Rendering with VUE in MicroStation

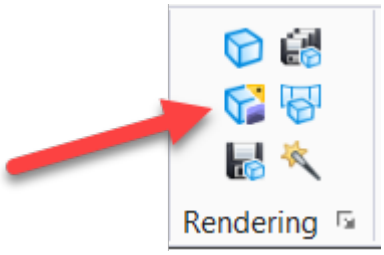
We are pleased to announce a technical preview of E-on Software's VUE Render Engine with **MicroStation CONNECT Edition Update 15**. This technical preview is a work in progress and all render settings are currently presets, a VUE render settings dialog will be available in the next update.

The VUE rendering engine uses Global Radiosity whereas Luxology uses Irradiance Caching and the render settings are different. For this technical preview the VUE render setting are hardcoded by way of rendering presets. In the next release we will have a new Vue render settings dialog. The VUE render engine also supports Path Tracing which in addition to using all CPU cores it will use all GPUs found in your system that support OpenCL. For interior renders you should find that Path Tracing combined with either NVIDIA or Intel denoisers will provide the best results, especially where the scene materials are Physically Based Materials (PBR).

Luxology's environment lighting consist of Physical Sky, Gradients and Image based lighting. Vue on the other hand supports Image based lighting, Gradients as well as Photometric Spectral Atmospheres that are much more realistic than just Physical Sky.

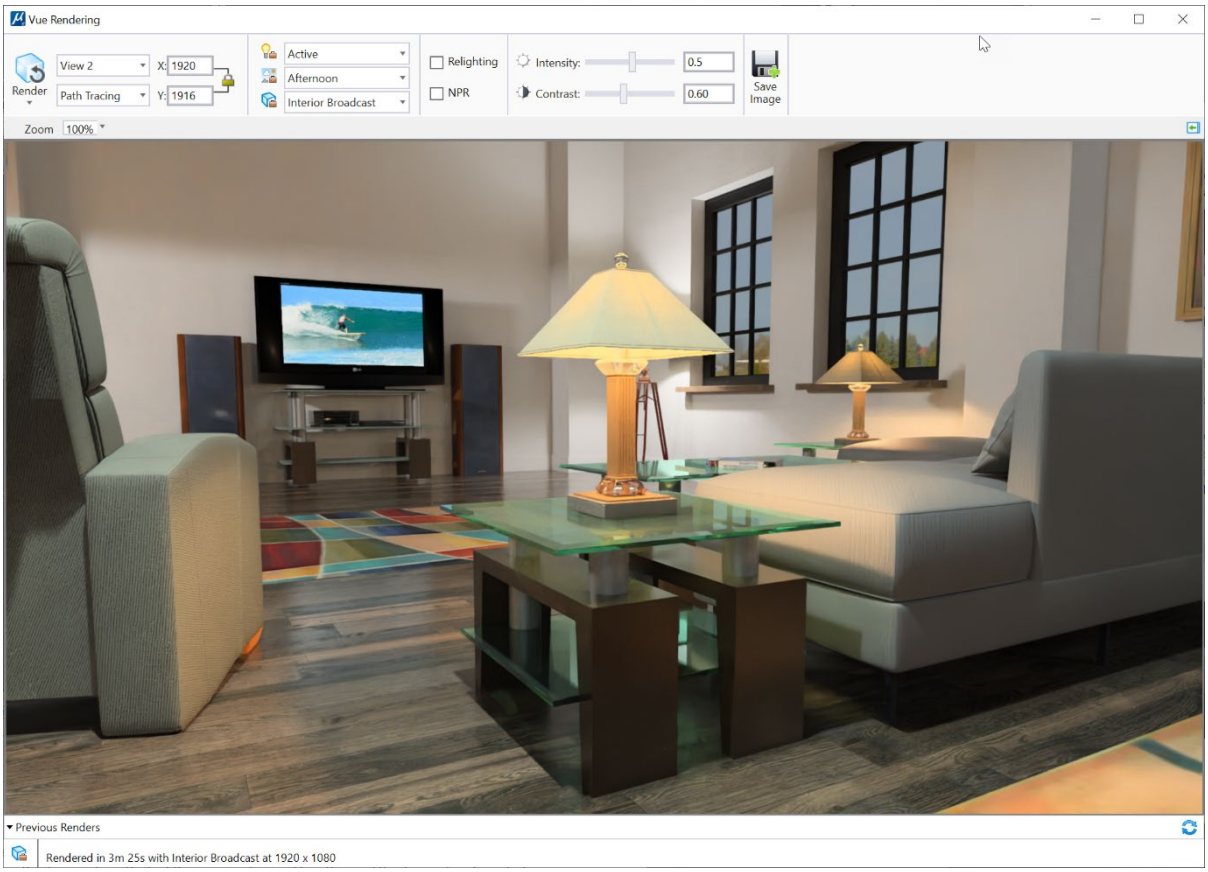
NOTE: PBR materials can dramatically increase render times for ray tracing whether using Luxology or VUE to render. This is because most materials in real life have blurry reflections, these blurry reflections can dramatically drive up render times for any ray tracer. If you plan to send your scene to LumenRT use PBR, LumenRT will use reflection maps and these materials will not have any effect on performance. The Path Tracer is not slowed down by the usage of PBR materials. In future versions we may address this issue for ray tracing by allowing reflection maps to be used where roughness values are high and difference between reflection map vs. scene reflections are not readily visible.

VUE Render Icon can be found in the Render Group when using the Visualization Task.

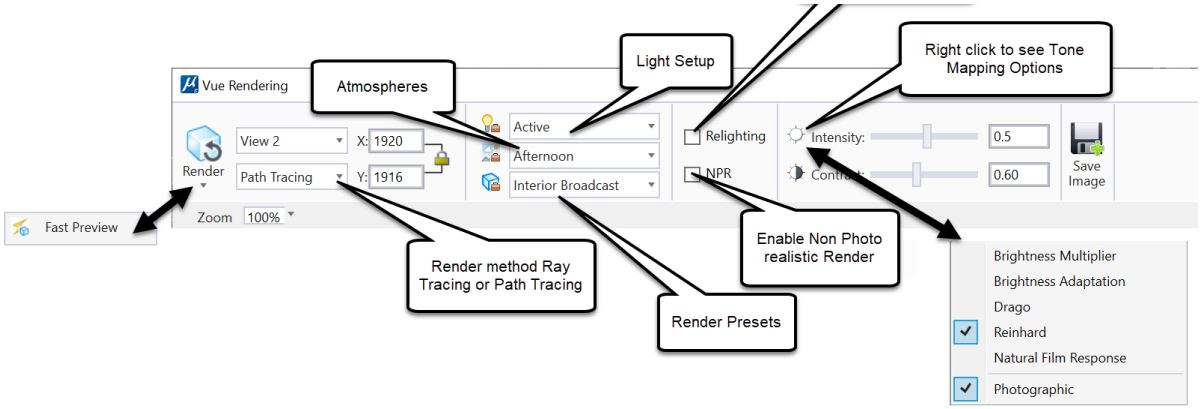


Clicking on the VUE Render icon will open the new VUE Rendering dialog.

NOTE: *VUE's render engine requires a CPU that supports Advanced Vector Extensions AVX meaning produced in 2011 or later.*



The VUE Rendering Dialog lets you choose the Rendering Method, Render Presets, Atmospheres, Light Setups, Tone Mapping Options and more.



Clicking on the Render icon from the dialog will launch a VUE rendering using the settings you have chosen. Clicking below the render icon will open a drop-down menu where you can choose Fast Preview Render as option. The Fast Preview uses lower quality settings and Ray Tracing to achieve faster render and is suitable for test renders. Fast Preview can also be used with Path Tracing because it is based on samples per pixel for quality, using the Exterior Final preset should provide good results when used with Intel or NVIDIA denoiser.

Fast Preview Render: Provides a good working balance between picture quality and render speed. It traces reflections, transparency and cast shadows correctly, although it only mocks-up advanced features like soft shadows, blurred reflections / transparency and depth of field. The last render pass is optimized for speed, and the picture is not anti-aliased. We recommend you stick to this mode preliminary work, and only switch to Final settings when you have finished brushing up your scene.

Rendering Presets

The Rendering Presets used by VUE are hardcoded at this time, the exceptions being stroke tolerance and caustics which are read from the Untitled Render Setup. You can expect a VUE Render Settings dialog in the next MicroStation CONNECT Edition update.

The VUE Render Engine uses the following rendering presets:

Exterior Final, Exterior Broadcast, Exterior Superior, Exterior Ultra, Interior Final, Interior Broadcast, Interior Superior, and Interior Ultra.

All Exterior render setups use one bounce of light for global illumination whereas all interior setups use 10 bounces. Exterior rendering being well lit require far fewer indirect samples than interior renders and therefore are optimized with one bounce when Ray Tracing.

The following list shows the **Indirect Samples** used by each Preset when ray tracing:

Exterior Final 256
Exterior Broadcast 256
Exterior Superior 400
Exterior Ultra 576
Interior Final 1024
Interior Broadcast 1600
Interior Superior 2116
Interior Ultra 3600

As each preset name would suggest the quality of the render can be improved by choosing the next preset in the list where Final is good, Broadcast is very good, Superior is even better, and Ultra is going to take the longest to render. In many cases Final should be fine, so start with it and go from there.

NOTE: You need to choose Broadcast or higher to get Texture Interpolation which would be an absolute requirement for rendering animation frames. Obviously, there are a multitude of other settings that change with each of these presets but rather than bore anyone with all the settings that can't be changed in this tech preview. Let's just say each one improves on render quality at the expense of render time no different the Luxology Presets you have used in the past.

The Path Forward is the Path Tracer

The VUE Render Engine incorporates an unbiased rendering method like Luxology's Monte Carlo or (Progressive Refinement) render. The VUE Path Tracer uses not only CPU and all cores (threads) but also all GPUs found in your system that support OpenCL greatly speeding up render times. In addition, the Path Tracer is not slowed down using new Physically Based Materials (PBR) supported in MicroStation

CONNECT Edition Update 13 or later versions. Whereas the ray tracer can be much slower to render PBR materials since almost all materials unless 100% rough will have blurry reflections.

The path tracer unlike the ray tracer requires almost no settings other than how many samples per pixel you want to use. Since it naturally simulates many effects that must be specifically set with other methods, such as soft shadows, depth of field, motion blur, caustics, ambient occlusion, and indirect lighting, far fewer settings are needed. One previous drawback to rendering with a Path Tracer in years past was noise in the render. Removing noise required many more samples per pixel which in turn increased the render times exponentially and, in some cases, it could take literally days to converge.

Path Tracer Samples per Pixel used by the Rendering Presets are as Follows:

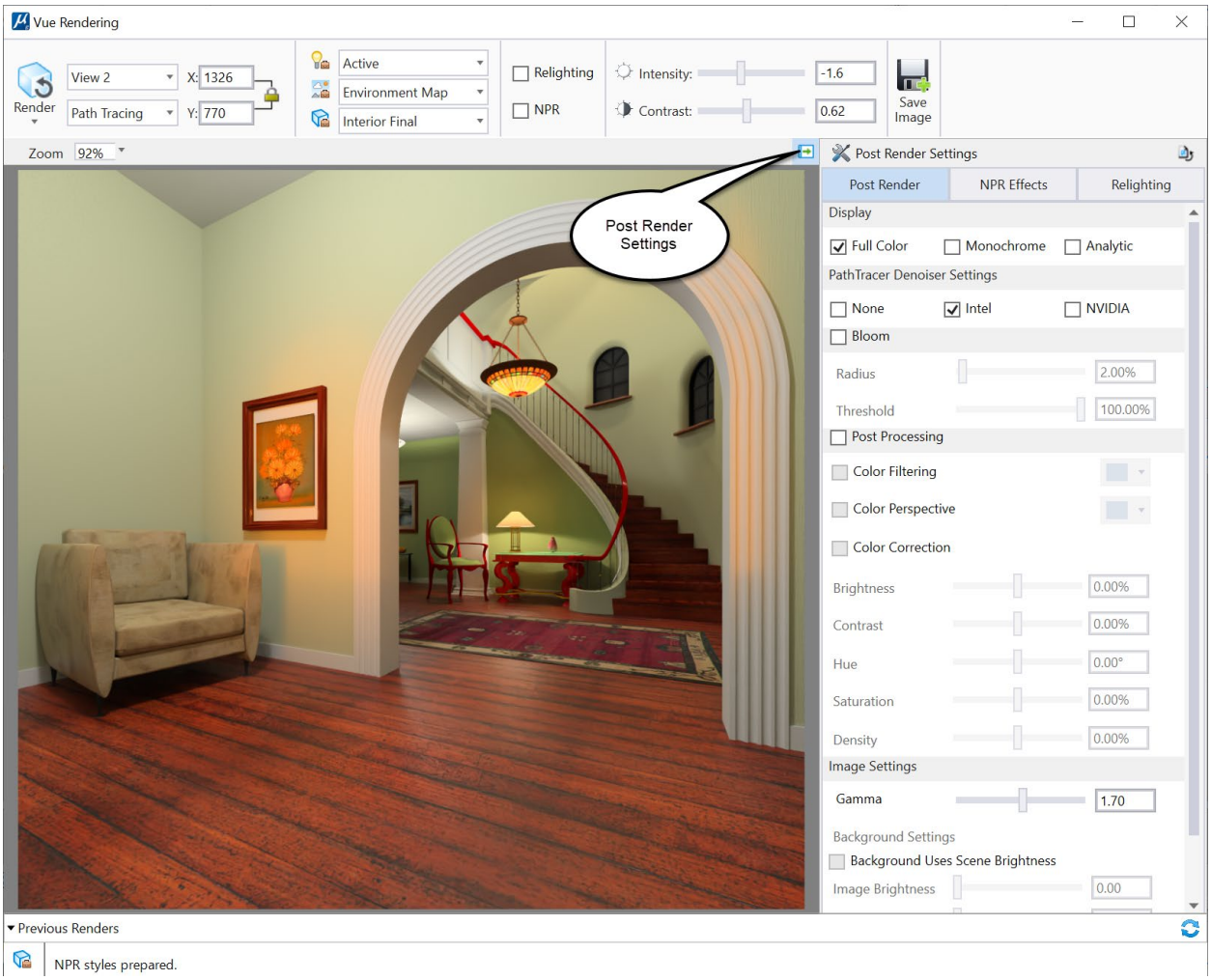
Exterior Final 64
Exterior Broadcast 128
Exterior Superior 256
Exterior Ultra 512
Interior Final 256
Interior Broadcast 512
Interior Superior 1024
Interior Ultra 4096

NOTE: Skylight openings, light dispersion, and volumetric lighting are currently not supported by Path Tracer. For this technical preview whether are not the Path Tracer renders caustics will depends on whether the option for rendering caustics is enabled in the Untitled render setup. For the Path Tracer to render colored shadows from transparent colored solids for lights other than sun light you will need to enable direct caustics in the untitled render setup. If the transparent material is applied to a surface and not a solid, then colored shadows can be seen in path traced renders whether caustics are enabled or not and regardless of light type.

Denoisers

The noise / time to render problem has been solved for the most part by powerful Artificial Intelligence (AI) Denoisers from the likes of Intel, NVIDIA and others. Acceptable renders, in fact amazing renders can be produced with far fewer samples per pixel. MicroStation Update 15 includes both NVIDIA and Intel denoisers. The Intel denoiser uses your CPU for the denoise operation while NVIDIA's denoiser uses NVIDIA GPU and requires a Maxwell based card or later such as Pascal, Turing or Ampere based card.

By default, we use the Intel denoiser if you want to turn off denoiser or use the NVIDIA denoiser you can change the setting from the VUE Render dialog's Post Render settings tab.


Vue Rendering
Render
View 2
Path Tracing
X: 1326
Y: 770
Active
Environment Map
Interior Final
Relighting
NPR
Intensity:
-1.6
Contrast:
0.62
Save Image
Zoom 92%
Post Render Settings
Post Render Settings
Post Render
NPR Effects
Relighting
Display
Full Color
Monochrome
Analytic
PathTracer Denoiser Settings
None
Intel
NVIDIA
Bloom
Radius
2.00%
Threshold
100.00%
Post Processing
Color Filtering
Color Perspective
Color Correction
Brightness
0.00%
Contrast
0.00%
Hue
0.00°
Saturation
0.00%
Density
0.00%
Image Settings
Gamma
1.70
Background Settings
Background Uses Scene Brightness
Image Brightness
0.00
Previous Renders
NPR styles prepared.

Before and after Denoised Examples

Path Traced using 512 samples per pixel 5 minutes 25 seconds

Same render after denoising using NVIDIA denoiser (less than 1/2 second to denoise)

Path Traced 256 samples per pixel 2 minutes 28 seconds to render

Same render after denoising using NVIDIA denoiser

Path Traced 256 samples per pixel 2 minutes 22 seconds

Same render after Intel Denoise

Atmosphere Editor

One exciting improvement of using the VUE render engine vs. Luxology is in VUE's ability to accurately render the atmosphere. The key to a successful exterior render is often the atmosphere it evokes. The scenes you render with VUE's advanced atmospheric engine are part of a world, a world that extends far beyond your scene. Imagine rendering your scene with a complete atmosphere having fog, haze, real clouds, infinite ones, and not just a backdrop picture of a sky.

Parameters that describe the atmosphere are numerous, if you want to create complex atmospheres from scratch which can be a complex and time-consuming process you should consider a copy of VUE. Any of the atmospheres created with VUE can be saved as an ATM file and opened with MicroStation's Atmosphere Editor and then be used to render a scene with VUE inside MicroStation. One limitation with MicroStation's Atmosphere Editor is that it will not allow for creation of new cloud layers, if you load a preset atmosphere that already has a cloud layer you will be able to adjust the amount of Cloud cover.

NOTE: You cannot add clouds to a preset where no clouds were used to begin with, but you can load an external ATM preset which will also bring in all the atmospheric settings including any cloud layer or layers saved with the ATM file.

MicroStation offers a list of predefined VUE atmospheres. Choosing one of them will let you to start building your scene from a good basis. You will be able to fine tune many atmospheric settings to improve the atmosphere of your renders. Basically, atmospheres include settings for the sky, clouds, sun, quality of light, fog, haze and effects such as rainbows and stars.

To open the Atmosphere Editor, you will need to click on its icon in the VUE Render dialog.

New: Click on this icon to create a new atmosphere that will not have clouds, if you want a cloud layer you will need to load an atmosphere that already has a cloud layer. As mentioned earlier creation of cloud layers are not possible and the only cloud adjustment will be cloud cover when cloud layer is available. After you use Duplicate you can double click on the name to rename it if you like.

Load ATM: Click on this icon to load an atmosphere preset ATM file.

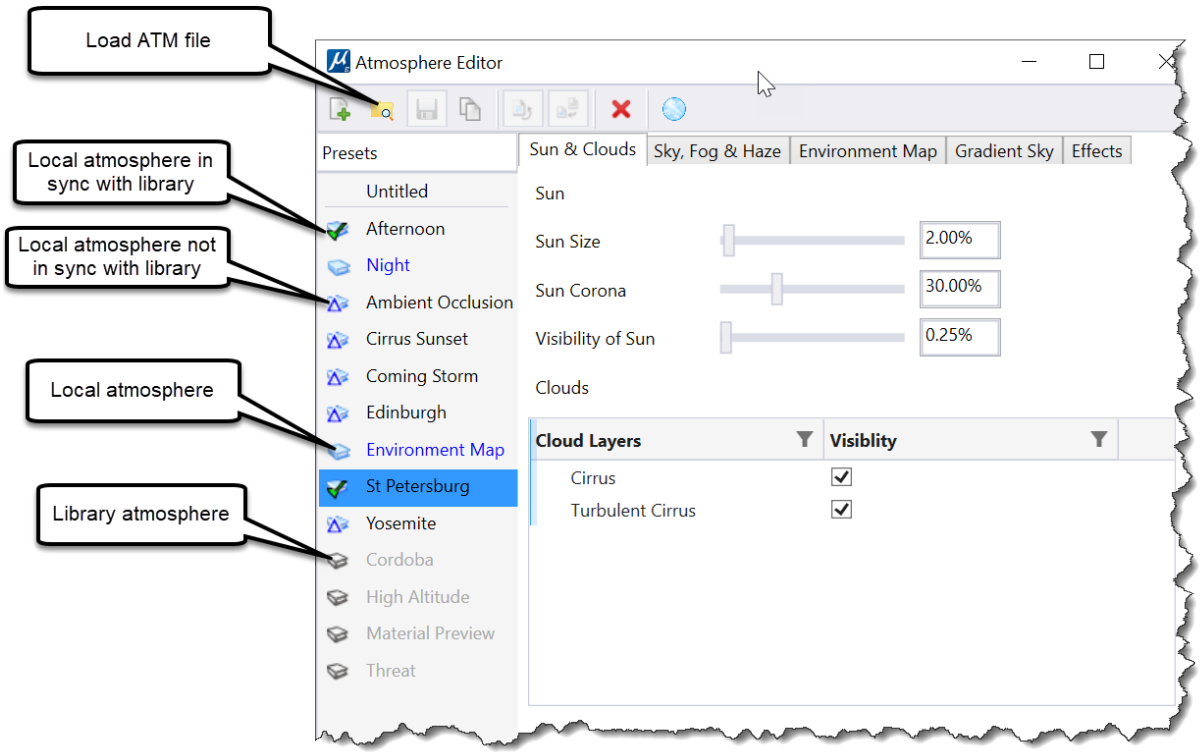
Save Preset: Click this icon to save your edited atmosphere or environment.

NOTE: This only saves to the DGN file that you are working in to share customized environments or atmospheres with others you will need to create a DGN Library file.

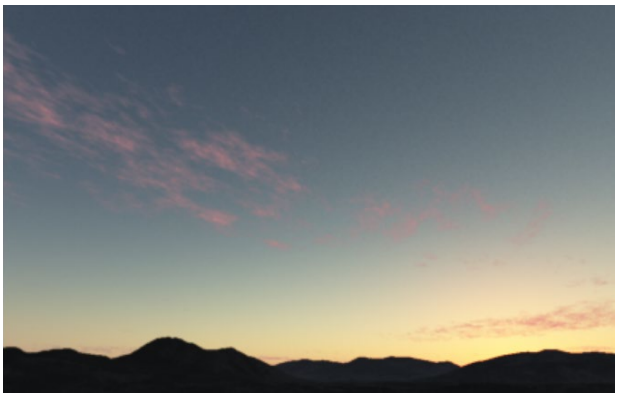
Duplicate: Click this icon to make a duplicate of the selected atmosphere. A great way to start a new atmosphere preset especially if you want a cloud layer use this.

Reset: Click this icon to reset the edited local atmosphere to match the last saved state.

Update from library: Click this icon to update the selected preset from the DGN Library.

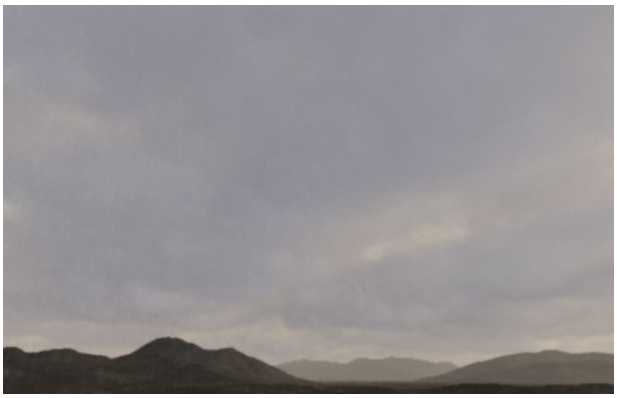


Atmosphere Presets: The following images will provide some idea of what to expect from the preset atmospheres delivered with MicroStation CONNECT Edition Update 15. Note that your scene's time of day, camera lens and position could result in a completely different look.

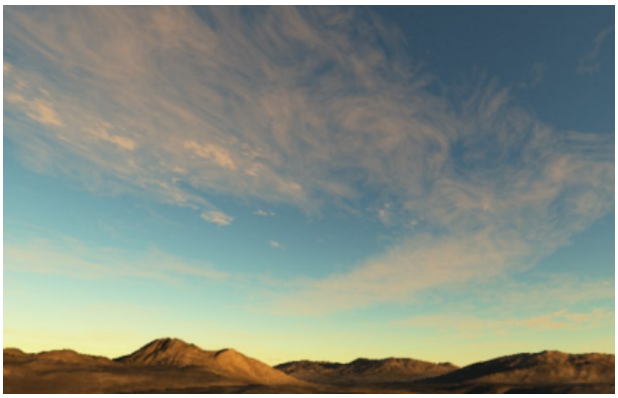


Cirrus Sunset

Coming Storm



Edinburgh



St Petersburg

Yosemite

Cordoba

High Altitude

Threat

Note: MicroStation currently uses *Photometric Spectral* based Atmospheres, however other atmospheric models will be supported in future versions. Photometric Spectral is VUE's hyper-realistic atmospheric model that accurately simulates the behavior of real-world atmospheres and lighting according to weather conditions. The appearance of sky, sun and clouds as well as the character of direct and ambient light are all affected by the delicate balance between the air, dust and water particles that constitute the atmosphere.

Sun & Clouds: The Sun & Clouds tab lets you set the Sun Size, Sun Corona and the Visibility of the Sun. If a Cloud layer exist, then addition controls for Visibility and Cover will be presented.

The **Sun Size** control lets you adjust the size of the disk that represents the sun in the sky.
If the value is non-zero, the sun will be visible, and the disk will be filled using automatic sun color based on Photometric Spectral Atmosphere. The color gradation ranges radially. If the sun size is zero, no sun will be visible in the sky, although it will still be emitting light. In this case the sun color is ignored.

Size of the corona: This setting is available to control the visible size of the solar disk that is added to the atmospheric glow. In the following renders the left Corona is 10% and the right Corona is 60%.

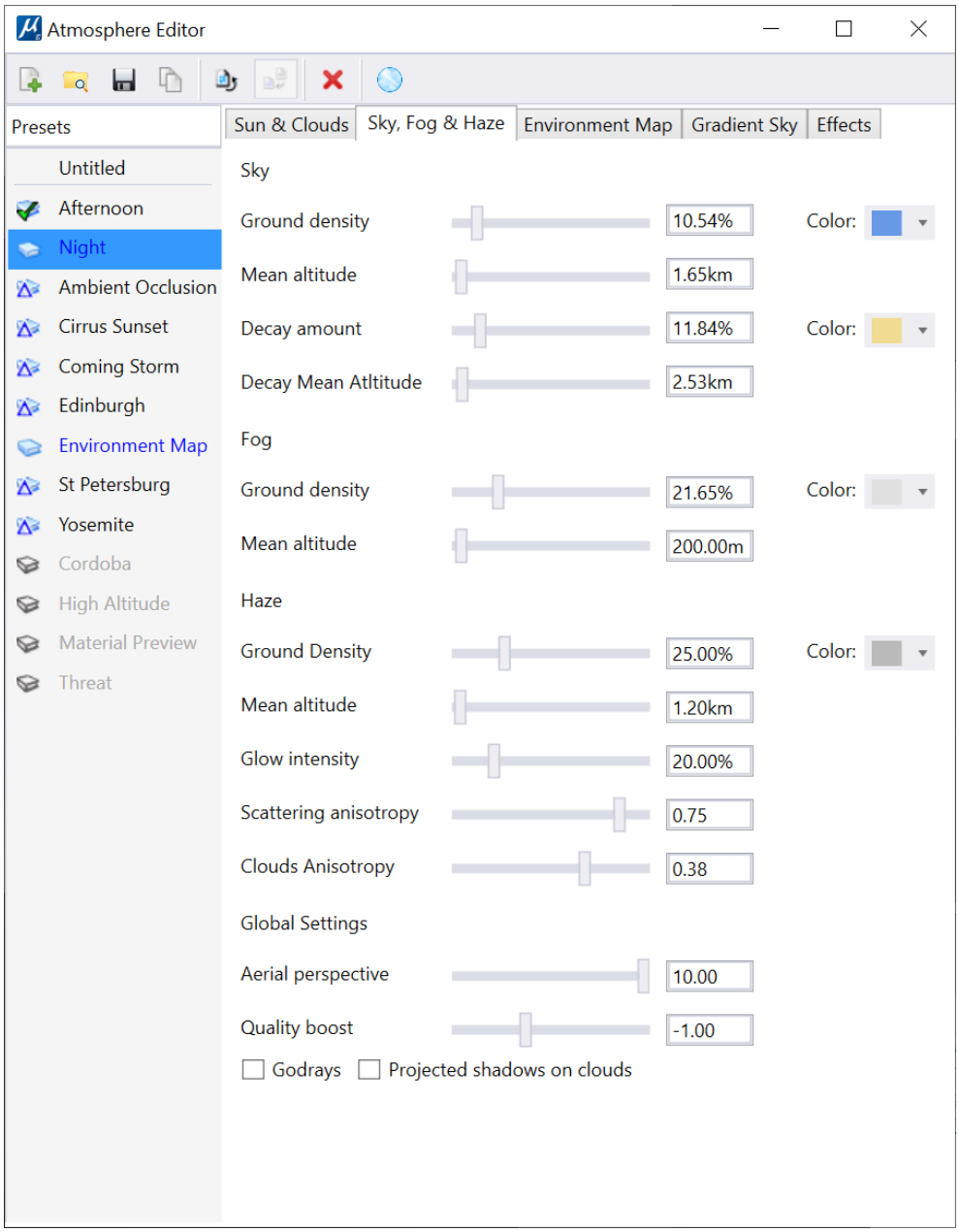

The **Visibility of the sun** control, which is specific to the Spectral atmosphere mode used in MicroStation's implementation, lets you adjust the sun disc visibility as rendered within the atmosphere without affecting sky or geometry lighting. A physically correct sun disc visibility corresponds to 100%, which will render a sun disc that will produce a correct image-based lighting intensity when exporting high dynamic range skies (using HDR or EXR file format).

Cloud Layers: You may toggle on or off cloud layer visibility and control the Cloud Cover.

Sky, Fog & Haze:

Although you may think fog and haze are used only on special occasions (e.g. to achieve particular photographic atmospheres), this is not the case. Whatever the weather conditions (unless you are out in space), you will find that fog and haze are always present. Fog and haze are what gives color to the sky. What changes is the distance at which they become significant. Fog and haze are important for fine tuning the atmosphere, because they give an idea of distance. Therefore, nearly all the predefined atmospheres have some amount of fog and haze. Because fog and haze are responsible for the color of the atmosphere, they are an essential component of the atmosphere model. By adjusting the density of the fog and haze you will adjust the color of the sky.

NOTE: When rendering using VUE's Path Tracer the Haze settings are rendered however Fog settings are ignored. The VUE Ray Tracer will use both Haze and Fog settings when ray tracing a scene.



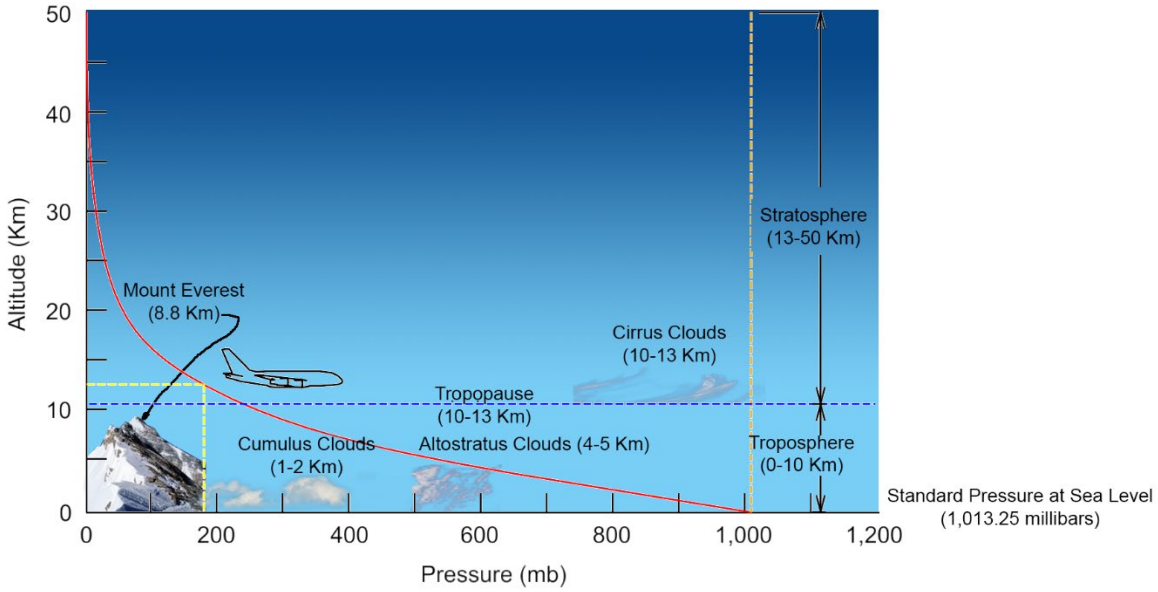
Sky, Fog & Haze tab is where you can adjust numerous settings, the controls in this group let you adjust the density of the gasses that constitute the atmosphere (namely nitrogen and oxygen). On earth, these gasses are responsible for the blue color of the sky, and the reddening of the sun near the horizon.

To get started click on one of the Library Atmospheres and make any change, notice the icon turns blue which means there is a local copy. Notice also that a blue book icon that has a triangle will indicate that it no longer matches or is out of sync with the one stored in the DGNLIB library.

The first set of controls in the Sky group are related to the sky, and the way the blue color appears:

Sky ground density: This setting controls the density of the atmospheric gasses at ground altitude.

Sky mean altitude: This indicates the rate at which the density of the atmospheric gasses drops with altitude. The lower the mean altitude, the more quickly the density drops (the atmosphere density is exponential with altitude as can be seen by the red curve in the graph below.

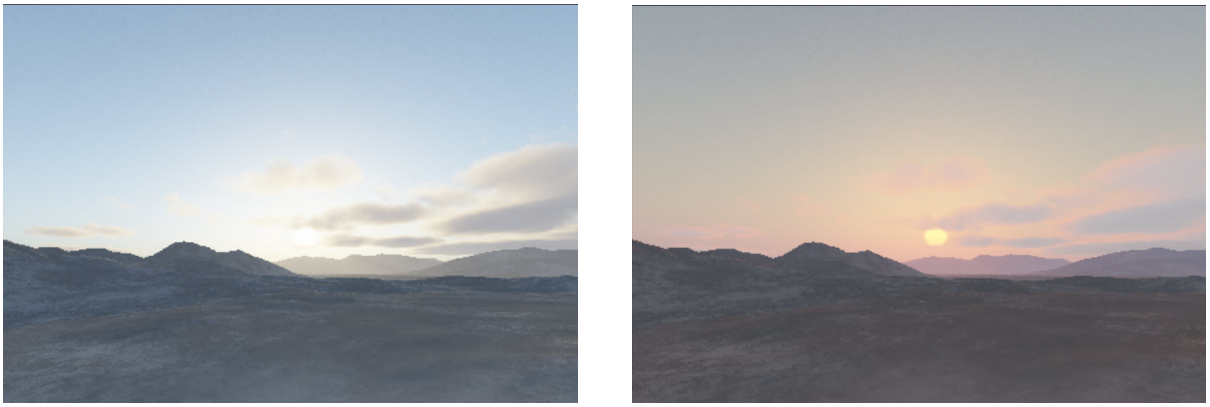


NOTE: Mean altitude is the altitude where density reaches half the density at ground level. Because density or pressure is exponential with altitude, this is usually a lot less than half the maximum altitude of the component. For instance, we know that the Earth's atmosphere reaches up to approximately 60 miles high, but it's mean altitude is only 5.5 miles or 8.85 Kilometers (at an altitude of 5.5 miles, the density of the atmosphere is half of that at ground level).

Sky color: This lets you change the color shift caused by the gasses in the atmosphere. On earth, this color is blue, but you can imagine alien planets where the gasses in the atmosphere result in a different color for the atmosphere.

The other settings in this group are relative to the color decay caused by atmospheric gasses.
This controls the way the color of light turns red as the sun gets closer to the horizon.

Decay amount: This is the amount of reddening that occurs as the sun gets closer to the horizon.



Decay at 10% on left and 50% on right

Decay mean altitude: Like for sky, this controls the rate at which the decay disappears with increasing altitudes.

Haze & Fog

The settings in this group control the other components of the atmosphere including small particles, such as dust, and humidity. Small particles are responsible for the haze while humidity is responsible for fog.

Haze ground density: This indicates the density of particles of dust and pollution at ground altitude. Haze is typically responsible for the gray color that appears near the horizon when the sun is high up in the sky.

Haze mean altitude: Controls the rate at which the density of small particles in the atmosphere drops with altitude.

Haze color: Controls the color that is added to the atmosphere as a result of the small particles. Usually, this color is gray.

Fog ground density: Indicates the density of water particles at ground altitude. These water particles create a strong glow effect when illuminated from behind. When there is a lot of humidity in the atmosphere, the atmosphere becomes gradually opaque.

Fog mean altitude: Controls the rate at which the density of water particles in the atmosphere drops with altitude.

Fog color: Controls the color that is added to the atmosphere as a result of the water particles. Usually, this color is a dark shade of gray.

Glow intensity: Glow is caused by water particles being illuminated from behind. They result in a bright glow around the sun. This setting lets you control the amount of glow in the atmosphere around the sun.

Scattering anisotropy: Controls how "directional" the glow effect is. It influences the overall shape of the glow effect around the sun, and how bright the fog is depending on the direction you look at.

Clouds anisotropy: This provides additional control over the way light is scattered inside clouds. This can make dramatic changes in sunset clouds nearest the sun, for example.

Global Settings

Aerial perspective: This setting controls the overall "thickness" of the atmosphere. A value of 1 corresponds to the typical Earth atmosphere. If you increase this value, the effect, in terms of atmosphere, will be like increasing the scale of your scene.

NOTE: Setting this value to 10, will boost the effects of the atmosphere allowing the fog and haze to be more pronounced without having to use "real-world" size environments. If you are looking for physical accuracy, you should set this value to 1, which is the aerial perspective of the Earth's atmosphere. You

should also construct your environments at Earth scale (hundreds of miles). For interior scenes where you don't want to have any visible fog or haze you can simply set this to zero.

Quality boost: This setting is available only in the volumetric and spectral atmosphere models. It controls the number of samples that are taken throughout the atmosphere in order to compute the interactions of light with the air. Increase the Quality boost setting if you can see noise in the atmosphere (beware: longer render times will result).

Godrays: When this option is checked, the clouds will cast shadows in the atmosphere, resulting in rays of light showing through the clouds. The result can be particularly impressive when the sun is low on the horizon. Rendering Godrays can dramatically increase the render times, without necessarily having any noticeable effect (just like in the real world, it takes very specific conditions to see Godrays shining through the clouds).

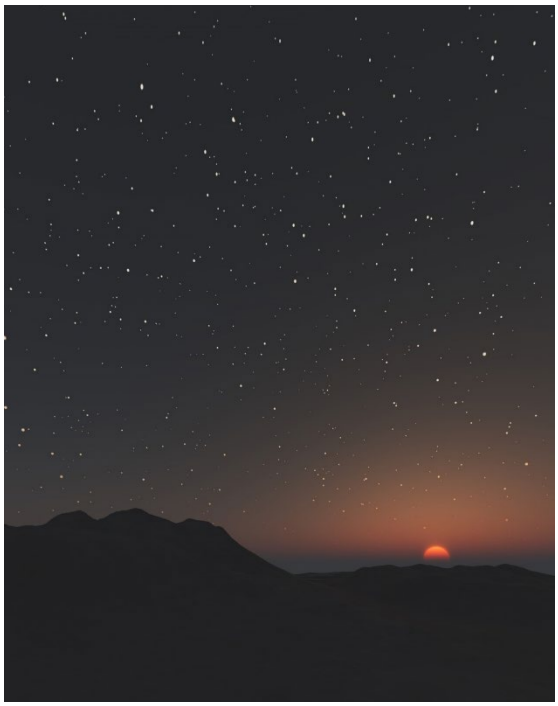
Projected shadows on clouds: If on this option will produce shadows on clouds from other clouds or any object above the cloud layer such as an airplane.

Effects

The Effects tab has controls that let you add cool atmospheric effects such as stars, rainbows or ice rings to your renders.

Stars: Select this option to automatically add stars to your skies. When you turn on stars, the following controls become active:

> **Number of stars**: Increase the value to add more stars in the sky.
>
> **Brightness**: Increase the value to make the stars brighter. If the sky is dark, you will probably want to increase the brightness of the stars. If it is blue, you may want to reduce it, because stars are barely visible in the daytime.
>
> **Twinkle**: Used to adjust the amount of twinkling of the stars in an animation. **NOTE**: *Twinkle will not make any difference in a render but may be supported by MicroStation Animator at some point in future*. A value of zero means that the stars don't twinkle at all. A value of 100% means that the stars may be completely "turned off" during the animation process.
>
> **Len flares**: This option adds tiny cross-like lens flares to all the brighter stars.
>
> **Colored stars**: checking this option makes the stars appear with random colors.



Atmosphere with Stars

NOTE: Stars are currently not rendered using Path Tracer. Stars will be more pronounced when using standard photometric atmosphere model support for this will be included in the next update.

Rainbow:
Selecting this option will automatically add a rainbow effect to your scene. However, you must understand that rainbows only appear when the sun is shining from behind the camera. If this is not the case, the rainbow will appear outside the field of view. So, if you don't see the rainbow, make sure the sun is placed behind the camera, close to the horizon. This is because rainbows are created by the light - from the sun being diffracted inside drops of water (rain) and reflected towards the source. When you turn on the rainbow feature, the following controls become active:

Intensity: This setting controls the overall intensity of the rainbow effect. The lower the setting, the less noticeable the rainbow will be.

Size: This setting controls the thickness of the rainbow (i.e. the amount of angular spread between the two extreme colors, red and blue).

Falloff: This setting controls the way the intensity of the rainbow reduces with altitude. If the value is high, the rainbow will vanish near the top. The higher the value, the shorter the rainbow.

Secondary bow: Turn this option on to display a secondary, inverted bow, larger and dimmer than the main bow. Notice how the sky becomes darker in between the two bows.

Realistic colors: Select this option if you want the rainbow to display a realistic distribution of colors, rather than the regular, comic-style red-green-blue rainbow.

Atmosphere with Rainbow Effect

(Future) Ice Rings:

NOTE: MicroStation currently only supports Photometric Spectral Atmospheres once support for additional Atmospheric Models is added Ice Rings will possible.

As opposed to rainbows, ice rings are only visible in the atmosphere when looking straight at the sun. Ice rings are caused by tiny crystals of ice in suspension in the air. These ice crystals concentrate light into a ring around the sun, at a specific angle around the direction of the light. This angle (22° , and thus the size of the ring, is directly linked to the angle between the sides of the ice crystals.
When you turn on the ice ring option (*this option is only available in the standard and volumetric atmosphere models*), the following controls become active:

Intensity: This setting controls the overall intensity of the ring effect. The lower the setting, the less noticeable the ice ring will be.

Size: This setting controls the thickness of the ring (i.e. the amount of angular spread of light). Low settings will make for less noticeable rings.

Parhelic arc: Check this option to show a parhelic arc around the ice ring. This is a secondary, much dimmer ring that appears at an angle of 46° around the direction of the sun.

Sundogs: Check this option to show the sundogs on either side of the sun. The sundogs are a horizontal flare of light that appear on either side of the sun, in between the sun and the ice ring.

Pillar: Check this option to show the sun pillar. The sun pillar is a vertical flare of light that appears to extend the central sun flare to the edges of the ice ring.

Environment Mapping

Environment Mapping: Especially suited for architectural visualization, environment mapping lets you easily set up an environment based on panoramic photographs. By using VUE's Image Based Lighting, HDRI support and global reflection mapping you can create a seamless integration between your scene and the background images.

If you have been rendering with the Luxology rendering engine you will already be familiar with using environment maps such as Sky Spheres, Sky Cylinders and Light Probes. These images can be HDRI or not and can be used to illuminate your scene using image-based lighting. The image the camera sees can be different from the one used for producing light and you may define a separate image for reflections.

NOTE: The VUE rendering engine currently is a bit different in the way that it handles cylindrical mapping as compared to MicroStation. We recommend using the Hemispherical Mapping mode instead of Cylindrical for cylindrical images until VUE's cylindrical mapping mode matches that of MicroStation. Our plan is to make sure that VUE matches what MicroStation displays so that one can dynamically position the environment map and have the rendered view match.

Mapping mode

The **Mapping mode** parameter can have the following values:

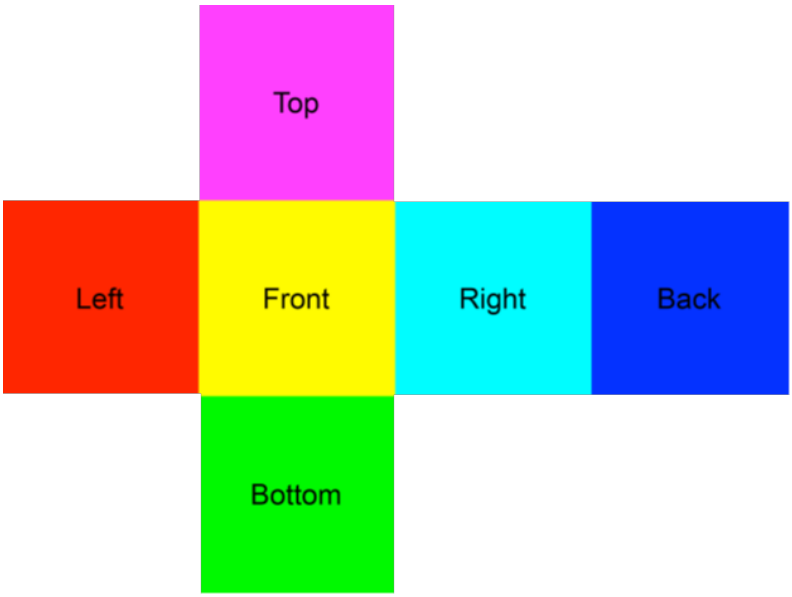
Spherical: This mode can be also called *equirectangular* where the image is spherically mapped, and the image rectangle where the Azimuth is the U coordinate and the Pitch is V coordinate.

Hemispherical: Like Spherical mode, the mapping is done via Azimuth and Pitch coordinates, but only upper half dome is mapped.

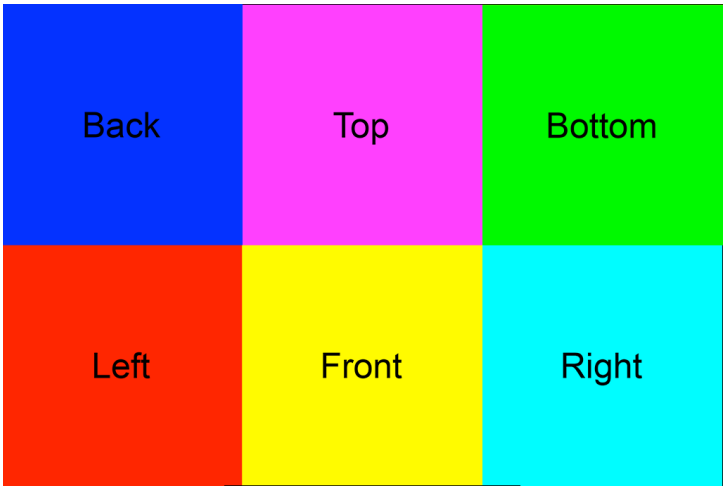
LightProbe: This mode allows the use LightProbe maps.

Cylindrical: This mode allows the use of Panoramic images as cylindrical.

Cube Map and Compact Cube Map: This mode allows one to use Cube Maps either with standard cube pattern or with compact one as shown in the following images.



Cube Map

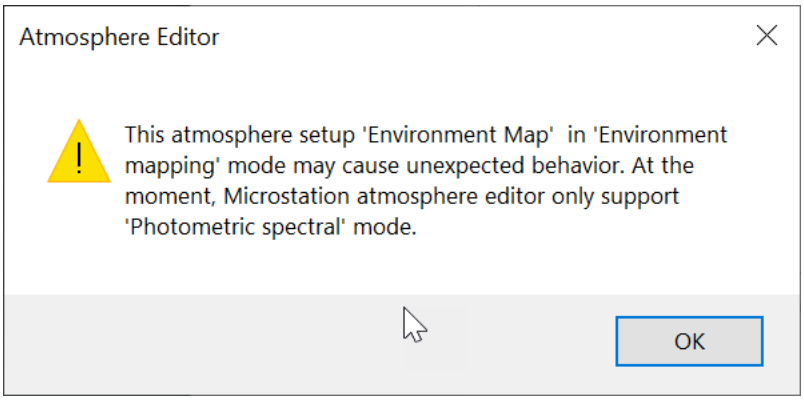


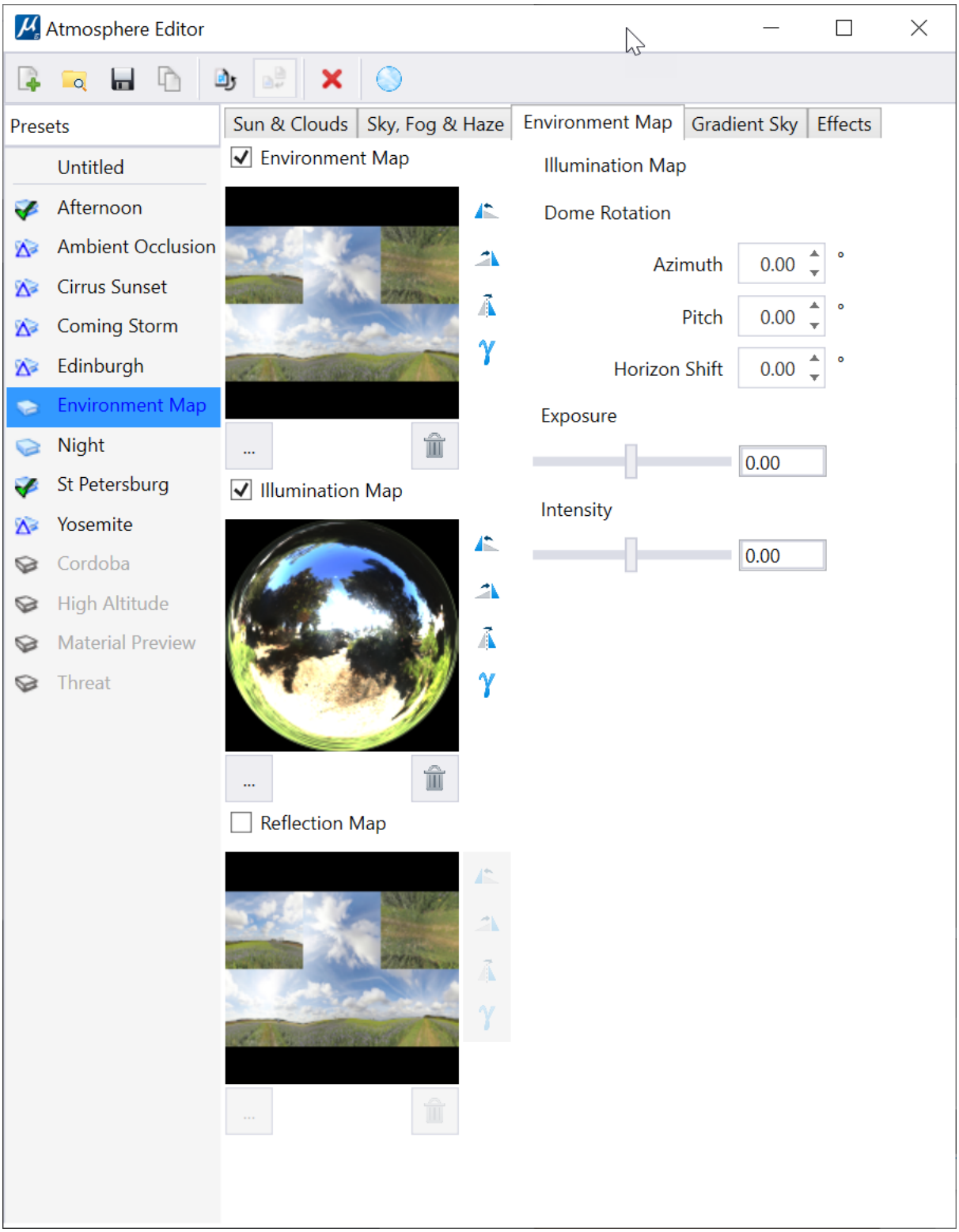
Compact Cube Map

The **Dome rotation** controls let you fine tune the placement on the environment map on the environment hemisphere. You can adjust the **Azimuth**, **Pitch** and **Horizon offset** parameters using these controls. Azimuth spins about the view's Z-Axis and Pitch rotates about the view's X-Axis.

The **Exposure** and **Intensity** sliders let you adjust the exposure and intensity of the environment map. If the current environment map is a high dynamic range image, you can view the entire image's dynamic range by sliding the exposure setting up and down.

NOTE: You will see the below message when using environments maps however in the next version of MicroStation this message will not be necessary as Standard Spectral atmospheric model will be supported when using environment maps.


Atmosphere Editor
This atmosphere setup 'Environment Map' in 'Environment mapping' mode may cause unexpected behavior. At the moment, Microstation atmosphere editor only support 'Photometric spectral' mode.
OK



...

To load a map, click the Browse icon below the map preview to open the Atmosphere file Browser and load an image map. The options are Environment Map, Illumination Map and Reflection Map if the

Illumination or Reflection maps are not checked the selected Environment Map is used. If you want a separate illumination or reflection map, simply enable the map and use the corresponding browse icon to find and load a different map.

Note: You don't have to use a HDRI image for Image Based Lighting. However, HDRI images produce the nicest results because they contain actual sources of light. If you use a standard picture, you will probably have to increase the sky dome lighting gain to compensate for the fact that there is no light in the map.

Each map can be adjusted by clicking the following icons:


Rotate Left: Will rotate the image map to left by 90 degrees.


Rotate Right: Will rotate the image map to right by 90 degrees.


Mirror: Mirrors the image map vertically.


Gamma: Open the Gamma settings allowing you to use system gamma or override it for the selected image map.


Remove Map: Click this icon to remove the image from selected map option.

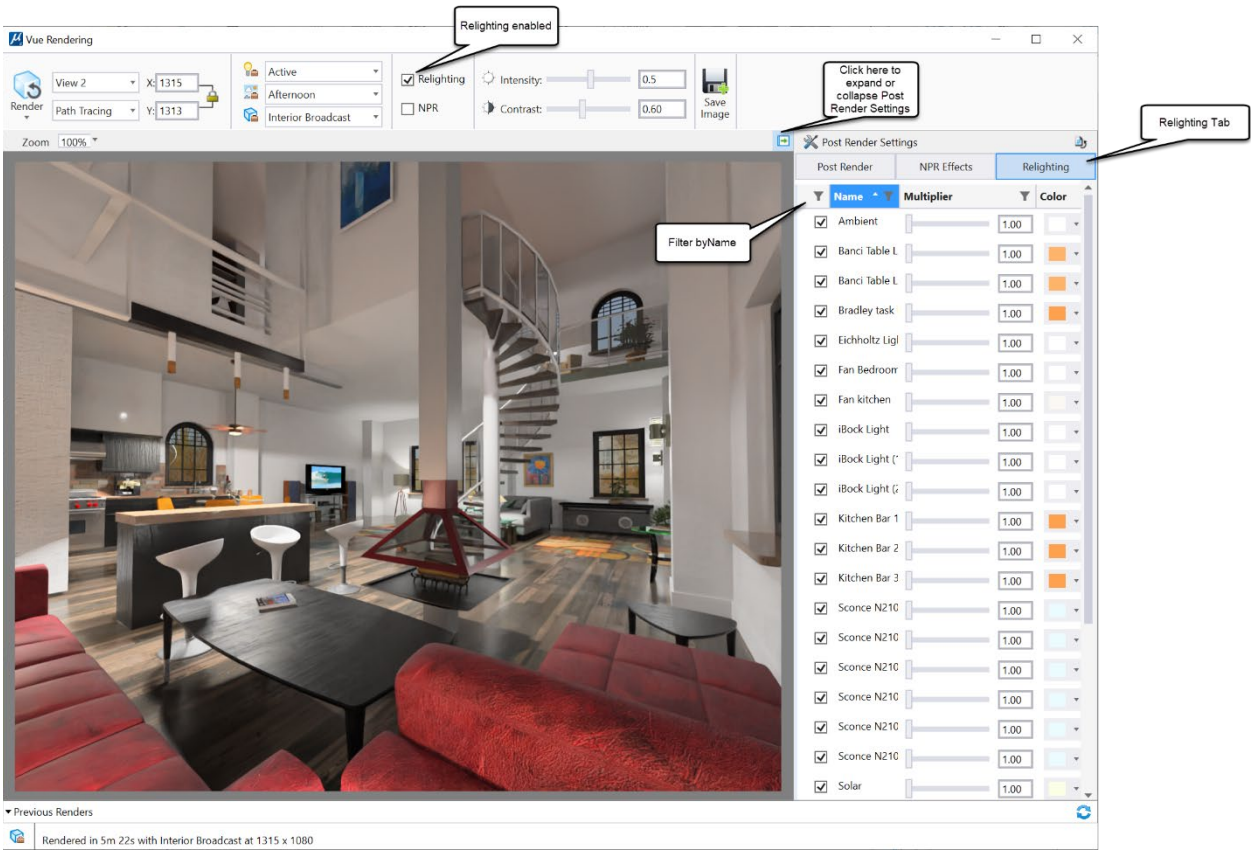
Relighting

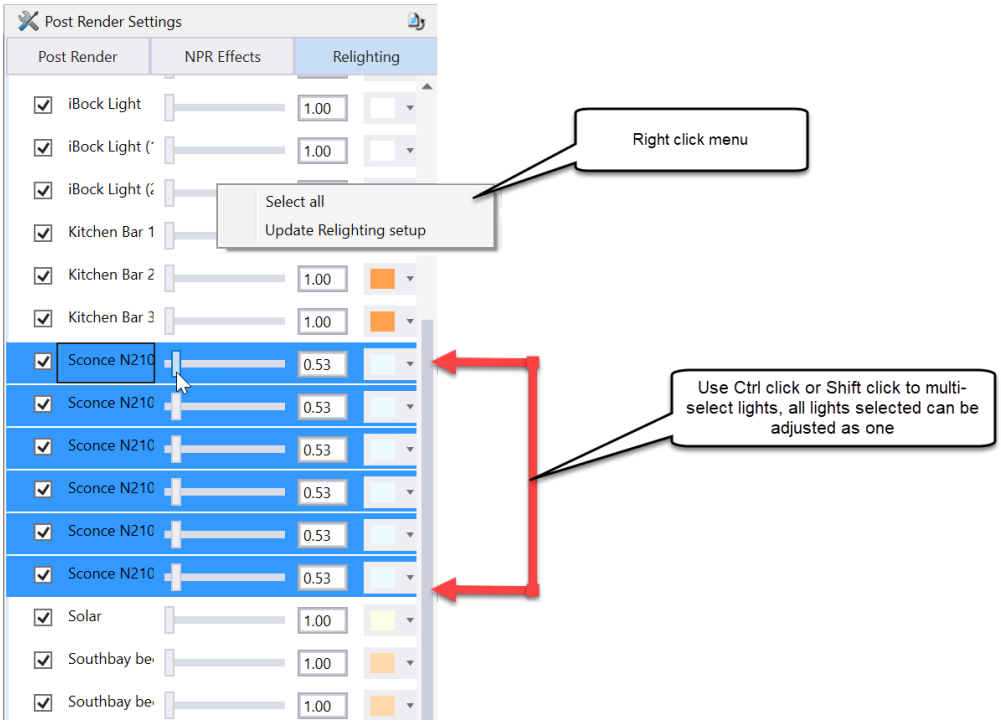
The VUE render engine support Relighting allowing you to adjust all lights in the scene after the render completes. While like Effects Manager in ability to create a light setup based on your adjustments it is much faster to render than Effects Manager as the information needed to make the adjustments are rendered in a single pass. The layers used by both Relighting and Non-photorealistic Rendering (NPR) are storied in the VUE History folder.

To enable Relighting, you need to check the option prior to rendering, when the render is complete the relighting information will be seen in the Post Render Settings of the VUE Render dialog.

After expanding the Post Render Settings, you can click on the Relighting Tab and adjust lighting intensities and color. You may optionally filter the list based on Name, Multiplier or Color.

TIP: It is a good idea to name the lights using Light Manager prior to rendering with relighting so that all the lights that might be on a switch have the same name. This will make it easier to multi-select those lights and be able to adjust Intensity and Color on all selects lights at once



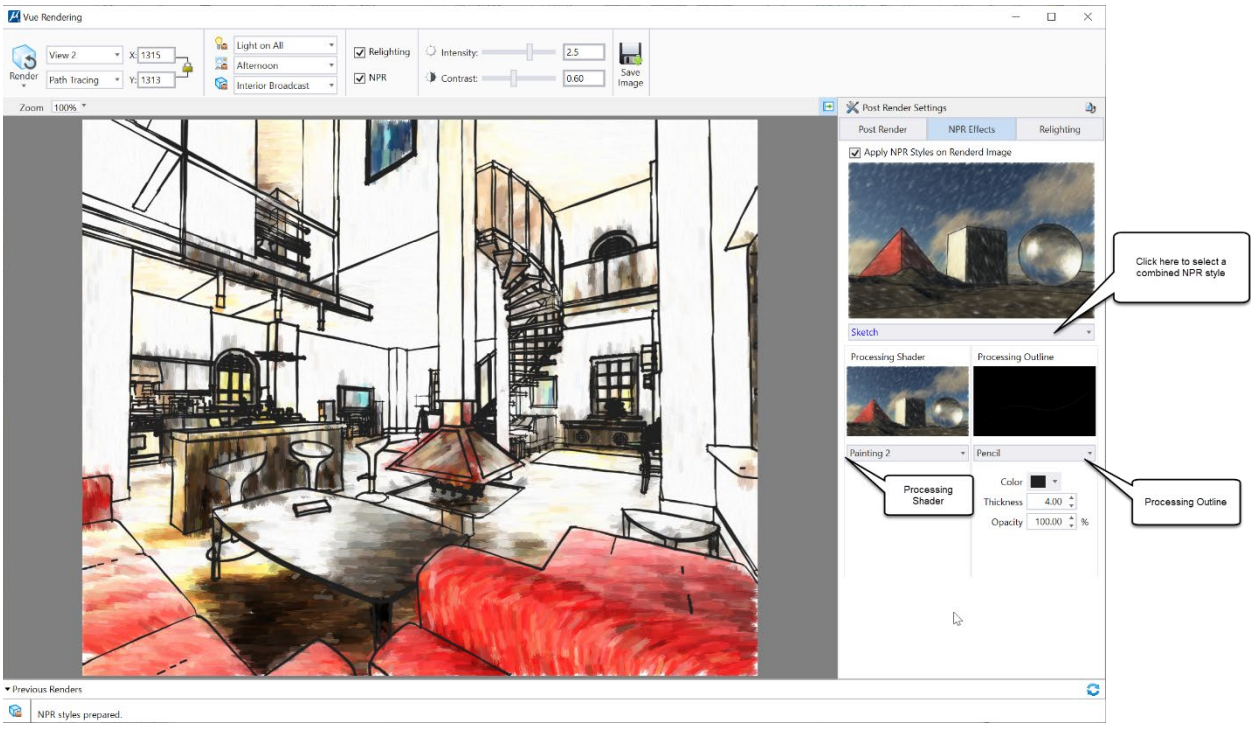


Once you have dialed in the lighting you can right click on any light in the list and choose Update Relighting setup. This action will create a local Relighting named light setup which will then appear in Light Manager.

In the below renders Relighting was used to set lights to a cool white color on the right image whereas the render on left has both cool and warm colored lights.

Non-Photorealistic Renders (NPR)

In addition to Relighting feature VUE's render engine also let you create Non-Photorealistic Renders. To enable NPR, you select the option prior to rendering when the render completes Expand the Post Renders Settings, the NPR settings will appear on the NPR Settings tab.

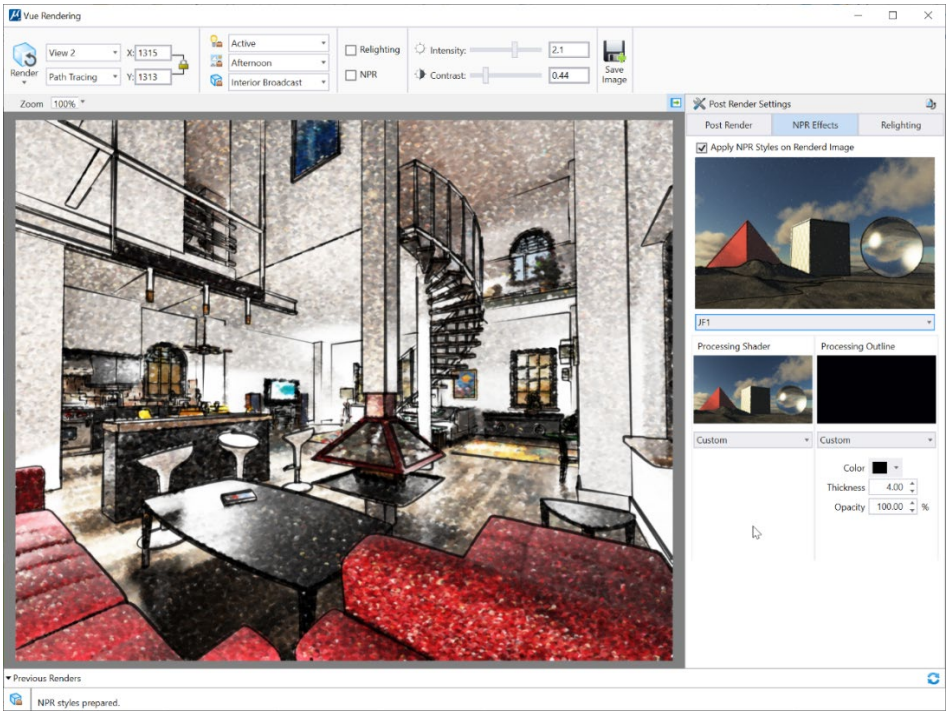


To apply NPR, you will need to check the Apply NPR Styles to Rendered Image option. You may choose a combined style, or you may create your own combination by selecting a Processing Shader and Processing Outline to create your own style. Note when you choose a combination style preset the Processing Shader and Processing Outline will automatically be set to Custom.

NPR using the Perspective Drawing Combined Style

If you have a copy of VUE you can create additional custom NPR styles and save them to the appropriate MicroStation folders. Typically found here C:\Program Files\Bentley\MicroStation CONNECT Edition\MicroStation\Default\NPR. Example can be seen below using combined effects with style JF1 created and saved with VUE to JF1.sty and copied to C:\Program Files\Bentley\MicroStation CONNECT Edition\MicroStation\Default\NPR\Combined.

You may want to create a folder or folders to store your custom NPR Styles rather than copy to program files folder. You can use the configuration variable **MS_NPRSTYLES** and define your folder for NPR such as C:\Users\your.name\Documents\NPR\Combined.



The Hidden Stuff

We have a couple of obscure goodies hidden in update 15 that you can try as well.

QuickVision Shadow Dynamics: To use the new shadows which will in most cases be much faster when manipulating a view than default method you will need to add a couple of configuration variables. The old method turns off shadows completely then redraws the shadows once the view manipulation stops. If you enable the new shadows the shadows are drawn continuously.

MS_SMOOTHMODE_SHADOWS = 1 This variable will add shadow dynamics for solar light only.

MS_SMOOTHMODE_SHADOWS_ALL = 1 This variable will add shadow dynamics for source lights in your scene.

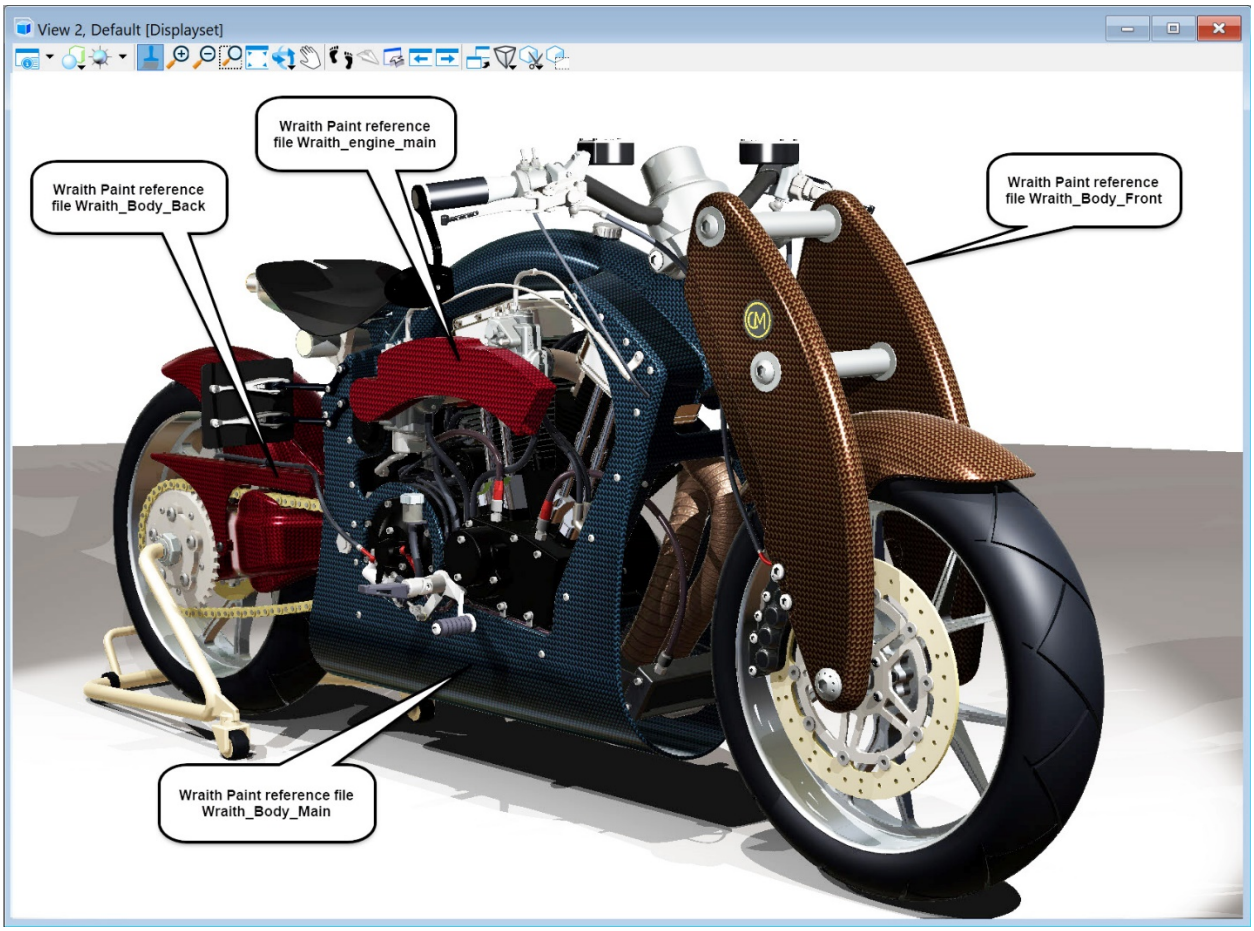
NOTE: If enabled the selection of elements in the shadow shaded view can be very slow, the workaround would be to use a non-shaded or shadowed view for selection.

MicroStation Materials Prefer Library Materials

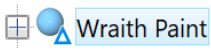
Okay this next one could very well be the most exciting thing for some of you that we have done in a while. Certainly, if you are one that has a longing for the old external material stuff you will love it. You Oldtimers know what I am taking about, the old ascii material MAT file and the external palette PAL. What was cool about the way these worked is that you could simply change the definition in the palette file and every file that pointed to it would see that definition change.

Imagine this scenario you have a multistory building with reference files for the various floors. While working on the building you come up some cool glazing or it could even be for example one of our library definitions Gray glass refract. You may also have several reference files and as you know when working with materials today editing one creates a local copy. A problem can arise when the material definition for each reference file is out of sync with the library version, meaning when you are in the visualization master file you could be seeing different definitions for the same material.

In the following example the motorcycle model's master file consists of several reference files where each has a different definition for the paint color, the name of the material is Wraith Paint but the local definitions for each file is different. When you open the individual file and look at the material editor you would see an out of sync symbol, indication that the local material is different than the library version.

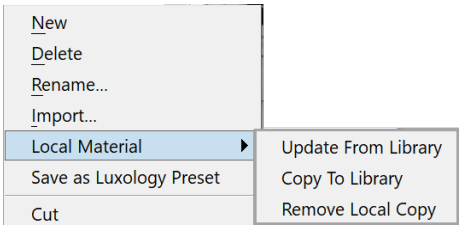


As you can see in above each reference file has a different definition for the paint material



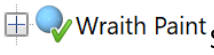
Out of sync symbol by right clicking on the material name you will see that you can either Update From Library, Copy to Library or Remove Local Copy.

NOTE: Motorcycle model by Peter Fotiadis entirely created using MicroStation.



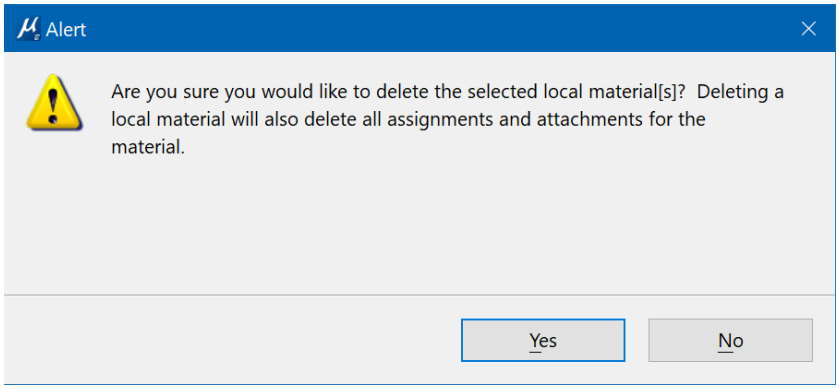
Update From Library will change the local definition to match that of the library.

Copy To Library will copy the local definition to the Library and the symbol will change to a Synced symbol.



Synced symbol indicating that the local definition matches that of the library.

Remove Local Copy will remove the local copy and you will also delete any assignments and attachments for the material. You will see a warning where you are given a chance to be sure before you click Yes or No.

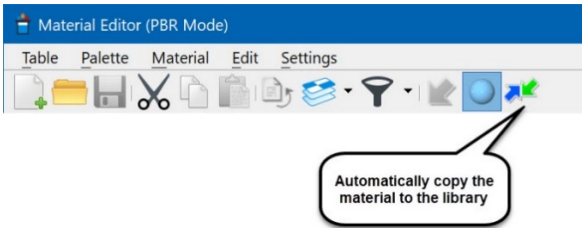


The current workflow to fix out of sync materials would be to open each reference and the sync the material definition by choosing either Update From Library or Copy to Library.

We have a new workflow where when using materials and having a library material associated with the material in a dgn file, the system will use that library material for displaying the element rather than the material in the referenced dgn file.

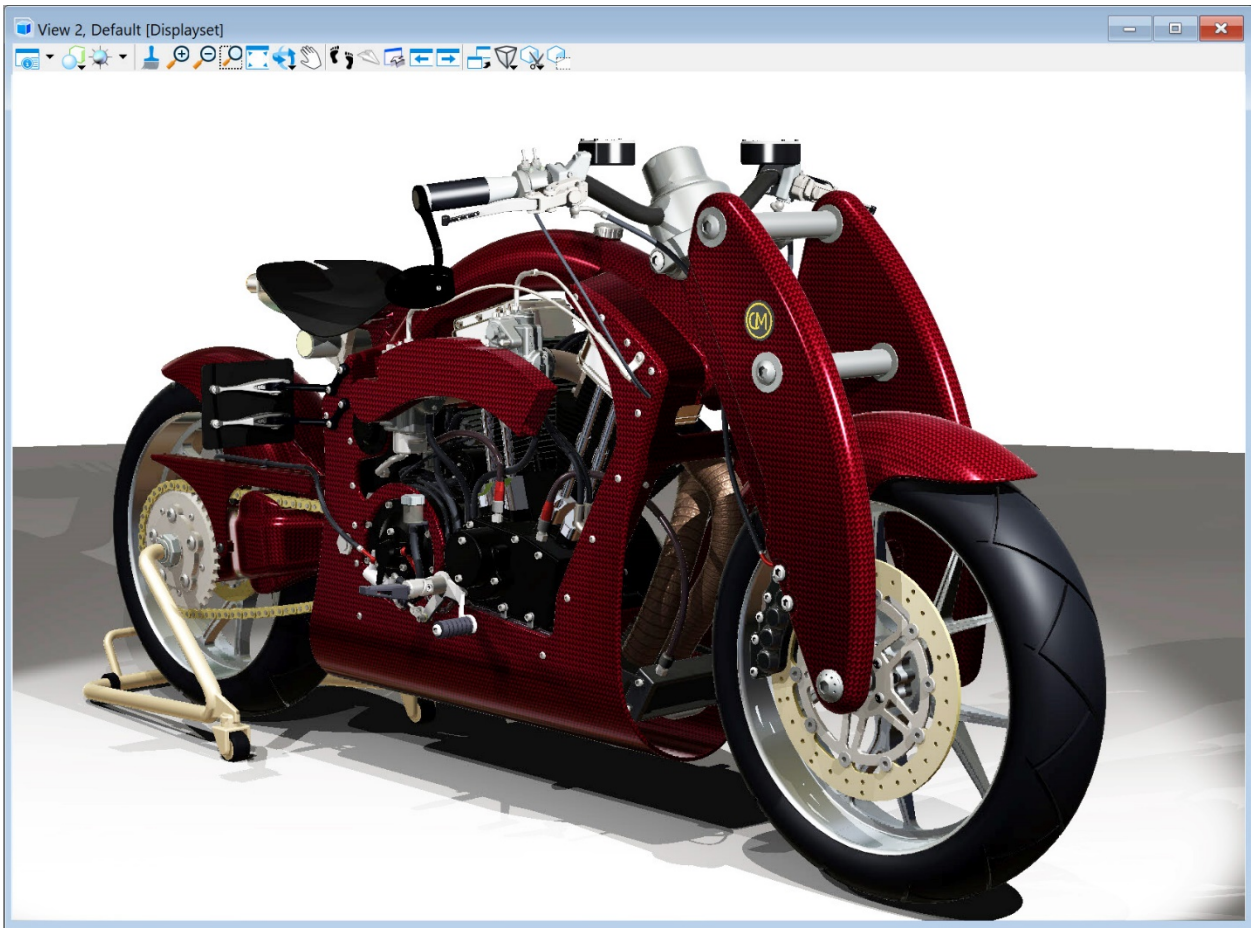
To use this mode, you will need to set the configuration variable:
MS_MATERIAL_PREFERLIBRARYMATERIALS = 1

NOTE: After setting the new configuration variable you will need to exit MicroStation and restart, then you will notice a change in the Material Editor.



If you click (toggle on) the Automatically Copy Materials to Library icon, then all your material edits will be automatically copied to the library and all the materials that share the same name used by any attached refence files will you use that definition.

In the below image capture you can see that after setting the configuration variable MS_MATERIAL_PREFERLIBRARYMATERIALS = 1 all the Wraith Paint material is identical to that from the library.



Motorcycle model after setting MS_MATERIAL_PREFERLIBRARYMATERIALS = 1

Physically Based Rendering materials (PBR)

Physically Based Rendering (PBR) is the latest enhancement to our QuickVision display system. This method of rendering provides photorealistic lighting in 3D environments and physically accurate distribution patterns of light and material definitions. PBR accurately represents a surface based on its interactions with light. Using PBR simplifies the process of creating realistic looking materials, resulting in a very accurate representation of surfaces that work well in all lighting environments.

Note: There are currently two standard PBR materials formats: The Glossy/Specular model, and Metal/Roughness model. MicroStation only supports the Metal/Roughness model for the time being. PBR material samples found over the Internet generally provide both formats.

Figure 1: Motorcycle shaded in MicroStation without PBR materials

Figure 2: Motorcycle shaded in MicroStation with PBR materials

PBR materials (or **Physically Based Rendering** materials) are a very generic class of materials that can describe most of existing surface types in a physically correct way, using a small set of parameters.

Those surface types can range from specular (smooth appearance) to diffuse (rough appearance), for both metals and non-metals. Intermediate surface types (commonly called glossy surfaces) are also supported, producing more or less blurry reflections. As PBR materials parameters can be spatially varying, a single PBR material can even describe a complex mix between several of these surface types.

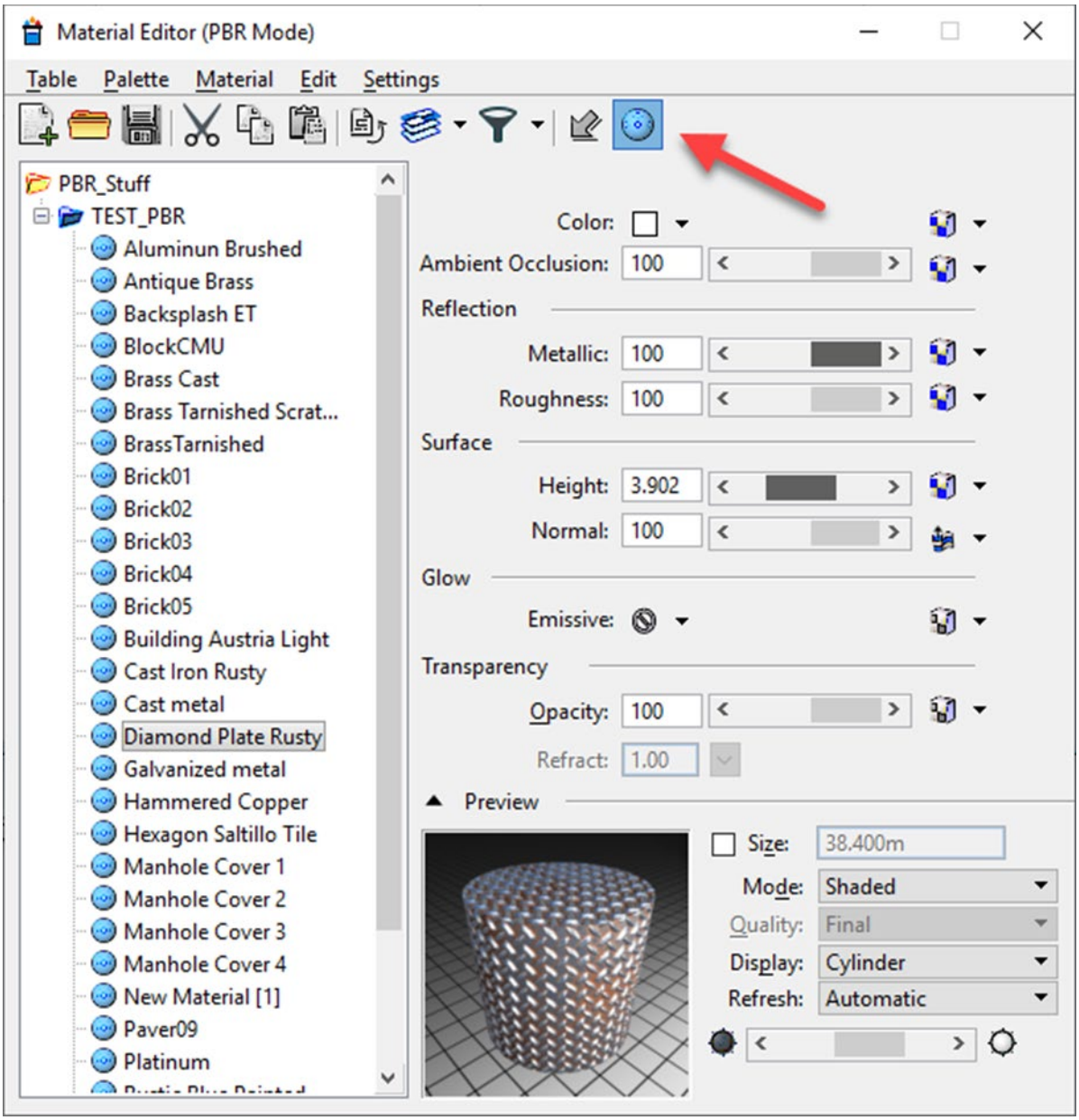
Note: The only surface types that PBR materials cannot describe are transparent surfaces (refractive or not). For transparent or translucent materials, the legacy material type should be used instead. In MicroStation we allow you to toggle on PBR for these materials strictly for enabling more realistic shading in Realtime using QuickVision. When Ray Tracing MicroStation will use the material definition you see when PBR is toggled off in the material editor.

As opposed to legacy materials, PBR materials are always reflective, their appearance will thus, change only based on how rough the surface is described at a microscopical level, effectively producing more specular reflections if the surface is rather smooth, or more diffuse reflections if the surface is rough. Because everything is reflective and modified by the roughness parameter whether as a map or value this can lead to increased render times when ray tracing. When a view is shaded in MicroStation the reflections are from the environment used seen as a “reflection map” and these are processed by the GPU in Realtime. In the future we plan to add ability to use reflection map or ray trace reflections on a per material basis.

You can access the PBR material settings in the Material Editor dialog by selecting the blue PBR icon.

Warning: PBR materials work extremely well when reflection maps are used as these pseudo reflections can be done in Realtime by the GPU. The main drawback to PBR at this time will be when ray tracing is used. Almost all realistic PBR materials will be less than 100% rough therefore PBR materials will greatly increase render times as blurry reflections are very compute intensive.

NOTE: The Path Tracer is not slowed down using PBR materials and at this time if you indeed plan to use PBR for your project we suggest using the Path Tracer. In future release we plan to allow per material reflection maps and quite possibly an automatic threshold where materials whose roughness values are less than 100% but not low enough to see the reflections, we could force reflection mapping rather than ray tracing them as blurry reflections.



Maps for various settings like Height, Normal, Ambient Occlusion, Metallic, Roughness etc. can be used to achieve the desired effects on materials.

Note: The PBR toggle in the material editor allows you to toggle between a legacy material definition and a PBR material. If you have a legacy material and enable PBR with the toggle the legacy definition is retained to go back to legacy definition, simply click the PBR icon and the legacy definition will appear.

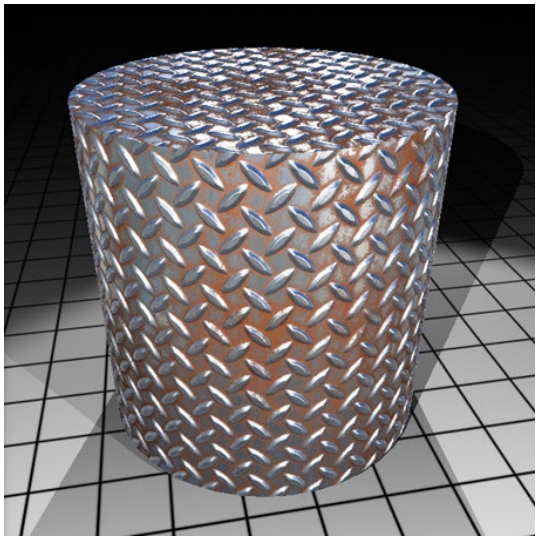
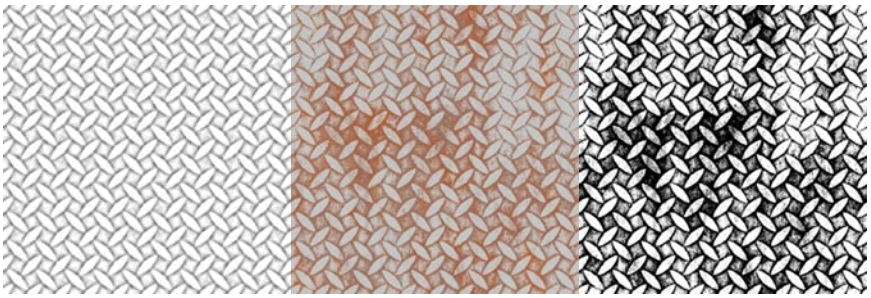


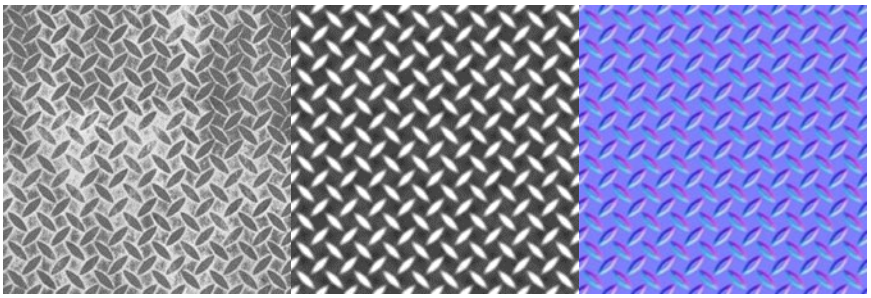
Figure 3: Image shaded in MicroStation. Diamond Plate PBR material using Base color map and maps for ambient occlusion, metallic, roughness, height and normal.

In the diamond plate PBR material shown, base color map with amount maps for ambient occlusion, metallic, roughness, height and normal are used to create a very realistic material. As you can see the areas where the rust appears is flat not shiny or metallic, this portion would be considered as dielectric. These rusty areas would be leaning toward or be black in the metallic map and be leaning toward white in the roughness map.

The following maps are used in the diamond plate material:



Ambient Occlusion *Base Color* *Metallic*



Roughness *Height* *Normal*

Ambient Occlusion: This map modulates incoming lighting over the surface.

Base Color: Defines the color diffuse reflection or albedo.

Metallic: White is pure metal and black is nonmetal. A value of 100 will denote raw metal, while a value of 0 will denote a nonmetal. Intermediate values are supported for smooth transitions, and describe a blended state between metal and nonmetal, but generally metalness masks are binary (either 1 or 0).

Roughness: Controls blurriness of the surface reflections, where white is non-shiny and black is shiny. The Roughness PBR channel describes, at a microscopical level, the surface irregularities that will define how light gets reflected off the surface (rougher surfaces will have larger and dimmer looking highlights, as well as blurred reflections, thus having a more diffuse look, while smoother surfaces will keep reflections more focused, thus having a more specular look).
A value of 0 will correspond to a perfectly smooth surface, producing perfect specular reflections.
A value of 100 will correspond to the maximum surface roughness, producing diffuse reflections.
Intermediate values will produce glossy reflections.

Height: The Height map uses Parallax Occlusion to provide an effect like displacement without creating geometry at render time as a displacement map does, also the effect from height map is inward away from the viewer the effect never appears to move or protrude outward toward the viewer. Height maps work with normal maps to effectively fake displacement without the overhead of creating many micro polygons at render time. A new Height Field View Attribute has been added, so you can turn off the display of height maps. When working in large scenes with many materials using height maps it is possible that viewing operations could become slow, especially where low-end graphic cards are used.

Normal: Normal map uses an image that stores a direction at each pixel. These directions are called normals. The red, green, and blue channels of the image are used to control the direction of each pixel's normal. Normal maps are commonly used to fake high-resolution details on a low-resolution model.

Emissive: Emissive maps can be used to provide effect like glow and allows the user to change the color which sets both the intensity and color of the emissive “glowing” portion of the map.

Emissive map used for led readout, emissive color a light blue

Emissive map used for led readout, emissive color a light green

Opacity: The Opacity map works as it does in a legacy material definition and can be used to make a portion of the mapped imaged completely transparent or partially transparent. When no map is used you can use opacity maps to create glass materials that will look realistic when shaded in MicroStation.

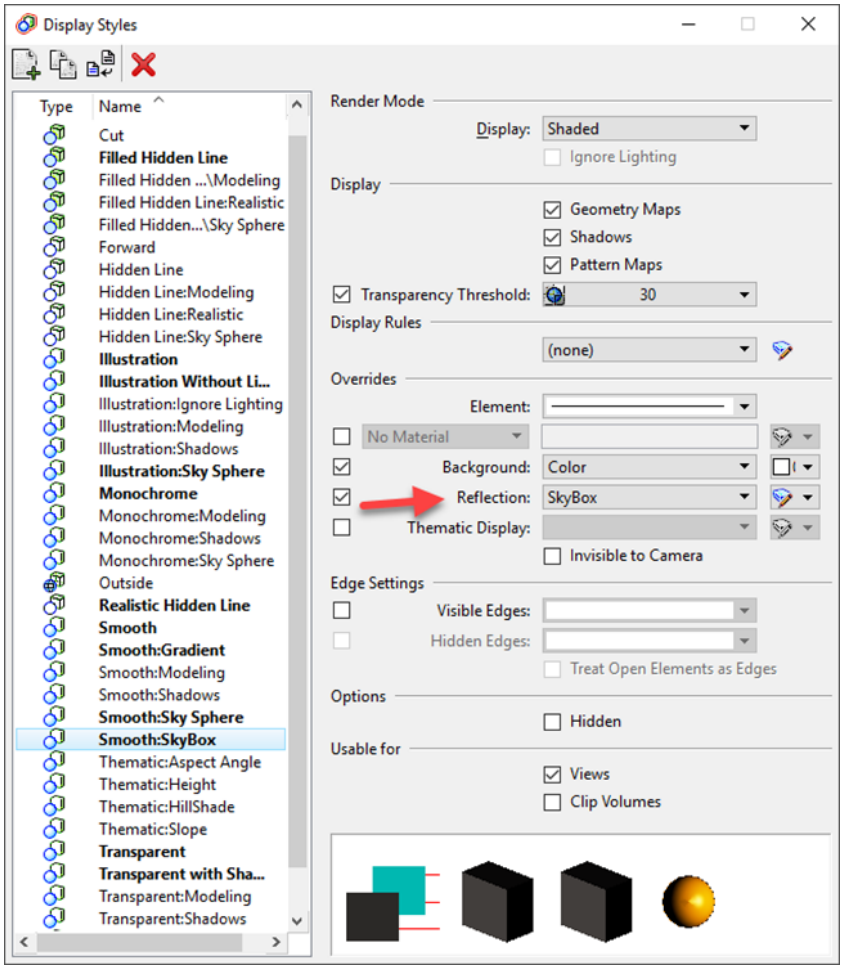
Opacity map used for windows, not completely transparent and reflective to appear as glass

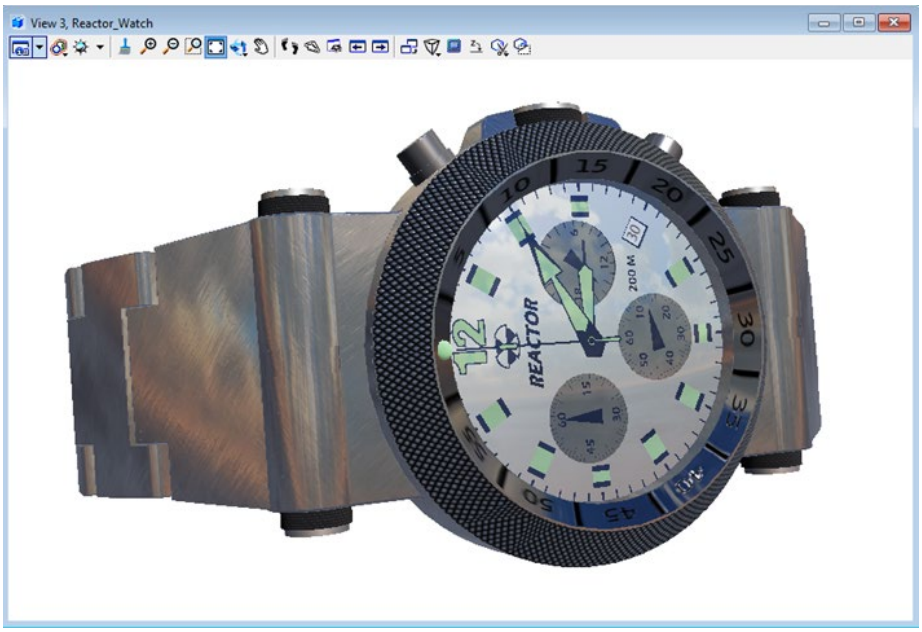
Note: The Ambient Occlusion channel defines how much of the incoming lighting is accessible to a surface point. For non metals, it only affects the diffuse contribution and will not occlude the specular contribution.

A roughness value of zero of black does not mean the material will be 100% reflective while it does provide for subtle reflections. To increase reflectivity further you will need to increase the metallic value. For example, a mirror would have a roughness of zero and a metallic value of 100%.

PBR uses mathematical equations to compute how a light source will diffuse or reflect when it interacts with two primary types of material: Metals (conductors) and non-metals (dielectrics). For Physically-based rendering of a material you don't have to manually tweak every lighting condition like you would do for non-PBR implementations of light. You can conveniently adjust the sliders associated with each map to set its value and view the results without the need to render the scene. This allows for faster production of assets along with enhanced visuals. In short, a very realistic look with less effort.

For QuickVision to effectively display PBR materials you will need to have a reflect environment defined. The Display Styles dialog now has a new Overrides for Reflection setting where you can define the reflection map used for Realtime reflections separate from the Background. You can for example, set the Background to be a color and then set the Reflection to be a SkyBox.





Watch model smooth shaded in MicroStation with reflection map

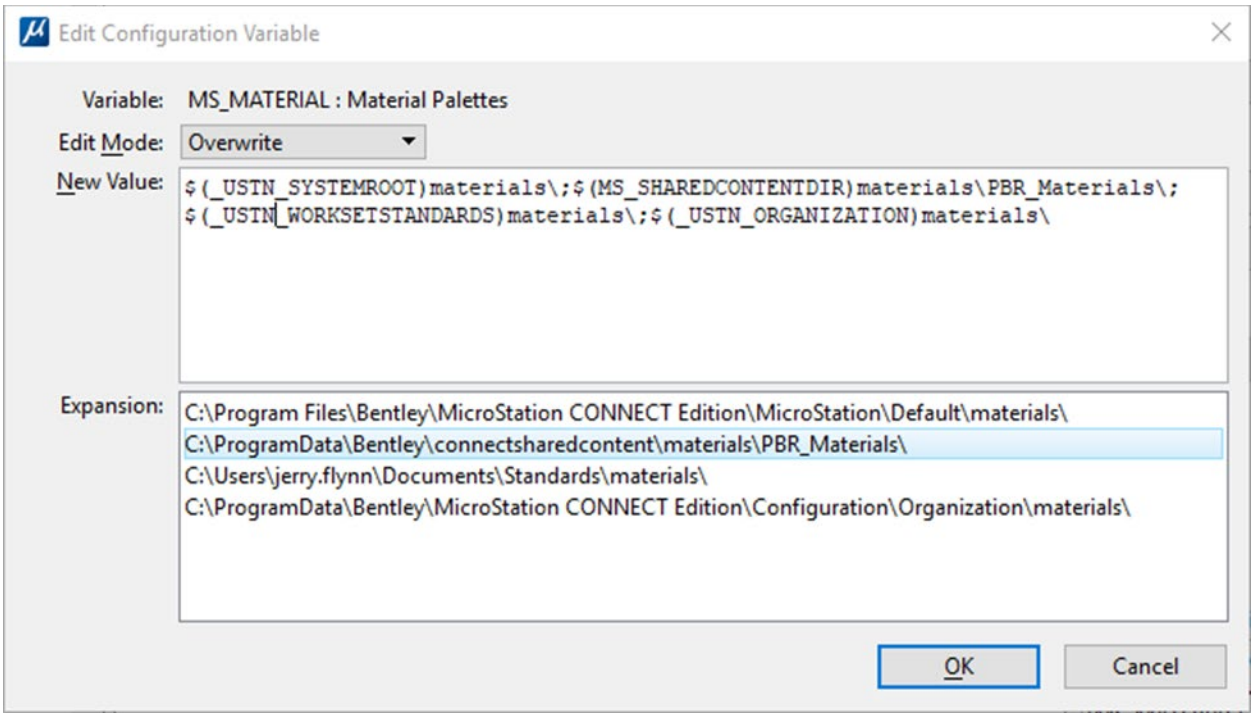
Using the Smooth: SkyBox display style you can see the reflections in the PBR materials used on the watch model.

Getting Started with PBR materials

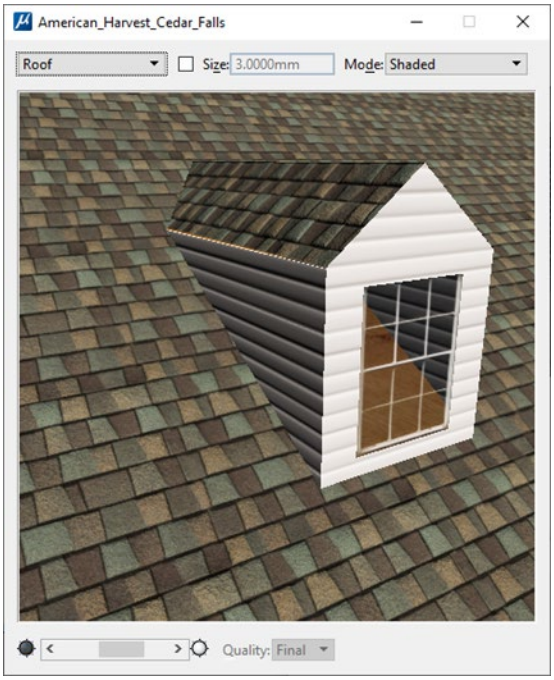
To make it easy for you to get started we have included a PBR version of the Bentley_Materials.dgnlib that has PBR definitions for the materials that you have been using for years. To prevent surprises for existing projects these materials while delivered are not connected. The old library with legacy materials is being used. Why did we not go ahead and enable the new PBR version? Simply because it is likely any of our materials that you might have used were probably customized by you, by changing the scaling, mapping mode etc. We kept the names the same and we intend to add a wizard to let you change to PBR and maintain your customization if any, but this is not quite ready.

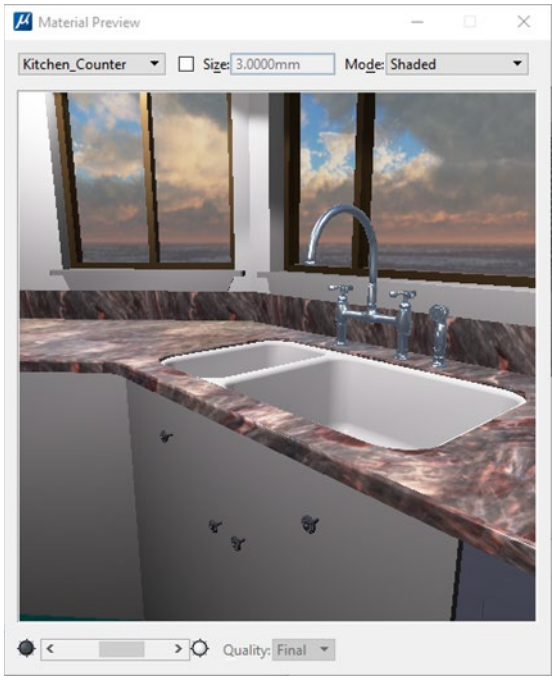
You have a couple ways to change and use these new PBR materials. The Bentley_Materials library is delivered by default to C:\ProgramData\Bentley\connectsharedcontent\materials and the new library is located here C:\ProgramData\Bentley\connectsharedcontent\materials\PBR_Library. You can rename or move the one located here C:\ProgramData\Bentley\connectsharedcontent\materials “for example change extension to be .dgn instead of .dgnlib” and then copy the dgnlib from here C:\ProgramData\Bentley\connectsharedcontent\materials\PBR_Library in its place.

You can also change the MS_MATERIAL environment variable to point to the new location, be sure to remove the old path to make sure you will be using PBR version.



Note: The PBR material maps can be found here C:\ProgramData\Bentley\connectsharedcontent\materials\PBR_Materials, this folder has already been added to the MS_PATTERN search path. In addition to these changes the Bentley_MaterialWidgets.dgnlib has been updated to support PBR workflow allowing you to use a shaded display for previews in the Material Editor. You will also notice two new preview widgets have been added Roof and Kitchen_Counter.





Addition resources for creating your own PBR materials:

Materialize (free)

Substance B2M

Substance Designer