORTANT *Smoothing is effective only if you choose the Phong or ray tracing option when you form the rendered image (*see *Chapter 5, Rendering, Shading options).*

Defining a Smoothing Angle

To assign a smoothing attribute, double-click on the solid entity, or right-click the mouse and select PROPERTIES.

Specify the smoothing as an angle, greater than 0° and less than 180°. Smoothing is applied to any edge where the dihedral angle is *greater* than the value you specify.

Thus a larger number of edges are smoothed if you specify a smaller smoothing angle. If you specify a smoothing angle of 0°, no smoothing performed.



Default Smoothing

If you do not assign a smoothing attribute to an entity, then smoothing is not performed.

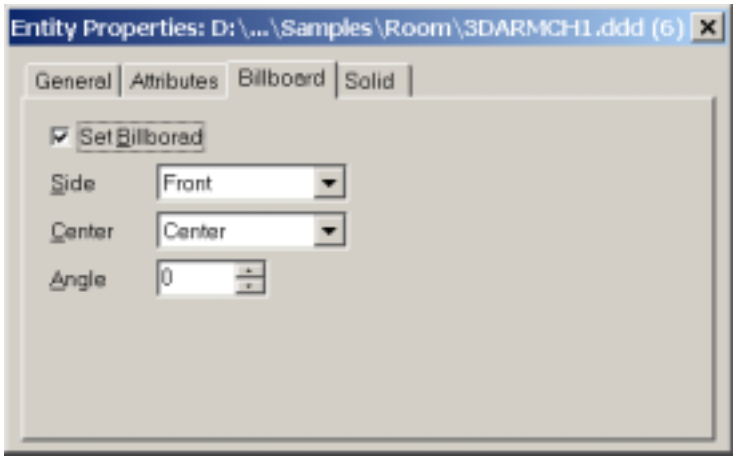
Billboards

Billboards are objects that always face the camera. For example, a flat object consisting of a simple polygon and a transparent texture (e.g. texture of a tree) can be defined as a billboard. Once an object is defined as a billboard, it will be automatically rotated towards the camera each time the camera is moved.

This feature is especially useful when placing objects such as trees and people in an architectural scene. When the cameras on the scene are moved around, Billboards automatically rotate towards each rendered camera – a time consuming task when done manually.

Defining Billboards

To define an object as a Billboard, right-click on an object and select Properties from the contextual menu. In the dialog box that opens, select the Billboard tab and check the Set Billboard box.



Side — Defines the object-side facing the camera (front, left, right, top, etc.).

Center — Defines the orientation of the selected object-side towards the camera (center, top-right, top-left, bottom-right, bottom-left etc.).

Angle — Defines the angle with which the object will be facing the camera.

Assigning Attributes to Entities

Polygons, Solids, and Walls

You can assign attributes to polygon and solid entities in your model. If you assign an attribute to a polygon and later expand that polygon to a solid (see *Polygons and solids, Expanding a polygon into a solid*, \p3d command, in the *ARC+ User's Guide*), the solid is automatically assigned the same attributes as the polygon.

When you assign an attribute to a polygon, the entire surface of the polygon is rendered with that attribute.

When you assign an attribute to a solid, all surfaces of the solid are rendered with that attribute. You can override this and render one or more polygon surfaces of the solid with different attributes, by assigning different attribute values to those polygons.

Remember that the two bases of a simple solid are polygons and you can assign attributes to the entire solid or to the bases alone.

The sides connecting the bases of a simple solid are *not polygons*. You cannot assign attributes to one of these sides alone unless you draw a polygon over it.

There are two exceptions to these rules:

- The smoothing attribute can be assigned to solids only. You cannot smooth a single polygon surface.
- If you apply a two-dimensional texture globally to a simple or rotational solid, it covers the sides but not the bases of the solid. To cover the bases as well, assign the texture separately to the base polygons or apply the texture nonglobally (see *Textures* earlier in this chapter).

Be sure to assign attributes to all entities that will be displayed in the rendered image. For example, assign attributes to three-dimensional wall solids. There is little purpose in assigning attributes to two-dimensional wall bases, however, since these are not usually visible in the image.

The Modeling and Rendering Modes

You can assign attributes in either the modeling mode or the rendering mode. The differences between these modes are summarized in the following table:

	In the Modeling Mode	In the Rendering Mode
Enter:	Individual commands for each attribute	One command
You can assign:	Color, material, texture, or smoothing (one at a time)	Color, material, and texture (all at once if desired)
Assign attributes to:	Individual entities or a selection group of entities	Individual entities
Indicate entities by:	Pointing to an edge (e.g., a vertical edge of a wall)	Pointing to any point on a visible surface of the entity or right-clicking its name in the scene tree and selecting PROPERTIES.
The attribute is assigned:	Immediately	Immediately
At the same time, you can set:		Lights Ambient light Background
You see the result:	When you form the rendered image	Immediately (preview with no shading or Phong shading)
You may mix attribute assignments with:	Any other ARC+ command	ARC+ Render Pro commands only

Assigning Attributes in the Rendering Mode

To enter the rendering mode, choose the following command:

\grdyned	Attributes Dynamic Editing

The model is displayed in the work windows. Use the VIEW menu and the draw toolbar to adjust the view as desired (see *Chapter 1.Getting Started, Windows and viewing icons*).

Assigning the Attributes

To assign an attribute: click on the solid entity, right-click the mouse and select PROPERTIES. Double-click the blank rectangle you want to edit.

To attach attributes, use the attach icons reviewed in *Chapter 1, Getting Started,* or Select Edit > Attach Mode from the menu bar and then select from the same menu choices as available in the icons below.

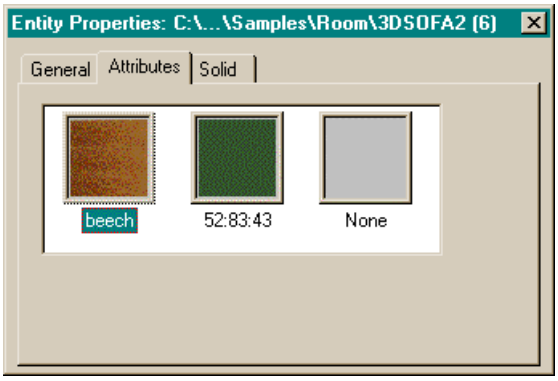
From left to right: Attach to entity. Attach to solid. Layers. Colors.

Click Attach to entity or Attach to solid icon and double-click the entity to open the Entity Properties dialog box and assign attribute. To attach to a layer or color click the appropriate icon to open a layers or color properties dialog box. If

you choose ATTACH TO SOLID, also specify how to wrap two-dimensional textures around simple solids (see *Textures*, earlier in this chapter):

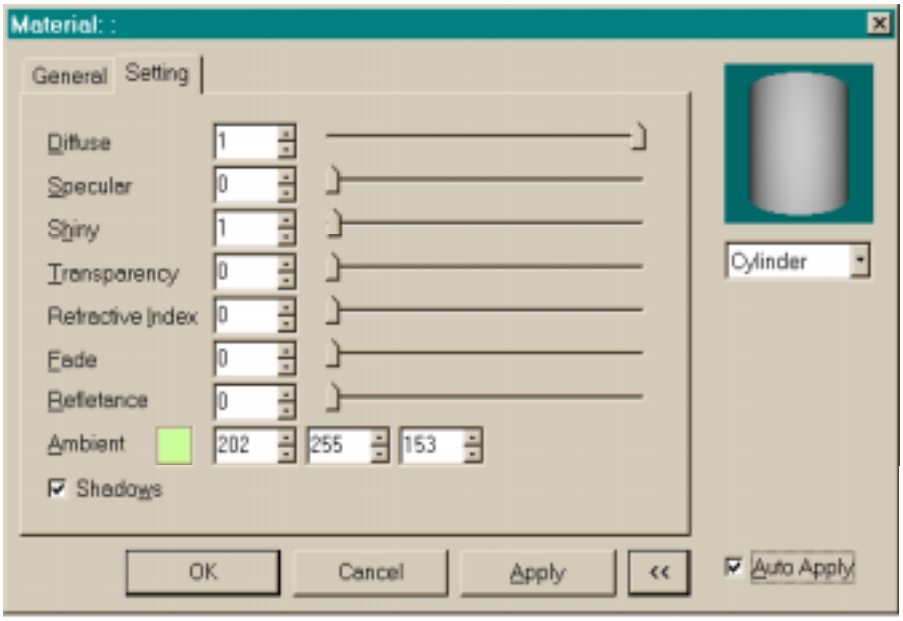
Attaching an attribute (texture, materials or color) is referred to as a 'look'.

IMPORTANT *The indicated point on the surface must be visible, not hidden behind any other entity. If no point on the desired surface is visible, rotate the model using the viewing icons until the surface comes into view.*



To assign an attribute, click on the solid entity, right-click the mouse and select PROPERTIES.

You can either assign an existing attribute or generate a new one, for each one of the displayed rectangles. To assign an existing attribute (color, material or texture), select it from the relevant toolbar, drag and drop it on the rectangle. To generate a new attribute, double-click the rectangle you want to edit. An attribute setting dialog box is opened.



Use all the editing options as explained in *Editing a Material* earlier in this chapter (or other attributes).

Saving an Edited Attribute

Click APPLY, AUTO APPLY or OK. A SAVE AS dialog box opens. Specify a name and click OK to add the modified texture to the rendering files.

NOTE *If you create a new attribute definition by editing a predetermined attribute, you will be asked to give it a subname.*

When you check AUTO APPLY, all changes are dynamically applied to the displayed model, along with the editing. When you click APPLY, the changes are applied when you click, and the dialog box remains open. When you click OK, the changes are applied and the dialog box is closed.

Placed Objects

You can assign attributes to the component entities of placed objects within your model.

When you do this, the attributes are stored in the source (library) file of the placed object. Thereafter, the placed object has the *same* rendering attributes in every model in which it is placed (unless you cancel or change the attribute values).

To avoid this, copy the source file to your working directory and place the *copy* in your model. When you save the model, the copy file is modified but the source file remains unchanged. For information on copying library files automatically, see *Chapter 1, Getting Started, Model and Rendering Files.*

Positive and Negative Solids

You can assign attributes to both positive (ordinary) solids and to negative solids (openings and voids). When you do this:

- A positive solid is rendered as you would expect-the attributes you assign are displayed on all surfaces.
- A negative solid is rendered as an open area in your model-for example a doorway or window.
- The attributes you assign to a negative solid are displayed at the boundary of the negative solid with a surrounding positive solid-for example a doorframe or windowsill.

Previewing the Rendered Image

You can view the effect of your attribute assignments on the rendered image at any time. Select one of the VIEW menu options or one of the icons at the draw toolbar:

WIRE FRAME View only the polygons forming the model (the default display). Your model is displayed as in the modeling mode of ARC+.

NO SHADING View the rendered model without shading effects also known as FLAT RENDERING. The true colors and textures of your model are displayed, exactly as they would appear in white ambient (uniform and non-directional) light. Your lighting scheme is ignored in this option, and the effects of material attributes are not displayed.

DYNAMIC RENDERING View rendered model with lighting and shadow effects, defined during dynamic rendering. Display the rendered image with the *Phong* shading option. You can observe the effects of your lighting scheme and of your color, material, and texture assignments. In order to save computation time, however, the quality of the image is lower than that of a DYNAMIC EDITING produced in the *Rendering the model* (\grender) command (see *Chapter 5, Rendering*).

RAY TRACE WHOLE WINDOW View the rendered image with the *ray-tracing* option You can also preview a portion of the model using the RAY TRACING method. Use this option, for example, to preview a region of the model to which you have assigned a transparent or reflective material attribute.

RAY TRACE BY RECTANGLE In the VIEW menu, select ray tracing by rectangle. Then drag the mouse to define a fence (rectangle) in the model. The area within the fence is displayed using the ray tracing method. The display returns to the normal preview method if you assign a new attribute value to an entity within the fence or if you click a different preview icon.

RAY TRACE PUZZLE Depending on the complexity of your image and other factors, it may take a little time for a preview to be drawn on the screen. You can halt the screen redraw at any time by pressing Alt+Shift. This has *no effect* on your attribute, lighting, or background assignments. You can choose a different preview icon, or you can continue making attribute assignments.

Customizing the Previewing Method

You can customize certain aspects of the preview display using the following command:

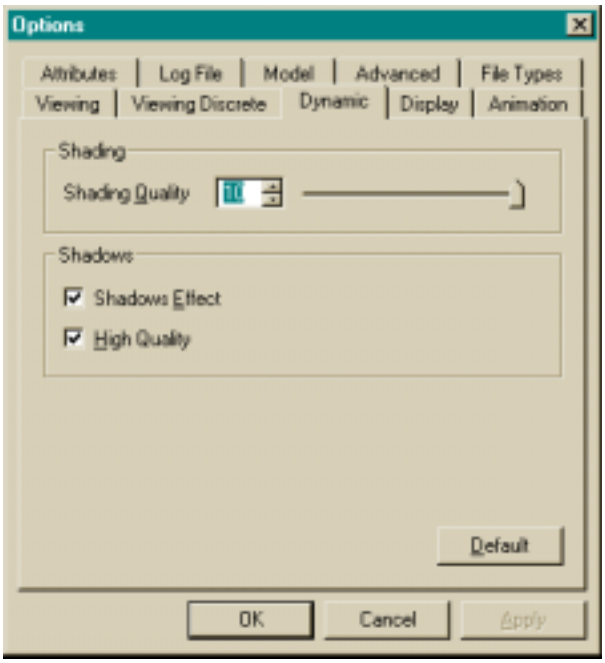
\grstde	Tools Options Dynamic

Using the dialog box, you may specify:

SHADING QUALITY A parameter influencing the quality of the DYNAMIC RENDERING image. Choose higher values for a higher quality image, or lower values to save computation time (range 1-10, default 8).

SHADOWS You can save time by turning SHADOWS EFFECT off. If you do this, ARC+ Render Pro *does not check* whether a surface of your model is shaded from a light source by other surfaces in your model. Therefore all shadows are eliminated from the preview image (default on).

HIGH QUALITY Produces the highest quality preview rendering, or turn it off to save time.



Click the default button to return to default settings.

Your image size setting takes effect only when you re-enter the *Assigning attributes in the rendering mode* (\grdyned) command. The other settings take effect immediately.

You can change your settings at any time. ARC+ Render Pro remembers your latest choices, so they remain in effect even in your next ARC+ session.

NOTE *These settings affect only the preview display. To set the size and quality of the final rendered image, see Chapter 5, Rendering.*

Changing, Querying, and Editing an Attribute Value

To change an attribute previously assigned to an entity, then simply reassign it. To cancel an attribute, enter the value *none* at the appropriate command prompt.

You may also *query* an entity to determine assigned attributes. You may *edit* an attribute that you have already assigned, by:

- Changing the RGB color combination
- Changing the optical properties of a material
- Changing the scale, orientation, colors, etc., of textures

When you edit a material or texture attribute, you give the modified attribute a new subname and save it in the rendering files. This allows you to create new materials and textures and apply them to entities in your model.

In the Modeling Mode

Use the INQUIRE and EDIT commands that appear in the ATTRIBUTES pull-down menus (see *Commands in the modeling mode*, later in this chapter).

In the Rendering Mode

Enter the rendering mode, select an attribute, right-click the mouse and select PROPERTIES. See above *Assigning attributes in the rendering mode.*

If you wish to query or edit an attribute, point to any visible surface of the entity, right-click the mouse and select PROPERTIES.

Setting the Background

In the rendering mode, you can assign a background to your rendering in the same way as you assign attributes to entities. The background may be any color or most two-dimensional textures (see *Chapter 4, Lighting, Background*).

To assign the background, select a color or a texture from the relevant tool bar, drag and drop it on the background.

If you wish to change the background, simply assign another color or texture to it. You *cannot clear* the background completely, since every rendering must have a background.

NOTE *You may also assign the background using the* SETTING THE BACKGROUND (\grbckgrd) *command, in either the modeling or rendering mode (see Chapter 4, Lighting).*

Color Mapping Table

You can color-code the entities of your ARC+ model using the fifteen standard ARC+ colors. For example, you could use color 1 for brick walls, color 2 for glass window panes, color 3 for metallic surfaces, etc.

Then, you can construct a *color-mapping table* to translate the standard ARC+ colors into color, material, and texture rendering attributes. In this way you map *color 1* to a brick texture with chalk-like optical properties, *color 2* to a transparent glass material with white color, *color 3* to a coppery color with aluminum-like reflectance, etc.

If you wish to override the color mapping for one or more entities in your model, then simply assign different attribute values to those particular entities.

To override, double-click a color in the scene tree. Drag and drop attributes from the color, texture and material bars into the attributes dialog box. You can edit and save these attributes by double-clicking the selected rectangle.

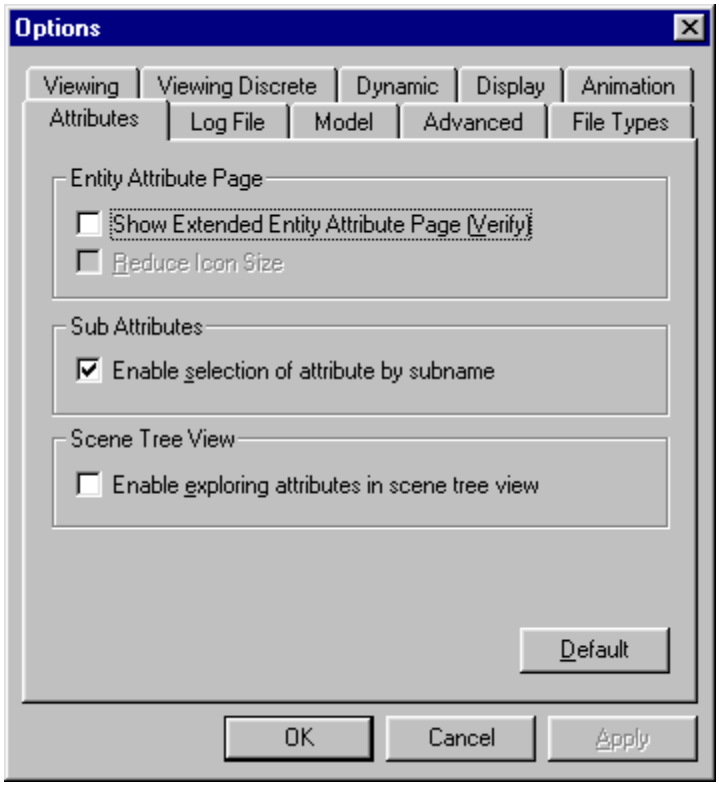
Layer Mapping Tool

You can automatically map the layers of ARC+ onto color, material, and / or texture attributes of your choice. For example, you can assign a red color and glass material attribute to all entities in layer 1, or a chalk material and carpet texture to all entities in layer 2.

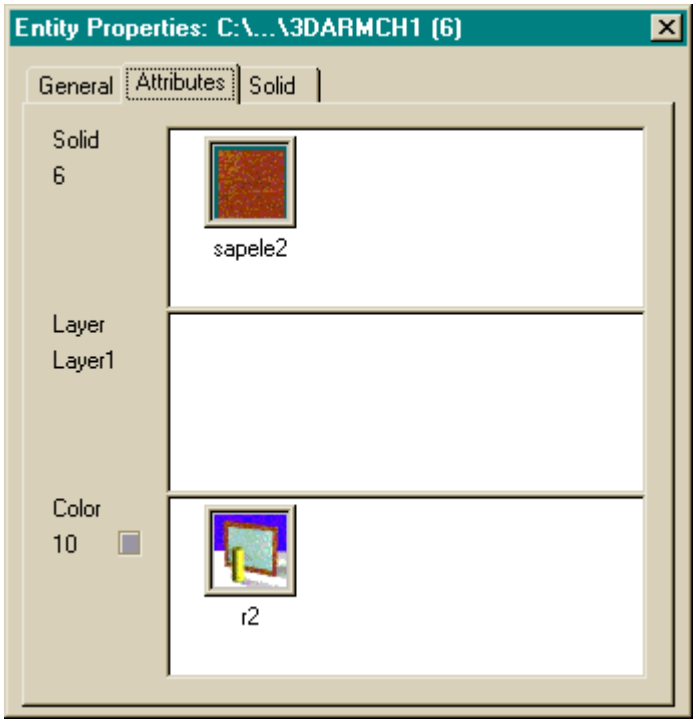
To map the layers, double-click on a layer in the scene tree. Drag and drop attributes from the color, texture and material bars into the attributes dialog box. You can edit and save these attributes by double-clicking the selected rectangle.

Viewing Attributes

To view a complete list of entity attributes, select Show extended entity attribute page in the Options dialog box, Attribute tab. Then double-click the entity to open the entity properties dialog box. Here you can view the solid, layer and color fields of an entity. This extended viewing is valuable in working with Attaching attributes discussed earlier and Combining Attributes discussed below.



SHOW EXTENDED ENTITY ATTRIBUTE PAGE (VERIFY)	Enable view of extended entity attribute page or reduce icon size.
SUB ATTRIBUTES	Enable selection of attribute by subname.
SCENE TREE VIEW	Enable exploring attributes in scene tree view.
DEFAULT	Click to return to default settings.



Combining Attributes

You can combine attributes to represent a great variety of construction materials and finishes.

For example, a "colorless" glass window pane can be represented with a white color attribute and a material with high transparency and low reflectance. The window can be converted to colored glass by giving it a nonwhite color while leaving the material attribute unchanged.

In the event of conflicts between attribute values assigned in different ways to the same entity, the following order of precedence (from highest to lowest) is employed:

- Polygon entity
- Solid entity
- Layer mapping tool
- Color mapping table
- Default attribute value

For example, suppose you have created several solid entities in your model, each with the standard ARC+ color 1. Assign a marble texture to one face of a single solid, a wood texture to the rest of the solid, map a brick texture onto the other solids using the color mapping table.

NOTE *Remember that textures override colors. If you assign both a texture and a color to an entity, the texture is rendered and the color is ignored (see* Textures, *earlier in this chapter).*

Creating and Previewing a Lighting Scheme

You can create or edit a lighting scheme while you assign attributes in the rendering mode. If you choose the DYNAMIC EDITING option from the attributes menu, you see the effect of your lighting scheme immediately on the rendered image.

Create or Edit Light Sources

Lights
Graphic Editing

Light-editing windows and a dialog area are displayed. Select and drag the light and target symbols with the mouse or enter options and numerical parameters in the dialog area. Click SAVE or SAVE AS to save the light in the rendering files. For further information on light definitions, see *Chapter 3, Lighting, Defining the location and type of lights* (\grlight) command.

Commands in the Modeling Mode

In the modeling mode, you must enter a separate command to assign or edit each attribute. In the rendering mode, the attributes are assigned interactively in a single operation, and the following commands are not needed (see *Assigning attributes in the rendering mode*, earlier in this chapter, \grdyned command).

Assigning and Editing Color, Material, or Texture

To assign and edit entities use the identical operating method described below.

Assigning: Polygon Entities

\catrib **\matrib,** **\tatrib**	Attributes Dynamic Editing Set Color/Material/Texture

Assigning: Solid Entities

\scatrib, **\smatrib,** **\statrib**	Attributes Dynamic Editing Set Color/Material/Texture

Editing: Polygon Entities

\greclr, **\gremat,** **\gretxt**	Attributes Polygon Attributes Edit Color/Material/Texture

Editing: Solid Entities

\gresclr, **\gresmat,** **\grestxt**	Attributes Solid Attributes Set Color/Material/Texture

Operating Method

Double-click the entity to open the Entity Properties dialog box and open the Attribute tab to view current attributes. Select textures or basic elements (such as glass, mirrors, etc.) from the selection window located to the right of your work window.

Select attribute (texture, material and color) and drag it to the appropriate field in the dialog box.

To delete an existing attribute value, select it in the dialog box and click the delete button on your keyboard.

If you are assigning a texture attribute, choose *solid mapping* (global wrapping around sides) or *single mapping* (applied individually to each surface).

NOTE *This option is effective only if you are assigning a two-dimensional texture to a simple solid or to certain rotational solids (*see *Textures*, earlier in this chapter*). With three-dimensional textures or other types of solids, this option is ignored.*

Smoothing a Solid

Assign a smoothing attribute value to a solid entity.

\grsmth

Select the Solid tab in the Entity Properties dialog box, click Smooth.

Specify the smoothing as an angle, greater than 0° and less than 180°. Smoothing is applied to any edge where the dihedral angle is greater than value specified. A *larger* number of edges are smoothed if you specify a *smaller* smoothing angle. If you specify a smoothing angle of 0°, however, then smoothing is not performed.

Indicate the solid entity to be smoothed.

IMPORTANT *Smoothing is effective only if you choose the Phong or ray tracing option when you form the rendered image (*see *Chapter 5, Rendering, Shading options).*

Modifying a Look

To modify the look of colors, materials and textures, select the attribute in the Attribute tab of the Entity Properties dialog box, as discussed above. The Look editor toolbar is now activated. This toolbar is reviewed in *Chapter 1, Getting Started*.

From left to right: Move texture left. Move texture right. Move texture up. Move texture down. Rotate texture left. Rotate texture right. Decrease texture scale X. Increase texture scale X. Decrease texture scale Y. Increase texture scale Y. Increase blending. Decrease blending.

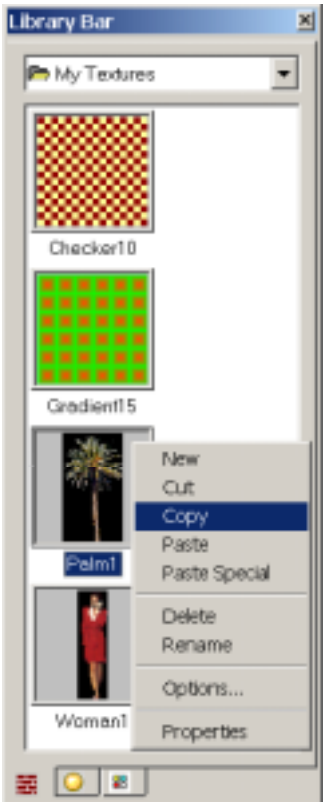
Click icon as desired to move, rotate, increase and decrease textures and blend colors.

Editing the Libraries

The Libraries can be customized in a number of ways: folders and subfolders can be added, and rendering attributes can be added up and edited (Library is a collection of rendering attributes such as textures, materials and colors).

Editing Rendering Attributes

The powerful library tools allow editing, adding, or deleting rendering attributes such as textures, materials and colors.



To delete a texture Right click on the texture in the library bar and select Delete.

To edit a texture Double click on a texture, or right-click on it and select Properties. A dialog opens in which you can edit various attribute parameters.

To add a new texture Right click on the library bar and select New, or select File > Import-Texture from the menu bar. In the import dialog box you can specify the library and category in which you want the new texture to be stored (see *Importing New Textures).*

To copy a texture Copy the texture from the scene, and paste it into the library bar.

To duplicate a texture copy the texture from the library bar and then paste it again.

Note: Read-only libraries cannot be edited. System libraries are read-only by default.

Custom Procedural Textures

Custom procedural textures can be added to ARC+ Render Pro. Sample procedural textures (shaders) such as Gradients, Checkers, and Strips are available in the User textures library. These procedural textures can be created using the Plug-ins development kit. The ARC+ Render Pro Plug-in Development Kit (PDK) allows third party developers to extend ARC+ Render Pro and create custom textures.

Importing New Textures to ARC+ Render Pro

Use the ARC+ Render Pro import texture command to add an unlimited number of new two-dimensional textures to the rendering library.

Creating a Texture

Each two-dimensional texture is defined by a bitmap file, which contains the repeating unit (pattern motif) of the texture. You can create the bitmap in any number of ways, for example:

- By drawing a motif with a graphics program
- By scanning a photograph or hand drawing
- By producing an image file using ARC+ Render Pro
- By editing a bitmap produced by any other method using image processing software

The bitmap size is only limited to the memory available in your computer. Many of the predefined two-dimensional textures supplied with ARC+ Render Pro, for example, have a bitmap size of about 200 x 200 pixels. You can create the bitmap in either a 256 color format (8-bit color) or an RGB format (24-bit color).

Optionally, you can create a texture that contains transparent areas, where the background shows through. To do this, color the desired transparent areas black (RGB = 0 0 0). This allows you to apply the texture with the TRANSPARENT PIXELS option (see *Textures*, earlier in this chapter), which produces the transparent effect.

Store the bitmap in one of the following file types: BMP, TIFF, TGA, PCX, GIF, or JPEG. For further information on the supported file types, see *Forming the image, Image file types.*

Save your bitmap files as you wish to display them. For example, if you name a file REDBRICK.TIF, the texture will be displayed under the name *redbrick* in the ARC+ Render Pro dialog boxes.

Importing Textures

In ARC+ Render Pro, textures have both a *category* and a *name*. You can add new textures to existing or new categories.

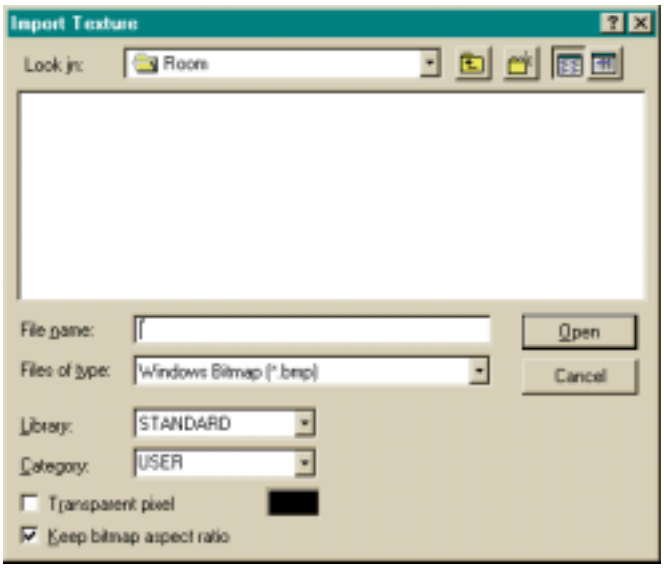
NOTE *To avoid potential conflicts between your textures and textures provided with ARC+ Render Pro, it is recommended to add textures only to categories that you define yourself, not to the predefined categories supplied with ARC+ Render Pro.*

To Import Textures

To import bitmap textures (see *Creating a texture*) into the library, run the following command:

File
Import Texture

The IMPORT TEXTURE dialog box is opened.



Select the file (or files) you want to import.

In the dialog box, specify the following options:

FILE NAME Defines the new file name.

TYPE Defines the new file type.

LIBRARY The library name.

CATEGORY The library folder where the textures bitmaps are stored. You can use an existing category or create a new one.

TRANSPARENT PIXEL Allows you to apply transparency to a specified color. Check the box and double-click on the color box next top it to select a color.

Defines areas with specified color (default black RGB = 0 0 0) of the texture bitmaps as transparent areas, where the background can show through.

This option sets TRANSPARENT PIXELS as the default for the texture. You can override the default when you apply the texture (see *Textures*, earlier in this chapter).

KEEP BITMAP ASPECT RATIO The icon is created with Bitmap aspect ratio.

The new textures are displayed in the ARC+ Render Pro library bar, ready for your use.

If You Install a New Version of ARC+ Render Pro

If you imported textures into the standard textures library, back up your texture bitmap files to another folder (not a subfolder of ARC+ Render Pro), *before* you install a new version of ARC+ Render Pro. Then install the new version of ARC+ Render Pro, and (if necessary) import again your textures in the new version.

3

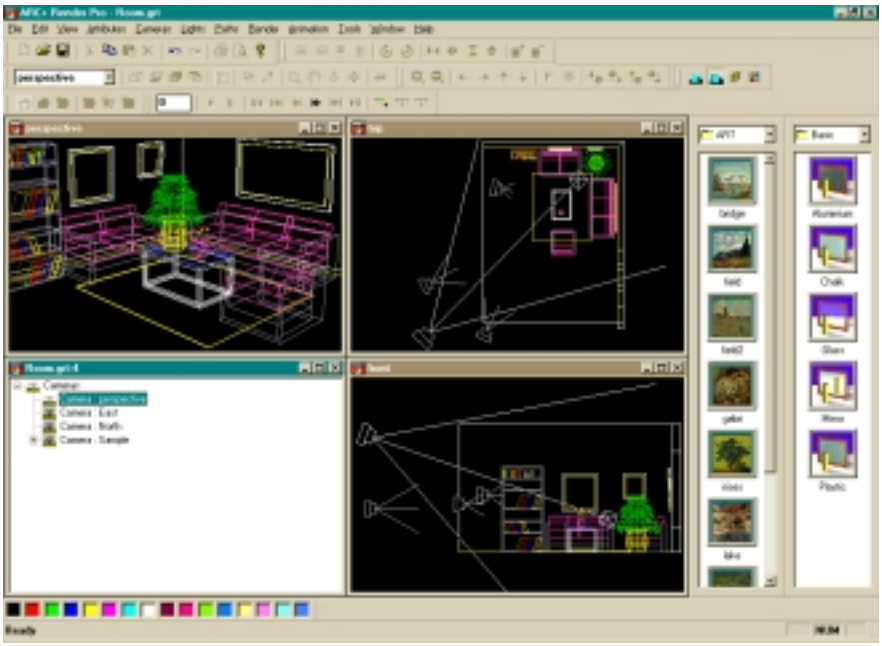
Cameras

Before rendering the model, define the camera or cameras of the rendered image. These cameras are the viewing points, the direction and perspective from which the model is observed. Each model contains five default cameras: perspective, north, south, east and west. You can modify the default cameras or create new cameras using the Camera Wizard.

It is important to keep in mind that the term *camera* has replaced the term *view*, used in earlier versions of ARC+ Render Pro.

Working With Cameras

Select Cameras > Graphic Editing.



The current or default view of your model, seen from the angle of the default camera, is displayed in the *axonometric window* at the upper left of this screen. This is the active camera.

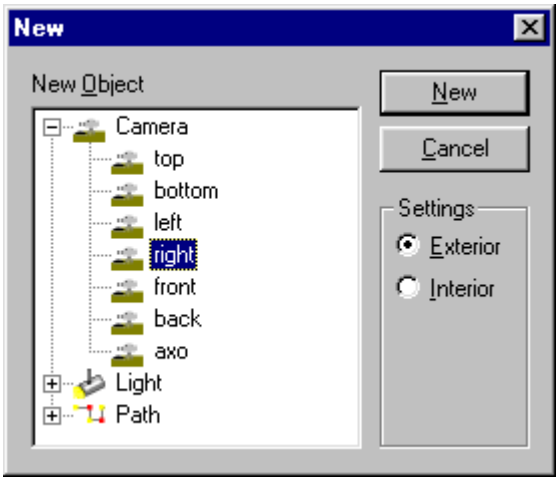
The remaining two work windows are *camera control windows* and work exactly like the view control windows in the modeling mode. Here you can change the view (from the camera's angle) by dragging the eye and target symbols or the line between them (see *Viewing, Using the control windows* in the *ARC+ User's Guide*).

The Camera Wizard

\greview

Select Edit > New from the menu bar, or right-click on any of the work windows and select New from the menu to open the NEW dialog box.

This dialog box is used to create cameras (this chapter), light (see *Chapter 4, Lighting*),

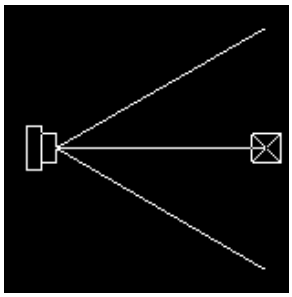


paths (see *Chapter 6, Animation*).

The camera wizard contains a list of camera choices, as well as exterior or interior settings. Select camera and setting and click OK.

The new camera is displayed graphically in both camera control windows. The camera setting is displayed in the active axonometric window.

NOTE *The active camera is represented with an additional box in its target line.*



Setting the Cameras in the Rendering Mode

You have two options in setting the cameras:

- Set the camera in the modeling mode using ARC+ control windows and commands (see Viewing, Setting the projection in the ARC+ User's Guide).
- Set the camera using ARC+ Render Pro menu, camera icons, and dialog boxes provided in the rendering mode. (This is the option discussed in this chapter.)

In either option, you must adjust the camera on the screen and then set the camera using an ARC+ Render Pro command. You can set the camera at any time. Once set, the camera is stored in the rendering files and used when you produce the rendered image.

NOTE *An additional factor affecting the rendering camera setting is the ratio of height to width of the image file (*see *Chapter 5, Rendering, Image file types).*

If you work in the rendering mode, you can set several different cameras and choose which one to use for each rendering. Use this feature, for example, to create a series of renderings that show your design from different perspectives.

Each camera is saved under a name that you specify. Keep in mind that the *current* camera is called the active camera.

Set one or more cameras for rendering using the dynamic editing mode.

\greview	Cameras Graphic Editing
\greview	Attributes Cameras

The ARC+ RENDER PRO screen is displayed (see *Chapter 1, Getting Started* for a detailed explanation of all the screen components).

Camera Control Windows

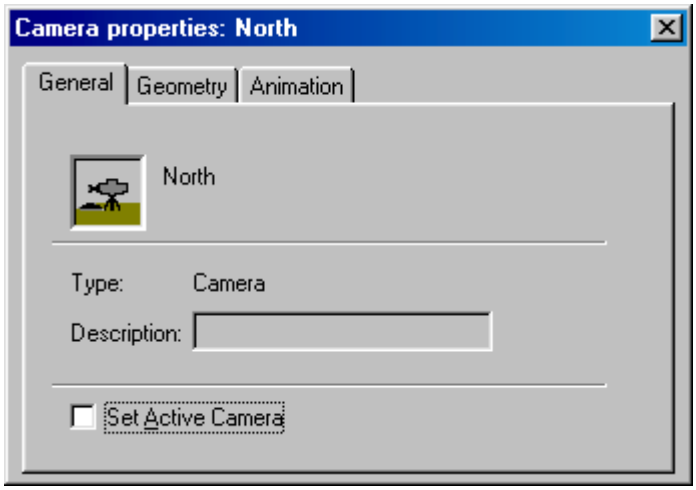
Select one of the camera icons (by clicking its icon in one of the CAMERA CONTROL WINDOWS) and drag the eye and target symbols with the mouse.

- ❑ If you wish to change the direction or perspective of the camera, drag the eye or target symbol alone.
- ❑ If you wish to pan the camera, drag the line between the eye and target.

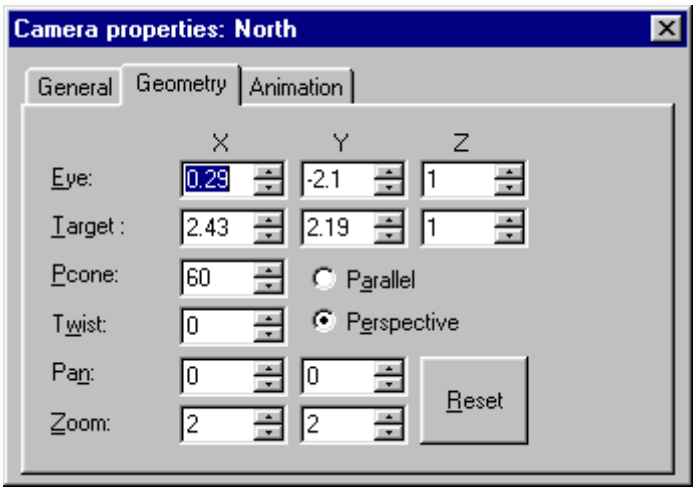
In either case, the changes you have made are reflected in the axonometric window, as well as in the parameter values of the CAMERA PROPERTIES dialog box (if displayed).

Changing Camera Settings

To control the properties of a camera, choose one of the following three options to open the CAMERA PROPERTIES dialog box:
Double-click its name in the scene tree, or right-click its name in the scene tree and select PROPERTIES, or right-click the camera icon in one of the camera control windows and select PROPERTIES.



Select the GEOMETRY tab.


Camera properties: North
General
Geometry
Animation
X
Y
Z
Eye:
0.29
-2.1
1
Target :
2.43
2.19
1
Pcone:
60
Parallel
Twist:
0
Perspective
Pan:
0
0
Zoom:
2
2
Reset

Camera Properties Dialog Box

In the dialog box you can set the following options:

EYE	The coordinates of the observer's eye in three-dimensional space. This can be at any point in the exterior or interior of the model.
TARGET	The center of the observer's cone of view.
PARALLEL/PERSPECTIVE	Set a parallel or perspective camera.
PCONE	The angle (breadth) of the perspective cone from the observer's eye. Set a narrower angle to restrict the camera to a limited area of the model.
PAN	Move the center of the rendered image by a specified distance in the x or y direction.
ZOOM	Expand a section of the cone viewed by the camera (centered about the pan coordinates) to fill the rendered image. Set equal values of the x and y zoom factors to enlarge a *square* area of the target area, or unequal values to enlarge a *rectangular* area.

NOTE *For a detailed explanation of these parameters, see* Viewing, Setting the projection *in the* ARC+ User's Guide.

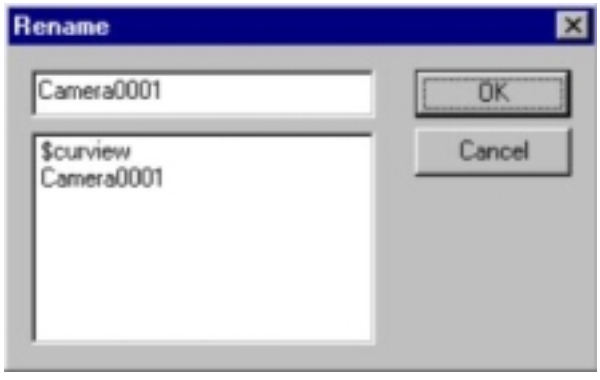
The effect of the changed parameters is immediately displayed in the axonometric window. If you change the EYE, TARGET, or PCONE parameters, the changes are reflected in the camera control windows as well.

Saving a Camera Setting

Every change in the setting of the selected camera (like any other object) is automatically saved, as part of the rendering files. If you do not want to apply the change, use EDIT > UNDO from the menu.

To add a camera, in the scene tree, copy an existing camera and paste it in the tree.

To customize the name of a camera, from the same menu, select RENAME. A RENAME dialog box is opened.



You can either select the default name ($CURVIEW) or the names already attached to your model, or type a new name of your choice.

You may save any number of camera settings under different names.

Selecting an Active Camera for Production

In the production mode, used to preview your work, you can select one of the camera settings that you saved as the active camera. When you render an image / animation of the model, the camera used will be that of the selected active camera.

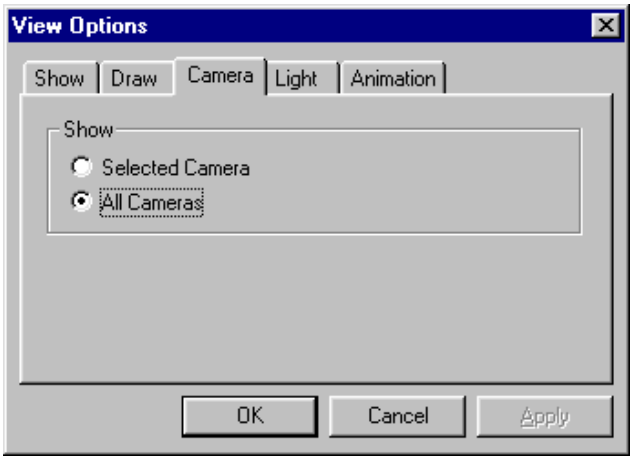
Select the name of the required camera in the SCENE TREE and right-click the mouse.

A pop-up menu is opened:

Select SET ACTIVE. Keep in mind that during rendering or animation you can change the camera desired.

Setting Camera View Option

Right-click in any camera control window to open the VIEW OPTIONS dialog box, camera tab.



Selected Camera Show the selected (current) camera in the camera control windows.

All Cameras Show all cameras in the camera control windows.

4

Lighting

Working with Lighting

Lighting enhances the 3D appearance of your images with highlights and shadows. In addition, ARC+ Render Pro offers the opportunity to create lighting animation. Lighting animation enables you to move and change lighting types within a static scene, as well as illuminate a walk-through animated scene. Lighting animation is fully discussed in Chapter 7.

In ARC+ Render Pro, you can define several types of illumination:

POINT	A light source, such as an interior lamp, that radiates with uniform intensity in all directions from a specified point.
SPOT	A light source that radiates in a cone-shape, from a specified point. You can define the angle of the cone and the variation of light intensity within the cone angle.
DISTANT	A distant source of light that casts parallel rays on all parts of the model. The location of the light source is specified and used to determine the direction of the light rays.
SUN	A distant source of light that simulate sunlight for shadow studies based on global position, date and time.
AMBIENT LIGHT	Uniform, non-directional light that illuminates all parts of the model, without regard to direction or shading.

You can define as many point, spot, or distant lights as you want, as well as ambient light. You can store the light definitions in the rendering files and turn individual lights on or off. This enables you to activate lights selectively to produce renderings at different times of day or night.

In addition, you can simulate atmospheric conditions and the surroundings of your model by defining:

FOG	Haze that blurs parts of the model that are more distant from the observer's eye.
BACKGROUND	Color or texture behind your model.

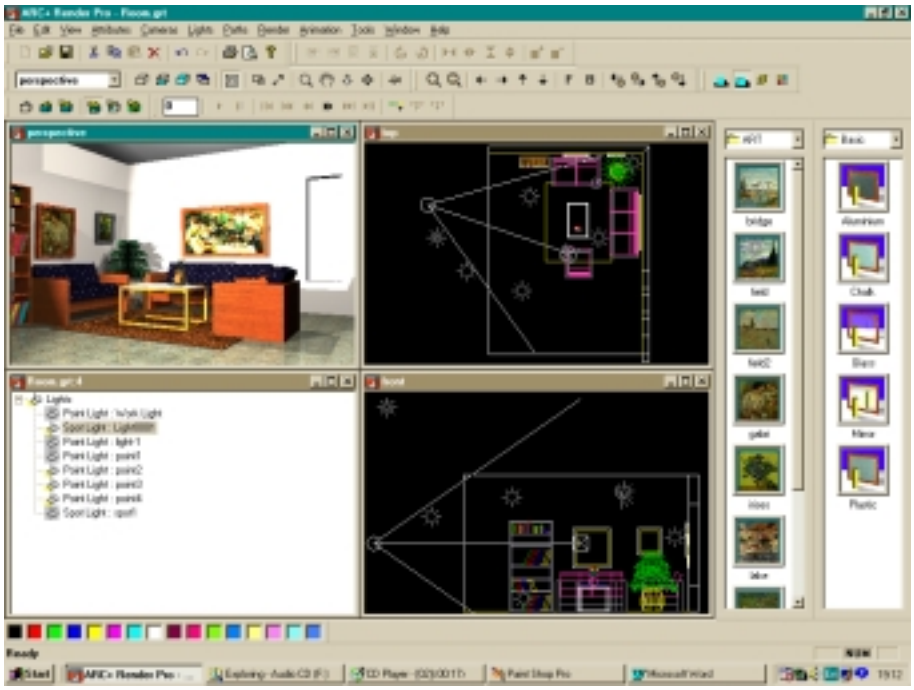
To set the lighting parameters, use commands on the LIGHTS menu or the LIGHT PROPERTIES dialog box. Alternatively, you can activate the light setting mode from the ATTRIBUTES menu (see *Chapter 2, Attributes*).

Defining the Location and Type of Lights

Define the location and direction of point, spot, and distant light sources.

\grlight	Lights Lights layout

The ARC+ RENDER PRO screen is displayed.



The current or default view of your model is displayed in the *axonometric window*. The two *light control windows* contain the symbols for the light sources

and targets. You can change the views in each window using the VIEW menu (see *Chapter 1, Getting started, Windows and viewing icons*).

Working with Work Light

A light source called Work Light, located at the observer's eye position, is *automatically* defined for every ARC+ model. By default, work light is a point source with a white color.

Defined as a cone or distant source, work light is always aimed at the target (center of focus) of the rendering view. If you move the eye or target, work light moves as well. You can freeze the position of the light source before moving the eye or target, save a copy of work light under another name. You *cannot* delete work light, but you can turn it off and alter its properties.

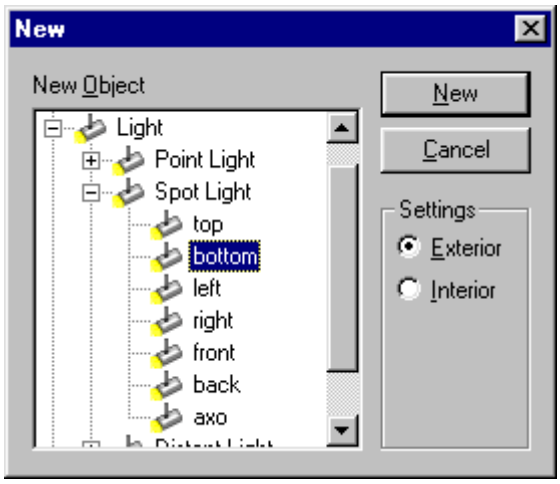
NOTE *By default, WORK LIGHT is turned on for models that you are rendering for the first time.*

The Lighting Wizard

\ Lights
Lights Layout

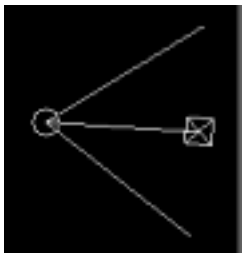
Select Lights > Lights Layout, then Select Edit > New from the menu bar or right-click on any of the work windows and select New from the menu to open the NEW dialog box.

This dialog box is used to create lights (this chapter), cameras (see *Chapter 3, Cameras*), paths (see *Chapter 6, Animation*).

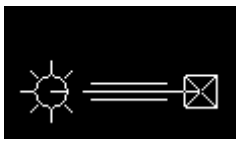


The light wizard contains a list of light choices, such as point, spot and distant, as well as exterior or interior settings. Select light and setting and click ok.

Point light The light rays emanate from a single point. See below for full information



Spotlight The light rays emanate from a single point. See below for full information.



Distant light The light emanates from a point removed from the image. See below for full information.

Point, Spot, and Distant Light Sources

For each light source define the location of the light. For spot and distant light sources, define the location of the light and a target point for the light.

SOURCE The xyz coordinates from which the light shines.

TARGET A point along a line from the light source, determining the direction of the parallel rays from a distant source, or the center of the cone from a spotlight.

Define these points either by typing the coordinates in the LIGHT PROPERTIES dialog box or graphically by dragging the location and target on the screen with the mouse.

You must also set the *color* of each light source:

RGB The RGB color of the light (see *Chapter 2, Attributes, Color Mapping*). The color of an entity in the rendered image is a combination of the color attribute that you have assigned to the entity and the color of the light. For example, a light with a yellow color will impart a yellowish tinge to the model.

NOTE *The RGB concept of color includes intensity of the light. To weaken the intensity of a light, simply reduce the RGB component contributions. There is no need for a separate intensity parameter.*

You can determine:

LIGHT ON The light source is on. If you turn the light off, the light source remains defined but is ignored in the rendering computation. You can turn the light back on at any time.

SHADOWS EFFECT ARC+ Render Pro checks whether each surface in the model is shaded by any other surface from each light source. If you turn shadows off for a light source, then the source is considered to shine on all entities of the model, and ARC+ Render Pro does not check for shadows from that source.

FADE By default, the light intensity is uniform at all distances from the light source. If you set a fade value that is larger than 0, the light decreases in intensity with distance from the source. The light fades more rapidly with larger values of this parameter (range 0-2).

Softening the Illumination

For point and spot sources, the light rays are considered to emanate from a single point. This may produce relatively harsh illumination with *sharp* shadows.

If you choose the ray tracing option to produce your rendered image (see *Chapter 5, Rendering, Shading options*), you can *soften* the illumination and produce fuzzier shadows by defining the following parameters:

RADIUS The radius of a point or spot light source, considered as a sphere.

RAY SAMPLE The number of points within the sphere from which light rays are considered to emanate. With a value of 0, this feature is turned off and all the light emanates from a single point. With a value of 2 or more, the light intensity is divided between more than one point and the illumination is softened.

These parameters are not applicable if you choose a shading option other than ray tracing.

Spotlights

For a spotlight, define the size of the light cone:

CONE ANGLE The angle of the light cone, for example, an angle of 5° means that only a narrow cone illuminates the model. A larger angle causes the cone to widen and illuminate a larger area in the target direction. The maximum angle is 180°, illuminating a hemisphere of space.

Optionally, you can alter the distribution of light within the cone by defining two additional parameters:

BEAM DISTRIBUTION By default, the light intensity is uniform everywhere within the cone angle. If you set a value other than 0 for beam distribution, the light has full intensity only at the center of the cone and fades to a lower intensity at the edges (range 0-50).

CONE DELTA The cone delta angle defines the sharpness of the cone edge. With an angle of 0°, *no* light falls outside the cone. With a larger angle, the light fades away beyond the cone edge. For example, a delta angle of 10° means that there is absolutely no light from the spot source at 10° away from the cone (range 0-180°).

Effect on Computation Time

The time required for the rendering computation *increases* when a larger number of light sources are employed. Usually, you can produce an excellent rendering with about 2-3 light sources plus ambient light. The ambient light ensures that shaded areas do not appear completely black in the image. The fade, cone angle, beam distribution, and cone delta angle parameters have only an insignificant effect on computation time.

The ray tracing option increases computation time, as a larger number of ray samples is defined for each light source. Usually, about 4 ray samples from each light source are sufficient for a good image. The radius value has *no* effect on computation time.

3 point light sources

3 spot light sources

2 distant light sources

2 distant light sources + ambient light

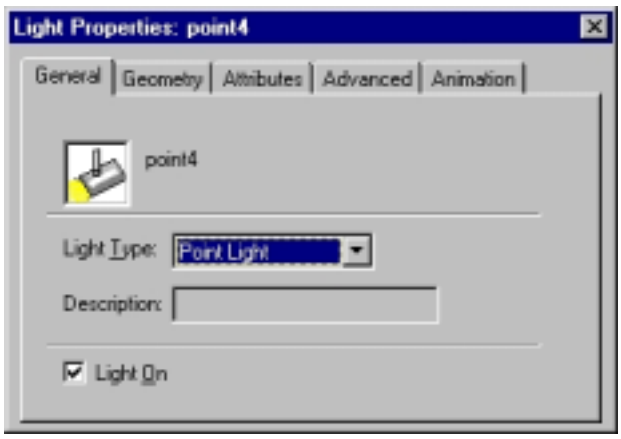
2 distant lights sources + fog

Setting Light Properties

To control the properties of a light:

Double-click its name in the SCENE TREE, or, right-click its name in the SCENE TREE and select PROPERTIES, or right-click the light icon in one of the light control windows.

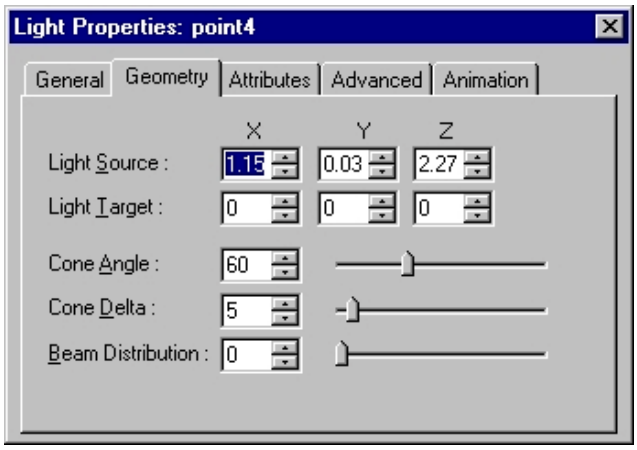
The LIGHT PROPERTIES GENERAL dialog box is opened.



LIGHT TYPE Choose point, spot, or distant from the scroll box.

LIGHT ON Check this box to turn the light source on. Remove the checkmark if you want to turn the light off.

When selecting the Geometry tab, the LIGHT PROPERTIES GEOMETRY dialog box is opened.

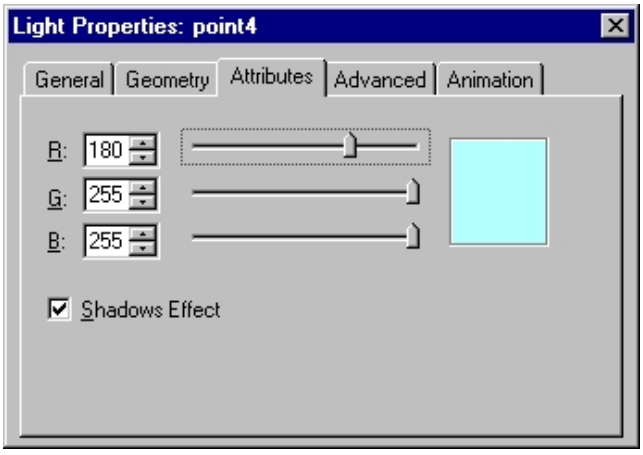


LIGHT SOURCE Enter the coordinates of the light source, or drag the source symbol in a model window with the mouse.

LIGHT TARGET (For spot and distant sources) Enter the coordinates of a point along a line from the light source, or drag the target symbol in a model window with the mouse.

CONE ANGLE For spotlights, enter the desired breadth, sharpness, and uniformity of the light cone.

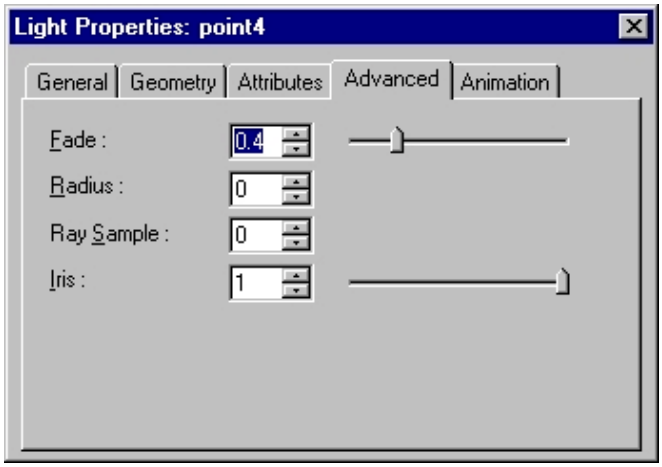
When selecting the Attributes tab, the LIGHT PROPERTIES ATTRIBUTES dialog box is opened:



R G B Adjust the RGB slide bars to the desired color of the light source.

SHADOWS EFFECT Check this box if you want ARC+ Render Pro to check for shadows from the light source.

When selecting the Advanced tab, the LIGHT PROPERTIES ADVANCED dialog box is opened:



FADE Adjust the slide bar or enter a numerical value to define the desired fading pattern of the light source.

RADIUS (For spot and point sources and for ray tracing) Enter a numerical value for the radius of the light source.

RAY SAMPLE (For spot and point sources and for ray tracing) Enter a numerical value for the number of points within the sphere of the light source.

IRIS (For spot light). Adjust the slide bar or enter a numerical value (between 0-1) to define the size of the circle illuminated by the spot light.

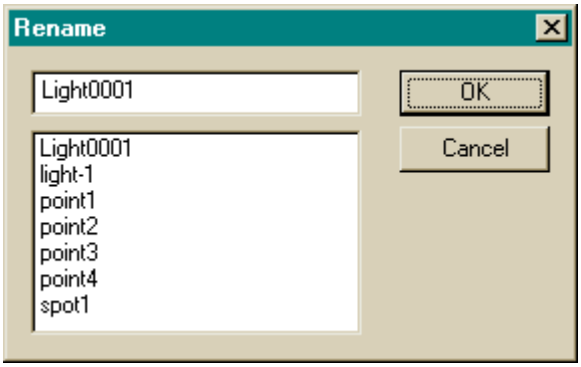
Naming Lights

To customize the name of a light, select a light in the SCENE TREE and right-click the mouse. A pop-up menu is opened:

Select RENAME.

A RENAME dialog box is opened:

You can either select one of the default names or type a new name of your choice.



Saving a Light Definition

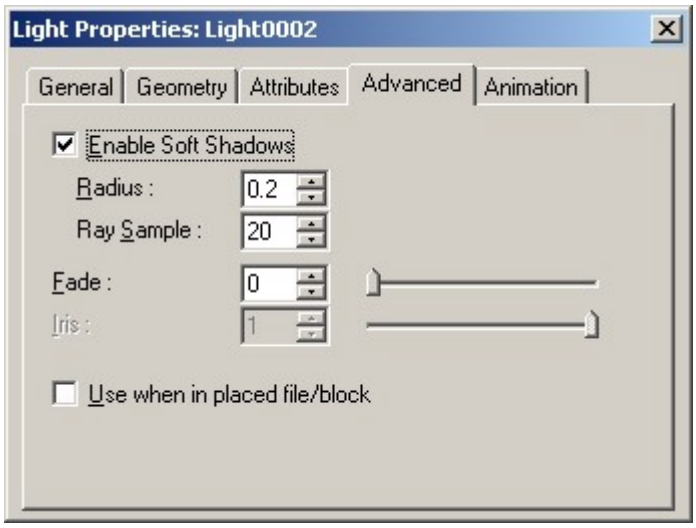
Every change in the setting of the selected light (like any other object) is automatically saved, as part of the rendering files. If you do not want to apply the change, use EDIT > UNDO from the menu.

NOTE *You can also define light sources from the ATTRIBUTES LIGHTS menu (see Chapter 2, Attributes, Creating and previewing a lighting scheme,* \grdyned *command).*

Soft Shadows

To create light with soft shadows:

Right click on the light and then click Properties. In the Light Properties dialog, click Advanced.



ENABLE SOFT SHADOWS — Check to enable soft shadows.

RADIUS — (For spot and point sources and for ray tracing) Enter a numerical value for the radius of the light source.

RAY SAMPLE — (For spot and point sources and for ray tracing) Enter a numerical value for the number of points within the sphere of the light source.

NOTE *Use ray tracing to produce picture with soft shadows effect. Note that soft shadows may considerably affect calculation time.*

Turning Lights On and Off

To turn light sources on or off, use one of the following ways:

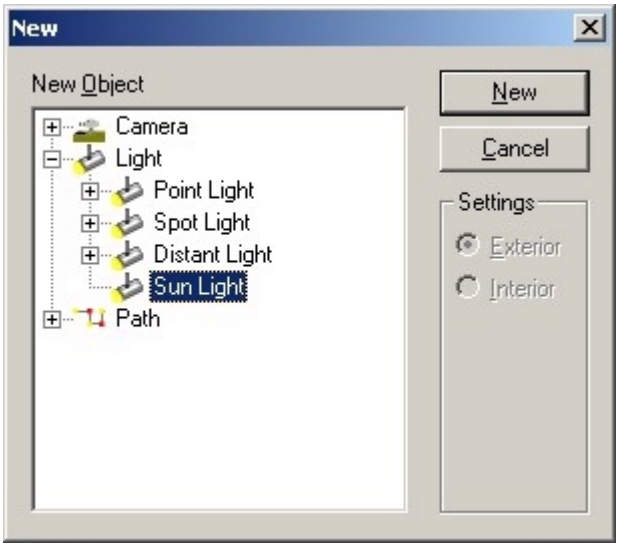
In the SCENE TREE window, select a light and right-click the mouse. In the menu that is opened click TURN LIGHT ON, or in the LIGHT PROPERTIES dialog box - GENERAL tab, click LIGHT ON.

Sun Light

Sun light is a distant source of light that simulates sunlight for shadow studies based on global position, date and time.

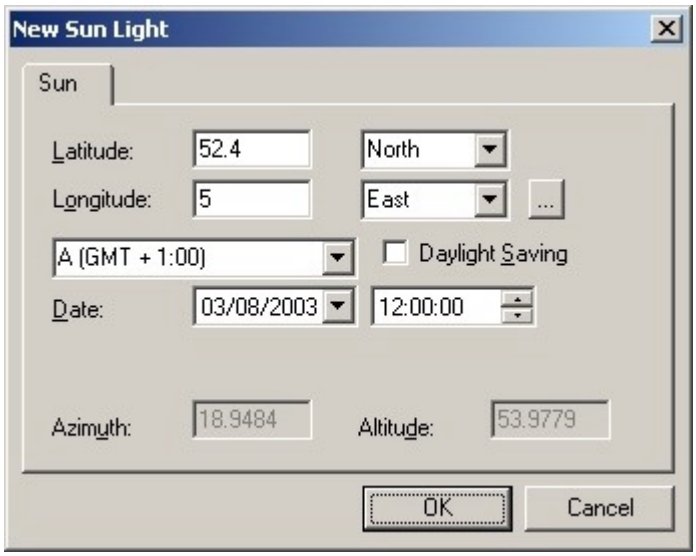
Insert Sun Light

Select Edit > New from the menu bar or right-click on any of the work windows and select New from the menu to open the NEW dialog box.



Click the + sign on the side of the LIGHT branch to open light options. Select SUN LIGHT and setting and click NEW.

The NEW SUN LIGHT dialog is displayed.



LATITUDE, LONGITUDE Global position on earth. Type latitude and longitude, or click the ... button to select geographic location from list of cities around the world.

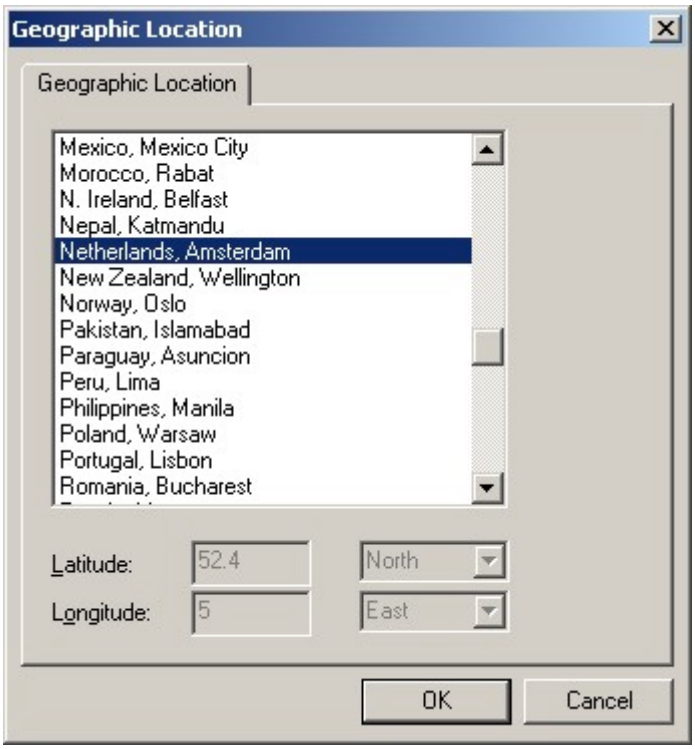
TIME ZONE Select time zone from list of available time zones.

DAYLIGHT SAVING Check if daylight saving is effective.

DATE, TIME Specify the required date and time.

Setting Geographic Location

To select geographic location from list of cities around the world, click ... button in the NEW SUN LIGHT dialog or SUN LIGHT PROPERTIES dialog. Select geographic location, and click OK.



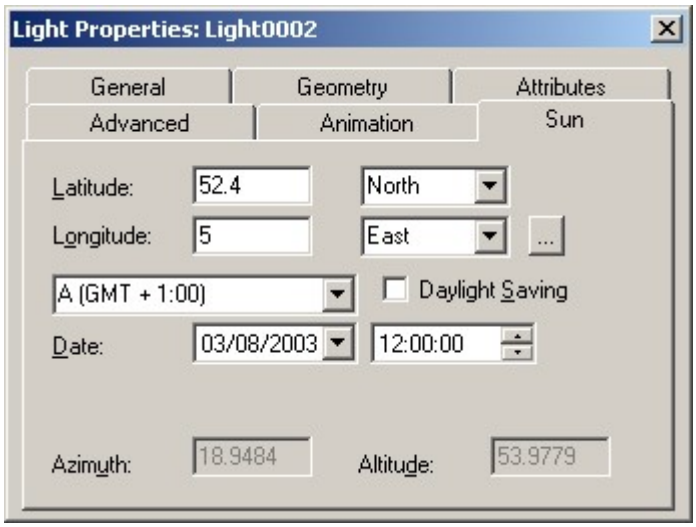
Setting Sun Light Properties

To control the properties of sun light:

Double-click its name in the SCENE TREE, or, right-click its name in the SCENE TREE and select PROPERTIES, or right-click the light icon in one of the light control windows.

The LIGHT PROPERTIES dialog box is opened.

When selecting the SUN tab, the LIGHT PROPERTIES SUN dialog box is opened.



The dialog is identical to the NEW SUN LIGHT dialog. You can change date and time, to simulates sunlight for shadow studies in different hours of day, and dates of the year.

Ambient Light

Ambient light is uniform, non-directional light of any RGB color. Ambient light illuminates all surfaces of your model equally, without regard for shadows or location of the surfaces.

Use ambient light in addition to point, spot, or distant light sources to *decrease* the depth of shadows in your model. Ambient light ensures that all portions of your model receive some illumination, so that shadowed areas are not completely black.

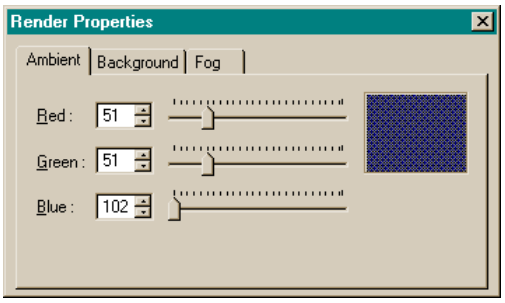
It is recommended to use a fairly low intensity of ambient light (i.e., low RGB component values). If the ambient light is too strong, the other light sources you have defined are likely to be washed out.

Setting Ambient Light

Set the color of ambient light illuminating all portions of your model.

\grlight	Lights Ambient Light

The RENDER PROPERTIES dialog box is opened:



Adjust the RED, GREEN, BLUE slide bars until the desired ambient light color is displayed.

Background

Every rendering must have a *background*. The background includes everything appearing behind the model in the rendered image.

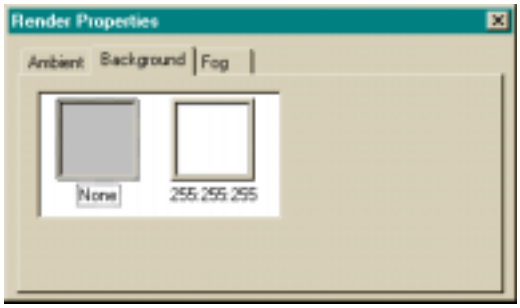
The background may be a solid color or a two-dimensional texture. The background is copied exactly into the rendered image. The colors or textures in the background are not rendered or otherwise changed during the rendering process.

Setting the Background

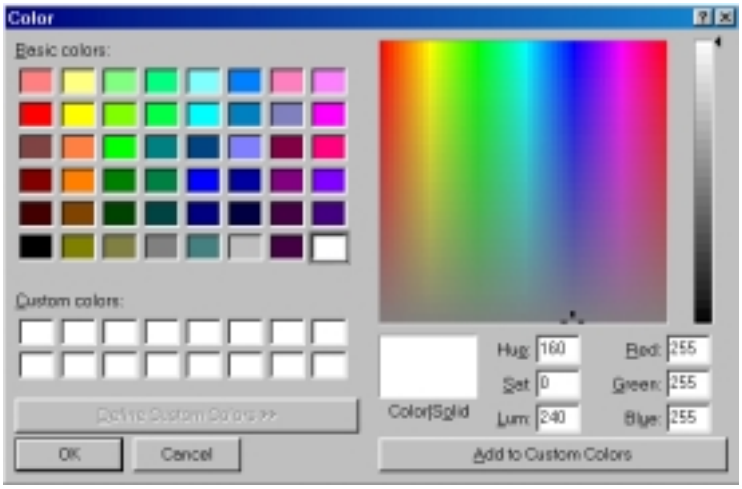
Set the background color or texture of the model.

\grbckgrd	Lights Background

A dialog box (similar to the one shown for ambient light) is opened.



Double click on the square: A color palette is opened. Adjust to your desirable color.



Fog

You can simulate atmospheric conditions by specifying fog in your rendering. Fog decreases the intensity of colors and gives objects in your image a hazy appearance. The effect increases with distance of the object from the observer's eye.

To define fog, you must specify a fog distance and color:

FACTOR A value of 0 turns this option off and the model is rendered without fog. A value other than 0 signifies the approximate distance at which entities in your model are obscured by the fog or the visibility distance. Thus, larger values mean less fog (default 0).

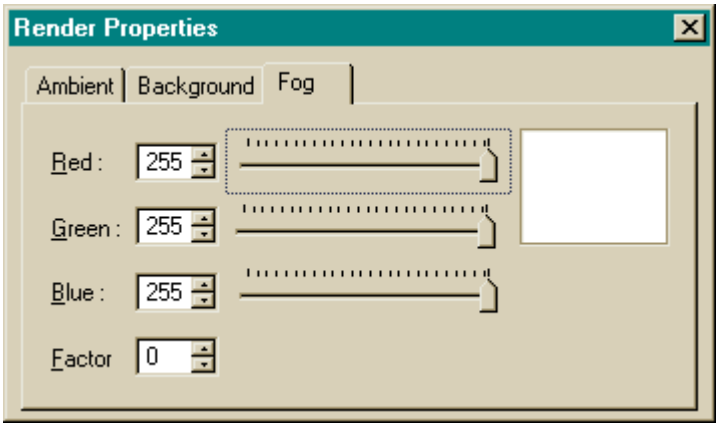
COLOR The RGB color of the fog, which tints the colors in your rendering slightly. The degree of tint *increases* with distance from the observer's eye.

Setting the Fog Value and Color

Set the degree and color of fog in your rendering.

\grfog	Lights Fog

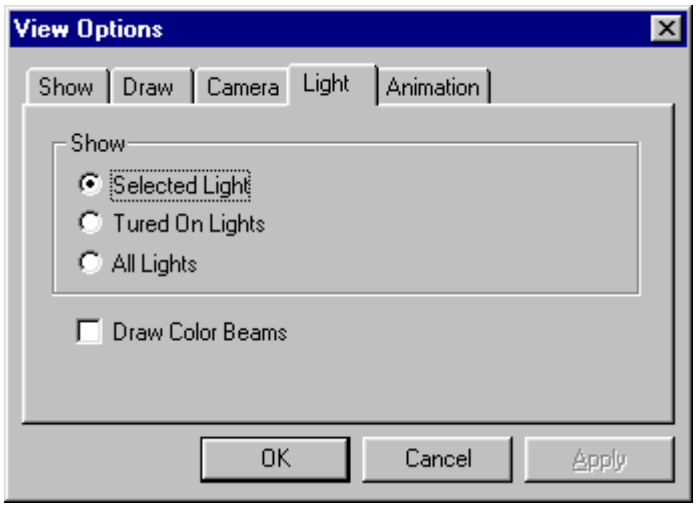
A dialog box (similar to the one shown for ambient light) is opened.



Specify the fog FACTOR, and adjust the RED, GREEN, BLUE slide bars until the desired fog color is displayed. Set the fog factor to 0 if you wish to turn this option off and render the model without fog.

Setting Light View Option

Right-click in any light control window to open the VIEW OPTIONS dialog box, light tab.



SELECTED LIGHT Show only the selected (current) light in the light control windows.

TURNED ON LIGHTS Show all the lights that are turned on, in the light control windows.

ALL LIGHTS Show all lights in the light control windows, including the ones that are turned off.

DRAW COLOR BEAMS Draw the light source and the light beams in their specified color.

5

Rendering

Images are the final products of rendering. ARC+ Render Pro provides several options by which you control the quality and type of the rendered image:

IMAGE FILE TYPE — The format and size of the image file that is created by ARC+ Render Pro. This determines image resolution (fineness of detail), completeness of color information stored in the file, and the suitability of the file if you wish to edit or print the image using other (non-ARC+) software.

RENDERING QUALITY — The level of sophistication at which ARC+ Render Pro computes the image. This determines the sharpness of shadows and highlights, smoothness of lines and of color gradations, and effects of transparency and reflections.

RENDERING OR RAY TRACING METHOD — In the *rendering* method, the effect of light falling directly on each surface of your model is computed. In the *ray tracing* method and in the *Phong* option of the rendering method, the effect of indirect illumination reflected from other surfaces or transmitted through transparent surfaces is computed as well.

It is important to understand option results, as well as computation time consideration in order to obtain lifelike images.

The rendering process can produce two types of scenes. The techniques utilized in creating these scenes are described in detail in this guide and can be combined in any number of ways to create a truly life-like 3D scene.

1. A rendered *image*, containing all the attributes (colors, textures and materials) included in your scene. See *Attributes, Chapter 2* for a complete explanation of working with scenes and attributes.

2. An animated scene. ARC+ render Pro offers several types of animation: walk-through animation discussed in detail in *Chapter 6, Walk-through Animation*, lighting animation discussed in detail in *Chapter 7, Lighting Animation*, and objects animation discussed in detail in *Chapter 9, Objects Animation*. These types of animation techniques can be combined in any number of ways to energize your scene. The rendering process can further be refined by defining the image quality and shading, as well as defining when the scene is to be rendered, immediately or at a later time. All these capabilities are discussed in this chapter.
3. A panoramic rendering. Panoramas enable viewers to get a panoramic view of 3D designs, discussed in detail in *Chapter 8, Panorama.*

Image File Types

Computer images are composed of tiny dots, called *pixels*. Your computer display contains a fixed number of pixels, for example 800 x 600 or 1024 x 768 pixels in the horizontal and vertical dimensions, respectively.

ARC+ Render Pro images are rectangular, with the width and height specified in pixels. A larger image size fills a larger area of your screen and provides finer detail in your rendering.

Each pixel in an image is displayed with a certain color value. This information is stored in the computer's memory and on your disk in an *image file.*

You can choose to create the image file in various industry-standard formats, for example JPEG (JPEG File Interchange Format), TIFF (Tagged Image File Format), BMP (Windows bitmaps), or PCX (PC Paintbrush). Using this feature, you can create and view an image with ARC+ Render Pro and then transfer the image file to other programs, for example:

- To a graphics or desktop publishing program for arrangement with other figures and with text
- For output on a color or black-and-white printer
- For color separation on automatic image setting equipment, prior to printing a brochure or book

Some of the image file formats store true RGB color information (over 16 million colors) using 24 computer bits (3 bytes) to store the color of each pixel. Other formats store a maximum of 256 different colors using only 8 bits (1 byte) per pixel.

The 24-bit formats give the most accurate color representation and the smoothest color gradations. An 8-bit format represents colors less accurately, but it produces smaller files that save space on your disk.

If you choose an 8-bit format, you may notice sharp boundaries between shades of colors, where no boundaries should exist. You can prevent this by producing the image with *dithering*, a computation method that varies the colors of individual pixels slightly and smoothes the color gradations.

Some file formats also offer an option of file *compression*. Choose a compression option to make the image file smaller and save space on your disk. Compression has no effect on color accuracy or other aspects of your image data.

NOTE *The TGA file type offers two additional formats, using 16 or 32 bits to store each color, with intermediate and high color accuracy respectively.*

Choosing an Image Format

See the documentation that came with your computer system to determine the number of pixels that your screen can display.

For viewing purposes, choose an image size that is no larger than your display screen. You can display an image that contains more pixels than your screen, but the image is cut at the edges.

Consider the width-to-height ratio of your screen and of the desired view. ARC+ Render Pro extends the view according to the image size that you define.

If you wish to transfer an ARC+ Render Pro image to another program see program-specific information to determine which file formats it can read. If you have difficulty reading a compressed file format with another program, try an uncompressed format instead.

If you are transferring the file for printing, consider the resolution of the printer when you choose an image size. Many laser printers, for example, offer a resolution of 300 dots (pixels) per inch. To exploit this resolution fully, choose an image size that contains 300 pixels for each inch (2.54 cm) of the planned printed dimensions. You can use paper size wizard to automatically calculate image size based on target page size and orientation, margins and DPI. See Paper Size Wizard in this Chapter for further information.

Effect on Computation Time

A larger image (more pixels) takes longer to compute and occupies more space on your disk.

HINT *Preview your rendering using a small image size. When the results are satisfactory, produce a final rendering in a larger size.*

The choice of file format has no significant effect on computation time.

Setting the Image File Type

Set the file type of the rendered image.

\grimgset	Render Setting

From the menu select RENDER > SETTING

The RENDER IMAGE SETTING dialog box is opened.

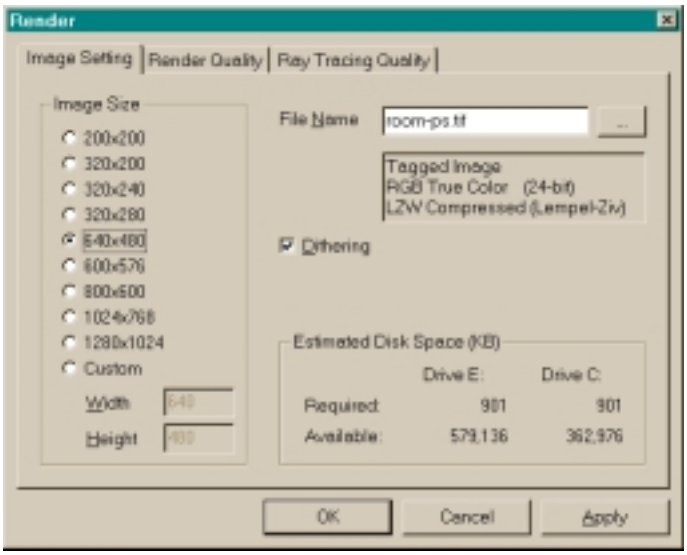


IMAGE SIZE

Specify the image size in pixels (width x height). You may choose between several predefined options ranging from 200 x 200 to 1280 x 1024 pixels, or you may type a custom size in the dialog box. Custom sizes may be as large as you want (2000 x 2000 for example), subject to the memory limitations of your computer.
To use paper size wizard (automatically calculates image size based on target page size and orientation, margins and DPI) click PAPER SIZE. See Paper Size Wizard in this Chapter for further information.

FILE NAME

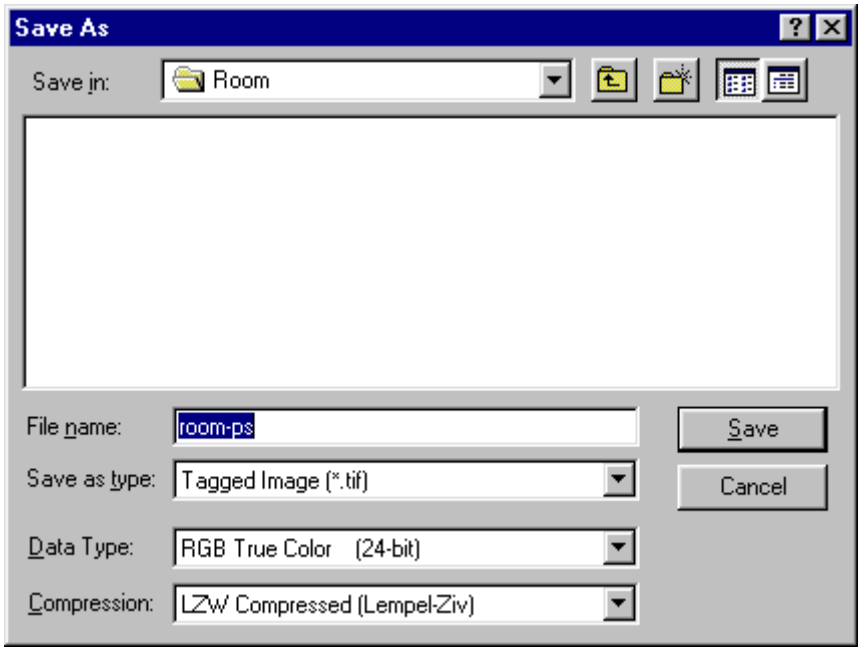
Specify a filename for the image, using any filename, but you should use the conventional file extension (listed in the table) to identify the file type on your disk.

Format	File Extension	True RGB Colors (24 bits) or 256 Colors (8 bits)
ARC+ image	.IMG	8 bits
Windows bitmap	.BMP	8 or 24 bits
Tagged image file (TIFF)	.TIF	8 or 24 bits
Targa image	.TGA	8 or 24 bits (also 16-bit and 32-bit options)
PC Paintbrush	.PCX	8 bits
CompuServe bitmap	.GIF	8 BITS
JPEG	.JPG	24 BITS

NOTE *In addition to the above formats, ARC+ Render Pro produces a temporary image file with the file extension .GRI. You may delete .GRI files if you find them in your disk directory.*

DITHERING Image dithering. Dithering is recommended to smooth color gradations in 8-bit file formats.

Click the ... button to accept or reject your choices. A SAVE AS dialog box is opened.



Use the DATA TYPE pull-down menu to choose the true-color (24 bit) or 256-color (8 bit) option for the file type.

Use the COMPRESSION pull-down menu to select a compression option, if one is offered for the file format you have chosen. Compression is always recommended, unless you are transferring the file to another program that cannot read the compressed format.

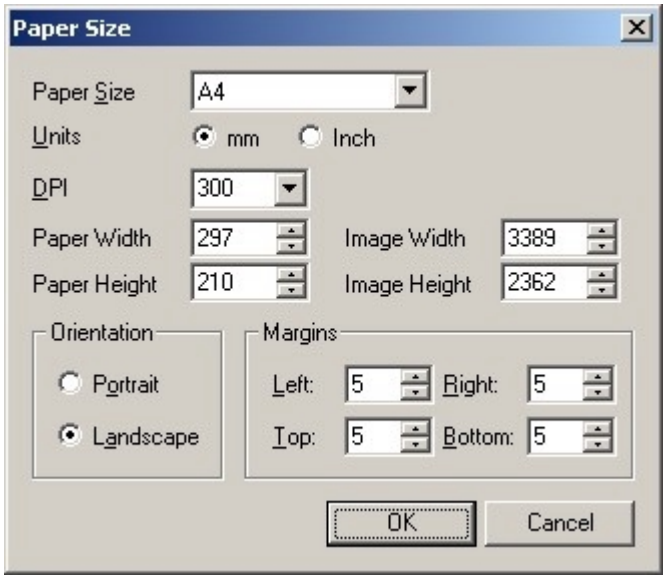
Save the file.

Paper size wizard

The paper size wizard automatically calculates image size based on target page size and orientation, margins and DPI.

Click PAPER SIZE in IMAGE SETTING dialog box.

The PAPER SIZE dialog box is opened.



PAPER SIZE Select the target paper size from PAPER SIZE combo box, or type custom paper width and height.

DPI Output resolution is defined in terms of the number of dots per inch, or DPI. The ideal is to match the resolution of an image to the resolution of the output device, usually a computer screen or printed document. The higher the dpi of the image (up to the limit of the output device), the better the quality of

the printed image. Typical ink-jet and laser printers print from 150 dpi to 300 dpi. Typical monitor resolution is 96 dpi. Select DPI from the DPI combo box, or type value.

ORIENTATION Select the page orientation: Portrait or Landscape.

MARGINS Page margins are the space around the edges of the page.

Rendering Quality

There are three main factors that influence the quality of the rendered image:

- Shading option: the way the illumination on each surface of your model is computed.
- Antialiasing: the smoothing of rough edges in the image that results from the digital nature of the rendering computation.
- Shadows, reflections, and transparency: the presence of realistic optical effects in your image.

Shading Options

You can choose several *shading options*, which determine how ARC+ Render Pro computes the illumination falling on surfaces of your model. By choosing an appropriate shading option, you can ensure a high degree of realism in your image and also minimize the time required for the rendering computation.

The shading options differ in their treatment of two types of illumination:

DIRECT ILLUMINATION Light falling *directly* from a light source (including ambient light) onto any point of the model.

INDIRECT ILLUMINATION Light that is *reflected* onto a surface from another surface of the model, or transmitted onto the surface through a transparent or partially transparent material in the model.

NOTE *Light passing through an opening (hole) in the model is direct illumination. Light passing through a transparent solid in the model, such as a window pane, is indirect illumination.*

In increasing degrees of realism and computation time, the following shading options are provided.

NO SHADING ARC+ Render Pro ignores both direct and indirect illumination. The model is rendered as though it were illuminated in uniform, non-directional, white light. The image is produced very quickly but lacks a feeling of three-dimensions.

FLAT SHADING Each surface of the model has a different but uniform shading, determined by its average angle to each light source. There are no gradations of illumination or shade on the surface. Indirect illumination is ignored.

GOURAUD SHADING The illumination is computed at the corners of each surface and interpolated at interior points of the surface. Gradations of illumination are continuous across the surface. The effect is realistic, but sharp highlights or shadow lines cannot be observed. Indirect illumination is ignored.

PHONG SHADING The illumination is computed at each point of each surface. Accurate gradations of illumination are computed. Sharp highlights and shadow lines are displayed. Both direct and indirect illuminations are realistically represented.

RAY TRACING Individual rays of light are traced from each light source to each point in the model, as they bounce from surface to surface within the model, and back to the observer's eye. Both direct and indirect illuminations are realistically represented.

Choosing a Shading Option

RAY TRACING **ADVANTAGES**: Produces the highest quality images. Fully exploits the material attributes assigned to entities in your model, such as reflectance and transparency (see *Chapter 2, ATTRIBUTES, Materials*). **DISADVANTAGES**: Ray tracing also takes much longer to run than the other methods.

PHONG SHADING **ADVANTAGES**: Provides results similar to ray tracing, including the effects of reflective and transparent materials. This options runs much faster than ray tracing.

FLAT AND GOURAND **ADVANTAGES**: Used to preview model before final

SHADING	rendering. **DISADVANTAGES**: Options are of more limited use.
NO SHADING	**ADVANTAGES**: Useful to preview the color and texture attributes of entities in your model. Since this option ignores your lighting scheme, it runs very fast and all colors and textures are rendered without change of tint, exactly as you assigned them.

Effect on Computation Time

Many factors influence the computation time required to produce the rendered image. They include (in approximately decreasing order of importance):

- Speed of your computer
- Number of pixels in the image file
- Number of lights
- Acceleration (ray tracing only)
- Number of ray samples per light and maximum ray depth (in ray tracing only)
- Checking for reflections and transparency
- Antialiasing (mainly in ray tracing)
- Checking for shadows
- Number of polygons in your model (mainly in ray tracing)
- Complexity of textures

The following table helps you choose the best recommended method for given parameters:

Shading method	Preview method	Computation time
Ray tracing	Flat or Gouraud shading	several minutes to many hours
Long ray tracing	Phong shading	overnight or weekend run
Phong shading	Other shading methods	Seconds - minutes

IMPORTANT *There is an important exception to these recommendations. If your image size is very large (more than about 1000 x 1000 pixels), you may receive* OUT OF MEMORY *messages during rendering. If this occurs, try ray tracing, which uses less memory than the other methods.*

Antialiasing

Because computer images consist of pixels, no true diagonal or curved lines can be displayed in the image. Instead, the lines are approximated by short steps of horizontal or vertical line segments. If you look closely, you can sometimes see

the steps, which give the diagonals or curves a rough appearance. This phenomenon is called *aliasing* in computer graphics jargon.

To *prevent* this, choose the *antialiasing* option. In the step region, antialiasing divides each pixel into a few parts and computes the average color of the parts. This produces a more realistic effect, smoothing over the discontinuities.

To choose the antialiasing option, you must specify:

SAMPLE PER PIXEL — The number of parts into which each pixel is divided. The range of sampling values is 1 (no antialiasing) to 25.

For ray tracing, you can also select:

ADAPTIVE SAMPLE PER PIXEL — Decreases computation time by applying antialiasing only where it is most needed.

Effect on Computation Time

With all shading options except ray tracing, antialiasing takes only a short time. In ray tracing, the computation time increases when a higher sampling value is employed.

Usually, a sampling value of about 4 produces good results in ray tracing. With the other shading options, a value of 8-10 is recommended.

Shadows, Reflections, and Transparency

To save time, as in a preliminary rendering, turn the *shadows* option off. If you do this, ARC+ Render Pro does not check whether a surface of your model is SHADOWED from a light source by other surfaces in your model. Therefore *all* shadows are eliminated from your image.

With all shading options except ray tracing, you can set the *shadows level* parameter (range 1-10, default 2). This parameter controls how shadows are computed in your image. Increase the parameter value if shadows appear patchy or uneven. Decrease the value if you receive IGNORE LIGHT warnings during the rendering computation.

If you choose the phong or ray tracing option, you can save time by *turning off* reflections and transparency. If you do this, the effects of indirect illumination are ignored. Alternatively, you may specify a *threshold* value of reflectance and transparency at which indirect illumination is computed. Materials with reflectance and transparency lower than the threshold are treated as non-reflective and / or opaque (see *Chapter 2, ATTRIBUTES, Materials*).

Another way to save time in ray tracing is to reduce the *maximum ray depth* parameter (range 1-10, default 6). The maximum ray depth is the number of

surfaces that a single light ray can hit as it bounces around your model. For example, the maximum ray depth controls the number of reflections that are computed between a pair of parallel mirrors.

Acceleration Option

You can reduce the computation time required for ray tracing by as much as 50%, by selecting an option called acceleration.

IMPORTANT *Acceleration is effective only if the ray tracing includes indirect illumination, i.e., transparent or reflective materials. The acceleration applies only to ray tracing, not to the other shading options.*

Choose an acceleration value from 1-6 (default 2). A value of 1 is equivalent to the ray tracing method employed in previous releases of ARC+ Render Pro. A value of 2 significantly speeds up the ray tracing with no effect on image quality. Higher values produce a greater acceleration with only a minor negative effect on quality.

To optimize ray tracing performance, try setting the maximum ray depth to the default value of 6 and increasing the acceleration value to the highest value that gives good image quality.

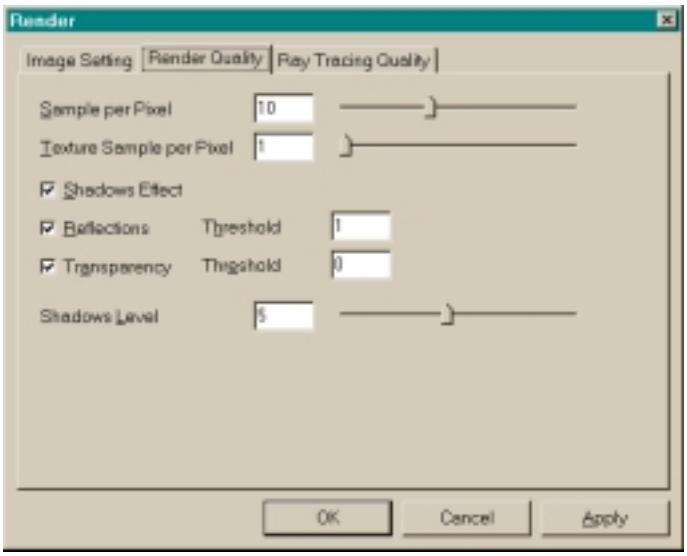
Setting the Rendering Quality

Quality Setting for All Shading Options Except for Ray Tracing

Set the antialiasing option and other options affecting image quality, for all shading options except for ray tracing.

\grqlty	Render Setting

Click the RENDER QUALITY tab in the RENDER dialog box.



Specify the SAMPLE PER PIXEL value for antialiasing (set to 1 if antialiasing is not desired).

Specify whether to compute shadows. Set the value of the shadows level by entering a numerical value or adjusting the slide bar.

If you choose the PHONG option, specify whether the computation should include indirect illumination-reflections and / or transparency. If you include REFLECTIONS and TRANSPARENCY, you may also specify the THRESHOLD value of material reflectance and transparency at which the system computes indirect illumination.

Click OK and exit the dialog box.

Quality Setting for Ray Tracing

Set the antialiasing option and other options affecting image quality, for the ray tracing option.

\grqlty	Render Setting

Click the RAY TRACING QUALITY tab in the RENDER dialog box. This step was discussed earlier in this chapter.

Follow the Render wizard windows as directed.

Producing the Rendered Image

- ARC+ Render Pro provides two commands that produce a rendered image. The render wizard guides you through all the necessary steps. *Render* (\grender): if you have chosen the no shading option or the flat, Gouraud, or Phong shading options
- *Ray tracing* (\rungrt): if you have chosen the ray tracing option.

Before you use either of these commands, assign rendering attributes to the entities of your model, and set the view, lighting conditions, image file type, and rendering quality options.

NOTE *You cannot edit or further render an image file with ARC+ Render Pro. To improve or alter the rendering of an image file, change the rendering attributes or options and perform the rendering again.*

Rendering the Model

As discussed at the beginning of this chapter, you can define all scene parameters to define your final rendered scene.

Render your model with the no shading option or with the flat, Gouraud, or Phong shading option.

\grender	Render Image

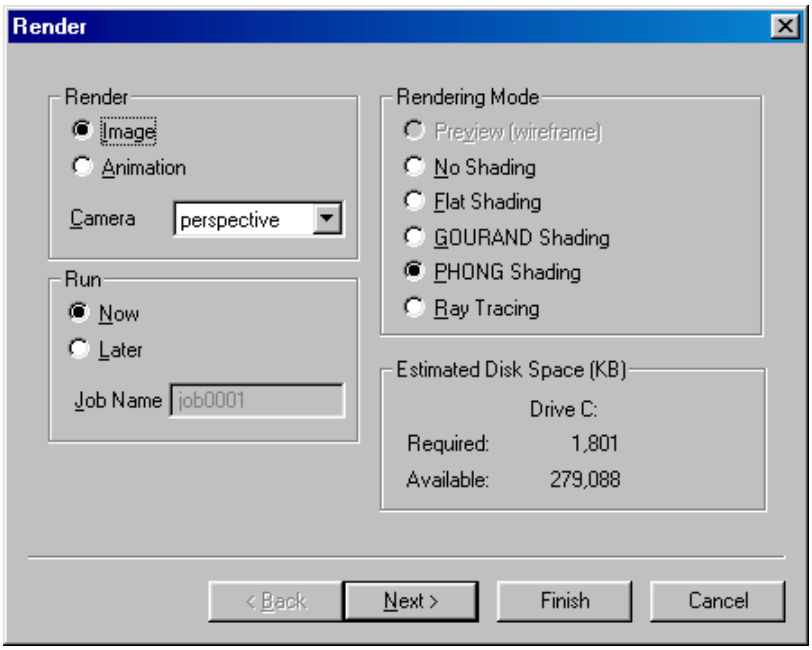
The RENDER dialog box opens

Setting Shading Option

Set the shading option in the RENDER dialog box.

Select a RENDERING MODE. Make sure the selected camera is the desired view for the rendered image. Press NEXT, and a wizard will guide you through the procedure of defining the production settings.

IMPORTANT *If you choose the ray tracing option, then you must perform the rendering using the* Perform ray tracing (\rungrt) *command. If you choose any other shading option, then you must perform the rendering using the* Rendering the model (\grender) *command.*



Select type of animation and immediate or delayed rendering in this dialog box.

RENDER

IMAGE Image created with attributes (see *Chapter 2, Attributes* and earlier in this chapter for further information).

ANIMATION Available animations: walk-through (see *Chapter 6, Walk-through Animation* for further information) and lighting animation (See *Chapter 7, Lighting Animation* for further information).

CAMERA Camera views available and can changed as required.

RUN

NOW Render the scene now.

LATER Render scene at a later time. See Make Later and Make Batch in *Chapter 6, Walk-through Animation* for further information.

JOB NAME If you chose to render *now*, The job name given is automatic. If you choose to render *later* you can rename job as desired.

RENDER MODE

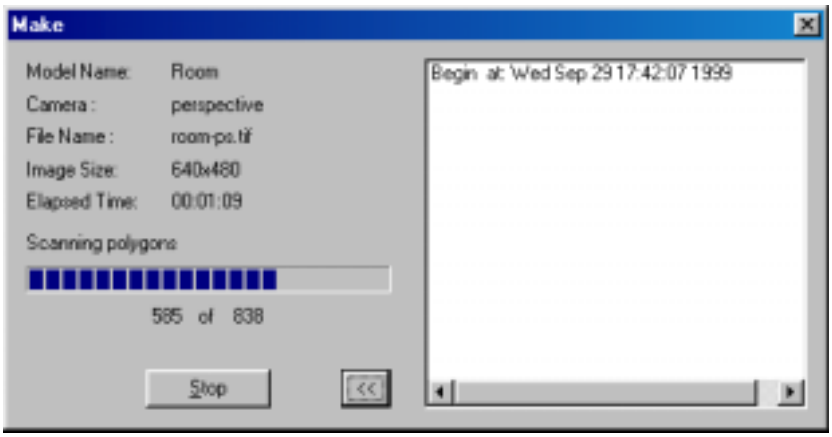
SHADING CHOICES Choose desired shading, see *Chapter 1, Attributes* for further information.

ESTIMATED DISK SPACE Lists drive, required space and actual space available.

You can select NEXT to set all the required rendering parameters in the IMAGE SETTING and RENDER QUALITY dialog boxes. The dialog boxes are very similar to the ones displayed during the quality setting session. The difference is that the settings now apply to the production process, not the rendering mode. The render wizard facilitates easy step-by-step navigation through this process, using pre-determined dialog boxes.

Click NEXT to advance from one dialog box to the next. Carefully examine all the settings in all the dialog boxes, to avoid production errors.

When all the parameters are set, click FINISH. The production process begins immediately without requesting further information.



IMPORTANT *Do not use this command if you have chosen the ray tracing option in the* Setting rendering quality (\grqlty) *command. The ray tracing option is ignored by this command and* phong *shading is used instead.*

NOTE *You are warned if the image filename that you have specified (see Setting image type, earlier in this chapter,* \grimgset *command) already exists in your disk directory. If so, choose to overwrite the existing file or specify a different filename.*

The screen displays the progress of the rendering computation plus any warning messages regarding aspects of the computation. Click STOP, at any time to stop the computation and exit the command.

When the computation is complete, the rendered image is displayed and the image file is automatically saved on your disk under the filename that you have specified.

The rendered picture is displayed in a small window. Click the WINDOW EXPAND icon if you wish to display the image on the full screen. Click the WINDOW CLOSING icon to clear the screen and exit the command.

Perform Ray-Tracing

Render your model by the ray-tracing method.

\rungrt	Render Image

The RENDER dialog box opens (see *SETTING SHADING Option*, earlier in this chapter). You can select NEXT to set all the required rendering parameters in the IMAGE SETTING and RAY TRACING QUALITY dialog boxes. The render wizard facilitates easy step-by-step navigation through this process, using pre-determined dialog boxes.

When all the parameters are set, click FINISH.

The command begins immediately without requesting further information.

IMPORTANT *Use this command only if you have chosen the ray tracing option in the* Setting rendering quality (\grqlty) *command. Any other shading option is ignored by this command and ray tracing is performed instead.*

NOTE *You are warned if the image filename that you have specified (see Setting image type earlier in this chapter,* \grimgset *command) already exists in your disk directory. If so, choose to overwrite the existing file or specify a different filename.*

The screen displays the progress of the ray tracing computation plus any warning messages regarding aspects of the computation.

Click STOP, at any time, to stop the computation and exit the command. A prompt enables you to save the partial computation and resume it at a later time. To continue, open the model in ARC+ (if it is not already open), enter ARC+ Render Pro, and choose the *PERFORM RAY TRACING* (\rungrt) command again. Choose to RESUME from where the computation was interrupted or to RESTART from the beginning.

When the computation is complete, the ray-traced image is displayed and the image file is automatically saved on your disk under the filename that you have specified.

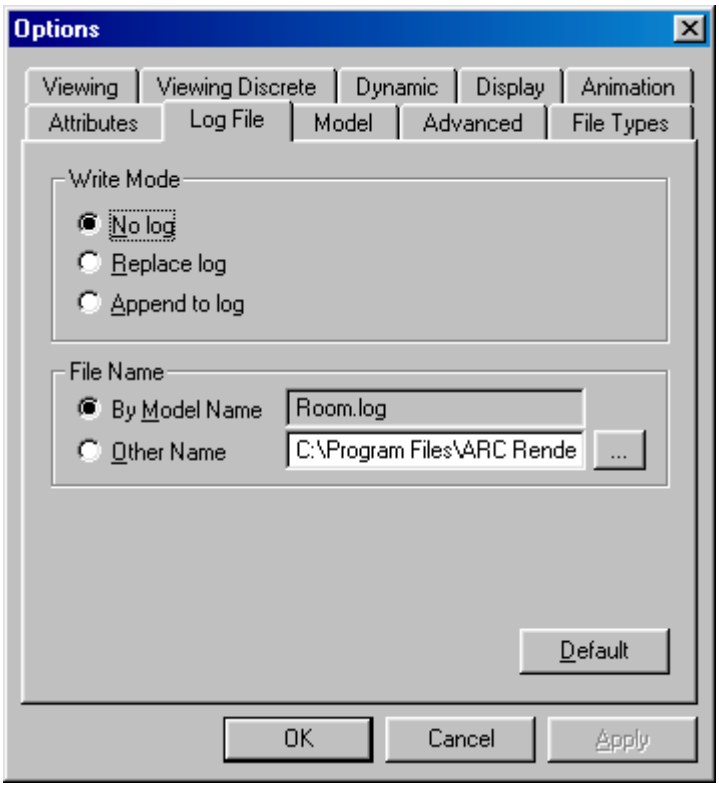
The rendered picture is displayed in a small window. Click THE WINDOW EXPAND icon if you wish to display the image on the full screen. Click the WINDOW CLOSING icon to clear the screen and exit the command.

Recording Rendering Data in a Logfile

You can output the messages from the rendering or ray tracing process to a file. The messages are similar to those displayed on the rendering or ray tracing screens.

Tools
Options
Logfile

The OPTIONS dialog box is opened. Select the LOGFILE tab.



In the dialog box, select the following options:

WRITE MODE

NO LOG	No log file is written.
REPLACE LOG	Replace messages from previous rendering sessions in log file with current messages.
APPEND LOG	Append current rendering session messages to previous messages in log file.

FILE NAME

BY MODEL NAME	Store the logfile under the same name and in the same directory as the model. The file extension is *.log.
OTHER NAME	Specify the name and directory to store the logfile.

You can read the log file using any ASCII editor or within ARC+ Render Pro.

	Edit View Log File

Displaying an Image

After you produce an image, it is saved as an image file on your hard disk. You can recall an ARC+ Render Pro image file at any time and display it on the ARC+ screen.

You can also display an image file created by another program if it conforms to one of the standard file formats supported by ARC+ Render Pro. You can display an image that contains more pixels than your screen, but the image is cut off at the edges. The image is displayed immediately and the rendering computation is not repeated.

Displaying an Image File

Display an image file on the ARC+ screen.

\grimgshw	Render Show Last / Show > Image

Choose to display either the last (most recent) image, or another image. If the latter, specify the disk directory, file type (extension), and file using the dialog box. From the command bar, select EDIT > PROPERTIES to display information such as the file name, size (in bytes) and dimensions (in pixels) and the type of compression.

The image is displayed in a window. Double-click the window header, or use the window expand icon to display the image on the full screen.

NOTE *If you specify a new filename in the* Setting the image file type (\grimgset) *command, you can no longer use the SHOW LAST IMAGE option. Use the SHOW IMAGE option instead.*

6

Walk-through Animation

The ARC+ Render Pro walk-through animation module provides a powerful artistic and marketing tool to the static rendered images. Walk-through animation enables you to view an image from any number of vantage points, including panoramic, ceiling, as well as, walk around objects and through doors and the like. ARC+ Render Pro also offers lighting animation discussed in detail in Chapter 7, and objects animation discussed in detail in Chapter 9.

You can add animation before or after rendering the image, although it is recommended to render the image *before* adding the animation.

Animation is created and measured in key frames and frames. A key frame in walk-through animation is simply a camera angle. The animation is produced by creating a series of camera angles moving along a given path. Frames are the measurement of images between key frames, compared to the frames of a movie or cartoon that are viewed at high speed to create the illusion of movement.

To obtain a lifelike walk-through of the image, it is important to understand the steps involved in creating the path of camera angles and the timing from key frame to key frame. For example, you can create a short walk-through around a table in a few simple key frames. To produce a smooth animation walk-through of a room or a tour of an apartment complex requires attention to sequence of the tour and the time it takes to make or compile this animation, your computer may need to run for a few hours or overnight.

Animation File Types

You can choose to create the image file in various industry-standard formats:

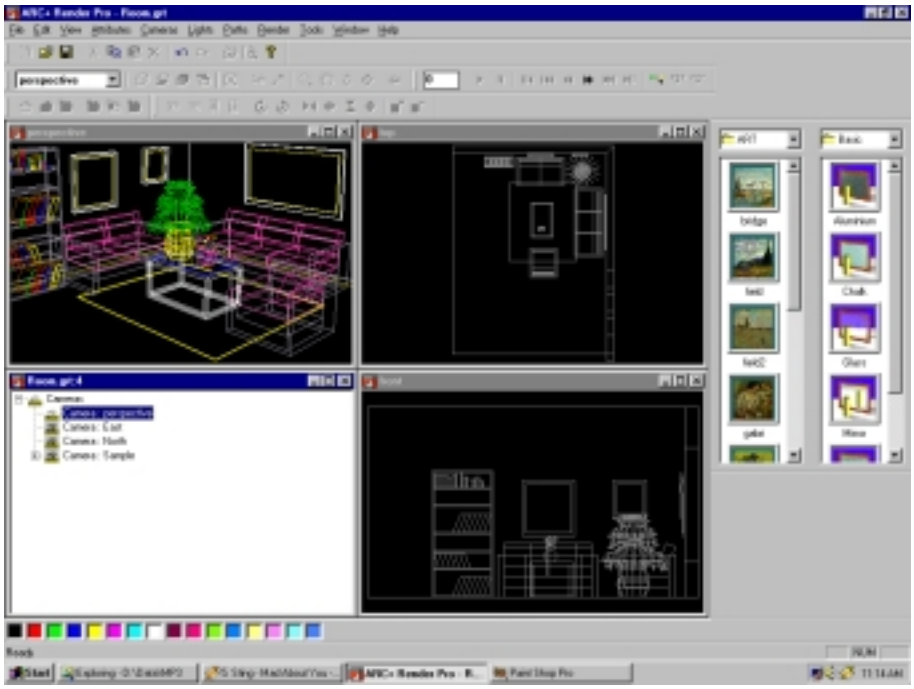
Format	File Extension	True RGB Colors (24 bits) or 256 colors (8 bits)
Windows AVI file	.AVI	8 or 24 bits
FLI Autodesk file	.FLI	8 bits
GIF Animation file	.GIF	8 bits
Image List File	.LST	8 or 24 bits
Image File List	.IFL	8 or 24 bits

Setting Animation Parameters

\	Paths Camera Path

From the menu select PATHS > CAMERA PATH

The top and front work windows (default views) change to gray.

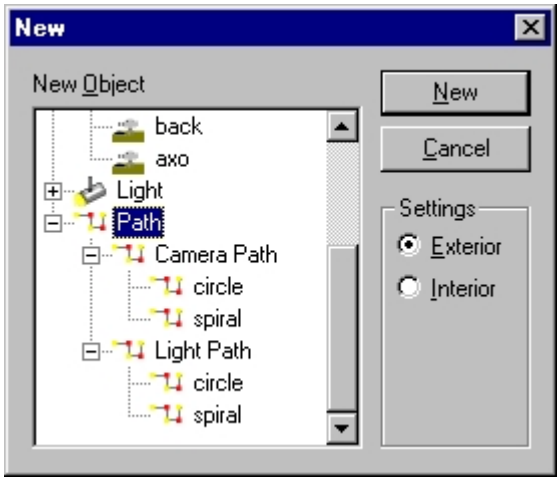


Once you begin to create the key frame path, the graphic display is shown in these two work windows, according to their specified view (the top view displays the key frames from an aerial view, while the front view displays a cut-across view). The view in the perspective work window moves along with the path created.

The two methods used to create an animation walk-through or path, using the Animation Wizard or creating paths manually are described below.

Animation Wizard

The Wizard simplifies path creation, especially for first time users. Select EDIT > NEW from the menu bar or right click the mouse in any of the work windows. Select New from the drop down menu. A NEW dialog box opens.



This wizard is designed to be utilized for cameras (see Chapter 3, Cameras, for more information), lights (see Chapter 4, Lighting, for more information) and for paths or animation walk-throughs.

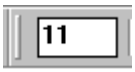
Click the + sign on the side of the Path branch to open path options. The three path options are path (default) enabling you to follow a straight or curved route; circle enabling you to circle the entire scene and spiral enabling you to spiral up or down through a scene. Selecting either circle or spiral activates the Settings option, enabling you to choose exterior (view from around the outer perimeter of the scene) or interior (view from within the scene).

When working with either a spiral or circular path in exterior mode, it is recommended that you click the Zoom Full icon on your tool bar, to view the entire scene. Click the Zoom Work Area icon to return to the normal scene view.

The wizard automatically creates the first key frame, represented as a red line drawn from the selected direction toward the center of the screen.

Animation Toolbar

The animation toolbar contains the following icons:



CURRENT FRAME Current frame.

PLAY Play created animation.

STOP Stop running animation.

GO TO FIRST FRAME Click to return to first frame created.

GO TO PREVIOUS KEY FRAME To tour the created path, frame by frame, click this icon or the GO TO NEXT KEY FRAME icon. A yellow line appears that moves from frame to frame along path in desired direction.

PREVIOUS FRAME Jumps back to previous frame.

GO TO NEXT FRAME Jumps to next frame.

GO TO NEXT KEY FRAME To tour the created path, frame by frame, click this icon or the GO TO PREVIOUS KEY FRAME icon. A yellow line appears that moves from frame to frame along path in desired direction.

GO TO LAST FRAME Jump to last frame.

ADD KEY FRAME Toggle on / off feature. Toggle On to create animation path. Toggle Off to edit or stop animation path creation.

DELETE KEY FRAME Delete specific key frame.

MAKE KEY FRAME To change a frame into a key frame, select the frame and click the Make Key Frame icon.

Create Paths Manually

To create paths manually, select PATHS > CAMERA PATH as described above. Click the Add Key Frame icon (toggle feature) on the animation toolbar. Once this icon is toggled on the cursor symbol changes from an arrow to a + sign.

You can create and modify key frames in either of the two windows, as they both display the exact same scene.

To create the first key frame, position the mouse on the first point and click. A red line is automatically drawn in the camera direction, towards the center of the image.

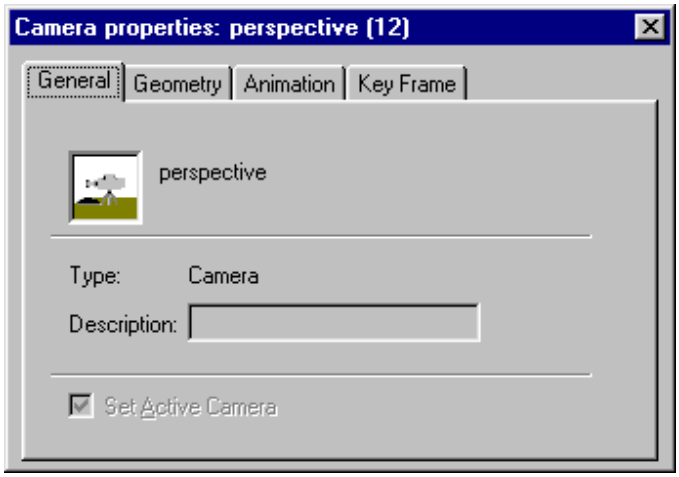
To continue the path of the walk-through, move the mouse in any direction or to any point and continue to click to create as many key frames as desired. Keep in mind that a smooth path of key frames, makes a smooth moving animation. You can also drag and click to any position to get the same results. The number of key frames created is displayed on the animation icon line.

As discussed earlier in this chapter, the key frames are actually camera views and as such, with each new key frame the Perspective window displays the corresponding view of the animation.

Camera Properties

As discussed, as long as the Add Key Frame icon is pressed, key frames can be added. To further define and determine camera parameters and functions, right-click the mouse on the camera view branch of the tree.

Click Properties in the menu to open the CAMERA PROPERTIES dialog box.



If this is a new image (without key frames), the CAMERA PROPERTIES dialog box contains only three tabs

GENERAL	Describes the camera view.
GEOMETERY	Describes the XYZ coordinates of the camera view.
ANIMATION	This window is inactive as there are no key frames available.

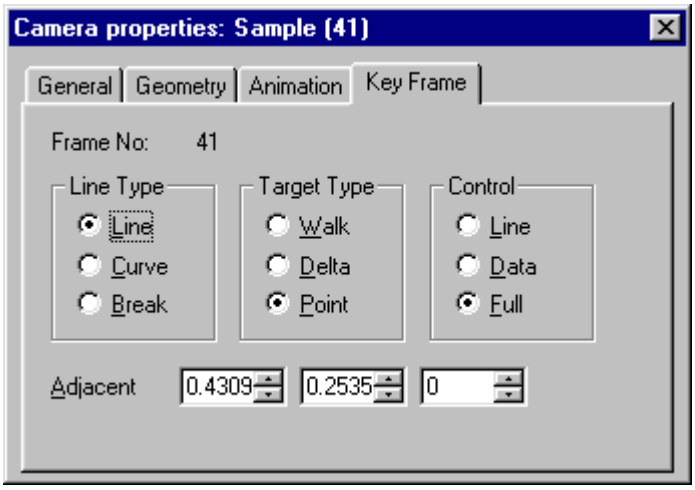
Adding a key frame activates the animation tab and adds an additional tab to this dialog box.

ANIMATION Displays number of frames and key frames created as well as path used.

KEY FRAME Describes the current key frame parameters.

Modifying Key Frames

The camera properties of each individual key frame can be modified. To modify the current key frame, click to display the CAMERA PROPERTIES dialog box. If you wish to modify an *existing* key frame, toggle off the Add Key Frame icon, then click the desired key frame to display the dialog box. Click the Key Frame tab.



This tab displays the current key frame number, along with the following features.

LINE TYPE Enables you to choose the type of line or camera view for this key frame. Line (default) is a straight path. Curve displays a blue line and enables you to bend or arch the path at this specific point. Break extrapolates the path without a view, i.e., it goes through the frames without moving until it reaches the next key frame. In essence standing in one place (going the curved, or a break between this key frame and the next). You can use this kind of break to zoom in or out of a certain specific area of the scene.

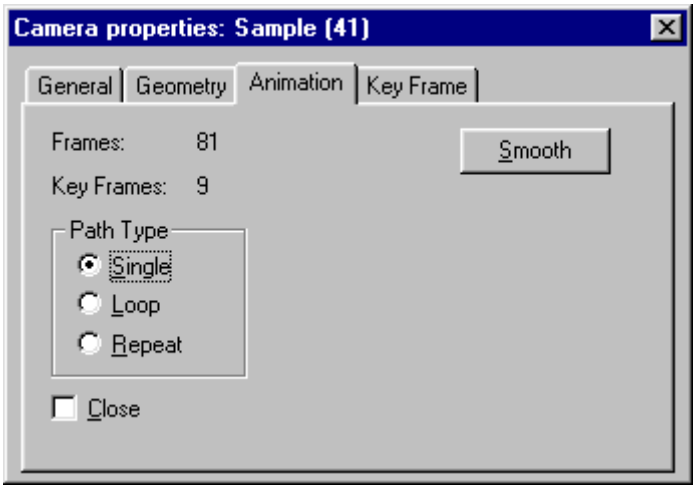
TARGET TYPE The target is the direction the camera faces. This feature enables you to determine how the target behaves when changing the location of the camera.

Point (default) indicates that the camera is always pointed in the same direction even if the camera itself changes location. Delta changes the camera direction. You can determine the direction for each camera separately, while keeping the same parameters, and therefore view a different path with each. Walk enables the camera to follow in the direction you are going.

CONTROL This feature enables full control over the type of key frame used, from either a geometric or eye view. Line allows you to control only the key frame's eye; direction and geometric parameters are determined by the *previous* key frame. Data enables you to determine only geometric parameters and not the eye. Full enables you to control all key frame parameters.

Modifying Animation Path

The animation path of an image can be determined at any time, either while the animation is being created or once it has been completed. Click the path to open the CAMERA PROPERTIES dialog box. Click the Animation tab.



This tab displays the total number of frames, as well as the key frame currently chosen. To choose data type, click the desired radial button.

PATH TYPE

SINGLE One single walk-through course.

LOOP	A continuous walk-through sequence, beginning at the start and then retracing its steps from end to beginning and back again.
REPEAT	A sequence that begins at the start and goes through to the end and then begins again at the beginning in a continuous movement.
CLOSE	Closes the path from the last key frame created to the first key frame.
SMOOTH	Animation effect described below.

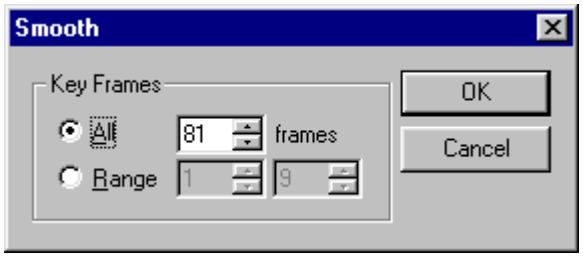
Smoothing

When creating an animation of a scene it is important to keep the following in mind. When creating a path, you position key frames according to a route you wish to walk through.

- Along your route you turn a corner or walk straight through a parking lot or sweep through a certain part of a scene. Each of these movements is represented by key frames. However, after making or compiling the animation you may find that the movement through certain parts of the route is quicker or slower than others due to the distance between key frames.
- The default frame rate, discussed below, is 10 frames per key frame. Since these same 10 frames exist between two key frames positioned far apart, as well as two key frames positioned very close together. The frame rate translates into the amount of time it takes to travel between key frames.

The smoothing process evens out or smoothes the difference to create a new division of the key frames, thus creating a smooth walk-through.

Click the Smooth button on the Animation tab to open the SMOOTH dialog box.



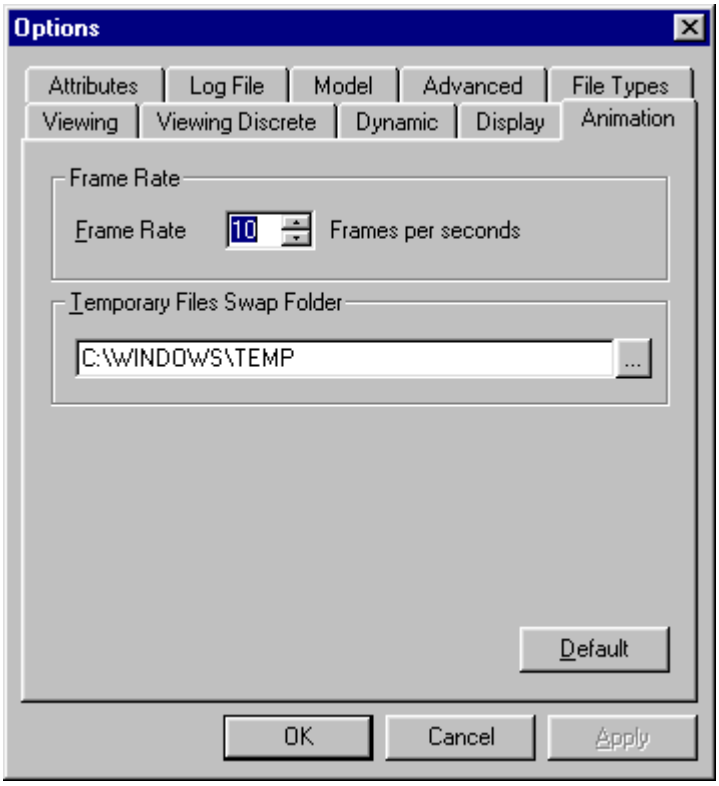
Click radial button to choose either all key frames or just a specific range of frames, should you wish to follow the nature flow of the area. You can also add on additional frames to create a better quality animation during viewing. Click appropriate radial button. Click OK to automatically return to the previous window.

Setting Frame Rate

As discussed, the frame rate is the number of frames between key frames. The default is 10.

To modify this rate click TOOLS > OPTIONS. Click Animation tab. Click desired rate and OK.

You can also set the temporary files swap folder location, used in rendering the animation files. Click the ... button to browse for a different location. Click the default button to return to all default settings. Click OK to return to previous window.

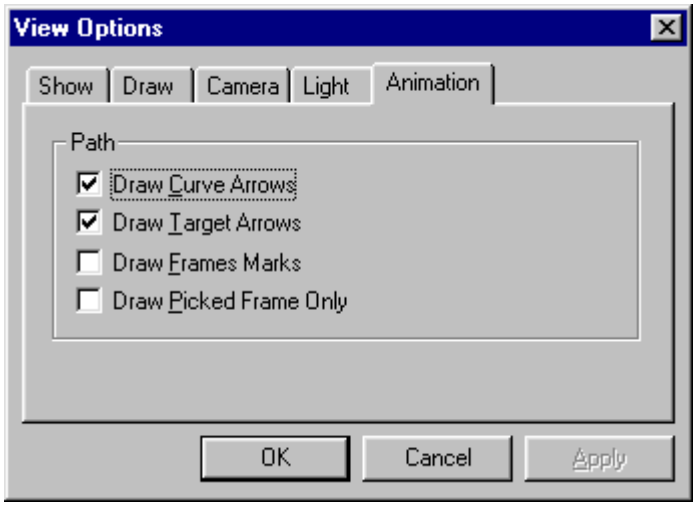


View Options — Animation

The key frame lines, as well as the entire animation path line can be modified.

Right-click your mouse in either the Top or Front view windows. Select Options in the menu to open the VIEW OPTIONS dialog box. This dialog box is discussed in greater detail in *Chapter 3, Cameras.*

Click the Animation tab.



Select one or more of the following choices, and then click the Apply button to view choices without leaving this dialog box. Click OK when you finished.

DRAW CURVE ARROWS This is a curve control feature. When activated, a small blue ribbon shape appears on the current key frame, enabling you to curve the path.

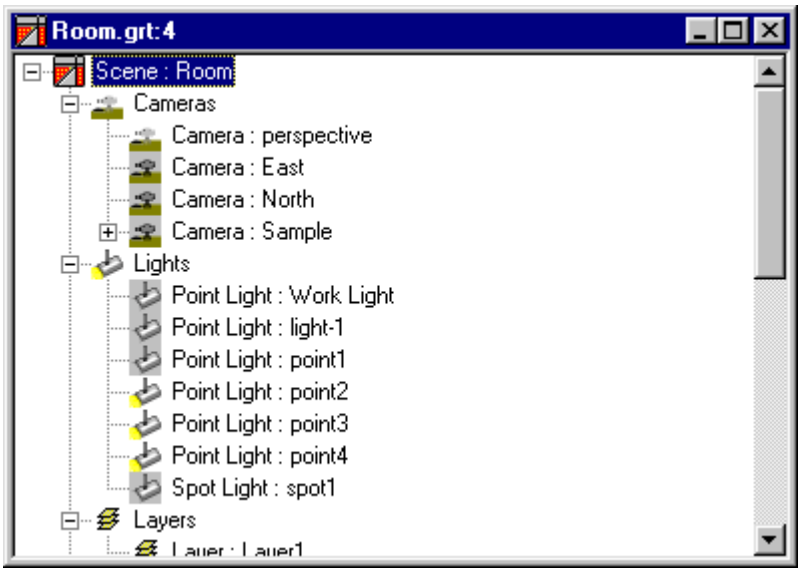
DRAW TARGET ARROWS This displays or hides the target line of each frame created (red colored line).

DRAW FRAME MARKS Displays all frames between each key frame (yellow line).

DRAW PICKED FRAME ONLY Displays only line picked. This view is recommended when working with a complex path.

Camera Tree View

As in all ARC+ Render Pro features, you can view the key frames created in the extended camera branch of the tree.

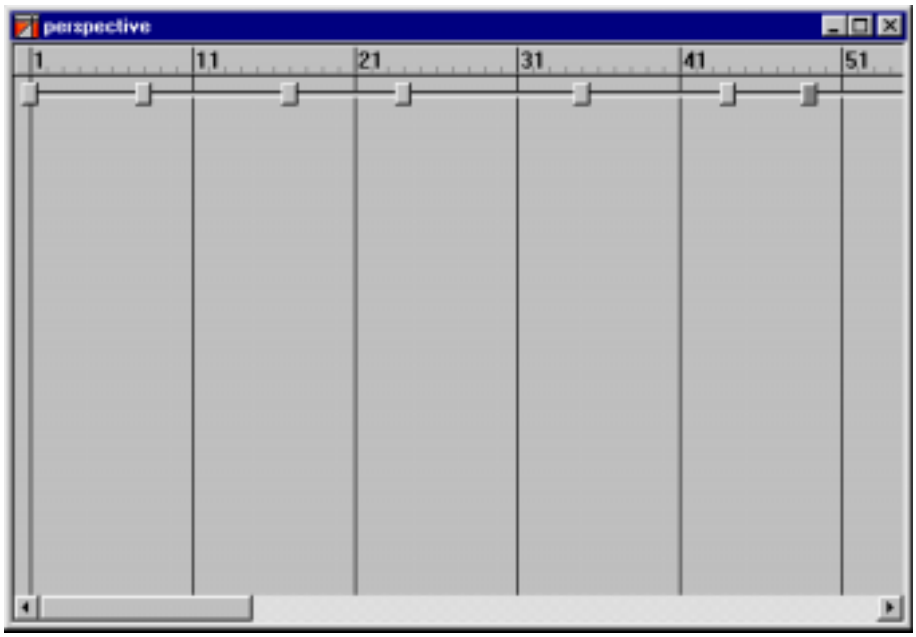


Path Frames

\	Paths Frame Settings

From the menu select PATHS > FRAMES SETTINGS

This opens a graph window representing a timeline of key frames. The movable buttons located on this line correspond to the key frames created. This window enables you to manually change the position of a key frame from one point to another.



Rendering a Walk-through Animation

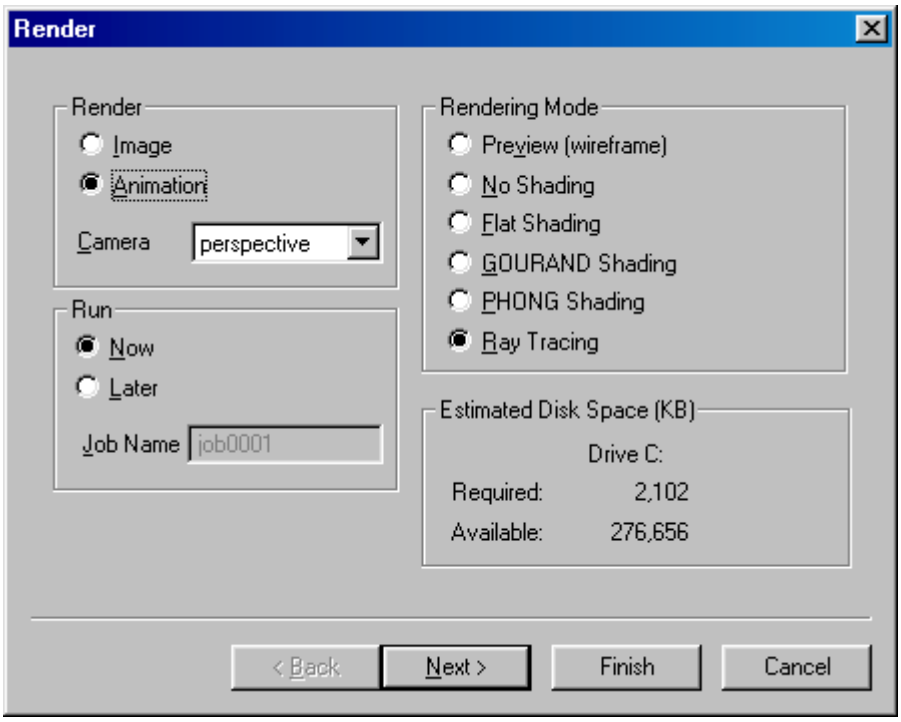
Once you have created the path of key frames and modified the timing and smoothness of the route sequence, it is time to make the animation. You have several make options, including: making the animation immediately, making a preview, making it later and creating a batch of animation files for scheduled making.

Animation — Make

\	Render Animation

From the menu select RENDER > ANIMATION

The RENDER dialog box opens.



RENDER The animation radial button is activated (default). The default camera view is selected in the drop down menu.

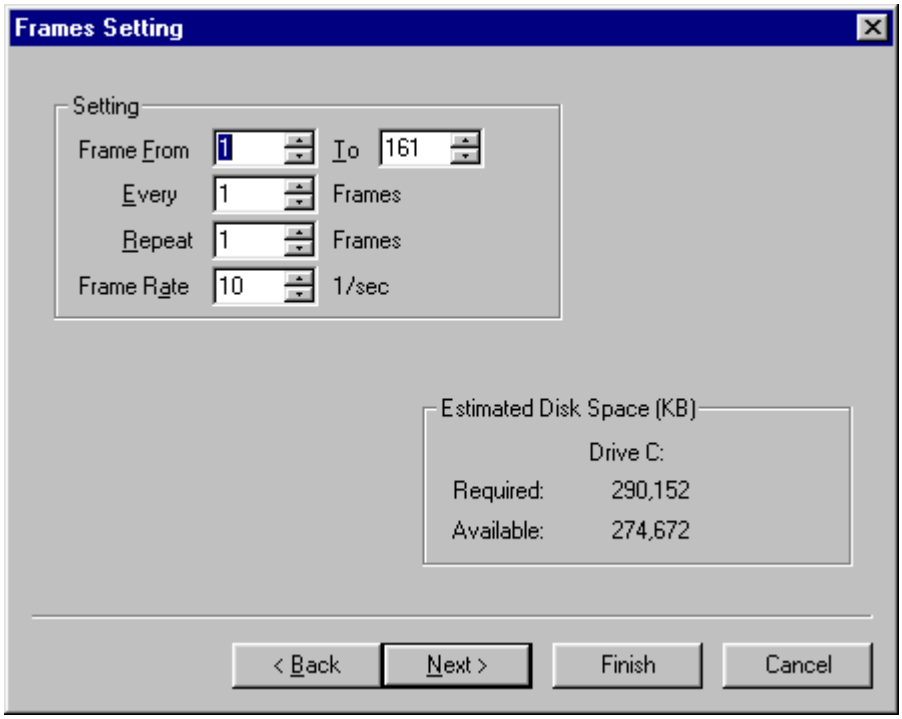
RUN Animation choices to schedule later (see Make Later, discussed later in this chapter).

RENDERING MODE See *Chapter 5, Rendering* for further information regarding these settings.

NOTE *If you change the settings in the Rendering Mode, they will become the default settings the next time you make or change something in the Render feature setup.*

ESTIMATED DISK SPACE Displays drive, disk space required and available.

Click the Next button to open FRAMES SETTING dialog box.



SETTING

FRAME FROM Set From and To frame parameters for animated rendering.

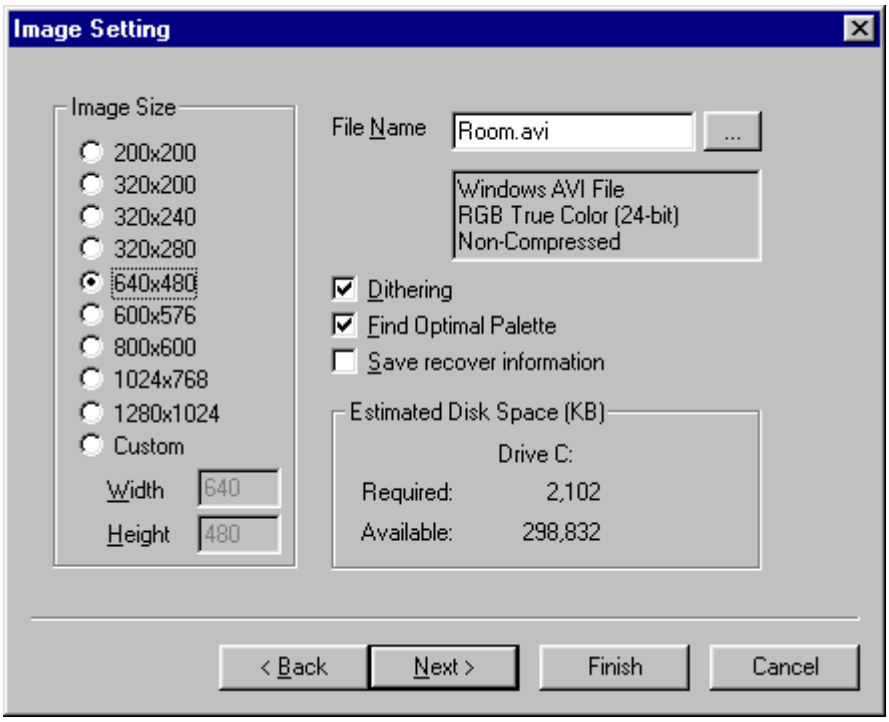
EVERY Set number of frames to jump within the animated rendered scene. For example, if you set the parameter to 5, then every fifth frame is animated.

REPEAT Set number of times *each* frame in the scene is repeated.

FRAME RATE Set the number of frames to seconds ratio.

ESTIMATED DISK SPACE Displays drive, disk space required and available.

Click the Next button to open IMAGE SETTING dialog box.



The IMAGE SETTING dialog box enables you to determine the following parameters.

IMAGE SIZE See *Chapter 5, Rendering*, for further information regarding these settings.

FILE NAME See beginning of this chapter for explanation on file options.

DITHERING See *Chapter 5, Rendering*, for further information regarding these settings.

FIND OPTIONAL PALETTE See *Chapter 2, Attributes*, for further information regarding color palettes.

SAVE RECOVER INFORMATION As the make animation process can take a long time and there is a possibility of outside problems, such as a power failure or a computer system failure, this feature enables recovery of the make process from the beginning until the process was stopped**.**

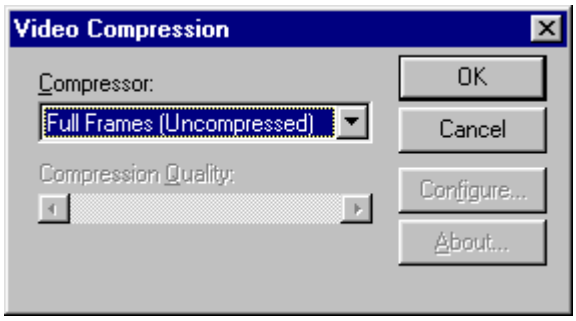
ESTIMATED DISK SPACE Displays estimated disk space required.

Click the Next button. The next dialog box opened depends on the Rendering Mode option chosen in the RENDERING dialog box.

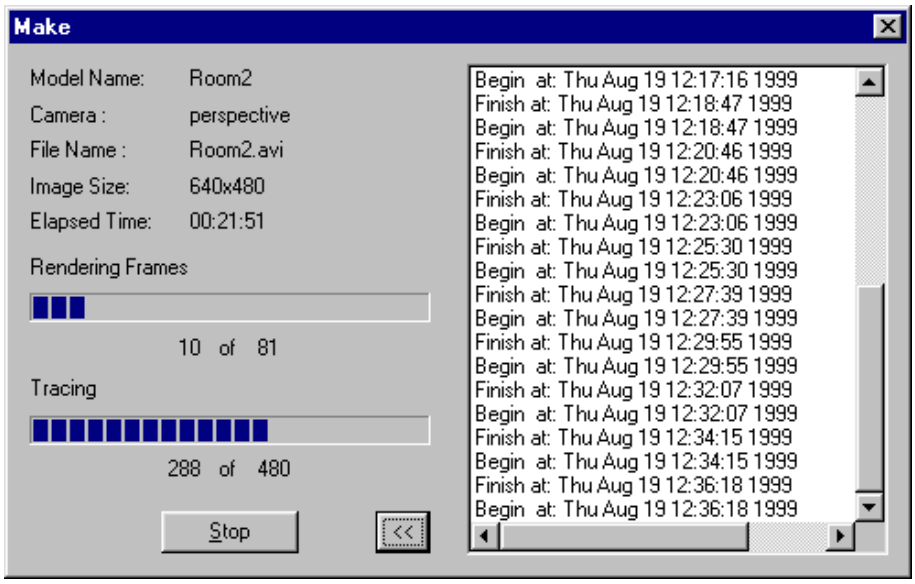
NOTE *You can click the Finish button at any time, even in the first dialog box.*

Click the Finish button to begin making or compiling the animation. A MAKE dialog box opens.

If you are working in an AVI format, a VIDEO COMPRESSION dialog box opens automatically in front of it.



The VIDEO COMPRESSION dialog box contains a drop down list of compression choices. Select compression and click OK to view MAKE dialog box.



This dialog box contains general file information, current making or compiling status.

Click the >> button to extend the window (the button changes to << when the window is opened). This portion of the window displays all image compiling information, including errors and the like.

Animation - Make Preview

\	Render Animation

To create a preview of the animation before future rendering:

From the menu select RENDER > ANIMATION

The RENDER dialog box opens, as displayed in Make Animation. Select Preview (wireframe) as the Rendering Mode.

Click the Next button to open IMAGE SETTING dialog box.

In the IMAGE SETTING dialog box, the default file format is FLI.

Animation - Make Later

\	Render Animation

To schedule animation for a later time:

From the menu select RENDER > ANIMATION

The RENDER dialog box opens, as displayed in Make Animation. Select LATER in the RENDER dialog box.

Once all dialog boxes have been executed, a message box displays the window: "Job XXX was successfully added".

This job is then added to the batch option described below.

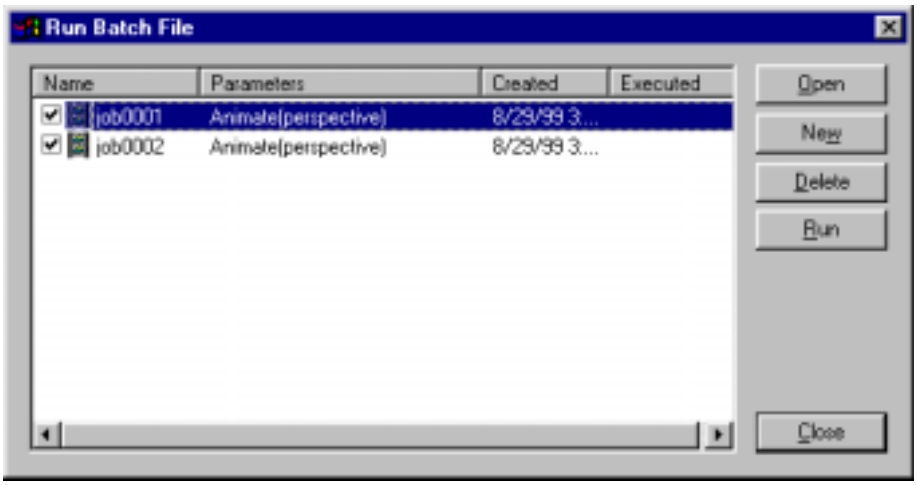
Animation - Make Batch

\	Render Batch

To work with one or more jobs scheduled for animation at a later time:

From the menu select RENDER > BATCH

This opens the RUN BATCH FILE dialog box.



This dialog box contains a list of all the jobs created under the Run Later option. This dialog box displays all jobs - images, animation and panoramas - including the names, parameters (camera names, etc.), dates created and executed.

To run batch, click RUN.

To delete jobs from batch, click to select the desired jobs, and click DELETE.

Click CLOSE to return to previous screen.

Animation - Play

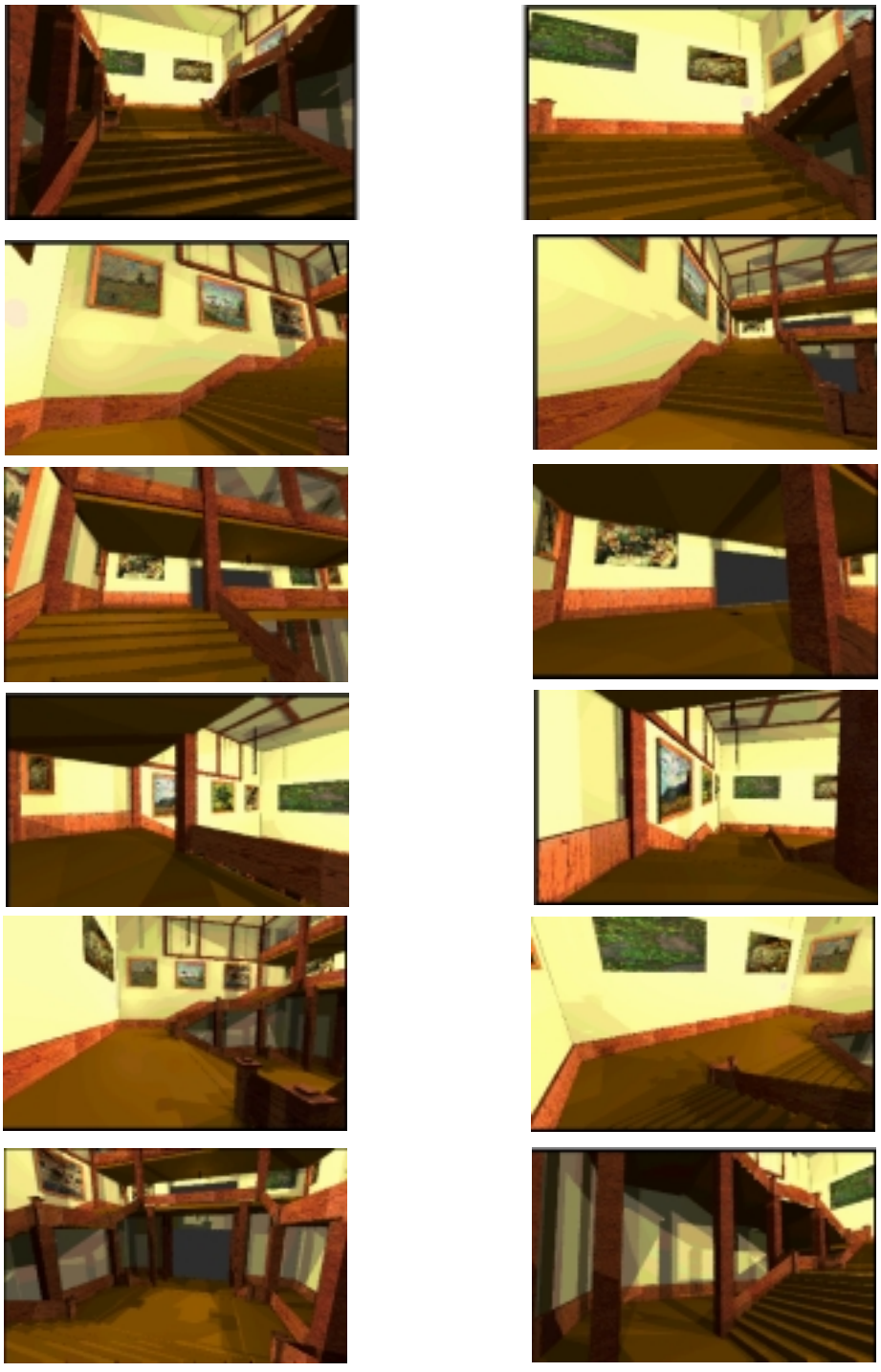
Render
Show
Animation

From the menu select RENDER > SHOW > ANIMATION. This opens a list of available animation files. Select file and click OK to play created animation.

Render
Show Last

From the menu select RENDER > SHOW LAST to play last created animation:

The following 12-scene strip presents an example of a walk-through animation. Note how the view changes and 'moves' through the scene, with each camera view.

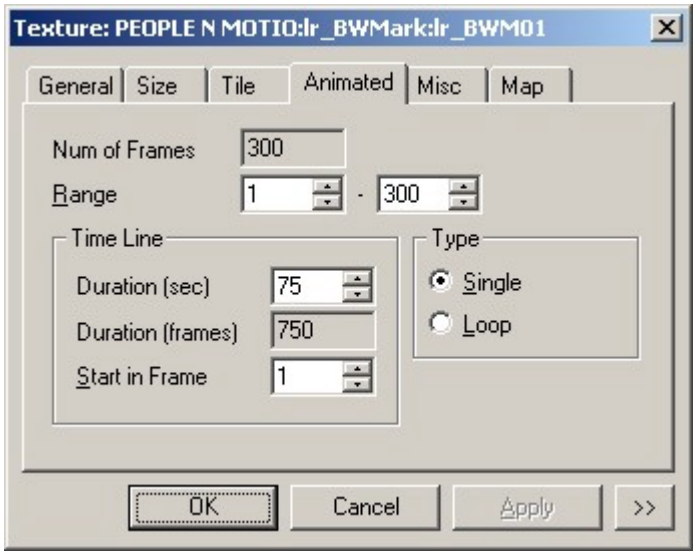


Animated Textures

In addition to walk-through animation abilities discussed in this chapter, lighting animation discussed in Chapter 7, and objects animation discussed in Chapter 9, ARC+ Render Pro offers animated texture capabilities. Any 2D animated GIF file, AVI video file or image files list (IFL) can be attached as a texture, see *Chapter 2, Attributes*, for a full explanation of attaching textures.

For example, an animated GIF can be attached to a TV screen to further enhance the real-life feeling of a scene.

To view and edit animated texture properties of a texture use the TEXTURE dialog box ANIMATED tab. This tab is available for video texture file only.



NUMBER OF FRAMEWS Number of frames in the animated texture.

RANGE The range of frames used the animated texture. By default the number of frames contained in the original video file becomes the number of frames in the animated texture.

TIME LINE

DURATION (SEC) Duration in seconds of the animated texture.

DURATION (FRAMES) Duration in frames of the animated texture.

START IN FRAME The number of frame in the animated texture to start from.

TYPE

SINGLE One single animation course.

LOOP A continuous animation sequence, beginning at the start and then retracing its steps from end to beginning and back again.

The following 6-scene strip presents an example of a texture animation. Look carefully at the picture on the wall, the number and direction of the open end of the circle 'moves' with each scene.

7

Lighting Animation

Lighting animation is an add-on module, similar in basic technique to the walk-through animation module discussed in Chapter 6. As in the walk-through animation, lighting animation provides another creative enhancement to the static rendered images. Lighting animation enables you to illuminate as well as to change the type of illumination viewed while touring the scene.

A scene can be enhanced with lighting animation in two ways:

- The scene remains static, that is, you only look at *one view* of the scene, and the lighting itself moves and changes direction, color or shape throughout the scene.
- *Both* the scene and the light move and change. As you tour the scene the lighting moves, changes color, shape and moves in its own pattern.

Before working with lighting animation, it is recommended that you review *Chapter 4, Lighting* and *Chapter 6, Walk-through Animation*, in order to re-familiarize yourself with all the lighting and animation features.

NOTE *It is important to keep in mind: Animation is created and measured in key frames and frames. A key frame is simply a camera angle. The animation is produced by creating a series of camera angles moving along a given path. Frames are the measurement of images between key frames, compared to the frames of a movie or cartoon that are viewed at high speed to create the illusion of movement.*

Animation File Types

You can choose to create the image file in various industry-standard formats:

Format	File Extension	True RGB Colors (24 bits) or 256 colors (8 bits)
Windows AVI file	.AVI	8 or 24 bits
FLI Autodesk file	.FLI	8 bits
GIF Animation file	.GIF	8 bits
Image List File	.LST	8 or 24 bits

Setting Animation Parameters

As discussed earlier in this chapter, it is recommended to review *Chapter 6, Walk-through Animation* to re-familiarize yourself with all aspects of the animation process. The following section incorporates the lighting animation feature into the animation process.

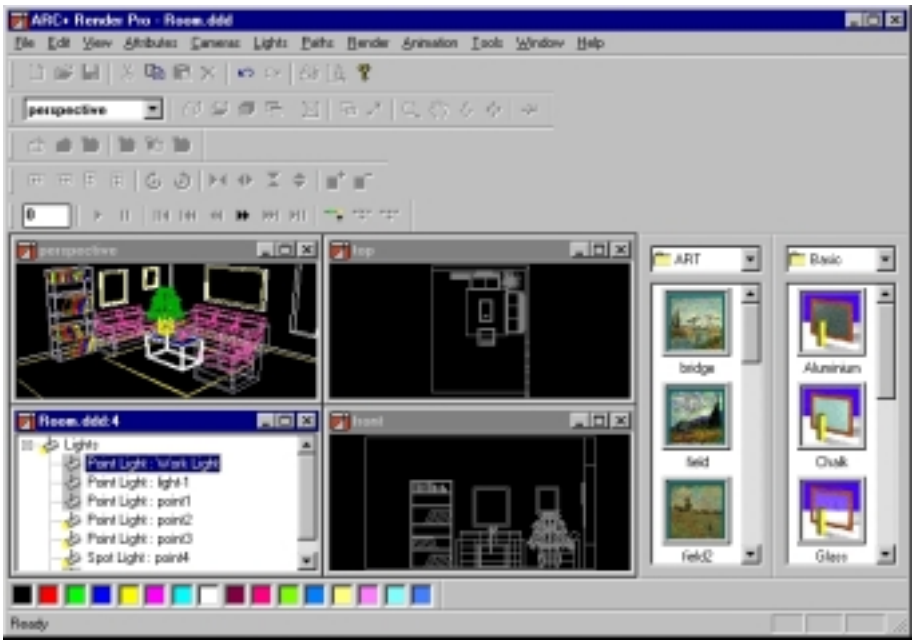
\	Paths Light Path

As with walk-through animation, lighting animation begins with setting the animation parameters. From the menu, select PATHS > LIGHT PATH

The top and front work windows (default views) change to gray.

Once you begin to create the key frame path, the graphic display is shown in these two work windows, according to their specified view (the top view displays the key frames from an aerial view, while the front view displays a cut-across view). The view in the perspective work window moves along with the path created.

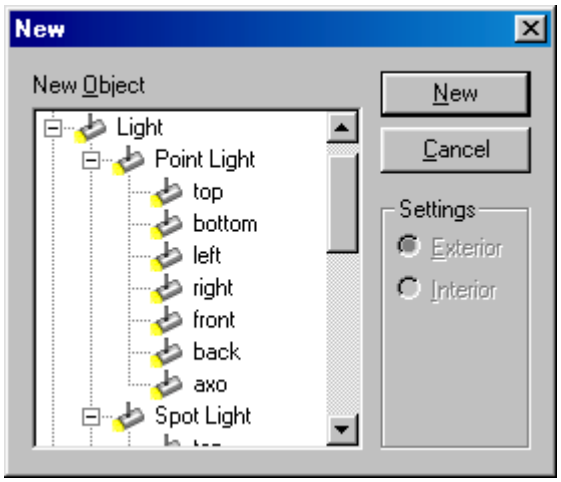
The two methods used to create an animation walk-through or path, using the Animation Wizard or creating paths manually, are described below.



Animation Wizard

The Wizard simplifies path creation, especially for first time users. Select EDIT > NEW from the menu bar or right-click the mouse in any of the work windows. Select New from the drop-down menu. A New wizard dialog box opens.

Click the + sign on the side of the Light branch to expand this branch.



As discussed in *Chapter 4, Lighting*, the lighting options available are:

- Point Light
- Spot Light
- Distant Light

Each option has seven lighting positions: top, bottom, left, right, front, back and axo. Selecting one of these positions activates the Settings option (to the right of the tree), enabling you to choose exterior (view from around the outer perimeter of the scene) or interior (view from within the scene)

Select desired lighting option and position (optional) and click New.

Click Add Key Frame icon and begin creating the path as discussed in the previous chapter. Review the Animation toolbar discussed in *Chapter 6, Walk-through Animation*.

As in walk-through animation, to create the first key frame, position the mouse on the first point and click. A red line is automatically drawn in the camera direction, towards the center of the image.

Lighting properties, such as lighting options, color, direction, cone angles can be modified and tailored to fit a certain type of lighting or area of the scene. For a full explanation of these features, see *Chapter 4, Lighting*.

Working with Lighting Animation - How to Overview

As discussed earlier in this chapter, lighting animation can be utilized in two basic methods. These basic methods can, of course, be improved, modified and transformed according to project requirements, technical skill and imagination.

It is important to keep in mind that modifying certain parameters change the default settings for the next action. In this case, if you worked with a walk-through animation, you need to open a new scene in order to work with a static scene with animated lighting.

Method One:

The scene remains static, that is, you only look at *one view* of the scene, and the lighting itself moves and changes direction, color or shape throughout the scene.

How to:

- Click Paths > Light Paths on the menubar.
- Click Edit > New on the menubar or right-click on work window to open drop down menu and select New.
- Expand Light branch and select light option and position.

- Click Add Key Frame icon to begin creating lighting animation and continue moving through the scene.
- To modify light options, toggle off the Add Key Frame icon, right-click desired key frame to open Light Properties dialog box.
- Render as explained in *Chapter 5 Render* and at the end of *Chapter 6, Walk-through Animation*.

Method Two:

Both the scene and the light move and change. As you tour the scene the lighting moves, changes color and shape and moves in its own pattern.

How to:

- Reset walk-through default
- Follow all the steps explained above.

Once you have created the types of light effects desired along the path, as well as defined the path desired (using the modifying, smoothing, setting frame rate, etc. features), you can render your scene as described in *Chapter 6, Walk-through Animation*.

The following 8-scene strip presents an example of a lighting animation. Note how the type and color of light, as well as its location, change and 'move' with each scene.




8

Panorama

Panoramic rendering enables viewers to get a panoramic view of 3D designs. ARC+ Render Pro lets you create two types of interactive panoramas:

1. Panoramic view - a 360^0 panoramic view of a scene, as seen from a fixed point of view
2. Panoramic objects – a 360^0 view of an object, as seen from a moving point of view turning 360^0 around a 3D model

By Viewings your 3D designs in one of the modes described above, your client can get a full perspective of your design. The panoramas you create can be viewed within Arc+ Render Pro, sent to clients by email to be viewed using a stand-alone viewer, or published on the web.

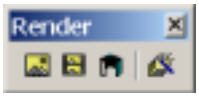
Producing a Panorama

You can produce a panorama for any camera in the model.

\

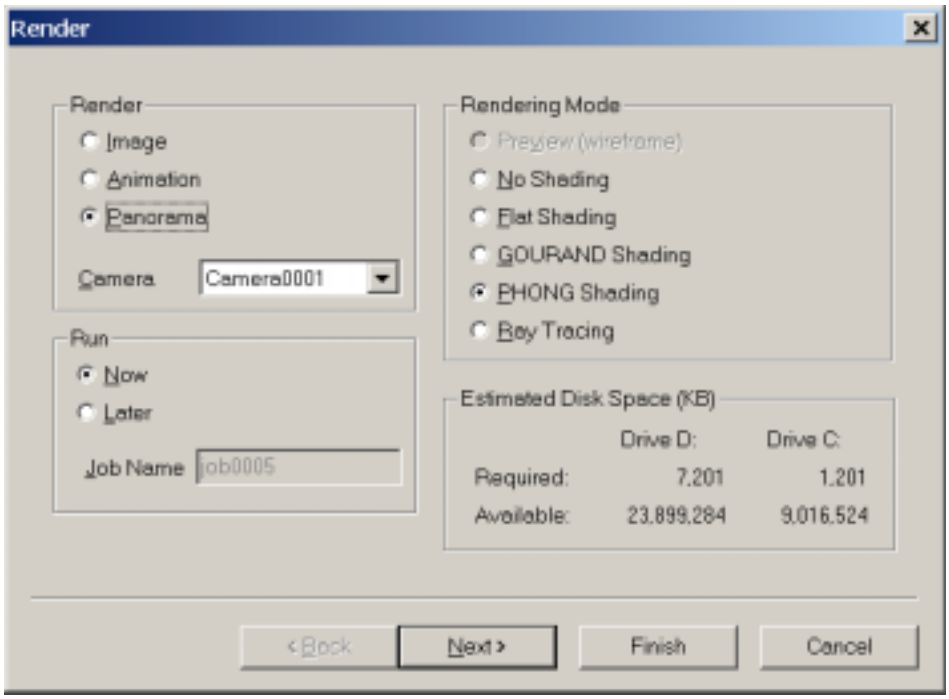
Render
Panorama

From the menu select RENDER > PANORAMA



Alternatively, you can choose Panorama from the Render toolbar.

The render dialog box opens.



PANORAMA The Panorama radio button is selected (default). The default camera view is selected in the drop down menu.

RUN The Panorama file is produced directly at the end of the creation process.

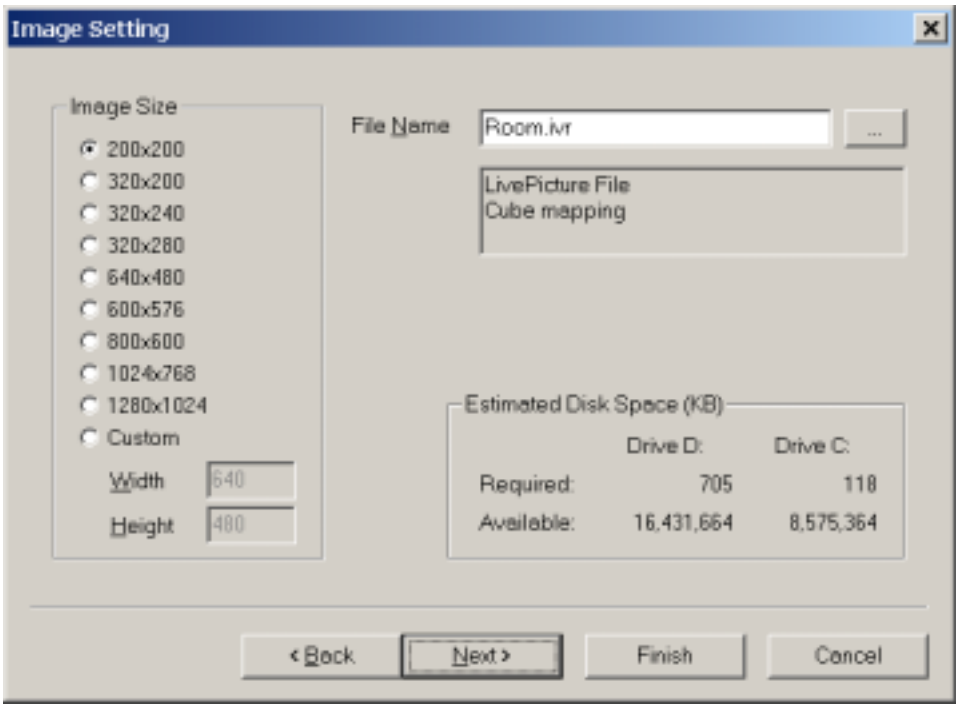
RUN LATER To schedule the creation of a panorama for later, select ‘Later’. Enter a name for the job. Complete the panorama creation process. After you click Finish, you’ll be presented with the message "Job XXX was successfully added".
To run select Render > Batch. In the dialog box that opens, select the job(s) you want to run and click Run.

RENDERING MODE for more information concerning Rendering, *See Chapter 5, Rendering*

***NOTE**: If you change the settings in the Rendering Mode, they will become the default settings the next time you use the Render setup.*

ESTIMATED DISK SPACE Displays the required and available disk space.

Click the Next button to open the image setting dialog box.



The image setting dialog box enables you to determine the following parameters:

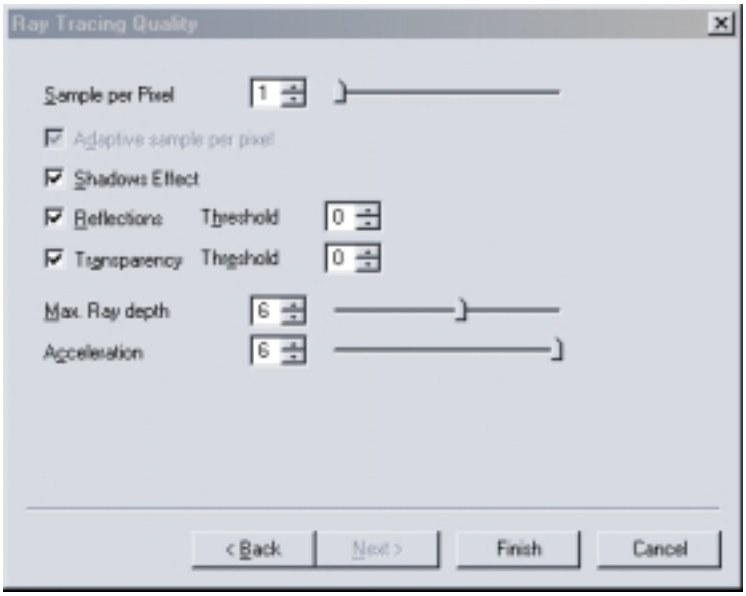
IMAGE SIZE for information regarding Image size settings See *Chapter 5, Rendering, Setting the Image File Type page 5-4*

FILE NAME CLICK ON THE ... button next to the Name box. In the dialog that opens, enter a name and select the file

type. LivePicture .Ivr is the default. You can also select VRML, which is a Panorama format requiring a VRML plug-in.
Select the panorama type from the Mapping drop-down menu at the bottom of the box:
Cube mapping - Panoramic view
Object mapping - Panoramic objects. If object mapping is selected, you may change the default number of sides you want the mapping to include

Estimated disk space Displays the required and available disk space.

Click the Next button. If ray tracing was selected the Ray-Tracing quality-setting dialog box is opened. If another rendering mode was selected The Render quality dialog box is opened



Specify the sample per pixel value for antialiasing (set to 1 if antialiasing is not desired).

Check the required options (Shadow Effect, Reflections and Transparency) and enter numerical values accordingly

Ray Depth the number of surfaces that a single light-ray can hit as it bounces around a model

Acceleration Ray Tracing computation-time. The maximum value is recommended. It accelerates computation-time with minor reduction in image quality.

When you are done, click Finish.

Displaying a Panorama

After you produce a panorama, it is saved as panorama files on your hard disk. You can display panorama in ARC+ Render Pro by choosing the panorama file in the dialog box.

\	Render Show > Panorama

Panoramas' viewing options

A panorama created in Arc+ Render Pro can be viewed within Arc+ Render Pro, using a stand-alone viewer, or published on the web. IVR panoramas are embedded in an html page and use a Java panorama viewer for viewing. The location of panorama viewer files can be defined before you create a Panorama, or changed later in the html file using an html or a text editor.

You define how the panorama file will be viewed by specifying the location of the panorama's Java viewer files (IVR CAB files).

Selecting a viewing option

\	Tools Options Panorama

From the menu select Tools > Options

In the dialog box that opens, select the Panorama tab and check the required option:

Software Folder	To produce a panorama to be viewed within Arc+ Render Pro. The panorama viewer files are stored in your software folder.
Target Folder	To produce a panorama to be viewed using a stand-alone viewer. The panorama viewer files are stored in a target folder (where your panorama file will be stored too). The panorama can be viewed independently of the software that created it, by sending the whole folder to other computers.
Web	To produce a panorama to be viewed on the web. The panorama viewer files are stored on the web, enabling easy publishing of your panorama on the web. If you select Web, you can change the default web address in which this panorama viewer will be stored.

After you determine the location of the Panorama viewer, you can produce the Panorama file.

9

Objects Animation

Objects animation is part of Animator plug-in, similar in basic technique to the walk-through animation module discussed in Chapter 6. As in the walk-through animation, objects animation provides another creative enhancement to the static rendered images. Objects animation enables you to move objects in your animation, and create impressive live animated scenes.

Before working with objects animation, it is recommended that you review *Chapter 6, Walk-through Animation*, in order to re-familiarize yourself with all the basic animation features.

Creating Objects Animation

Animating an object is based on changing properties of the object in each keyframe along the animation time line. Objects in the scene can be manipulated in each keyframe: you can translate (change the position), rotate (change the orientation), and scale (resize) an object.

The main workflow steps of object animation are as follows:

- Go to keyframe
- Define the transform properties of the object in the current keyframe

Animation layout

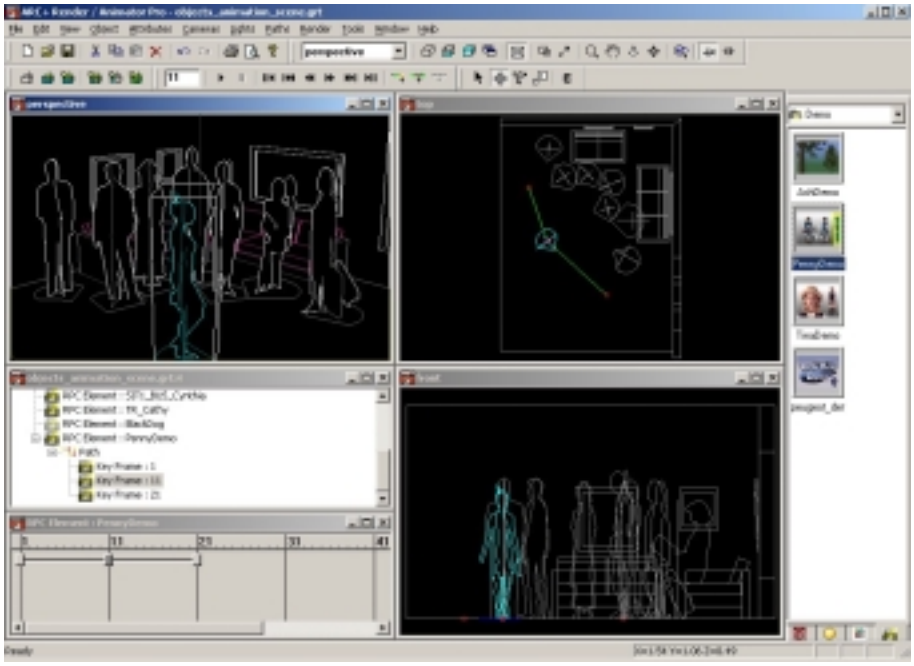
As discussed earlier in this chapter, it is recommended to review *Chapter 6, Walk-through Animation* to re-familiarize yourself with all aspects of the animation

process. The following section incorporates the objects animation feature into the animation process.

\ Paths
Object Path

As with walk-through animation, objects animation begins with setting the animation layout. From the menu, select PATHS > OBJECT PATH

The top and front work windows (default views) change to gray. Once you begin to create the key frame path, the graphic display is shown in these two work windows, according to their specified view (the top view displays the key frames from an aerial view, while the front view displays a cut-across view). In the perspective view, the object is moved along the motion path created.



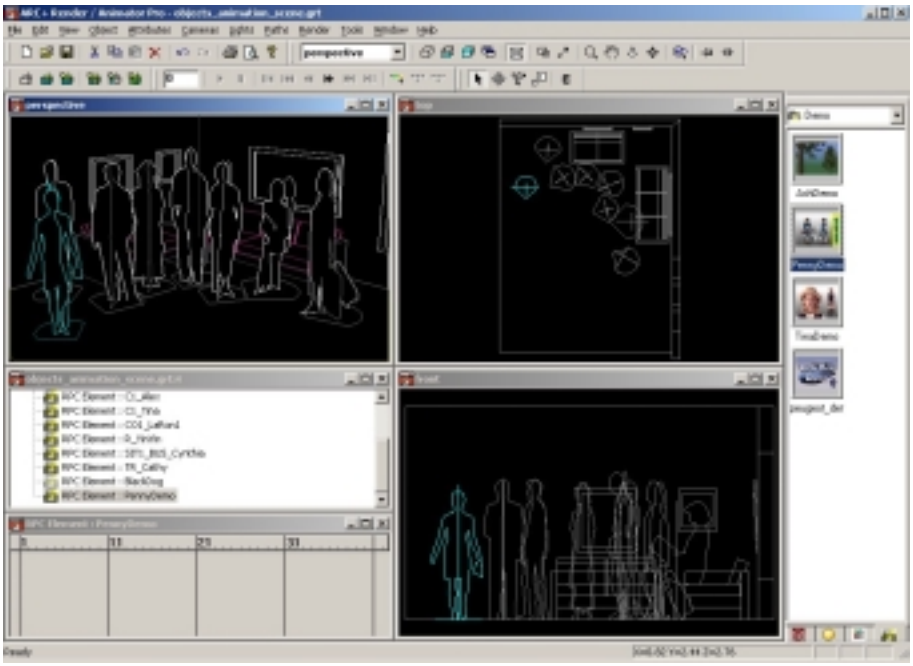
Working with Objects Animation

As discussed earlier in this chapter, objects animation is based on keyframes. You define the position, orientation and size of an object in each keyframe.

The following example presents the steps to create motion path composed of 3 keyframes.

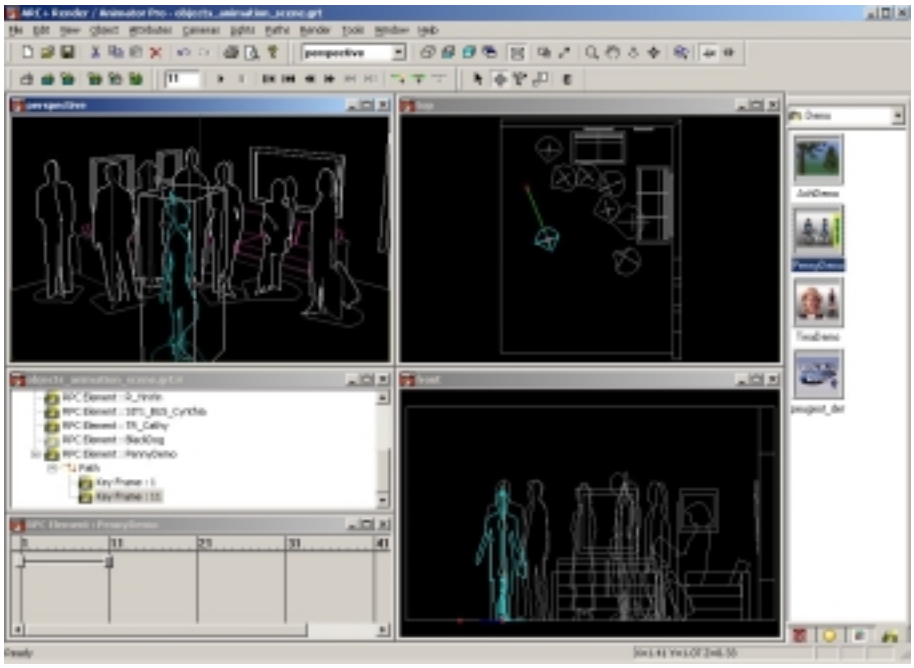
Step 1:

- Click Paths > Object Path on the menu bar.
- Click on the placed element that you want to move



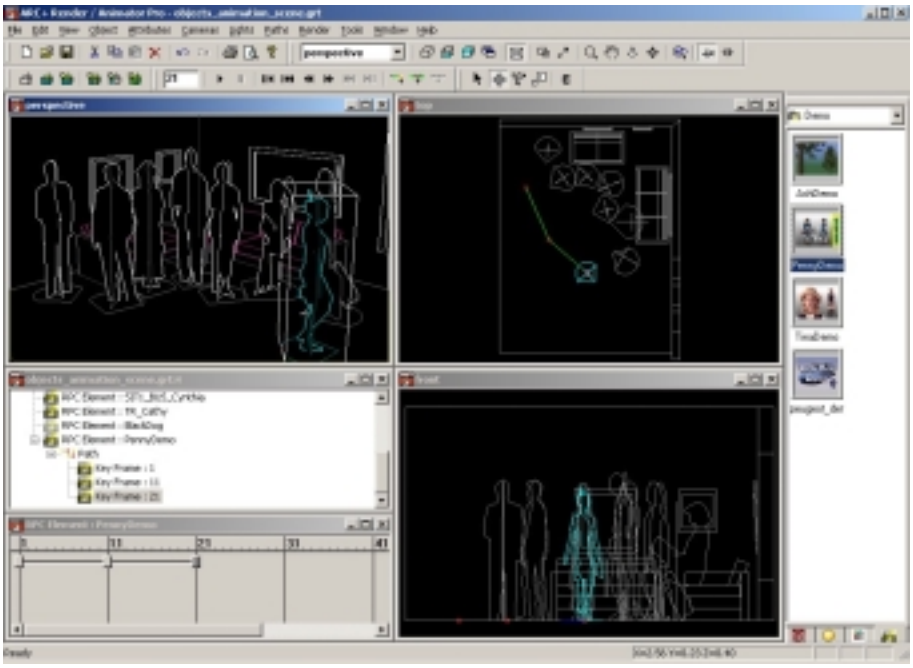
Step 2:

- Go to next keyframe, for example: 11 (type the frame number in the animation toolbar, or click on the frame number in the frames view)
- Drag the object to desired location



Step 3:

- ❑ Go to next keyframe, for example: 21
- ❑ Drag the object to desired location



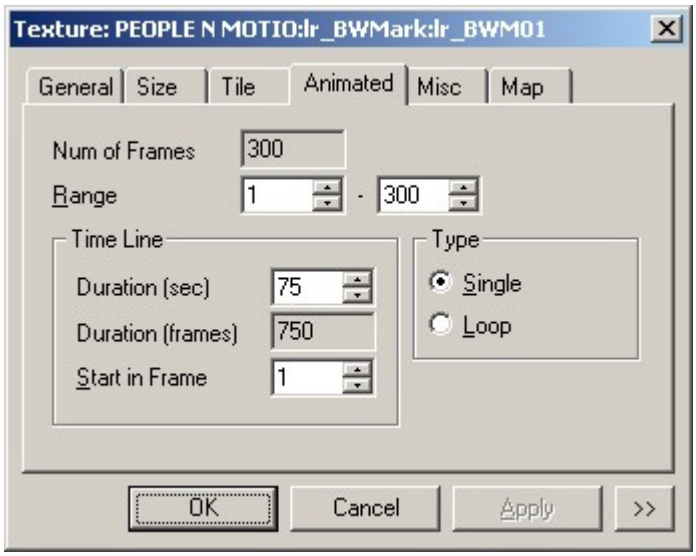
The object path is ready. Click RUN in the animation toolbar, to preview the animation, Click STOP, to stop the animation preview. Produce the animation, as explained in *Chapter 5 Render* and at the end of *Chapter 6, Walk-through Animation*.

Combining objects animation and video textures

Video textures are also part of Animator plug-in. Object animation can be combined with video textures to create impressive effects. For example, you can animate placed element consist of single polygon with video texture of walking man attached to it.

To edit the video texture properties, right click on the entity and select Properties. In the Attributes tab, double click on the texture. The video texture properties are shown in the ANIMATED tab.

NOTE *To select an entity, make sure that Entity Mode in the Objects toolbar is on.*



The following strip presents an example of objects animation. Note how the video texture of walking man is combined with object animation, while the video texture of standing woman is attached to static polygon.

Working with objects

Entities such as placed element and RPC element are referred as objects in this chapter. Objects in the scene can be manipulated: you can translate (change the position), rotate (change the orientation), and scale (resize) objects. You can change the transform properties of an object in each keyframe.

Selecting and manipulating objects

You can select and manipulate objects in the scene using the Objects toolbar displayed below.

The function of each icon is described below:

	**SELECT**	Select an object. The object is visually indicated as selected by changing its color.
	**TRANSLATE**	Select and translate (move) an object.
	**ROTATE**	Select and rotate an object
	**SCALE**	Select and scale (resize) an object

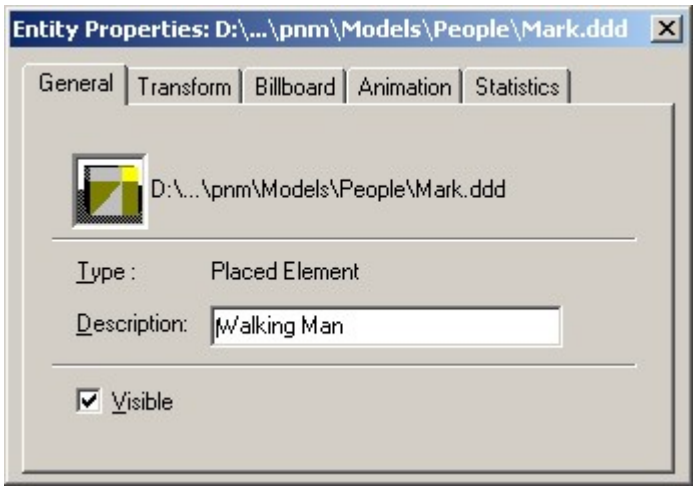
E	**ENTITY MODE**	When entity mode is on, click picks an entity such as polygon and solid (suitable for rendering working mode). When entity mode is off, click picks an object such as placed element and RPC element (suitable for objects animation working mode).

NOTE *To select an object, make sure that Entity Mode in the Objects toolbar is off. Then click on the object you want to select. The object is visually indicated as selected by changing its color.*

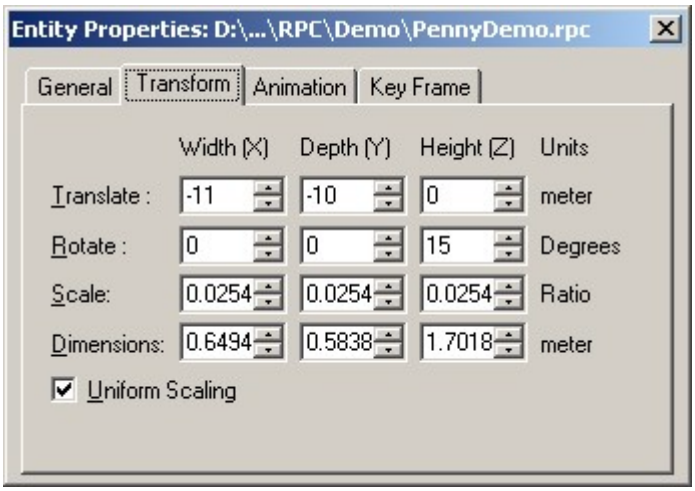
The transform properties (position, orientation and size) of objects are shown in the object properties dialog box, described in the next section.

Object properties dialog box

To view the properties of an object, either double-click the object, or right-click the mouse and select PROPERTIES, to open the object properties dialog box.

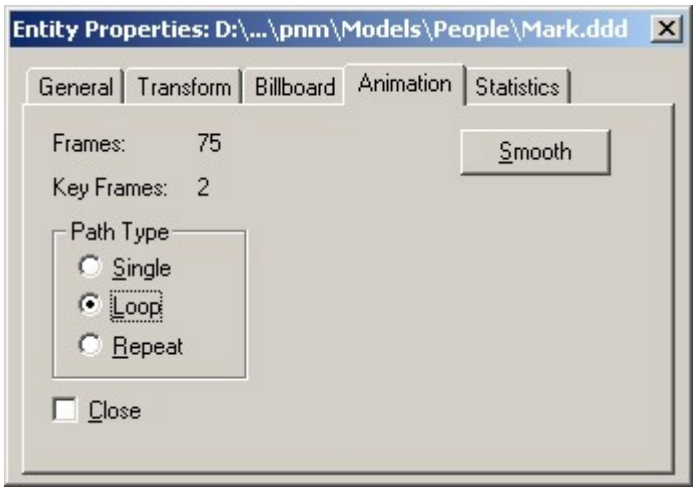


To view and change the transform properties (position, orientation and size) of objects, click TRANSFORM in the object properties dialog box. Here you can view and change the translate, rotate and scale values of an object.



TRANSLATE	Position of the selected object
ROTATE	Orientation of the selected object
SCALE	Scale of the selected object
DIMENSIONS	Size of the selected object
UNIFORM SCALING	When uniform scaling is on, scale is done uniformly for all axes. When uniform scaling is off, you can scale independently each axis of the object.

When selecting the ANIMATION tab, the animation dialog box is opened. This window is inactive when there are no key frames available.

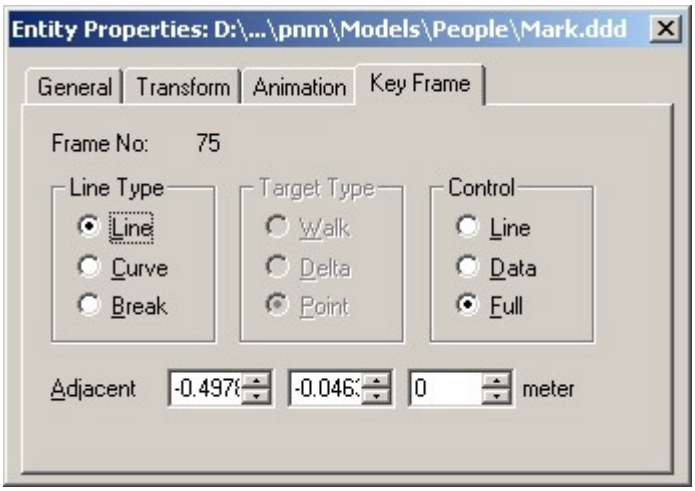


This tab displays the total number of frames and keyframes in the object path. To choose path type, click the desired radial button.

PATH TYPE

SINGLE	One single animation course.
LOOP	A continuous animation sequence, beginning at the start and then retracing its steps from end to beginning and back again.
REPEAT	A sequence that begins at the start and goes through to the end and then begins again at the beginning in a continuous movement.
CLOSE	Closes the path from the last key frame created to the first key frame.
SMOOTH	Smooth the animation path to create motion with constant velocity.

When selecting the KEY FRAME tab, the key frame dialog box is opened. This tab is available only when object have animation path and key frame is selected.



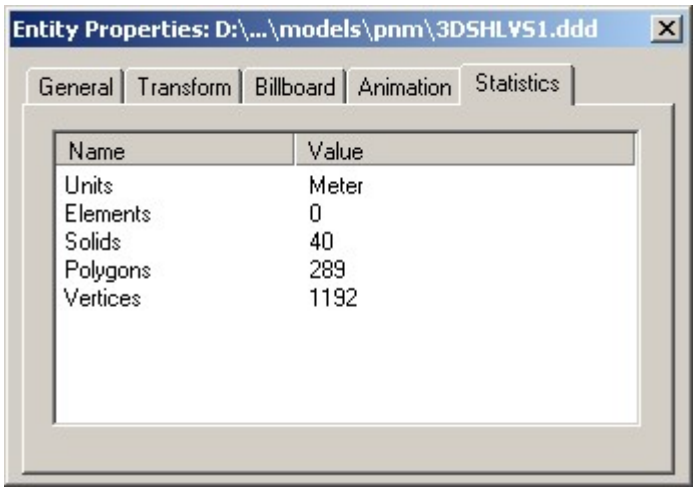
This tab displays the current key frame number, along with the following features.

LINE TYPE Enables you to choose the line type of path for this key frame. Line (default) is a straight path. Curve displays a blue grip and enables you to bend or arch the path at this specific point. Break stops the motion until it reaches the next key frame.

TARGET TYPE The target type is not relevant for object path. The target is used to define the direction behavior in camera and lighting animation.

CONTROL This feature enables full control over the type of key frame used, i.e. what is changed in the key frame: line of path, object data or both. Line allows you to control only the key frame's position in path; other object properties are determined by the *previous* key frame. Data enables you to determine only object properties (e.g. size) but not the position in path. Full enables you to control all key frame parameters.

When selecting the STATISTICS tab, the statistics dialog box is opened.

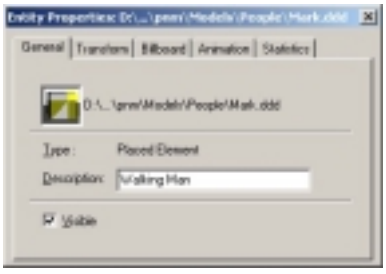


This tab displays statistics about the select objects, such as the total number of solids, polygons and vertices.

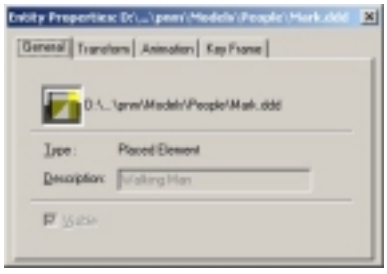
Properties dialog box and current frame

The properties dialog box shows properties according to the current frame. To see all parameters of entity without relationship to animation, view the model in basic state (frame is 0 in the animation toolbar). To see parameters of entity in specific key frame or frame, view the model in the specific key frame or frame (type the frame number in the animation toolbar, or use the animation toolbar to go to the specific key frame or frame, or click on the frame number in the frames view). For a further explanation about frames, see *Chapter 6, Walk-through Animation.*

The tabs and fields shown in properties dialog box is according to the current frame:



Basic state



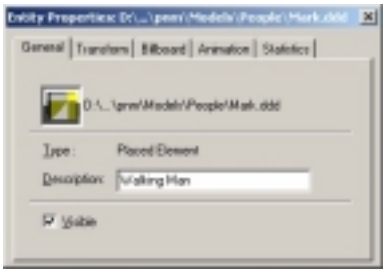
Keyframe selected

NOTE *The key frame tab is available only when object have animation path and specific key frame or frame is selected. When viewing model in basic state (frame is 0 in the animation toolbar) this tab is not available.*

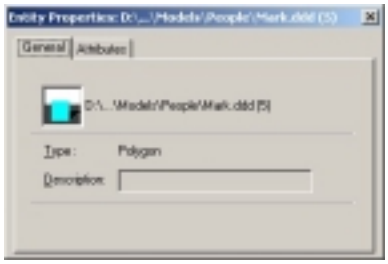
Properties dialog box and entity mode

The entity mode determined which entity is picked when you click on the 3D view. When entity mode is on, click picks an entity such as polygon and solid (suitable for rendering working mode). When entity mode is off, click picks an object such as placed element and RPC element (suitable for objects animation working mode).

The properties dialog box shown is according to the entity type e.g. placed element or polygon:



Placed element



Polygon

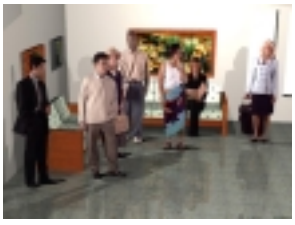
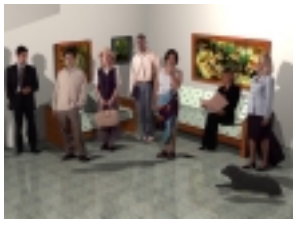
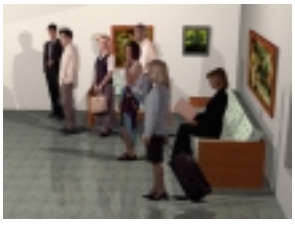
NOTE *To select an object (i.e. placed element), make sure that Entity Mode in the Objects toolbar is off. Then click on the object you want to select. The object is visually indicated as selected by changing its color.*

10

Photo-realistic Objects

This chapter explains how to insert photo-realistic objects into your scene using ARC+ Render Pro commands.

Photo-realistic objects, such as people, trees and automobiles, are supported by RPC plug-in. With RPC plug-in, you can place and edit RPC objects that are dynamically replaced at render-time with the image that is appropriate for the current viewing direction. RPC technology provides new level of photo-realism, with significantly improved rendering time, in remarkably simple user interface as easy as drag and drop.

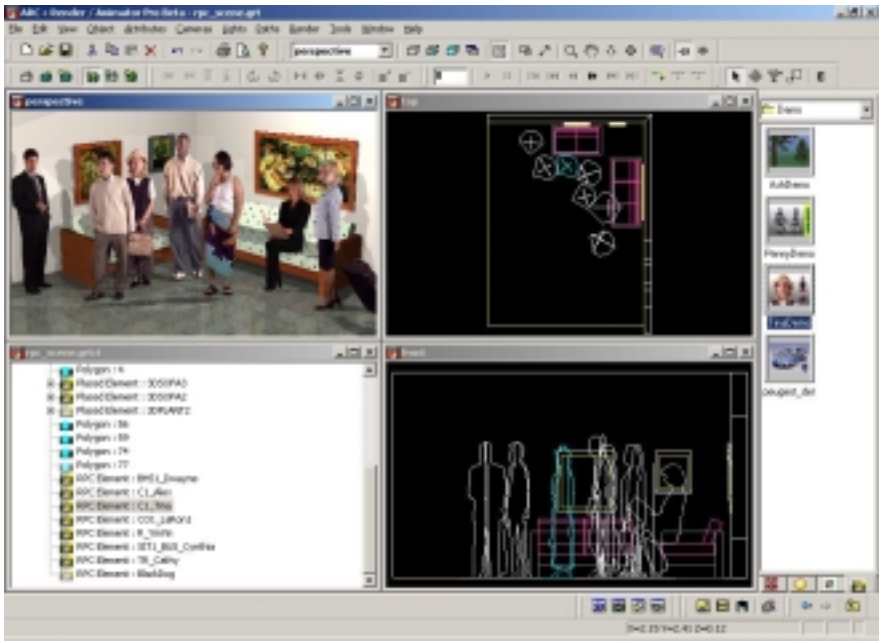
What is Photo-realistic Object

Photo-realistic objects are rendered using image-based rendering technology. RPC is the first major commercial project in the evolution of image-based rendering technology. Rather than rely upon complex geometry to represent objects in 3D, RPC technology utilizes image data, and is capable of reflecting an incredible richness of detail. The use of continuously updated and synthesized image data creates a stunningly effective 3D illusion.

A simple representation is used to orient your RPC content within the geometry of your scene. At render time the RPC Plug-in calculates the viewing angle of the RPC object relative to the virtual camera. The appropriate corresponding images are then synthesized, creating the illusion that a complete 3D object exists in the scene.

Working with Photo-realistic Objects

Photo-realistic objects are available in the Models library bar. The Library stores RPC photo-realistic objects, which can be easily inserted into your scene. Commercial RPC plug-in is required to support commercial RPC content. Demo RPC content can be used without RPC plug-in license.



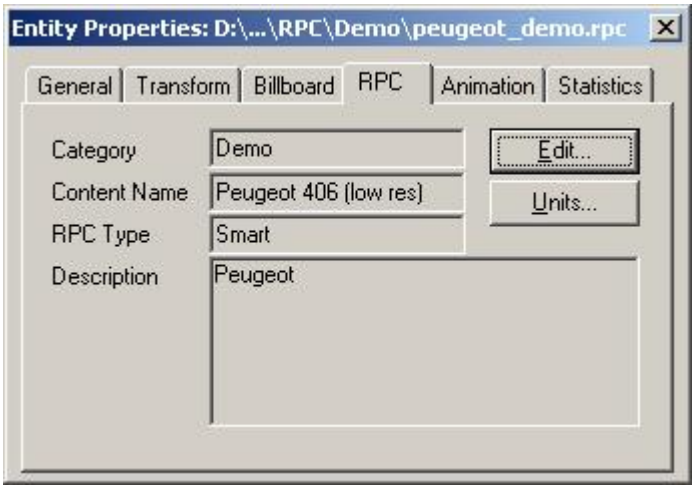
To insert a photo-realistic object, select it from the relevant library bar, and drag and drop it into your scene.

NOTE *To render RPC element correctly, select drawing mode that support transparency mapping, such as ray tracing.*

To delete an existing photo-realistic object, select the object you want to delete, and press the delete button on your keyboard, or click Delete on the Edit menu.

NOTE *To select a photo-realistic object, make sure that Entity Mode in the Objects toolbar is off. Then click on the object you want to select. The object is visually indicated as selected by changing its color.*

To view properties of RPC element, either double-click on it or right-click the mouse and select PROPERTIES, then click RPC.



Some RPC objects provide additional editable parameters (for example: steering of wheels of automobile RPC object). To edit RPC parameters, click EDIT.

To change the units of a RPC element, click UNITS, and select the appropriate units. Default units for RCP objects are inches.

Photo-realistic objects can be manipulated and animated as other objects. For further information about working with objects, see Working with objects in chapter 9, *Objects Animation.*