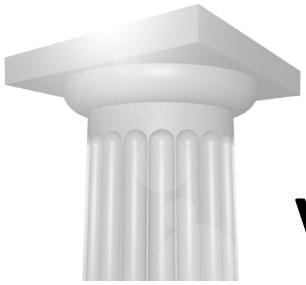

Visualization with Luxology

Module Overview

Visualization requires lighting, cameras, materials and good renderer. MicroStation V8*i* provides all of these.

Module Prerequisites

- Basic understanding of MicroStation or 3D modeling software
- Helpful if you have done any Visualization before
- Understanding of MicroStation 3D Views and View Controls
- Some Photographic experience

Module Objectives

After completing this module, you will be able to:

- Change View Perspective
- Camera Setup and Navigation
- Render a view
- Use Luxology Manager
- Apply Materials
- Place Lighting
- Output to 3D PDF

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Introduction

When thinking about rendering consider the following:

- Near and Far views (Depth of Field)
- Horizontal vs. Vertical
- Motion or Static
- Light vs. Dark

Composition is a key element in getting started, essentially framing the shot. A good way to get started is to pick up your camera and take pictures. Think about how you are composing these pictures instead of just pointing and shooting. For example, good photos usually have strong horizontal and vertical elements which leads to a balanced picture. For Light and Dark consider reviewing the work of good black and white photographers, like Ansel Adams.

Rendering is the process of depicting a 3D model through the display of shaded surfaces. MicroStation V8*i* provides sophisticated photo-realistic rendering with the Luxology rendering engine. It can produce extremely high-quality images and

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animations from huge datasets that typically include vast numbers of parametrically replicated geometric elements.

Curtains with a sub-surface scattering effect

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. As well, there is support for photometric lighting through the IES standard.

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How you approach rendering will depend largely on what you require as the finished result. Render setups let you quickly change from quick draft level output through to the finished photo-realistic image.

Aluminum cans with anisotropic reflections

This module is to teach the basics of Rendering and is not a thorough examination of the rendering technology in MicroStation. For a more comprehensive course please take our MicroStation V8*i* for Rendering course.

Display Styles

A Display Style consists of a shading mode plus other settings and overrides (color, transparency, etc) that you can specify. Display styles are created and managed in the Display Styles dialog. They are typically saved as shared resources in DGN libraries, but can be stored in the active file.

The point of using Display Styles is to have a permanently shaded (until you change it back to wireframe) view. You can zoom, pan and rotated in shaded mode with Display Styles turned on.

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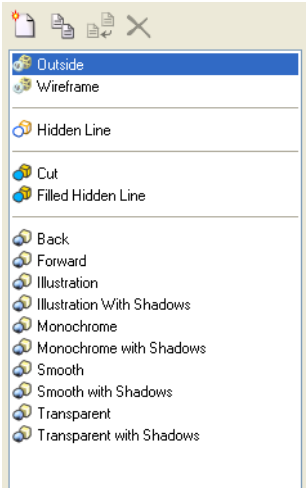
Display styles apply to saved and dynamic views, as well as normal views. The list of styles is sub-divided by Display mode. Wireframe display styles are followed by hidden line, filled hidden line, and shaded display styles.

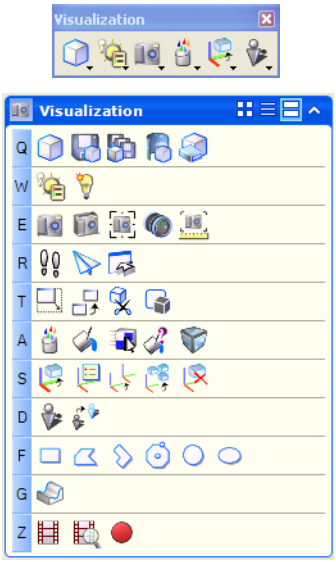


Review the module on 3D View Controls for more information on Display Styles.

Visualization Task

The Visualization task is only available in 3D models.

Visualization tasks are six separate tasks that can be accessed from the Visualization toolbox or the Visualization tasks.



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Render Task

This tasks provide the:

- Render tool
- Render Image to File
- Render Multiple Images to Files
- Render Panorama
- Render Settings dialog

Lights Task

Provides ability to access:

- Light Manager
- Place Light

Cameras Task

Used to:

- Setup Camera
- Define Camera
- Photo Match
- Camera Lens
- Focal Distance

Materials Task

The Materials Task is used to:

- Define Materials

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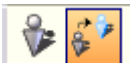
- Apply/Attach Materials
- Manipulate/Adjust Materials
- Query Materials
- Environment Maps

Material Projections

These tools are used to:

- Attach Projection
- Edit Projection
- Match Projection
- Create Projection groups
- Remove Material Projection

RPC Tools



Ability to:

- Place RPC cells
- Edit RPC cells

Camera Setup and Navigation

Setup Camera

The Setup Camera tool is designed specifically to set up views for rendering. When using this tool, a camera view is selected and you have the option of displaying its viewing cone in all other views that display the same volume of the design file. When this tool is selected you are prompted to select an active view. In this example View 2 the Right Isometric view is selected. You now have the option of selecting the camera position and target using any of the other open

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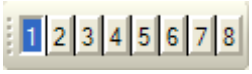
views. You can work in one view and use AccuDraw to manipulate the camera and target position.

After an active view is selected you can then select the type of lens available from the options list and enable Camera Height, Target Height or select these positions using AccuDraw and AccuSnap on the view geometry.

Finding the tool

There are several ways to find the Camera tool, from the Visualization Task, the View Control tool bar or a key-in. When setting up or using a Camera it is useful to have multiple views open.

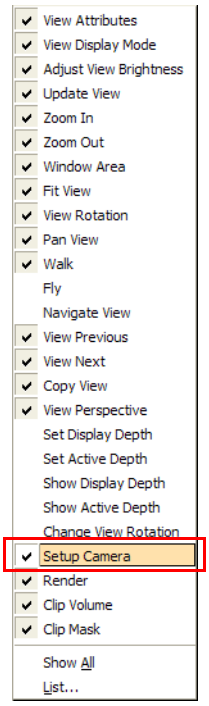


➔ Exercise: Finding the Camera Tool

1. Open Render_exercise.dgn and open the Model 01_Camera.

   Views 1 through 4 should be open.

2. In the View Control tool bar, right click on any tool and from the menu select Setup Camera.



The tools is now available in your View Control tool bar.

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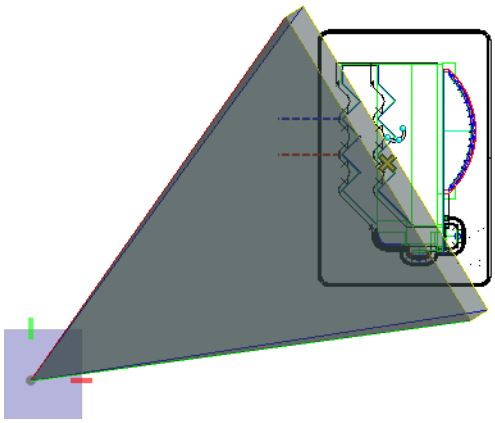
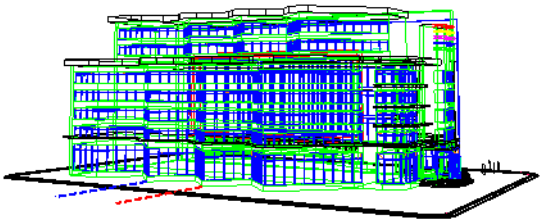
➔ **Exercise: Setting up the Camera**

1. Select Setup Camera (E + 1) and enter a data point in View 2 (the Isometric view).
2. Then left click in the Top View to set the camera position.
3. One more left click in the Top view to as shown, to set the camera target.



4. View 2 now shows the geometry through the camera lens.



You can use other tools to manipulate the camera as needed. The most common method is to choose the Navigate View tool (you might need to right click and turn this tool on like you did with the Camera Setup tool) in the View Control tool bar.

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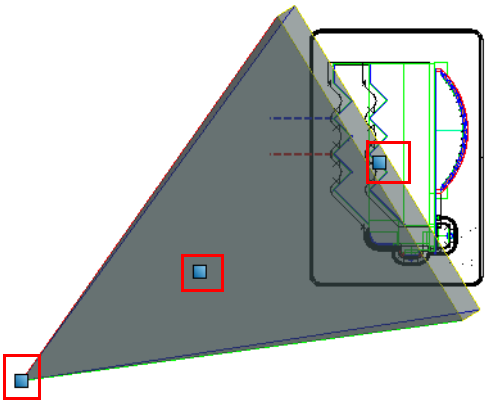
You can now manipulate one of the three dots or handles.



In addition you can use the Define Camera tool to manipulate the position of the camera or what it is pointing at, plus many other settings.

Luxology Dialog

The Luxology dialog allows you to control Rendering, Materials and Lighting. You can open Luxology from *Utilities > Render > Luxology*, or click on the Render icon in the View control tool bar or Visualization task.

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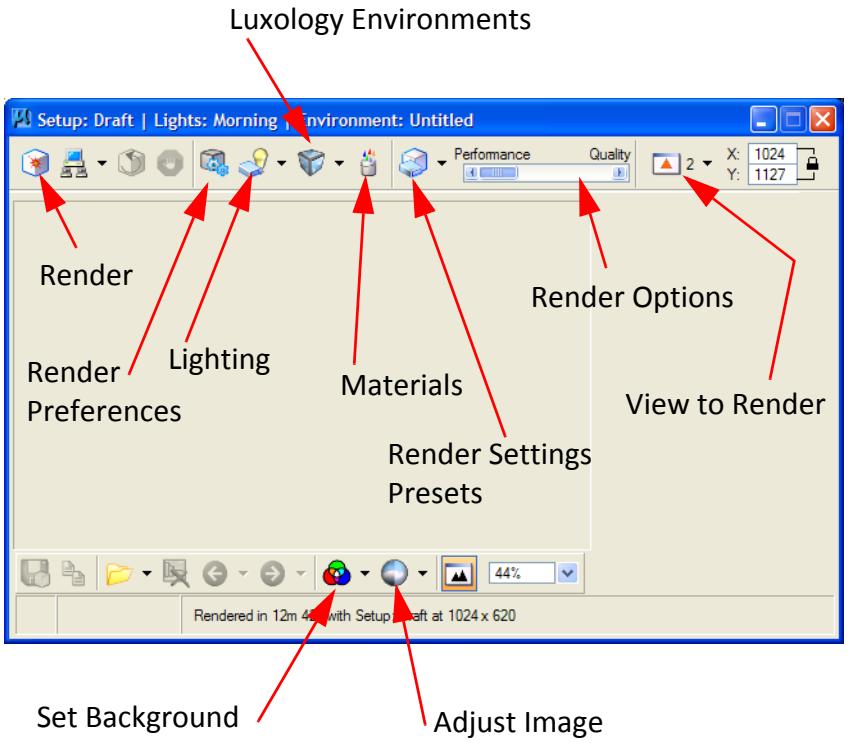
Once again you can turn this tool on by right clicking on the View Control tool bar and selecting Render from the menu.



Left click on the Render icon to see the rendered image. The time to render is dependent on several variables like: complexity of model, lighting, materials, operating system and hardware.

Note: To remove the points select Render Settings and turn on *Ignore Open Elements and Text*.

For the most part you can select a Rendering Setting Preset and click the Render button.

Note: While the Luxology rendering is running you can do other things in MicroStation, so Luxology is non-modal.

➔ **Exercise: Using the Luxology Renderer**

1. Continue in Render_exercise.dgn and open the model 02_Render.
2. In the Visualization task, select Render (Q + 1).
3. In the Luxology dialog, set your View to View 2.

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4 From Luxology Render Settings select Draft.

5 In the Luxology dialog, press the Render button.

Depending on your system this may take a few minutes.

Luxology Environments

Luxology environments can now be saved and recalled at render time. The environments are similar to render settings in that they too 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, you can edit the Luxology_render.dgnlib delivered in your workspace by default or create a new library file and place it in a dgnlib search path with your custom environments. The environment types are Sky, Light Probe, Image, Image Cube and Gradient. All environments produce indirect light on to the scene and are controlled by a brightness slider. You can illuminate a model or scene solely by the enabled environment by choosing Override Existing Lights.

Lighting

Lighting is the ***KEY*** to photo-realism!

Spend more time with lighting and you will have better results.

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Where your goal is to produce realistic images of your models, you can use the Luxology rendering engine. This takes into account both direct and indirect lighting, such as reflection of light and refraction. Additionally, it can calculate diffuse reflections and caustics (such as reflected light, and refraction). For these two features, in particular, the following points should be kept in mind:

You should use real world working units for your model, and lighting values are input as lumens.

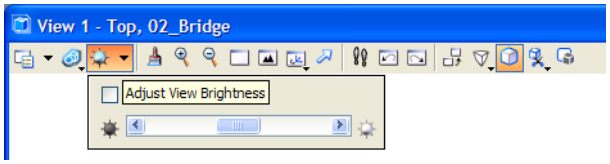
IES lighting files should be used to correctly display the lighting characteristics of different lamps, such as halogen lamps, incandescent lamps, or fluorescent tubes.

Care has to be taken when defining materials, to ensure that realistic values are defined. You should set the display gamma value for your output.

Default Lighting

Default Lighting consists of a shadow casting light over the viewer's shoulder, plus some ambient and a flash. This lighting is ideal for modeling in 3D, as it always provides very good illumination of a model relative to the observer.

Because Default Lighting is a view attribute, you must enabled it to be used to illuminate your model.



To use Default Lighting, you must enable it for any view(s) where you want use it. This is done by clicking the Adjust View Brightness tool on the view border and turning on the Default Lighting toggle. When the Brightness tool is clicked, you will see a brightness slider and a toggle for enabling Default Lighting; checking the option turns on the Default Lighting for the view. The icon on the Adjust View Brightness tool changes to reflect the current state.

When the Display Mode of a Display Style is Shaded, that is, anything other than wireframe and hidden line, then the hardware renderer uses Default Lighting or the user-defined lights (Scene Lighting), depending on the Default Lighting view attribute.

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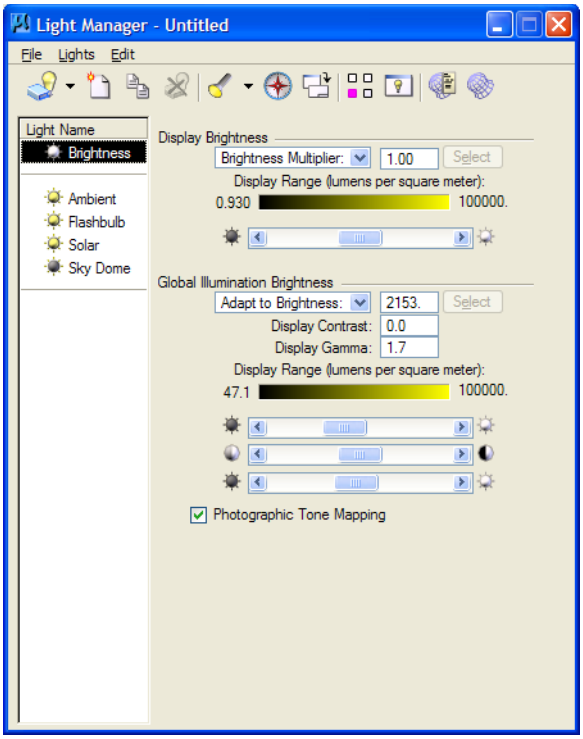
If a Light Setup other than From View is chosen, the Render tool overrides this view attribute and uses scene lighting.

When using the Render tool, to see the effects of Default Lighting, turn on Default Lighting for the view you are rendering; make sure that Light Setup: From View is chosen. To render a view using scene lighting, you can chose any light setup other than From View, or render a view with Default Lighting off. If you choose Light Setup: From View and enter a data point, the current state of the view attribute Default Lighting for that view determines which lighting is used.

There are two basic types of lighting that you can control: Global Lighting and Source Lighting. To open the Light Manager, select the Light icon in the Luxology Manager.



Global Lighting

Global lighting affects all elements in a model.

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Brightness

There are new settings for control the overall brightness of an image. The Brightness control are split into two sections: Display Brightness and Global Illumination Brightness. Both of these have two options:

Brightness Multiplier

Scales all pixels by a specified factor. In the field, set the scale factor to be applied to the brightness of the pixels for the next rendering.

Adapt to Brightness

Sets the brightness for the middle of the range. In the field, set the intensity (in lumens) that should be used as the middle of the display range for the next rendering.

Ambient

Ambient lighting affects every element in the model. It adds lighting equally to all elements. As you increase the value of Ambient lighting, the amount of contrast diminishes. Ambient lighting is useful for illuminating surfaces that would not otherwise receive light. No shadows are cast by Ambient light. Settings for this light source let you adjust its Lux, Color, and Temperature (in Kelvin or K). One lux is equal to one lumen per square meter. Essentially, one lumen is the minimum amount of light the human eye can see. For a full definition please refer to the glossary.

Flashbulb

Like a flashbulb on a camera, this light source illuminates all elements that are facing the viewing position or camera. Useful for checking models during construction, you also can use it to add light to a final image. No shadows are cast by this light source. Settings in the Global Lighting dialog, let you adjust the Lux, Color and temperature of the Flashbulb.

Solar

Used to simulate lighting from the Sun, Solar lighting has settings that let you set any of the following:

- Latitude, longitude, time and date of the rendering.
- Solar Direction Vectors of the sunlight.

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- Azimuth Angle and Altitude Angle of the Sun.

You can input this data manually in the appropriate fields, or you can use dialogs to select a city from a list or pick a location from a map of the world. These dialogs are opened by clicking one of the following options in the Location section of the Global Lighting dialog:

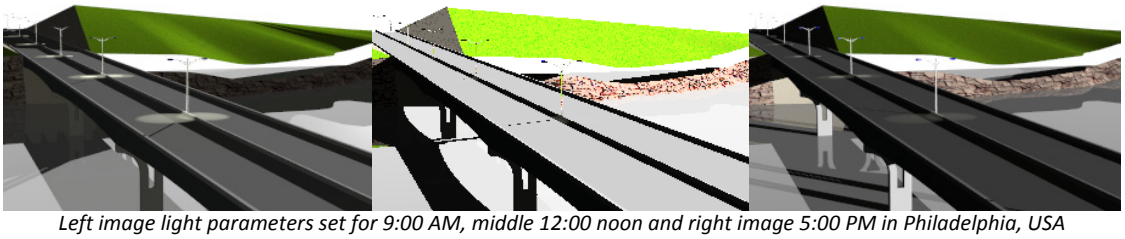
Cities — opens the Location By City dialog from which you can select a city from the list.

Get Long./Lat. from Google Earth— opens Google Earth. In Google Earth you can enable *View > Grid* to display longitude and latitude and *View > Sun*, which will show time automatically. With this method, you must still enter the GMT Offset manually in MicroStation.

Get Long./Lat. from KML file - Allows you to select a KML file to fill in Long./Lat. from what is stored in that KML file. Again you must fill in the GMT Offset manually in MicroStation.

Zones — Opens the GMT Offset By Time Zone dialog from which you can select a time zone.

Optionally, you can turn on Solar Shadows to view the effect of shadows generated by the Solar lighting (sunlight) when rendering with the Phong or Ray Trace options. As with other Global light sources, you can specify the Lux, Color and temperature of the simulated sunlight.



Left image light parameters set for 9:00 AM, middle 12:00 noon and right image 5:00 PM in Philadelphia, USA

Sky Dome

The Sky Dome provides direct illumination and mimics sky lighting.

Using Sky Dome with Shadows enabled can increase the render time significantly. The Shadow setting of Soft - Coarse (32 samples) is recommended for faster rendering.

Lux

Displays the value for the sky lighting with the current settings. If the Sun would be below the horizon, then “No Sun” displays.

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Color type

Option menu that lets you select the type of color used.

- User Defined — Lets you set the color of the sky lighting, via the Color setting, or automatically via the Temperature setting.
- Physically Based — Sky color is computed based on factors such as the Sun position, air quality, and cloudiness.
- When illuminated only by sky, different parts of the sky may have different colors. This can result in different sides of a building having different lighting.

Color

Sets the color of the sky lighting. Clicking on the color swatch opens a color selector dialog, which is similar to the True Color tab and Color Book tab of the Active Color dialog.

Temperature

Option menu that lets you assign a color temperature to sky lighting. When a color is chosen manually, with the Color setting, Temperature is set to Custom.

Shadow

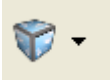
If on, shadows are generated for the added sky lighting. Sharpness of the shadows is controlled by the option menu.

➔ **Exercise: Using Global Lighting tools**

1. Continue in Render_exercise.dgn and open the model 06_Global Lighting.

   Several settings have been set for you, let's review them.

2. Open the Luxology dialog (Q + 1).



3. Click on the Luxology Environment Settings.

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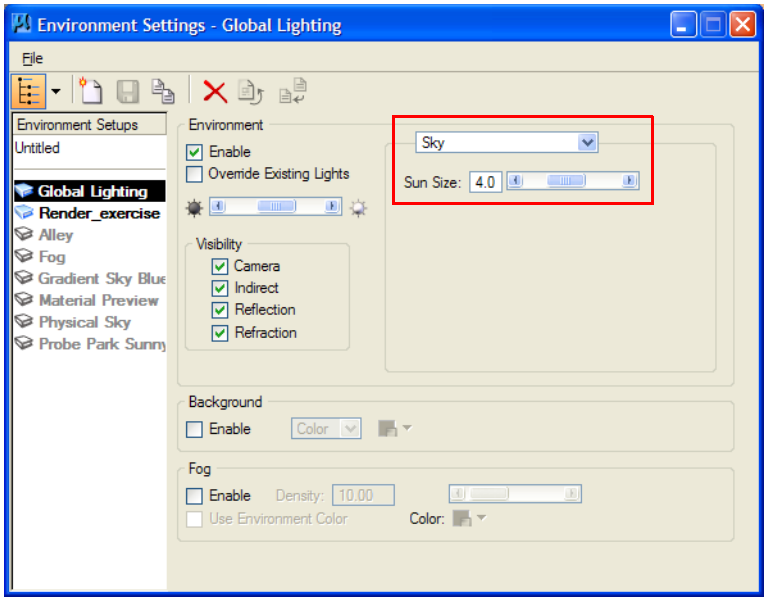
4 Select the Global Lighting Environment Setup.



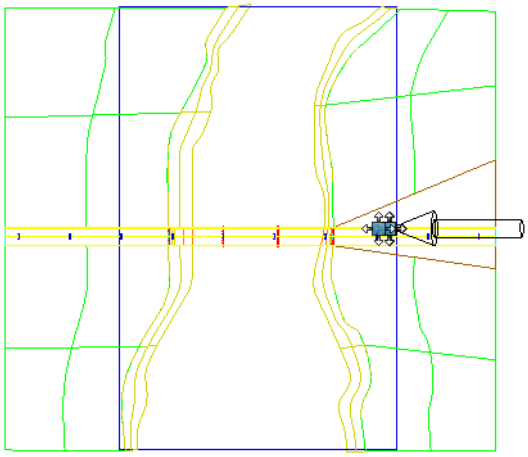
Note that Sky has been selected with a Sun Size of 4.

5 Open the Light Manager (W + 1).

You can also open this dialog from inside the Luxology dialog.

6 In the Light Manager, select Solar.

7 In the tool bar across the top select Highlight.



Highlight and Element Section selected.

Warning: You must select the Highlight option in order to see the Sun in the final render.

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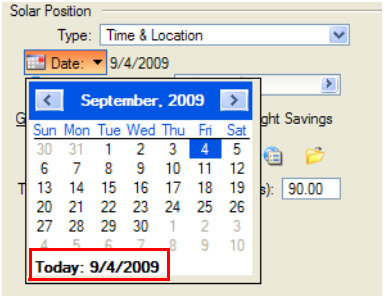
8 Change Temperature to 3200 K Sunrise/Sunset.

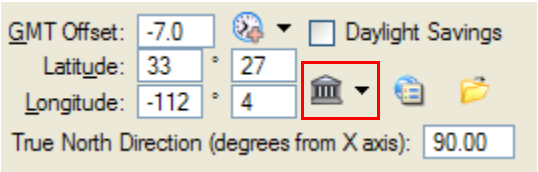
9 Change to the current date.



Click on the current date to set the current date.

10 Set Time to 7:00am

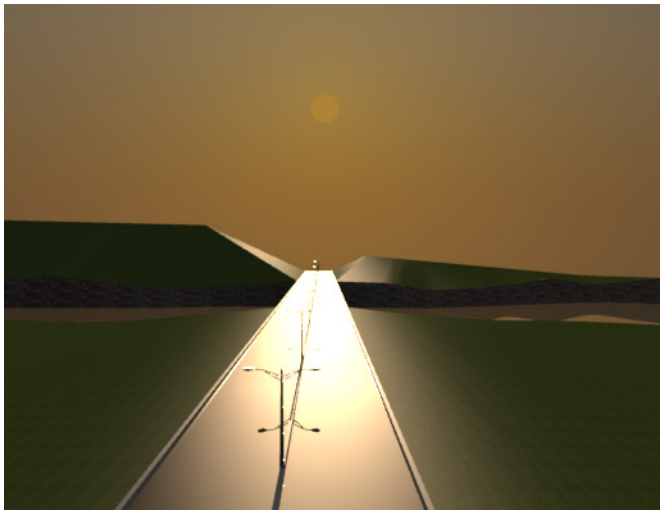
11 Select Position by City and choose Phoenix.



You can also choose a City by getting a Latitude and Longitude from Google Earth or a KML file.

12 Leave all other values at default.

13 In the Luxology dialog, select view to render as View 2 and press Render.



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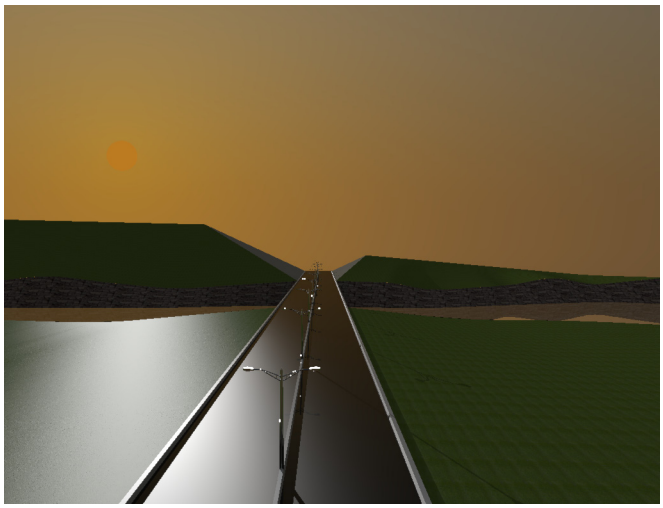
14 Change location to a Melbourne, Australia and re-render. Note changes to shadows and intensity.



15 Use the Define Camera tool and try moving the camera to other positions and re-render.

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 brightnesses across the range of the display.

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

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Source Lighting

Unlike Global Illumination, which is controlled solely from a dialog, Source lighting consists of light sources in the form of special cells that you place in the design. This is done with the Define Light tool, which you will look at shortly. First, a brief description of source lighting.

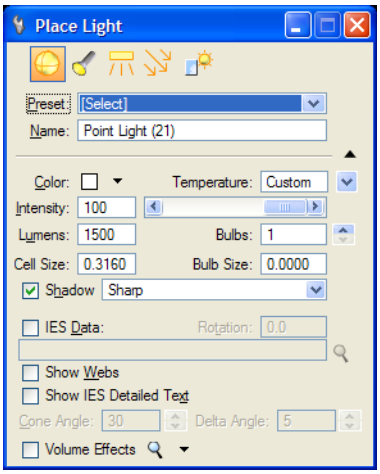
Source lighting cells are stored in the cell library lighting.cel, which is accessed automatically by the Place Light tool. You do not have to attach this cell library before placing light sources. The Place Light tool has various settings for each light source type, which you enter prior to placing the light source. The same tool lets you modify them, if necessary, at a later date. The cells consist of construction class elements and are placed by default on level Default.

Place Light tool

Source lighting provides a choice of 5 lighting types; Point, Spot, Area, Directional and Sky Opening. These light sources provide lighting as follows.

Point

Similar to a light globe, point light sources radiate light in all directions, from a point light source. Shadows can be generated by this light source in Ray Trace rendering only; they are not supported by Phong rendering.



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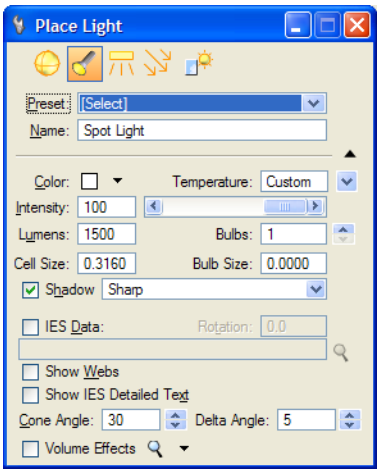
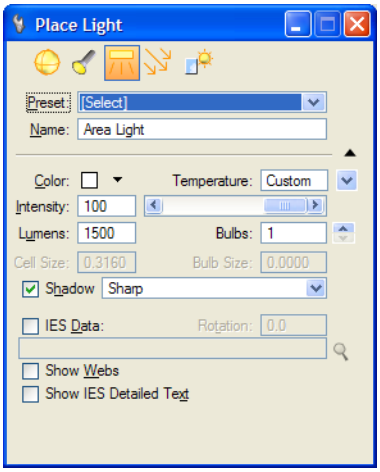
Spot

Directional light source that behaves similar to a flashlight. Spot Lights have a conical beam. This can be defined to taper off to zero at the edge of the beam. You can define the Cone Angle for the beam and a Delta Angle through which the beam reduces from full intensity to zero. Shadows can be generated by this light source for Phong and RayTrace rendering.



Area

Created from existing polygons in the design, these light sources are useful for simulating fluorescent lighting, for example.



Directional

Directional light source that produces parallel light rays throughout the design, similar to sunlight. It does not matter where in the model that you place one of

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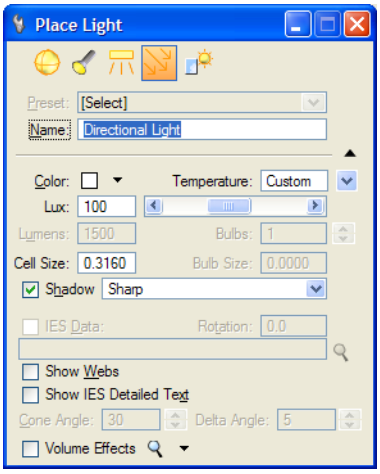
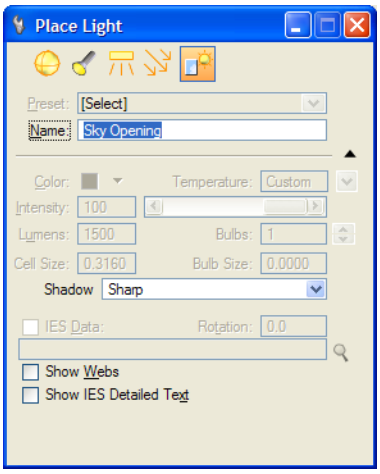
these light sources, all surfaces that face the direction of a Distant light source are illuminated by it. Shadows can be generated by this light source for Phong and RayTrace rendering.



Sky Opening

Sky Opening generates more efficient solutions for indoor scenes lit with Solar Lighting, Sky Light, or Distant Light sources, through an opening in a wall or ceiling. Rather than consider the entire “sky” for calculating the lighting effect, only the lighting that is visible through the opening is considered.

Each source lighting cell that you place in a design can have different settings for such things as Intensity and Color. You can specify whether or not they cast shadows for the supported rendering modes.



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Place Light tool settings

You use the Place Light tool to create and modify light sources in your design.

Tool settings for the Place Light tool are as follows.

Tool Setting	Effect
Preset	• Option menu that lets you select from a list of predefined lights. • Presets available for Point, Spot and Area lights.
Name	Text field that lets you define a name for the light source that you are creating. Giving light sources unique names helps you identify them if you want to modify them in some way, or delete them. Where no name is input, the light is given a default name that identifies the type of light source. Where there are other light sources present of the same type, with the same name, then the name is incremented. For example, Spot Light, Spot Light (1), Spot Light (2), and so on, for Spot Light sources.
Color	Opens the color dialog, which is used to specify a color for the light source.
Temperature	Option menu that lets you assign a color temperature to the light source.
Intensity	Sets the intensity of the light source (default is 1.0) for standard rendering (up to Phong). For radiosity, particle tracing, and ray tracing, that use real world lighting, acts as a multiplier to the Lumens setting.
Lumens	Sets the light source brightness, for use with ray tracing, radiosity solving, and particle tracing. Acts as a multiplier of the light source's Color and Intensity values to simulate real world lighting values. This value, when multiplied by the Intensity of the light, specifies the overall brightness, in Lumens.
Bulbs	Lets you assign multiple bulbs, with the defined settings, to the light source.
Cell Size	(Distant, Point, and Spot Lights only) Sets the size of the light cell, in master units.
Bulb Size	(Point Lights and Spot Lights only) Sets the size of the light source. For soft shadows calculations, the ray tracing process assumes a default size of 12 inches for all point and spot lights. This can cause unnatural lighting in situations where light sources are placed within fixtures, where the fixtures are expected to cast shadows. For these situations, you can change the default size with this setting.

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Tool Setting	Effect
Shadow	If on, the light source can cast shadows in a Phong, or Ray Traced, rendered image, as well as with a Radiosity solution, or a Particle Traced image. In Phong rendered images, only Distant, Area, and Spot lights can cast shadows. In Ray Traced, Particle Traced, or Radiosity rendered images, all light source types can cast shadows. For Ray Tracing, sharpness of the shadows is controlled by the Shadows setting on the Render Mode tab of the Render Settings dialog when mode is set to Ray Trace. If, however, Shadows is set to Per Light, then the sharpness of the shadows is controlled by the individual light source's Shadow option menu setting. This determines the number of samples used to calculate the shadows. • Sharp — Number of samples — 1 • Soft - Coarse — Number of samples — 16 • Soft - Medium — Number of samples — 64 • Soft - Fine — Number of samples — 160 • Soft - Very Fine — Number of samples — 256 • Custom — Appears when an existing light source has a number of samples that differs from those listed above.
IES Data	If on, and an IES file has been selected, then IES data is used in the calculation of the light from the light source.
Rotation	Lets you enter a value to rotate the photometric characteristics for the IES light source.
Cone Angle	(Spot Light only) Sets the angle of the beam cone of a spot light source. Used to focus the beam.
Delta Angle	(Spot Light only) Sets the angle, at the edge of the beam cone, through which a Spot Light beam falls from full intensity to zero.
Volume Effects	See below

Volume Effects

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

Scatter Color

Sets the scatter color value. Clicking the color icon opens a pop-up dialog to set the color.

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

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Scatter Color RGB values set to 94,94,94 (left) and 40,50,156 (right)

Samples

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

Samples set to 40 (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.

Height set to 2 meters (left) and 0.5 meters (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.

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 10% (left) and 80% (right)

Density

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

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Density set to 10% (left) and 80% (right)

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.

Attenuation set to 0% (left) and 50% (right).

➔ **Exercise: Place an Area light source as a fluorescent ceiling light**

1 Continuing in Render_exercise.dgn, open the model 07_Source Lighting.

View 2 is a camera view that has been set up for rendering. Views 1, 3 and 4 have been set up to simplify adding the light sources.

2 From the View Border or View Attributes make View 2's Display Style set to Smooth with Shadows.

Currently, the Light Manager has Ambient and Flashbulb enabled for illuminating the scene.

3 From the Visualization task select Light Manager (W + 1).

4 Enable the Solar light in the Light Manager dialog with the following settings:

Intensity: 15

Shadow: Sharp

Date: Current Date

Time: 09:30 AM

City: Phoenix

Note: You can change the Time and watch the light coming in from the window move in VIew 2.

5 Select Place Light (W + 2) with the following tool settings:

Name: Halogen1

Preset: halogen 250W Bulb

Bulbs: 2

Shadow: Soft-Fine

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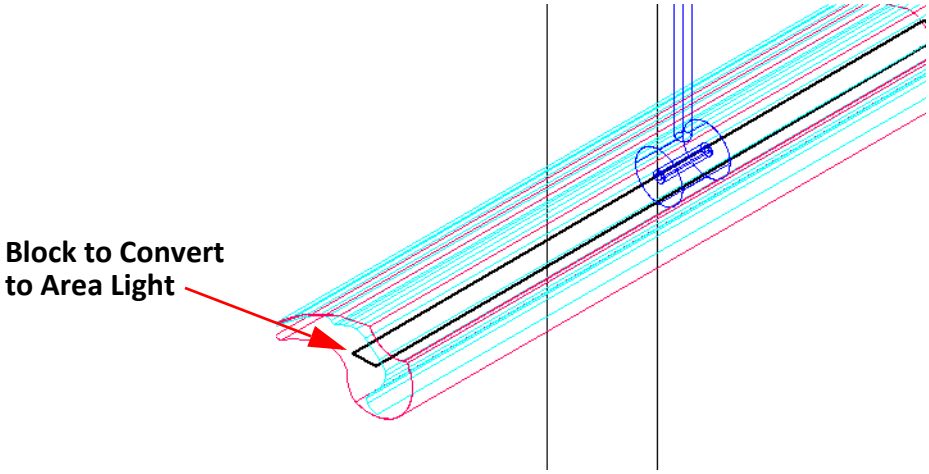
6 In View 4, identify the block element inside the overhead fluorescent light, and indicate the downward direction. You can confirm the direction in the Front view.



7 Repeat step 5 for the second overhead light and name it Halogen2.

Note: Light Direction can be changed at any time by selecting the light source using the Element selection tool and adjusting the light target handle or by enabling the Highlight tool in the Light Manager and selecting the light source name.

8 Select the Render tool (Q + 1).

9 From Luxology Environment Settings select Render_exercise.

10 With Draft Luxology Render Settings and render View 2.

11 Use the Adjust Images Settings tool to adjust Brightness.

12 Try various light settings. Disable all lights, change colors, Presets, Date, and custom Lumen settings.

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When you placed the light source, you gave it a name. If no name was given then the system would generate a default name, Area Light. Any additional point lights would default to Area Light(1), Area Light (2), and so on.

Naming light cells can help you later if you want to edit them. Using the Place Light tool, you don't need to have light source cells displayed in a view, you can simply select them from the list.

Point light sources radiate light in all directions, you do not have to consider direction. With Spot Light lighting, a directional lighting source, you must define the direction in which the light is shining.

Fences and Rendering

Using a fence lets you try numerous iterations of light settings without waiting for entire scene to render. After you are satisfied with your settings then render the entire scene.

Materials

Materials allow you to add realistic imagery to surfaces, like wood, marble, glass, etc. Luxology allows for many types of formats, like JPG or TIF or specialized Luxology materials to add Fur, Displacement Maps or 3D materials.

By default, Luxology rendering assumes that each design file surface is made of a material with a smooth shiny surface, such as plastic. Material definitions let you specify that an element is water or wood or brickwork. When rendered, instead of seeing the plastic element, you see the specified material. Each material definition can include a pattern map and/or a bump map, as well as other settings determining the finish and transparency/translucency of the material plus much more. Pattern maps and bump maps are image files that are applied to surfaces during the rendering process.

Material definitions and assignments can be separated into two distinct categories — local and external. By default, materials are local and saved in palettes with the DGN file, while external materials require external material assignment table (.mat) and material palette (.pal) files to be present during rendering. Options in the Material Editor dialog's Table menu let you convert or export local materials to external files.

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Where required, you can access local palettes and their materials that are stored in other DGN files.

Material definitions — attributes related to color, texture, opacity (transparency), and finish — are created and stored in material palettes. For external materials, these are palette (.pal) files and always must be present when applying materials, or rendering. For local materials, the external palette file is required only the first time that you access a material. By default, it is then stored in the DGN file.

Many sample material definitions are supplied with MicroStation. If you do not plan to create your own material definitions, but want to apply existing material definitions to elements, see the Apply Material tool.

Pattern maps

A pattern map is an image file that is applied to an element. You can think of this in terms of wall-papering a wall. When you render an element that has a pattern map applied to it, instead of seeing the element (wall) you see the pattern map (wall-paper). MicroStation provides a large range of image files, in JPG and TIF format, that can be used for pattern maps. These are stored in the …\Workspace\system\materials\pattern folder. Additionally, you can use your own image files as pattern maps.

Bump maps

Like pattern maps, a bump map is an image file that is applied to an element. Where it differs from a pattern map is that a bump map applies roughness or texture to a rendered surface. While it is not mandatory for bump map images to be grey-scale, quite often they are. MicroStation uses the contrast in the bump map image to calculate texture, or bumps, in the rendered image. As part of the material definition, you can vary the height of these bumps. This lets you use the same bump map image file, for example, to create cast metal from very rough-cast through to nearly smooth.

Materials stored in DGN

By default, all palettes and their materials now are stored locally in the DGN.

Where required, you still can convert or export the materials and palettes to external files.

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Material palettes can be used from any DGN or DGN Library. You can review: C:\Documents and Settings\All Users\Application Data\Bentley\MicroStation\WorkSpace\System\dgnlib

for more information on how to do this.

You can access material palettes from any DGN or DGN Library file. When you select *Palette > Open* from the Material Editor, you can select a DGN file to display the palettes contained within it.

Material tables

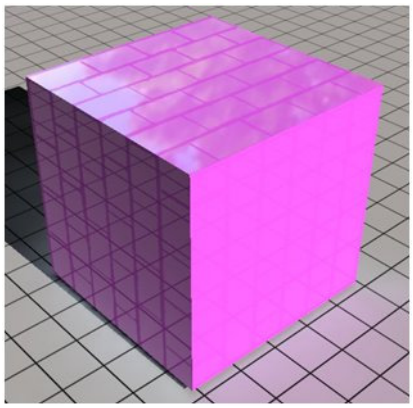
When you assign materials from a palette file to an element in a design, the assignment is stored in a material table. By default, material tables are given the same name as the design file but have a .mat suffix. Also, by default, material tables are saved in the same folder as the design file. You can save them with another name and in another folder, if you wish.

Material Tables can be stored in the DGN file itself so no external file is needed.

Hint: Using Element Selection is a quick way to find and change material assignments and attachments.

Additional Map Types

Clear Coat - The clear coat map changes the perceived thickness of the clear coat lacquer effect.



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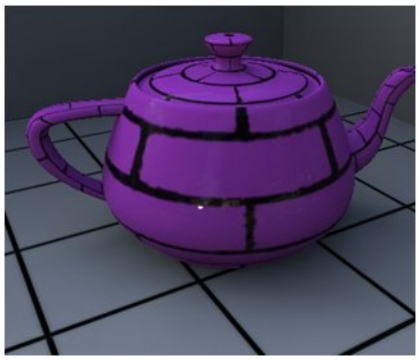
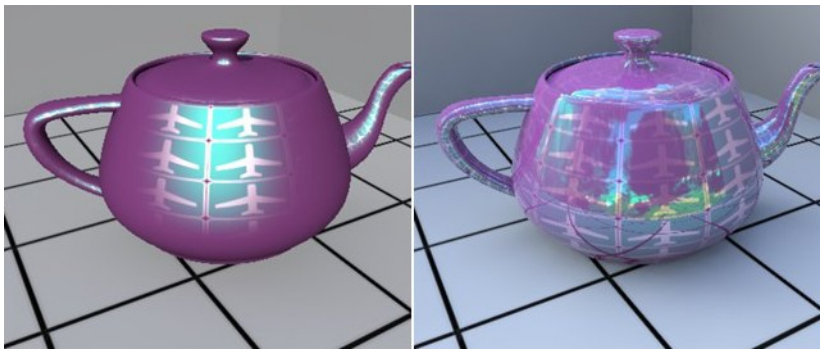
Diffuse - A diffuse map can be used in conjunction with a pattern map to give more contrast to the diffuse reflection.



Glow - The pixels in a glow map specify the fraction of glow emitted by the surface at that point up to 100%.

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

Specular Color - If a surface is reflective, then the specular color map is also used as the reflect color.



Left: Specular Color Map, Right: Reflective

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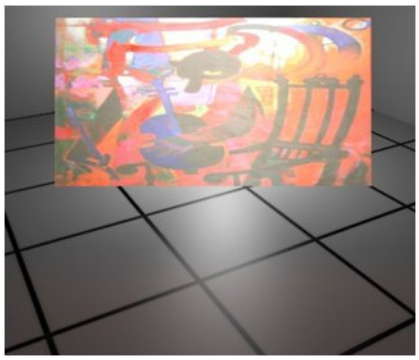
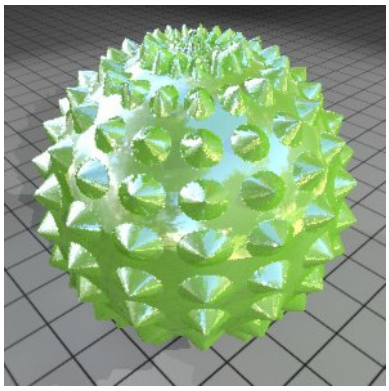
Transparent Color - A transparent color map can be used to vary the transparent color of a surface.

Translucent Color - A translucency color map can be used to vary the translucent color of a surface.



Displacement - 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.



Displacement map on a smooth sphere

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Materials Update for V8*i*

Enhancements to the Materials tools include changes to the default method of storing materials and multi-layer material capability.

- By default, all palettes and their materials now are stored locally in the DGN. Where required, you still can convert or export the materials and palettes to external files.
- You can access material palettes from any DGN or DGN Library file. When you select *Palette > Open* from the Material Editor, you can select a DGN file to display the palettes contained within it.
- New mapping options, let you apply an image, gradient, procedure, or Operation (Tint or Gamma) to the Color, Translucency, Specular, Reflect, Finish, Opacity, and Bump channels. As well, each channel can be multi-layered. The Material Editor lets you access the mapping option via icons for each channel.
- You can use the X, Y, (and Z for 3D procedures) lock setting in the Units definition for a material map to lock the image into the aspect ratio of the original image. When the lock is enabled, any changes to the X, Y, or Z settings automatically is reflected in changes to the other settings to maintain the aspect ratio of the original image or procedural texture.

The Apply Material Tool

Using the Apply Material tool, you can:

- Assign material definitions to elements in the design file either by Color/Level or as an Attribute.
- Check the material that is attached to an element.
- Remove material definitions from elements in the design file.
- Preview how a material will look on an element.

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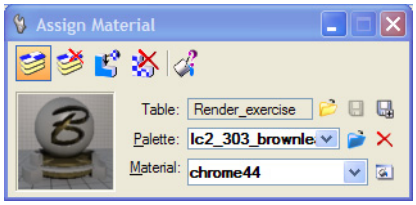
When you select the Apply Material tool, the Apply Material tool settings opens. From this dialog, you can load palette files, apply materials or open the Define Materials dialog.



From left to right, the icons across the top of the Apply Material tool's dialog let you select from:

- Assign by Level/Color — to attach a material to elements of a particular color(s) on a particular level(s) in the model.
- Remove Assignment — to remove an existing level/color material assignment from elements in the model.
- Attach — to "physically" attach a material definition to an element, or a face of a solid, in the model. This setting take precedence over level/color assignments.
- Remove Attachment — remove a material attachment from an element or the face of a solid in the model.
- Query — to check for a material assignment to an element in the model. With AccuSnap active, you simply hover the pointer over the element being queried, and a tool tip displays the assignment or attachment information.

Working with Materials

To apply materials you can Assign them to a Level and Color combination or Attach them to an individual face of a 3D object.

➔ **Exercise: Assigning a Material**

1. Continue in Rendering_exercise.dgn.
2. Open the Model 03_Materials.
3. In the Visualization task select Render (Q + 1).

4. Click on the Material icon in the Luxology Manager.

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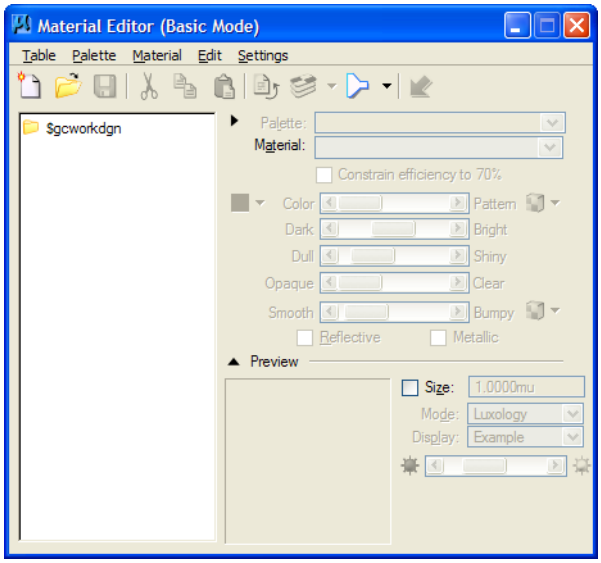
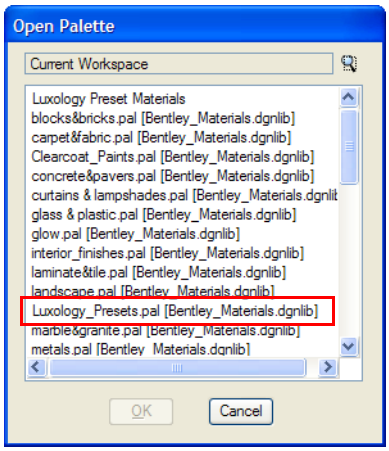
This opens the Material Editor.



5 Click on Open Palette or select the menu item *Palette > Open*.

6 Select the Luxology_Presets.pal [Bentley_Materials.dgnlib].



You now have access to all materials in that palette.

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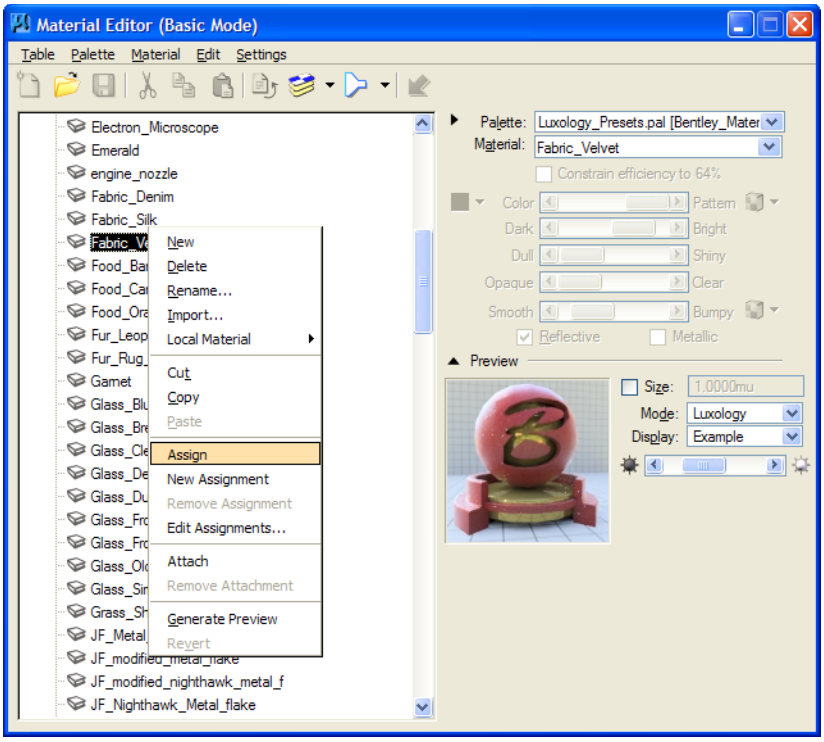
7 Right click on Fabric - Velvet and select Assign.



8 Left click once on the cushion of the chair and left click again on nothing (empty space).

The second left click is to Accept the assignment of the material.

9 From the same palette select the material: Metal_Chrome and assign to a leg of the chair.

10 From the Material Editor dialog, select *Palette > Open.*

11 Select the carpet&fabric.pal [Bentley_Materials.dgnlib] palette.

12 Select the material: carpet_52

13 Right-click and Assign carpet_52 to the block representing the floor plane.

14 Select the Render tool.

15 In the Luxology dialog, select Luxology Render Settings and choose Draft.

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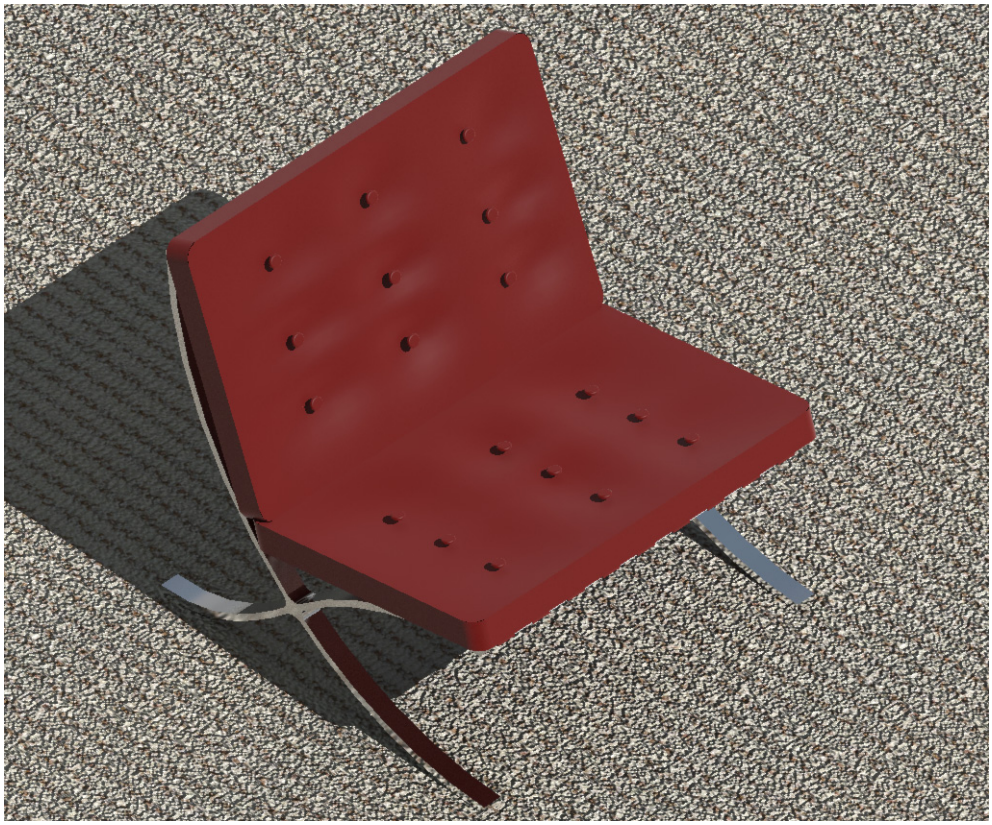
16 Render the model by selecting Render in the Luxology Manager.



17 Explore other materials (for example, Black Leather from carpets&fabric) and try them out. You can Remove Assignment, by using the right-click menu on a specific material.

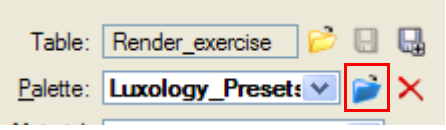
➔ **Exercise: Attaching a different material to faces of a solid**

1 Continuing in Render_exercise.dgn, open the model 04_Materials 2.

2 In the Visualization task select Apply Material (A + 1).

3 Click the Attach icon in the Apply Material tool setting icon bar.

4 Click the Open palette icon in the tool settings.



5 Select the palette: blocks&bricks.pal [Bentley_Materials.dgnlib].

6 From the Materials list, select brick back alley.

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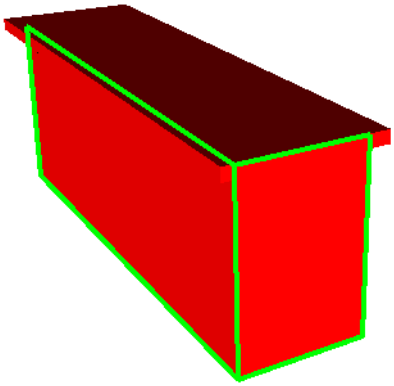
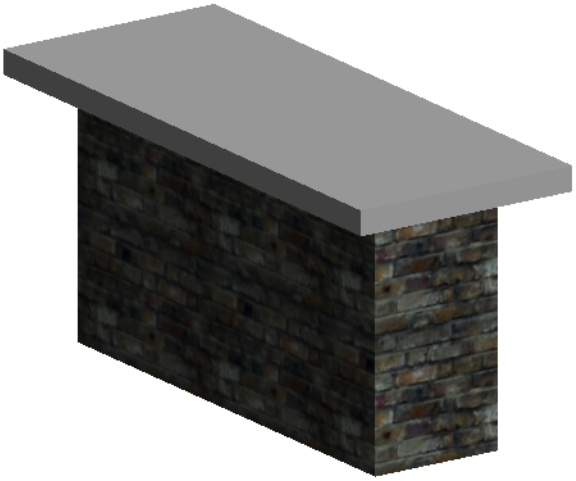
7 In View 2, identify the solid and select the each face of the table bases. Use (Ctrl+) for multiple faces.



8 Use Display Style - Smooth in View 4.



9 Open the palette wood.pal [Bentley_Materials.dgnlib].

10 From the Materials list, select Wood 37.

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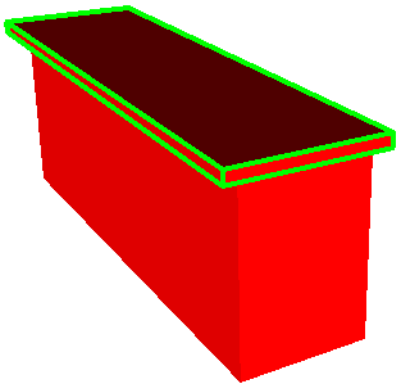
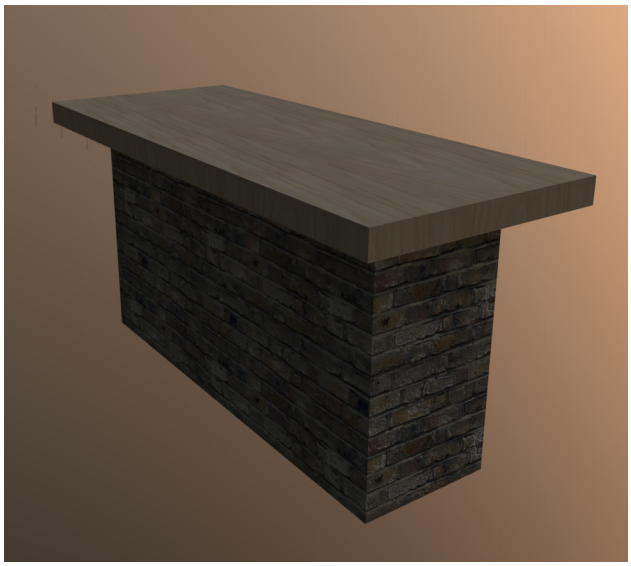
11 In View 2, identify the solid and select the table top and side faces.



12 Use the Render tool with Draft Luxology Render Setting and render View 4.



Multi-Layered Materials

You can create materials that consist of multiple layers of pattern maps, bump maps, procedures, gradients, and/or operations (tint or gamma setting). AN example might be showing tire tracks on a road or graffiti on a wall or dirt on a surface.

New mapping options let you apply an image, gradient, procedure, or Operation (Tint or Gamma) to the Color, Translucency, Specular, Reflect, Finish, Opacity, and Bump channels. As well, each channel can be multi-layered. The Material Editor lets you access the mapping option via icons for each channel.

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You can define the way that the pattern/bump maps are blended and you can assign a value for opacity, to allow one map to be seen through another.

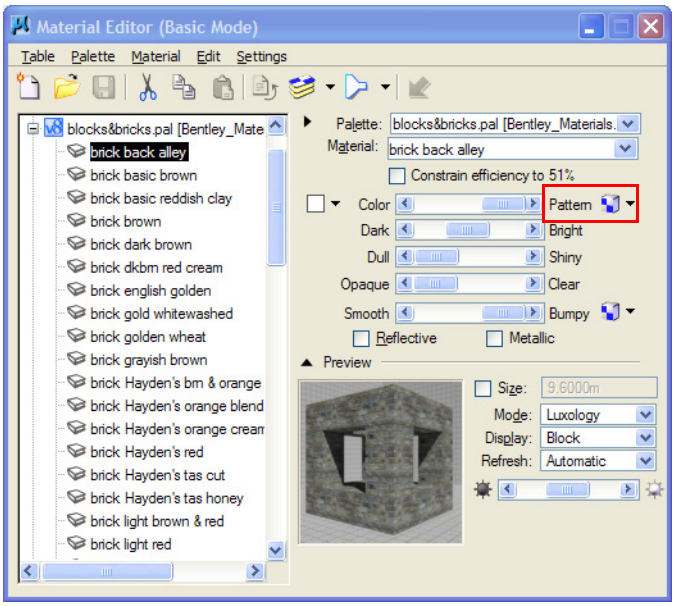
Adding layers of pattern maps, lets you create more complex materials. For example, you can create a brick wall that includes 1 or more signs, or have a material with partial opacity.

You can add layers to your material definitions, with various blend modes. The layers can be toggled as required.

Warning: Multi-layered materials are not backward compatible with MicroStation V8 XM Edition v8.9.2 and earlier.

➔ Exercise: Creating and using Multi-Layered Materials

1. Continuing in Render_exercise.dgn, in the model 04_Materials 2, from the Visualization task open the Materials Editor (A + 1).
2. Open the Palette blocks&bricks.pal [Bentley_Materials.dgnlib].
3. Expand the node on the left pane and highlight the material brick back alley and click the Pattern Map icon.



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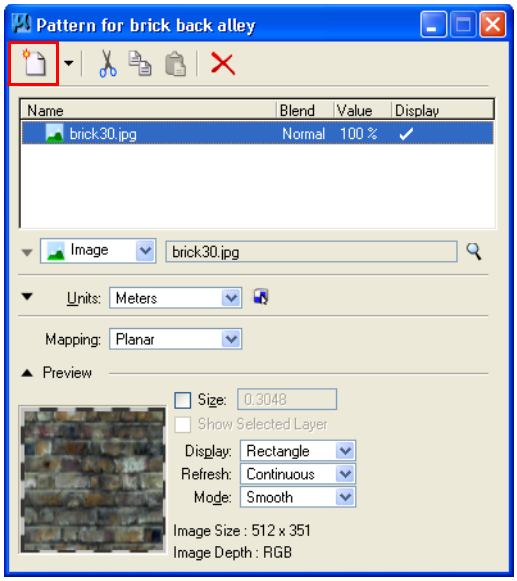
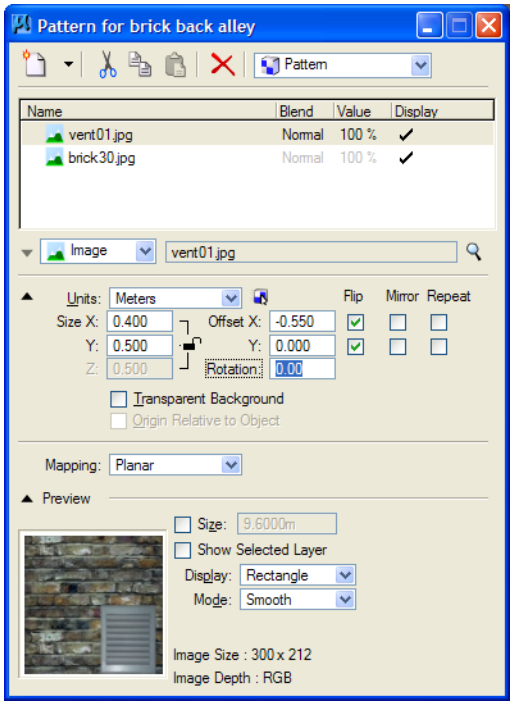
4 From the top left click New Layer and select vent01.jpg.



5 Set the following:



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6 In View 4 zoom in on the right side of front table and Render using Draft Luxology Render Settings.

Smooth Display Style of View 4

Projection modes for Pattern/Bump Maps

Projection modes are assigned to elements, rather than the material. This lets you use the same material with various projection modes depending on the geometry.

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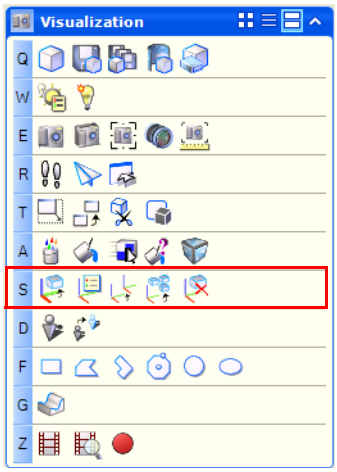
Control projection modes using the Materials task.



Projection modes for materials

Several projection modes are available:

- Directional Drape - Mapping is applied relative to the direction specified by the Orientation setting
- Cubic - Mapping is applied in a cubic fashion relative to the geometry.
- Spherical - Mapping is applied in a spherical fashion relative to the geometry.
- Cylindrical -Mapping is applied in a cylindrical fashion relative to the geometry.

Warning: Material projection modes are not backward-compatible with MicroStation V8 XM Edition v8.9.2 and earlier.

Tools for controlling Material Projections

The Materials task adds 5 tools for handling material projections.

➔ **Exercise: Using Material Projections**

1. Continuing in Render_exercise.dgn, open the model 05_Projections.
2. Assign the material - Brick Aged to the sphere.

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3 Render to see the results.

4 Select Attach Projection (S + 1) with the following tool setting:

Method: Spherical

5 Enter a data point on the sphere.

6 Render to see result.

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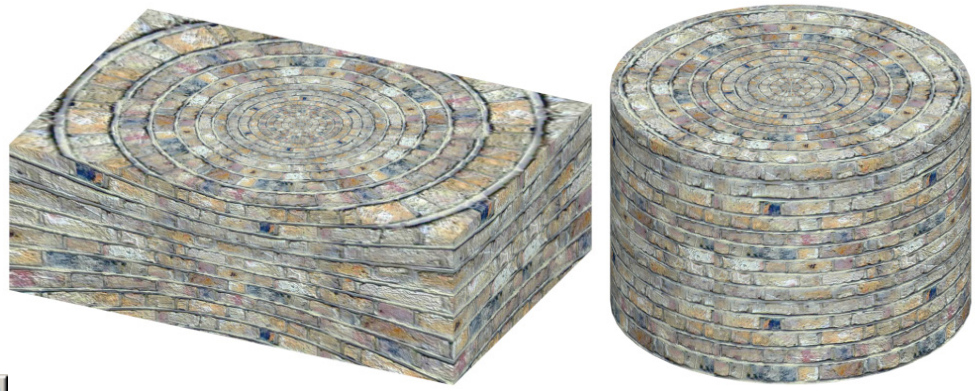
7 Repeat with the cylinder and Slab.



8 Select the Edit Projection tool (S + 2) with the following settings:

Select: Scale Projection

Attach To: Element

Mapping: Cubic

9 Click on the Arrows to select a variety of scale directions.

10 Us the Remove Projection tool (S + 5) and remove the projection from the slab.

11 Make a Copy (3 + 1) of the slab and place it on the side of the original slab.

12 Attach a new projection (S + 1) to both of the slabs.

13 Edit the Projection scale of one of the slabs.

14 Select the Match Projection tool (S + 3) with the following settings:

Enable: Projection Scale

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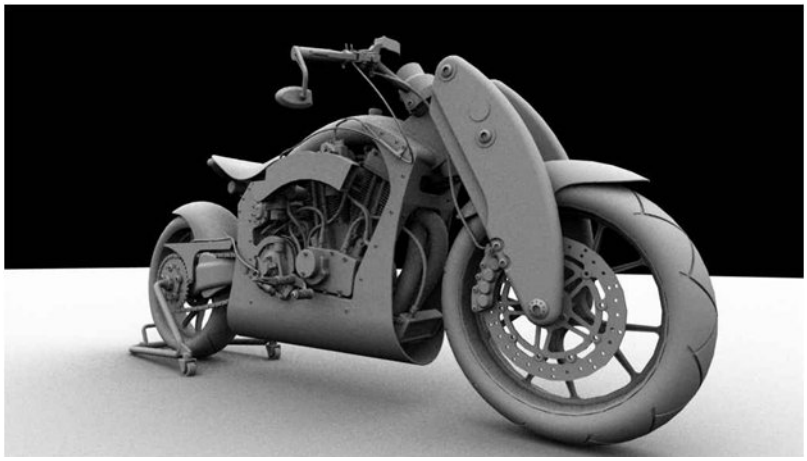
15 Select the slab that the projection scale was modified then select the other slab to match this project on this slab.

Ambient Occlusion

An additional rendering method is Ambient Occlusion, which is found from Luxology Render Settings.

Ambient occlusion is a shading method used in 3D computer graphics which helps add realism to local reflection models by taking into account attenuation of light due to occlusion. Ambient occlusion attempts to approximate the way light radiates in real life, especially off what are normally considered non-reflective surfaces.



Ray Tracing

Ray Tracing is still available from Luxology Render Settings.

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Output of Imagery

There are many ways to share your computer graphics imagery (CGI). One way is to create a 3D PDF of your rendered model (see next module), another is to Save an image to disk.

Save Image

Now that you can set up and create rendered images of your models, you might want to save one or more of them and impress your friends and clients by sending them a file containing the image. You can quickly save MicroStation images using the Save option in the *Utilities > Image* menu.

You have many choices when saving your images, such as file format, resolution and type of shading. As well as being able to save your images, MicroStation provides a viewing facility and a way to perform limited modifications.

There are many variables that you can adjust when saving images, however, you will find that most remain consistent once you begin to integrate images into your workflow.

These tools are found on the *Utilities > Image* menu. In addition to these basics you can also convert images, capture the screen as an image and save an image using multiple computers to speed up the processing time.

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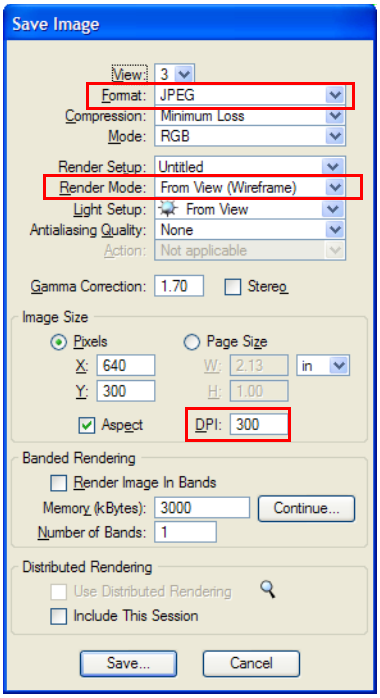
To save an image to disk you can use *Utilities > Image > Save*.



Here you can choose several things, including: Format, DPI and Render Mode. For a quick test choose Luxology from Render Mode.

Saving a rendered image

To save an image, select *Utilities > Image > Save*, which opens the Save Image dialog.

- View controls which view will be rendered.
- Format controls the type of file format in which the image file will be saved. MicroStation supports a wide variety of file formats including JPG, TIF, TGA, Postscript, PCX and others.
- Compression selects the type of file compression for those formats that allow it. For example, if you select JPEG then you have the option of choosing High Loss (high compression) through to Minimum Loss (high quality).
- Mode lets you select the bit depth of the image or grey scale.
- Shading lets you select which type of shading to use. For high quality images that cast shadows, select RayTrace shading mode.
- Shading Types lets you select between Normal, Antialias and Stereo.

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- Action is set to Ray Trace, Radiosity, or Particle Trace only. Sets the rendering action to be performed.
- Resolution controls how large an image you produce, in terms of pixels. Thought should be given to displaying the saved image. In order to display the saved image, you must have enough RAM on your video card to hold the image. This depends also on what bit depth (24 bit or 8 bit) you select in Mode.

  When one of the Resolution values (X or Y) is adjusted the other updates to maintain the view aspect ratio. Using higher resolution allows you to have more pixels to work with, hence a finer quality image.
- Gamma Correction controls the white content of an image. The values range from 0.10 to 3.00. A value of 0.10 is very dark while 3.00 is very bright.

Image Size lets you control the output size of the image in pixels, or unit as well as how many dots per inch are recorded.

Banded Rendering allows for an image to be broken up into strips or bands for network rendering.

Distributed Rendering lets you process an image using 2 or more PCs networked together.

After specifying the settings for your image, you can save the image with a unique file name and place it on your hard drive. The default location in which MicroStation stores image files is the out directory, such as …\Workspace\projects\examples\General\out.

Viewing a saved image

MicroStation has a viewing utility that lets you view your saved rendered images and perform a number of editing and manipulation operations.

To view a rendered image, from within MicroStation, select *Utilities > Image > Display.*

Distributed Rendering

You can use several machines to do one rendering or animation by using Distributed Rendering. Distributed Rendering now is included and does not have

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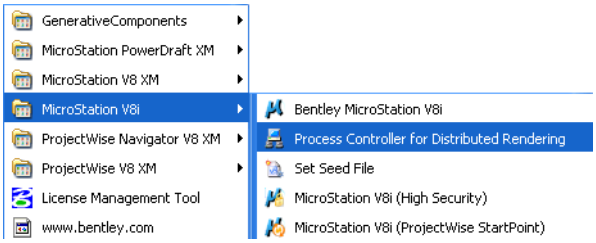
to be downloaded as a separate package. Its basic requirement is that all processors taking part in the rendering have access to all the DGN, texture, RPC, and raster files to be used in the rendering. It is also necessary that all processors taking part in the rendering have access to the output path.

Simplified setup for Distributed Rendering

Setting up this new version of Distributed Rendering is simple and it does not require any external database server as was required previously. To use Distributed Rendering, you must first launch the Distributed Processing Controller from the MicroStation start menu.



The first time that you start the controller, you are prompted to define your Shared (probably server) Directory. This determines where Distributed Rendering stores the information it needs to configure your controller and pass data back and forth between multiple machines. All machines that will participate in the rendering

➔ How to set up Distributed Rendering

1. From the Start menu, select *Bentley > MicroStation V8i > Process Controller* for Distributed Rendering.

The Configuration Settings dialog opens.

2. To select a Shared directory, click the button to the right of the field.

3. Select a shared folder and click OK.

4. Click OK.

5. When Distributed Rendering is available, the Bentley Distributed Processing Scheduler icon appears in the System tray.

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Distributed Rendering Related dialogs

The Scheduler is accessed by right-clicking the Process Controller tray icon and choosing Open Scheduler. The Job Monitor is accessed by right-clicking the Process Controller tray icon and choosing Open Job Monitor.

Scheduler

The Scheduler dialog is used to schedule times that your system is available for contributing to processing images.

Job Monitor

The Job Monitor dialog displays the progress of your distributed rendering tasks.

Visualization Glossary

This glossary defines visualization terms used with MicroStation.

actor

In an animation sequence, an element(s) that are scripted to move or rotate in a controlled manner. Created as a cell.

adaptive subdivision

Process within radiosity solving that dynamically subdivides a surface element mesh along shadow boundaries, resulting in more accurate and detailed shading.

aliasing

Source of several common computer graphics artifacts such as jagged lines, missing objects, and jerky motion in animation. In signal processing terms, aliasing is caused by the under-sampling of a signal, resulting in some high-frequency components of the signal assuming the alias (or false identity) of the low frequency components, and mixing together in such a way that they can no longer be distinguished properly.

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ambient light

Imaginary light that is presumed to strike every point on a surface with equal intensity. Used to approximate the large-scale effects of diffuse inter-reflections, a phenomenon not usually accounted for by most lighting methods. Ambient light should be turned off when using particle tracing or radiosity solving, both of which take into account the diffuse reflection of light between surfaces.

animation camera

Actor that is scripted to designate a viewing position, orientation, and perspective for animation.

animation settings file

File (".asf") that contains design and rendering settings while recording an animation sequence. Particularly useful for collaborative recording of animation scripts on networked systems or continuing disrupted recordings.

anisotropy

Is the property of being directionally dependent, as opposed to isotropy, which means homogeneity in all directions. It can be defined as a difference in a physical property (absorbance, refractive index, density, etc.) for some material when measured along different axes.

antialiasing

Special rendering processing to remove or limit the appearance of aliasing artifacts in an image or an animation sequence. See also sample.

area light source

Light source created from a shape element. This type of light source casts softer, more natural shadows than a Point light source.

camera

Imaginary entity that specifies a scene's viewing position, orientation, and perspective. See also animation camera.

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candela

The candela is the unit of luminous intensity; that is, power emitted by a light source in a particular direction. A common candle emits light with a luminous intensity of roughly one candela.

caustics

Lighting effects caused by light reflected off surfaces, or refracted through transparent objects.

color bleeding

Shading effect observable in particle traced and radiosity solutions caused by diffuse-inter-reflections between surfaces. For example, a colored wall often reflects a small amount of its color onto an adjoining white wall.

diffuse interreflection

A global process of light transport among all the surfaces in an environment, based on a series of diffuse reflections between surfaces.

diffuse reflection

Type of reflection that sends light in all directions with equal energy. Diffuse reflection is said to be “view independent.” See also specular reflection.

displacement maps

Displacement maps simulate the geometry used to create them in the first place, and display the displacement map geometry in place of the underlying element.

dolly (camera)

To move the view cone while keeping the camera and target points in the same positions relative to each other — that is, without changing its orientation.

dolly (light source)

To move a directional light source and its target point such that they remain in the same positions relative to each other — that is, without changing its orientation.

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elevate

To move the view cone, linearly, in a vertical direction.

environment cube

Imaginary cube surrounding the entire design, on which images are applied as environment maps.

environment

Image file representing the projection of a 3D environment onto a 2D surface from a specific point of view. A map set of these files can be applied to the six faces of the environment cube that surrounds a design (or environment). An environment map is not directly visible in the view, but is seen only when reflected or transmitted by surfaces in the model to which material characteristics are applied.

field rendering

Animation script recording technique that results in frames that consist of two fields each (one for the even numbered scan lines and one for the odd-numbered scan lines). Used to improve playback on NTSC and PAL video display systems that employ interlaced display.

focal point

The point at which initially collimated (parallel) rays of light meet after passing through a convex lens, or reflecting from a concave mirror.

frame

Single rendered image that is part of a series of rendered images that make up an animation sequence.

frame number

Identifies a frame's relative position in an animation sequence. Since the speed of an animation sequence (expressed in frames per second) is constant throughout the animation, frame numbers can also be thought of as points in time. Therefore, fractional frame numbers can be specified in script entries.

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Fresnel effects

Effect of the angle of view on the reflectivity and transparency of a surface. For example, a window appears more reflective than transparent when viewed at a sharp angle.

frustum

Geometric shape used to describe the viewing volume in computer graphics, where the viewing plane sits at the top of a truncated pyramid that extends into the 3D environment.

global lighting

Shading of a surface that takes into account both direct lighting and some indirect lighting, such as reflections and refractions.

high dynamic range images

Luxology renders to a 64-bit High Dynamic Range (HDR) image and these images must be Tone Mapped to display on non-HDR monitors. We have implemented two different tone mapping options from which to choose. The options are Photographic tone mapping or a histogram-like tone mapping that works well when you have a limited color palette or monochromatic image. This wider dynamic range allows HDR images to more accurately represent the wide range of intensity levels found in real scenes ranging from direct sunlight to faint starlight.

highlight

Brightly-lit area on a surface caused by a specular reflection.

illumination

Specification of lighting on a surface.

image point

In photomatching, a known point on the photograph or rendered image that correlates to a monument point in the computer model.

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image script

Text file (".scr") containing entries that define the names of design files, views, output filenames and formats, and rendering options for batch rendering.

interpolation

Method by which an animation parameter smoothly varies from one state to another. Also refers to the blending of adjacent pixels of a texture map for smoother rendered images.

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.

keyframe

Frame in which the locations and orientations of particular elements are explicitly specified.

keyframing

Most basic method of animation, in which keyframes are defined, and the system automatically computes the frames in between (a process known as "tweening").

local lighting

Shading of the surface that accounts for direct lighting only — that is, lighting directly attributed to light sources.

local material

Material definition for a model stored within the DGN file rather than externally in a palette (".pal") file.

lumen

Units in which the brightness of light sources is expressed. Lumens are the photometric equivalent of watts, but only account for energy in the visible part of the electromagnetic spectrum. If a light source's Intensity setting is 1.0, its Lumens setting closely approximates lumens.

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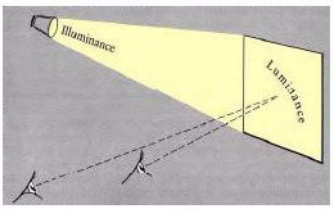
luminance versus illuminance

Illuminance is the amount of light coming from a light fixture that lands on a surface. It is measured in Lux. A typical office has an illuminance of between 300 to 500 lux on desktops.

Luminance describes the amount of light leaving a surface in a particular direction, and can be thought of as the measured brightness of a surface as seen by the eye. Luminance is expressed in Candelas per square foot, or more commonly, Candelas per square meter (Cd/m²). A typical computer monitor has a Luminance of about 100 Cd/m².



lux

The lux is the SI unit of illuminance and luminous emittance. It is used in photometry as a measure of the apparent intensity of light hitting or passing through a surface. One lux is equal to one lumen per square meter.

monument point

In photomatching, a known point in the model whose corresponding image point is visible.

NTSC

National Television Standards Committee. Video standard for television systems in the United States, Canada, and Japan.

script

Animation script whose entries are listed in the Animation Producer settings box. The open script can be previewed and recorded.

PAL

Phase Alternating Line. Dominant video standard for television systems in Europe and Australia.

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pan

To manipulate the view cone by revolving either the camera about the target (horizontally or vertically), or vice-versa.

parametric motion control

Animation method in which the position and orientation of elements are mathematically specified as a function of time.

photomatching

Process of matching a model's viewing perspective to that of a photograph or rendered background image, which is attached to the model as a reference raster file. The expected result is a composite image in which the model is superimposed on the background image with correct positioning and orientation.

procedural bump map

Special type of bump map that dynamically calls a procedural texture function to compute a perturbed surface normal rather than performing a lookup into a stored image.

procedural pattern map

Special type of pattern map that dynamically calls a procedural texture function to compute pixel color rather than performing a lookup into a stored image.

procedural texture

Function that takes either a 2D texture coordinate or a 3D world coordinate as input, and returns a texture value (either a color for a pattern map or a normal for a bump map). The function can perform anything from a simple lookup into a standard texture map to a very complex calculation. When a solid to which a 3D procedural texture is applied is rendered, the solid appears to be sculpted from the specified pattern rather than wrapped with the pattern.

roll

Rotate the camera about the view Z-axis.

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sample

In antialiasing, the process of examining part of a pixel. Samples are combined into a final pixel value. The number of samples and the threshold at which sampling stops are adjustable settings.

script

Text file (".msa") that contains animation script entries — directions concerning keyframes, views, parameter definitions, settings, actors, animation cameras, and targets.

specular reflection

Type of reflection that sends light primarily in a single outgoing direction related to a single incoming direction by the principles of geometric optics, resulting in either a mirror-like reflection or a glossy highlight. Specular reflection is said to be view-dependent.

terminator

Line separating light and dark on curved surfaces, most noticeable when an object is illuminated by a single light source.

texture map

Stored image used for texture mapping.

texture mapping

Process of applying detail to a surface without explicitly modeling it as part of the geometry of the surface. This process can be either a standard lookup into an image texture map or a function call to compute a value algorithmically. The resulting value can be used either as a pixel color value (as in a pattern map) or as a perturbed surface normal (as in a bump map).

tweening

In keyframing, the process in which the system automatically computes the frames in between keyframes.

uniform sampling

Regular distribution of samples, equally spaced in all dimensions.

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velocity

Rate of change of an animation parameter as it varies from one state to another.

view cone

Dynamically displayed indication of view extents that is used to set up the camera.

view-dependent lighting

Global lighting of a 3D environment that varies from image to image as the position of the view is changed, primarily because of specular reflections or refractions of visible surfaces.

view-independent lighting

Global lighting of a 3D environment that remains constant from image to image as the position of the view is changed, thereby allowing for reuse, which significantly shortens the rendering time of subsequent images.

viewing pyramid

See view cone.

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