MicroStation Visualization V8i

(SELECTseries 1) Luxology Update 1

This is an unfinished draft document for Luxology Update 1, and we are continuing to add additional content and topics. Any items marked with a * will be documented further in the final version. Please inform jerry.flynn@bentley.com of any errors you encounter.

What's New

- Updated Bentley_Materials.DGNlib with improved definitions
- Redesigned Material Editor with tabbed interface
    - New material settings have been added for the following:
        - Reflect map and color options
        - Glow map
        - Fresnel with maps
        - Absorption Distance
        - Sub Surface Scattering
            - Dissolve
            - Sub Surface (was Translucency) map and color options
            - Front Weighting
            - Scattering Distance
        - Dispersion options
        - Additional Refraction values for common materials
        - Refraction Roughness and Maps
        - Fur
            - Separate material for fur strands
            - Auto Fading

        - Hair Shader
    - Shading effects moved to Expert tab
    - Added Blur Reflections, Blur Refractions and Displacement to Basic Mode
    - Added many new material widgets
    - Added support for Luxology procedural shaders
    - Added option to specify gamma level for texture maps
- Redesigned Light Manager with tabbed interface
    - Added Light preview with light preview widgets
    - Added Volume Density with Density map
    - Added Volume Scatter Color and Color maps
    - Added Shadow Color Maps
    - Added options to scale effect on Diffuse, Specular and Caustics
        - Added maps for Diffuse and Specular scale effect
- Environment dialog
    - Added option to unlock environment brightness
- Added improved stereo support
    - Option to toggle between Anaglyph and Side-by-Side
- Added option to save multiple images from Luxology history
- Added ability to render large images (at least 10000x10000 pixels) from Luxology dialog*
- Improved animation efficiency by using native Luxology animation scripts*+

Overview

Bentley Systems entered into a technology agreement in 2008 with Luxology LLC – to license Luxology's rendering engine for inclusion within MicroStation V8*i* and future versions. The Luxology rendering engine was included initially in MicroStation V8*i* as a technology preview and as of SELECTseries 1, it has replaced the legacy renderer to become our photo-realistic rendering engine.

Though the Luxology technology is the preferred renderer for a broad community of users, including major film studios, it is ideally suited to the demanding requirements of AEC applications. It can quickly produce extremely high-quality images and animations from huge datasets that typically include vast numbers of parametrically replicated geometry elements.

Features of this technology that contribute to its high-quality renderings include global illumination and physically-based shading models. These provide advanced optical phenomena such as anisotropic blurry reflections, indirect caustics, and subsurface scattering. In addition, realistic camera models include lens distortion, motion blur, and depth of field. Physical sky and physical sun rendering provides accurate sunlight at any location.

Working with MicroStation's Luxology rendering

All work with Luxology rendering is initiated from the *Luxology Render* dialog, which you open by selecting *Utilities > Render > Luxology* or by clicking the Render tool in the Visualization Task pane. You may also select *Tools > Visualization > Render*.

Because MicroStation's *Luxology Render* application is modeless, it can coexist with the standard MicroStation view windows. Additionally, the *Luxology* rendering process is multithreaded, which means that once the preprocessing stage of a rendering is completed, you can continue to work in MicroStation while the rendering is progressing.

Buckets

When rendering with Luxology, the image is first broken into small pieces, which are referred to as "buckets." The number of buckets in an image is dependent on the bucket size relative to the final image size. The Bucket Size is set in the *Luxology Render Preferences* dialog. For instance, if the image size is set to 400 by 400 pixels and the buckets are set to 40 pixels, Luxology renders 100 buckets to complete the image. The advantages to rendering with buckets are many:

The render engine can heavily leverage multi-processor and multi-core computers so that Luxology rendering derives a near linear speed boost from each new physical processor and significant boosts from additional cores.

Bucket rendering provides a method for very large image rendering as well as the rendering of projects with a very large memory footprint (billions of polygons, for example). By selectively loading and purging the data required for each individual buckets, Luxology can dramatically reduce memory requirements. The more buckets that are used to purge data or cache the image to disk, the less memory that is used. This, however, is at the expense of performance as there is some overhead to repeatedly loading and saving geometry and image data during the render.

Bucket Size

Bucket size is controlled in pixels via the Bucket Size setting. The default bucket value is 40, which means that each bucket will be 40 pixels wide and 40 pixels high. Using larger Buckets increases the amount of memory required but can result in speed improvement.

However, if multiple threads are being used it is important to remember that using smaller Buckets can result in a better load balanced total frame. It is likely that when using multiple Buckets they will not finish at exactly the same instant, therefore there will usually be one bucket/thread computing when the other bucket(s)/thread(s) are finished.

If the Buckets are very large, the amount of time the render engine is using only one thread will increase, which of course, decreases the impact of the additional processors on final render time. You might come to the conclusion that you should set the bucket size as small as possible. This is erroneous because this can actually result in increased render times since there is some processor overhead in managing the Buckets.

Instancing

The Luxology rendering engine is optimized to efficiently handle large numbers of identical pieces of geometry using a technique known as “replication.” This makes it ideally suited for handling AEC data sets which, typically, contain vast numbers of identical components. For example, a typical plant file may contain thousands of identical valves or pipe elbows.

When MicroStation renders with the Luxology engine, it handles replication at two levels.

At the lowest level, as geometry is meshed and sent to the rendering engine, it automatically detects that meshes have already been encountered at a different location and rather than sending the entire mesh, it sends only the location information. This type of instancing is very similar to the techniques that are used to compress standard imaging files.

MicroStation also supports a higher level instancing based on cells (both shared and unshared). This instancing works in a similar manner to the mesh instancing except that it detects duplicated cells and sends only their location rather than the entire cell contents. This produces a higher level of optimization for models with many cells. It avoids the meshing step for the instanced cells and also allows instancing of some types of geometry that are not suitable for the mesh instancing.

Lighting

All lighting settings for rendering are controlled in the *Light Manager* dialog. You can access this dialog, plus any existing setups, from the *Luxology Render* dialog, or from the Lights toolbox.

Indirect Lighting

In order to fully understand the illumination settings for Luxology rendering it is critical to first understand the technical process of indirect illumination. While it is intuitive to imagine light coming from a 3D light or a luminous surface and traveling to reach the surfaces then bouncing around a room, the actual process of rendering with indirect illumination is quite the opposite. As the surface is evaluated rays are cast outward from the surface randomly and evaluated when they strike other surfaces in the scene. The sum of those evaluations is what contributes to the color and brightness of the original surface.

To get a more precise idea of how indirect illumination is estimated at a point on a surface, imagine the top half of a transparent globe resting on the surface, so that the point's surface normal is poking through the North Pole. Rays are fired from the surface point through random points within each "cell" formed by the latitude and longitude grid lines, with one ray per cell. These rays go out and hit either other surfaces or the distant environment, and the average color that they see is the indirect irradiance estimate ("irradiance" being the technical term for incoming light).

Now imagine we need to shade a flat surface, and the environment image is all black except for one concentrated bright region. Each shading point on the surface sends rays as described above. For some points, maybe two of their rays will be fortunate enough to hit the bright region, while for other points only one ray hits it and the rest of the rays see black. With some points getting twice the irradiance of others, you can predict that the surface will look quite splotchy if Irradiance Caching is on (or grainy if it is off). If, however, we subdivide the transparent hemispheres more finely (that is, use more rays), the number of hits and misses will be much more consistent between neighboring surface points, smoothing out the shading. While Luxology's indirect illumination is based on this hemispheric sampling, there are two very different approaches to the use of these samples, Irradiance Caching and Monte Carlo.

The default method utilizes a technique called Irradiance Caching. The concept behind this technique is that by leveraging a smaller number of more accurate samples and blending between them, you can achieve an image of perceived quality in a shorter amount of time than with the Monte Carlo method. This method samples every pixel with lesser quality, which often results in a "grainy" image.

When Irradiance Caching is disabled, Luxology falls back to generating a hemispherical shading sample for every pixel in the image. As a result, you must be careful about the number of rays you use. This number will be multiplied by the millions of pixels in your image and that could be a lot of rays. With Irradiance Caching active, Luxology intelligently samples the scene at strategic locations. It then interpolates between them for a smoother overall final frame.

The simplest way to think about Monte Carlo versus Irradiance Caching is as follows:

Monte Carlo uses a lower quality (fewer rays) sample at every single pixel.

Irradiance Caching uses fewer, much higher quality (more rays), samples and blends them together.

Irradiance Cache 2 minutes 46 seconds(interior good setup)

As a result, when the samples are not accurate enough in Monte Carlo, there will be significant variance from one pixel to the next which appears visually as grain. When using Irradiance Caching, the variance is spread across from sample to sample which yields splotches visually. With Monte Carlo there is one remedy which is to simply increase the number of rays per pixel. This can cause render times to increase dramatically, for example in the following images from left to right the render times were 3 minutes 10 seconds, 4 minutes 13 seconds and 8 minutes 12 seconds.

Monte Carlo method from left to right 128, 512 and 2000 indirect rays

Irradiance Caching provides several approaches to reducing artifacts, which include increasing the number of rays, adding Supersampling, and increasing the number of samples required to create a blend (Interpolation Values).

With this understanding of the basic concepts, the following definitions will help you more effectively balance your scene performance/quality when working with indirect illumination.

Direct vs Indirect Lighting

Luxology provides both direct and indirect lighting sources.

Indirect lighting provides a global illumination or radiosity rendering model that uses the environment and existing geometry in the scene to provide shading.

Direct lighting models utilize 3D lights to directly illuminate surfaces.

While these two models are computed separately, by default their results are added together to give the final shading result. Each model has specific advantages. When used together wisely you can optimize both the speed and quality of your rendered images.

Direct light has the distinct advantage of providing the exact location of light so that when a pixel is evaluated the renderer can simply loop through the visible lights and add the appropriate shading values from each. This direct lighting approach gives very accurate lighting results very quickly. The disadvantage is that this model does not account for the effects of secondary lighting such as bounced light or light coming from luminous surfaces. The number of samples per light only needs to go higher than 1 sample when some soft-edged shadows are intended. The wider the spread on the soft edge, the higher the sample value should be to provide reasonable quality.

Antialiasing

Antialiasing improves image quality by reducing jagged edges. For example, you might find a red region in part of a pixel and a green region in another part. Antialiasing examines different parts of a pixel and combines the values to achieve a smooth image.

No Antialiasing left image and 8 sample Antialiasing right image

Materials

Material definitions and assignments/attachments are controlled in the *Material Editor* dialog. You can access this dialog from the *Luxology Render* dialog, or from the Materials toolbox. With this release, several changes/additions have been made to the *Material Editor* dialog (see Changes to the Material Editor dialog).

Bump Maps vs Displacement Maps

Both bump maps and displacement maps add realistic 3D effects to materials without the need to create the geometry. For example, a bump map included in the material definition of a brick wall produces realistic brickwork in the rendered image without you having to model the bricks and mortar.

Where bump maps are unrealistic, however, is at the edge of geometry. At these locations, the line of the underlying geometry displays, rather than the bump map. Displacement maps, on the other hand, simulate the geometry used to create them in the first place, and display the displacement map geometry in place of the underlying element.

Normal Maps

A normal map allows the surface normal of a polygon to be completely defined by an image. Similar to bump mapping, a normal map perturbs the surface normal. Normal maps replace the surface normal at every point on the surface. This allows lower polygon models to be used but to keep the detail of the surface normals as if a more complex model is used. This can be seen in the image below where the image on the right has better shadow definition especially in areas of low displacement due to the normal map than the image on the left.

How Displacement Maps work

When using displacement maps the displacement procedure creates additional geometry in the scene at render time. This means that this new geometry will be added to the calculation of light, materials and visibility. Displacing geometry in a scene can increase the render time significantly especially if it is in high quantity.

Tips for using Displacement Maps

Because displacement maps require extra memory and processing time, be careful using them. Typically:

Use Displacement Maps only when needed.

If a bump or pattern map give you the same result, then there is no need for a displacement map. Remember, normal pattern and bump maps are material properties, whereas a displacement map is new additional geometry.

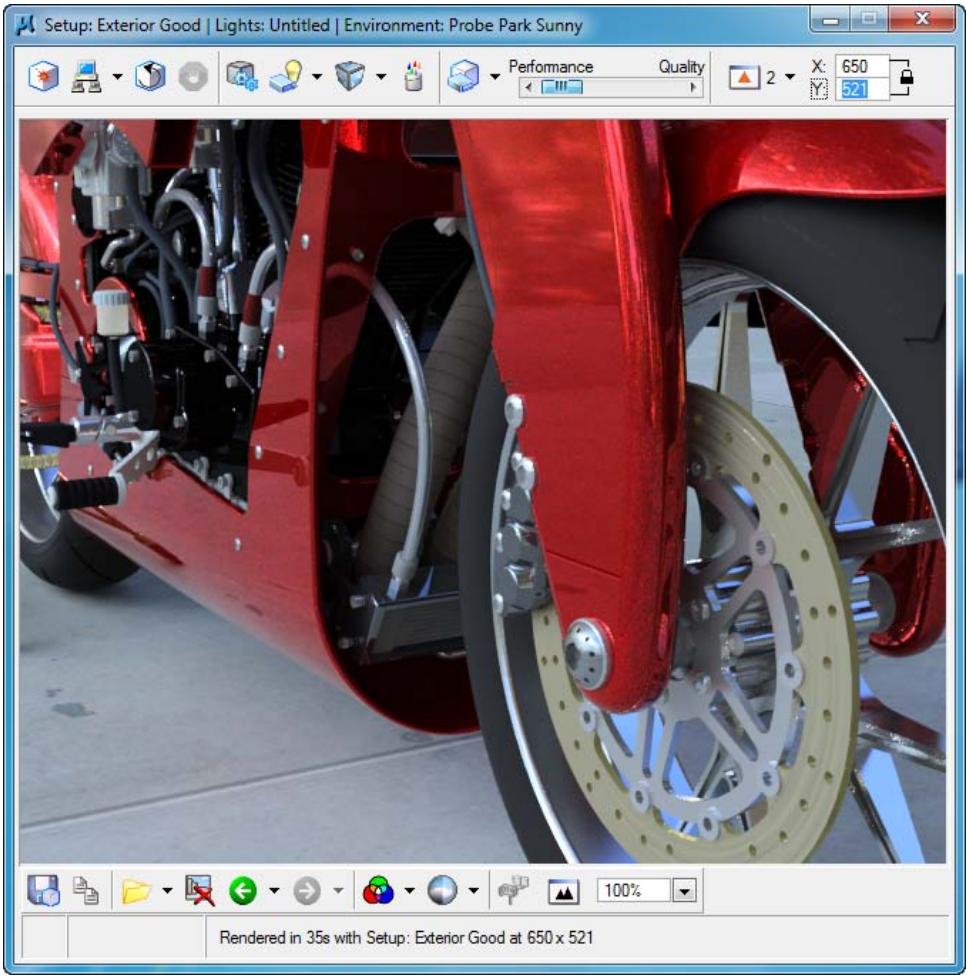
Apply displacement on visible items. If the beautiful wool rug you are using in the interior shot is being displaced, but only a small strip of it is visible, then slice the rug and only apply the displacement to that small strip. Luxology rendering will have to calculate the displacement off screen if there are any refractive or reflective materials that may catch the displacement. If there are not any refractive or reflective surfaces, Luxology is smart enough not to have to calculate the off screen displacement.

Adjust the displacement settings in the Render Settings dialog Advanced tab to suit the need of the rendered shot. The default Displacement Rate of 1.0 may be more than what's needed for the render. Try increasing this setting to 1.5 or 2 and do a preview or region test render.

Slice up displaced geometry to smaller physical segments. This utilizes memory management at render time and decreases render times. There is no need to overdo it as you will increase your render times if the polygon count goes too high. A little hit and miss experimentation in the scene will help you in the long run.

Luxology Render dialog

Used to add or modify Luxology rendering settings and to preview the rendering. Opens when you select *Utilities > Render > Luxology*.



Begin Luxology Render

Starts the Luxology rendering process to render a new solution. Use this tool the first time that you render a model, or whenever you make changes to geometry, lighting, or materials.

Once the *preprocessing* phase of the rendering is complete, the computation process continues independently. This lets you use other MicroStation tools in parallel with the rendering. During this phase, you can abort the rendering with the *Cancel Luxology Render* tool.

Re-display Current Solution

Where the only change to a rendered scene is the camera view, lets you re-use the current solution. This greatly speeds up the rendering time. Because the irradiance information is cached, where the new view contains areas seen in the previous render, the rendering time can be considerably less than the initial render.

Cancel Luxology Render

Aborts the current Luxology rendering. This option is enabled only when a rendering is in progress.

Luxology Render Preferences

Opens the *Luxology Render Preferences* dialog.

Light Setup

Clicking the icon opens the *Light Manager* dialog, which lets you:

Adjust the settings for both the global and source lighting in the model.

Save the current settings as a lighting setup for future use.

Set a previously saved light setup to be active.

Access the Light Manager dialog.

Clicking the down-arrow opens a drop-down menu from which you can select a previously saved lighting setup.

Define Materials

Opens the *Material Editor* dialog, which lets you define and apply materials.

Setup

Clicking the icon opens the *Render Settings* dialog, which lets you define settings for output and global illumination. Groups of settings can be stored as Render Setups for future use.

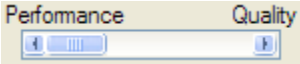
Clicking the down arrow opens a drop-down menu of predefined setups from which you can choose. These setups are delivered with MicroStation Luxology Technology Preview and are stored in the file *Luxology_render.dgnlib* in the *workspace\System\dgnlib* folder.

Examples of delivered render setups:

Ambient Occlusion – 256 Occlusion Rays, Occlusion Range 0, 1 Indirect Bounces, 8 Samples antialiasing.
Caustics – 97 Irradiance Rays, 1 Indirect Bounces, 8 Samples antialiasing.
Depth – 64 Irradiance Rays, 1 Indirect Bounces, 1 Sample antialiasing.
Depth of Field – 257 Indirect Rays, 2 Indirect Bounces, 256 Samples antialiasing.
Draft – 64 Irradiance Rays, 1 Indirect Bounces, 1 Sample anti-aliasing.
Exterior Best – 257 Irradiance Rays, 2 Indirect Bounces, 8 Samples antialiasing.
Exterior Better – 131 Irradiance Rays, 1 Bounces, 8 Samples antialiasing.
Exterior Good – 85 Irradiance Rays, 1 Indirect Bounces, 8 Samples antialiasing.
Interior Best - 512 Irradiance Rays, 5 Indirect Bounces, 8 Samples antialiasing.
Interior Better - 340 Irradiance Rays, 3 Indirect Bounces, 8 Samples antialiasing.
Interior Extreme – 512 Irradiance Rays, 10 Indirect Bounces, 16 Samples antialiasing.
Interior Good – 257 Irradiance Rays, 2 Indirect Bounces, 8 Samples antialiasing.
Material Preview – 32 Irradiance Rays, 1 Indirect Bounces, 1 Sample antialiasing.
Raytrace - Indirect Illumination disabled, 8 Samples antialiasing.

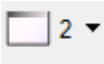
NOTE: Antialiasing samples set to 1 sample means no antialiasing will be used.

Quality slide control



Lets you quickly adjust keyed values inside the selected render setup and performs the same function as the *Quality slide control* in the *Render Settings* dialog. Both slide controls are synchronized if the same setup is selected in both dialogs.

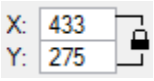
View



Opens a drop-down menu that lets you select the view you want to render with Luxology. Choices are the Active view or you can select a particular view by its number (from 1 to 8).


When Active View is selected the icon will be displayed with an orange triangle.

Image Size

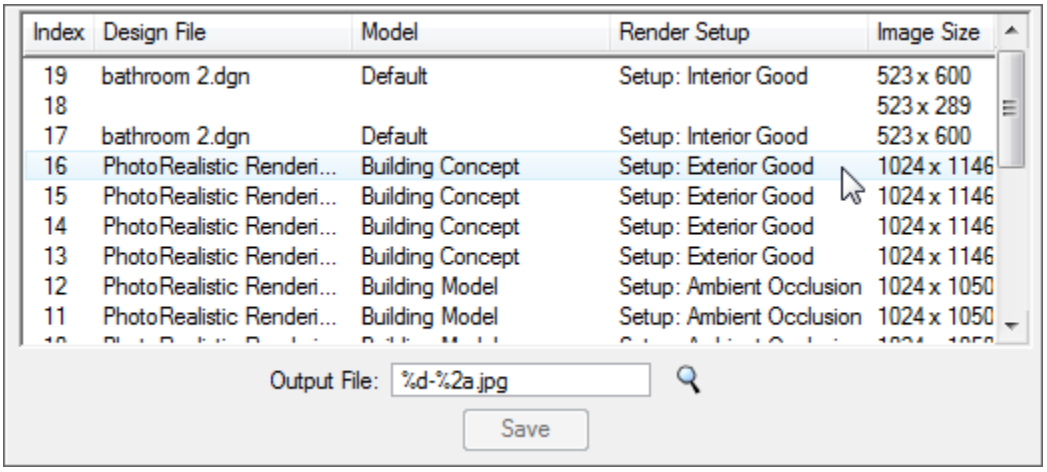


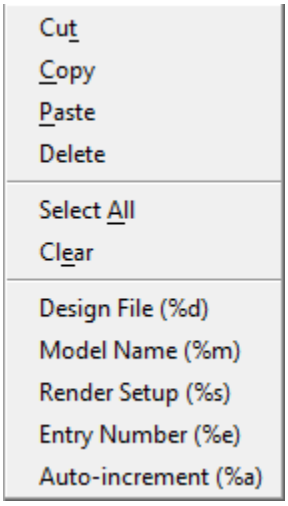
Controls the size of the rendering. The units can be changed in the *Luxology Render Preferences* dialog. If the lock icon is enabled (default) then the aspect ratio of the image will be locked to the aspect ratio of the view being rendered.

Save Luxology Render

Opens the *Create Luxology File* dialog, which lets you save the current Luxology rendering to an image file. The standard image formats are available as well as "Radiance High Dynamic Range" (HDR). The HDR format stores high definition imagery that you can post process in applications such as Photoshop.

By clicking the down arrow to the right of the Save Luxology Render icon you can select a file or multiple files to save to disk in the image format of your choice. The file that make up the list will depend on where you are in history for instance if you have 100 images in you history folder and you are currently on the 50th image then you will on see the first 50 images. To see all 100 images use the right arrow to move to last image, then click the save image down arrow to see the entire list.





By right clicking in the Output File field you will be presented with the following options:

Cut- Cuts the text from the Output File field.

Copy - Copies the text from the Output File field.

Paste - Paste text into the Output File field.

Clear - Clears the text in the Output File field.

Design File (%d) – Includes the Design File name as part of the file name.

Model name (%m) – Includes the Model name as part of the file name.

Render Setup (%s) – Includes the Render Setup name as part of the file name.

Entry Number (%e) – Includes the Entry Number (index) as part of the file name.

Auto – increment (%a) – Automatically increments appends numbers to the file name.

NOTE: **%e** or **%a** or both should be used when saving multiple history images to disk.

Copy Luxology Rendering to Clipboard

 Copies the current Luxology rendering to the clipboard.

Set Luxology Rendering History Folder

 Sets the folder in which to store the history Luxology renderings.

See also, the configuration variable MS_LUXOLOGY_HISTORY in Luxology Configuration Variables.

Delete Current Image

 Deletes the currently displayed image from history.

Previous Luxology Render

 (Enabled only when a previous rendered image is available) Clicking the icon lets you view the previously rendered image.

Clicking the down-arrow opens a drop-down menu from which you may select any previous history image to view.

You can set the number of history images stored in the *Luxology Render Preferences* dialog (default 100).

Next Luxology Render

 (Enabled only when a latter rendered image is available) Clicking the icon lets you view the next rendered image.

Clicking the down-arrow opens a drop-down menu from which you may select any latter history image to view.

You can set the number of history images stored in the *Luxology Render Preferences* dialog (default 100).

Background

If an environment is not used by the Luxology renderer, you can change the background. Using the drop-down dialog, you can use its option menu to change the background to be a Color, an Image, or None.

After selecting the required setting, the state of the Icon changes to reflect the current condition.

None – Background is black.

Color – Background Color is used.

Image – Background image is used.

When background is set to color or image, clicking the Background icon opens the Modify Color or Open Image dialog as appropriate. You can do this also by clicking the magnifying glass icon in the drop-down dialog.

Enabling the lock retains the same background setting for future rendering.

Updates the current environment setup's color or background image with the current background settings.

Adjust Image Settings

Clicking the icon opens the *Luxology Image Settings* dialog, which lets you adjust settings for the currently displayed rendering.

Clicking the down arrow opens the same settings in a drop-down menu.

Stereo Image Type

When a stereo image is displayed (stereo enabled in setup), you use this toggle to switch between displaying a side-by-side stereo pair or anaglyph display.

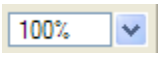
Side-by-Side (cross-eyed) stereo pair

Anaglyph

Fitted To Window

Displays the current rendered image, fitted to the dialog window.

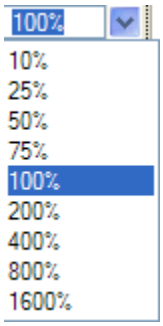
Zoom Factor



Sets the magnification of the image.

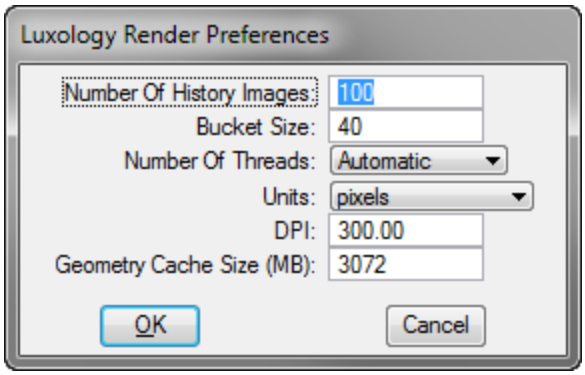
To set the zoom factor, you can:

- Key in a zoom factor.
- Select from commonly used preset values in the drop-down menu.
- Use the mouse wheel.



Luxology Render Preferences dialog

Used to set Luxology rendering preferences. Opens when you click the *Luxology Render Preferences* icon in the *Luxology Render* dialog.



Number of History Images

Sets the number of images retained in history (default is 100). Setting the number of history images to 0 disables the limit and allow you to have as many history images as you have room to store.

Bucket Size

Controls the size (in pixels) of the sub-image "buckets" that are produced during the rendering process.

Number of Threads

Option menu that lets you select the number of threads used by the Luxology rendering engine. This lets you optimize how much processing power is left over for tasks besides rendering. It is strongly recommended that you do not set this value higher than the number of cores available on the computer. For the best rendering performance, set this option to Automatic (the default).

Units

Sets the units for rendering and saving images. Options are pixels, in(ches), mm, or cm.

DPI

Set the dots per inch for display and printing.

Geometry Cache Size

Sets the cache size for geometry created by the Material Fur Settings in the Advanced Mode settings of the Material Editor dialog.

OK

Accepts the displayed settings and closes the dialog.

Cancel

Ignores any changes to the settings and closes the dialog.

Render Settings dialog

Used to create custom rendering setups for use with MicroStation's photorealistic rendering. Opens when you click the Setup icon in the *Luxology Render* dialog.

The *Render Settings* dialog title displays the current render setup settings being displayed. Double-clicking an entry in the tree view, makes the setup active for rendering. Three tabs give you access to Settings, Global Illumination, and Advanced settings.

Icons in the tree view indicate the state of the render setup as follows:

 - Local setup. If the name displays in:

Blue - it has yet to be saved locally.

Black - it has been saved locally.

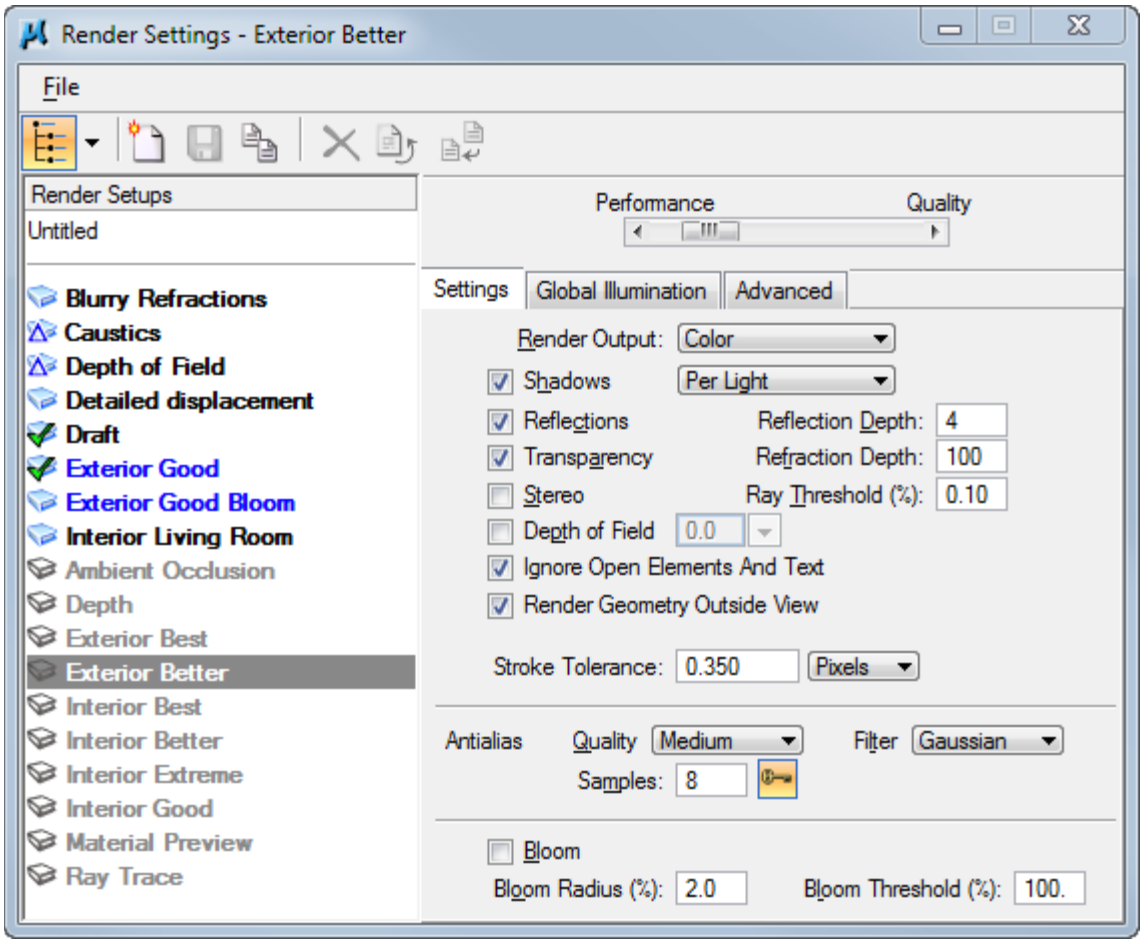
 - Library setup

 - The local copy matches one in the library.

 - The local copy differs from the one in the library. If the name displays in:

Blue - it has yet to be saved locally.

Black - it has been saved locally.



Show Setup List

Toggles tree view visibility on and off, for render setups.

When you select (single-click) a render setup from the list, its settings appear in the tabbed section of the dialog.

Double-clicking on an entry in the tree view makes it the active setup for rendering.

When not visible, you can click the down-arrow to open a drop-down menu of the available render setups from which you can select (equivalent to single-click selection in the tree view).

New Setup

Creates a new (local) rendering setup. By default, it is given the name Untitled-n, which you can edit to a name of your choice.

Save Setup

 When you change an existing setup, or create a new one, the Save Setup icon is enabled to indicate a save is possible. Names of setups that are yet to be saved appear in blue in the tree view.

Copy Setup

 Copies the selected setup, if the setup exists in the Luxology_render.dgnlib, a local copy is made.

Delete Setup

 Deletes the selected setup.

Only local setups, designated with a  symbol, can be deleted.

If you have copied a setup that exists in the library, and then deleted it, the library symbol changes to gray  when the local copy is deleted.

Setups that are local, and do not exist in an external DGN library, are permanently deleted.

Reset Setup

 (Enabled only when you have made a change to a setup) Returns the setup to its previously saved state.

Update from library

 Synchronizes the local setup to match the one in the DGN library.

Quality slide control

Lets you quickly adjust keyed values inside the selected render setup. The slide control is present also in the *Luxology Render* dialog. Both slide controls are synchronized if the same setup is selected in both dialogs.

Values in the Settings and Global Illumination tabs that may be adjusted with this control are indicated by a key icon.

Clicking the key icon enables/disables the setting for adjustment with the slider.

 Indicates keyed setting that is disabled for adjustment.

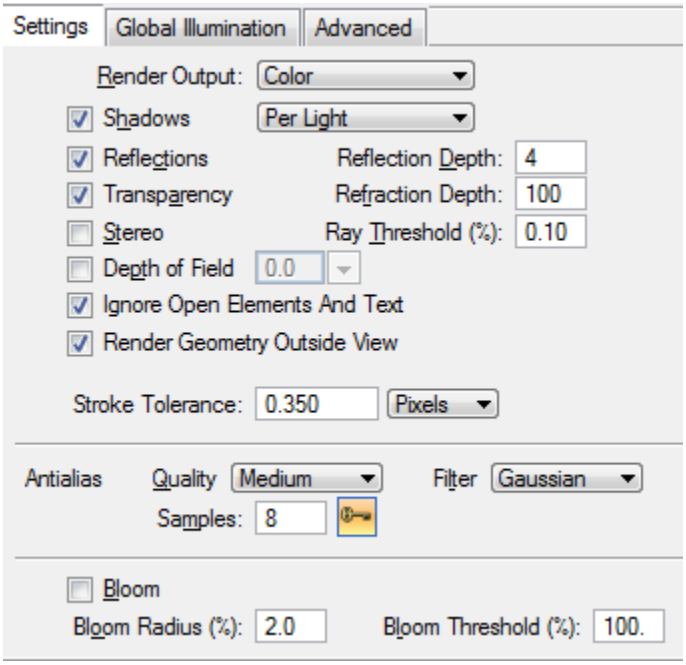
 Indicates keyed setting that is enabled for adjustment.

Render setups that are delivered with MicroStation have appropriate key values activated. For example, the Ambient Occlusion setup has Occlusion Rays keyed but Irradiance rays are not.

> ***Note:*** Where you use a custom setting that is outside the normal range, the slide control cannot be used to adjust them. For example, the Interior Extreme setup does not use a keyed value for *Indirect Bounces* because it is set to 10. This is far higher than what should be used for 99% of renderings and thus outside the range of the slider.

Settings tab

The Settings tab contains controls that affect the rendered output.



Render Output

Sets the type of output for the rendering.

Color – output is rendered with the defined colors and materials.

Ambient Occlusion – shades the model in such a way as to accentuate its nooks and crannies. Ambient Occlusion means that all pervasive and equal ambient lighting is occluded by objects within the scene to create shadowing. You can get ambient occlusion renders by simply choosing the Ambient Occlusion Setup and hitting the Render button.

Setting the Output to Ambient Occlusion is equivalent to using all white diffuse surfaces lit by a white environment. For example, if half the rays coming from the point being shaded hit geometry, then the point is half occluded and will be 50% grey. If all the rays hit geometry, then the point will be black. If no rays hit the geometry, then the point will be 100% white.

Ambient Occlusion uses Global Illumination to perform the rendering. The quality of the Ambient Occlusion pass is dependent on the number of Occlusion Rays used. The default value of 257 produces high quality results. You can improve performance (at the expense of quality) by decreasing the number of Occlusion Rays to 64 or less.

NOTE: Ambient Occlusion only works for exterior scenes, as most interiors would probably be completely in shadow.

Example of Ambient Occlusion

Depth – Produces grayscale images where the values are based on the distance from the back-clipping plane or, if one is not defined, the back of the geometry visible in the scene. Lighting has no effect when using Depth output. This option can be used, for example, to create a displacement map from existing geometry. Where required, you can use a selection set to include multiple elements in the displacement map.

The depth output image also can be used with third party image editors to quickly produce high quality Depth of Field effects by using lens blurring filters.

By default, a Top view is used for the image. Where an Auxiliary Coordinate System (ACS) is active and ACS Plane lock is on, the Top view for the ACS is used. If ACS Plane lock is off, then the standard Top view is used.

To create a displacement map from existing geometry

You can create a displacement map by following these steps or you can use the Material Editor (simpler method) to create displacement map from geometry.

a. Set up a Top view that encompasses just your geometry.

b. Re-size the view so that it is square.

c. Use the Set Display Depth tool to define the near and far clipping planes as the top and bottom of the geometry respectively.

d. Turn on Clip Back and Clip Front in the View Attributes.

e. Open the Render Settings dialog and set Render Output to Depth.

   Note: If the geometry has prominent curved surfaces, you should use a very fine Stroke Tolerance value.

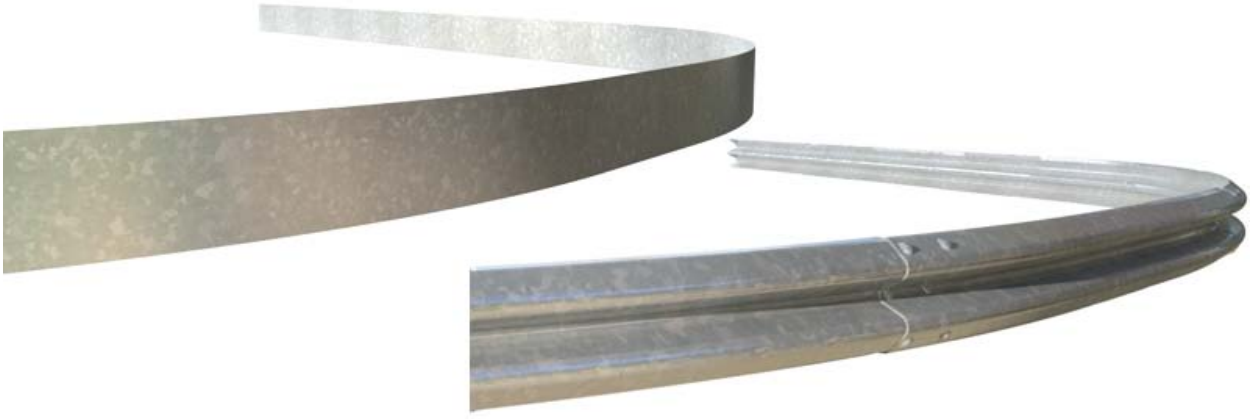
f. Start the Luxology rendering.

When the rendering is complete, you should save the image to a lossless format to avoid compression noise.

When you have created the displacement map, you can use it to create a new material. To do this, you should set the displacement value to the height of the geometry used to generate it. When this material is assigned to a flat plane, it should render almost identically to the original geometry.

It is much simpler to use the ***Create New Material From Geometry*** method. Select the geometry that you want to use. From the Material Editor dialog main menu, select *Material > New Material From Geometry.* Then enter a data point in the view you want to use to create the displacement material.

In the following image you can see the results of applying a displacement material to a simple surface created by extruding a line along a path. The image on the left is without displacements and the image on the right is with displacements. As you can see at render time the Luxology render engine using micro polygon displacement transforms the simple geometry into the perfect guardrail.



Shadows

If enabled, shadows are included in render. The sharpness of the shadows' edges can be set from the list box at the right. Where softer shadows are required, more samples are taken.

Per Light – shadow type is that as defined by each light.

Sharp – 1 sample

Soft – Coarse – 16 samples

Soft – Medium – 64 samples

Soft – Fine – 160 samples

Soft – Very Fine – 256 samples

Reflections

If enabled, reflections are rendered.

Reflection Depth

(Reflection enabled only) Sets the number of reflection bounces that are rendered (allowed values - 0 to 999).

Transparency

If enabled, transparency is rendered.

Refraction Depth

(Transparency enabled only) Sets the number of transparent surfaces a ray can travel before no longer being considered (allowed values - 0 to 999).

Stereo

When enabled, two images are rendered and displayed as side by side cross-eyed stereo pair. The cross-eyed stereo may be viewed by crossing your eyes until you see a stereo image appear between the two images. This method is referred to as free view because you do not need stereo glasses to see the stereo image.

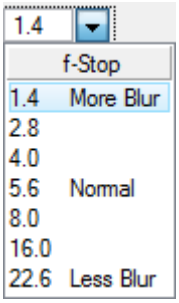
The Luxology Render dialog has a toggle to switch between display of stereo pair or anaglyph using (Red/Cyan) or (Amber/Blue) stereo glasses.

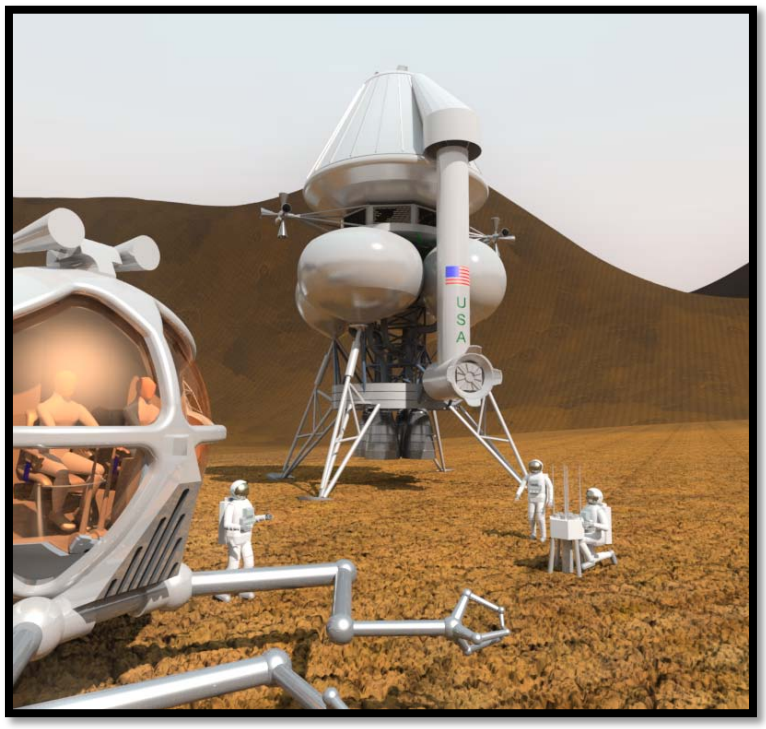
Ray Threshold (%)

Sets, as a percentage, the minimum contribution that a reflected or transmitted ray needs before that ray will be computed.

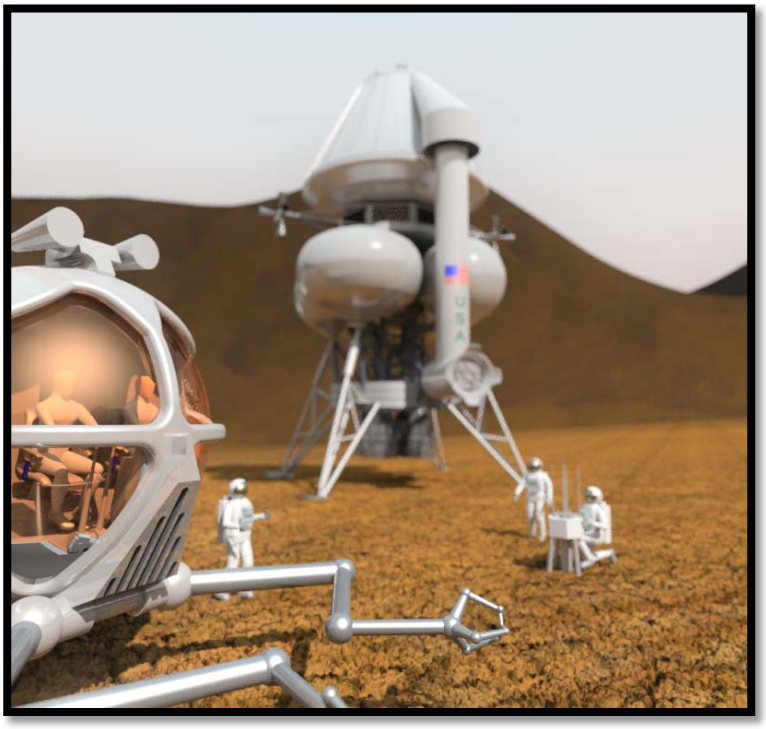
Depth of Field

(Antialiasing enabled, in a camera view, only) If enabled, Depth of Field effects are rendered. When Depth of Field is enabled, the f-Stop field also is enabled. In this field, you can type, or select from a drop-down menu, an f-Stop for the camera lens (lens aperture) to simulate the depth of field of a camera.





Without Depth of Field



With Depth of Field

You can see in the preceding image that when depth of field is used, the Mars rover appears in focus and the astronauts and the Mars lander are progressively out of focus (blurry).

Depth of field refers to the range of distances that an image is in focus for a given lens aperture. Objects beyond that range typically appear somewhat out of focus — the further outside the range, the more out of focus. When an image is rendered with Luxology and the Depth of Field toggle is on, changes in focus will be rendered.

Associated with this setting is the Focal Distance setting for the Camera Position settings in the **Define Camera** tool.

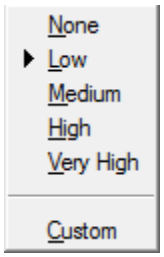
Note: For best results use a high antialias sampling rate (64 -256).

Antialias Quality

Controls the antialiasing quality by setting the number of samples that are taken during antialiasing.

You can select a predefined setting, or you can create a custom setting.

The predefined quality options are presented in a list box and they change the number of samples used by Luxology for antialiasing.



None - 1 sample

Low - 4 samples

Medium - 8 samples

High - 16 samples

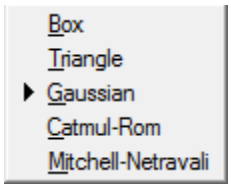
Very high - 64 samples

Custom - User defined (1-256 samples)

Note: For rendering Depth of Field effects, it is recommended that you use between 64 and 256 samples.

Antialias Filter

Sets the type of antialiasing filter to be used. The antialiasing filter determines the pattern to use when evaluating a pixel.



Box - Each pixel is affected only by the samples within its borders, and each sample is weighted equally. This is sharp but rather artificial.

For example, imagine two pixels side by side, and a sample very close to the border between them. That sample contributes 100% of its color to whichever pixel it lies in (even if it is only inside that pixel by a tiny margin) and 0% to the other pixel.

Triangle - Each pixel is affected by all the samples within it and also samples up to halfway across all the neighboring pixels.

Samples are weighted with a linear falloff based on their distances from the center of the pixel. Sometimes, this is called a Tent or Bartlett filter and is equivalent to the "enhanced antialiasing" added to LightWave in 1996 for use in Titanic. In this case, a sample in the middle of the border between two pixels would contribute roughly equally to both pixels.

Gaussian (the default) - Performs a more accurate sample. This generally yields the best results although it may be slightly slower than the Box or Triangle options. Each pixel is affected by samples that might be all the way across the neighboring pixels (any sample that is within a radius of 1.5 pixels of its center), and samples are weighted with a bell curve.

Artists use these filters for both the technical differences and the artistic outputs they provide. For instance, Arch-visual renders tend to look better when the *box* or *triangle* filters are selected. They look sharper and crisper than their Gaussian counterpart in areas where antialiasing is needed, at either geometric or material borders.

Catmull-Rom generally yields slightly sharper results than Gaussian.

Mitchell-Netravali offers good results when dealing with problematic moire created by fine texture patterns.

Occlusion Rays

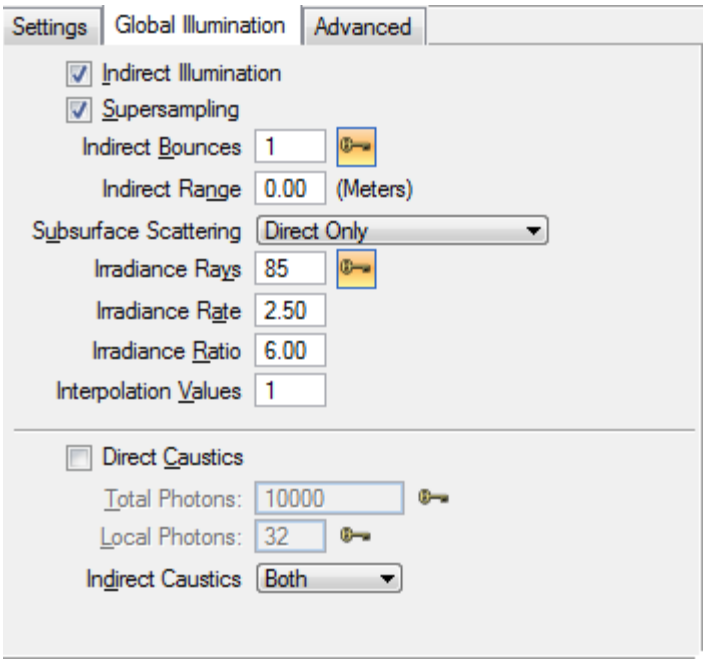
(Render Output set to Ambient Occlusion only) Sets the number of indirect rays used (default 64).

Occlusion Range

(Render Output set to Ambient Occlusion only) Sets the distance an indirect ray travels before being terminated. In the case of a ray being terminated due to the indirect range value, it is assumed that the ray would eventually hit the environment background. For more on this topic see **Indirect Range** in the Global Illumination section.

Global Illumination tab

The Global Illumination tab contains all the settings that control how indirect light is processed by the Luxology rendering engine.



Indirect Illumination

If enabled (default), indirect lighting is considered.

If disabled, the Luxology render results in a ray traced image.

By default, when Indirect Illumination is enabled, the Irradiance Caching method for radiosity also is enabled. This means that the **Indirect Rays** option is disabled in favor of the **Irradiance Rays** within the **Irradiance Caching** settings area.

Supersampling

If enabled, a boost is added to the irradiance ray count and these additional rays are fired at areas that differ greatly from their neighbors.

After all rays have been fired for a particular irradiance evaluation, Supersampling looks at the resulting ray color of each hemisphere cell. It then sends additional rays through those cells that differ a lot from their neighbors, getting a more detailed look at high contrast areas of the environment resulting in a more accurate estimate.

Currently about 25% more rays are fired, so for a setting of 100 rays you really get 125. The results, however, will be better than if you had just used a setting of 125 without Supersampling. This is because the rays for Supersampling will be going in the more important directions. It is recommended to leave this option on at all times. Generally, it improves your render quality with minimal performance impact.

Indirect Bounces

Sets the number of bounces an indirect ray takes before terminating. The default value of 1 means that a single bounce is used to calculate how a surface's environment affects it. This is less accurate than a multi-bounce solution since, in the real world, photons bounce all over to illuminate the environment.

The sacrifice in quality using fewer bounces, however, is rewarded by increased performance. By increasing the number of indirect bounces the Indirect Rays are fired from the initial surface and bounce off the first surface they hit then continue traveling and hitting surfaces until the maximum number of bounces is met.

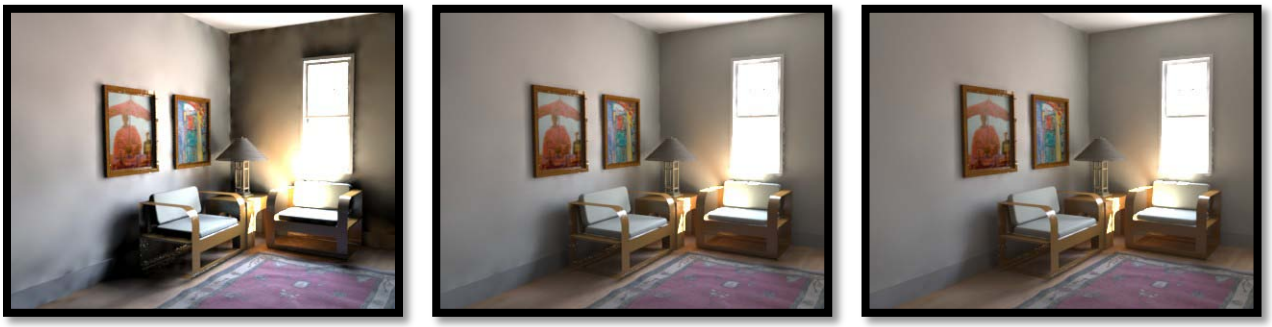
As you add bounces, the number of calculations increases, as does render times. While the result is more technically accurate, there are naturally occurring diminishing returns in each additional bounce. It is recommended that you adjust your scene with a single bounce and then add additional bounces to see how great an impact they have on the end result.

For most exterior scenes, a single bounce suffices. Interior scenes benefit from additional bounces, but you should rarely need more than 4 or 5.

If a scene is mostly illuminated by a single small area of light, adding bounces can dramatically improve the overall brightness and look of the rendered image.

Tip: To reduce the number of bounces required you can increase the Ambient Intensity in Light Manager.

Since the effect of multiple bounced illumination rays is to simply boost the overall lighting by some averaged color, you can reduce the number of bounces and set the Ambient Color and Intensity to mimic those final bounces. This saves time and yields realistic results.



From left one bounce, two bounce and five bounce

Indirect Range

Sets how far an indirect ray can travel before it is terminated. In the case of a ray being terminated due to the indirect range value it is assumed that the ray would eventually hit the environment background.

This is a very useful way to optimize render times. Generally, reducing the indirect range improves render speed. Setting this value too low, however, creates unnatural lighting effects. In these cases many rays that otherwise would have ultimately hit a geometric surface, resulting in a shadow, may get cut off early. They may illuminate the surface unrealistically, with the backdrop color, rather than shading it with the surrounding geometry. Leaving the value at 0 is similar to setting an infinite value. In other words, rays will not be terminated prior to striking the environment.

Another advantage in limiting the range of indirect rays is that, in large complex scenes, a limited Indirect Range can allow geometry segments that are off-screen, or in already completed buckets, to be flushed from memory more easily. This is because Indirect Rays may be stopped by the limited range before reaching the bounding boxes of those segments. Without being limited, such rays could cause all the polygons in those segments to be brought back into memory.

Subsurface Scattering

Subsurface scattering is the effect of light bouncing around inside a material and being "tinted" prior to exiting. This is most obvious in materials like marble, wax, or translucent liquids.

Example showing subsurface scattering of light as it penetrates a material

With Direct Only enabled, rendered images still can contain effects from both indirect illumination as well as Subsurface Scattering, but the two will not affect each other. This is the default behavior for speed reasons.

When either or both of the indirect illumination settings are enabled, indirect illumination rays will be considered when evaluating Subsurface Scattering effects, with a resulting increase in the rendering time.

Direct Only – direct lighting only is considered.

Indirect Affects Scattering – indirect lighting is considered when calculating subsurface scattering.

Scattering Affects Indirect – subsurface scattering is considered when calculating indirect lighting.

Both – both the indirect lighting, and the effect of subsurface scattering on indirect lighting, are considered in the rendering.

Irradiance Rays

Sets the number of Irradiance Rays that are fired out from the surface in order to sample indirect illumination.

Technically, Irradiance Rays are the same as Indirect Rays. As a matter of convenience, Luxology has settings for both Irradiance Rays and Indirect Rays, since the two forms of indirect illumination require vastly different numbers of samples.

Irradiance Caching relies on much higher quality samples distributed sparsely across the project whereas Indirect Illumination without Irradiance Caching uses lower quality samples at every pixel. Having two values allows you to easily switch between Irradiance Caching and traditional Indirect Illumination without constantly adjusting the number of Rays for each sample.

Irradiance Rate

Sets the minimum distance in pixels between irradiance values. That is, the distance between the points on a surface where irradiance is computed and stored in the cache.

Irradiance Ratio

Sets the ratio between the minimum spacing (the Irradiance Rate) and the maximum spacing. For most cases the default of 6.0 is appropriate. For example, you might want minimum spacing of only half a pixel, but still keep a maximum spacing of 15 pixels, so the Irradiance Rate and Irradiance Ratio settings would be 0.5 and 30.0 respectively.

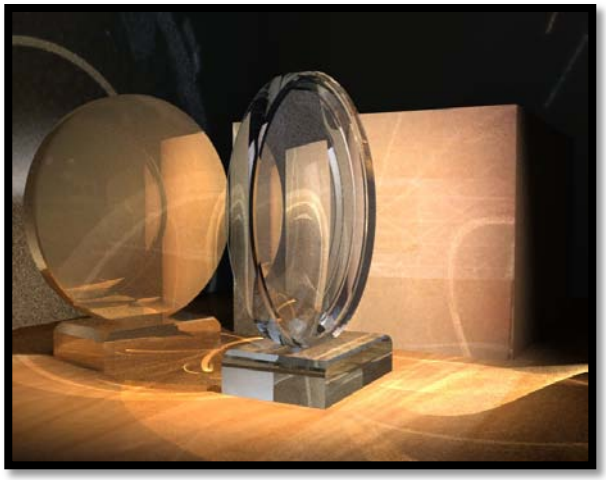
Interpolation Values

Sets the minimum for the number of nearby values to interpolate.

For example, we will look at a case where this value is set to three. If the point being shaded can find only two nearby previously computed values in the cache, then it forces the computation of a new value at the current point. The final irradiance at that point will be a blend of all three values. In this way it tends to smooth out the shading. Increasing this value improves render quality at the expense of render time.

Direct Caustics

If enabled, Photon Mapping is used to calculate direct caustics in the rendering.



Left: image with no direct caustics *Right: same model with Direct Caustics enabled*

The photon count is divided among all active 3D lights with a bias based on the power of the light, meaning that the brighter lights get a larger share of the shot photons.

Total Photons

Sets the total number of photons shot into the scene.

Local Photons

Sets the number of local Photons used and indicates the number of photons required for each pixel sampled. When the pixel is rendered, a search along the surface locates the nearest photons up to the local photon count. The default setting of 32 indicates that 32 photons will be used for each pixel rendered, lower values will produce sharper caustics.

Local photons set to 5 (left), and 32 (right)

Indirect Caustics

If enabled, caustic effects from indirect lighting are calculated. Indirect caustic effects are those of light accumulation on a surface after reflecting or refracting from another surface. The classic example is the light pattern on a table as it is cast through a wine glass. For caustic effects, from indirect illumination, there are four options:

None – No indirect caustics are rendered.

Reflection – Only reflected indirect caustics are rendered.

Refraction – Only refracted indirect caustics are rendered.

Both – Both reflected and refracted indirect caustics are rendered.

Advanced tab

The Advanced Tab provides a tree view containing all settings from the Settings and Global Illumination tabs. In addition, there are some important settings that are only revealed on this tab, in the General Settings tree.

Refinement Threshold

Sets the contrast tolerance, which dictates how much contrast between samples is acceptable.

Set to 100%, the Refinement Threshold would do nothing at all as it would accept brightness steps as high as 255 (the upper bound of 24 bit images).

Set to 0%, no pixels would be inside the threshold. The range of control spans the 0 to 255 brightness steps so that a threshold of 50% will accept pixel contrasts of 128 steps; whereas a setting of .1 will only tolerate 25 brightness steps between samples. Again we see that Rates increase quality and computation when set to lower values. Once the pixel has been evaluated, if it is determined that the brightness contrast of samples exceeds threshold, that pixel is re-evaluated using the **Refinement Shading Rate**.

Refinement Shading Rate

The Refinement Shading Rate lets you set a higher quality evaluation that is only computed on pixels that are identified by the **Refinement Threshold** as “problem areas.”

Micropoly Displacement

(Applies to textures containing displacement maps only) If enabled, textures containing displacement maps are tessellated.

Displacement Rate (pixels)

Controls the number of polygons created during Micropoly Displacement rendering of displacement maps. Increasing this setting decreases the number of polygons. Even small changes to this value will have a large impact on the overall polygon count. The default value of 1 means that any micro-polygon that has an edge longer than 1 pixel will be further tessellated.

Displacement Ratio

Controls the amount of subdivision in areas of the scene that are not visible to the camera. Low values will create more polygons and high values less.

This setting works in tandem with the Displacement Rate setting, letting you balance the amount of micropoly displacement in a scene so that memory usage can be kept to a minimum.

Minimum Edge Length (mm)

Sets the distance below which an edge of a polygon is not split.

Smooth Positions

If enabled (default), when a surface is diced into micro-polygons, the initial positions of the micro-polygon vertices lie on a curved surface based on the original smooth vertex normals.

If disabled, all the initial positions of the micro-polygon vertices will lie exactly on the flat planes of the original polygons.

Lens Distortion

Adds a distortion factor to the rendered image, where:

A positive value produces a “barrel” effect.

A negative value produces “pin cushioning.”

Barrel effect – Positive Lens Distortion

Pin-cushion effect – Negative Lens Distortion

Ignore Open Elements and Text

If enabled, open elements and text are not rendered.

Render Geometry Outside View

If enabled the complete scene is used to compute the rendering solution, including geometry behind the camera. This is similar to the MicroStation setting “Render all Objects.”

Luxology Environments

An environment is simply your surroundings; look around the space where you are sitting everything that you see is your current environment. If you get up and move to a different position your environment changes. When you render in MicroStation, you can specify an environment to use which can provide indirect light, and contribute reflections and refractions to your scene.

When rendering an interior scene, you should not use an environment unless you have an opening for light to penetrate the interior space from the outside. The environment can provide additional light through a window or other openings and could be made visible to the camera as an option. It is not recommended to use the environment in cases where there are no openings to the outside, because the illumination provided would not be seen and would require additional needless work be done by the CPU, adding to render times. In an interior scene, the scene itself becomes your environment, therefore the more objects you have, such as furniture, paintings, and other clutter the more interesting and realistic the reflections will be in any reflective or refractive materials.

Environment Types Overview

MicroStation now supports five different environment types; these are Sky, Light Probe, Image, Image Cube and Gradient. When you open a design file in MicroStation, we provide you with a few named environment setups; these are Alley, Fog, Gradient Sky Blue, Material Preview, Physical Sky and Probe Park Sunny. These environments can be customized and you can create any number of environments for use with your particular scene.

It is important to note that all environment types can produce indirect light onto the scene and the amount of light produced can be adjusted by moving the brightness slider in the Environment Setup dialog. As an option, you can choose Override Existing Lights. When this option is selected the scene will be entirely illuminated by the indirect light from the selected environment.

When you enable an environment, you can set the Visibility options to suit the scene. The visibility options are Camera (you will see the environment where you would see sky in the render), Indirect (the environment will produce indirect light, Reflection (the environment will be reflected in objects that have reflective materials) and Refraction (the environment will be visible through transparent materials).

If you want to create your own environments in addition to the ones we provide and make these available in any design, you need to create a DGN Library file (which is just a DGN with the file extension changed to dgnlib). You can create your own custom render setups, and environment setups in the DGNLib. This file needs to be located in a folder where MicroStation looks for DGN Libraries.

Sky - When you choose Sky as your environment, the scene will be illuminated by the physical sky color which is determined by the time of day and the Light Setup being used. For Physical Sky to work, you need to enable solar lighting and set the time of day so that the sun is above the horizon. If the sun is below the horizon and Sky is enabled, the color will be black (as it should be).

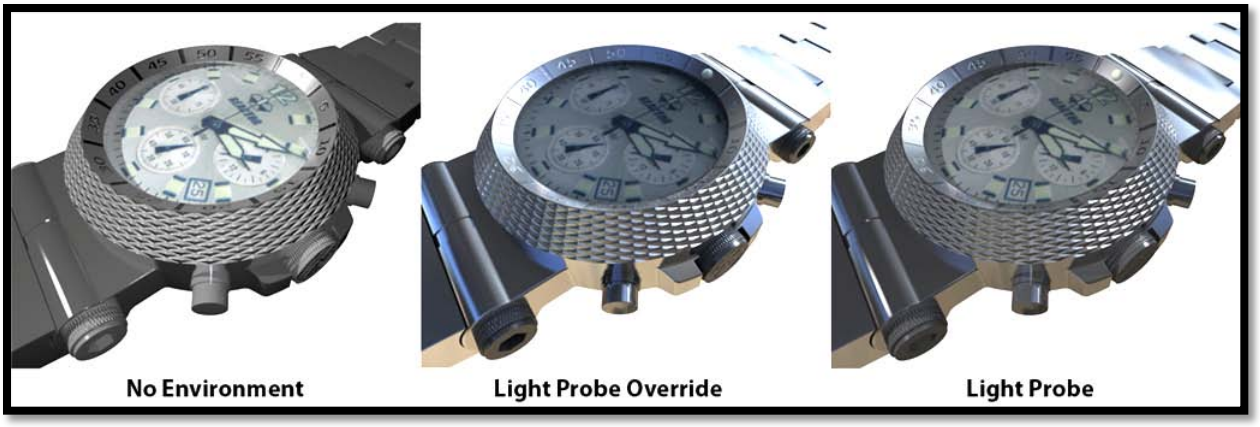
When Sky is enabled, you can also provide a size for the Solar Disk which can be seen in the rendered sky. Using larger values increases the solar disk size and can provide dramatic telephoto lens effects.

Image rendered using Physical Sky with Bloom

Light Probe – When you choose Light Probe, you can choose any supported image format, however the most common type is the High Dynamic Range format (.HDR). You can find plenty of light probes online, and we recommend Unparent Light Probes.

http://www.unparent.com/photos_probes.html

Light Probes are made using mirror balls and are photographed using multiple bracketed exposures to produce an image with high dynamic range. MicroStation's Light Probes do not produce direct light. Although the Luxology engine supports this feature, Luxology does not recommend it. In fact, they strongly discourage using the environment as a direct light source. Render times can be much higher with no visible gain in quality. For this reason we currently do not allow the environment to be used as direct light.



The preceding images are example of how important an environment can be in producing realistic renderings from real world models. In the left most image, no environment is used and there is nothing to reflect but the background color. This produces an almost monochromatic image and the stainless steel material looks nothing at all like stainless steel. In the center image, a light probe is used with override enabled, and now the stainless steel has an environment to reflect and it looks like stainless steel. In the right most image, the light probe is used but without override. The watch model is illuminated by a combination of solar light, ambient and the light probe. As you can see, this still looks much better than the first image where no environment is used.

Same scene being lit by different High Dynamic Range (HDR) Light probes

Image – When you choose Image for your environment, you can choose from several different Projection types. These are Planar, Cylindrical, Spherical, Cubic and Front.

Planar — lets you choose the plane in which the image is located. The ability to manipulate the scale and rotation dynamically in a future update makes this mode more useful but, at the moment, what you see is what you get.

Cylindrical — the image is projected as a cylinder around the scene. We will be adding more manipulation capabilities to the projection in a future update, such as mirror edge, repeat and scale.

Spherical — the image is projected as a sphere encompassing the scene.

Cubic — the image is applied to the six faces of a cube encompassing the scene. This method works similar to the way environments were applied in previous versions of MicroStation, often referred to as a Sky Box. However, you can't specify a different image for each face; for this you should use **Image Cube**.

Front — the image is applied to the front plane of the scene. In this projection mode, if the image is visible, it would appear the same as if a background image were used. Not much to gain using this mode because enabling it to be visible to the camera negates being able to change the image after the render completes. Also, the visible reflections do not look as convincing as cylindrical or spherical mapping.

Image rendered with cylindrical image visible to all but camera, background image used for visible background

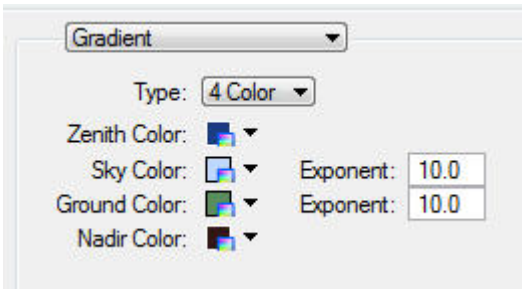
Image Cube – When you choose Image Cube, you can define the six sides of a box that surrounds your scene. This method is identical to the method MicroStation used for legacy render modes, ray trace, particle trace and radiosity. When using an Image Cube you can rotate the environment about the global Z-Axis.

If the environment is made visible to the camera, you should use specialized images that are intended to be used for a sky box. These images are warped to appear correct when seen from inside of the box without visible corners or seams. Proper Image cube imagery can be time consuming to create. Start by first creating a seamless 360 panorama image. This image is then mapped to a cylinder using MicroStation, where you render the Front, Right, Left and back images by rotating a 90 degree camera located in the center of the cylinder. In the final render, the camera looks straight up capturing a portion of the sides to form the Top image. The Top image is then edited in an image editor where one must artistically fill or paint in a large black hole with a convincing sky.

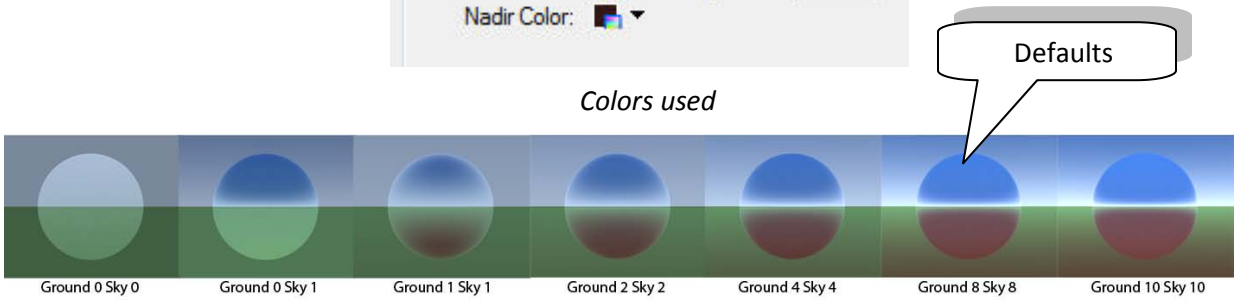
Image rendered using Image Cube visible to Camera, Reflections, Refractions and Indirect Light

Gradient – When you choose Gradient you can choose between either 4 Color or 2 Color. The options are Zenith Color (looking straight up), Sky Color, Ground Color and Nadir Color (looking straight down). When using a four color gradient you can set the Exponent value, which controls the percentage of sky or ground color used in the gradient. Using a low value, such as zero for both, results in only ground color and sky color being used in the gradient with no mixing of zenith and nadir colors. If you, for example, use an exponent for sky color of 4 and zero for ground color, there is some mixing of zenith color with sky color but no mixing of ground color with nadir color.

To give you a better idea of how this works, in the graphic below, see the rendering of a reflective sphere with the environment visible to the camera. Note that the camera used is a Front View with some perspective added.



Colors used



You can see that as the exponent values are increased, more of the Zenith and Nadir colors appear in both the reflections and the visible sky. The default Exponents for Sky and Ground are 8.0, which provides an even distribution of the gradients in the visible sky.

Background - In order to have a Save Multiple script or an animation script call up and use a background image or use a particular color, this information can be set and stored with your Environment Setup. If the Background in enabled, the camera visibility switch will be disabled (you cannot have a background visible if you are rendering one using an environment). The background can be an image or a custom color.

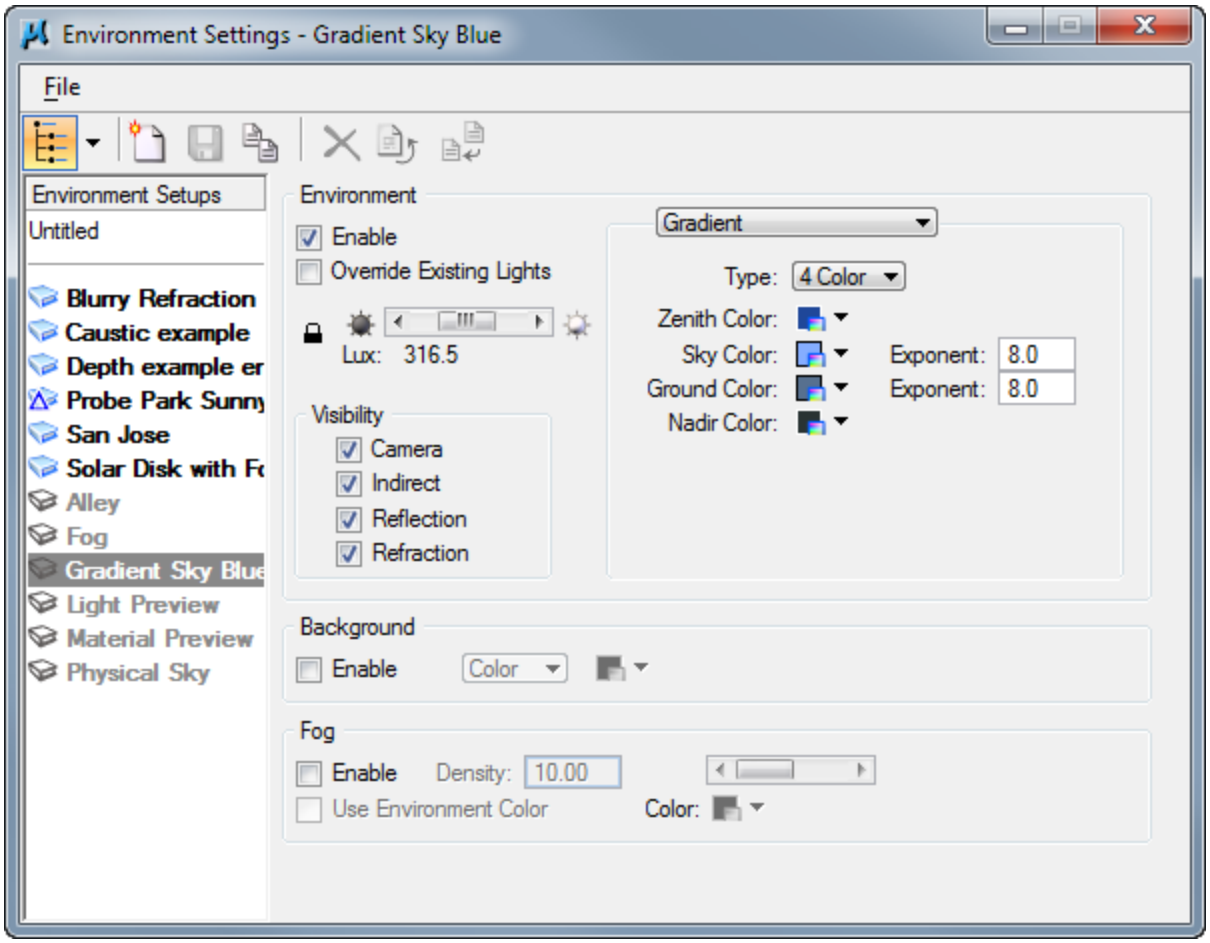
Fog – In addition to being able to define the type of environment used, you also can set values for fog effects. If enabled, the Fog produces an exponential fog effect rather than a linear one as in legacy render modes. You can set the density, and you can use either a color or have the fog use the environment color (the latter produces really cool results).

4 Color Gradient Sky with Fog Density of 0.25 and Environment Color used for fog color

Environment Settings Dialog

Contains controls for environmental settings for Luxology rendering, as well as controls the visibility of these environment settings.

 Clicking the Luxology Environment Settings icon on the Luxology Render dialog opens the Environment Settings dialog.



Environments can be saved and recalled at render time. The environments are similar to render settings in that they can be stored in a DGN library file (DGNLib). If you want to have environment setups that can be used by any instance of MicroStation, edit the Luxology_render.dgnlib or create a new library file and place it in a DGNLib search path with your custom environments.

Show Setup List

Toggles tree view visibility, for environment setups. When you select (single-click) an environment setup from the list, its settings appear in the tabbed section of the dialog. Double-clicking on an entry in the tree view makes it the active environment setup. When not visible, you can click the down-arrow to open a drop-down menu of the available environment setups.

New Setup


Creates a new environment setup file.

Save Setup


When you change an existing setup, or create a new one, the Save Setup icon is enabled to indicate a save is possible. Names of setups that are yet to be saved appear in blue in the tree view.

Copy Setup

 Copies the selected setup. If the setup exists in the Luxology_render.dgnlib, a local copy is made.

Delete Setup

 Deletes the selected setup. Only local setups can be deleted.

If you have copied a setup that exists in the library, and then deleted it, the library symbol changes to gray when the local copy is deleted. Setups that are local, and do not exist in an external DGN library, are permanently deleted.

Reset Setup

 (Enabled only when you have made a change to a setup) Returns the setup to its previously saved state.

Update From Library

 Synchronizes the local setup to match the one in the DGN library.

Enable

If on, the Environment is used during rendering operation.

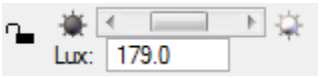
Override Existing Lights

(Environment Enabled only) Existing light sources in the model are ignored and the environment (only) is used to illuminate the scene.

Intensity Slider

(Environment Enabled only) Luxology uses the environment as an indirect light source. The intensity slider controls how bright (how much light) is produced by the environment at render time.

You can now unlock the intensity slider and type Lux values; when the intensity slider is locked, it behaves strictly as a multiplier.



Camera

Environment is visible where the background color of the view normally would be visible.

Indirect

Controls whether or not the environment is used as an indirect light source. If you choose the Override Existing Lights option, then you should leave Indirect enabled; otherwise you will not have any lights.

Reflection

Environment is visible in reflections where the background color of the view normally would be visible.

Refraction

Environment is visible through transparent elements where the background color of the view normally would be visible.

Environment Type

Select an environment type:

Sky — A physical sky is used.

Light Probe — A HDRI image is used.

Image — A standard image is used.

Image Cube — Six images are used, one for each face of the environment cube surrounding the scene.

Gradient — Lets you choose a two or four color gradient, and define the colors, to simulate the environment.

Sun Size

(Environment Type set to Sky only) Lets you specify a size for the solar disk between 0 and 10 (default 1). You can key in values, or use the slide control. In scenes where you are using telephoto lens, and especially sunset or sunrise scenes, you may want to increase this to 4 or 5 for more dramatic effect.

Sun Size set to 5 (left) and 10 (right)

File

(Environment Type set to Light Probe or Image only) Lets you select an image for the environment.

Rotation

(Environment Type set to Light Probe, Image, or Image Cube only) Lets you apply a rotation factor to the environment images. Rotation is about the vertical axis (the Z axis).

Projection

(Environment Type set to Image only) Option menu lets you set the way that the image file is projected for the rendering.

Planar — A 'Planar' projection is similar in concept to a movie projector, but the associated image is projected onto the surface orthographically, meaning the projection rays travel perpendicular from the virtual projection plane onto the surface.

Cylindrical — The image is projected as a cylinder around the scene.

Spherical — The image is projected as a sphere encompassing the scene.

Cubic — The image is applied to the six faces of a cube encompassing the scene.

Front — The image is applied to the front plane of the scene.

Front|Back|Left|Right|Top|Bottom

(Environment Type set to Image Cube only) Lets you select images for the six faces of the environment cube.

Clear All

(Environment Type set to Image Cube only) Clears image files from all faces of the environment cube.

Type

(Environment Type set to Gradient only) Lets you set the type of gradient to be used for the environment.

4 Color — Lets you select four colors (Zenith, Sky, Ground, and Nadir) to simulate the sky and ground. There is a soft blend between the Zenith and Sky colors and also between the Ground and Nadir colors. The boundary between Ground and Sky is hard edged to give the illusion of an horizon.

2 Color — Lets you select colors for Zenith and Nadir.

Zenith Color

Sets the color that is directly overhead and this ramps into the Sky color. Click the color swatch to open the color selector dialog.

Sky Color

Sets the color that starts at the horizon and ramps upward.

Ground Color

Sets the color for simulating the ground.

Nadir Color

Sets the color directly below the camera and ramps upwards into the Ground color, which terminates at the horizon when it meets the Sky color.

Exponent Settings

(Type set to 4 Color only) Lets you control the blending of the Zenith/Sky and Ground/Nadir colors. Higher values push the gradient transition closer to the horizon, while lower values spread the gradient further across the available spectrum.

Rotation

(Environment set to Light Probe, Image, or Image Cube only) Lets you apply a rotation factor to the environment images. Rotation is about the vertical axis (the Z axis).

Typically, this can be used to correctly position the Sun in an environment image.

Background

If Enable is on, you can set and store the color or image used as background with a named environment setup that be recalled at render time. Background can be Color, Image or None.

Fog

It Enable is on, fog effects are rendered.

Density

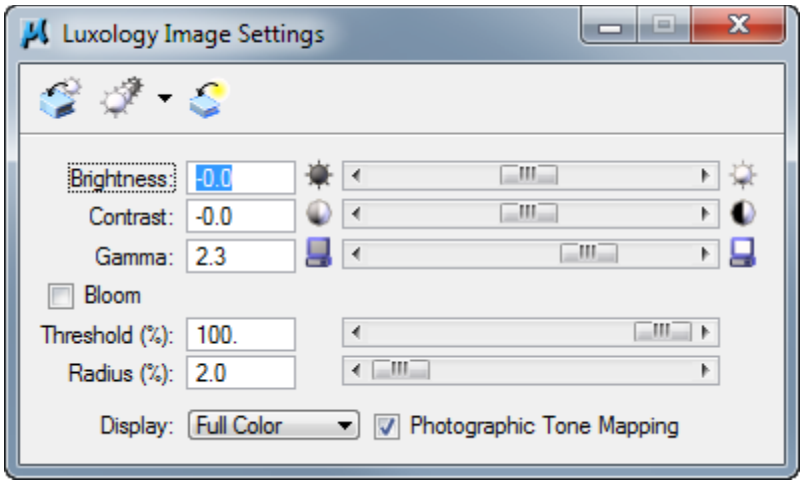
Controls how much fog effect is used. Fog gains intensity exponentially as items become father from the camera.

Use Environment Color

If on, the fog color matches the current environment.

Luxology Image Settings dialog

Used to adjust the currently displayed Luxology rendered image. Opens when you click the Adjust Image Settings icon in the *Luxology Render* dialog.



Update Active Light Setup

 Pushes the current Brightness and Contrast settings to the active light setup.

Brightness and Contrast defaults used when beginning a new rendering are always taken (pulled) from the active light setup. This means that each image has a predictable starting point and Luxology images created from other dialogs (such as Save Multiple) will have the same appearance.

In a typical workflow, you can render an image in the Luxology render dialog, tweak your image settings with visual feedback, then push the settings back to the active light setup. You then can save the modified setup for later use in either the Luxology render dialog or other rendering dialogs.

Adapt to Brightness/Brightness Multiplier toggle

Lets you toggle between Adapt to Brightness and Brightess Multiplier mode, which applies to the Brightness setting. Clicking the icon toggles between the two modes. Alternatively, you can select the mode from the drop-down menu.

The icon updates with the current mode:

 Indicates Adapt to Brightness mode, which is an approximation of the way the eye works. When we focus on a certain part of a scene, our eyes 'adapt' to the brightness that we are focusing on. Brighter areas appear washed out, and darker areas lose detail.

Imagine sitting in a dark room looking out the window towards a bright field. When you focus on the bright outdoors, everything in the room will appear quite dark. If, instead, you focus on something in the room, (after a few seconds) you will see that clearly, but the outside scene will look washed out.

The key to using Adapt to Brightness is that you are picking the actual brightness level (in lux) to which you want the eye to adapt.

NOTE*:* Here, higher numbers mean "adapt to brighter points", so the overall image will appear darker.

 Indicates Brightness Multiplier mode, an automatic adjustment where 1.0 means we should use the automatic adjustment based on the brightness of the view, and higher numbers mean make the image brighter by that amount.

Brightness Multiplier scales all pixels by a specified factor in the next rendering.

As long as an image is displayed in the Luxology Render dialog, the Adapt to Brightness and Brightness Multiplier levels will synchronize with each other.

Brightness

Controls the brightness for the rendering, in combination with the Adapt to Brightness/Brightness Multiplier toggle. You can key in values directly, or use the slider. The allowable range depends on the selected mode:

Adapt to Brightness – allowable range is 0.001 to 501188.0

Brightness Multiplier – allowable range is -4 to 4.

Contrast

Controls the contrast for the rendering.

You can key in values directly, or use the slider. Allowable range: -2 to 2.

Gamma

Used to adjust for differences in display hardware. Typically, a view gamma of 1.7 works well for most LCD displays. Printers often require a higher gamma value, usually between 2.0 and 3.0. Once you have set the best gamma value, for your device, you should not have to change it again until your hardware changes.

You may find that a Gamma of 2 to 2.3 works well for most interior renderings and that you can use lower Gamma values for exterior scenes.

The default setting for Gamma is controlled in the *Luxology Render Preferences* dialog.

Bloom

When enabled you may make adjustments to Bloom Effects.

 Updates the active Render Setup with the current Bloom settings.

Bloom (sometimes referred to as light bloom or glow) is a computer graphics effect used to reproduce an imaging artifact of real-world cameras. The effect produces fringes (or feathers) of light around very bright objects in an image. This effect can be especially useful when creating realistic physical sky images where the solar disk is visible in the view.

Without Bloom Effect

With Bloom Effect

Threshold

Used to adjust the amount of Bloom effect, lower values produce stronger effects, and higher values less effect, for instance a setting of 100 will produce no bloom.

Radius

Radius is used to adjust the size of the feathering around areas receiving the bloom. Low values produce tighter bloom effect, whereas larger values will tend to spread the light further and softens the effect.

Display

Adjusts the output color mode for the displayed image.

- Full Color – image displays in full color.

- Monochrome – image displays in gray-scale
- Analytic – image displays in a false-color display of the light (excluding ambient) reaching surfaces. Red represents the most through to Blue, which represents the least.
  Colors range from: Red > Orange > Yellow > Green > Blue.

Photographic Tone Mapping

If enabled, photographic tone mapping is applied to the image. This setting can produce an image that is more like that which your eyes would see. This applies particularly to images with a small dynamic range (where the lightest pixel is only about 100 times brighter than the darkest). Where the image has a high dynamic range, the normal image may be better.

Essentially, tone mapping is mapping the values of the pixels from lux (lumens per square meter) into the 0-255 range for graphics displays. No matter what, some tone mapping operator is always required.
Comparing the two methods:

Photographic Tone Mapping tries to approximate the human visual system.

Non-Photographic Tone Mapping tries to spread the brightness across the range of the display.

As a general rule, Non-Photographic Tone Mapping will always give you a reasonable image, but Photographic Tone Mapping should give you a more realistic image.

Luxology Configuration Variables

Several configuration variables are used by Luxology rendering.

MS_LUXOLOGY_HISTORY - If set to a valid directory, your Luxology history images will be written to and read from the location specified by this variable.
If this configuration variable is set, it will override the history directory that you define in the Luxology dialog. That is, when you open MicroStation, the history directory is set by this variable. During a design session, you can change the history directory, but it will apply only for that session.

MS_LUXOLOGY_TMP - If set to a valid directory, all temporary files needed for the rendering and storage of Luxology images will be placed in the location specified by this variable.
Potentially, this is a large amount of data, so it is best to use a local drive for optimum performance.

MS_IMAGEOUT - If set to a valid directory, this will be the default location that appears in both the *Utilities->Image->Save* and the *Luxology Save Image* dialogs.

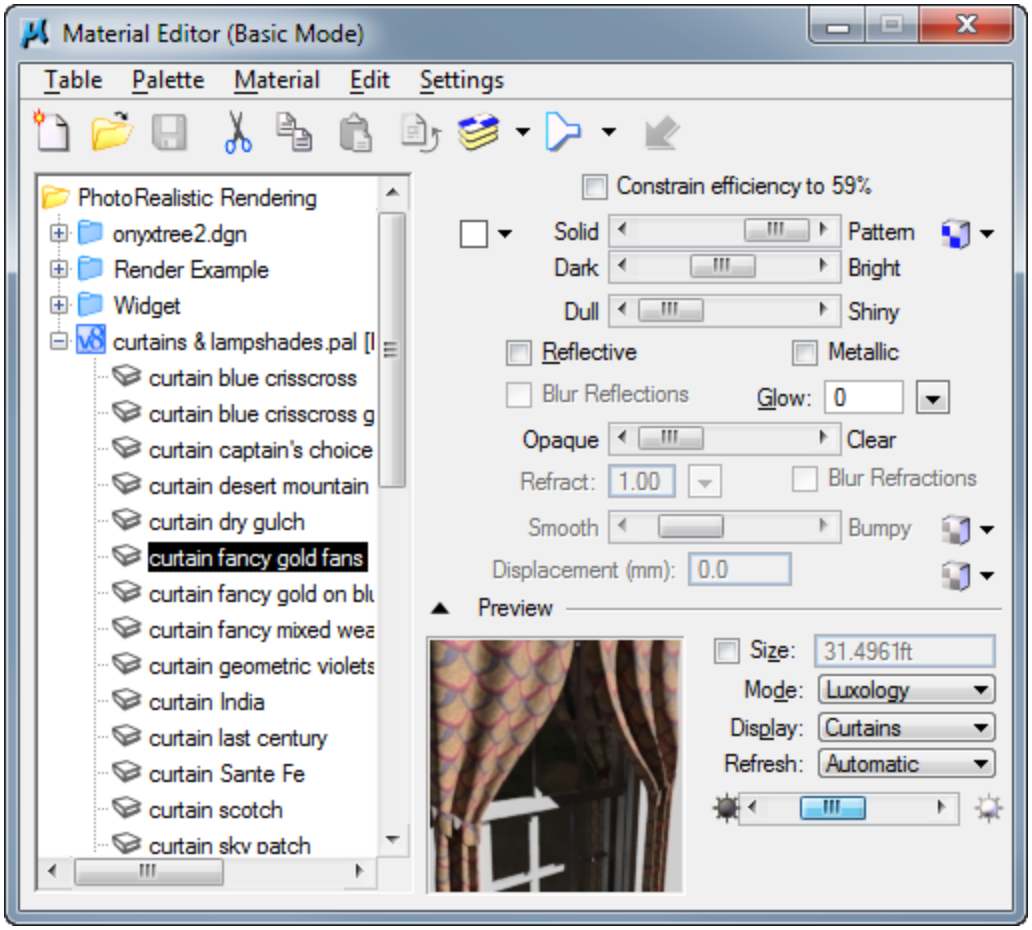
Material Editor Dialog

 Used to create materials or modify a material palette.

Opens when the Define Materials tool is selected in the Materials toolbox, or when *Settings* > *Rendering* > *Materials* is chosen, when you double-click the material preview window in the Apply Material tool dialog, or when you select Edit Material in the right-click menu of the material preview window.

When working with Bentley Building products, you can modify a material from within the Material Editor dialog, but its part assignment can be changed only through the part editor for the particular product.

Two modes are available in this dialog — Basic Mode and Advanced Mode. The title bar of the dialog displays which mode currently is active.



Material Editor (Basic Mode)

The palette tree is now always visible, the Material Editor dialog is resizable, and can be resized by dragging the border. As of this update the Material Editor's Advanced mode uses logical tabs to separate various settings. By adding tabs we are able to add several new material settings in this update.

In the tree view, you can use a right click menu to manipulate materials. Additionally, you can use drag and drop to move or copy materials from one palette file to another. That is, you can:

Click-and-drag selected materials to move them from one palette to another.

<ctrl-click-drag> to copy selected materials from one palette to another.

Palette

Displays the current material palette. A drop-down menu lets you select other palettes that have been loaded.

Material

Displays the current material, which is contained in the current palette file. A drop-down menu lets you select other materials that are contained in the material palette.

Palette Tree

The Palette Tree is opened/closed by the Show/Hide Palette Tree icon to the left of the Palette field.

Material settings

Material settings control how the material is rendered. Two modes are available, Basic and Advanced, which is indicated in the dialog title. Advanced mode can be toggled on/off by selecting Settings > Advanced.

Preview

The Preview section of the dialog includes a display of the material with the current settings applied.

New Material icon

Creates a new material entry in the currently selected material palette. The material has the default settings and focus is on its name, to let you input a new name.

If no material palette is selected, then a new palette is created to contain the new material.

Open Palette icon

Opens the Open Palette dialog, which lets you select a palette to load.

Save Palette icon

(Enabled only when a change has been made to a material palette) Saves the currently selected material palette. If the palette is new, the Save Palette As dialog opens, which lets you save the new palette file.

Cut icon

(Enabled only when a material is selected) Copies the selected material to the Windows clipboard and deletes the entry from the palette file.

Copy icon

(Enabled only when a material is selected) Copies the selected material to the Windows clipboard.

Paste icon

(Enabled only when one or more materials have been copied to the clipboard) Pastes the contents of the Windows clipboard into the selected palette.

Revert to saved material icon

(Enabled only after a change has been made to one or more settings for an external or library material) Lets you revert to the saved version of the material.

Apply Material icon

Starts the Apply Material tool, with the selected method active. The active icon reflects the same icon as displayed on the Apply Material tool dialog. Method can be selected from a drop-down menu that opens when you click the arrow to the right of the icon. Options are:

- **Assign Material** — To assign a material by level and color.
- **Remove Assignment** — To remove a material assignment by level and color.
- **Attach Material** — To attach a material to an element, or face of a solid.
- **Remove Attachment** — To remove a material attachment from an element or face of a solid.
- **Query Material** — To query the material assignment for an element.
- **Preview Element** — To preview the material on one or more elements in the model.

Filter materials icon

Lets you define which materials are displayed in the palette tree. When the Filter icon toggle is pressed in, then the current material filter becomes active. A filter icon displays in the Palette Tree view, also. When the Filter icon is not pressed in, then no filter is applied. Hovering the pointer over the Filter icon displays a tool tip that displays the selected filter that is in use, or will be used if the Filter icon is pressed. The arrow icon, at the right of the Filter icon, opens a menu to let you choose a filter. Choosing a filter, automatically turns on that filter. Filter options are:

- **Filter Used** — Displays only those materials that have been assigned in the DGN file and/or those that have been attached to elements in the active model.
- **Filter Assignments** — Displays only those materials that have been assigned by level and color in the DGN file.
- **Filter Attachments** — Displays only those materials that have been attached to elements in the active model.
- **Filter Part Assignments** — (Bentley Building products only) Displays only those materials that have been attached to parts.
- **Filter Unused** — Displays only those materials that have not been assigned by level and color in the DGN file.

Get Library Changes

Updates the changes made to the library.

Table menu > Manage

Opens the Manage Material Tables dialog.

Table menu > Local Materials > Convert To > Local Table and Palettes

(V8 compatible materials only) Converts external materials to local copies, or updates the local copy if it already exists.

Table menu > Local Materials > Convert To > External (V8) Table and Palettes

(Local compatible materials from V8 XM Edition or later only) Converts local materials to an external V8 compatible material table and associated palettes.

Table menu > Local Materials > Convert To > External (V8) Table And Unified Palette

(Local compatible materials from V8 XM Edition or later only) Converts local materials to an external (V8 compatible) material table and creates a single external palette file.

Table menu > Local Materials > Export To > External (V8) Table And Palettes

(Local compatible materials from V8 XM Edition or later only) Creates an external V8 compatible material table, for all local materials, that references the relevant palette files.

Table menu > Local Materials > Export To > External (V8) Table And Unified Palette

(Local compatible materials from V8 XM Edition or later only) Creates an external V8 compatible material table for all local materials, along with a single palette file containing all local materials.

Table menu > Local Materials > Update From Library

(Local materials in the table that have external equivalents only) Copies external versions of materials locally, or updates existing local materials from the external palettes.

Table menu > Local Materials > Copy To Library

(Materials in the table that have external equivalents only) Copies local materials to the external palettes, or updates the external copies if they already exist.

Table menu > Local Materials > Remove Local Copy

Removes local copies of materials from the table.

Table menu > Refresh

Refreshes the Material Editor dialog, including the internal/external/out_of_synch status of the materials and attachments.

Palette menu > New

Creates a new palette entry in the current material table.

Palette menu > Open

Opens the Open Palette dialog, which lets you select a material palette to load.

Palette menu > Save

(Enabled only if a change has been made to the selected palette file) Saves the selected palette file.

Palette menu > Save As

Lets you save the selected material palette to a file with a different name.

Palette menu > Refresh

Refreshes the palette list box.

Palette menu > Generate Preview

(Disabled if no attachments associated with the material) Starts the Apply Material tool with method set to Remove Material Attachment.

Palette menu > Local Materials > Update From Library

Updates local materials from definitions in the external palette.

Palette menu > Local Materials > Copy To Library

Copies the local material(s) from the selected palette to the external palette, or updates the external materials if they exist.

Palette menu > Local Materials > Remove Local Copy

Deletes the local materials from the selected palette.

Palette menu > Unload

Unloads the selected material palette file.

If any materials from the selected material palette file have been used in the current DGN file then an Alert box appears to warn you of this fact. If you still accept the unloading of the material palette file, then those materials are either resolved from other material palettes (having materials of the same name) or moved to the Missing Materials palette.

Material menu > New

Creates a new material, using default material attributes, with focus on the material name so that you can give it a name of your choice.

Material menu > Import

Opens the Open Palette dialog, which lets you select a material palette file, from which to import one or more materials via the Import Materials dialog.

Material menu > Local Material > Update From Library

Updates the selected local material from the palette file.

Material menu > Local Material > Copy To Library

Copies the selected local material to the palette file, or updates the external material if it exists.

Material menu > Local Material > Remove Local Copy

Removes the local copy of a selected material from the model.

Material menu > New Material From Geometry

Creates a material with displacement and opacity maps generated and sized from the height of the geometry.

Material menu > Assign

Starts the Apply Material tool with method set to Assign by Level/Color.

Material menu > New Assignment

Creates a new assignment of the current material, to be edited in place.

Material menu > Remove Assignment

(Disabled if no assignments associated with the material) Starts the Apply Material tool with method set to Remove Assignment.

Material menu > Edit Assignments

Opens the Material Assignments dialog, which lets you manually edit assignments of the material by level and color.

Material menu > Attach

Starts the Apply Material tool with method set to Attach.

Material menu > Remove Attachment

(Disabled if no attachments associated with the material) Starts the Apply Material tool with method set to Remove Material Attachment.

Material menu > Generate Preview

(Disabled if no attachments associated with the material) Starts the Apply Material tool with method set to Remove Material Attachment.

Material menu > Revert

(Disabled if no changes have been made to the settings of a material) Reverts a material's settings to its previously saved state.

Edit menu > Delete

Deletes the selected material. An Alert box gives you a second chance prior to deleting the material. If the material has been assigned to an element in the DGN file, then another Alert box warns you of this. If you delete a material that has assignments, its assignments will be moved to another material with an identical name if one exists, or else the material is moved to the Missing Materials palette at the bottom of the material tree.

Edit menu > Rename

Lets you rename a material.

Edit menu > Cut

Copies the selected material(s) to the Windows clipboard, and deletes them from their respective material palette file(s).

Edit menu > Copy

Copies the selected material(s) to the Windows clipboard.

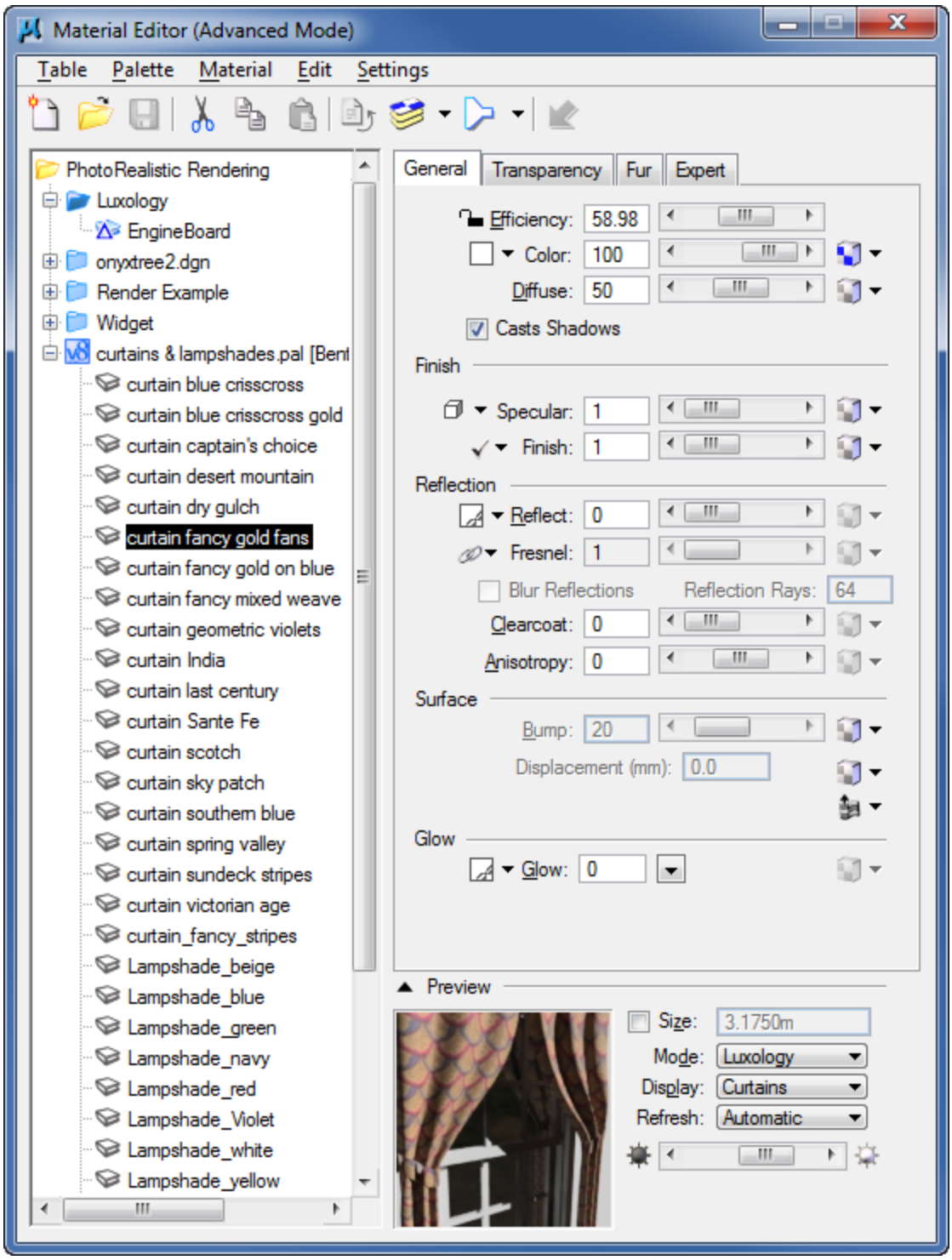
Edit menu > Paste

(Disabled if clipboard empty) Inserts material(s) from the Windows clipboard into the current palette.

Settings menu > Advanced Mode

If checked, displays the Advanced Mode settings. If unchecked, displays the Basic Mode settings.

Material Editor (Advanced Mode)



Material Editor General Tab

The material editor dialog has a new tabular Graphical User Interface (GUI) that make possible an increase the number of material settings while still maintaining the roughly the same footprint. This provides you with much more control over your materials than was previously possible. On the General tab you control several different material settings with Efficiency at the top.

Efficiency

Lets you define the efficiency of the material directly, either by adjusting the slider, or by keying in a value in the associated field. Efficiency is defined as the total percentage of incoming light that is re-transmitted back into the environment. This includes diffuse and specular reflections, as well as the light transmitted through opacity and translucency. When the efficiency is 100% or greater, it is displayed in red, warning that the material is unrealistic. Typical materials in the real world generally range in efficiency from 30% to 70%.

Clicking the Lock icon toggles the lock on and off.

If on  (locked), the efficiency of the material is locked such that modifying the diffuse, specular, opacity, or translucency components will automatically adjust the other components to maintain the efficiency value.

If off  (unlocked), modifying the diffuse, specular, opacity, or translucency components changes the efficiency value, but does not automatically adjust the other components.

Color button

Defines the color used for the material when rendered.

Clicking the arrow icon opens a menu with the following options:

Custom — Use the custom color. You can define the custom color by clicking the color  button to open the Base Color dialog, which lets you define the color. When Custom is selected, the color button displays the selected Base Color.

Use element color  Uses the color of the element in the model.

Pattern map icon

Defines whether or not a pattern map is used by the material. Click the arrow icon to open a menu with the following options:

On  A pattern map, if defined, will be used in the material. Hovering the pointer over the pattern icon displays the name of the current pattern map.

If a pattern map is defined, click this icon to open the Map Editor dialog opens, which lets you edit the settings for the pattern map. This includes options for selecting an image file, a Procedure, Luxology Procedure, or a Gradient. If a pattern map is not defined, clicking this icon opens the Open Image file dialog, which lets you select an image file for use as a pattern map.

Off  No pattern map will be used by the material.

Color scale

Specifies the percentage of the pattern map that is used in the material versus color. Values range from 0 (solid color with no pattern map) to 100 (entirely pattern map) and may be keyed in to the text field, or adjusted using the slider.

Diffuse

Defines the percentage of incoming light that is reflected in all directions equally. This affects the overall brightness of the material.

(Dark/Bright setting in Basic Mode) the intensity of the material's diffuse color — can range from Dark (no diffuse color) to Bright (100% diffuse color).

How the diffuse color is defined depends on the color setting. Click the color menu to see the following options:

- **Custom** — lets you select a color, using a color picker dialog, which is opened by clicking the color button.
- **Use element color** — uses the color of the element(s) in the model to define the diffuse color.

By mixing the diffuse color with a pattern map, the need for many different pattern maps is reduced. For example, both blue and pink marble materials could be created by mixing different base colors with a single marble pattern map.

Specular, Finish, Reflect and Fresnel

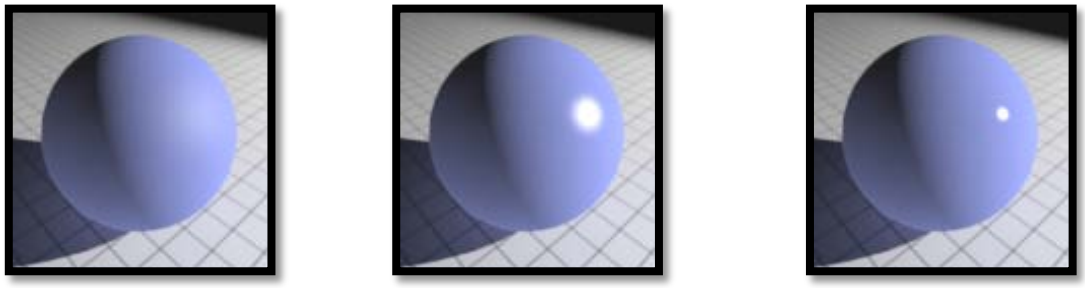
(Dull/Shiny control and Reflective toggle in Basic Mode) These three settings affect materials as follows:

- **Specular** — sets the amount of incoming light that is reflected in the opposite direction to the incoming light. Values range from 0 (Dull) to 100 (Shiny).
- **Reflect** — controls the amount of light from other objects that is reflected. Values ranging from 0 (None) to 100 (Full).
- **Fresnel** — at glancing angles (those perpendicular to the camera), reflectance values increase. The Fresnel setting realistically increases the specular amount at these glancing angles producing a physically correct surface.
- **Finish** — (Visible only when specular is greater than zero) controls the roughness of the surface, which controls the size of specular highlights. Values range from 0 (Rough, with larger highlights) to 100 (Smooth, with smaller more intense highlights).

The Finish and Specular settings interact to produce specular highlights, or lighting “hot spots,” for a material.

A highly polished material, such as chrome that has high Specular and Finish values, produces concentrated and bright specular highlights.

A rough material, such as felt that has low values for Specular and Finish, has dull and more spread out specular highlights.

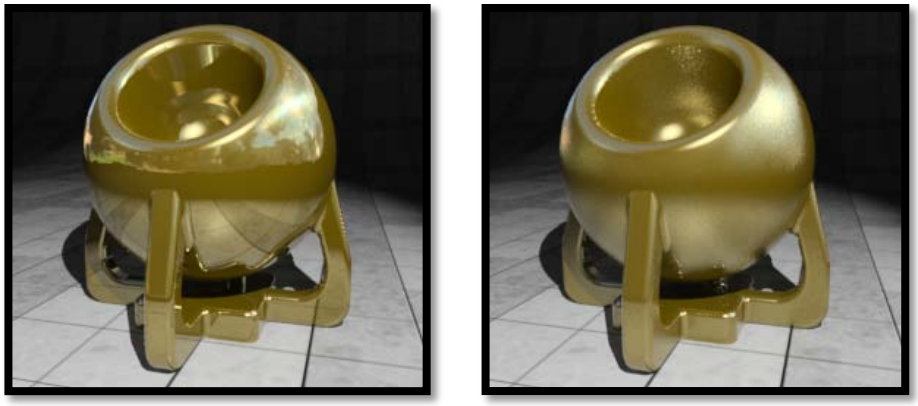


Left: Rough (low Specular and/or Finish), Center: Smooth (medium Specular and Finish), Right: Highly polished (high Specular and Finish)

Varying Fresnel from left 0, 25, 50, 75 and 100%

Blur Reflections and Reflection Rays

If Blur Reflections is enabled, reflections visible in the material are blurred. Reflection Rays sets how many reflection rays are used to create the blurring for rendering with Luxology. Higher numbers of reflection rays will produce smoother (less noisy) blurring effects at the expense of render time.



Reflective material with Blur Reflections disabled (left) and enabled (right)

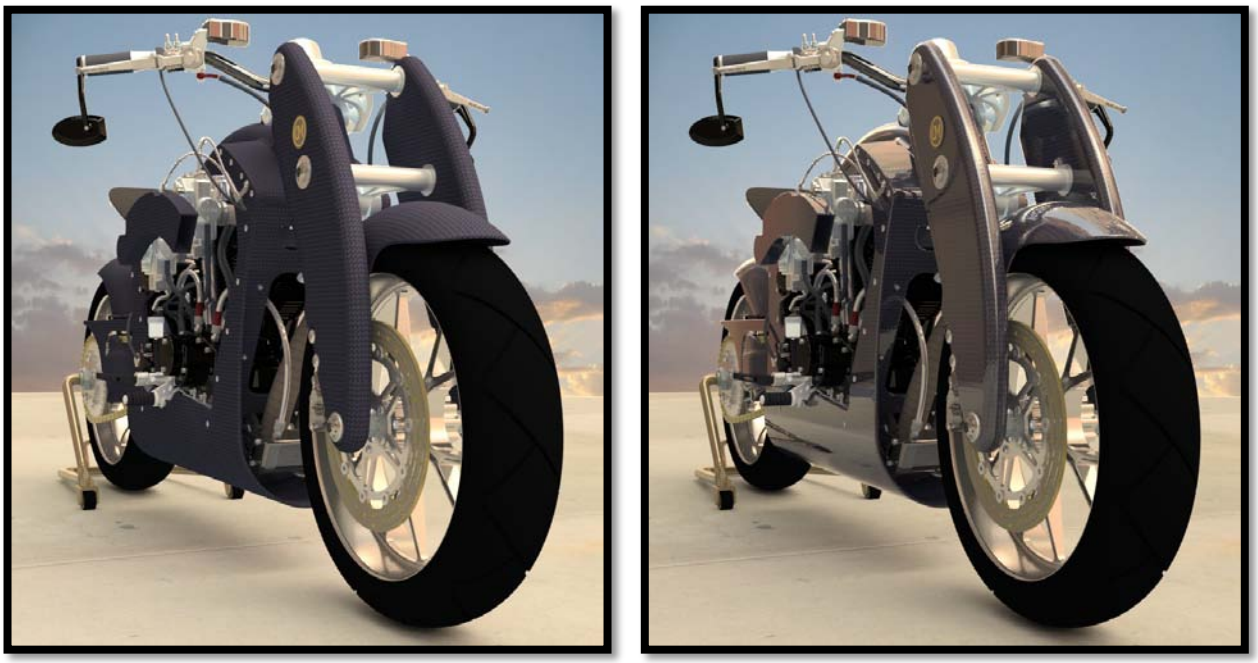
NOTE: The amount of blurring depends on the materials finish with higher finish values producing less blur. You may find that by using higher finish values you can get acceptable blurring with a lower number of reflection rays and improved render times.

Clearcoat

Produces a clearcoat lacquer effect on the material, allowing you to create very realistic automotive paints and other finishes where a layer of clear coating is applied to a base coat material.

The Clearcoat slider goes from 0 (None) to 100 (Full), with good results for most automotive paints at around 30 to 60. You can key-in values above 100, which will produce even thicker clear coating.

Note: When adding a clearcoat layer, Reflect can be set to zero since the basecoat is essentially the pigment (color) layer. Adding clear coating will result in a reflective finish.



Left image motorcycle paint (base color) and right with clear coat added

Glow

Defines the amount of light the material appears to emit. This value adds to the overall reflectance of the material, independent of the amount of incoming light. Click the option menu button to the right to select from a range of values for common light emitting objects.

Sign materials without glow on left and with glow on right

Map Editor

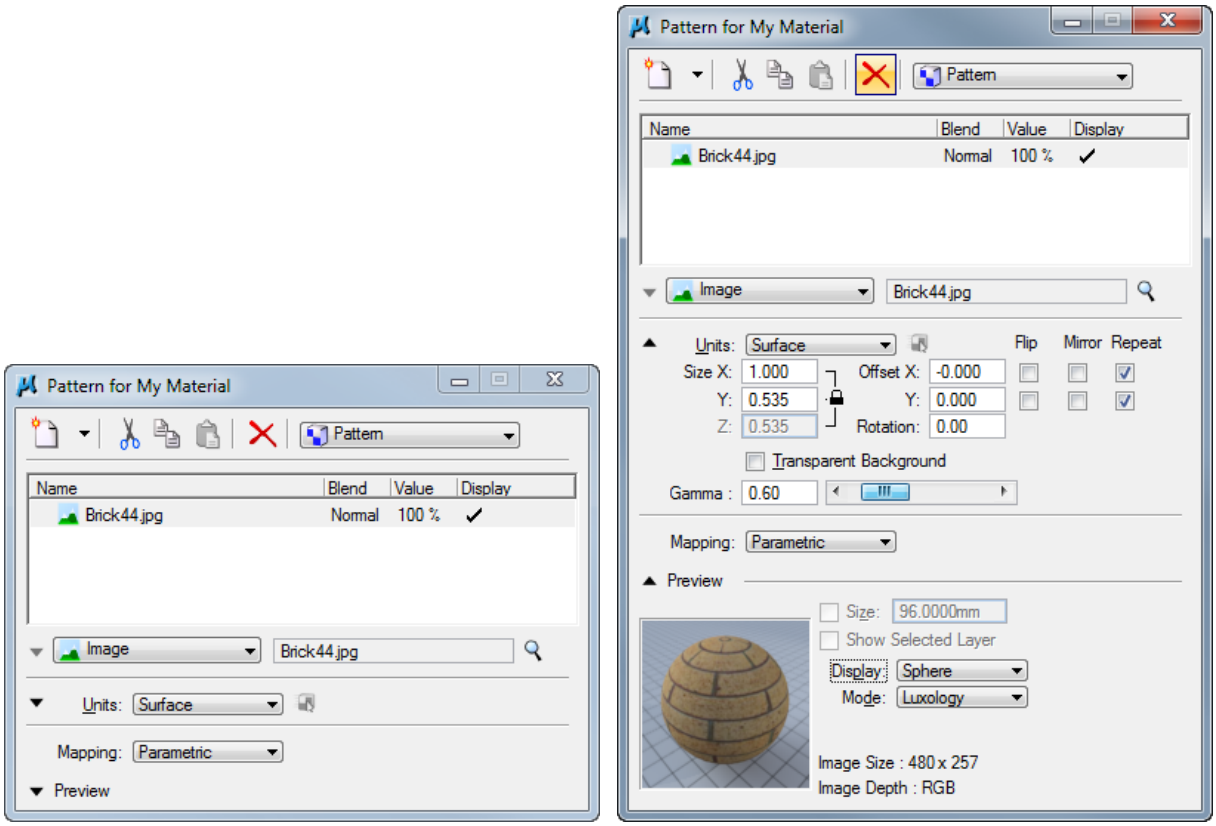
Used to edit the settings for pattern maps and bump maps that are applied to surfaces during rendering. Opens when you click the Pattern Map or Bump Map icons in the Material Editor dialog, or when you click the Map Editor icon in the Dynamically Adjust Map tool's settings. The various sections of this dialog can be collapsed or expanded as required. The dialog is resizable.

Materials may consist of a number of layers. The Blend, Value, and Display column values for the bottom layer in the list are not editable and appear dimmed.

Gamma (per texture)

You can set the gamma for each individual texture used in creating your material. This can be quite useful because the default gamma used to render is 1.7. By lowering the gamma of the texture used you can in effect prevent your textures from appearing overly bright and lacking contrast. In the following images the left image uses texture gamma of 1.0 and in the right image texture gamma is set to 0.5.

On left all texture gamma 1.0 (default) and set to 0.5 on right



Map Editor collapsed left and expanded right

New Layer (icon)

Adds a new layer to the layers list. By default, an image layer is created. Clicking the down arrow icon opens an option menu for selecting the available map layer items.

- **Image** — Opens the Open Image File dialog, which is used to select an image file to be added as a layer.
- **Gradient** — Adds a Gradient layer to the layers list box.
- **Procedure** — Adds a procedural texture layer to the layers list box.
- **Group** — Adds a group layer to the layers list box.
- **Operator** — Adds an operation layer to the layers list box.
- **Luxology Procedure** — Adds a Luxology procedural texture layer to the list box.

Cut layer (icon)

Removes the selected layer from the layers list and copies it to the clipboard.

Copy Layer (icon)

Copies the selected layer to the clipboard.

Paste Layer (icon)

Inserts the layer from the clipboard to the layers list.

Delete layer (icon)

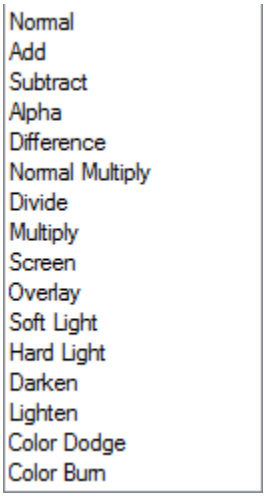
 Removes the layer from the layers list.

Name

Displays the name of the map image file, gradient, procedural texture, or operator, for th**e layer**.

Blend

Does not apply to Tint operator Click on the Blend value for the required layer and select the required blend option from the menu. Blend defines how the image from a layer is blended with images from layers below it in the Map Editor dialog.



Blend Modes

Blend Modes

- **Normal**— This method simply paints the image with the current color with no modification. If you choose a blue brush, you will be applying blue pixels to the image map when you paint. This is the most commonly used (and default) option.
- **Add**— This blend mode is true to it's name as it simply adds the layer pixel color to the existing pixel colors. If the current pixel is blue and you add a red brush the result will be purple whereas the default Normal method would paint red over the blue pixel.
- **Subtract** — This blend mode simply subtracts pixel values of one layer with the other. In case of negative values, black is displayed.

- **Alpha**— This option uses the selected image as an alpha channel map and requires both a foreground and background image. If the foreground or background image is not defined these pixels are seen as holes or transparent.
- **Difference**— Subtracts the top layer from the bottom layer or the other way round, to always get a positive value. Blending with black produces no change, as values for all colors are 0. (The RGB value for black is 0,0,0). Blending with white inverts the picture.
- **Divide**— This blend mode simply divides pixel values of one layer with the other
- **Multiply**— This blend mode runs a straight multiplication of the R,G and B components of the top layer image pixels by the RGB values of pixels in the layer below. If, for instance, where in the image you have a pure blue pixel and multiply with pure green, the result will be black since you are multiplying zero values. Pure blue is 0.0, 0.0, 1.0 and pure green is 0.0, 1.0, 0.0 so this when you multiple each component together the result is 0.0, 0.0, 0.0.
- **Screen**— With Screen blend mode the values of the pixels in the two layers are inverted, multiplied, and then inverted again. This is in some way the opposite of multiply. The result is a brighter picture.
- **Overlay**— Combines Multiply and Screen blend modes. Light parts of the image become lighter and dark parts become darker.
- **Soft Light**— This is a softer version of Overlay. Applying pure black or white does not result in pure black or white.
- **Hard Light**— Combines Multiply and Screen blend modes. As opposed to Overlay, the contrast is also increased.
- **Darken**— This blend mode takes the darkest value for each pixel from each layer.
- **Lighten**— This blend mode takes the lightest pixel value from each layer.
- **Color Dodge**—This decreases the contrast to make the bottom layer reflect the top layer: the brighter the top layer, the more its color affects the bottom layer. Blending with white produces white, blending with black does has no affect on the image.
- **Color Burn**—This darkens the top layer increasing the contrast to reflect the colour of the bottom layer. The darker the bottom layer, the more its colour is used. Blending with white produces no difference.

Value

Sets the value for a layer. To make a change, click on the Value entry for the selected layer. Values settings vary for the different types of layer.

Image (pattern or bump map) — Click on the image Value setting to open a slider that lets you vary the opacity from zero to 100 percent. Other editable values, for the selected image, display below the layers list box.

Procedural textures — Click on the procedural textures value setting to open a slider that lets you vary the opacity from zero to 100 percent. Other editable values, for the selected procedural texture, display below the layers list box.

Gradient — Click on the Gradient Value to open a slider that lets you vary the opacity from zero to 100 percent. Other editable values, for the selected gradient, display below the layers list box.

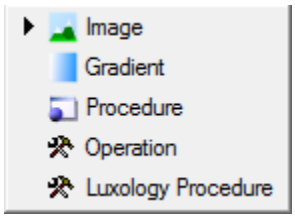
Tint (operator) — Click on the color swatch to open a color picker dialog that lets you define a color.

Luxology Procedure — Click on the procedural textures value setting to open a slider that lets you vary the opacity from zero to 100 percent. Other editable values, for the selected Luxology procedural texture, display below the layers list box.

Display

Click on the Display entry to toggle the display state of the layer.

Map Option Menu



Lets you select the type of file to be used for the map.

Image — Lets you select an image file, using the Open Image File icon to the right of the option menu and the text field. The name of the selected image file appears in the text field. Hovering the pointer over the name field will display the full path name of the image file in a tool tip.

When an image is selected, an expandable mapping section directly below lets you define how the image is mapped.

Gradient — Lets you select a gradient as a material map. A second option menu on the right lets you choose a Linear or Radial gradient.

With the image section expanded, clicking the color key buttons below the gradient display sample, opens the Gradient Color Chooser dialog, which lets you select the colors for the gradient. Clicking on the gradient strip lets you place further color keys to control the gradient. Up to 50 color keys can be assigned to a gradient. See Gradient maps for information on creating gradients.

Procedure — Lets you select a procedural texture from an option menu on the right. Hovering the pointer over the procedure option menu will display the full path name of the procedural file in a tool tip.

With the image section expanded, custom settings for the selected procedural texture appear below the option buttons.

Operation — Lets you add Tint color, clicking the color button below lets you select a color.

Luxology Procedure — Lets you select a procedural texture from an option menu on the right.

Preview section

The Preview section displays a sample of the material or a selected layer.

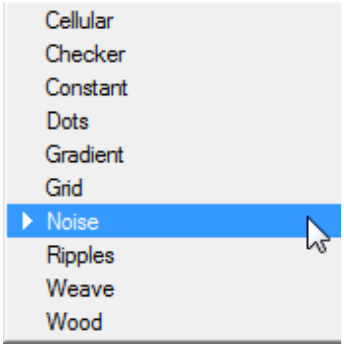
Right-click menu

- **Cut** — (Same function as the Cut Layer icon) Removes the selected layer from the layers list and copies it to the clipboard.
- **Copy** — (Same function as the Copy Layer icon) Copies the selected layer information to the clipboard.
- **Paste** — (Same function as the Paste Layer icon) Inserts the layer from the clipboard into the layers list.
- **Paste Special** — Replaces the currently selected layer information with that in the clipboard.
- **Delete** — (Same function as the Delete Layer icon) Removes the layer from the layers list.
- **Group** — Creates a group containing the selected layer(s).
- **Ungroup** — Moves the selected layer(s) from the group to be standalone layers in the list.
- **Move To** — (Group present only) Lets you move the selected layers to an existing group. Where more than one group is present, an option menu lets you choose from a list of the groups.
- **Move Up** — Moves the selected layer or group up one row in the list box.
- **Move Down** — Moves the selected layer or group down one row in the list box.

Luxology Procedure

Procedural textures are generated by the computer using various parameters and can be quite useful for adding layers and creating effects. They can be used for bumps and displacements without the need for external imagery such as Tiff, Targa or JPEG files.

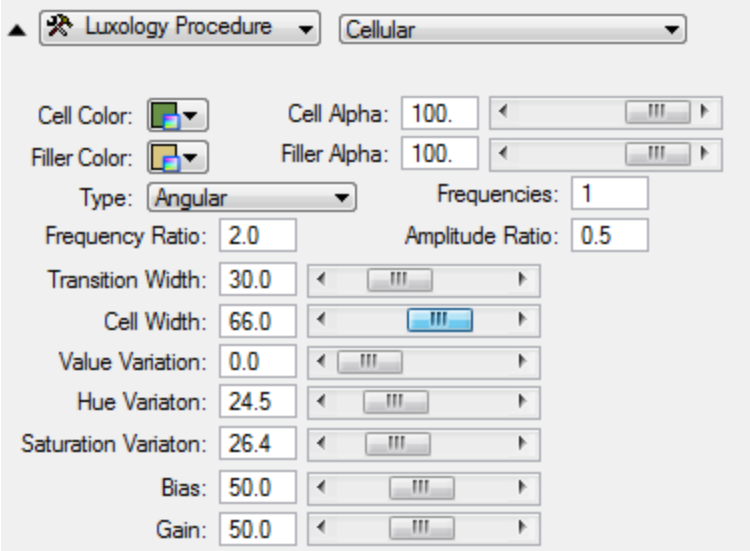
When Luxology Procedure is selected you find the following list of Procedures to choose from:

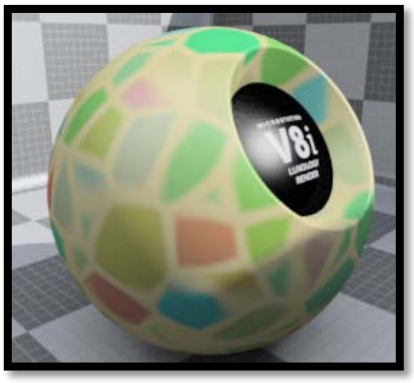


Luxology Procedural Textures

Cellular

The Cellular texture is procedural and has 2 zones, the Cell and the Filler. The texture will modulate from one zone to the other based on the particular algorithm and user settings. Each zone can have a value, color and alpha value. Which of these are used is dependent on the Effect channel to which the texture will be applied. For instance, if the texture is to be used as a displacement the Value settings would be utilized whereas setting the texture Effect to Luminous would use the Color and Alpha settings for Cell and Filler. The Cellular texture is incredibly versatile and can create effects ranging from veins and cobblestone to crumply water and lizard skins.





Cell Color: Determines the color of the texture where the Cell is most concentrated. This color will ramp to the Filler Color. The Color option is only used when the texture layer is set to an Effect that requires color. The dedicated Cell Color 'Alpha' will determine how transparent the Cell zone will be.

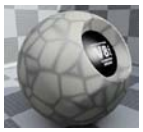
Cell Color (amount): Determines the magnitude of the texture where the Cell is most concentrated. This value will ramp to the Filler value. This control is only active when the texture layers Effect is set to a non-color attribute.

Filler Color: Determines the color of the texture between the Cells. This color will ramp to the Filler Color. The Color option is only used when the texture layer is set to an Effect that requires color. The dedicated Fill Color 'Alpha' will determine how transparent the Fill zone will be.

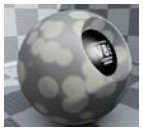
Filler Color (amount): Determines the magnitude between the Cells. This value will ramp to the Filler value. This control is only active when the texture layers Effect is set to a non-color attribute.

Filler Alpha: Determines the alpha value of the texture between the Cells. This alpha value will ramp to the Filler Alpha value. The Alpha option is used in conjunction with the Color setting.

Type: The Type popup allows you to quickly change between the styles of Cellular texture. The options are Round and Angular. These options determine how the texture interpolates between its sample points.



Angular: This option creates a somewhat linear interpolation between the sample points in the texture which results in an effect similar to cobblestone in the default setting. This mode can be used to generate effects ranging from lunar surface to craggy skin.



Round: The Round type of cellular texture creates circular spots randomly distributed based on the texture. In the default settings the texture looks simply like overlapping soft edged dots. Adjusting the settings can yield effects ranging from cauliflower to chipped rock.

Cell Width: This setting determines the maximum scale of the texture details. At 100% the maximum scale of any single detail in the texture would be equal to the Texture size as set by the texture locator size values. If you want to change the scale of the details of the texture this is the value to use. To set the overall scale of the texture you will modify the texture scale on the Texture Locator tab.

Transition Width: This value controls the amount of gradient falloff around each of the texture details. Driving this value over 100% can also yield interesting effects.

All "noise" style procedurals can be "layered" to create a fractal effect. The traditional style of fractal includes layering a noise pattern multiple times with each new layer increasing in frequency (smaller details and more of them) and fading in value. When you add a Cellular or Noise texture in Luxology the default settings are not "fractal" in that they only use a Frequency value of one, this means there is only one "layer" of the procedural effect. Adding multiple frequencies will create a more fractal look to the texture and will invoke the Frequency Ratio and Amplitude Ratio controls.

Frequencies: Determines the number of "layers" used by the procedural. When set to less than 2 the Frequency and Amplitude Ratios are disabled. Adding more than one frequency increases the detail in the procedural texture which increases computation times.

Frequency Ratio: The Frequency Ratio determines how much detail to add into each additional application of the noise texture when the Frequencies value is set to a value greater than 1. The default value of 2 will result in the second frequency of the texture being twice as high as the first. The visual effect of this is a pattern that seems to be half as large but with twice as many occurrences. With more than 2 frequencies each additional "layer" of the noise will have twice the frequency of the last.

Amplitude Ratio: This value determines the strength of each additional "layer" of noise when frequencies are greater than 1. By default the setting is at .5 which yields an effect where each additional set of frequencies have half the value of the previous.

Value Variation: The 'Value Variation' percentage allows you to randomly vary the brightness or luminosity of each individual cell. Higher numbers will increase the differences between cells while lower ones will have decreased brightness variations.

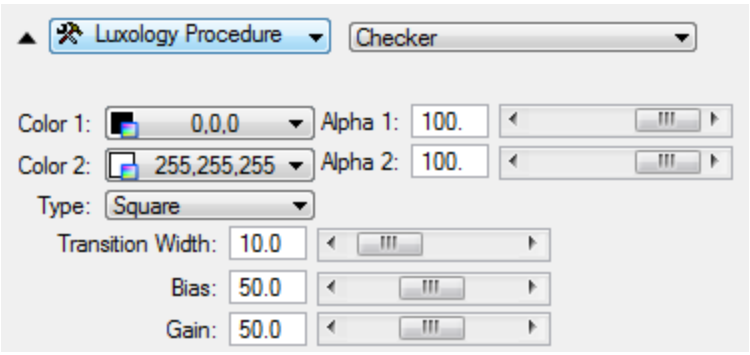
Hue Variation: The 'Hue Variation' percentage allows you to randomly vary the hue or color of each individual cell. Higher numbers will increase the color differences between cells while lower ones will have decreased color variations.

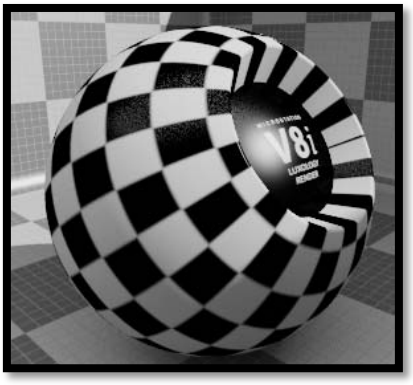
Saturation Variation: The 'Saturation Variation' percentage allows you to randomly vary the color saturation of each individual cell. Higher numbers will increase the differences between cells while lower ones will have decreased saturation variations.

Bias: Increasing this value will cause the texture to favor the Cell color or value over the Filler whereas decreasing the value causes the Filler color or value to be favored.

Gain: The Gain setting is similar to a gamma control that effects the falloff of the gradient ramp between the cell and filler values. Setting the Gain to 100% will create a very sharp falloff effect whereas setting the value to 0 would create a plateau around the value or color mid-point with sharp falloff on either extreme of the gradient.

Checker





The Checker texture uses two colors or values and creates a pattern of alternating squares that resembles a Checker board.

Color 1 (amount): Determines the magnitude of the texture at the center of each sample location. This value is blended into the Color 2 amount based on proximity to surrounding sample points. This control is only active when the texture layers Effect is set to a non-color attribute.

Color 1: Sets the color that will be used at the center of each sample location. This color is blended into the Color 2 value based on proximity to the surrounding sample points. The Color option is only used when the texture layer is set to an Effect that requires color.

Alpha 1: Determines the alpha value of the texture to correlate with Color 1.

Color 2 (amount): Sets the value that will be used at the between the sample points. This value is blended into the Color 1 (amount) based on proximity to the surrounding sample points. The Value option is only used when the texture layer is set to a non-color attribute.

Color 2: Sets the color that will be used at the between the sample points. This color is blended into the Color 1 value based on proximity to the surrounding sample points. The Color option is only used when the texture layer is set to an Effect that requires color.

Alpha 2: Determines the alpha value of the texture to correlate with Color 2.

Type: There are two types of checker texture, Square and Cube.

Square — Creates a two dimensional checker pattern that is projected through the mesh based on the Projection Axis of the Texture Locator.

Cube — Creates a grid of three-dimensional cube volume that when intersected by the geometry reveals a checker pattern that can be seen from all angles.

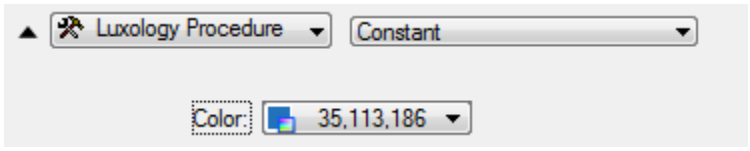
Transition Width: This value determines the size of the gradient ramp between the checkers along their borders. Using large values will create a softer border and decreasing it will create a very sharp edge on the borders.

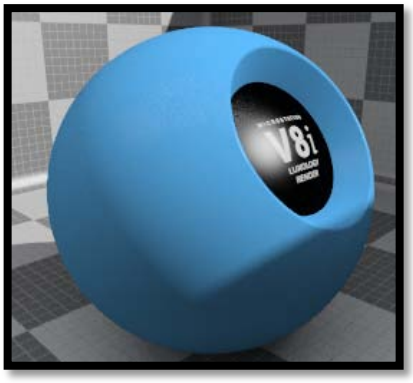
Bias: Increasing this value will cause the texture to favor the primary color or value over the Filler whereas decreasing the value causes the secondary color or value to be favored.

Gain: The Gain setting is similar to a gamma control that effects the falloff of the gradient ramp between the cell and filler values. Setting the Gain to 100% will create a very sharp falloff effect whereas setting the value to 0 would create a plateau around the value or color mid-point with sharp falloff on either extreme of the gradient.

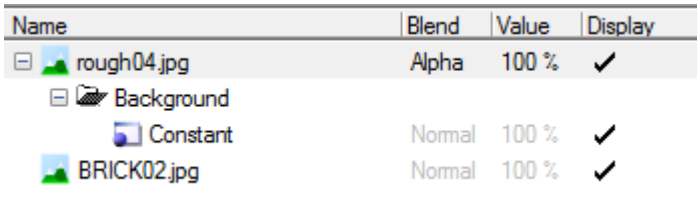
Constant

The Constant texture simply generates a constant Value (amount) or Color. This can be useful for setting a single color or value to a specific Effect without the need to create an entire Material. For instance, with a Constant color as a layer you could use it for tinting or with alpha to provide foreground or background color.



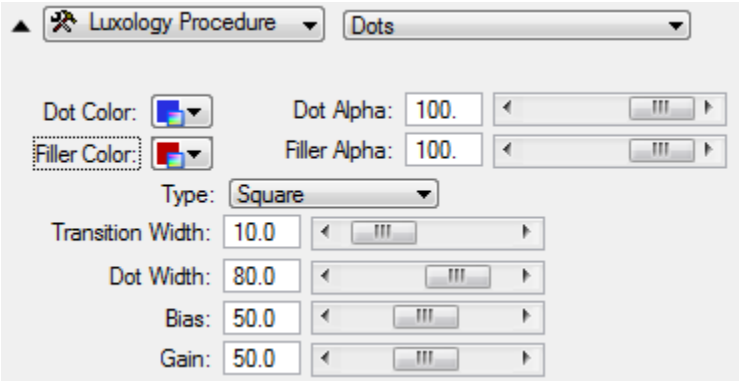


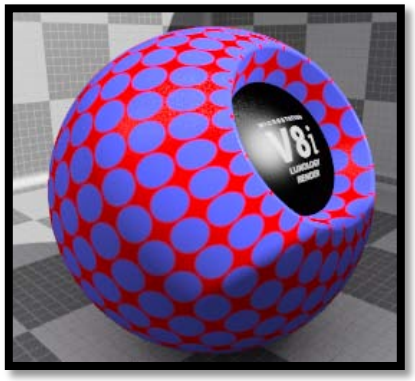
In the following example you can see that a constant procedural color is used along with alpha to provide the splattering of blue paint on a brick wall.



Dots

The Dots texture creates a grid like pattern of dots across the surface of the mesh. These dots default to fairly uniformly positioned and hard edged but can be modified for different placements and soft ramped dots.





Dot Color (amount): Determines the magnitude of the texture where the Dot is most concentrated. This value will ramp to the Filler value. This control is only active when the texture layers Effect is set to a non-color attribute.

Dot Color: Determines the color of the texture where the Dot is most concentrated. This color will ramp to the Filler Color. The Color option is only used when the texture layer is set to an Effect that requires color.

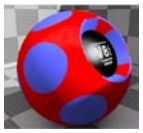
Dot Alpha: Determines the alpha value of the texture where the Dot is most concentrated. This alpha value will ramp to the Filler Alpha value. The Alpha option is used in conjunction with the Color setting.

Filler Color (amount): Determines the magnitude between the Dots. This value will ramp to the Filler value. This control is only active when the texture layers Effect is set to a non-color attribute.

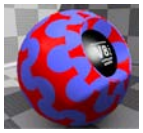
Filler Color: Determines the color of the texture between the Dots. This color will ramp to the Filler Color. The Color option is only used when the texture layer is set to an Effect that requires color.

Filler Alpha: Determines the alpha value of the texture between the Dots. This alpha value will ramp to the Filler Alpha value. The Alpha option is used in conjunction with the Color setting.

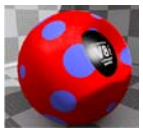
Type: The Type parameter changes the method for applying the dots to the surface.



Square — The default Square mode creates a series of perfectly aligned rows and columns of dots that are projected in 2D against the mesh. You can see this effect in the image thumbnail image shown here where parametric mapping was used.



Hexagon — This mode is similar to the Square method with the exception that the dots are shifted from row to row such that the filler creates a hexagonal pattern. The thumbnail image shown used parametric mapping.



Cube — This type setting creates a three dimensional array of spheres that intersects with the surface of the mesh. For any projection type other than UV, which causes the dots to lay perfectly on the surface, the mesh will intersect the spheres at different cross sections resulting in dots of varying thickness as you can see in the image above. This image uses the Cubic projection style.

Dot Width: This setting controls the diameter of the dots with 100% creating dots that meet adjacent dots edge to edge.

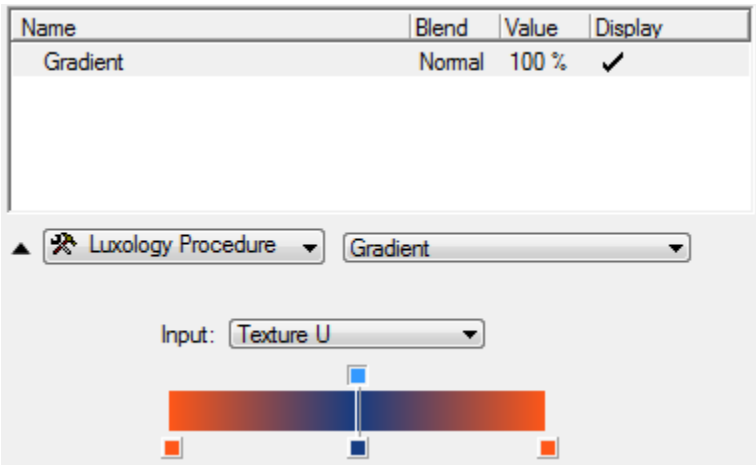
Transition Width: The Transition Width creates a smooth ramp blend from the Dot color or value to the Filler color or value. This is set as a percentage of the distance between the dot and the filler. Extreme numbers can be used to create interesting effects.

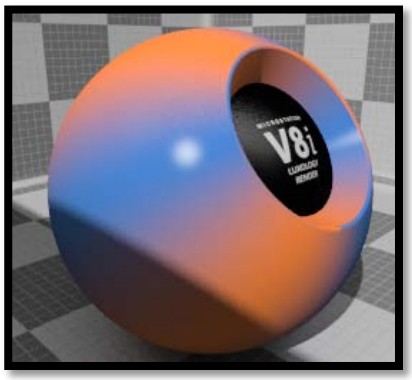
Bias: Increasing this value will cause the texture to favor the Dot color or value over the Filler whereas decreasing the value causes the Filler color or value to be favored.

Gain: The Gain setting is similar to a gamma control that effects the falloff of the gradient ramp between the dot and filler values. Setting the Gain to 100% will create a very sharp falloff effect whereas setting the value to 0 would create a plateau around the value or color mid-point with sharp falloff on either extreme of the gradient.

Gradient

The Gradient texture is a powerful asset especially when used with other layers. Gradients provide a method for creating parametric materials. Put simply, gradients remap colors or values based on some input. For instance, with a gradient texture you could tell a surface to ramp from purple to light blue based on the incidence angle or purple to green based on the slope of the surface. Gradients can also control the color of fur, and replicators procedurally.





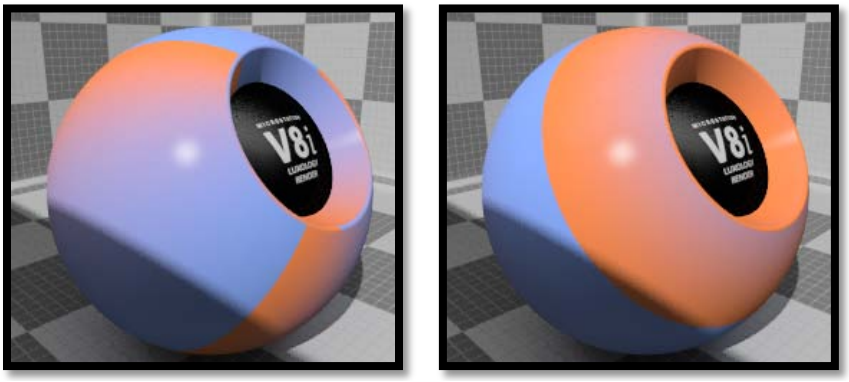
Blend: The Luxology shading system uses a layered approach, with shaders being built one upon another. This permits users to define how subsequent layers 'blend' with each other. The blend mode selector allows the user to select from the various modes available.

Value: Allows the users to change the opacity of the selected shader layer. Reducing values will reduce the overall effect of the shader layer. Since shader layers have no associated RGB values or textures themselves, this setting here is like a gradual 'off ' switch.

Display: The 'Display' checkbox allows the user to toggle the shader layer on and off without losing any settings.

Input: There are many different input parameters to choose from which makes the Gradient texture incredibly powerful.

Texture U and **Texture V**— Determines the direction in which the gradient is applied.

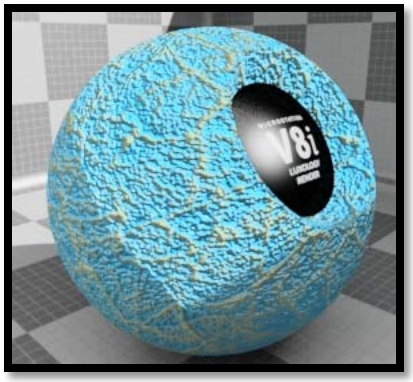


Texture U left and Texture V right

Bump Height — When set to Bump Height the Gradient is driven by any Bump Map textures that are effecting the same material and the input value becomes a percentage where 100% is the highest peak of the bump texture. If there are no texture layers driving the bump map effect the Gradient will be ineffective.

Gradient bump height using dirtmap008.jpg

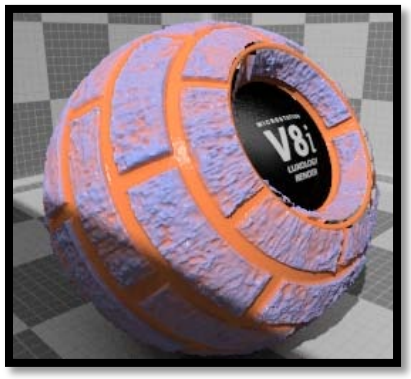
By inverting the bump used for the previous rendering we get the following image:



Gradient bump inverted

Distance to Camera— Modulates the value as a function of the physical distance to the camera.

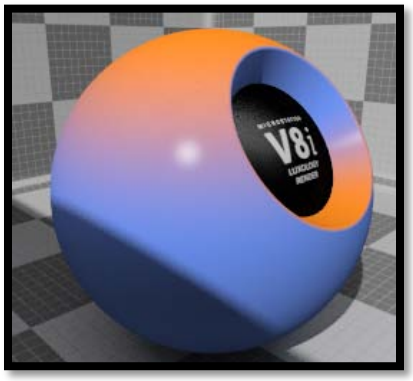
Displacement Height— Similar to Bump Height this input parameter is driven by the Displacement texture layer .



Fur Parametric Length— This drives values along the length of individual fur fibers, 0% at the root, to 100% at the tip. Frosted tips? No problem.

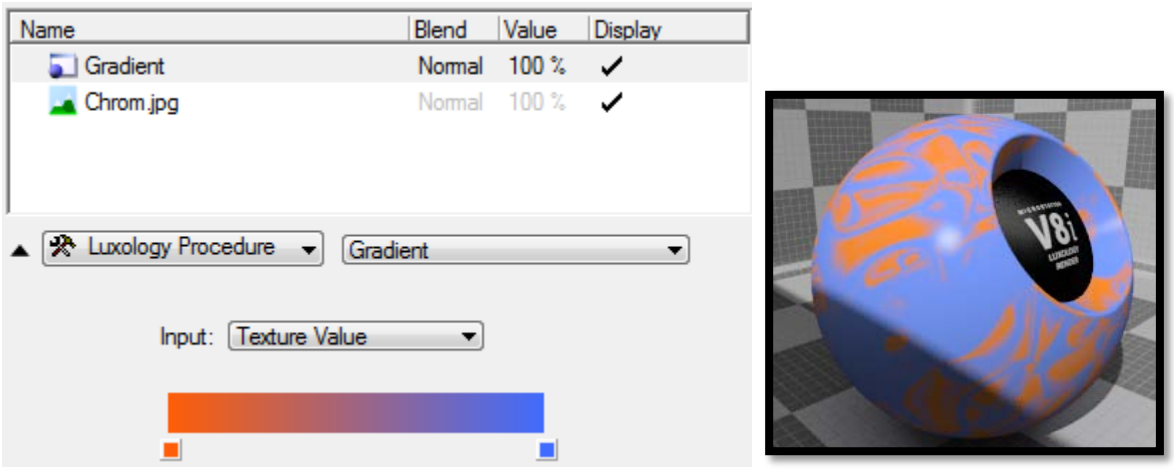
Gradient along fur strands

Slope— This is simply the angle of the surface normal as compared to the World axes.

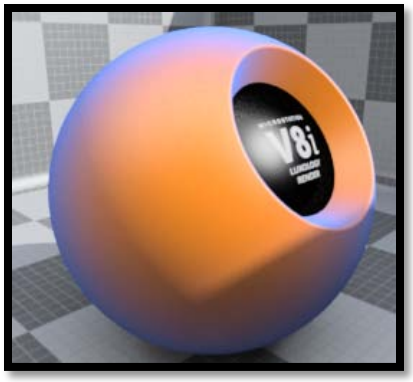


Gradient Slope

Texture Value— This setting will force the Gradient to modulate the Texture layer directly beneath it regardless of that Texture's Effect setting. The Gradient needs to be located above the texture (pattern) in the layer list as shown in the following image.



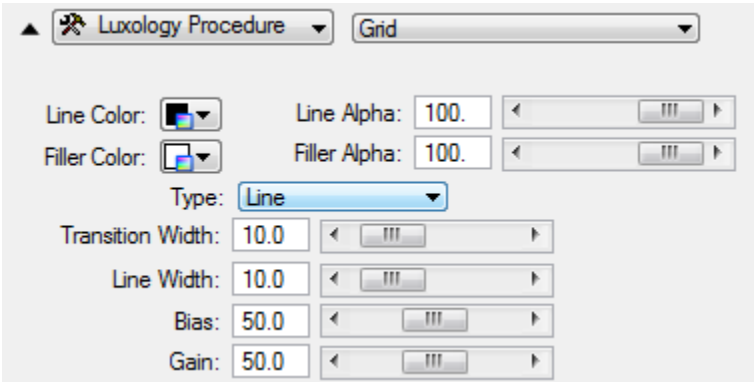
Incidence Angle— This is the angle between the camera and the surface being evaluated. Surfaces that face the camera head on have an incidence angle of 0 while the edges that face away (perpendicular) to the camera have a value of 90 degrees. This setting is often used to simulate the Fresnel effect.



Gradient Incidence Angle

Grid

The Grid texture creates a grid pattern between two amount (grayscale) or color settings; the Line Amount/Color and the Filler Amount/Color. The pattern of the lines is determined by the Type setting and their thickness by the Line Width value. Between the lines and the filler exists a transition zone which is determined by the Transition Width.



Line Color (amount): Determines the grayscale value of the texture where the lines appear. This control is only active when the texture's effect requires a grayscale amount map such as a bump or displacement.

Line Color: Determines the color of the texture where lines appear. This control is only active when the texture's effect requires color.

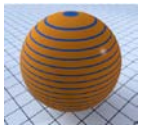
Line Alpha: Determines the alpha value of the texture where lines appear. This control is only active when the texture's effect requires color.

Filler Color (amount): Determines the value of the texture where there are no lines. This control is only active when the texture's effect requires a value.

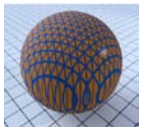
Filler Color: Determines the color of the texture where there are no lines. This control is only active when the texture's effect requires color rather than a value input.

Line Alpha: Determines the alpha value of the texture where there are no lines. This control is only active when the texture's effect requires color rather than a value input.

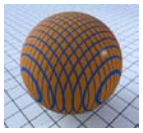
Type: The Grid can be generated in many different styles. These styles are determined by the Type setting. The various options include 'Line', 'Triangle', 'Square', 'Hexagon', and 'Cube'.



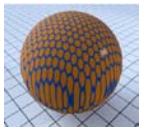
Line — This pattern consists of parallel straight lines. The orientation of the lines are determined by the Texture Locator Axis setting.



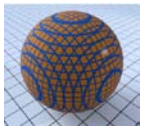
Triangle— This pattern interconnects the series of parallel lines with additional diagonal lines which intersect to create triangles.



Square— Two sets of lines running perpendicular to each other to create a square shaped grid. This is the default setting as it creates what we traditionally visualize when thinking of a "grid."



Hexagon— One series of parallel lines is intersected by a series of interconnecting lines which create hexagons at each of the intersection points.



Cube— This pattern is similar to Square with the key difference being that it is a truly three-dimensional texture with a third set of parallel lines that extend the texture back in the third dimension (whereas the Square pattern can be thought of as a two dimensional pattern that is extruded into the third dimension).

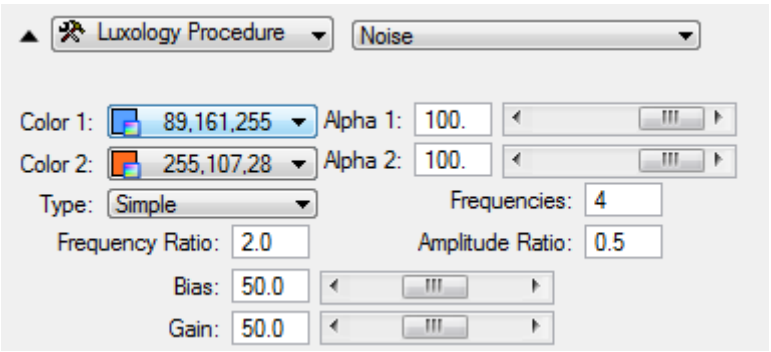
Line Width: This setting determines the width of the lines as a percentage of the texture area. Setting this value higher, results in thicker lines until the lines completely cover the surface at 100%. Reducing the value, results in thinner lines. (Tip: When using extremely small values to create very thin lines make sure to leave a small amount of Transition Width as this will provide an antialiasing effect on the fine texture.)

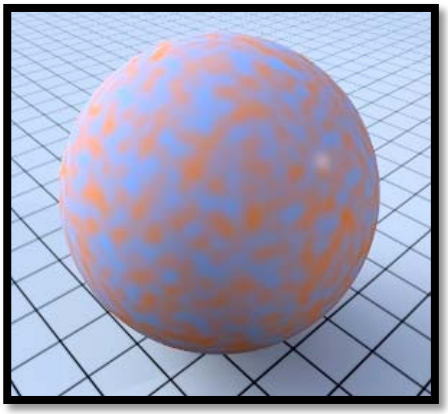
Transition Width: This setting determines the width of the gradient ramp between the line value or color and the filler value or color.

Bias: The bias control will cause the texture to "favor" either the Line or Filler value or color. By increasing the bias more of the Line value or color will appear while decreasing the number will force more of the Filler color into the gradient blend.

Gain: The gain control adjusts the falloff curve in the gradient ramp. Using a very high value closer to 100% will create a very sharp falloff at the edges of the gradient. In this case the falloff curve would be an s-curve with a sharp vertical line at the midpoint. Using small numbers closer to 0% will favor a mid-tone value. The s-curve used for the falloff in this case would have a long horizontal line.

Noise





The Noise texture has 2 zones, the Color 1 and Color 2. The texture will modulate between the two based on the particular algorithm and user settings. Essentially there are pseudo random points created in 3D space and the texture blends from one value to the next based on the proximity of one sample point to the next. Each zone can have a color and alpha value. Which of these are used is dependent on the Effect channel to which the texture will be applied.

For instance, if the texture is to be used as a displacement, the amount would be based on the grayscale value being utilized whereas setting the texture Effect to Luminous Color would use the Color and Alpha settings for Color 1 and Color 2. The Noise texture is incredibly versatile and can create effects ranging from clouds and mold to smoke and marble.

Color 1 (amount): Determines the magnitude of the texture at the center of each sample location. This value is blended into the Value 2 based on proximity to surrounding sample points. This control is only active when the texture layers Effect is set to a non-color attribute.

Color 1: Sets the color that will be used at the center of each sample location. This color is blended into the Color 2 value based on proximity to the surrounding sample points. The Color option is only used when the texture layer is set to an Effect that requires color.

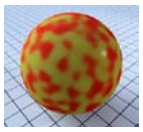
Alpha 1: Determines the alpha value of the texture to correlate with Color 1.

Color 2 (amount): Sets the value that will be used at the between the sample points. This value is blended into the Value 1 based on proximity to the surrounding sample points. The Value option is only used when the texture layer is set to a non-color attribute.

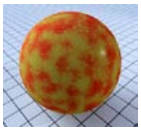
Color 2: Sets the color that will be used at the between the sample points. This color is blended into the Color 1 value based on proximity to the surrounding sample points. The Color option is only used when the texture layer is set to an Effect that requires color.

Alpha 2: Determines the alpha value of the texture to correlate with Color 1.

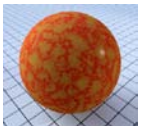
Type: The Type popup allows you to quickly change between the styles of Noise. The options are Simple, Fractal and Turbulence.



Simple — Simply modulates between Color/Value 1 and Color2/Value 2 and does not allow for additional Frequencies to be added preventing it from becoming “fractal”.



Fractal — Unlike Simple, Fractal also allows for Frequency settings above 1. Once additional frequencies are added to a noise or cellular pattern then becomes “fractal”. Each additional frequency of the texture is layered over the previous. The relative detail and amplitude of the additional frequencies is modulated by the frequency and amplitude ratios.



Turbulence — The Turbulence setting is very similar to the Fractal setting but the gradient ramp between the between the two Color/Value modulates up and down rather than a straight ramp.

NOTE: All “noise” style procedurals can be “layered” to create a fractal effect. The traditional style of fractal includes layering a noise pattern multiple times with each new layer increasing in frequency (smaller details and more of them) and fading in value. When you add a Luxology Cellular or Noise texture the default settings are not “fractal” in that they only use a Frequency value of one, this means there is only one “layer” of the procedural effect. Adding multiple frequencies will create a more fractal look to the texture and will invoke the Frequency Ratio and Amplitude Ratio controls.

Frequencies: Determines the number of “layers” used by the procedural. When set to less than 2 the Frequency and Amplitude Ratios are disabled. Adding more than one frequency increases the detail in the procedural texture which increases computation times.

Frequency Ratio: The Frequency Ratio determines how much detail to add into each additional application of the noise texture when the Frequencies value is set to a value greater than 1. The default value of 2 will result in the second frequency of the texture being twice as high as the first. The visual effect of this is a pattern that seems to be half as large but with twice as many occurrences. With more than 2 frequencies each additional “layer” of the noise will have twice the frequency of the last.

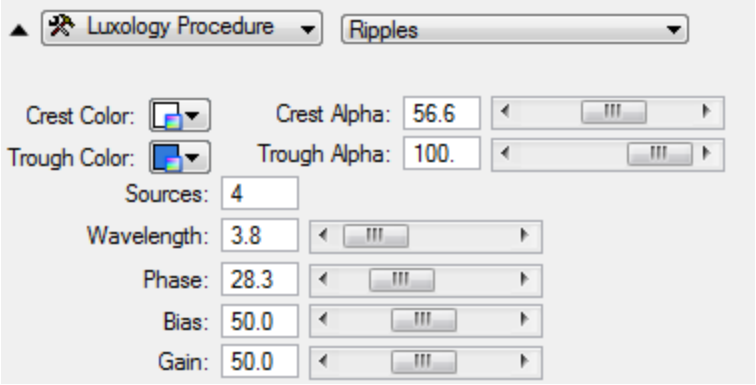
Amplitude Ratio: This value determines the strength of each additional “layer” of noise when frequencies are greater than 1. By default the setting is at .5 which yields an effect where each additional set of frequencies have half the value of the previous.

Bias: Increasing this value will cause the texture to favor the primary color or value over the Filler whereas decreasing the value causes the secondary color or value to be favored.

Gain: The Gain setting is similar to a gamma control that affects the falloff of the gradient ramp between the cell and filler values. Setting the Gain to 100% will create a very sharp falloff effect whereas setting the value to 0 would create a plateau around the value or color mid-point with sharp falloff on either extreme of the gradient.

Ripples

Like raindrops on a puddle, the procedural texture Ripple creates a series of concentric circles that originate within a given area and continue outward toward infinity. The texture scale determines the area where the ripples will originate, while Sources, Wavelength and Phase determine the specific look of the ripples. The Ripple texture is a good choice when you need to simulate undulating waves.



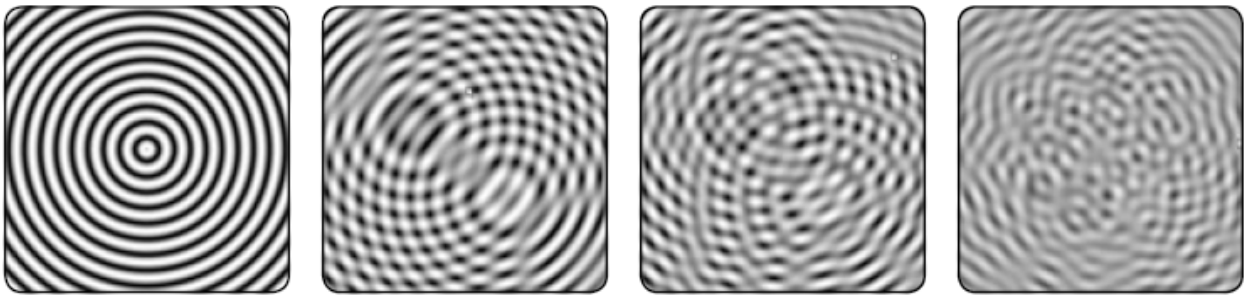
Crest Color: Only available when Ripple is applied to a color channel, such as diffuse color, 'Crest Color' will allow you to specify the RGB color value for what would be the top part of the wave along with its own Alpha value that ramps toward the trough determining how transparent the Crest will be.

Crest Color (amount): Only available when Ripple is applied to a non-colored channel, such as bump or displacement, the 'Crest Value' will specify the intensity or height of the top of the wave.

Trough Color: Only available when Ripple is applied to a color channel, such as diffuse color, 'Trough Color' will allow you to specify the RGB color value for what would be the lowest part of the wave along with its own Alpha value that ramps toward the crest determining how transparent the trough will be.

Trough Color (amount): Only available when Ripple is applied to a non-colored channel, such as bump or displacement, the 'Trough Value' will specify the intensity or depth of the bottom of the wave.

Sources: The 'Sources' value determines the number of ripple generators your surface will have, greater numbers give more complex rippled surfaces, while lower numbers will more obviously show the concentric circles the ripples are made from.



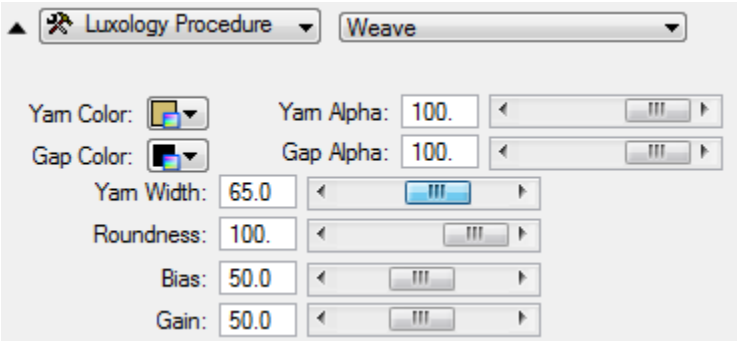
Illustrated from left to right is 1 source, 2 sources, 3 sources and 8 sources

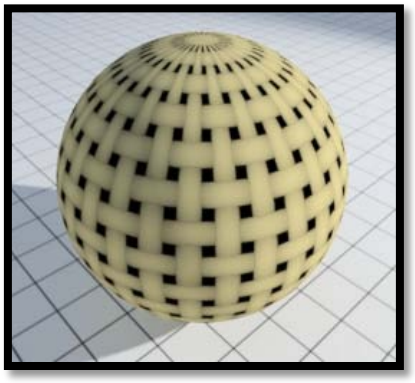
Wavelength: The 'Wavelength' value determines the distance between each ring. Higher values will move the rings further away from each other, while lower rings will increase their frequency, moving them closer together.

Phase: The 'Phase' value determines the position of the wave as it radiates from its center point. Animating this value in the negative direction would cause the waves to move outward, and in the positive direction to move the waves inward.

Weave

The 'Weave' procedural texture simulates woven yarn, in a basic basket-weave pattern. A series of parallel rows, combined with columns that thread over and under alternating rows forming the basic pattern. Yarn Width and Roundness control the look of the actual woven strands.





Yarn Color: Only available when Weave is applied to a color channel, such as diffuse color, 'Yarn Color' will allow you to specify the RGB color value for the columns and rows of virtual yarn along with its own Alpha value determining how transparent the Yarn will be.

Yarn Color (amount): Only available when Weave is applied to a non-colored channel, such as bump or displacement, 'Yarn Value' will determine the intensity or height of the columns and rows of the virtual yarn.

Gap Color: Only available when Weave is applied to a color channel, such as diffuse color, 'Gap Color' will allow you to specify the RGB color value for the spaces between the virtual yarn along with its own Alpha value determining how transparent the gaps will be.

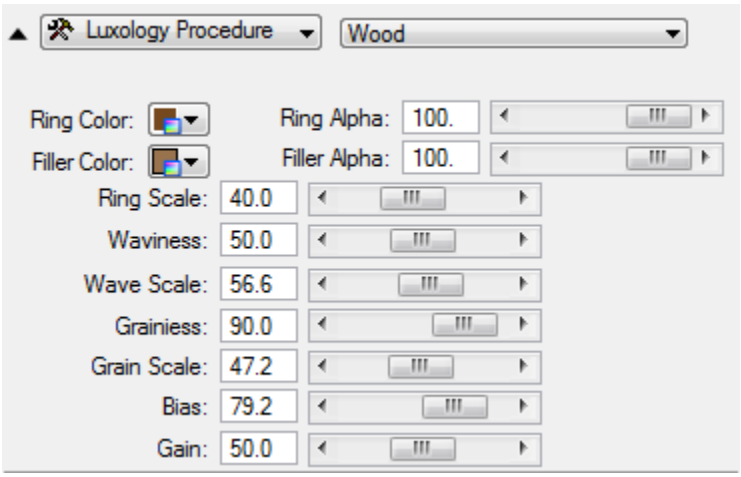
Gap Color (amount): Only available when Weave is applied to a non-colored channel, such as bump or displacement, 'Gap Value' will determine the intensity or depth of the gaps between the virtual yarn.

Yarn Width: The 'Yarn Width' setting determines the thickness of the virtual columns and rows of yarn. A value of 100% will completely eliminate the adjoining gaps looking like a tightly woven basket, while smaller values will simulate loosely woven meshes such as a net or screen.

Roundness: The 'Roundness' setting determines how round the strands of virtual yarn look, A value of 0% would leave the strands completely flat while a value of 100% would render them as if tiny woven tubes.

Wood

The Wood procedural is an effective texture that is designed to simulate wood grain. Of course, like any good procedural, the Wood texture can be used for effects far beyond its simple namesake. The texture is composed of Rings which are distorted by "waves" and a layer of noise. This creates a combination of effects to simulate the wood grain pattern quite nicely.



Ring Value: Determines the strength of the texture where the ring patterns occur.

Ring Color: Determines the color of the texture where the ring patterns occur.

Ring Alpha: Determines the alpha value of the texture where the ring patterns occur.

Filler Value: Determines the strength of the texture between the Rings.

Ring Color: Determines the color of the texture between the Rings.

Ring Alpha: Determines the alpha value of the texture between the Rings.

Ring Scale: This percentage value determines the size of the rings in the texture.

Waviness: This percentage value drives the amount of distortion that will occur to the rings in the texture.

Wave Scale: This percentage value sets the size of the wave distortion that is used to deform the rings in the texture.

Graininess: This percentage value determines how visible the grain effect is when it is composited with the ring texture. Decreasing the graininess value will result in a more subtle grain appearance.

Grain Scale: This value determines how large the grain spots are.

Bias: Increasing this value will cause the texture to favor the Ring color or value over the Filler whereas decreasing the value causes the Filler color or value to be favored.

Gain: The Gain setting is similar to a gamma control that affects the falloff of the gradient ramp between the rings and filler values. Setting the Gain to 100% will create a very sharp falloff effect whereas setting the value to 0 would create a plateau around the value or color mid-point with sharp falloff on either extreme of the gradient.

Diffuse map icon

Defines whether or not a diffuse map is used by the material. Click the arrow icon to open a menu with the following options:

On  A diffuse map, if defined, will be used in the material. Hovering the pointer over the diffuse icon will display the name of the current diffuse map.

Click the icon to open the Open Image file dialog, which lets you select an image file for use as a diffuse map. After selecting the image file, the Map Editor dialog opens, which lets you edit the settings for the diffuse map. This includes options for selecting an image file, a procedure, or a gradient.

The Diffuse amount map acts as a multiplier for the diffuse color setting. Applying a diffuse map will give an effect where the material has no diffuse reflectance where the pixels of the map are black, up to the amount specified in the material where the pixels are white. A diffuse map can be used in conjunction with a pattern map to give more contrast to the diffuse reflection.

Wood floor with no diffuse map (left) and with simple scuff mark (gray scale) diffuse map (right)

Off  No diffuse map will be used by the material.

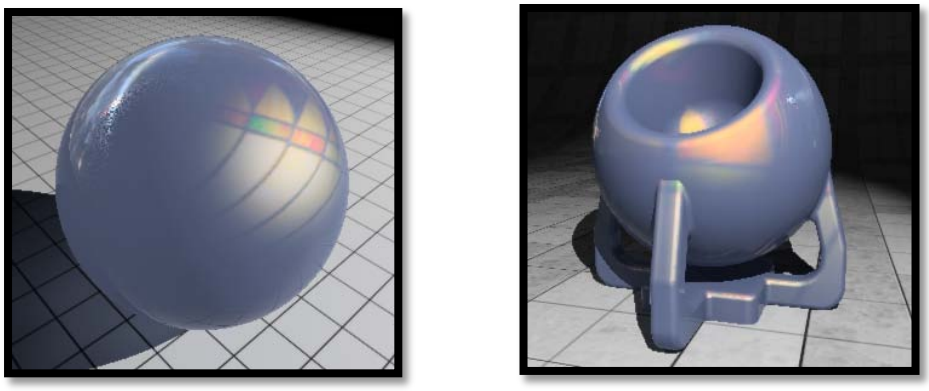
 Link to pattern | bump | specular | reflect | opacity | translucency | finish

Links Diffuse mapping to the selected map or setting.

Unlink — (Available only if the Diffuse map currently is linked another map or setting) Lets you unlink the Diffuse setting.

Specular Color maps

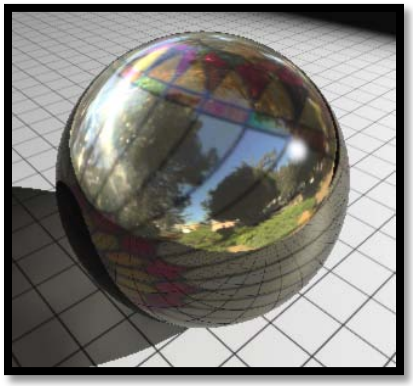
A Specular color map can be used instead of a solid color to define the specular color for a material. In the image below, the surface has a solid diffuse color but a specular color map is assigned. If a surface is reflective, then the specular color map can be linked to reflect color.



Example Widgets using solid color and tiffany lamp pattern for specular color

Reflect Color maps

A reflect color map can be used to vary the reflection color of a surface. In addition to selecting a color or map, you can also link the reflection color specular colors. By default, this is linked to Specular.



Tiffany lamp pattern used as reflection color map

Finish Maps

(Enabled only when Finish is set to Custom and has a value greater than zero) Lets you link Finish to a map or other settings. Click the arrow icon to open a menu with the following options:

On 

A pattern map, if defined, will be used with Finish. Hovering the pointer over the pattern icon will display the name of the current pattern map.

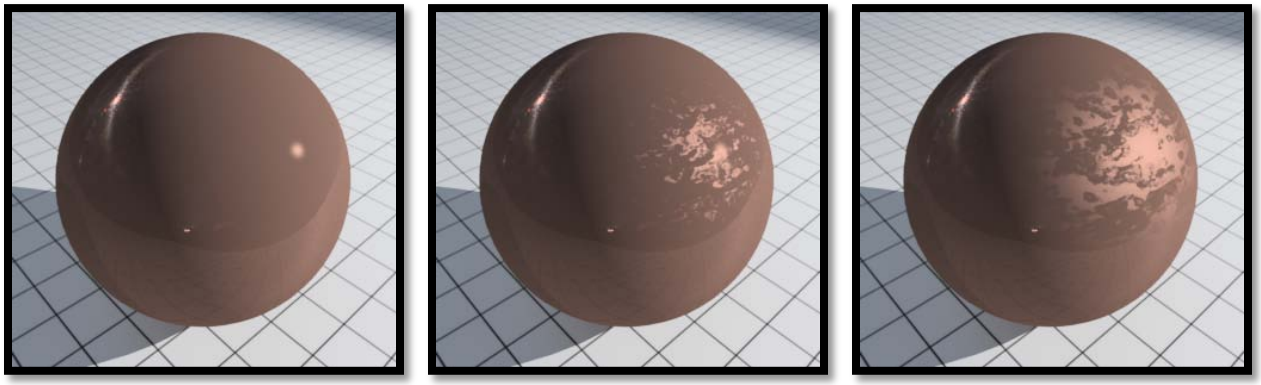
Click the icon to open the Open Image file dialog, which lets you select an image file for use as a pattern map. After selecting the image file, the Map Editor dialog opens, which lets you edit the settings for the pattern map. This includes options for selecting an image file, a procedure, or a gradient.

Off — Turns off Finish mapping.

Link to pattern/bump/specular/reflect/opacity/translucency

 Links Finish mapping to the current pattern or bump map, or to the setting for specular, reflect, opacity, or translucency.

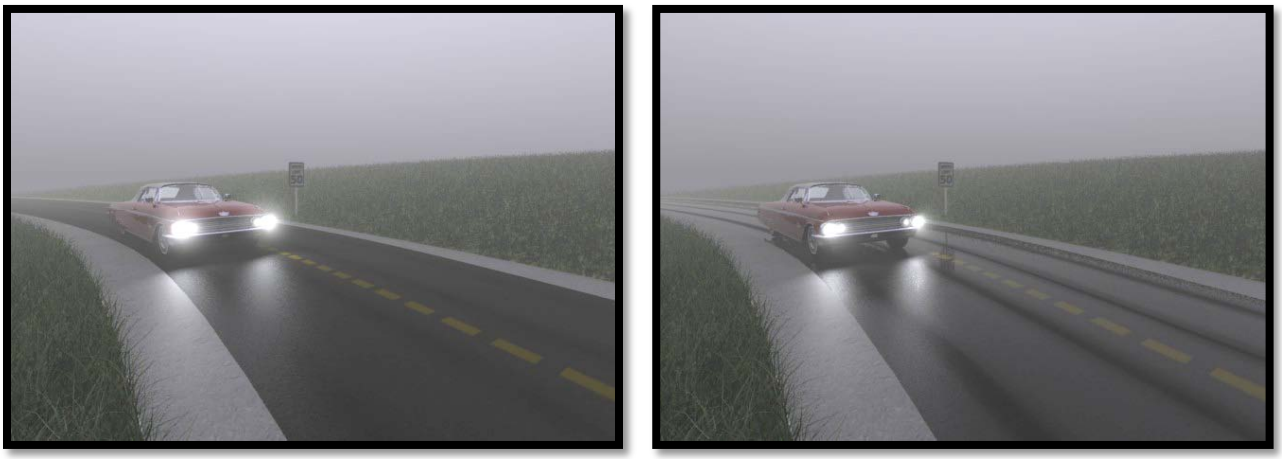
Unlink — (Available only if the Finish map currently is linked another map or setting) Lets you unlink the Finish setting.



Left image no finish map used center with map and right image with map inverted

Clear Coat maps

The clear coat map changes the perceived thickness of the clear coat lacquer effect. Being a value map, black pixels in the map apply a 0% clear coat, and white pixels apply the clear coat value defined in the material. The clear coat is reduced where the areas of the map are dark.



Left image with uniform clearcoating and right image with dry lines from clearcoat map

In the preceding example a clear coat map is used to modify the clear coating that is used to make the roadway look wet. By using a clear coat map we can vary the amount of clear coating and effectively add the dry lines where the traffic has been. Bump maps

Material definitions can include one or more bump maps, which can be any image (even the same image as that used for a pattern map). Brighter portions of the image are interpreted as high points, or bumps, and darker areas are interpreted as depressions or dents (this can be inverted in the bump map settings.)

Bump maps can be used with pattern maps to simulate realistic surfaces. For example, a material definition can use a bricks and mortar pattern map, along with the equivalent bump map, to produce realistic bricks and mortar.

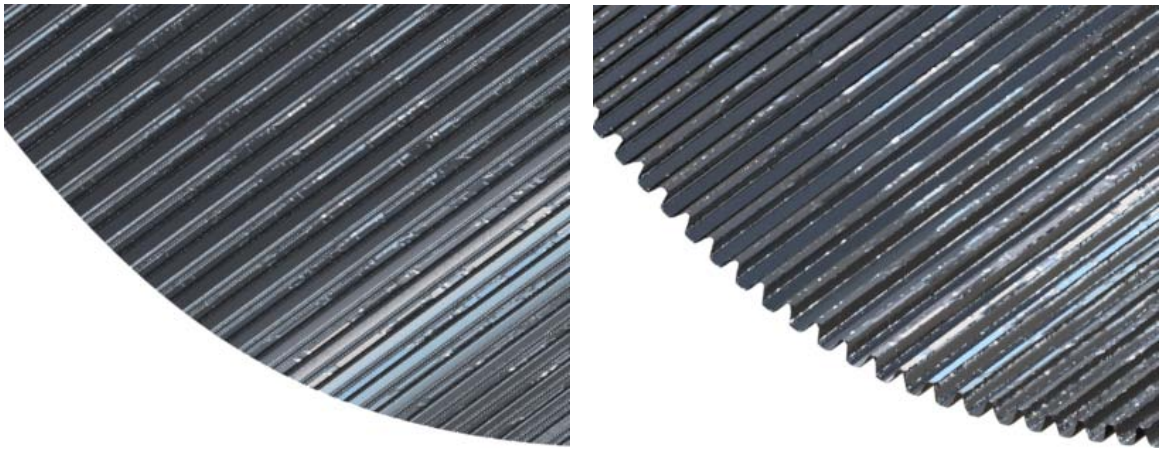
Surface modifiers

Bump Maps

Bump map can add realistic 3D effects to materials without the need to create the geometry. For example, a bump map included in the material definition of a brick wall will produce realistic brickwork in the rendered image without you having to model the bricks and mortar.

Left no bump map, middle with bump map and right brick texture with bump map

Where bump maps are unrealistic, however, is at the edge of geometry. At these locations, the line of the underlying geometry displays, rather than the bump map. Displacement maps, on the other hand simulate the geometry used to create them in the first place, and display the displacement map geometry in place of the underlying element. The following image shows this clearly, where the left image has a bump map applied and the right image uses a displacement map.



How Displacement maps work

When using displacement maps the displacement procedure creates additional geometry in the scene at render time. This means that this new geometry will be added to the calculation of light, materials and visibility. Displacing geometry in a scene can increase the render time significantly especially if its in high quantity.

Tips for using Displacement Maps

Because displacement maps require extra memory and processing time, care should be taken with using them. Typically:

Use Displacement Maps only when needed.

If a Bump or Pattern map give you the same result, then there is no need for a Displacement Map. Remember, normal Pattern and Bump maps are material properties, whereas a Displacement Map actually is new additional geometry.

Apply displacement on visible items only. If the beautiful wool rug you´re using in the interior shot is being displaced, but only a small strip of it is visible, then slice the rug and only apply the displacement to that small strip. Luxology rendering will have to calculate the displacement off screen if there are any refractive or reflective materials that may catch the displacement. If there aren´t any refractive or reflective surfaces, Luxology does not to have to calculate the off screen displacement.

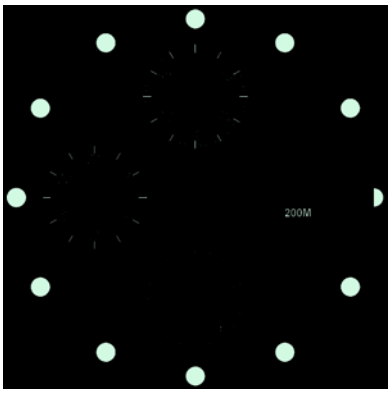
Adjust the displacement settings in the Render settings properties tab to suit the need of the rendered shot. The default Displacement Rate of 1.0 may be more than what is needed for the render. Try increasing this setting to 1.5 or 2 and do a preview or region test render.

Slice up displaced geometry to smaller physical segments. This helps Luxology in utilizing memory management at render time and will decrease render times. There is no need to over do it as you will increase your render times if the polygon count goes too high. A little hit and miss experimentation in the scene will help you in the long run.

Glow maps

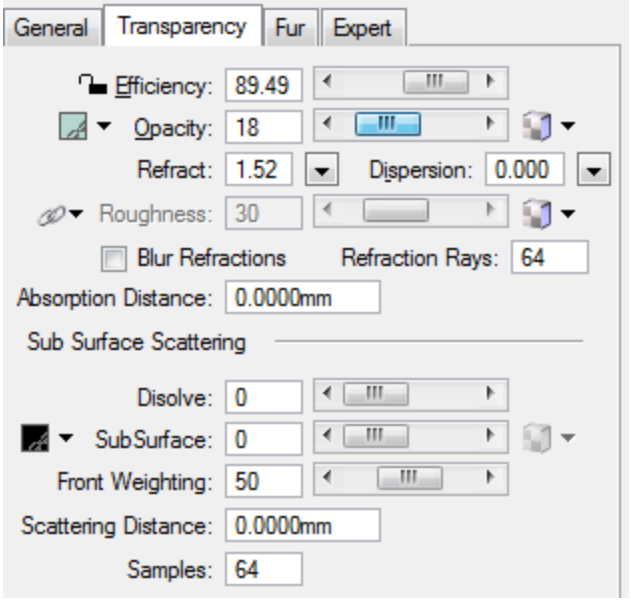
The pixels in a glow map specify the fraction of glow emitted by the surface at that point up to 100%, which uses the value of glow defined in the material.

For example by using the following grayscale image the amount of glow is varied by the map, where the image is white the glow value is 100%, where it is black the glow amount is zero. You can see in the rendering how this glow map affects the outcome of the rendering.



Glow map image left and rendering using the material right

Transparency Tab (Advanced mode Only)



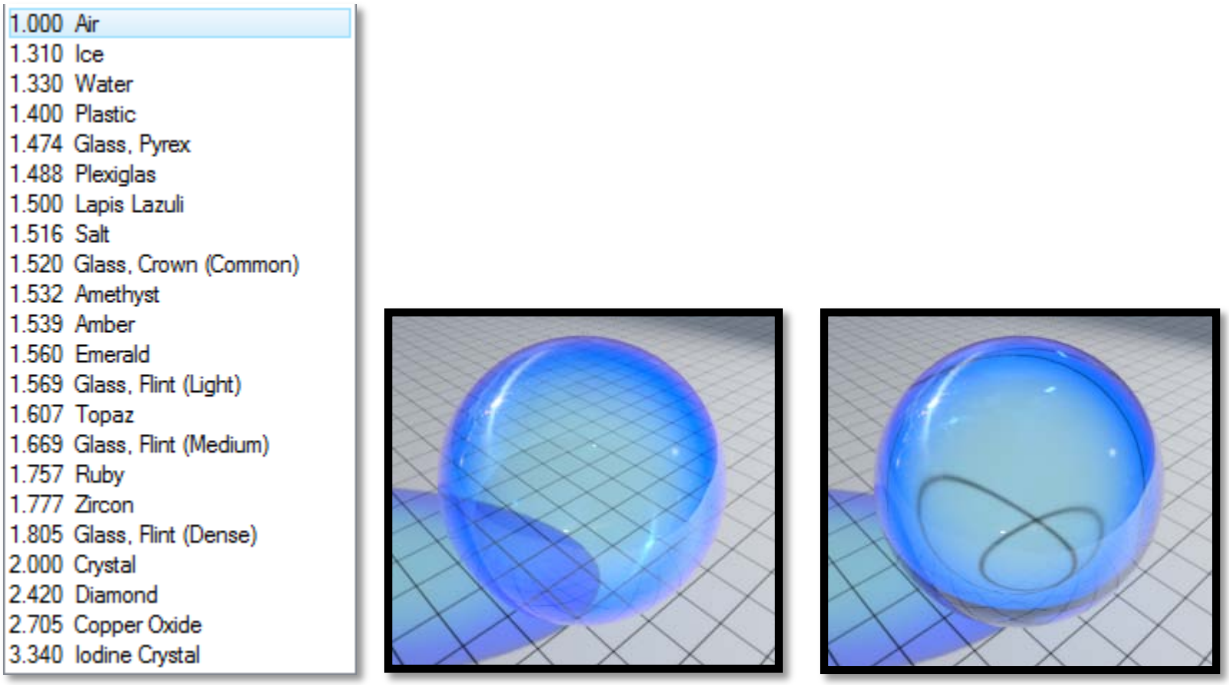
Opacity

Defines the percentage of incoming light that is not transmitted directly through the material. Values may range from 0 (Clear) to 100 (Opaque) and may be keyed in to the text field, or adjusted using the slider.

Refract

(Visible only when additional opacity properties are displayed and enabled only when Opacity has a value less than 100) Sets the index of refraction, which controls how much the light changes direction as it passes through a transparent material. Values range from 0.1 to 3.0. A value of 1.0 causes no change of direction.

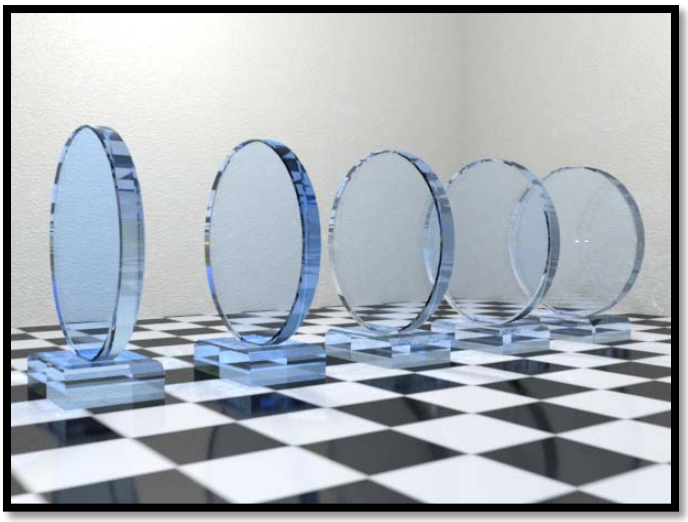
Values may be entered in the text field, or selected from the option menu which opens when you click the arrow icon. This provides several standard values for refraction — Air, Water, Plastic, Glass, Crystal, Diamond.



Refraction options left, preview sphere with refract of 1.0(air) center and refract 1.474 right

Absorption Distance

Colored transparent surfaces don't often exhibit even coloration. Thin areas will appear colorless while thicker areas will tint with color. The 'Absorption Distance' controls this effect setting how far a ray must travel to get 100% of the Transparency Color. The falloff is determined by Beer's Law, just as in the real world. In the following example you can see the effects as the absorption distance is varied (diameter of glass is 125mm).



From left in millimeters 0, 50, 100, 150 and 200

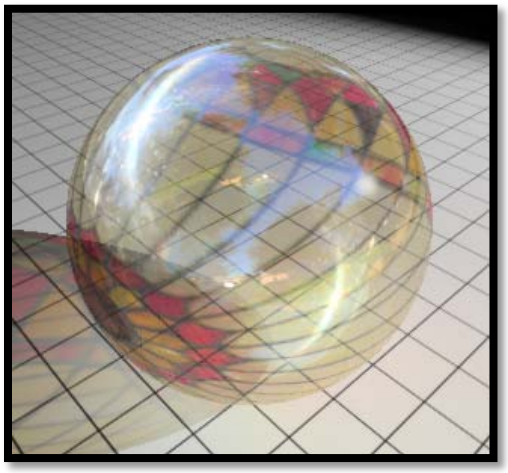
Opacity maps

Maps for Opacity vary the transparency across the material with the darker parts of the map being more transparent.

Opacity maps used for Stencil effect glass

Transparent Color maps

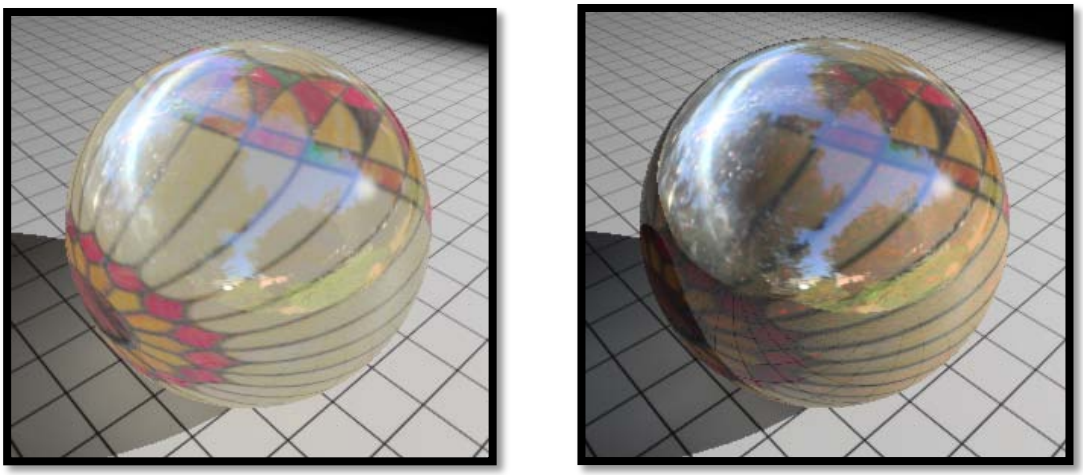
A transparent color map can be used to vary the transparent color of a surface. In addition to selecting a color or map, you can also link the transparent color to either the diffuse or specular colors. By default, this is linked to Specular.



Example of Transparent Color Map

Sub Surface Color maps

A Sub Surface color map can be used to vary the sub surface color of a surface. In the image below, a material is used with only a translucent color map. In addition to selecting a color or map, you can also link the translucency color to either the diffuse or specular colors. By default, this is linked to Diffuse.



Example of Sub Surface Color Map, Scatter Distance 1 meter left and 5MM right

Material lighting effects

Rendering relies on the reflection of light off surfaces in the design file. Material definitions include settings for various properties that affect the way that lighting is treated. Using the Material Editor dialog, you can specify settings that determine the appearance of materials in your rendered images, including applying maps.

Many settings are available that affect the appearance of materials. If you hover the pointer over these settings, in the Material Editor dialog, a tool tip displays a description of the setting.

Sub Surface Scattering

Dissolve

Enables the object using this material to be faded from view, higher values produce more fading. A Dissolve value of 100 means the object will completely disappear from view when rendered.

Sub Surface

Sub Surface controls the amount of light that illuminates the side of the surface opposite the light source. That is, the percentage of incoming light that is transmitted through the material and scattered in all directions as it exits the material.

Preview display

Additional options have been added to the material preview display. To the standard options of Sphere, Rectangle, Cylinder, and Cube, have been added Example Teapot, Glow Bulb and Glass. Examples for a palette are contained in saved views with names in the form of **$preview$***paletteName***$***exampleName*.

If *exampleName* is omitted, it will appear in the example list as "*Example*". For a palette named "*Woods*", all the following syntaxes are equivalent, and would appear as "*Example*".

$preview$Woods
$preview$Woods$
$preview$Woods$Example

To use multiple examples for a palette, any example after the first requires a unique number. For example:

$preview$Woods$Block
$preview$Woods$**1**Bench
$preview$Woods$**2**Door

To provide examples that would be used for all palettes, omit the palette name. For example:

$preview$ $**100**Torus
$preview$ $**101**Window

The following examples (for all palettes) currently provided by Bentley are included in "…\System\Materials\Bentley_Materials.dgnlib":

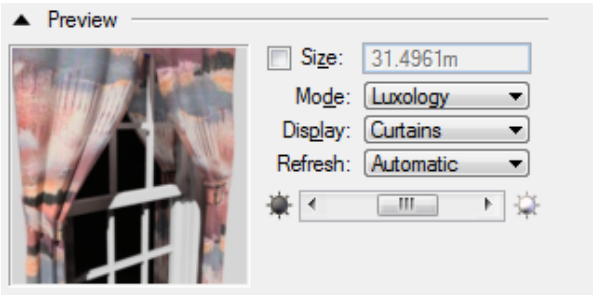
$preview$ $Sphere
$preview$ $1Rectangle
$preview$ $2Cylinder
$preview$ $3Cube
$preview$ $4Teapot
$preview$ $6Glow Bulb
$preview$ $7-Glass

You can override these by using the same numbers, or supplement them by adding unique numbers.

Working with preview displays

For the *Example* display item, the system looks for a saved view **$preview$**, first with the palette name suffix, and then without. For example, with the *Metals* palette, the first search is for a saved view named **$preview$metals**. If that is not found then **$preview$** is used.

This lets you create examples specific to the palette content. For example, the "Curtains" palette can display the curtain material as curtains on an example window.

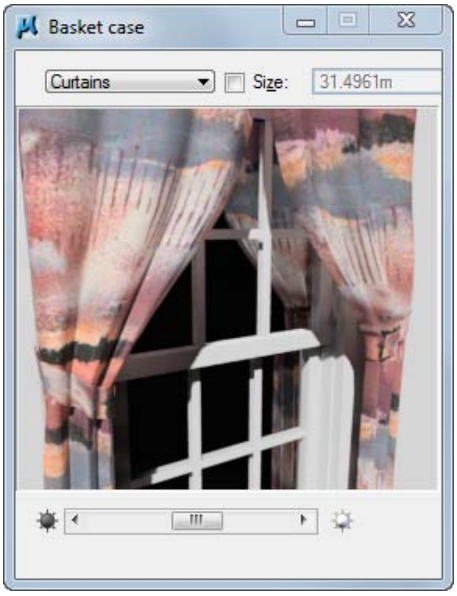


Example display for Curtains palette

Example saved views should each point to a unique model within the dgnlib. Within this model, any geometry that you want to display the preview material should have the material “preview” attached. When the example is displayed as a preview, the geometry with other materials will be displayed “as is” and geometry with “preview” attached will be displayed with the currently selected material.

Separable Preview Window

Double-clicking the Preview Window opens a resizable window displaying the preview and includes the Brightness slider, along with Display and Size settings. The name of the material displays in the window title bar. When this window is open, the original display is blanked. When you close the separate window, the preview again displays in the original preview window.



Material Editor separate Preview Window

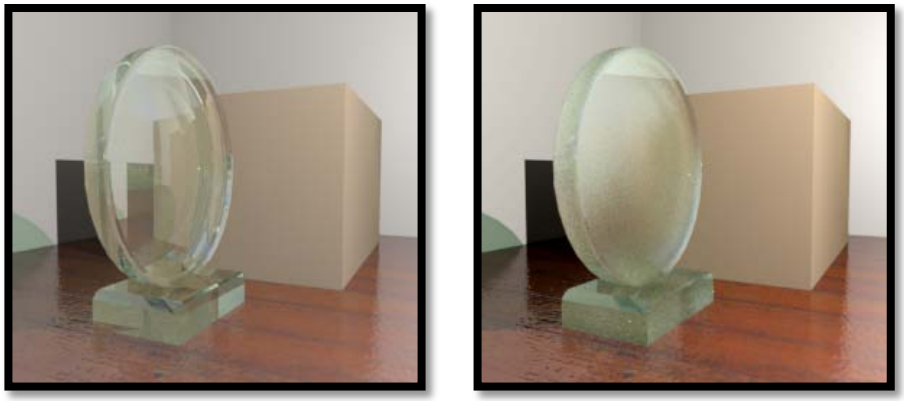
When you edit a material a new preview image that represents the current material is rendered and saved. This representation is stored within the DGN file for local materials and the images are stored in file with the extension of .pal_Previews for external palettes.

You can make adjustments to the Material Preview Render Setup and Environment Setup to increase the quality of your material previews (at the expense of render time). For Example you might create a glass palette where seeing the effects of caustics would be beneficial, in this case you could open the Material Preview Render Setup and enable Direct Caustics.

In the preceding material preview image in order to have a background visible through the window, the Material Preview Environment Setup was modified to make the environment image visible to the camera.

Blur Refractions and Refraction Rays

If Blur Refractions is enabled, items visible through the material are blurred. Refraction Rays sets how many refraction rays are used to create the blurring for rendering with Luxology.



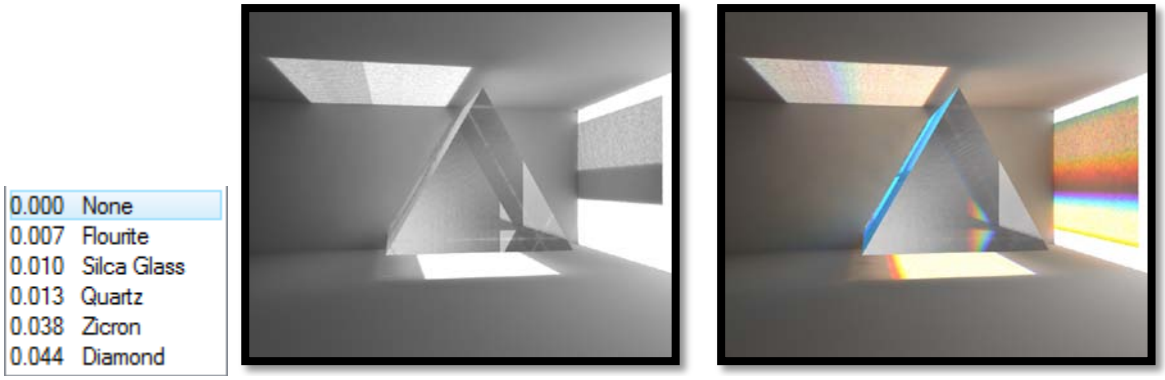
Transparent material with Blur Refractions disabled (left) and enabled (right)

Roughness of the blurry refraction is controlled by the refraction roughness value, found on the transparency tab when using the advanced mode of the material editor. The higher the roughness value, the rougher the surface, resulting in refractions that are more blurred.

Blurred refraction with Roughness set to 5 (left) and 20 (right)

Dispersion

Sets the amount of light separation on transmission through a material, such as occurs when light passes through a prism. A drop down list of common physically correct dispersion values are available to choose from by clicking on the down arrow to the right of Dispersion.



Dispersion options left, prism rendered without dispersion middle and rendered with dispersion added right

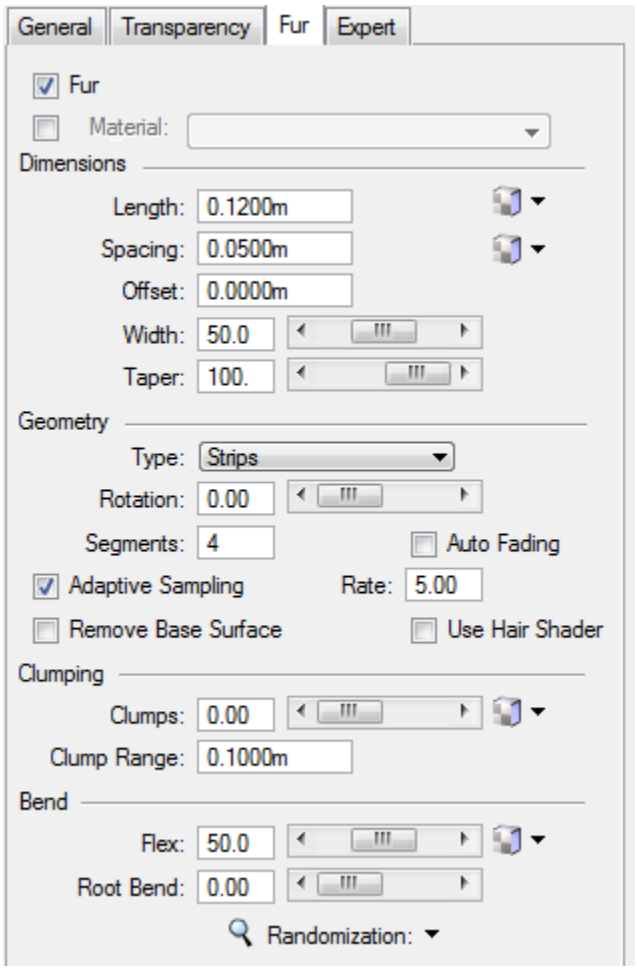
NOTE: To render dispersion effects you will need to use Direct Photon Mapped Caustics.

Material Editor Fur Tab

The Fur settings are now located on a tab rather than a pop down menu. By moving to a tabular format with the material editor we were able to add many addition material settings for fur and other settings as well.

When a surface with fur is rendered the Luxology rendering engine will create geometry representing the fur on each surface the material is on. This fur geometry uses a geometry cache, and this has a size setting which is now available in the "*Luxology Render Preferences*" dialog. The amount of memory used for fur creation is based on the number of fur strands which is defined by the fur spacing and length, the size of the elements the fur is placed upon and the number of segments each piece of fur contains.

It is possible that fur creation can exceed the geometry cache size. If this is the case the fur spacing should be increased and the number of segments should be decreased. This will help reduce the geometry cache size. If it is still not possible to render the scene due to the area of fur coverage being large then a different technique should be used.



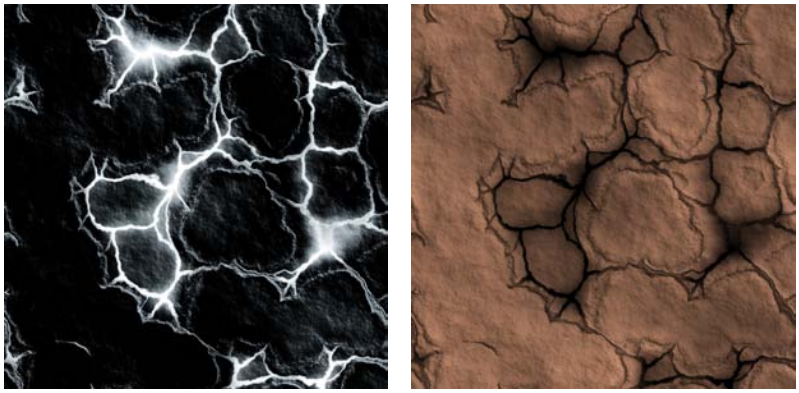
Fur

This toggle button enables fur for the material such that any element which uses the material in the design file will now be covered with fur as specified in the above dialog.

Material

You can now have a separate material for the fur strands. This allows you to create a realistic base (dirt) material for the ground and then have a realistic grass material that is applied only to the fur strands.

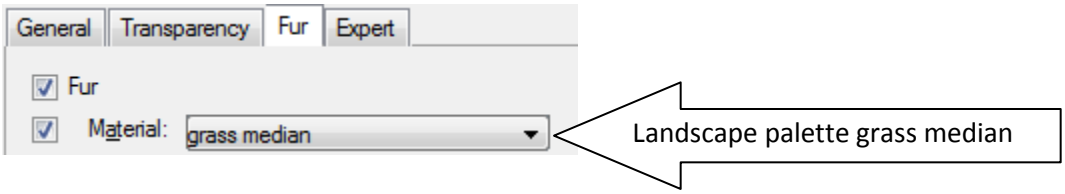
In the following example a realistic ground surface material was created. A custom fur length map was used to make the grass appear to grow only where the deep cracks appear.



Fur length map left and texture for ground material right

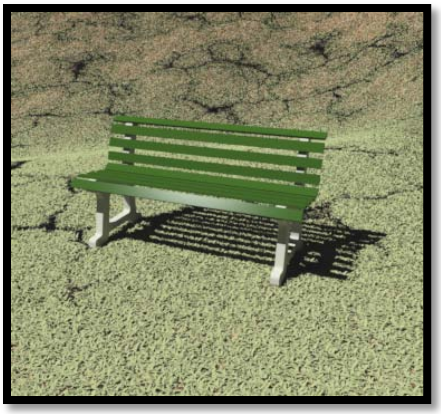
Without separate fur strand material left and with right

As you can see in the preceding images using the park material preview widget, the fur strands in the left image are from the initial texture and the fur strands are darkened by the underlying texture. In the right image the fur strands are using separate material and the fur strands are colored by the separate material. The fur strands in the right image are using “grass median” from the landscape palette in Bentley_materials.dgnlib.



Notice how the grass appears to gravitating toward the crevices, this effect is made possible by the fur Length Map. If the map were to be inverted you would have the no grass growing in the crevices as can be seen in the following image.

NOTE: Fur only grows in the direction that the surface normal is pointed.

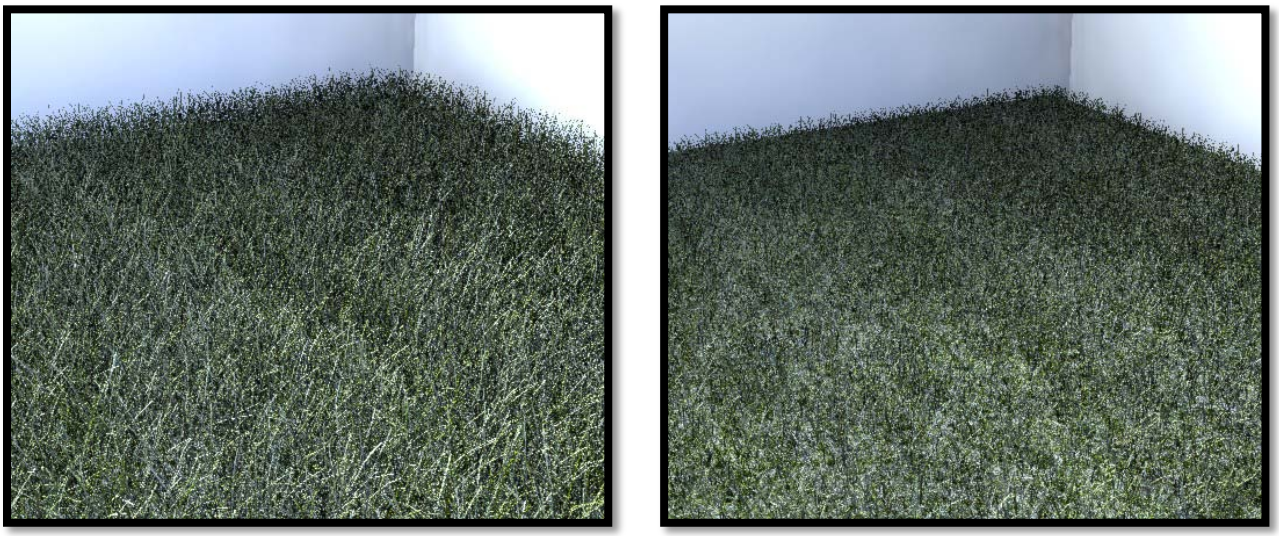


Inverted fur length map

Dimensions

Length

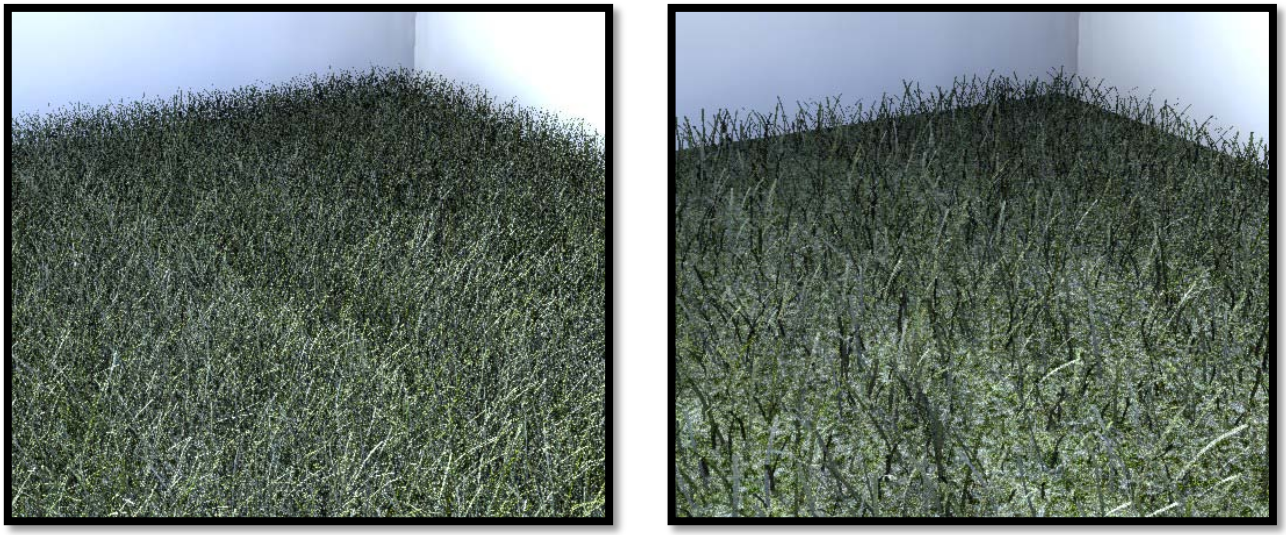
This is a master unit value which is the length of each individual fur strand. This value can be randomly modified by settings described further on in this section.



70mm length left and 30mm length right

Spacing

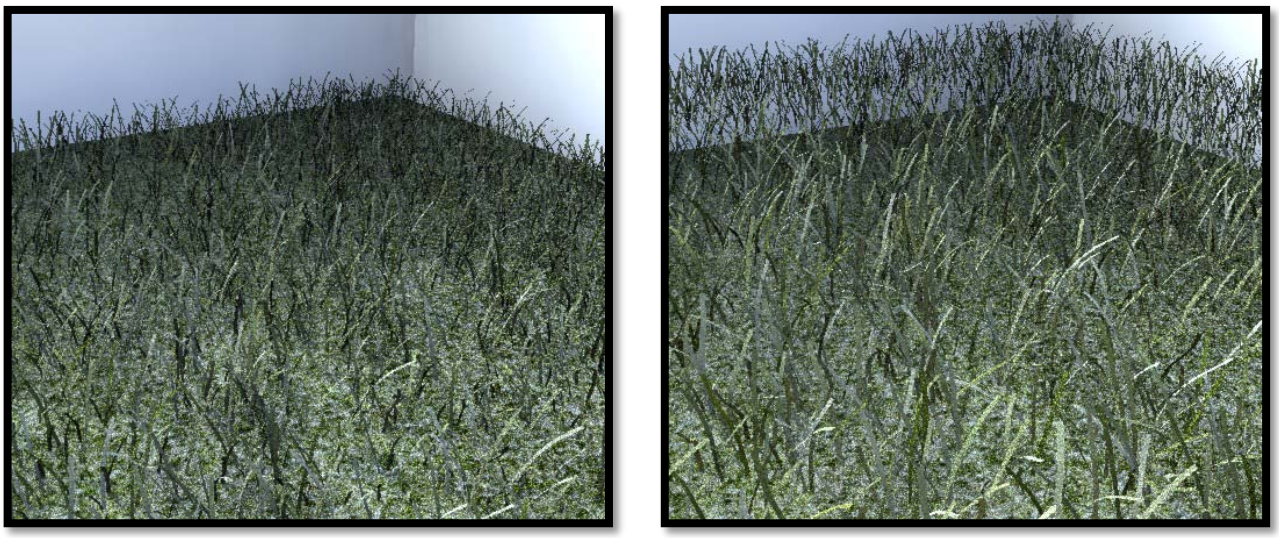
This is a master unit value is the spacing between individual strands of fur. The Randomization value can be modified in the Randomization Settings pop down menu.



5mm spacing left and 15mm spacing right

Offset

This is the offset distance the fur is created from the surface it is on. In the following images, the image on the left the offset is 0mm so the fur is on the surface and in the image on the right the offset is 100mm.



Offset zero on left and 100mm on right

Width

The width at the root of each fur strand is a percentage of the spacing between individual strands. In the following images the image on the left has width set to 10% and the spacing is set to 15mm making the width 1.5mm. In the image on the right the width is 50% making the width of the strand 7.5mm. Note that when fur spacing is large you can make your grass appear fuller by increasing the fur width to values above 100%.

Taper

The taper value allows the width of the fur strand to be reduced over its length. As can be seen in the in following images, the image on the left has a taper of 0% meaning the width of the root and tip of each fur strand is the same or 7.5mm in this case. In the right image a taper setting of 50% reduces the width to 3.75mm at the tip of the strand.

Taper set to zero left and 50% right

Geometry

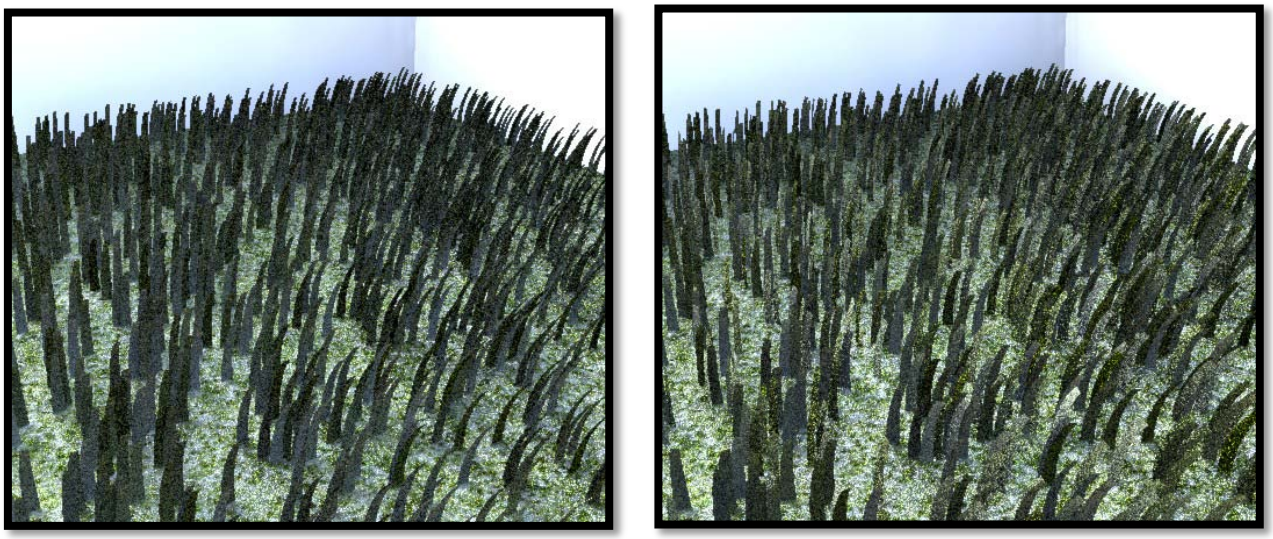
Type

There are 2 types of geometry which can be created for individual fur strands. All the previous images had their type set to strips (the most realistic and efficient option for grass). You may also set the type to be cylinders, where each fur strand is a cylinder as can be seen in the following image. Note using cylinders for fur requires more memory for the geometry cache and also takes longer to render individual images.

Type set to Cylinders

Rotation

This value will randomly rotate individual fur strands at their root. A value of 100% will give a random rotation of up to 180 degrees.



Strip rotation zero on left and 50% on right

Segments

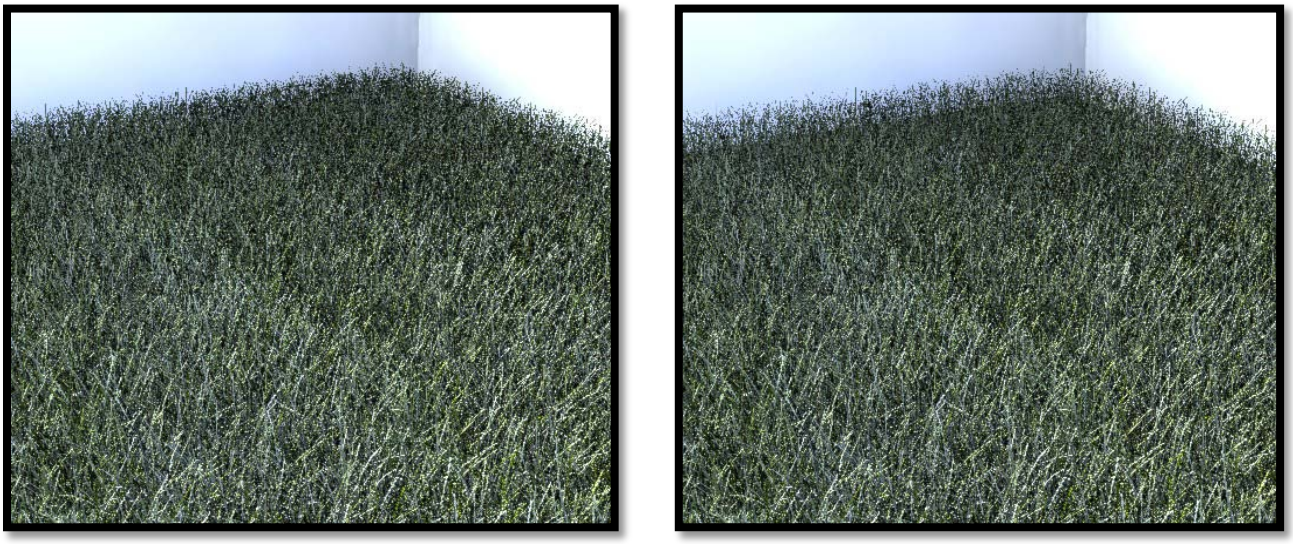
This is the maximum number of sections which make up a fur strand. A strand which has more bend will require more segments in order to display smoother curvature. Using more segments will generate more polygons at render time and consume more memory.

Auto Fading

Auto Fading should generally be enabled only when animating scenes that use fur materials to prevent fur strands from popping in or out between frames.

Adaptive Sampling

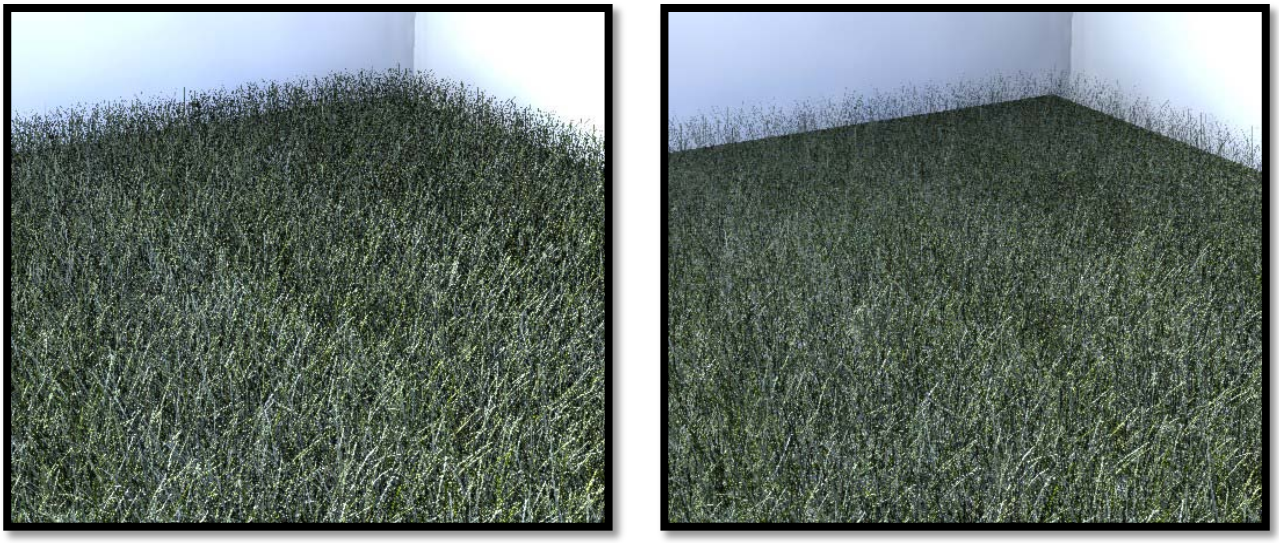
Enabling this toggle will decrease the density of the fur as it recedes away from the camera, reducing the overall memory requirement for the fur geometry. This setting is used in conjunction with the Fur Rate setting. As you can see in the following rightmost image the amount of fur is reduced the further away from the camera it is. We highly recommend that you enable adaptive sampling when using fur materials to prevent



No adaptive sampling on left and with adaptive sampling on right

Rate

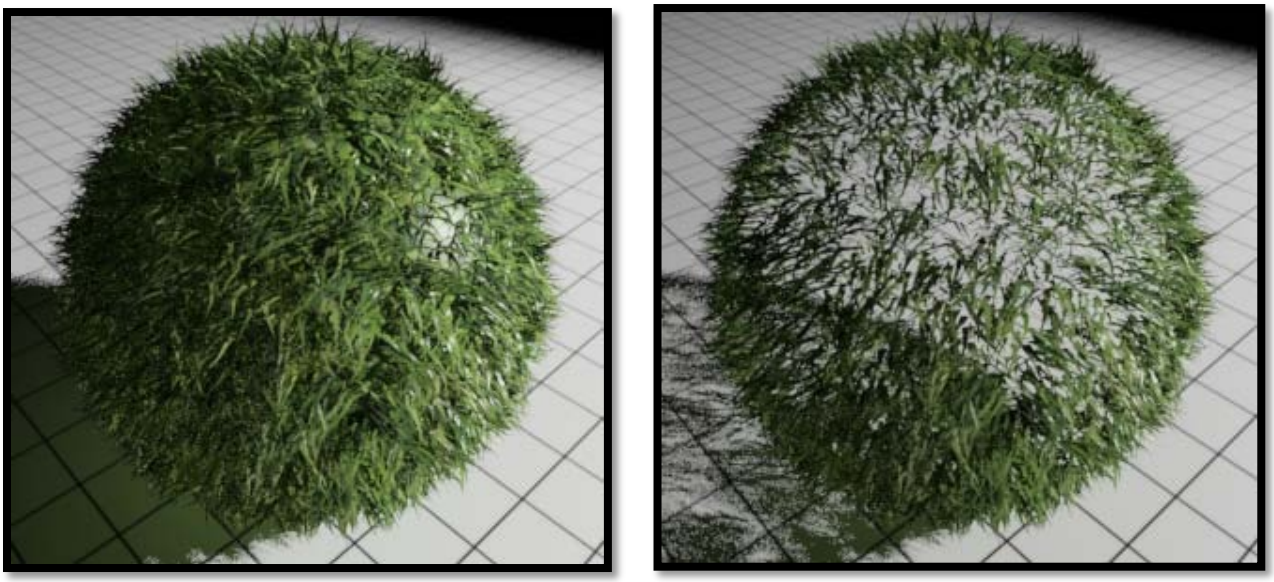
This setting specifies a threshold that Adaptive Sampling uses to reduce the number of fur strands. This is calculated as an average distance in pixels between 2 fibers. This setting is best used when there are large numbers of fur strands which recede into the distance i.e. grassy fields. Larger values for fur rate increase the amount of reduction of the fur density with distance from the camera



Fur rate of 4 on left and 8 on right

Remove Base Surface

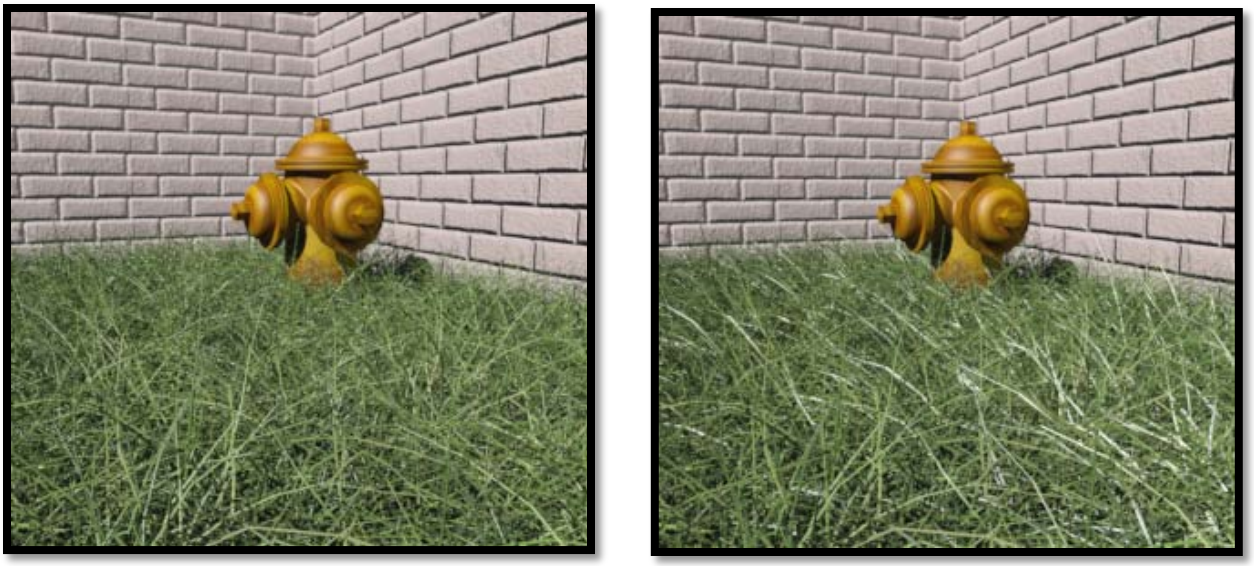
When "Remove Base Surface" is enabled only the fur strands are visible in the render and the base surface does not appear.



Left without remove base surface enabled and right with remove base surface enabled

Use Hair Shader

When "Use Hair Shader" is enabled, the specular shading normal is rotated toward the camera creating highlights that run parallel to the fur direction providing an overall more realistic 'hair' type highlight. Generally speaking you would not enable Use Hair Shader unless the geometry type is set to cylinders.

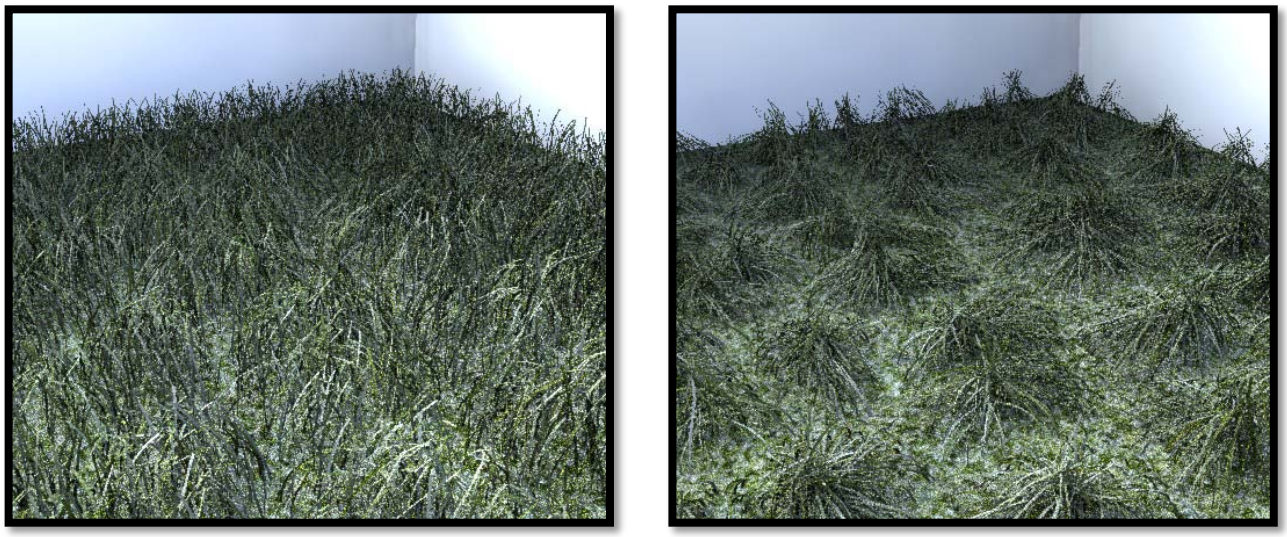


Without "Use Hair Shader" left and enabled right (Geometry Type set to Cylinders)

Clumping

Clumps

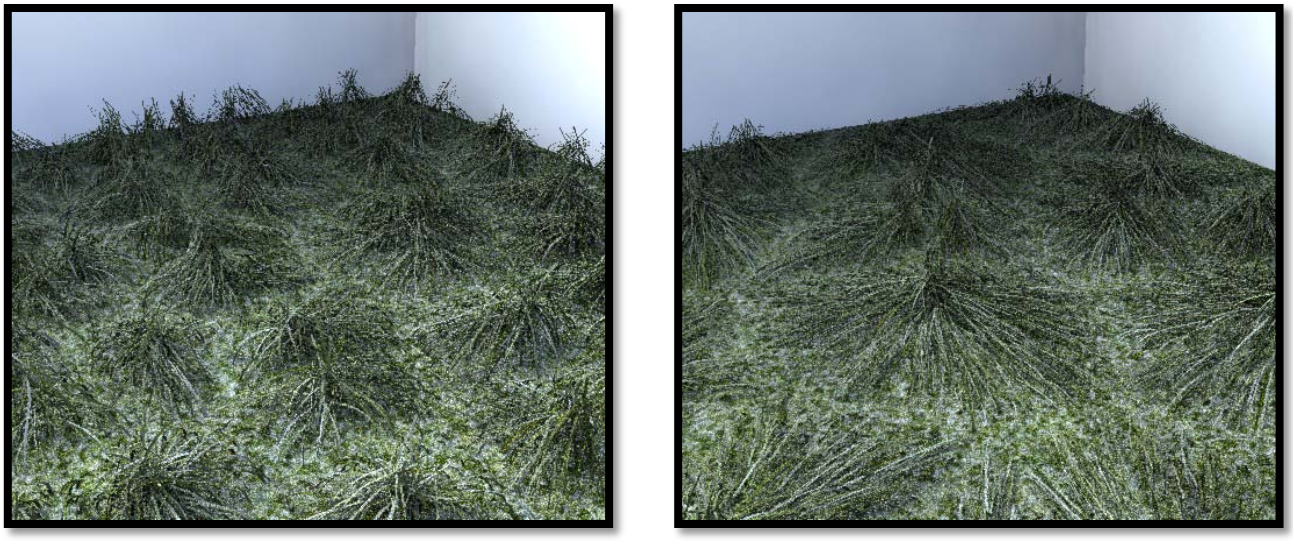
This is the effect of small groups of fur strands gathering together in small groups. Higher values of this setting will cause a tighter grouping of the strands.



Clump value of 10% on left and 60% on right

Clump Range

This distance sets the average area of fur strands which will gather together and is based on the Clump percentage.

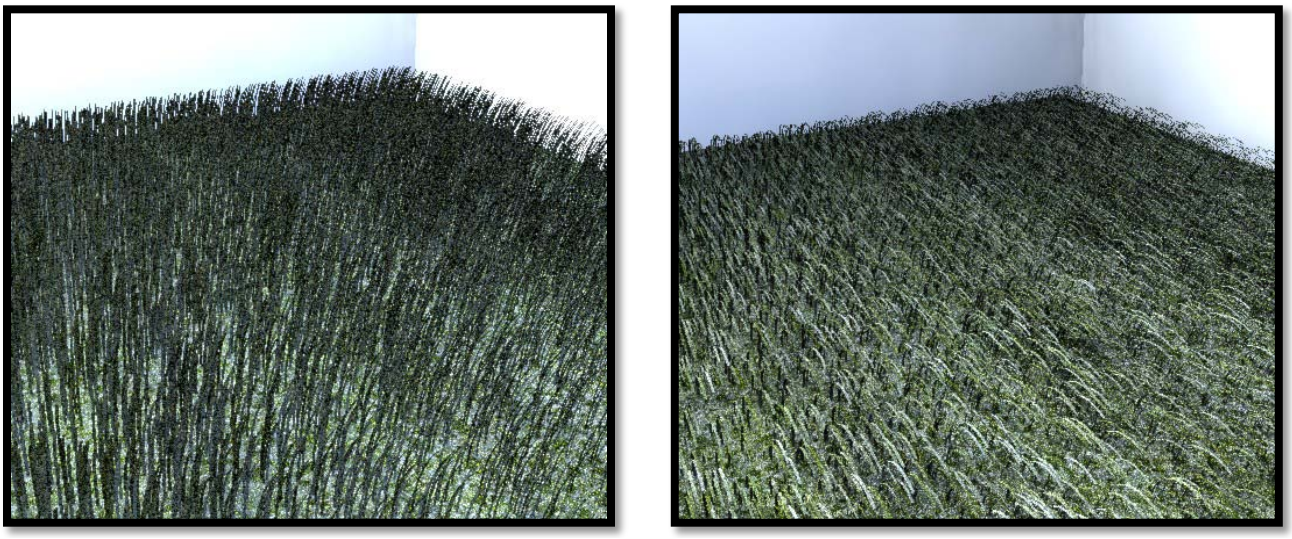


Left with clump range of 100mm and right 200mm

Bend

Flex

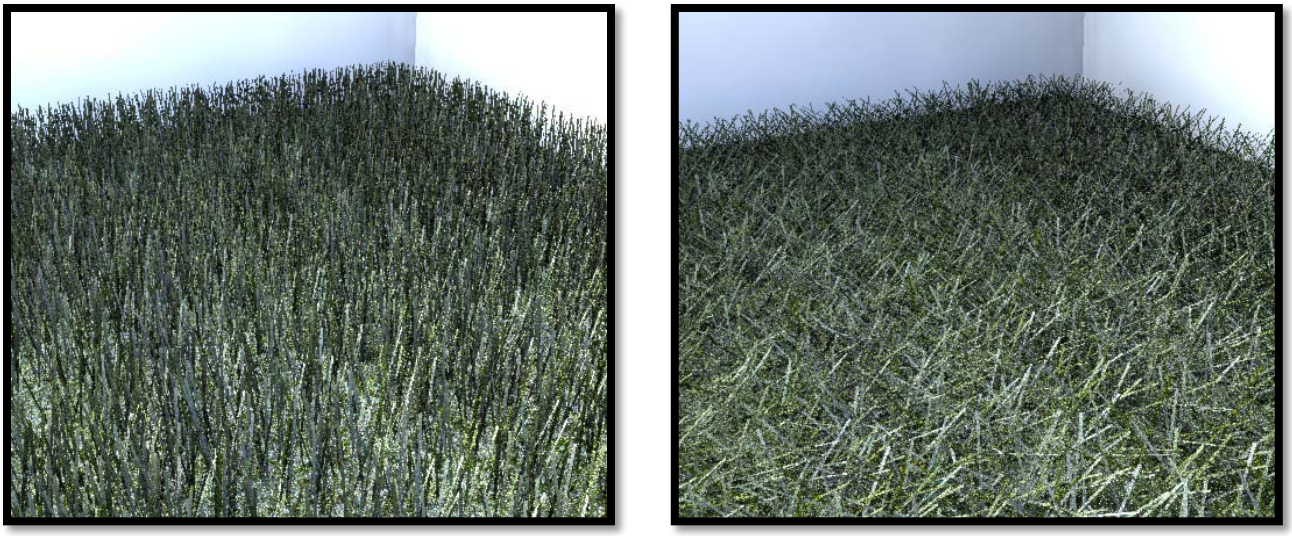
This setting causes individual fur strands to bend. A value of 0 will produce straight fur strands and a value of 100% will cause the fur strand to bend 180 degrees.



Left fur flex of 20% and right fur flex of 60%

Root Bend

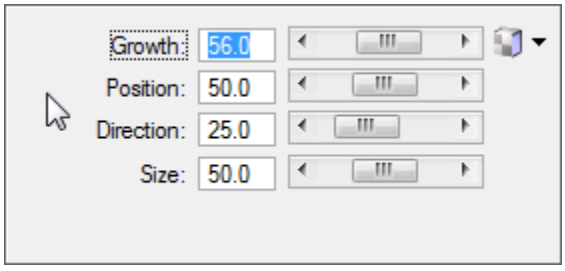
When this value is 0% the direction of the fur strand is based on the smoothed polygon normal at the base of the fur strand. As the value is increased to 100% the fur strands lay over towards the surface in the direction of the fur growth.



No root bend left and 50% root bend right

Randomization Settings

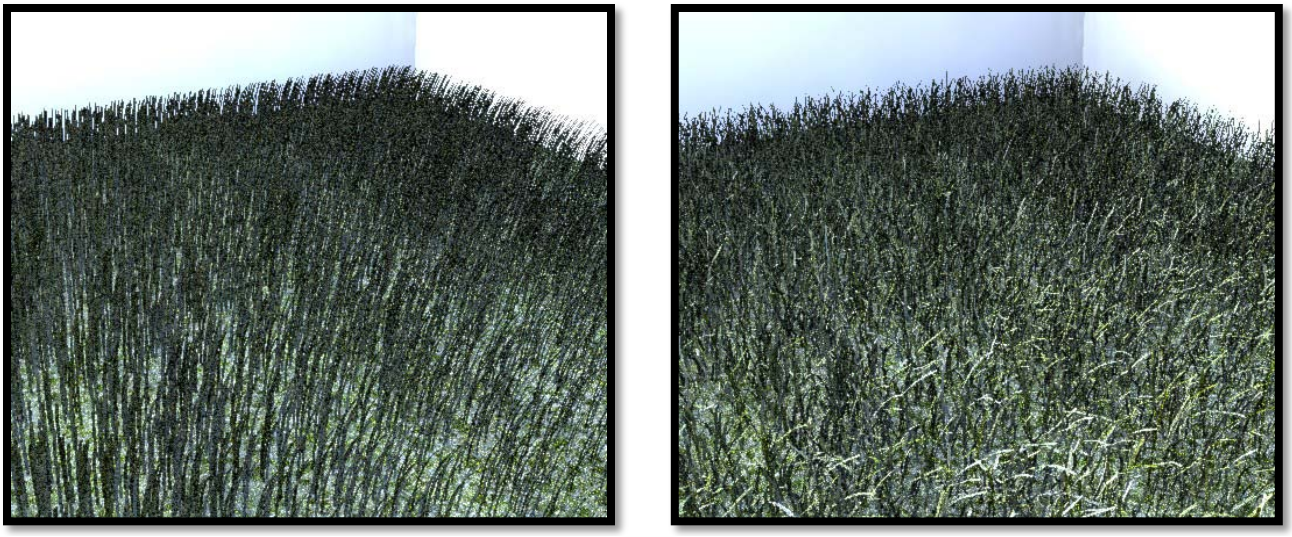
There are four randomization settings that can be accessed through the use of a pop down menu located on the Fur tab below the Bend options.



Randomization Settings Pop Down Menu

Growth

This value will increase the randomness of the growth of the fur strand along its length.



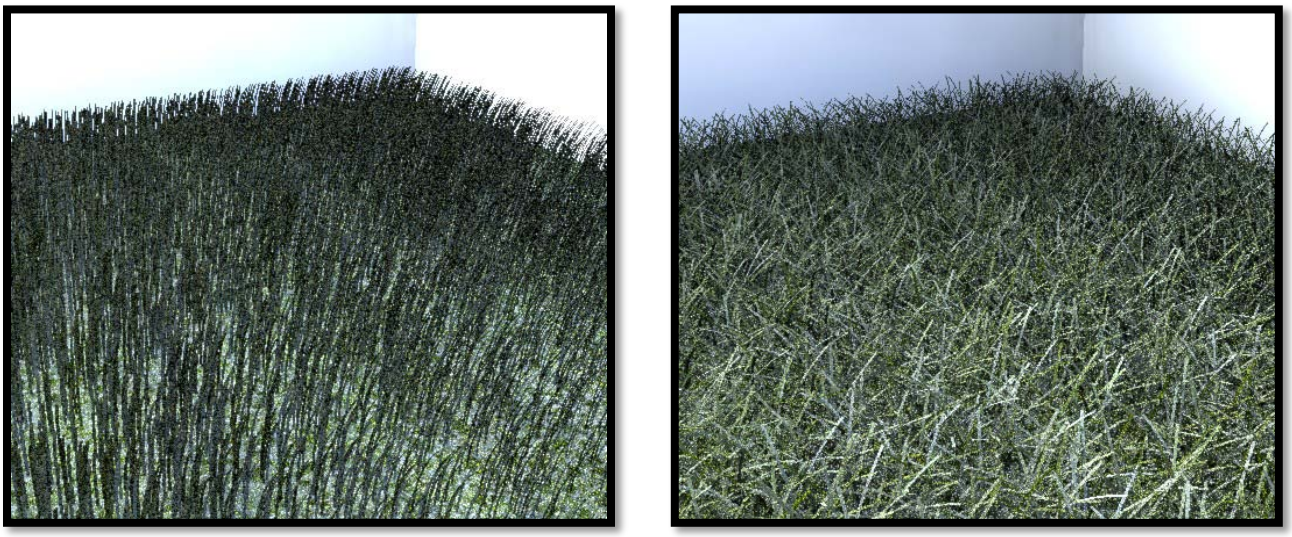
Left no growth randomization and right with 50% growth randomization

Position

This value will increase the randomness of the position of the fur strands. This really only has an effect when the fur spacing is large.

Direction

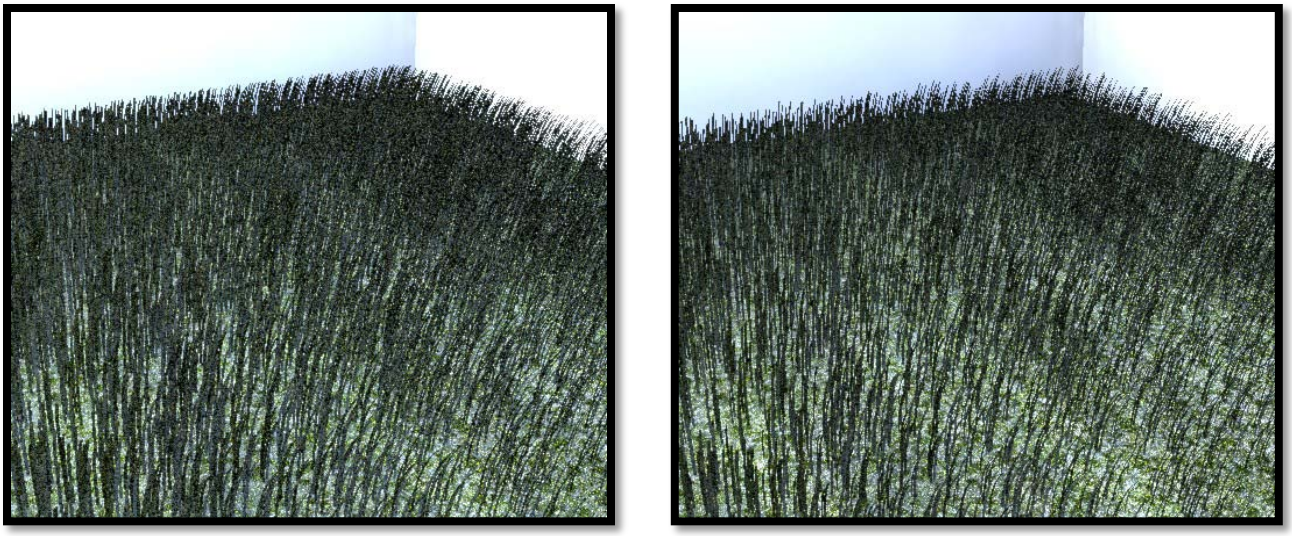
This value will randomize the angle of rotation for the root of the fur strand.



Left image no direction randomization and right 50% direction randomization

Size

This value will randomize the overall scale of each fur strand. This change is most noticeable around the edge of the fur.



Left no size randomization and right 50% size randomization

Fur Maps

Fur Length Map

This map can be used to determine the height of the fur across a surface. The height of the fur is based upon the intensity of the pixel in the image. Where a white pixel will produce full height fur strands a black pixel will produce 0 height fur strands. In the image below a simple black and white checker image is used to demonstrate this.

Example with length map

Fur Spacing Map

This map controls the fur density across a surface. The darker the pixel in the image the less dense the fur will be in this area. Here is an example where a similar checker pattern is used but the checks are white and dark grey. It can be seen that the dark grey areas have less dense fur.

Example with fur spacing map

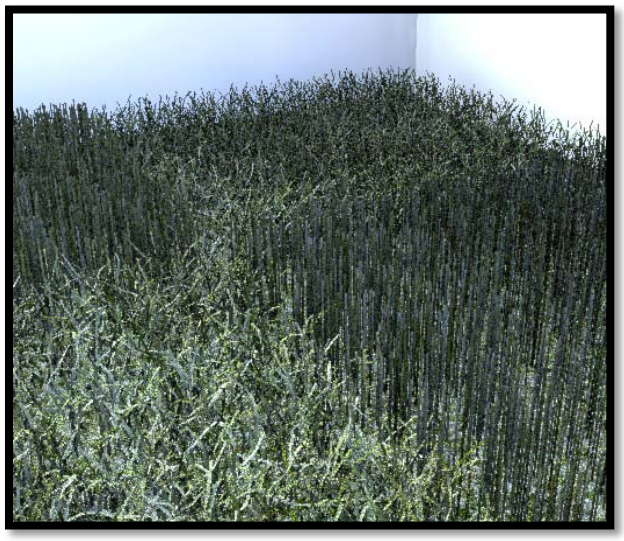
Fur Clumping Map

This map controls the clumping of the fur across a surface. Used in combination with the fur clumping value, the intensity of the pixel in the map scales the fur clumping value. Such that a black pixel will result in no clumping and a white pixel will result in using the clumping value set in the dialog.

Example with fur clumping map

Fur Growth Map

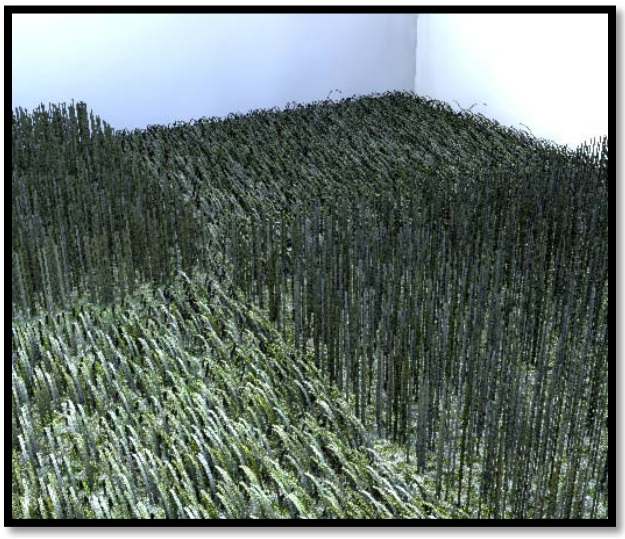
This map controls the growth randomness across a surface. In the image below all the randomness has been switched off except growth jitter and it can be seen in the image that where the map pixels are black there is no growth jitter and all the fur strands are the same length. In the areas where the map pixels are white there is jitter applied to the value specified in the dialog.



Example with growth map used

Fur Flex Map

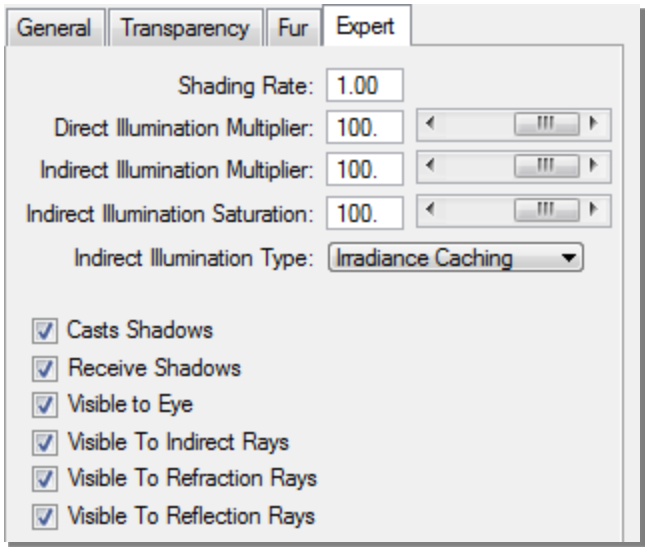
This map controls the amount of fur flex across a surface. Again the intensity of the pixels in the map combine with the flex amount set in the dialog to control the fur flex across the surface.



Example with fur flex map

Expert Tab (Advanced mode only)

The Expert Tab contains numerous advanced settings that can be used to control the way light behaves when striking a material and also settings that control a material's visibility. Although these settings reside on what we refer to as the "Expert" tab that does not mean we are trying to deter their use unless you are an expert. These are the settings that for the majority of your materials you will seldom need to adjust from the default values.



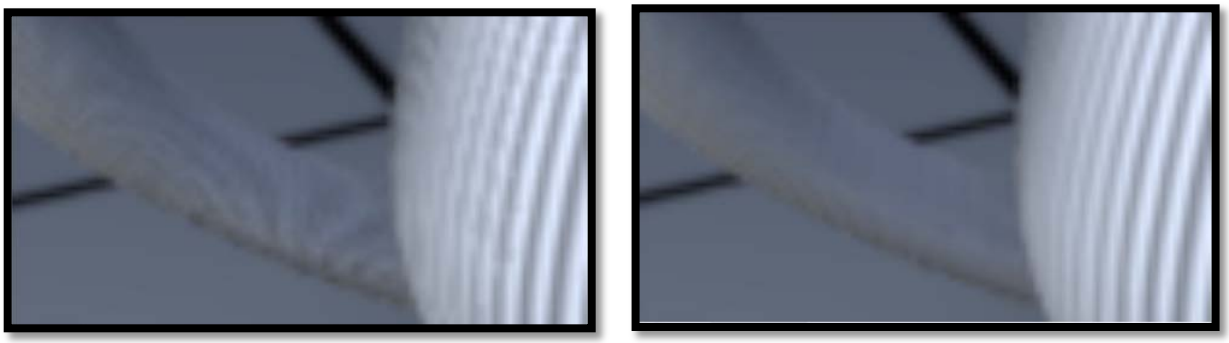
Shading Rate

This is a per material antialiasing value that represents the subdivision of a pixel, in the X and Y directions, for extra sampling values.

For example:

Setting the value to 1 means no subdivision is performed and one sample is taken per pixel.

Setting the value to 0.5 means divide the pixel in half, in the X and Y directions, and take a sample for each new area. This results in 4 samples being taken for each pixel. A typical use of shading rate is to reduce high frequency noise, as shown in the following example.



The image on the left, which was rendered with a shade rate of 1.0, has a bump map that is producing noise on the handle of the teapot. This is eliminated, in the image on the right, by setting the shade rate to 0.5 for the teapot material.

Direct Illumination Multiplier

Controls the effect of direct lighting on the material.

This setting along with "Indirect Illumination Multiplier" and "Indirect Illumination Saturation" are used for balancing the effect of direct and indirect illumination in the scene.

In the following examples, the scene is illuminated with a Solar light only. For the image on the:

Left – the teapot material has Direct Illumination Multiplier set to 100% (normal).

Right – the teapot material has Direct Illumination Multiplier set to 0%. That is, no direct light is affecting the teapot and it is illuminated only by the light reflected from the walls and floor.

Indirect Illumination Multiplier

Controls the affect of indirect lighting on the material.

In the following examples, the scene is illuminated with a Solar light only. For the teapot on the:

Left – Indirect Illumination Multiplier is set to 100%. Areas that are in shade from the Solar light, still receive indirect illumination.

Right – Indirect Illumination Multiplier is set to 0%. Areas that are in shade from the Solar light appear very dark.

Indirect Illumination Saturation

Controls the saturation of a material from the color of indirect light sources.

In the following image the Indirect Illumination Saturation setting for the teapot material in the image on the:

Left - 100%, which is shown by the color of the indirect light affecting the teapot material.

Right - 0%, which shows in the color of the teapot not being affected.

Indirect Illumination Saturation 0% on right teapot

NOTE: In the preceding rendering the Japan Alley light probe was used and much of the indirect (bounced) light color is coming from the environment. In addition any bounces off the materials in a scene such as the wood material the pots are sitting on will also tend to tint the articles within the scene with bounced light. You can effectly control the amount of tinting using the Indirect Illumination Saturation setting on a per material basis.

Indirect Illumination Type

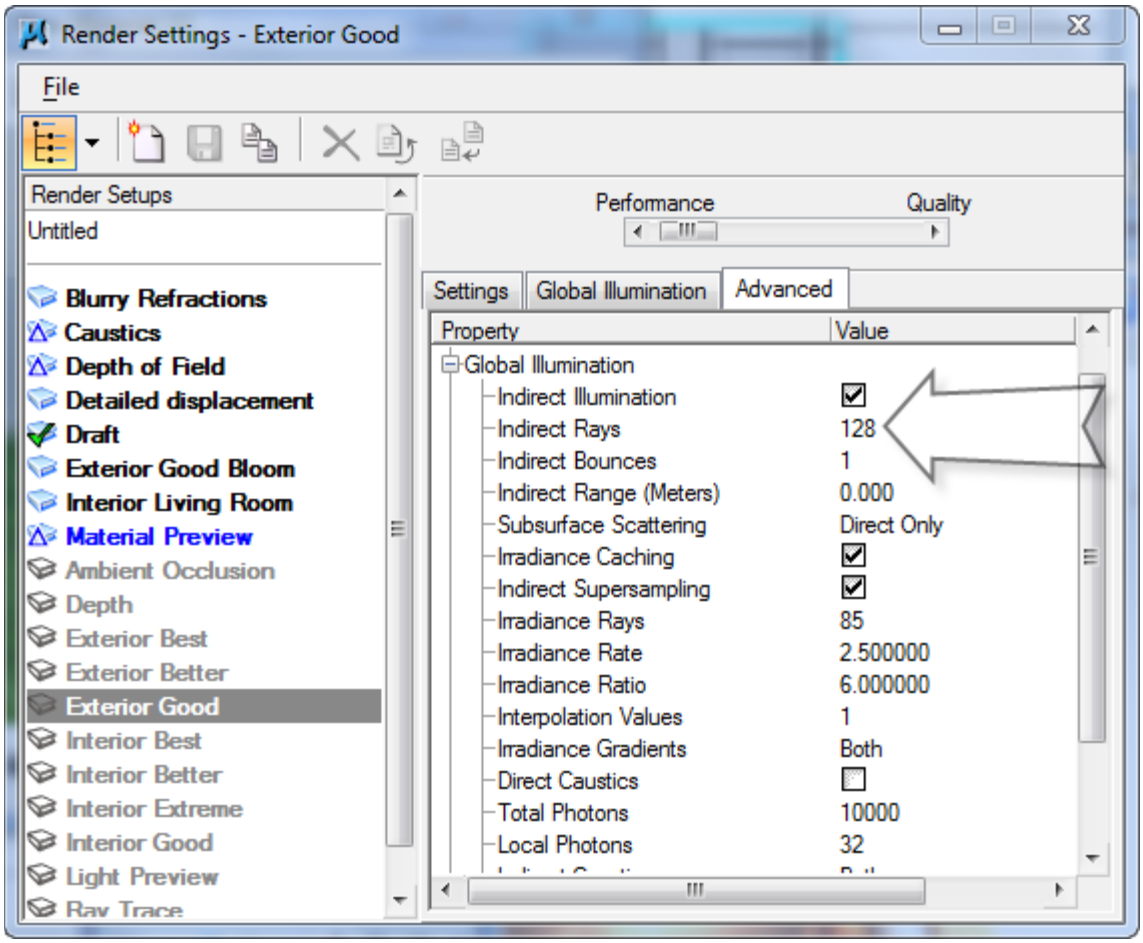
Controls the type of indirect illumination algorithm used when rendering an element having the material. Choices are: None, Monte Carlo, or Irradiance Caching.

In the following image, illumination is from an indirect light source (a light probe). From left to right, the teapot material has Indirect Illumination Type set to None, Monte Carlo, and Irradiance Caching.

As shown, the teapot is not illuminated in the left image, while the Monte Carlo algorithm results in more grain on the material in the right teapot than when Irradiance Caching is selected as seen in the center teapot.

Indirect Illumination type none left, irradiance cache center and Monte Carlo right

This graining cause by using Monte Carlo can be reduced by increasing the number of indirect illumination rays, as shown in the following images. The default of 128 indirect rays works well for Irradiance Cache but my not be sufficient for Monte Carlo. To change this value you will need to open the Advanced Tab of the Render Setting dialog.



Render Settings dialog Advanced Tab

The left image uses 64 Indirect Rays per pixel, while the right image used 1024 rays

Casts Shadows

If enabled, the material can cast shadows. If disabled, no shadows are cast by the material.

Receive Shadows

The Receive Shadows option controls whether or not the material will receive a shadow from other objects in the scene.

In the following images, Receive Shadows is:

Enabled for the floor material in the left image and receives a shadow from the teapot.

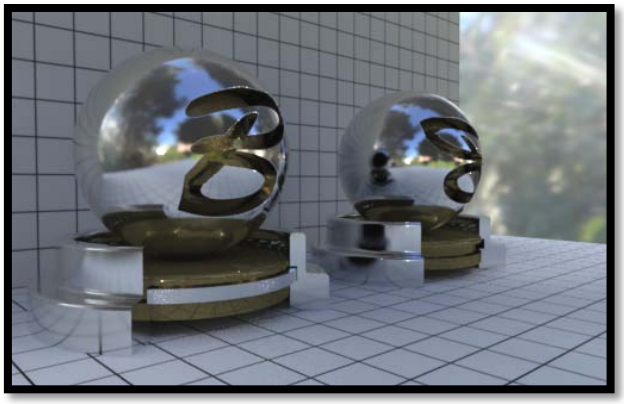
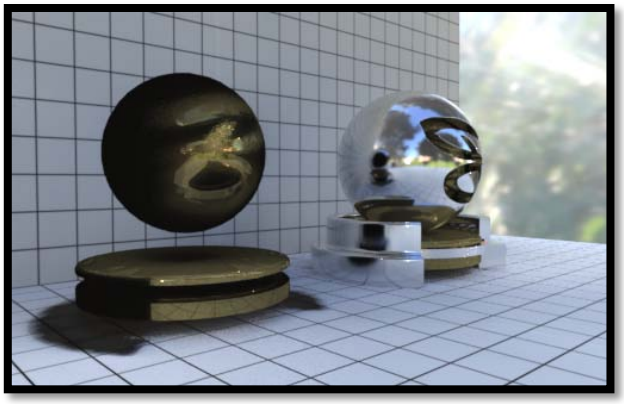
Receive Shadows disabled in the right image resulting in no shadowing on the floor from the teapot.

Visible to Eye

The Visible to Eye option controls the visibility of a material and whether it can be seen by the camera or not.

If disabled, any geometry with the material applied, will be invisible to the “eye” in the rendered image. The geometry still participates in the lighting calculations and can cast shadows into the view, but the geometry itself will not be directly visible. It still may be visible in reflections and refractions. For example you could remove an object (such as a tree) that is obscuring the item of interest by making its materials not visible to the camera.

In the following images, Visible to Eye is enabled for the polished stainless steel material in the left image and disabled in the right image. Notice that in the right image the stainless material still is visible in the reflection.

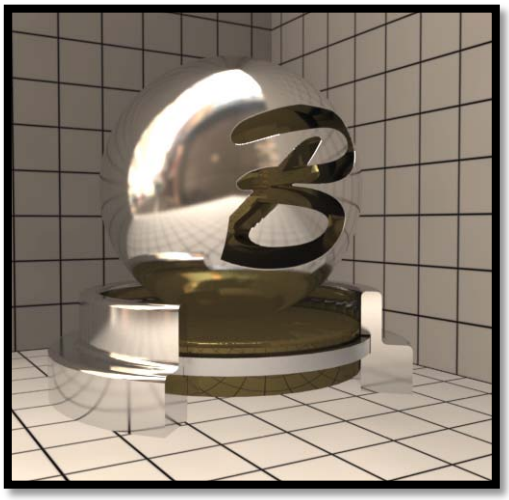



Visible to Indirect Rays

Visible to Indirect Rays controls visibility of the material during the indirect illumination pass.

If disabled, those elements using the material do not contribute to the indirect illumination of the scene.

In the following images, illumination is entirely from a Light Probe, which is an indirect light source. In the following example images, the widget's materials have Visible to Indirect Rays enabled in the left image, and there is a shadow under the widget. In the right image, the setting is disabled and there is no shadowing.

Visible to Refraction Rays

Visible to Refraction Rays controls visibility of the material in refractions.

In the following example images there is a block of glass in front of the widget, covering the right half of it. The widget's stainless material has Visible to Refraction Rays enabled in the left image and disabled in the right image.

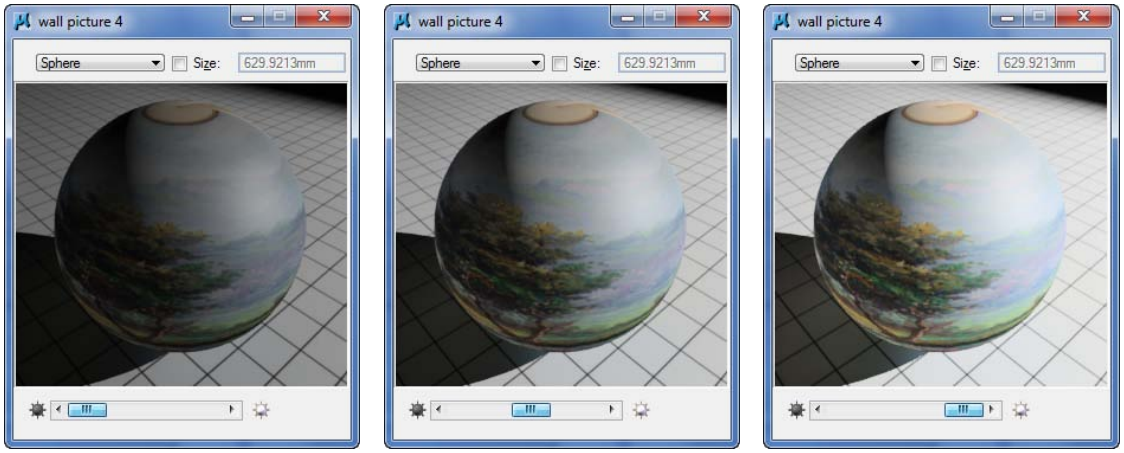

Visible to Reflection Rays

Visible to Reflection Rays controls the visibility of the material in reflections.

In the following example images, the widget's polished stainless material has Visible to Reflection Rays enabled in the left image and disabled in the right image.


Material Preview Brightness Slider

Lets you adjust the brightness of the preview display.



Example from left dark to bright

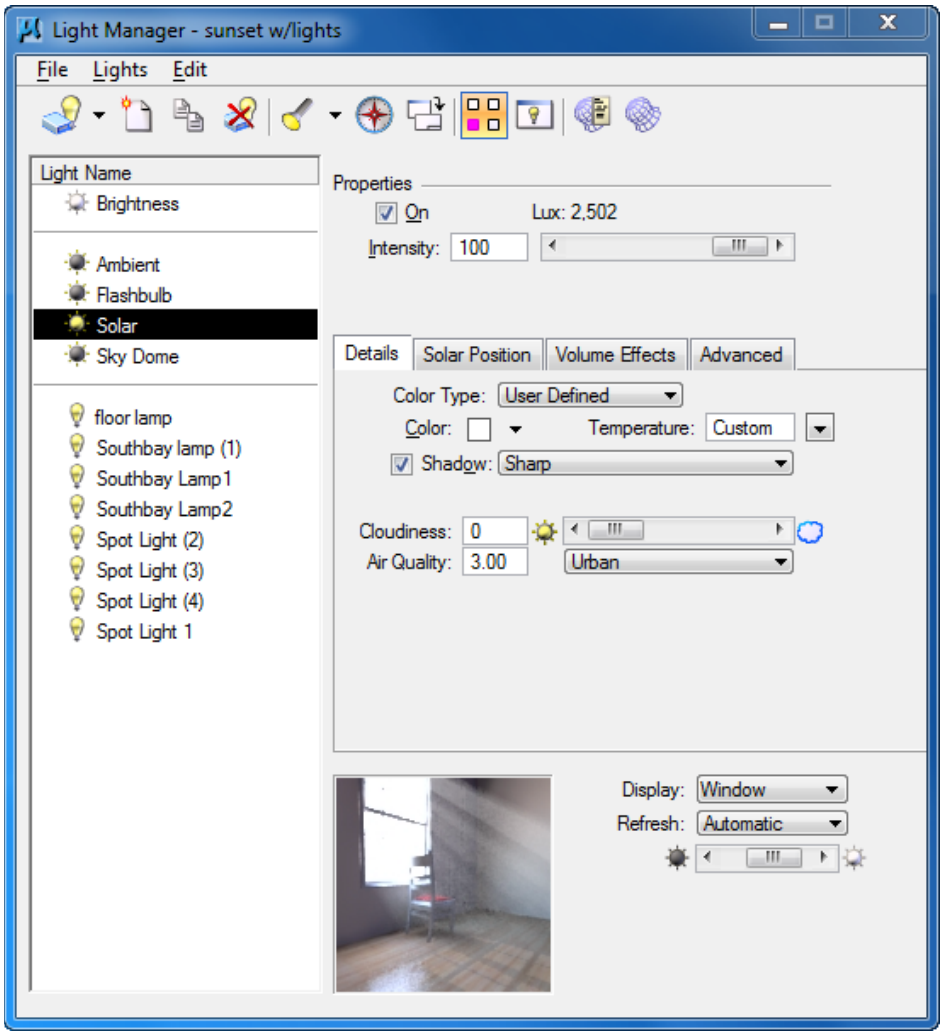
Light Manager

The Light Manager has been updated for this release, like the Material Manager we have moved to a tabbed dialog in order to implement additional features without creating a giant real estate consuming dialog.

New Light Previews are now available and can be very useful for quickly determining settings for Volume Light effects. Now you can get a quick preview without kicking off a time consuming render job only to find you have the wrong volume density, scatter density or scatter color. The light previews widgets like the material editor preview widgets can be added to or customized by the user. The light preview like the material preview may be enlarged into a separable dialog.

Light Manager Dialog

Used to control light setups and the settings for both global and source lighting. Other options let you place or delete source lighting cells and to define the direction of North in the model. When you highlight a light source in the Light Name list, its settings are displayed for editing as required. Opens when you select the Light Manager tool, or when you choose Settings > Rendering > Light Manager.



Light Setup List - Toggles the display of light setups list, from which you can select a saved lighting setup. When the list is not displayed, you can click the Down arrow to open an option menu that lets you select from saved lighting setups.

New Setup - Creates a new lighting setup in the Light Setups list, having a default name “Untitled-x” (where x is a numeric extension). The default name may be edited as required.

Copy setup - Copies the selected light setup and adds the copy to the list. By default the copy is given the same name as the original with a number appended.

Delete Setup - Deletes the selected light setup.

Option menu, with icon, that lets you place a light source cell, or create an area light source from an existing element. The icon defaults to the previously selected light source type, with the option menu displaying the remaining options available.

 **Place Point Light** — Opens the Place Light tool with Point Light selected.

 **Place Spot Light** — Opens the Place Light tool with Spot Light selected.

 **Place Area Light** — Opens the Place Light tool with Area Light selected.

 **Place Directional Light** — Opens the Place Light tool with Directional Light selected.

 **Place Sky Opening** — Opens the Place Light tool with Sky Opening selected.

NOTE: Sky Openings are not currently used by MicroStation's Luxology rendering engine, but plans are being made to support these in a future release. Sky Openings were used by MicroStation's legacy render modes as an efficient means to direct skylight into opening such as windows.

 **Define North** - Lets you define North for the model. You do this by entering two data points, defining first a reference point and then the direction for North.

 **Choose Selected lights** - Selects the lights in Light Manager, (tree view display) that are currently selected in the view.

Highlight - When on, selects the lights in the view as the light names are selected in the Light Manager (tree view).

Center - Centers the view to the origin of the light selected for single selection and centers to the average of the origins of the lights for multi select of lights in the Light Manager.

 **Show IES Detailed Text** - If on, for an IES light source, a text window opens to display the Photometric Data File Information for the IES light source.

 **Show IES Webs** - If on, for an IES light source, then the photometric characteristics for the IES light source are displayed graphically.

File menu options

New Setup - Performs the same function as the New Setup icon.

Copy Setup - Performs the same function as the Copy Setup icon.

Rename Setup - Lets you rename the selected light setup.

Delete Setup - Performs the same function as the Delete Setup icon.

Lights menu options

On - Turns on the selected light.

Off - Turns off the selected light.

Toggle - Toggles the on/off state of all selected lights.

Edit menu options

Select All - Selects all lighting in the Light Name list.

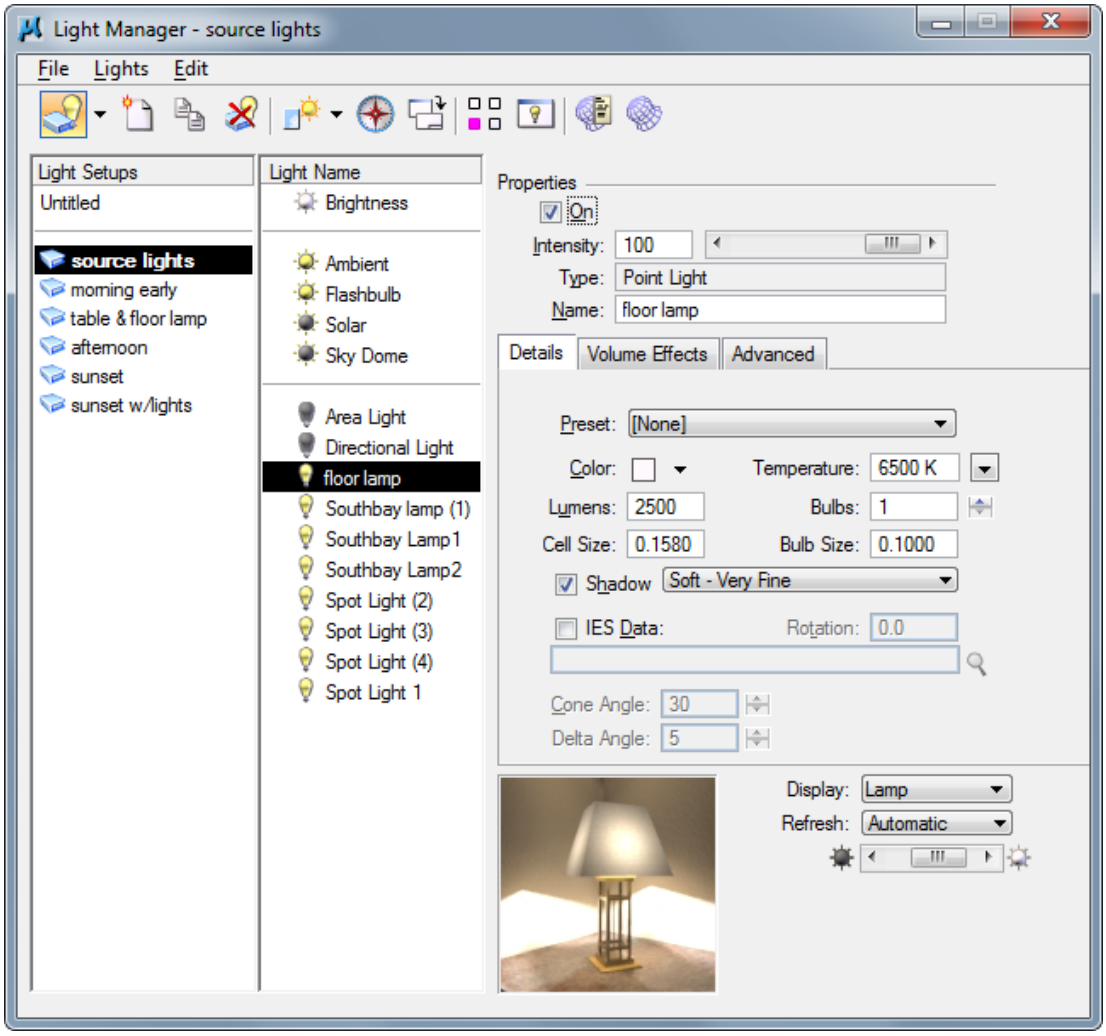
Select None - Deselects any lighting in the Light Name list.

Invert Selection - Deselects currently selected lights and selects currently unselected lights in the Light Name list.

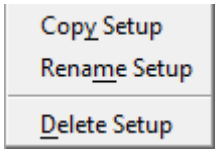
Delete Light - (Source lighting only) Deletes the selected light(s).

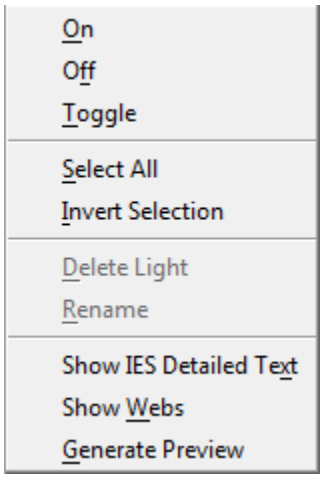
Rename - (Source lighting only) Lets you rename the selected light.

In the following image capture of the new Light Manger dialog you can see a list view of the Light Setups this can be toggled display can be toggled on or off by clicking the Light Setup List icon. You can as an option use the drop down list when the setup list is not displayed by clicking the down arrow to the right of the icon.



Right Click menus are available for Light Setups and Light Names, right clicking on a named setup or on a light name in the list produces the following right click menus.





These options are self explanatory, the Generate Preview, generates a light preview for the selected light.

New to Light Manager in this update

The Light manager has been updated with new tabs for setting various settings this updated dialog box includes several new settings and features.

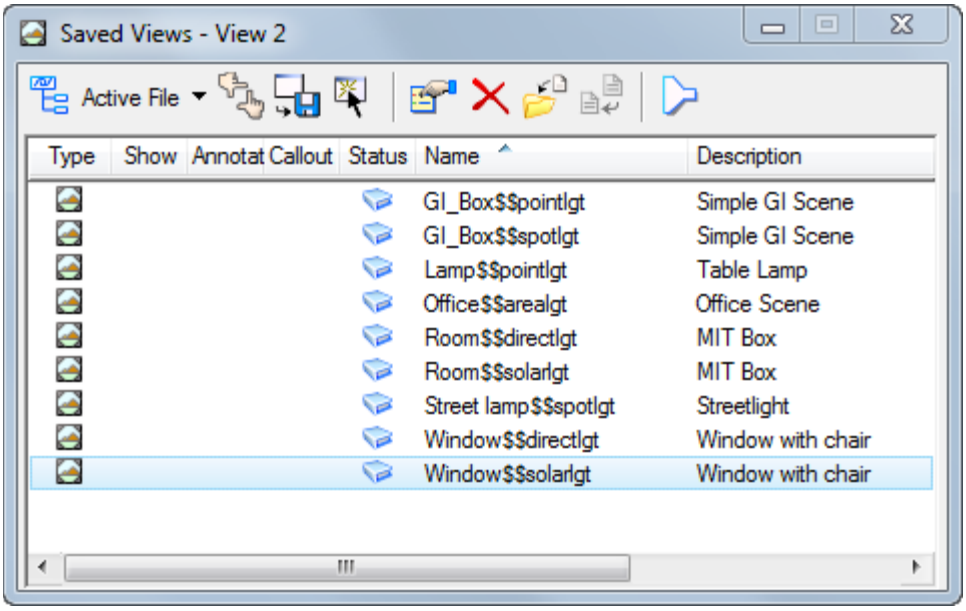
The information and settings that appear in the Light Manger depend on the Light Name selected from the light list view on the left side of the dialog. For example when you select Brightness, Ambient or Flashbulb you will only see the settings that pertain to these light adjustments or types.

When you select a light from the light list you see the new tabular format with tabs for Details, Solar Position (only when solar light is selected), Volume Effects (only for Solar, Distant, Point and Spot Lights) and Advanced.

Notice that we now have a Light Preview similar to the preview system we implemented for the material editor. The Light Preview can be enlarged by double clicking the preview. The Preview is intended to give you a quick preview of a lights color and is especially useful for adjusting volumetric effects.

The Light Preview can be seen at the bottom of the Light Manager dialog for Solar, Distant, Point, Spot and Area Lights. Depending on the type of light selected, you will have different Light Widgets to choose from. These Light Widgets are models that are stored in the Bentley_LightWidgets.dgnlib which is located in your ..workspace\systems\materials folder.

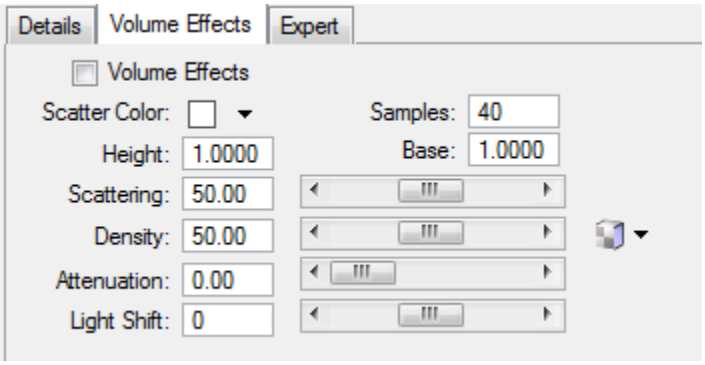
You can easily create additional light preview widgets by adding models to this file or creating a dgnlib file with the widgets in the materials folder. A saved view must be created for each preview with a unique prefix name that identifies the object, separated with $$ and then a suffix that describes the light type. The suffix names are solarlgt, distantlgt, spotlgt, pointlgt and arealgt. Examples of proper light widget saved view names can be seen in the following saved view dialog.



When creating light widgets each model should have a light setup with the name **Preview** to indicate that this setup is to be used as a Light Preview widget.

Volume Effects Tab

Contains controls for lighting Volume Effects. Available settings vary, depending on the type of light source selected.



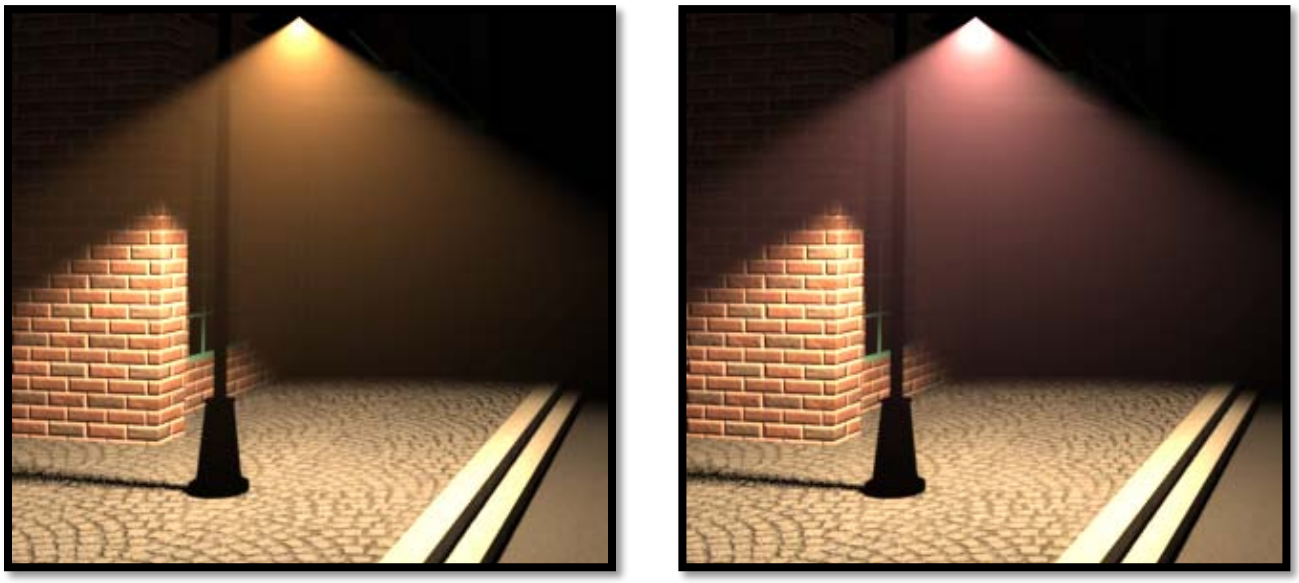
Volume Effects

If enabled Volume Effects are rendered.

Scatter Color

Sets the scatter color value.

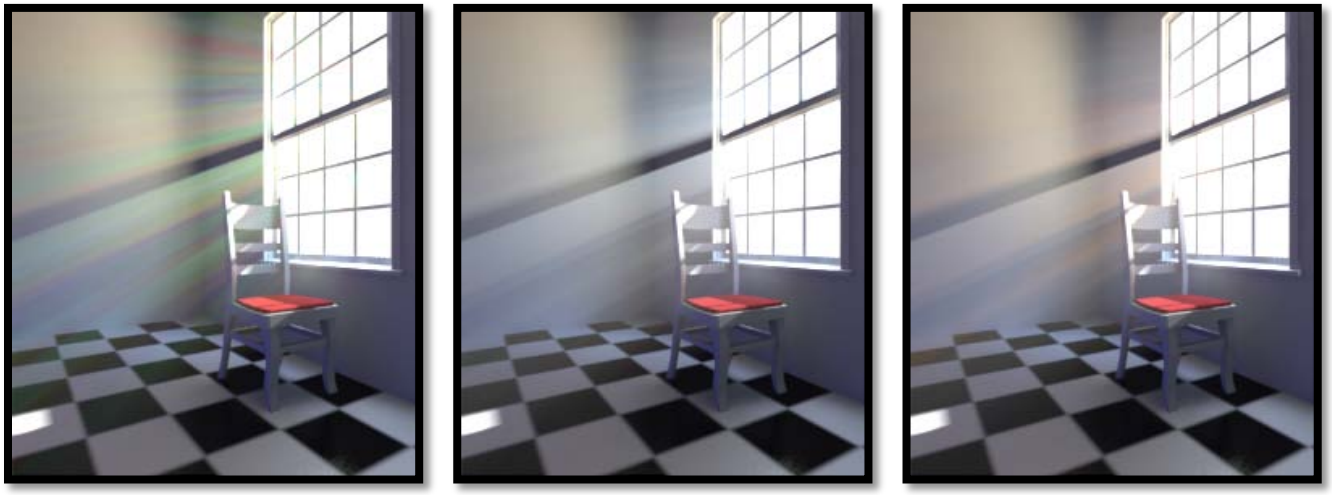
Scatter Color can be thought of as the color of the “dust” particles making up the volume through which the light is passing.



Scatter color set to an incandescent color on left and magenta on right

Scatter Color Map

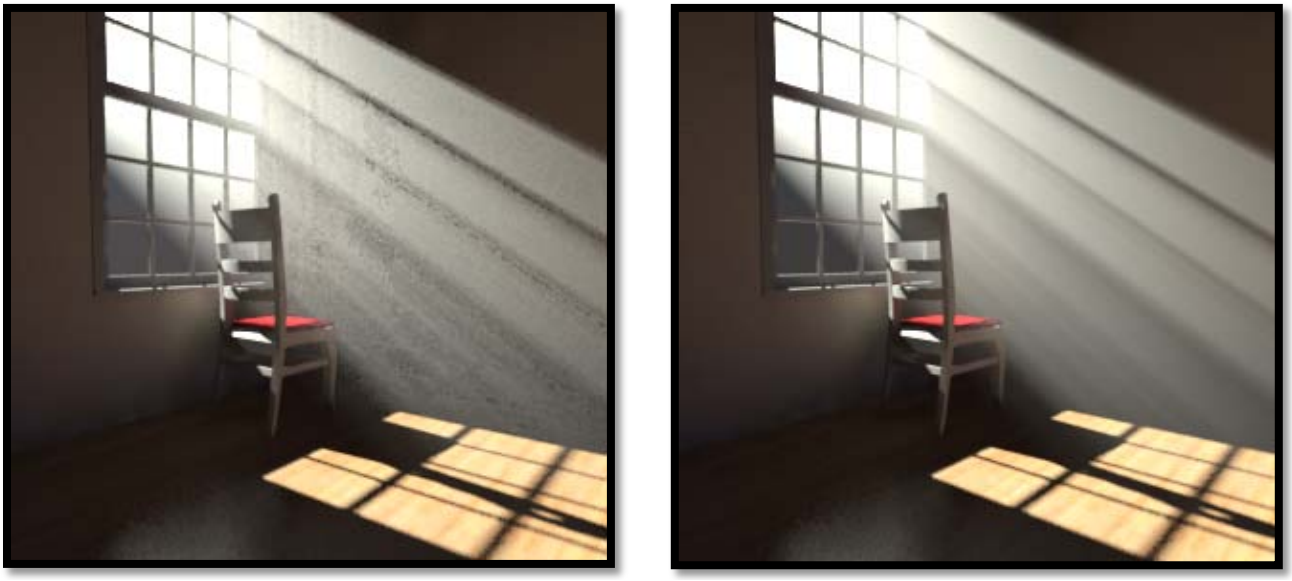
You may choose a Custom Map to control or vary the scatter color to produce more interesting volume lighting effects.



Examples where scatter color maps are used

Samples

Controls the accuracy of the volumetric effect underneath shadowing objects. Increasing the samples value improves the accuracy.



Samples set to 20 left and 200 right

Height

(Applies to Spot Lights, Directional, and Solar lights only) Sets the height in working units, of the scattering effect in the volume associated with the light.

Left image Volume Height set to 10 units and 20 right

Radius

(Applies to Point, Directional, and Solar lights only)

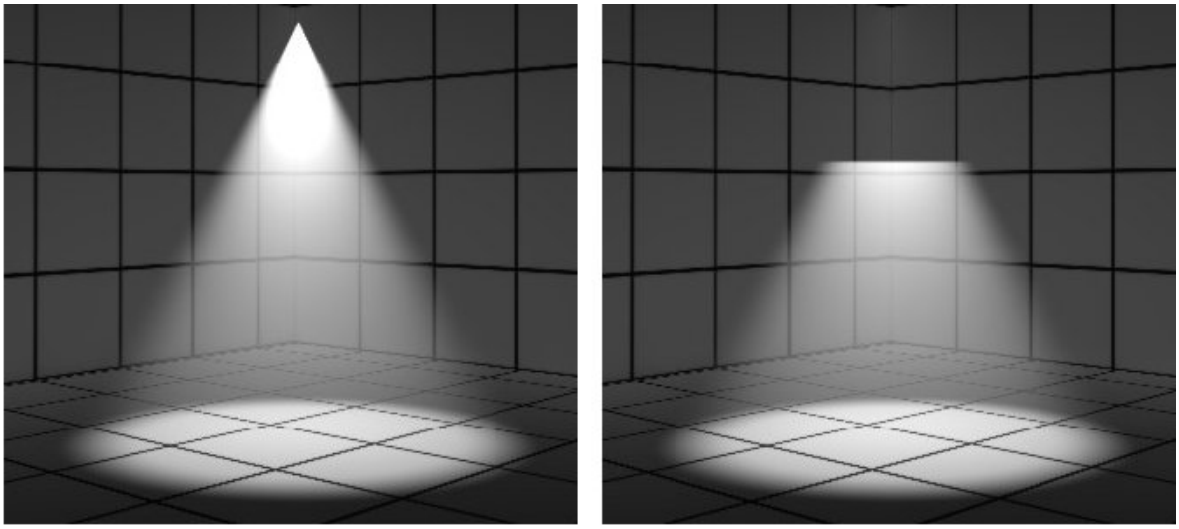
For Solar and Directional lights, Radius defines a cylinder radius. This, combined with the height, creates the volume through which scattering occurs.

For point lights, Radius defines the radius of the sphere for the scattering volume.

Radius set to 2 units left and 1 right

Base

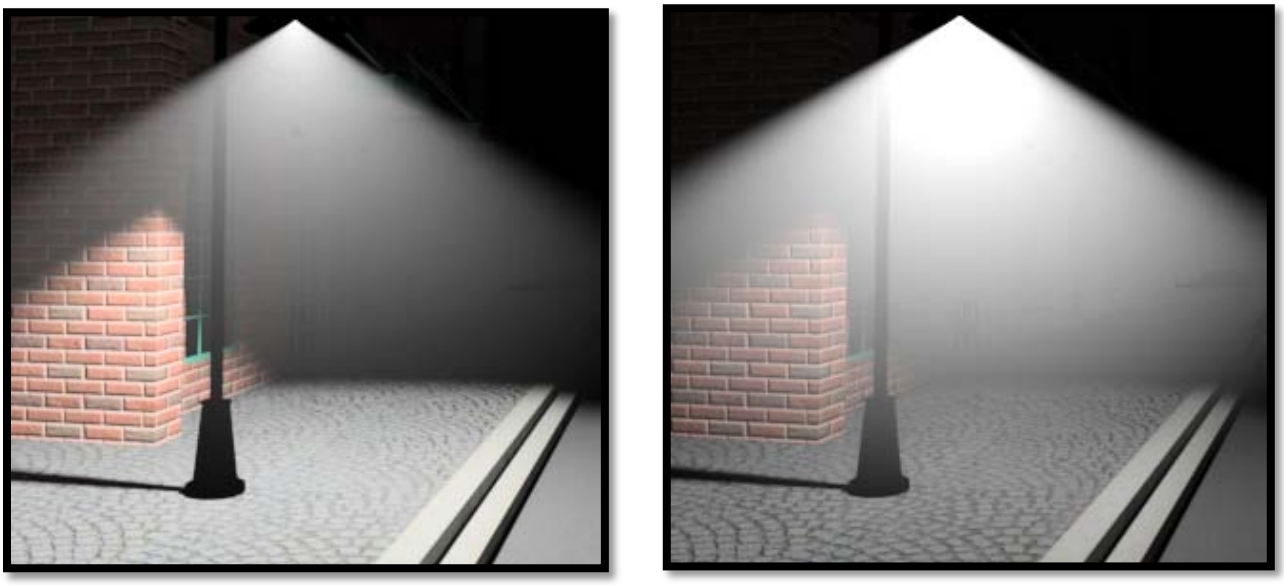
(Applies to Spot lights only) Defines the offset from the spotlight at which the scattering can occur.



Base set to 0 meters left and 0.2 meters right

Scattering

Controls the amount of light scattering which occurs inside the volume. Higher values result in more scattering.



Scattering set to 2% left and 50% right

Density

Sets the density for the volumetric effect. Higher values will make the volume thicker and more opaque.

Volume Density 10% left and 50% right

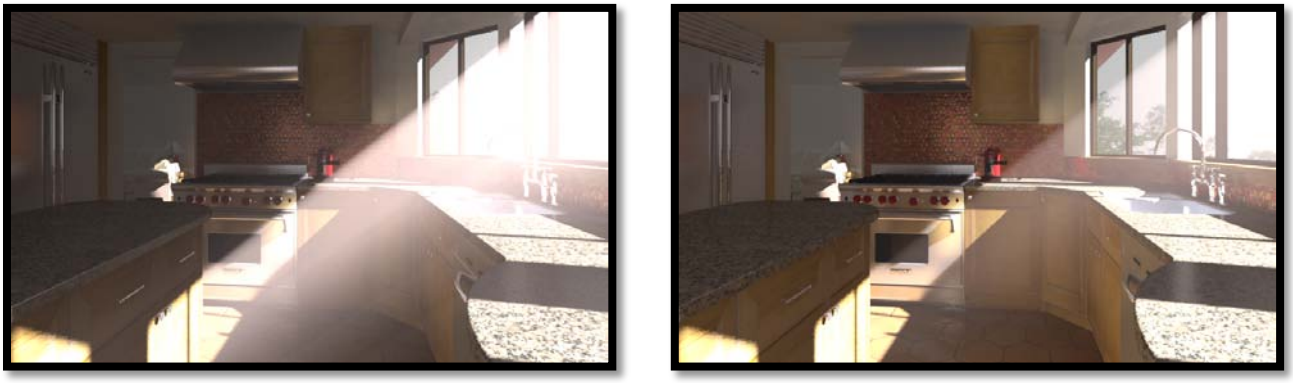
Density Map

You may use a Density Map to control or vary the volume density. For example you can use a grayscale image like a bump or specular map to create more realistic volume effects.

Volume Density Map used to vary volume density effect

Attenuation

Controls the amount of attenuation of the effect. A value of 0% gives a natural fall off and as the value increases the fall off becomes greater.



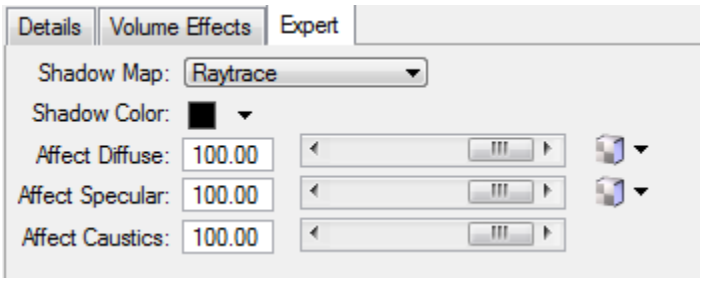
Left 50% Density 0% Attenuation Right 50% Density 50% Attenuation

Light Shift

As the light is increasingly attenuated, certain wavelengths are absorbed or scattered, the 'Light Shift' function can mimic these effects. Negative values push the color of the volume increasingly toward light blues, while positive values push the color toward warmer orange and red hues. The 'Light Attenuation' value must be a number above 0% to see any effect, in the following examples attenuation is set to 50%.

Light Shift from left to right -100%, -50%, 0%, +50% and +100%

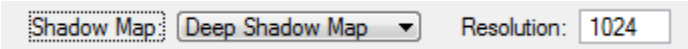
Expert Tab



Shadow Map

Options are default Raytrace and Deep Shadow Maps In instances when you want a light to cast a shadow, Ray Traced will give the most accurate results. Deep Shadow maps are useful for volumetric lights.

When you select the Deep Shadow option you will be able to specify the resolution with the default being 1024, higher values produce more shadow detail.



Shadow Color

Shadow Color, controls the color of shadows from opaque objects. Options are Custom and Color Map, by using a gray color rather than black for shadows you can remove overly dark shadows from your scene even where only one bounce of light is used. By using a color map the shadow color can be varied rather than be a constant color.

Table lamp shadows set to black left and gray (RGB 100,100,100) left

Affect Diffuse

This percentage value will control how much the light contributes to the final Diffuse shading of the scene. You can set this value to 0% if you want to hide the light from Diffuse shading. This allows the creation of a "Specular only" light source.

Left Affect Diffuse and Specular 100% right Affect Specular 0%