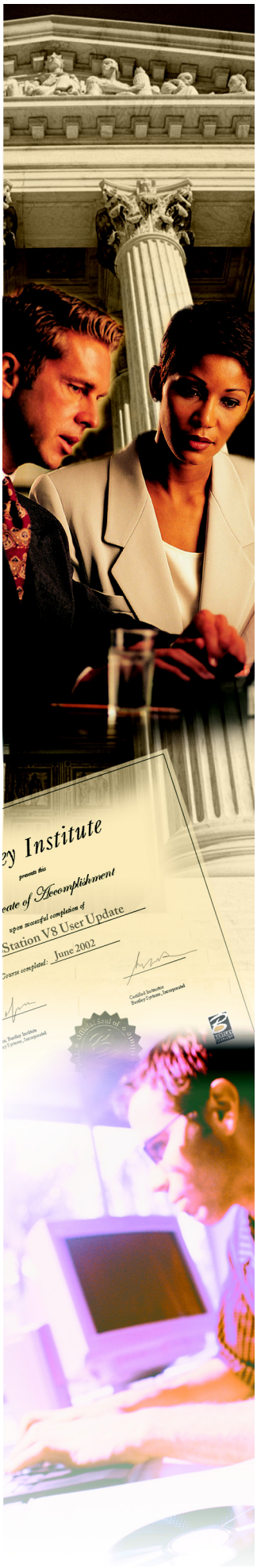

MicroStation for Animation
V8*i* SELECTseries 3

Bentley Institute Course Guide

TRN019780-1/0002

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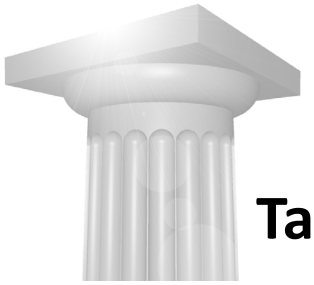

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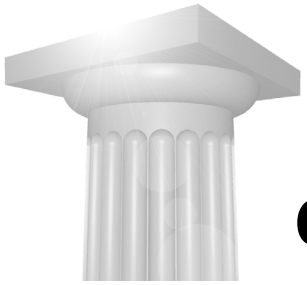


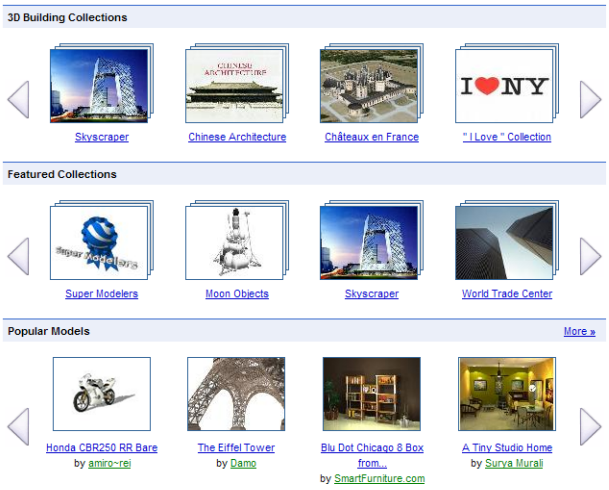
Course Overview

Course Description

This course is designed to teach the new animation user how to produce animated movies.

The MicroStation V8*i* for Animation course requires knowledge of MicroStation 3D. While it is intended for users with beginner through intermediate skills, it covers many advanced topics as well. Even an expert animator can learn valuable tips and tricks to improve animations.

Note: This course covers Animation only, not rendering, which is a separate course. This course does not cover 3D modeling. We recommend that you use the 3D Warehouse for 3D objects. You can access the 3D Warehouse from within MicroStation by selecting *Utilities > 3D Warehouse.*



This course assumes you know nothing about Animation. It starts out slowly, covering important basics, and then progresses to more advanced topics. The course is presented in order of importance, beginning with three basic requirements for Animation; Keyframing, Actors, and Animation Cameras, which are different than the regular MicroStation camera.

Target Audience

This course is recommended for the following audience(s):

- Architects
- Engineers
- Designers
- Visualization Specialists

Prerequisites

- Knowledge of MicroStation V8*i* Interface
- Knowledge of 3D tools, methods, and view controls
- Basic knowledge of Luxology rendering
- Basic understanding of computer generated animation

Course Objectives

After completing this course, you will be able to:

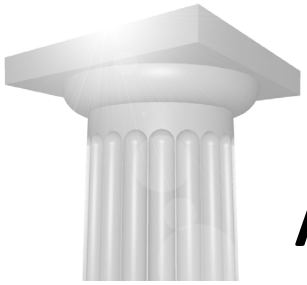
- Create and use actors
- Control actors through hierarchy and parametric animation
- Animate cameras
- Create and record scripts

Modules Included

The following modules are included in this course:

- Course Overview
- Animation Overview
- Keyframing
- Animating Actors

- Actor Hierarchy
- Parametric Animation
- Animating Cameras
- Traffic Simulation
- Animating Lights
- Animating Materials
- Scripts



Animation Overview

Module Overview

This module contains an overview discussing what animation is, as well as a brief explanation of the various types of video formats and output.

Module Prerequisites

- Understanding of basic MicroStation functionality
- Understanding of MicroStation models
- Fundamental knowledge about 3D tools and view controls

Module Objectives

After completing this module, you will be able to:

- Understand video standards
- Use KeyFrame animation tools
- Create a basic KeyFrame animation

Animation Overview

When you think of animation, one of the first things that comes to mind are cartoons. By drawing pictures with successive movement of objects, the cartoons appear to come to life. Cartoons today are typically created on a computer and some of the in-between pictures or frames are computed rather than drawn by hand.

What all forms of cartoon animation have in common is that they create perceived motion by showing successive frames at a relatively high speed. Computer cartoon animation usually shows 10-20 frames per second. By comparison, traditional hand-drawn animation uses anywhere from 8 frames per second (for poor quality animation), 12 frames per second (for standard animation), or 24 frames per second (for short bursts of smooth, realistic motion).

Human visual accuracy is limited to about 12 images per second. If you see more than 12 images per second, the brain thinks it is seeing continuous motion. If you see fewer than 12 images per second, the brain knows it is looking at single images presented rapidly.

When animating with MicroStation you will find that MicroStation does most of the work for you. You must only think about key events, or points in time, and then script these events to occur. MicroStation determines the in-between frames and interpolates positions based on the parameters you describe.

Animation is a helpful tool that helps you see exactly what is happening in a dynamic design. Whether you are doing a walk-thru of a building or plant, or showing how to remove a piece of equipment, animation can make the process clear. It can be valuable to animate in 2D to show a progression of events.

Video or Movie Output

MicroStation can handle a smooth 30 frames/sec and at a DVD quality resolution. Since most of your animation work will be played back on a PC, the final output can be converted to MPEG-1 or MPEG-2 format suitable for playback on a desktop or laptop system. MPEG (pronounced M-peg), stands for Moving Picture Experts Group, and is the name of the family of standards used for coding audio-visual information in a digital compressed format. The major advantage of MPEG compared to other formats is that MPEG files are much smaller but have good quality. This is due to the sophisticated compression techniques that the MPEG format uses.

You will be recording at 30 frames or images per second. When you play your animations back using Windows Media Player, they will play at 30 frames per second.

You can choose from several digital formats when creating animations to be played back on a computer. There is the Microsoft AVI format that can be configured to use a variety of compression/decompression routines or codecs. You also can choose Windows Media Video movie format, or WMV format.

If you intend to create video for playback on a television, MicroStation's Animator can output to HDTV, NTSC or PAL standard size frames and also supports interlaced field rendered frames.

While the MicroStation Movie Player can create movies in various formats from your rendered frames we recommend that you consider using a professional Non-Linear Editing NLE software program such as Adobe Premiere for editing your video. If you want to create professional quality movies that have soundtracks and other effects such as fades you will want to invest in a good NLE program.

Video Standards

NTSC

NTSC stands for National Television System Committee, which devised the NTSC television broadcast system in 1953. NTSC is also commonly used to refer to one type of television signal that can be recorded on various tape formats such as VHS, 3/4" U-matic and Betacam.

The NTSC standard has a fixed vertical resolution of 525 horizontal lines stacked on top of each other, with varying amounts of “lines” making up the horizontal resolution, depending on the electronics and formats involved. There are 59.94 fields displayed per second. A field is a set of even lines or odd lines. The odd and even fields display sequentially, interlacing the full frame. One full frame is made of two interlaced fields, and displays about every 1/30 of a second. THe remaining 0.06 fields/sec are used for time correction.

NTSC format is used in North and South America, with the exception of Brazil which uses a modified version of PAL.

PAL

PAL stands for Phase Alternation by Line, and was adopted in 1967. It has 525 horizontal lines making up the vertical resolution. Fifty fields display and interlace per second, making a 25 frame per second system. An advantage of this system is a more stable and consistent hue (tint). PAL-M is used only in Brazil. It has 525 lines, at 30 frames per second.

The PAL format is used in most of Europe, Africa and Asia, including Australia.

HDTV

HDTV - High-definition television is a television broadcasting system with a significantly higher resolution than traditional formats (NTSC, SECAM, PAL) allow. HDTV is broadcast digitally.

While a number of high-definition television standards have been proposed or implemented on a limited basis, the current HDTV standards are defined in ITU-R BT.709 as 1080 active interlaced or progressive lines, or 720 progressive lines, using a 16:9 aspect ratio. The term “high-definition” can refer to the resolution specifications themselves, or more loosely to media capable of similar sharpness, such as photographic film.

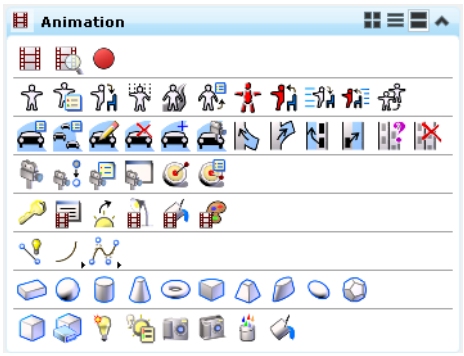
The Animation Task and Tools

Following is an overview of the Animation tools and the interface used to create animations.

➔ **Exercise: The animation interface**

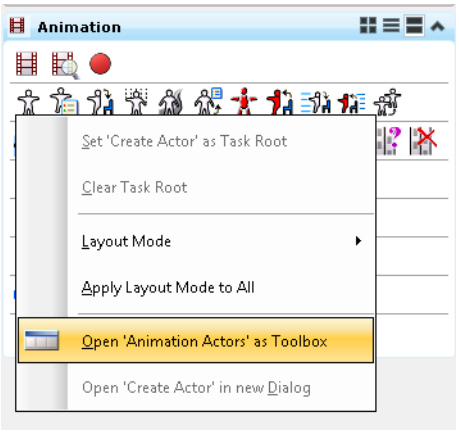
1. Launch MicroStation and 01_KeyFrameanimation.dgn.
2. From the Tasks dialog on the left side of the application window, click Animation.

   The Animation task gives you access to all the animation tools, as well as basic drawing, 3D primitive, and visualization tools.



Important tools are the Animation Producer and Animation Preview tools, the Create and Manipulate Actor tools, and the KeyFrames dialog tool.

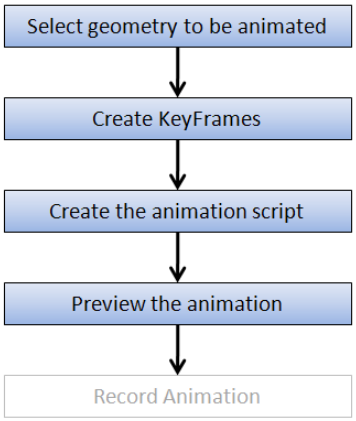
Note: You can right click on any tool and open the toolbox to which it belongs as an individual toolbox.



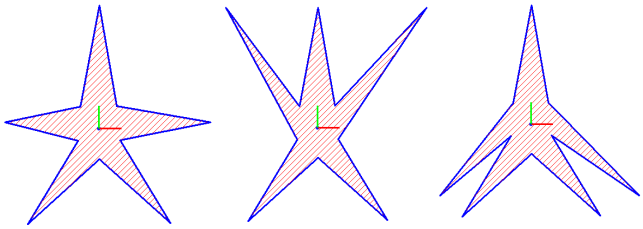
KeyFrame animation

A KeyFrame is a moment in time where the locations of elements are explicitly specified. KeyFrame animation is a sequence of poses where each pose is slightly different than the first. This process is like creating a cartoon, where the cartoon character appears to be moving across the screen. This type of animation is the most basic of all animation methods.

The following is a workflow for this type of animation.



These images are KeyFrames of a star, showing a starting pose, a middle pose, and end pose.



➔ **Exercise: Creating KeyFrames**

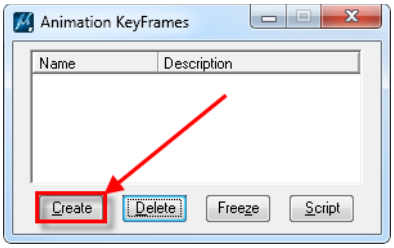
1 Continuing in 01_KeyFrameanimation.dgn, from the Animation task, select the Animation Producer dialog tool.

Note: You may have to activate the license against your SELECTserver license before the dialog opens.

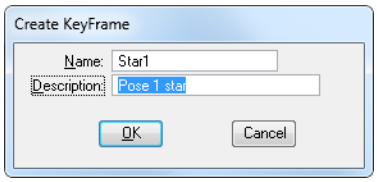
2 Select the star using the Element Selection tool.

3 In the Animation Producer dialog, select *Tools > Named KeyFrames*.

4 In the Animation KeyFrames dialog, click Create.



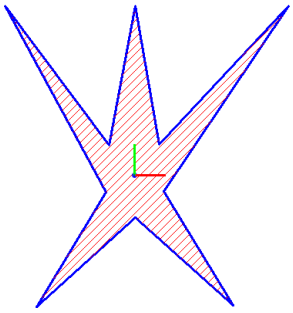
5 In the Create KeyFrame dialog, type the name Star 1, add the Description, Pose 1 star, and then click OK.



Note: It is important to create descriptions that will identify the scene or the action that takes place in a scene. These let you go back and easily review the purpose of a KeyFrame.

6 Click in the view or click Clear in the Element Selection tool settings to release the star.

7 Move the star's left and right points upward using the Modify Element tool from the Main toolbox.

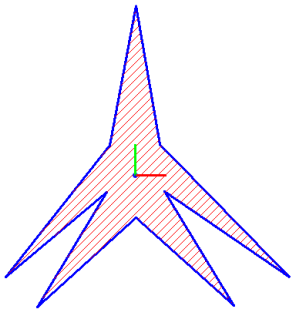


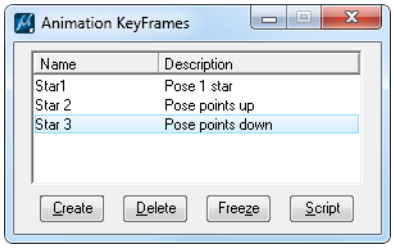
8 Select the star using the Element Selection tool.

9 In the Animation KeyFrames dialog, click Create.

10 Type the name Star 2 and add the Description Pose points up.

11 Using the same process, create pose 3 with the points in a downward position.





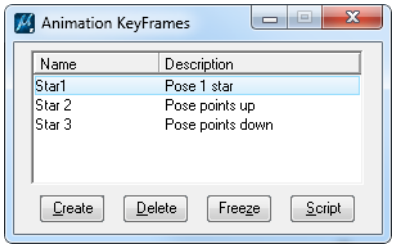
Scripting the KeyFrames

After you have created your KeyFrames, you must create a file that provides directions about what to do, and in what order, this is called a script. MicroStation will automatically create the transition images from one KeyFrame to another, involving movement, rotation, or element changes. This process is called tweening.

In the following exercise you will create a script file for the star.

➔ **Exercise: Scripting the KeyFrames for the star**

1 Continuing in KeyFrameanimation.dgn, in the Animation KeyFrames dialog, with the Start KeyFrame highlighted, click Script.

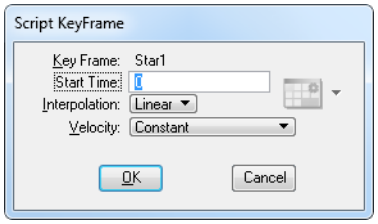


2 In the Script KeyFrame dialog, set the following, and then click OK:

Start Time: 0

Interpolation: Linear

Velocity: Constant



Since Start is the first KeyFrame, the beginning of the animation, the start time is 0. In the following steps you will set the start time for the remaining KeyFrames.

3 Set the Script KeyFrame parameters for Star 2 as follows:

Start Time: 10

Interpolation: Linear

Velocity: Constant

4 Set the Script KeyFrame parameters for the Star 3 KeyFrame as follows:

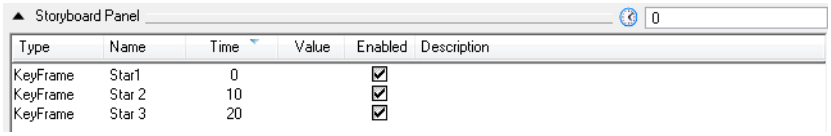
Start Time: 20

Interpolation: Linear

Velocity: Constant

In the Animation Producer dialog, markers are placed in the timeline grid at the 0, 10, and 20 seconds.

Hint: If you expand the Storyboard Panel in the Animation Producer dialog, all KeyFrames are listed.



5 In the Animation Producer dialog, select *Settings* > *General* make sure the following parameters are set:

In the Range section - *End:* 20

In the Preview section - *Loop:* Enabled

6 Close the dialog and also the Animation KeyFrames dialog.

7 From the Animation tasks, select the Animation Preview tool and dock the dialog at the bottom of the application window.

8 Click Play in the Animator Preview dialog.

The star appears as if it is trying to fly.

9 Click Pause Animation when you are done.

10 Create KeyFrames for the rocket and car.

Remember, you can move, rotate, and modify an element for each KeyFrame.

11 When you are done, select *File > Close* from the main menu bar.

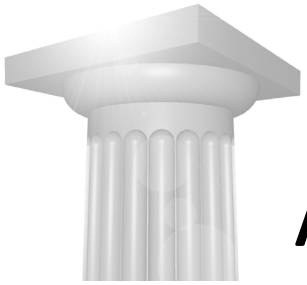
The Animation Preview and General Settings Dialogs

This dialog is used to play animations so you can see how they perform. There are controls on the right side of the dialog like those of typical video applications.

Above these, one field shows the elapsed time. Options to the right of this field let you select the view window in which you want to see the preview. There is also a tool to open the Animation Settings dialog.

The way the time is shown at the bottom of the Animator Preview dialog depends on the first Time Display setting in the Animation Settings dialog. You can choose to see hours, minutes and seconds along with frames, or just frames.

You can also set a data format. If your Time Display is set to a date style format, clicking the icon to the right of the field opens a Select Start Time dialog, which lets you select the month, year, and day.



Animating Actors

Module Overview

This module shows you how to create, manipulate, and animate elements that are automatically placed in a Named Group when you create an Actor. You will also learn how to record scripts and save animations to Adobe PDF files.

Module Prerequisites

- Complete the Animation Overview module
- Fundamental knowledge of 3D tools and view controls
- Fundamental knowledge about rendering
- Basic knowledge about AccuDraw

Module Objectives

After completing this module, you will be able to:

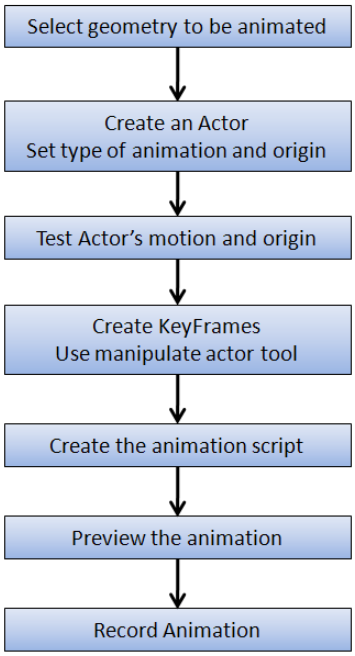
- Create animation actors
- Preview scripts
- Create 3D content in Adobe PDF
- Record animation scripts
- Use the Movie Player

Creating and Manipulating Actors

Animation Actors

In an animation sequence, an Actor is a Named Group that is scripted to move, rotate, or scale in a controlled manner. The tools for creating and manipulating Actors are located in the Actors toolbox, which is opened from the Animation task.

Following is the workflow for creating an animation sequence using Actors:

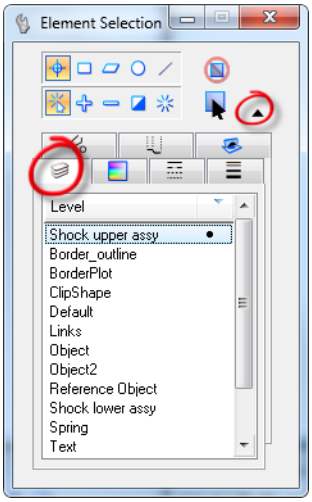


➔ **Exercise: Create an Actor and test its movement**

1. Open 02_animateactors.dgn.

2. Use the Element Selection tool to select all geometry on the level Shock upper assy.

You must click the Show Extended Settings arrow in the Element Selection tool settings. Then just click the level name on the Level tab to select the elements.



3 From the Animation task, select the Create Actor tool, with the following tool settings:

Name: upper shock

Move Along: Z Enabled (X and Y are disabled)

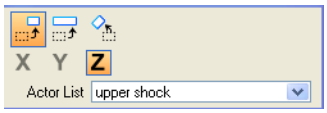
4 Following the status bar prompt, snap origin to the center of the assembly in View 1, the Top view.

You can now test the Actor's motion.

5 Select the Manipulate Actor tool with the following tool settings:

Move Actor: Enabled

Actor List: upper shock



The Actor highlights.

6 In View 2, move the pointer up and down.

It will move along the Z-axis.

7 Reset when you have confirmed movement along the Z-axis.

Important: Do not accept with a data point or the element's position will change. Reset after testing an Actor's movement.

➔ **Exercise: Create another Actor and test movement**

1 Continuing in 02_animateactors.dgn,use Level Display to make the Spring level the active level and then turn off all other levels in View 4

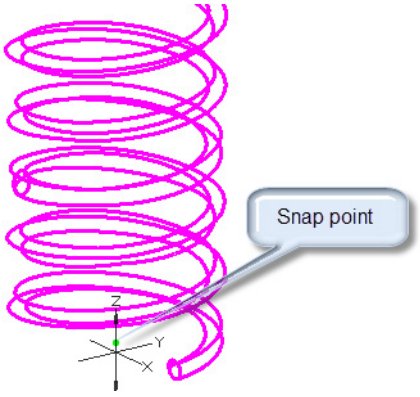
2 Use Element Selection to select all the geometry on the level Spring.

3 From the Animation task, select the Create Actor tool with the following tool settings:

Name: spring (change the previous name)

Scale Along: Z enabled (X & Y disabled)

4 Snap to the green weighted point in View 4 and enter a data point to create the spring actor.



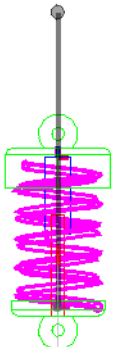
5 Select the Manipulate Actor tool with the following tool settings:

Scale Actor: Enabled

Actor List: spring

Method: By Points

6 Drag the pointer along the Z-axis to test the scaled movement. The spring should appear to expand and compress about the origin



7 Reset after confirming scaling about the Z-axis.

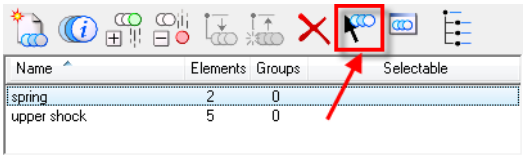
As mentioned previously, Actors are grouped together in Named Groups. The following exercise shows you how to isolate the elements that comprise and actor using this fact.

➔ **Exercise: Actors are Named Groups**

1 Select *Utilities* > *Named Groups* from the main menu bar.

2 In the Named groups dialog, select one of the Actors.

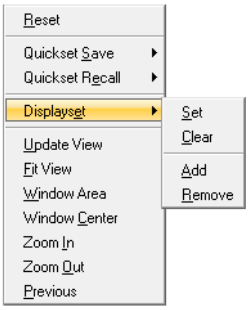
3 Click the Select Elements in Named Group tool.



The elements that comprise the actor are selected.

4 Click on the Set DisplaySet from Selected Named Groups icon to isolate this geometry.

Note: DisplaySet visibility is a View Attribute. You may easily create or clear a DIsplaySet by using Shift Right Click to bring up a context menu. You can also remove or add additional elements to the DisplaySet.



5 Enter a Shift Right Click and choose DisplaySet Clear.

Now you'll create KeyFrames to give movement to the assembly.

➔ **Exercise: Creating KeyFrames**

1 Continuing in 02_animateactors.dgn, from the Animation tasks, click the KeyFrames tool.

2 Use the Element Selection tool and select the levels Shock upper assy and Spring.

3 In the Animation KeyFrames dialog, click Create, type the following, and then click OK:

Name: Up

Description: Shock in up position

4 Use the Element Selection tool to select only the Shock upper assy level.

5 Select the Manipulate Actor tool, with the following tool settings:

Move Actor: Enabled

Actor List: upper shock

6 Move the upper assy 2.5 units along the negative Z-axis.

7 Enter a data point in View 3.

8 Select the Manipulate Actor tool, with the following tool settings:

Scale Actor: Enabled

Actor List: spring

Method: Active Scale

Z Scale: 0.6

9 Enter a data point in View 3.

10 Use the Element Selection tool and select the Spring and Shock upper assy levels.

11 In the Animation KeyFrames dialog, click Create and type the following:

Name: Down

Description: Spring compressed

To make sure an actor always returns to a certain position, you can set a Freeze at that position.

12 Clear the selection set.

13 In the Animation KeyFrames dialog, select the Up KeyFrame and click Freeze to return the geometry to the uncompressed position at the end of the animation.

➔ Exercise: Scripting the KeyFrames using the Animation Producer Dialog

1 Continuing in 02_animateactors.dgn, in the Animation KeyFrames dialog, with the Up KeyFrame selected, click Script.

2 Set the following in the Script KeyFrame dialog, and then click OK:

Start Time: 0

Note: Since this is the beginning of an animation at frame 0, the Interpolation setting has no effect.

3 Script the Down KeyFrame as follows:

Start Time: 29

Velocity: Decelerate

4 Script the Up KeyFrame as follows:

Start Time: 59

Velocity: Decelerate

5 Select *Settings > General* in the Animation Producer dialog, and set the following:

Range section - *End:* 59

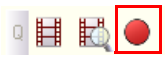
Preview section - *Alternate Views:* Enable the View 2 toggle and the Loop check box

6 Close the dialog.

7 Preview the animation by clicking Start in the Animator Preview dialog.

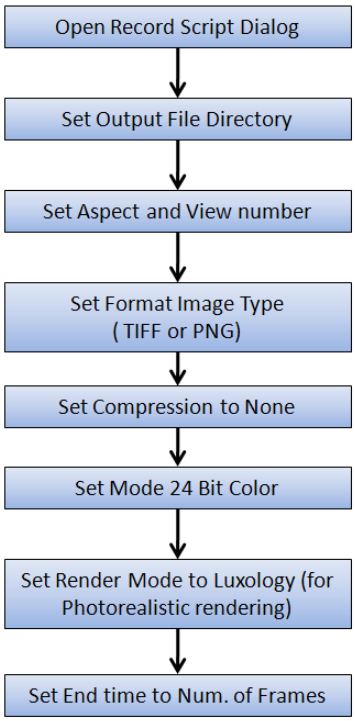
Recording Animations

Select *File > Record Script* in the Animation Producer, or click the Record tool in the Animation task, to open the Record Script dialog. The dialog is used to set the file format and record the active script.

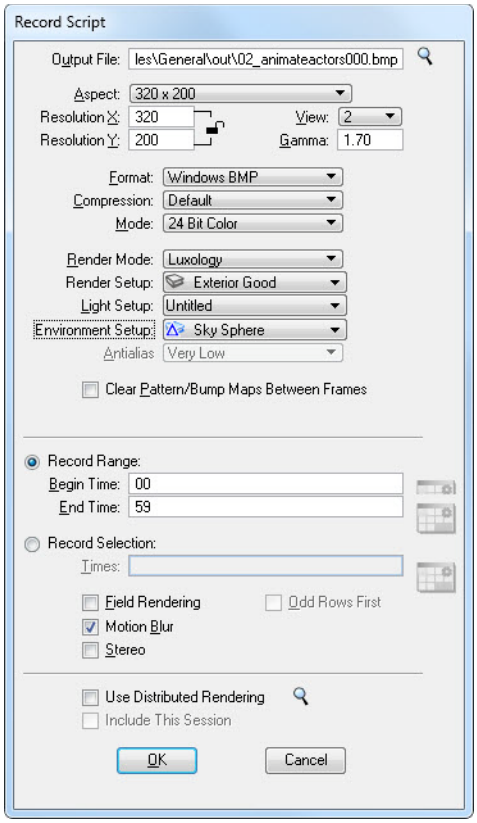


The workflow and important settings are discussed here.

Following is a typical workflow for recording an animation sequence.



The dialog

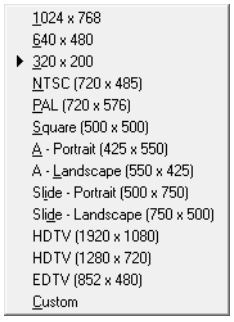


Output File

When opened, the active file is listed. Click the magnifying glass to select another output folder. The default folder is the \out folder in the project in which you are currently working.

Aspect

Is set to 320X200 pixels by default, but common and custom settings are available from the option list.



Note: When recording for playback on NTSC and PAL television systems, interlaced video is used. This means that each frame actually consists of two fields. Each field contains half of the frame scan lines, and only a single field is refreshed in each scan. An NTSC screen that displays 30 frames per second will therefore display 60 fields per second.

Warning: Digital TVs and all computers that display all the scan lines in a frame simultaneously are very common today. This is referred to as non-interlaced or Progressive Scan video. For video playback on computers you will alway see all the scan lines so progressive scan and not interlaced video is your only option. Unless you really plan to create a video for and old analog TV you should not use Field Rendering. As you can clearly see in the following image, you see both fields at once and where fast motion occurs you will see an obvious separation between the two fields.

Field Rendered Example frame

Resolution X,Y

Custom resolution values can be entered but remember the larger the value the more memory and time it takes to render the animation sequence.

View

Sets the View number for the view you want to record.

Gamma

Gamma correction of images is required to compensate for properties of human vision, and to maximize the displayed image relative to how humans perceive light and color. A setting of 1.0, means that no gamma correction is used. The settings range for the Animator output is from 0.01 - 3.0 a typical value for Luxology renderings would be 1.5 - 2.2.

Format

The preferable method for creating animation movies using MicroStation V8*i* (SELECTseries 3) is to save individual sequential frames. You will use the TIF (Tag Image File Format) in this Animation course. These files can be loaded into the Movie Player inside MicroStation V8*i* by selecting *Utilities > Image > Movies*.
Creating individual frames is preferred because it provides greater flexibility. If you have an interruption in the rendering process, you can re-render the remaining frames using the same file name and sequence number. The remaining frames with incremental sequence numbers will be created. You do not have to re-render the entire project.

Compression

A lossy compression such as JPEG should never be used for rendered animation frames using Luxology. In the first place we render to a floating point image Bentley Image or BIMG file and these contain more information than can be displayed so they must first be Tone Mapped to be displayed in 8bit RGB True Color and saved as TIFF or JPEG. More about BIMG files later but you are not doing yourself a favor saving frames as JPEG you might be saving some disk space but if you care about quality just say no to JPEG.

You might think that JPEGs are great and they are for saving static images but the truth is they introduce some artifacts or noise depending on the amount of lossy compression used. When you make your movie and create a media file such as Windows Media Video (WMV) or and AVI this introduces more artifacts. If you are old enough to remember VHS tape think what happened when you copied a movie and then copied the copy. The first copy was not as good as the original and the copy of the copy was even worse.

JPEG format:

- Minimum Loss
- Low Loss
- Medium Loss
- High Loss

TIFF format

- PackBits Compression - (Popular Macintosh format also used by USGS for the DRGs)
- JPEG Compression - (A lossy compression method where some original data is lost)
- Deflate Compression - (Extended), (lossless compression that came from PKZIP)
- None (no compression)

Windows AVI

- DV Video Encoder - (typically used for Video Camcorder's.)
- MJPEG Compressor - (Motion JPEG (M-JPEG) a class of video formats where each video frame or interlaced field of a digital video sequence is separately compressed as a JPEG image)
- Cinepak Codec by Radius - (Originally used with QuickTime but also used Microsoft Video for windows and MPEG-4)
- Intel IYUV codec - (a bit slow, older format but works with many applications)
- Microsoft RLE - (Run Length Encoding simple compression method)
- Microsoft Video 1 - (MS-CRAM early video compression codec, Microsoft Video for Windows 1.0)
- TechSmith Screen Capture Codec - (Used with Camtasia but not always compatible with other applications)

Windows WMV

- Windows Media Video 9 Screen - (high compression used for capturing computer display Media player 7 or later))
- Windows Media Video V7 - (Windows XP 7.0)
- Windows Media Video 9 Image - (Media player 7 or later)
- Windows Media Video 9.1 Image - (Media player 7 or later)
- Windows Media Video V8 - (Media player 8.1)
- Windows Media Video 9 - (Media Player 6.4 or higher, Mac OS, media player 9.1 Pocket PC and Smartphone)
- Windows Media Video 9 Advanced Profile (Media player 7 or later)

All others Formats use a Default compression for the specific format.

Mode

Determines the number of colors in the output file.

Render Mode

All Render Modes have a Light Setup and options for setting Antialias but only Luxology provides Render, Light and Environment Setup options. In Luxology the Antialias value is set in the Render Settings dialog.

Record Range

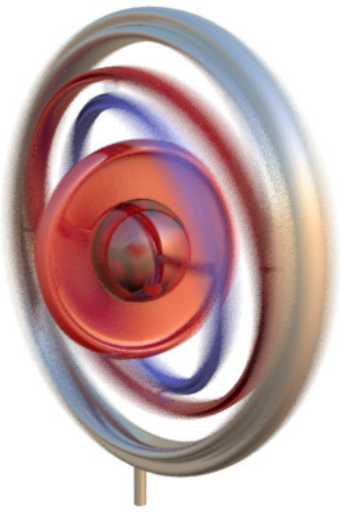
If on, you can select the start and End time for your recording. For example 1-30 records frames 1 through 30, 1,25 records frames 1 and 25 and 1,25-30 records 1 and frames 25 through 30.

Field Rendering

Enable only for interlaced video for NTSC or PAL video formats. Do not use this option if you intend to make videos for playback on your computer.

Motion Blur

If on, motion blur is rendered by Luxology. Motion blur is the effect of "blurring" objects as they move on the screen, giving them a smooth and more realistic appearance of motion. It is recommended that you use motion blur this will prevent stuttering especially where the motion is fast. Motion Blur requires that Anti-aliasing be enabled in the render setup where higher quality Antialias settings produce smoother blurring at the expense of render time.



Motion Blur enabled

Stereo

If on, creates a 3D animation with a stereo effect that is visible when viewed with 3D (Red/Blue) glasses. Can also be set to render side by side stereo pairs for display with active (shutter glasses) or passive (polarized glasses).

Record Selection

If on, lets you define a range of frames/times to record

Use Distributed Rendering

This is enabled if a valid shared directory is identified. If enabled it allows Distributed Rendering (DR) when rendering the animation frames to disk. When DR is used to render animation frames each machine renders a complete frame whereas participating machines render buckets or portions of an image when DR is used for rendering a still image.

Include This Session

If on, the current session of MicroStation will contribute to the rendering. If off Luxology renders will always include the session regardless but for any other display style the current session will not be used to compute frames.

Hint: Unchecked this when you wish to use the current MicroStation session for other work and your animation frames are not using Luxology for rendered output.

➔ **Exercise: Record a script for the shock animation using Luxology rendering**

1. Continuing in 02_animateactors.dgn, click in View 2 to make it the active view.

2. Click Record in the Animation tasks.
3. In the Record Script dialog, set the following:

   Output File: Use the default or select a location you will remember

   Aspect: 640 X 480

   Format: Tag Image File Format

   Compression: None

   Mode: 24 Bit Color

   Render Mode: Luxology

   Render Setup: Exterior Good

   Light Setup: 3:25PM

Environment Setup: Sky Sphere

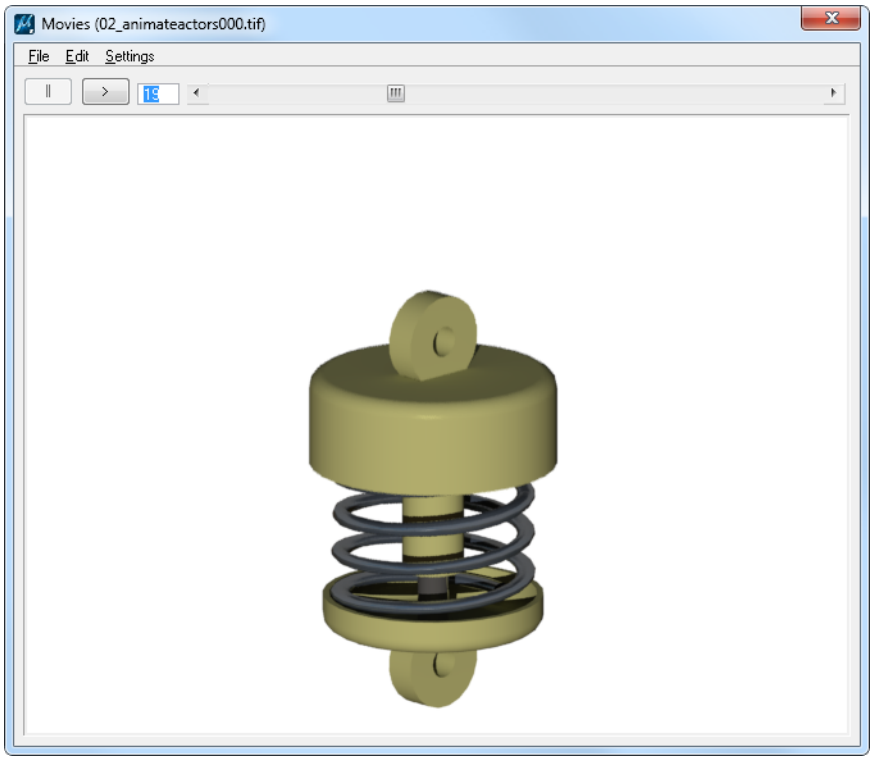
4 Click OK to begin recording.

Note: If you need to cancel recording, right click to enter a reset or press Ctrl + C on the keyboard.

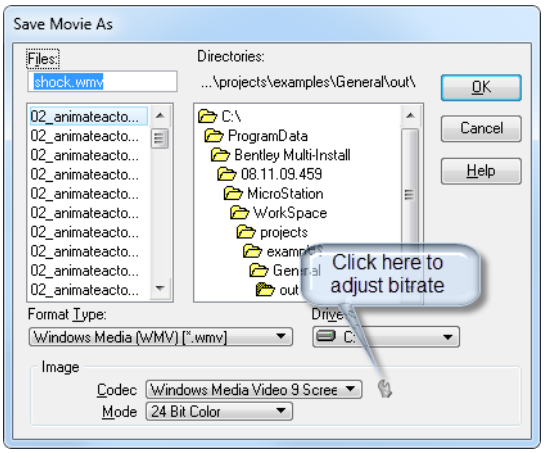
5 When the final frame has been recorded, select *Utilities > Image > Movies* from the main menu bar.

6 In the Movies dialog, select *File > Load,* and navigate to your output file.

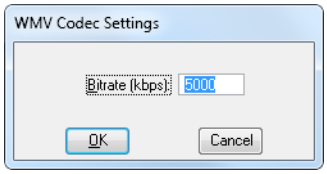
7 Select first frame 02_animateactors000.tif and play the movie.



8 If the movie plays as expected, Pause it, select *File > Save As and save it as Windows Media (WMV) (*.wmv)* change the output name to shock.wmv.

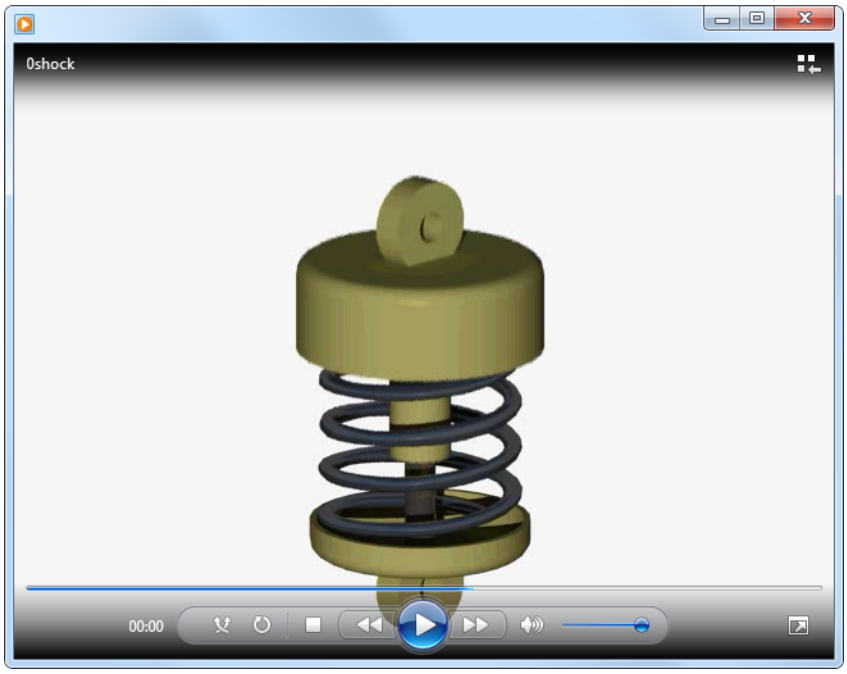


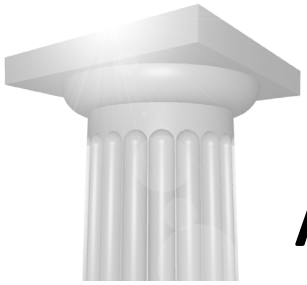
9 Click on the wrench icon to adjust the WMV Bitrate, change it to 5000 and click OK. This will improve the quality but also increase the size of the movie.



10 Click OK on Save Movie as dialog to make the Window Media Video file.

11 If available, launch Windows Media Player and open 02_animateactor.wmv.





Actor Hierarchy

Module Overview

This module explains how to edit scripts and create a hierarchy of Actor assemblies. The Actor assemblies are simply attached to each other in logical order. You will also learn how to create more advanced key framed animation.

Module Prerequisites

- Know how to create Actors
- Knowledge about 3D view controls and AccuDraw

Module Objectives

After completing this module, you will be able to:

- Attach actors to create assemblies
- Create a KeyFrame hierarchy
- Script animation using KeyFrames
- Preview animations
- Target Actors

Actor Hierarchies

Actor hierarchies let you create more complex animation scripts by assembling Actors into hierarchical relationships. The ability to attach one actor to another is referred to as creating a parent-child relationship.

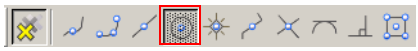
Create Desk Lamp Actors

In the following exercises you will create actors that make up a desk lamp. You will assemble them into a logical hierarchy, forming a parent child relationship. This makes it easier to create KeyFrames to animate the lamp.

➔ **Exercise: Create and test the Shade Actor**

1. Open 03_dlamp.dgn.
2. Maximize View 3 and Zoom In on the desk lamp.

   The Center snap will make it easier to snap to the geometry and place origins.
3. From the main menu bar, select *Settings* > *Snaps* > *Button Bar* and dock the Button bar at the bottom of the application window.



4. Double click the Center snap to make it the active snap mode.

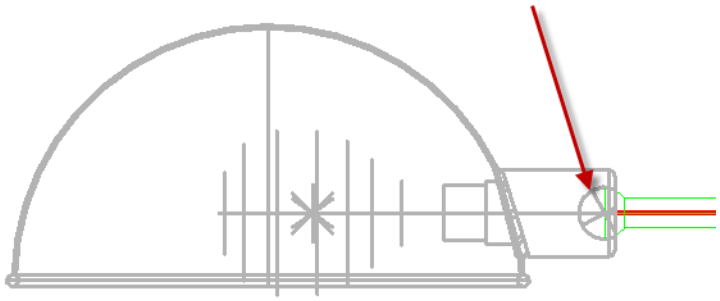
5. Use the Element Selection tool to select all the geometry on the Lampshade level including the construction elements.

6. Select the Create Actor tool, with the following tool settings:

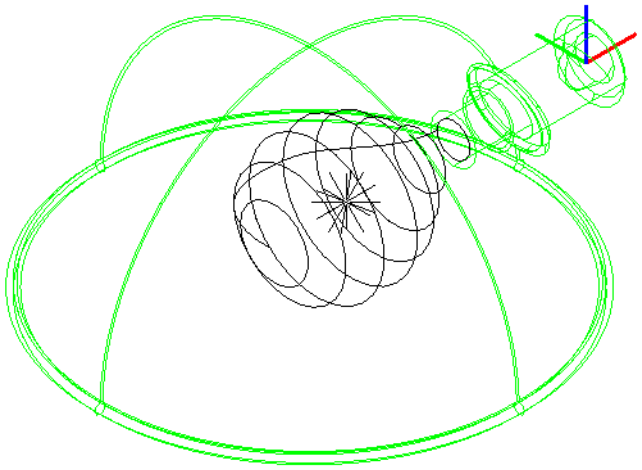
   Name: Shade

   Rotate About: X and Y (Disable all other motion)

7 Move the pointer over the sphere where the shade meets the red weighted line AccuSnap will snap to the center of the spherical socket.



8 Enter a data point to create the Actor.

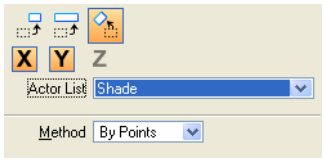


9 Select Manipulate Actor with the following tool settings:

Rotate Actor (icon): Enabled

Actor List: Shade

Method: By Points



10 Enter a data point and move the pointer to test the actor's motion, and then reset without entering another data point. Because the actor can

rotate about either the X or Y axis you can switch between the two axises by simply enabling the rotation you want in the Manipulate Actor Tool Settings.

Important: Remember to reset. Do not enter a data point when testing an Actor so you do not change its position.

You test Actors to make sure they are behaving as expected. If they are not, you can use the Modify Actor tool to change them. If an origin is not located correctly, you can move it with MicroStation's Move tool to the correct location.

➔ **Exercise: Create more Actors for the lamp**

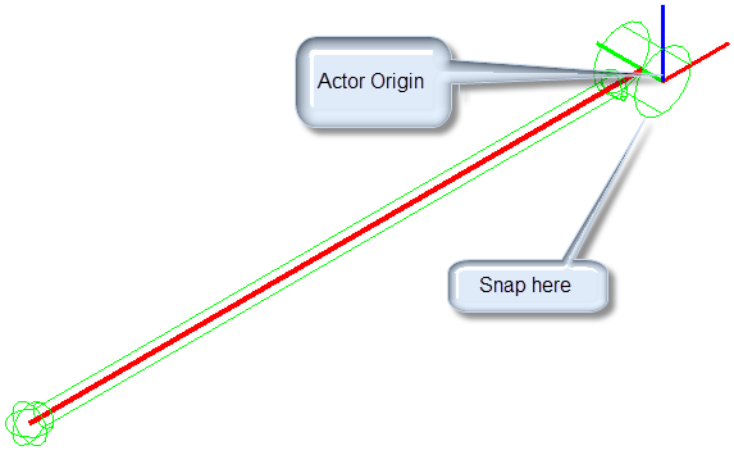
1 Continuing in 03_dlamp.dgn, use Element Selection to select all geometry on the Upper arm level.

2 Select the Create Actor tool, with the following tool settings:

Name: Upper_arm

Rotate About: Y (Disable all other motion)

3 Identify the origin by snapping to the opposite end of the cylinder in View 4, and then entering a data point.



4 Select Manipulate Actor, with the following tool settings:

Rotate Actor: Enabled

Actor List: Upper_arm

Method: By Points

5 Enter a data point and move the pointer to test the actor's motion, and then reset without entering another data point.

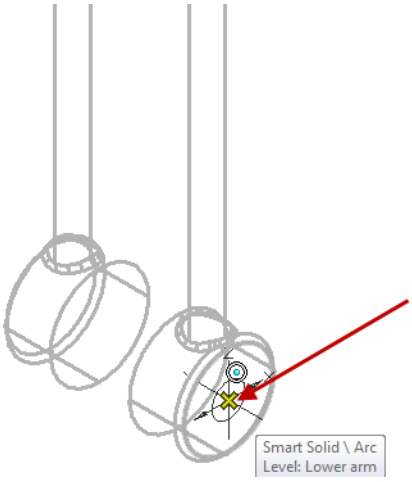
6 Use Element Selection to select all geometry on the level Lower arm level.

7 Select the Create Actor tool, with the following tool settings:

Name: Lower_arm

Rotate About: Y (Disable all other motion)

8 Move the pointer over the lower part of the arm, snap to the center, and enter a data point.



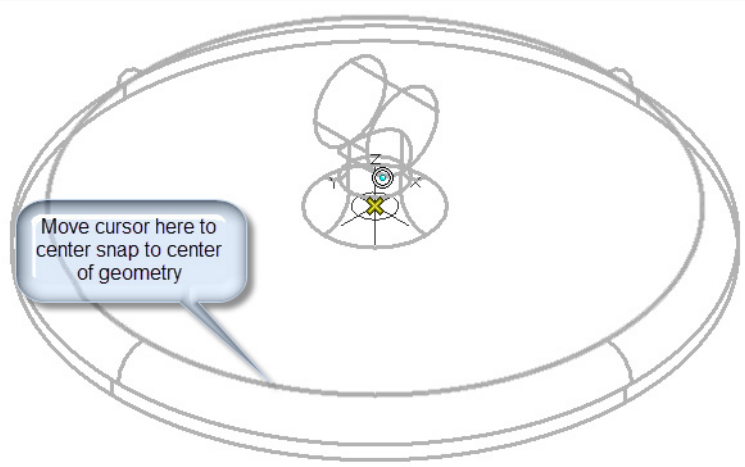
9 Use the Element Selection tool and select all geometry on the Base level.

10 Select Create Actor, with the following tool settings:

Name: Base

Rotate About: Z (Disable all other motion)

11 Enter a data point at the center of the base.



12 Test both Actors using the Manipulate Actor tool.

All the Actors have been created for this animation. In the next section you will learn how to create an actor hierarchy for the desk lamp.

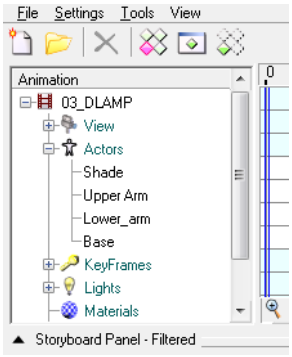
Assemble the Desk Lamp

Now that you have created Actors from the individual components of the desk lamp you must attach them together to create the hierarchy.

The Shade will become a child of the Upper_arm, the Upper_arm a child of the Lower_arm, and the Lower_arm a child to the Base. Whenever a parent is moved, the children under it will also move.

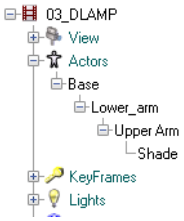
➔ **Exercise: Creating a hierarchy using Animation Producer**

1. Continuing in 03_dlamp.dgn, select the Animation Producer dialog tool.
2. In the Animation Producer's Animation pane, click on the + sign next to Actors.



3. Click on the Shade actor and drag it to the Upper_arm Actor.

   The Actors are nested.
4. Drag the Upper_arm Actor to the Lower_arm Actor.
5. Drag the Lower_arm Actor to the Base actor.



6. Select Manipulate Actor with the following tool settings:

Rotate Actor: Enabled

Actor List: Upper_arm

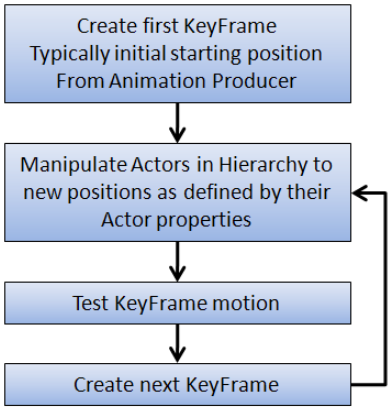
Method: By Points

7 Enter a data point over the Upper_arm and move the pointer to test the rotation. Notice how the shade now moves with the upper arm actor Reset.

8 Test the Lower_arm and the Base if you like, resetting when done.

Create KeyFrames

Now that you have created the actors and attached them to form a hierarchy, an assembly, you must position the lamp into several KeyFrame positions. Then you create a script. The goal is to have the lamp appear lifelike. The workflow follows.



You will create intermediate KeyFrames to prevent the lamp shade from hitting the table or the object sitting on the table.

➔ **Exercise: Create KeyFrames for the desk lamp**

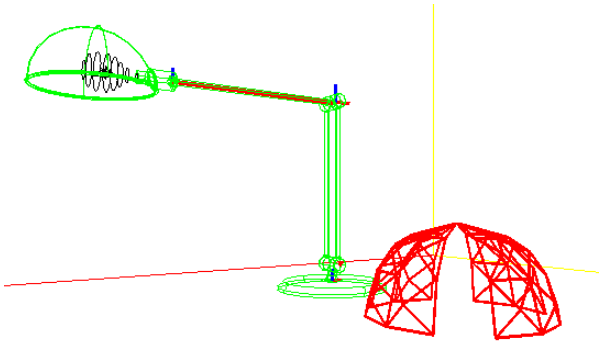
1 Continuing in 03_dlamp.dgn, select the KeyFrames dialog tool.

2 In the Animation KeyFrames dialog, click Create and click the desk lamp at the Base in View 2(this selects all the actors in the hierarchy) and accept with a data point.

3 In the Create KeyFrame dialog, set the following, and then click OK:

Name: Start

Description: Initial position



The next KeyFrame will swing the lamp to the side.

4 Select the Manipulate Actor tool, with the following tool settings:

Rotate Actor: Enabled

Actor List: Base

Method: Active Angle set to 90 degrees

5 Enter a data point.

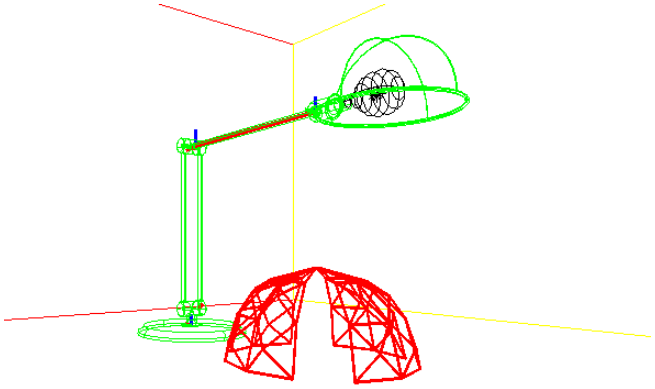
The desk lamp rotates 90 degrees.

6 In the Animation KeyFrames dialog, click Create, enter a data point on the lamp base, and another to accept.

7 In the Create KeyFrame dialog set the following, and then click OK:

Name: p1

Description: Rotate base 90 degrees



For the next KeyFrame you will move the lower arm 20 degrees.

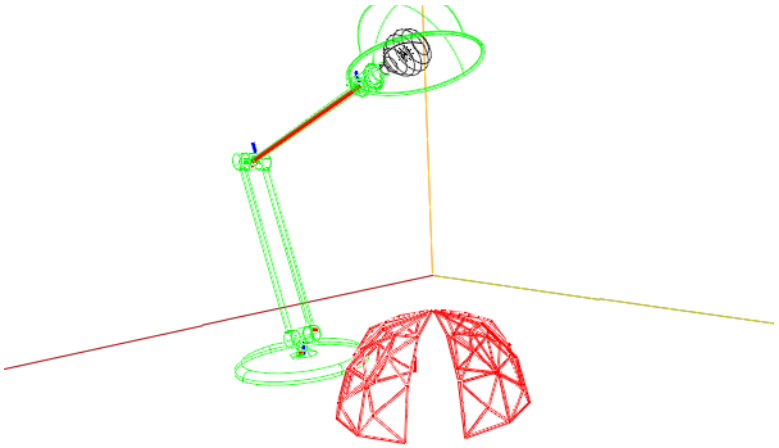
8 Select Manipulate Actor with the following tool settings:

Actor List: Lower_arm

Method: Active Angle set to 20 degrees

9 Enter a data point in the view.

10 In the Animation KeyFrames dialog, click Create, enter a data point on the lower arm, and another to accept.



11 Set the following in the Animation KeyFrames dialog, and then click OK:

Name: p2

Description: Rotate lower arm 20 degrees

The next KeyFrame requires you to make multiple moves within the same KeyFrame. You will rotate the Shade -45 degrees, the Base -20 degrees, and the Lower_arm -20 degrees.

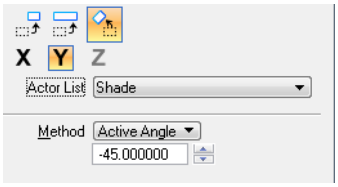
➔ **Exercise: Create more KeyFrames to create further motion**

1 Continuing in 03_dlamp.dgn, select Manipulate Actor, with the following tool settings:

Actor List: Shade

Method: Active Angle set to -45 degrees

2 Set Rotate to Y.



3 Enter a data point in the view.

4 Change the following tool settings:

Actor List: Base

Method: Active Angle set to -20 degrees

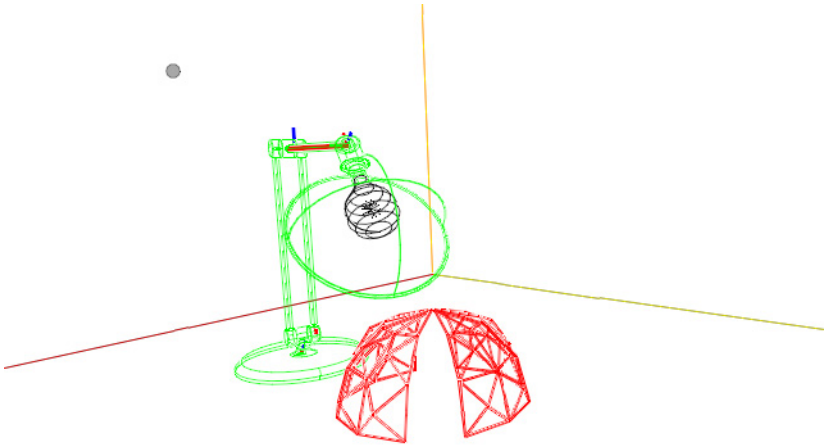
5 Enter a data point in the view.

6 Change the following tool settings:

Actor List: Lower_arm

Method: Active Angle set to -20 degrees

7 Enter a data point in the view.



8 Create a KeyFrame of the desk lamp in this position using the parameters:

Name: p3

Description: Rotate all

9 Repeat the previous steps, using the following parameters:

Rotate the Upper_arm -35 degrees

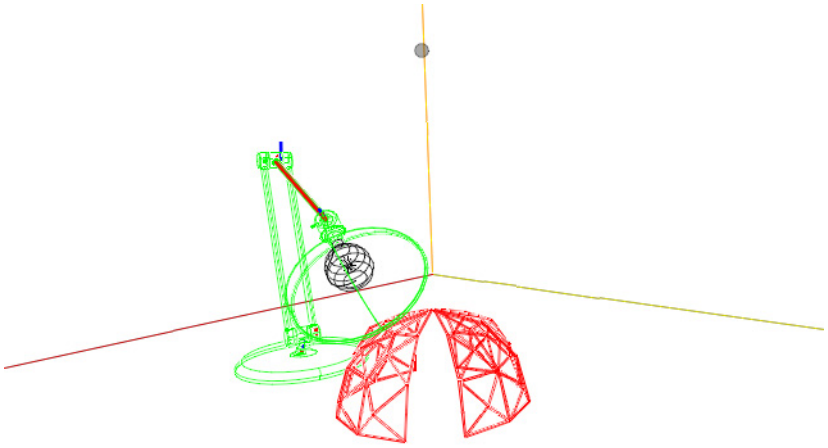
Rotate the Lower_arm 20 degrees

Rotate the Shade By Points until it is pointing at the element on the desk. If want to use Active Angle you can rotate in Y 30 degrees and in X - 30 degrees to get the shade pointed.

10 Create a KeyFrame of desk lamp in this position with

Name: p4

Description: Rotate toward element



11 Now, in the Animation KeyFrame dialog, select the Start KeyFrame and click Freeze. This moves the geometry back to the start position.

➔ Exercise: Create the desk lamp script

1 Continuing in 03_dlamp.dgn, click the Animation Producer tool.

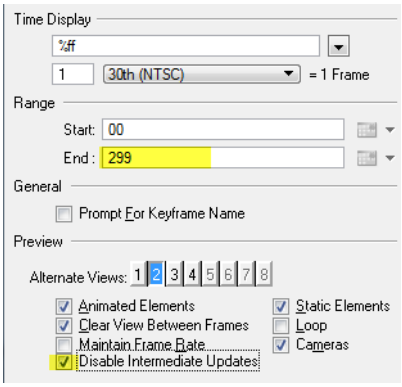
2 In the Animation Producer dialog, select *Settings* > *General* and set the following:

Start: 00

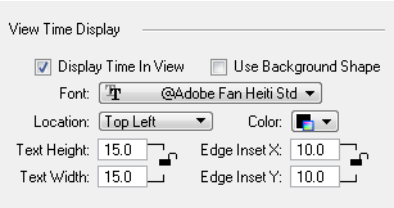
End: 299

Note: Because the start time begins at frame zero you will have a total of 300 frames. The animation that you are creating is going to play at 30 frames per second with and end time set to 299 you are creating an animation that will be exactly 10 seconds in length.

3 In the Preview section check the option to Disable Intermediate Updates.



Note: If want to see the frame number (Time) display in the view you can enable the Display Time In View option in the Animation Settings dialog.



4 Close the dialog.

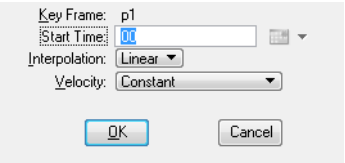
5 In the Animation Producer dialog's Animation pane, expand the list of KeyFrames by clicking on the +.

6 Right click the Start KeyFrame, select Script from the pop-up menu, set the following, and then click OK:

Start Time: 00

Interpolation: Linear

Velocity: Constant



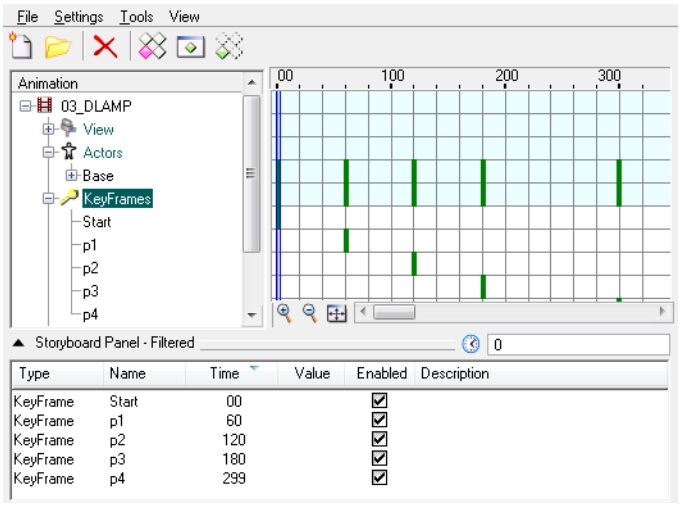
7 Now script the rest of the KeyFrames as follows:

p1: Start Time set to 60

p2: Start Time set to 120

p3: Start Time set to 180

p4: Start Time set to 299



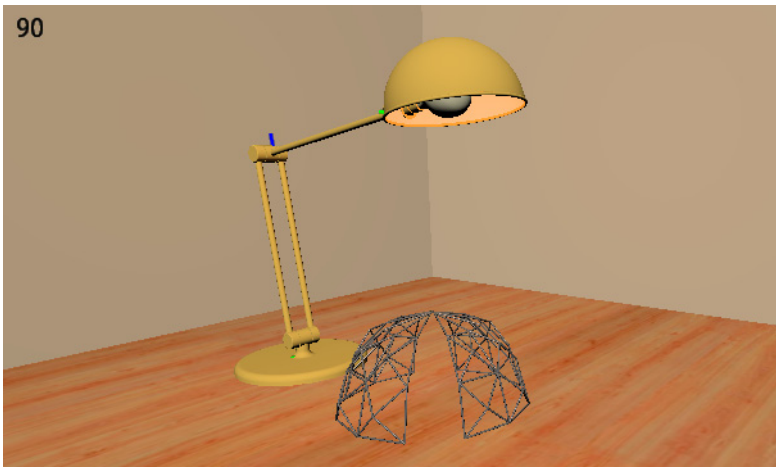
➔ Exercise: Scaling a Script

1. Continuing in 03_dlamp.dgn, bring View 2 to the top.
2. Attach the Saved View Camera View to view 2.

3. Click the Animation Preview tool.
4. Click and drag the progress bar through time, watching the preview in View 2 and in the Animation Producer dialog.

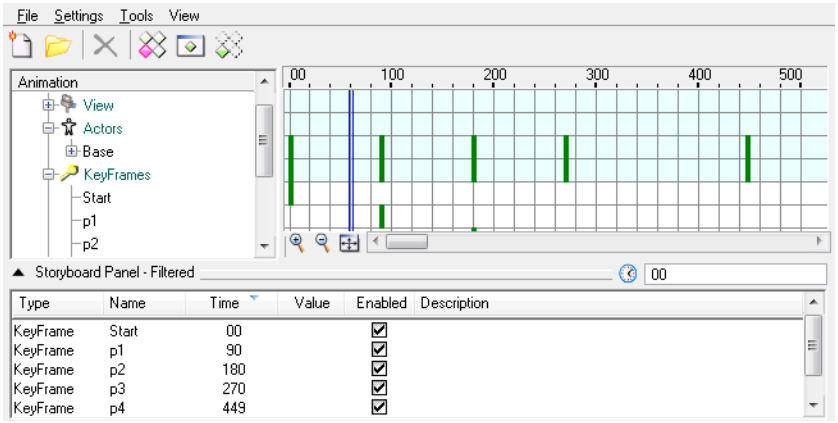
   The blue time bar indicator moves along the Animation Producer's timeline grid.
5. In the Animator Preview dialog, type 90 in the field above the Play button and press Enter.

The Animation Producer's time bar moves to frame 90 and the desk lamp is positioned at frame 90 in view 2.

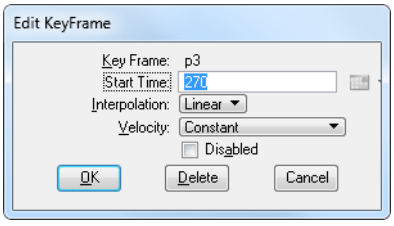


6 From the Animation Producer dialog, select *File > Scale Script*.

7 Type 1.5 as the Scale Factor and click OK to scale the script.



There is no need to save a script, as it is continuously saved in the design file. If you want to create another script, you can create a new script or copy this script and edit it. If you want to edit the time that a KeyFrame occurs you can double click on the Type KeyFrame in the Animation Produce dialog to open the Edit KeyFrame dialog.



You may also click on the green vertical bar in the Timeline window and drag it to move the time. If you hold the Ctrl key and drag you will make a copy of a KeyFrame, this is useful if you want to add a pause.

Clearing a script (*File > Clear Script*) will remove all actors and KeyFrames. If you want to keep actors and KeyFrames, creating a new script based on them, select *File > Copy Script* in the Animation Producer. If you want only actors, but no KeyFrames, create a New Script which retains actors but not KeyFrames.

Targeting Actors

In the next exercise you will make a minor change to the script for the desk lamp. By adding a target object and scripting the Shade actor to follow or remain focused on this target, you can have the shade always facing the object on the table.

➔ **Exercise: Actors targeting Actors**

1. Continuing in 03_dlamp.dgn,use the Element Selection tool to select the elements on the level structure.

   You will make an actor out of this geometry.

2. Select Create Actor tool, with the following tool settings:

   Name: Structure

   Enable: Does not matter what is enabled here because you will not be manipulating the actor.

3. Place the origin at the top center of the structure. You may want to change to the Keypoint snap for this.

   The origin of this Actor will be the target for the Shade Actor so it will swivel to remain focused on this point during the animation. You just need to add a line to the script for this to take place. First, you will copy the original script so that you have both versions.

4. In the Animation Producer dialog, select *File > Copy Script.*

5. In the Copy Script dialog, set the following, and then click OK:

   Name: Focus lamp

   Description: Structure track

6. From the Animation Task, Cameras toolbox, select the Script Target tool with the following tool settings:

Start Time: 0

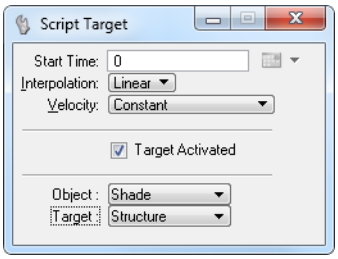
Interpolation: Linear

Velocity: Constant

Target Activated: Enabled

Object: Shade

Target: Structure

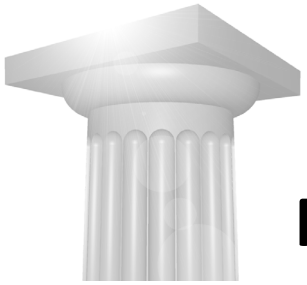


7 Enter a data point in any view to add this item to the script.

8 In the Animator Preview dialog, click the Play button to preview.

The desk lamp's shade is in motion focusing on the structure Actor's origin.

9 Select *File > Close* when you are done.



Parametric Animation

Module Overview

This module will teach you how to animate actors using parameters that you define. It also shows how to use built-in mathematical functions to create more complex animations.

Module Prerequisites

- Know how to script Actors
- Understand what variables and functions are

Module Objectives

After completing this module, you will be able to:

- Use equations to control motion of Actors
- Apply parametric controls in Animation Scripts

Parametric Motion Control

This type of animation method is useful when basic KeyFrame animation is very difficult or when the equation for a motion is already known. Motion control parameters are created in the Animation Parameters dialog.

Animation Parameters dialog

Parameters and equations are defined in the Animation Parameters dialog which you can open by selecting *Tools > Parameters* in the Animation Producer dialog.

MicroStation includes a number of built-in variables and functions for defining actor motion equations or custom parameters. When defining an equation, you can include custom parameters that you have previously defined, or you can key-in the entire equation. The built-in variables and functions are case sensitive and must be typed exactly as shown. Case sensitivity also applies for any custom parameters you create.

Some parametric motion equations can often be used by a number of designs. You can save time by creating custom parameters that define these equations, and then using them when scripting your actors.

If parameters are used often, they should be saved in a separate script file that contains only those custom parameters. In the future, this script file can be included in a new script.

Built-in variables

These are available for developing actor motion equations, or developing custom parameters with the Script Actor tool.

Variable	Description
frame	Frame number
pi	The mathematical value, Pi, which is the ratio of the circumference to its diameter
tSeconds	Elapsed time from beginning of sequence in seconds
beginFrame	Beginning frame of current sequence

Variable	Description
endFrame	End frame of current sequence
maxFrame	maximum frame number

Built-in functions

These are available for developing actor motion equations or custom parameters with the Script Actor tool. These functions are identical to those in the standard C math library, except that all angular values are expected, and returned in degrees rather than radians.

Function	Description
radiansFromDegrees(d)	Radians from degrees
degreesFromRadians(r)	Degrees from radians
secondsFromFrame(f)	seconds from frame number
cos(angle)	Trigonometric cosine of angle
acos(value)	Arc cosine of value
sin(angle)	Sine of angle
asin(value)	Arc sine of value
atan(value)	Arc tangent of value
atan2(valueY, valueX)	Arc tangent of valueY/valueX
tan(angle)	Tangent of angle
cosh(value)	Hyperbolic cosine of value
sinh(value)	Hyperbolic sine of value
tanh(value)	Hyperbolic tangent of value
exp(value)	Exponential of x
log(value)	Natural logarithm of value
log10(value)	Base 10 logarithm of value
pow(x,y)	x to y power
sqrt (value)	Square root of value
fabs (value)	Absolute value of
ceil(value)	Smallest integer not less than value
floor(value)	Largest integer not greater than value
fmod (value)	Modulus of value
rand ()	Pseudo random number
srand(x)	Set random seed

Scripting an actor with a parametric equation

In the next exercise series, you will use two of the built-in variables, maxFrame and frame, which define the maximum frame number and the current frame number, respectively. You will write an equation that instructs the actor to rotate one revolution during the course of the animation sequence.

Note that cranking the winch handle one revolution would produce 2/3 revolution in the middle gear and 1/3 revolution in the winch's drum, so you would need to crank the handle 3 revolutions to make one complete revolution of the winch drum.

➔ **Exercise: Create custom motion control parameters**

1. Open 04_winch.dgn.
2. Click the Animation Producer dialog tool.
3. From the Animation Producer dialog, select *Settings* > *General* and make sure the following are set:

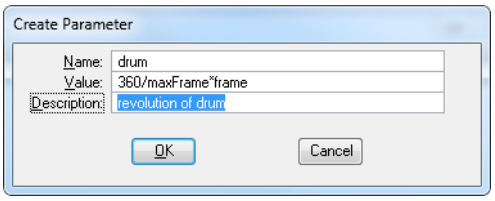
   Range section - *End:* 179

   Preview section - *Alternate Views:* 2
4. Select *Tools* > *Parameters*.
5. In the Animation Parameters dialog, click Create, set the following, and then click OK:

   Name: drum

   Value: 360/maxFrame*frame

   Description: revolution of drum



6. Create another parameter as follows, and then click OK:

   Name: gear

   Value: -drum*24/12

   Description: reverse direction of drum at 24/12 speed

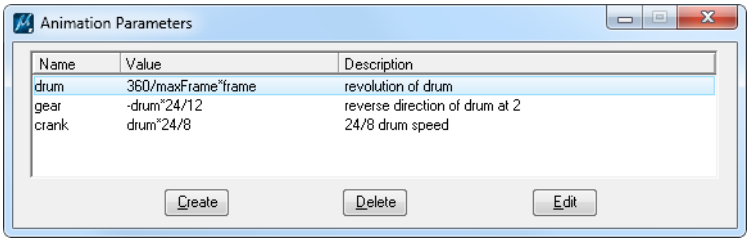
This means that if the drum goes around once, this gear will make two revolutions in the same amount of time.

7 Create another parameter as follows, and then click OK:

Name: crank

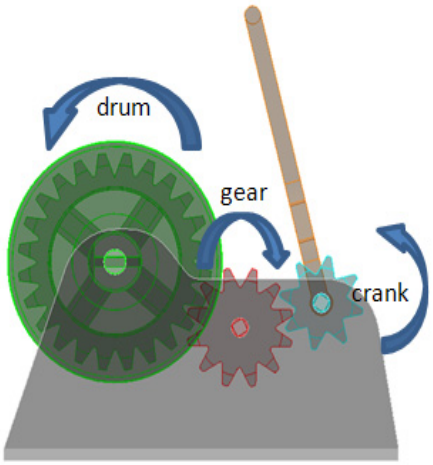
Value: drum*24/8

Description: 24/8 drum speed



Look at the custom parameters you have created. All the motion is now tied to the winch drum motion.

The middle gear rotates in the opposite direction of the crank and at a speed of 24/12, or 2x the drum speed. In other words, if you rotate the drum one revolution, the middle gear makes 2 revolutions in the opposite direction from the drum. The crank has 8 teeth and it is also tied to the drum motion. If you turn the drum one revolution, the crank turns in same direction as the drum and at 24/8 drum speed, or 3 revolutions.



You certainly could simplify the parameters. Instead of using 24/12 and 24/8, you could use 2 and 3, respectively. The numbers were chosen so you could see the relationship of the gears based on their tooth count.

➔ **Exercise: Create animation script using custom parameters**

1. Continuing in 04_winch.dgn, from the Animation Actors toolbox, select the Script Actor tool.
2. Select the drum actor from the Actor List, set the following in the Script Actor dialog, and then click OK:

   End: 179

   X Rotation: drum

   This is the value you set in the Animation Parameters dialog. In this example (360/maxFrame*frame) use 179, the total frames in this animation, and you will see that the drum rotates 2 degrees for each frame.

Note: The custom parameters you created are case sensitive, so if you used all capitals to create a parameter you must use all capitals to apply it in the Script Actor dialog.

3. Select the gear actor from the Actor List, set the following, and then click OK:

   End: 179

   X Rotation: gear

4. Select the crank actor from the Actor List, set the following, and then click OK:

   End: 179

   X Rotation: crank

5. Click Play in the Animator Preview dialog to preview the current script.

➔ **Exercise: Edit custom motion control parameters**

1. Continuing in 04_winch.dgn, in the Animation Producer dialog choose Tools > Parameters. The Animation Parameters dialog appears.
2. In the Animation Parameters dialog, double click the drum parameter to edit it, or select drum from the list and click Edit.
3. Change the Value to -3*360/maxFrame*frame and click OK.

   This increases drum revolutions from 1 to 3 and also reverses the motion. Editing this one value causes the entire mechanism to reverse and speed up. The winch drum now makes three complete revolutions, but in the opposite direction from the previous animation.

4. Click Play in the Animator Preview dialog to preview the current script.

As you can see, the animation plays in reverse and at 3 times the previous speed.

➔ **Exercise Challenge: Create your own script with new parameters**

1 Use new parameters that will link everything back to the motion of the crank, rather than the drum.

Hint: Hint in this scenario one turn of the crank would produce 1/3 of a revolution in the drum actor.

Important: Clearing the script will remove all actors and KeyFrames from the current script. If you want to keep the actors and KeyFrames and create new script based on these you should choose File > Copy Script from the Animation Producer. If you only want actors and no KeyFrames or parameters, you can choose to create new script, this retains actors, but not KeyFrames or parameters.

2 Select *File > Close* when you are done.

Animating a Clock with Parameters

In the next exercise series you will animate a clock and tie the motion together using a common parameter. To save time, the animation actors have already been created for this exercise.

➔ **Exercise: Create clock animation parameters**

1 Open 05_clock.dgn.

2 In the Animation Producer, select *Tools > Parameters*.

3 Click Create, set the following, and then click OK:

Name: hour

Value: 360/maxFrame*frame

Description: 12 hours

4 Create another parameter as follows, and then click OK:

Name: minute

Value: hour*12

Description: 12 revolutions

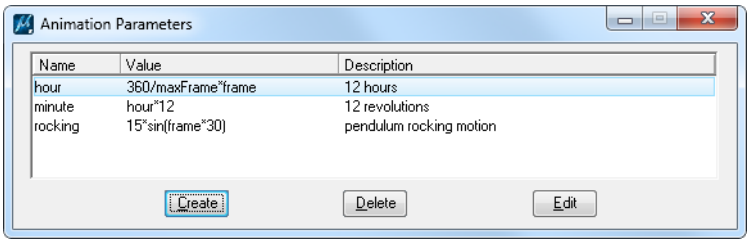
5 Create another parameter as follows, and then click OK:

Name: rocking

Value: 15*sin(frame*30)

Description: pendulum rocking motion

Click OK to create the parameter.



➔ **Exercise: Create a clock animation script**

1 Continuing in 05_clock.dgn, from the Animation Actors toolbox, click the Script Actor tool.

2 Select the hour-hand actor from the Actor List, set the following, and then click OK:

End Time: 359

Y Rotation: hour

3 Select the minute-hand actor from the Actor List, set the following, and then click OK:

End Time: 359

Y Rotation: minute

4 Select the pendulum actor from the Actor List, set the following, and then click OK:

End Time: 359

Y Rotation: rocking

5 Click Play in the Animator Preview dialog to preview the current script.

The animation preview is fast. To slow it down you can scale the script up by a factor. You can also edit the rocking parameter, creating a speed variable that lets you easily control the speed of the pendulum.

➔ **Exercise: Editing the script and parameters**

1 Continuing in 05_clock.dgn, from the Animation Producer select *File > Scale Script*.

2 In the Scale Script dialog, set the following, and then click OK:

Scale Factor: Enabled

Scale: 10

The script is now 3590 frames long. The Scale Script dialog lets you scale by a factor and you can also change the duration in time or frames.

3 Click Play in the Animator Preview dialog to preview the current script.

The clock's motion is slowed, but the pendulum's motion is still a little too fast. You can edit the parameters you created earlier to slow it down.

You will create a new parameter that will allow you to easily adjust the speed of the rocking pendulum.

4 In the Animation Parameters dialog, click Create, set the following, and then click OK:

Name: ps

Value: 3

Description: pendulum speed

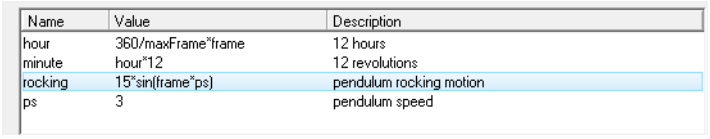
In the next step, you will edit the rocking motion equation to use the new parameter.

5 In the Animation Parameters dialog, double click rocking, set the following and then click OK:

Value: 15*sin(frame*ps)

This replaces 30 with the new parameter.

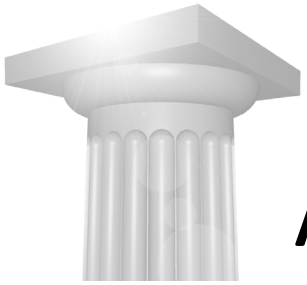
The portion of the parameter that effects the speed the pendulum swings now uses a variable, (ps) that you can edit to change the speed.



Name	Value	Description
hour	360/maxFrame*frame	12 hours
minute	hour*12	12 revolutions
rocking	15*sin(frame*ps)	pendulum rocking motion
ps	3	pendulum speed

6 Click Play in the Animator Preview dialog to preview the current script.

7 Select *File > Close* when you are done.



Animating Cameras

Module Overview

This module describes how to place animation cameras and how to attach a camera to path.

Module Prerequisites

- Understanding of 3D view controls
- Understanding of basic MicroStation procedures
- Knowledge about AccuDraw

Module Objectives

After completing this module, you will be able to:

- Place animation camera
- Attach cameras to paths
- Script cameras and targets
- Script animation targets using KeyFrames
- Preview animation
- Use a Velocity Graph
- Activate and deactivate targets

Introduction to Animation Cameras

Animation cameras are specialized actors. Their motion can be controlled using KeyFrames, paths, or scripts the same as regular actors. They can also be manipulated with the Manipulate Actor tool or positioned with any of the standard manipulation tools. Camera Targets can be another actor, where the actor's origin is the actual focal point for the target or you can use the create target tool to place predefined one.

You can have multiple targets and cameras in a design file but there can only be one camera on at any given time. You can however have MicroStation interpolate between two cameras, or targets to gradually transition from what one camera sees to what the other one sees even if they both are in motion.

You can use one or more animation cameras in an animation sequence by scripting each one to become active from a particular frame number. The animation view is taken from the designated camera, from the specified frame. Additionally, you can specify targets at which an animation camera is aimed.

MicroStation has pre-defined target and camera actors that can be placed and then renamed.

Animation Camera tools

These tools are located in the Animation tasks. Tools are as follows.

- Create Animation Camera
- Modify Animation Camera
- Script Camera - use this tool to specify the frame number at which to begin using an animation camera
- Camera View - use this tool to show the view from an animation camera in a view window
- Create Target
- Script Target - use this tool to Specify the frame interval during which to use an animation camera target

The Storyboard

Before the creation of any animation you should first consider the objectives of the animation. These objectives may be your own or are provided by others.

In the next exercise you are presented with an urban renewal project of the city of Long Beach and you will want to highlight some of the cities major landmarks. Here is a layout of most of the items to be highlighted in the animation. The camera path will show these individual landmarks in the animation.

Defining a Camera Path

In the following exercise series, you will place an animation camera and then use the Define Actor Path tool to attach the camera to a B-spline path.

➔ **Exercise: Create a camera animation**

1 Open 06_Longbeach.dgn.

2 Open View 5.

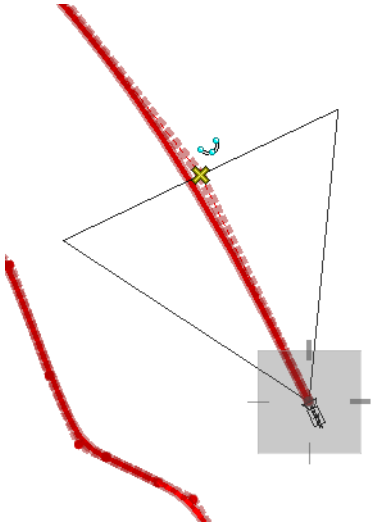
In this view, Camera path is the active level and the other levels are not displayed to make placement easier

3 From the Animation tasks select the Create Animation Camera tool with the following tool settings.

Standard Lens: Wide

Cell Scale: 1000

4 Snap to the B-spline curve at the pole on the right end, as shown, enter a data point, move the pointer to the second pole and enter another data point.



5 Set the following in the Create Camera dialog, and then click O:

Name: Main Camera

Description: Flying camera

Hint: The Description is optional, but can be very helpful when you have multiple cameras in a design.

6 From the Animation tasks, select Define Actor Path, with the following tool setting:

Actor List: Main Camera

The status bar prompts you to identify a path.

7 Enter a data point anywhere on the B-spline path.

You are then prompted to Identify a direction.

8 Enter a data point in front of the animation camera to define the direction.

9 In the Define Actor Path dialog, set the following, and then click OK:

End Time: 599

Velocity: Constant

10 Click the Animation Preview tool and click Play to see the Main Camera Actor move along the defined path.

11 When done, use the slider to move the camera back to the start position.

➔ **Exercise: Turn the camera on at frame zero**

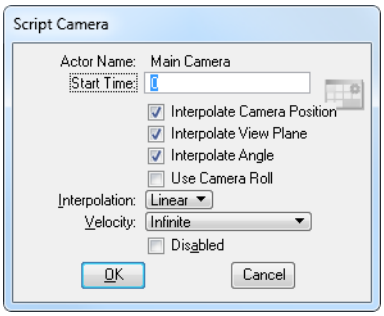
1 From the Animation tasks, select Script Camera, with the following tool setting:

Actor List: Main Camera

2 As prompted, enter a data point on the camera and another to accept.

3 Set the following in the Script Camera dialog, and then click OK:

Start Time: 0



The Main Camera turns on at frame zero. The animation script is complete. The camera will fly down the path looking along it. To see the script so far, you need to open the Animation Producer.

4 From the Animation Settings toolbox, click the Animation Producer dialog tool.

5 In the Animation Producer dialog, click Longbeach in the Animation pane.

You can see two items have been added to the script, a Path and a Camera.

6 In the Animation Producer select *Settings* > *General* and observe the following, and close the dialog:

Preview section - *Maintain Frame Rate*: Disabled

If Maintain Frame Rate is enabled in the Animation Settings dialog, MicroStation will try to maintain the 30 frames / sec preview. In order to do this, geometry may be dropped from frame to frame in the preview. If you prefer to see all the geometry you can disable this option, the default is for this option to be disabled.

Previewing the animation script

Now you have the script ready to preview. Depending on the performance of your system and graphics card, you may need to make adjustments to improve the preview performance.

➔ **Exercise: Preview the animation**

1 Continuing in 06_Longbeach.dgn, open View 8.

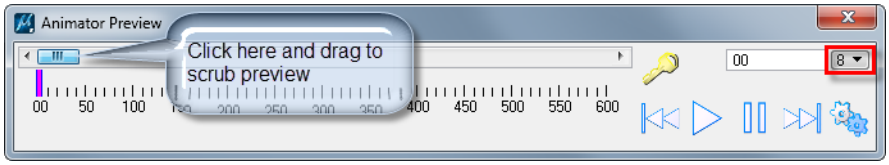
View 8 has been saved with the level containing the trees turned off. This provides a smoother preview as there is less geometry to update. Another way to make the preview play more smoothly is to reduce the size of the view window used for previewing the animation.

2 From the Visualization Task Pane select the View Size tool and enter a data point in View 8 to start the tool.

3 In the View Size tool dialog, click on the Aspect bar to see a drop down list of presets and choose 640x480.

4 Close the dialog.

5 In the Animator Preview dialog, set the view number, above the Play/ Pause controls to 8, and then click Play.



Hint: You can interrupt the preview by entering a reset.

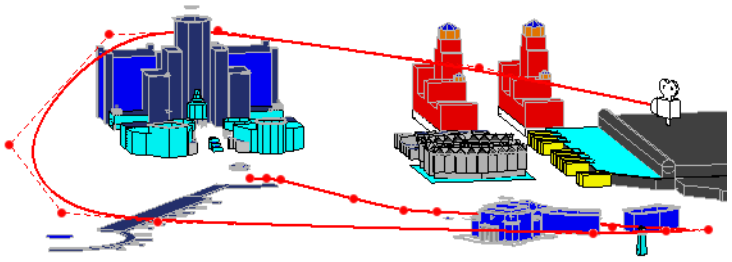
You can see that the animation needs some improvement. Since the camera only looks along the path, you are not focused on more important things in the model. To create a visually compelling story, you must make a few changes.

6 Close View 8 and the Animation Producer.

Adding Targets

In the next exercise you will make one minor change and preview the animation again. You will add a target to draw the focus of the animation camera to the

center of the city. Later, you will put this target in motion for a smooth animation that highlights the landmarks and showcases the design.



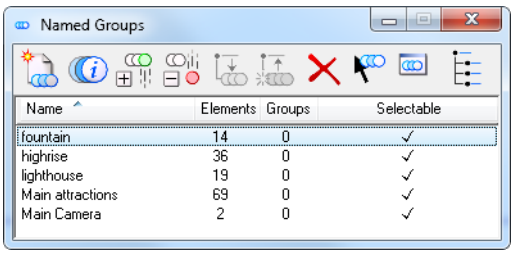
You will see how to use Named Groups and Display Sets to place a target, rather than toggling levels.

➔ **Exercise: Adding and scripting an animation target**

1 Continuing in 06_Longbeach.dgn, make Fountain the active level.

This step is important so that the target is on the same level as the geometry to which it is associated.

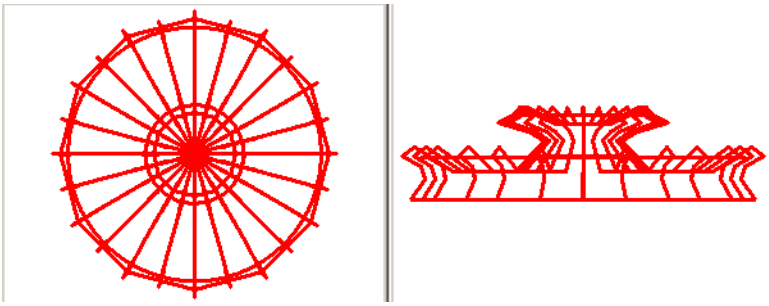
2 Select *Utilities* > *Named Groups* to open the Named Groups dialog.



3 Select fountain, and then click the Select Elements in Named Group icon.

4 Now click the Put Elements into DisplaySet icon.

5 To make it easier to place the target, Fit Views 1 and 3.



6 Reset, and then enter a data point to de-select the elements.

The fountain elements are isolated so you can easily place the target.

7 From the Animation task, select Create Target with the following tool settings:

Cell Scale: 1000

A target graphic is attached to the pointer.

8 Snap to the center of the fountain in View 1 and enter a data point to place the target.

9 In the Create Target dialog, set the following, and then click OK:

Name: Target1

Description: Main target

If you are wondering why the description was not fountain target instead of main, it is because you will be using KeyFraming to provide motion to this target where it will be used to look at several sites along the camera's route or path.

10 Right click, select DisplaySet Clear from the pop-up menu to clear the current DisplaySet.

11 From the Animation Cameras toolbox, select Script Target with the following tool settings:

Start Time: 0

Object: Main Camera

Target: Target1

12 Enter a data point in any view to add this item to the script.

Since the Time is 0 the Main Camera actor will be focused on the Target1 actor from the beginning.

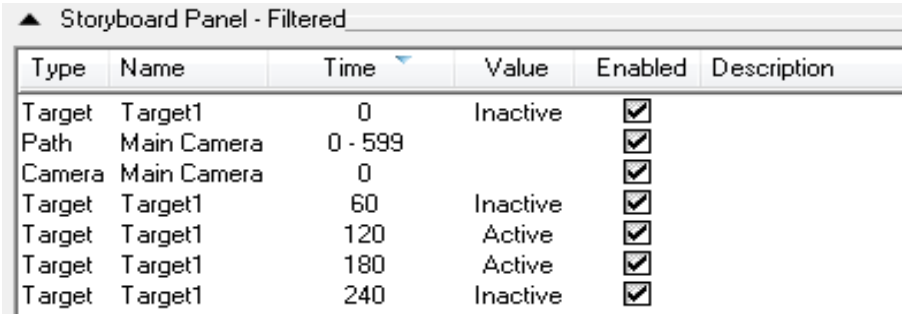
13 Open View 8 if closed.

14 In the Animator Preview dialog, set the view number, above the Play/Pause controls to 8, and then click Play.

As you can see, the animation is different than the first, as the camera remains focused on the fountain landmark throughout the entire animation.

Activating and de-activating targets

This is done using the target activated toggle for each actor in the Animation Producer dialog. By default it is enabled, which means the camera will look at the target. Disabled, the camera will look in its original direction during the time interval it will interpolate between the two.

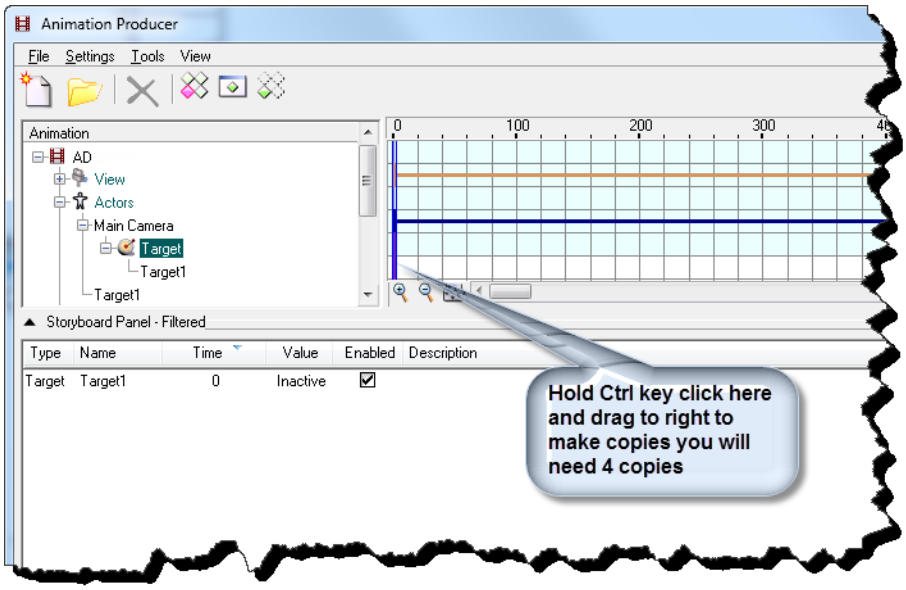


In the script shown here the camera will be looking along the path from frame 0 to 60. For frames 61-120, the camera will be interpolating to look at the target. For frames 121 to 180, the camera will be looking at the target. From frames 181 to 240, the camera will be interpolating back to look along the path. At frame 240 the camera will be looking in the path direction.

Note: Target frame and value can be edited in the Animation Producer by clicking directly on item in scripted list above or frames can be modified by clicking on frame tick mark in Animation Producer timeline and dragging to new frame.

➔ **Edit the Script to activate and deactivate the target**

1 Open the Animation Producer and expand the Storyboard Panel.



2 Choose File Copy Script and set the Following in the Copy Script dialog:

Name: AD

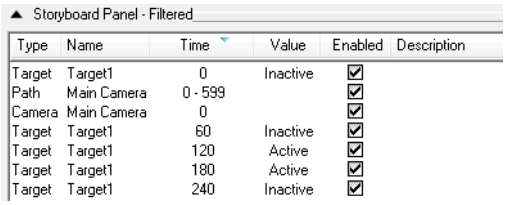
Description: Activate Deactivate Targets

3 Hold Ctrl key and click on the Target1 purple vertical bar in the Timeline and drag it to the right to make a copy.

The Time does not matter you will edit these in later step.

4 Repeat this operation until you have a total of 5 Target1 items in the Timeline.

5 Change the Time and whether or not the target is active or inactive to match the following by clicking on the items.



Type	Name	Time	Value	Enabled	Description
Target	Target1	0	Inactive	☑	
Path	Main Camera	0 - 599		☑	
Camera	Main Camera	0		☑	
Target	Target1	60	Inactive	☑	
Target	Target1	120	Active	☑	
Target	Target1	180	Active	☑	
Target	Target1	240	Inactive	☑	

6 Open View 8 if closed and Preview the Script in View 8.

As you can see the camera starts out looking ahead then transitions to focus on target then it stays focused on the target then it transitions back to looking ahead. This one method to go from looking ahead along the path and then focusing on a target and then back to looking ahead.

KeyFraming a target

In the next exercise series, you will learn how to animate a target. By setting a target in motion, you can change the visual focus to several landmarks along the way and convey the overall project scope with the animation. Using KeyFraming, you will find the target is much easier to control than having the target follow a defined path as with the camera. A KeyFrame is a moment in time that precisely defines the locations and orientations of particular elements, in this case the target.

Having the camera's target in motion during the animation can be accomplished by moving the target on which the camera is focused. In this case, the Target1 Actor will be moved to each landmark location you want to see along the way. Then, by creating KeyFrames of the target at these focal points, you can easily set the camera target in motion with a simple animation script.

You could also accomplish this using fixed targets activating and de-activating them along the way, causing the camera to pan from a target to the path, and then back to a target as the camera moves along the path.

The following items are to be seen in this animation:

- The high-rise building
- The fountain in central city park
- The lighthouse
- The waterfront from lighthouse to fountain

➔ **Exercise: Create a KeyFrame of the fountain target**

1 Continuing in 06_Longbeach.dgn, use Element Selection to select the Target actor you place earlier at the fountain.

2 From the Animation Producer choose File Open Script, choose Longbeach and then click OK.

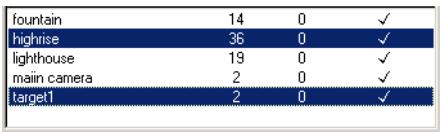
3 From the Animation Task, select the KeyFrames dialog tool, and then click the Create button.

4 Set the following in the Create KeyFrame dialog, and then click OK:

Name: Fountain

Description: focus on fountain

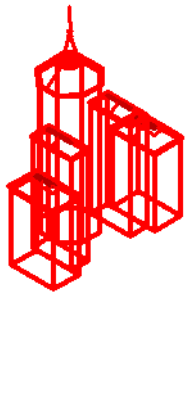
5 In the Named Groups dialog, select both the highrise and Target1 Named Groups.



6 Click the Select Elements in Named Group icon.

7 Click the Put Elements into the DisplaySet icon.

8 Fit View 2.



9 Reset, and then enter a data point de-select the elements.

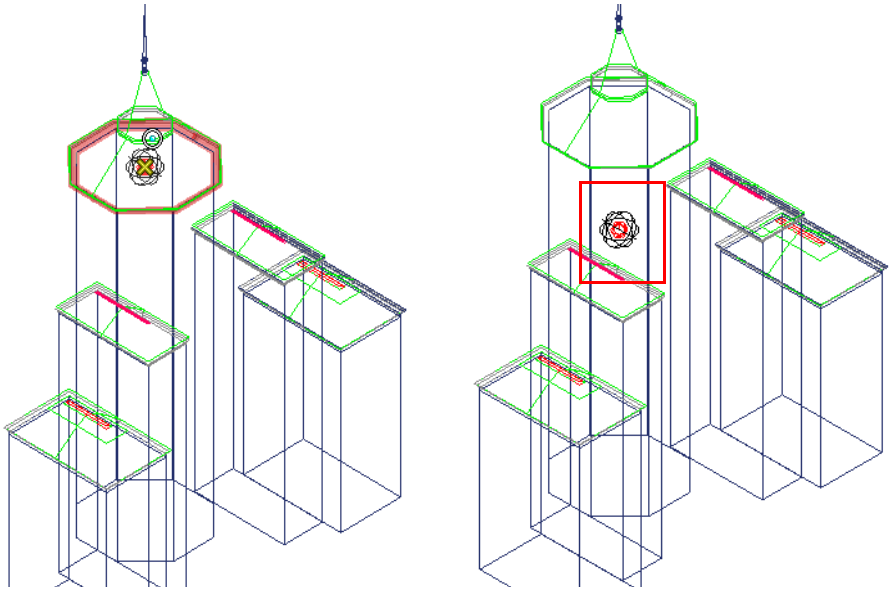
Enabling the graphic group lock ensures that you move both the target Actor's origin and coordinate system, which could be moved separately if the lock is not on. This is true for any Actor, not just a target Actor.

10 Select *Settings* > *Locks* from the main menu bar to make sure the Graphic Group lock is enabled.

11 Make the Center snap the active snap.

12 Select the Move from the Main toolbox, snap to the center of Target1, and enter a data point.

13 Using AccuDraw, move the target to the top of the highrise, and then position it as shown.



14 Make sure the target is selected.

15 Click on the Create KeyFrame tool and then click on the Create button.

16 Set the following in the Create KeyFrame dialog, and then click OK:

Name: Highrise

Description: focus on highrise

17 Shift + Right click and select DisplaySet Clear from the pop-up menu.

Now you have two KeyFrames listed in the Animation Producer dialog. Next you will create a KeyFrame of Target1 at the lighthouse.

➔ **Exercise: Create a KeyFrames of the lighthouse target**

1 Continuing in 06_Longbeach.dgn,choose Utilities > Named Groups.

2 In the Named Groups dialog, select both the lighthouse and Target1 Named Groups.

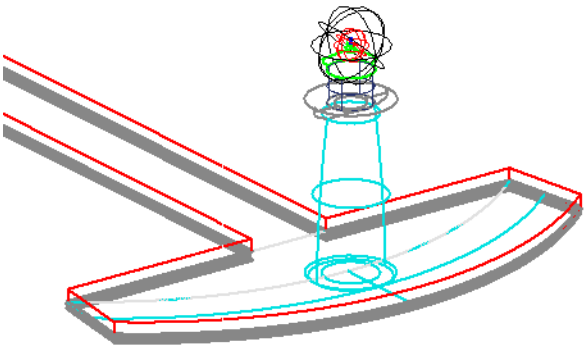
3 Click the Select Elements in Named Group icon and then the

4 Click the Put Elements into the DisplaySet icon.

5 Fit View 3.

6 Reset, and then enter a data point deselect the elements.

7 Move Target1 by center snapping on the target then Keypoint snap to the top of the lighthouse to move.



Target on top of lighthouse as seen in View 2

8 With the Target 1 actor selected, create a KeyFrame as follows:

Name: Lighthouse

Description: focus on lighthouse

9 Right click and select DisplaySet Clear from the pop-up menu.

Creating a Storyboard

Early in any animation project you should map out what you want to show using a storyboard. A storyboard is a visual script or outline form of an animation. It can

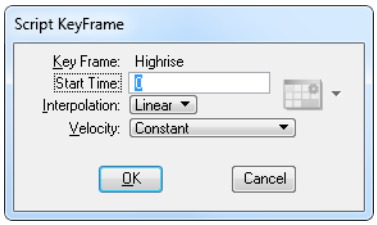
be a series of visual images that simply illustrate the animation's key scenes and events. You can even plan the animation by describing key sequences, or events, as they would occur.

The plan is for the camera to move along the path as follows:

- Start the animation by focusing on the highrise building at frame 0
- At frame 100, the camera moves to focus on fountain
- As the camera moves around the highrise, the target can be moved out to the lighthouse and remain there until the camera approaches, at around frame 450.
- The target can then be moved back to the fountain, so that at the end of the animation the focus will be back on the fountain

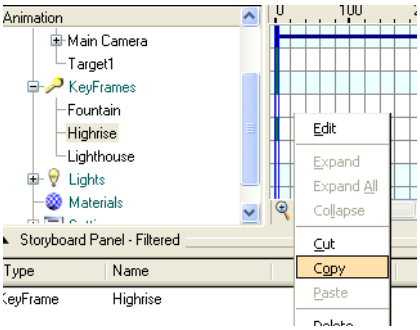
➔ Exercise: Scripting the KeyFrame motion of the target for the camera path

1 Continuing in 06_Longbeach.dgn, in the Animation Producer dialog List, right click the Highrise KeyFrame, select Script and make sure the Start Time is set to 0, click OK to add to script.



The Highrise KeyFrame item is now listed in the Storyboard Panel. The Camera now focuses on the high-rise at frame zero.

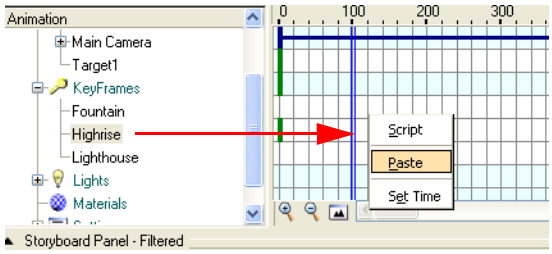
2 Right click on the Highrise KeyFrame in the timeline grid and select Copy from the pop-up menu.



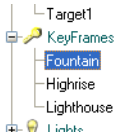
3 Drag the blue time bar from the left side of the grid to 100 in the timeline grid.

You can also type 100 in the field to the right of the clock at the right of the panel.

4 Right click on the timeline in the same row as the Highrise KeyFrame and select Paste.



Now you will script the Fountain KeyFrame.



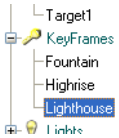
5 Right click on the Fountain KeyFrame, select Script, set the following, and then click OK:

Start Time: 150

6 Ctrl click on the Fountain KeyFrame you just added and drag it to the right between 200 and 300.

The KeyFrame you copied by holding the Ctrl key and dragging should be around frame 250 + or - a frame or 2 is fine. You can simply drag it without holding the Ctrl Key to move it.

Now you will script the Lighthouse KeyFrame.



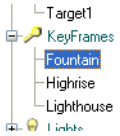
7 Right click on the Lighthouse KeyFrame select Script, set the following, and then click OK:

Start Time: 400

8 Right click on the Lighthouse KeyFrame select Script, set the following, and then click OK:

Start Time: 440

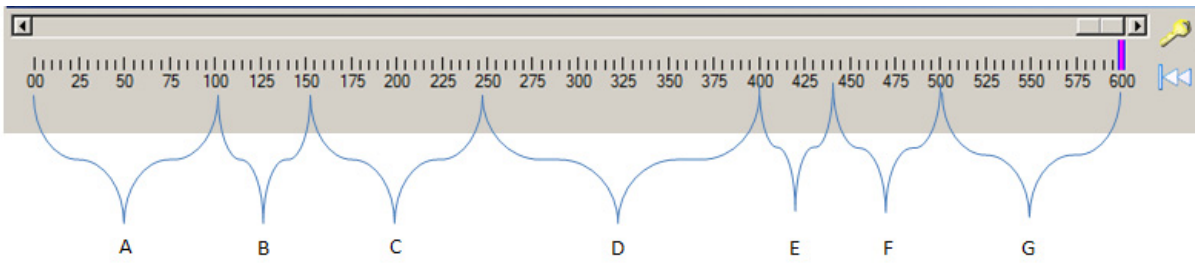
Last, you will script the last KeyFrame for the Fountain.



9 Right click on the Fountain KeyFrame again, select Script, set the following, and then click OK:

Start Time: 500

Following is a summary of the timeline and the Storyboard Panel.



Storyboard Panel - Filtered

Type	Name	Time	Value	Enabled
KeyFrame	highrise	0		☑
KeyFrame	highrise	100		☑
KeyFrame	fountain	150		☑
KeyFrame	fountain	250		☑
KeyFrame	lighthouse	400		☑
KeyFrame	lighthouse	440		☑
KeyFrame	fountain	500		☑

A = Focus on highrise building
B = Move from highrise to fountain
C = Focus on fountain
D = Move from fountain to lighthouse
E = Focus on lighthouse
F = Move from lighthouse to fountain
G = Focus fountain to end of animation

The target is moved rapidly from the lighthouse back to the fountain to prevent the camera from turning around and appearing to back away from the lighthouse target. This would happen if the focus remained on the lighthouse past frame 450.

➔ Exercise: Previewing the script

1 Continuing in 06_Longbeach.dgn, open View 8.

2 In the Animation Producer dialog, select *Settings* > *General*, set the following, and then close the dialog:

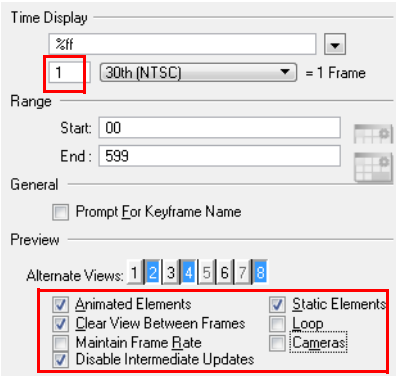
Time Display (input box): 1

Animated Elements: Enabled

Static Elements: Enabled

Clear View Between Frames: Enabled

Disable Intermediate Updates: Enabled



3 In the Animator Preview dialog, set the view to 8 and click Play to preview the modified script.

The animation looks much better, but the timing seems a little off at the lighthouse. The focus stayed on the lighthouse and the camera turned around and looked back as it was passing the lighthouse. A simple edit of the script can correct this.

4 In the Animation Producer's Storyboard Panel, right click in the Lighthouse KeyFrame's Time column at 440, change to 445, and press Tab or Enter.

This will hold the focus on the light house a little longer and prevent the camera from turning around as it passes.

5 In the Animator Preview dialog, set the view to 8 and click Play to preview the modified script.

Actors on Paths

In the previous exercises you created and moved a camera along a defined path. Any Actor can move along a path. The path can be a closed element. such as a block or circle, or an open element, such as a line, line string, curve, arc, or B-spline curve.

The Define Actor Path tool from the Animation Tasks is the tool used to place an Actor on a path. Actors can be located in the active model, or in referenced DGN or DWG files. The Actor can be identified as follows:

- Graphically, by clicking on the Actor
- Select its name from the Actor List options

In the next exercise series, you will attach actors to paths and create custom acceleration curves to speed up, slow down, stop, or even reverse direction as the actor travels along a path.

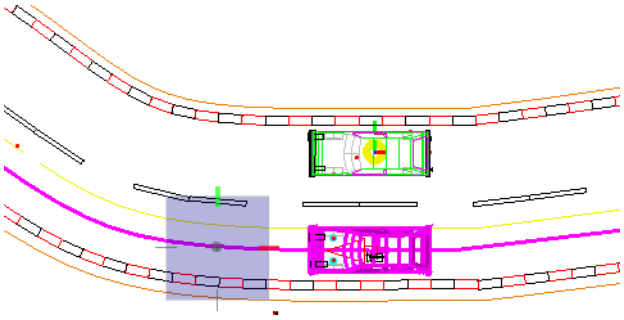
➔ **Exercise: Actors on paths**

1. Open 07_car_race.dgn.

2. From the Animation Actors toolbox, select the Define Actor Path tool with the following tool setting:

   Actor List: CAR1-1

3. Enter a data point on the cyan B-spline path in View 1.



   A direction arrow inside the car shows the direction the actor will take along the path. You are prompted to identify the direction.

4. With the direction arrow pointing to the left, enter a second data point to accept.

5. In the Define Actor Path dialog, set the following, and then click OK:

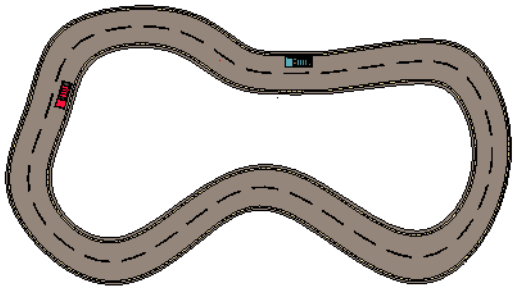
   Start Time: 00

   End Time: 600

   Velocity: Constant

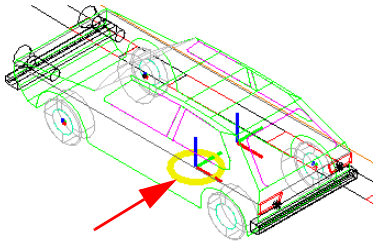
6. Bring View 2 to the top.

7 Open the Animator Preview dialog, set the view to 2, and preview the animation.



8 Minimize View 2.

The CAR2 actor is attached to a actor named DUMMY, which is a circle underneath the car.



This DUMMY actor is a construction element that can be Switched off, or not seen in a view where the View Attribute for Constructions is off. In the hierarchy, the DUMMY actor is the top level actor, so by attaching it to the path, it drags CAR2 actor around the track. The assembled hierarchy with the DUMMY actor at the top lets previously created KeyFrames of the CAR2 actor be introduced at any point, or time, along the path.

➔ **Exercise: Attach the DUMMY Actor to the path**

1 Continuing in 07_car_race.dgn, select Define Actor Path with the following tool setting:

Actor List: DUMMY

2 Enter a data point on the cyan colored B-spline path and set the direction to the left.

Even though the DUMMY actor is not located over the path, it still follows it as if a parallel path had been created.

3 In the Define Actor Path dialog, set the following, and then click OK:

End Time: 600

Velocity: Constant

Both cars will now travel around the race track at the same constant velocity.

4 In the Animator Preview dialog, preview the animation in View 2, minimizing when done.

Velocity Graphs

A velocity graph lets different Actors move at different rates of speed. In the Animation Producer dialog, select *View > Velocity Graph* to display this tool.

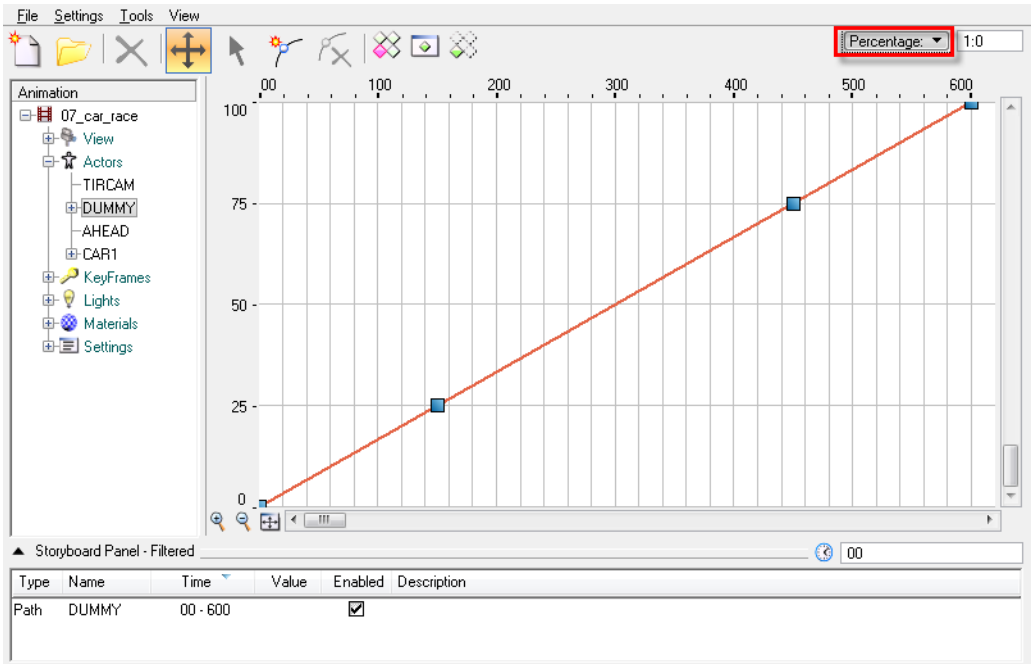
➔ **Exercise: Using the Velocity Graph**

1 Continuing in 07_car_race.dgn, in the Animation Producer dialog, select *View > Velocity Graph*.

The numbers at the top are frame numbers, while the numbers along the side indicate the distance as a percentage.

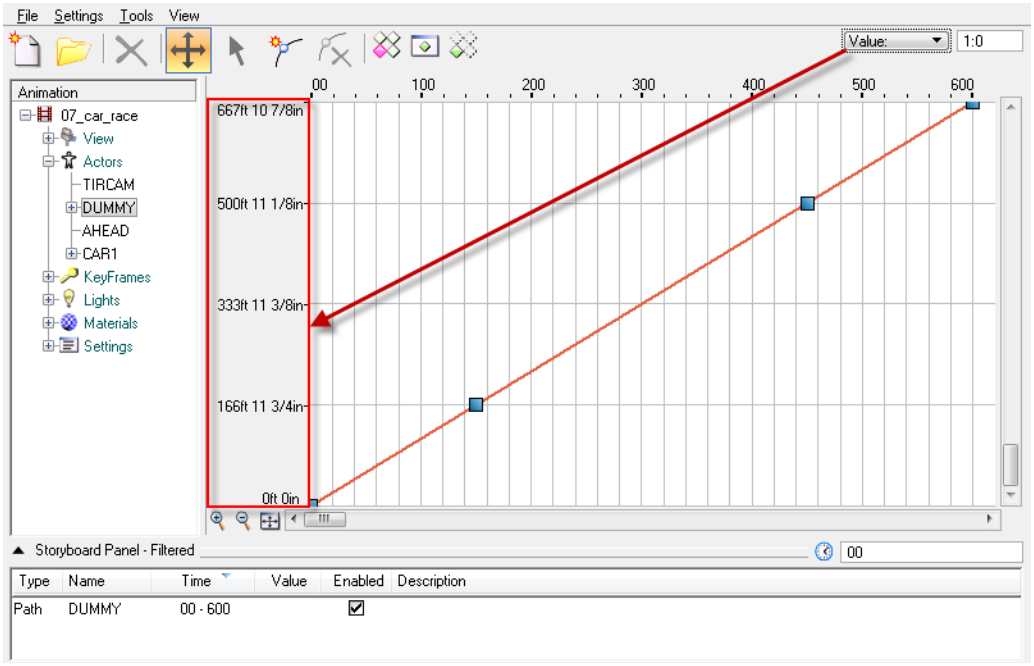
2 In the Animation Producer's Animation pane, expand the list of actors and click on the DUMMY actor.

You see a straight line that starts at zero on the lower left and extends to the upper right corner at frame 600. This is constant velocity.



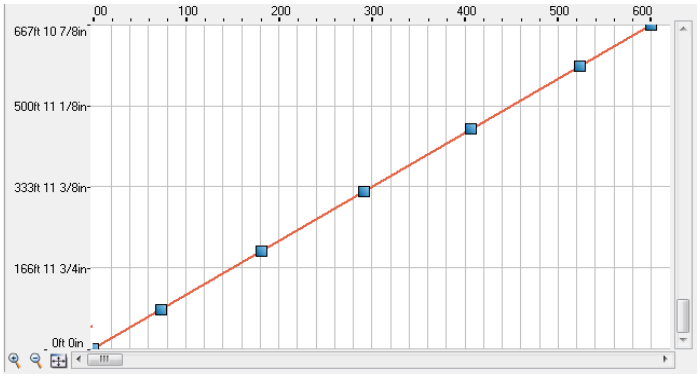
3 In the Animation Producer dialog's upper right corner, click the arrow next to Percentage and choose Value.

The Velocity Graph changes so the distance is displayed in units, rather than a percentage of distance.



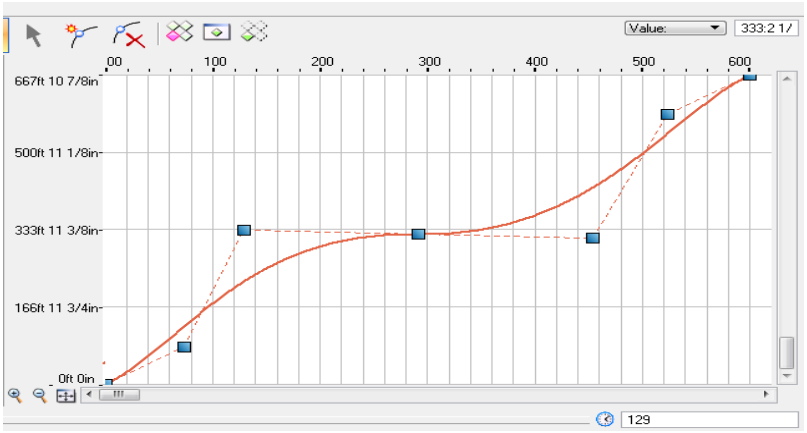
4 In the Animation Producer, click the Add Point icon, and then click on the center of the line.

Additional points appear on the line. You can move these points to form a smooth curve.



5 In the Animation Producer, click the Move Points icon.

6 Click and drag the second point on the line to form a smooth curve, leaving the center point at the original location.

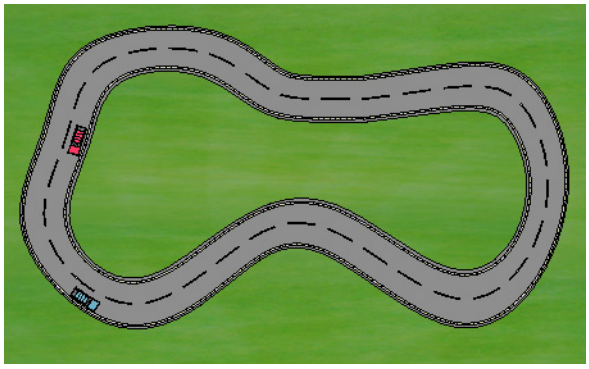


As you click on the points in the velocity graph, the distance is displayed in the upper right, and time is displayed in the lower right.

The curve you see represents rapid acceleration in the beginning, slowing in the middle, followed by more rapid acceleration, and then a slight slowing at the end.

7 In the Animator Preview dialog, preview the animation in View 2.

The CAR1 moves at a constant velocity but the other car speeds up, slows down, and then speeds up again.



Preview at frame 150

8 Return the animation to frame 0 and minimize View 2.

The steeper the rise in relation to the passage of time, the faster the Actor is moving. If the curve has a flat spot, the Actor would be stopped since time would be passing, but the distance would not be changing.

What would happen to the actor if the curve were to slope downward?

More Scripting for a Realistic Animation

In the next exercise you will place an animation camera into CAR1's driver seat.

➔ **Exercise: Place a camera in CAR1**

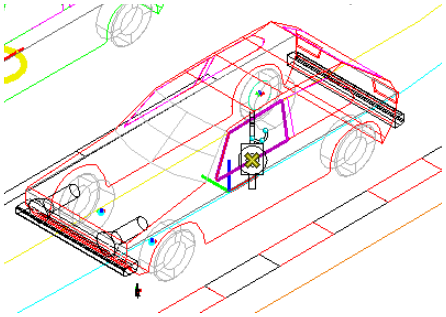
1. Continuing in 07_car_race.dgn, Zoom In on the cars in View 8.

   This view is an Isometric view and Construction elements are enabled in the view. This lets you see the camera actor which is a construction element. Note that the Graphic Group lock is on in this file.

2. From the Animation Cameras toolbox, click Create Animation Camera with the following tool setting:

   Cell Scale: 30

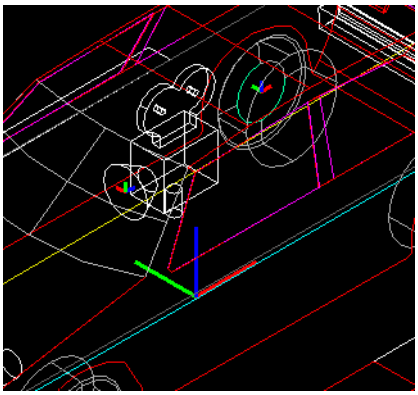
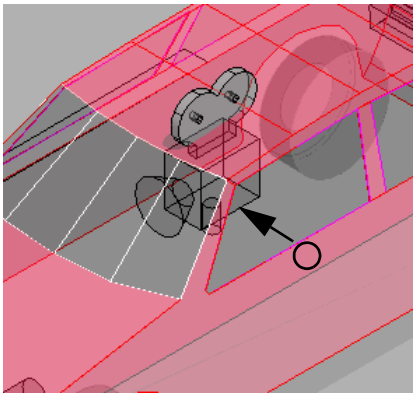
3. Snap the camera to the midpoint of the driver's door and, with focus in the AccuDraw window, type the letter <O> to establish a temporary origin.



   This also sets the view depth.

4. Now type <T> to place AccuDraw in a top orientation.
5. Move the camera to the +Y for 1.0 units, type <O>, type <F> for a front orientation and move .5 units in +Y direction to set the height of the camera.
6. Enter a data point.

7 Set the target point at 35 units in the -X direction (-35), and enter a data point.

8 In the Create Camera dialog, set the following, and then click OK:

Name: carcam

Description: CAR1

9 Select the Script Camera tool with the following tool settings:

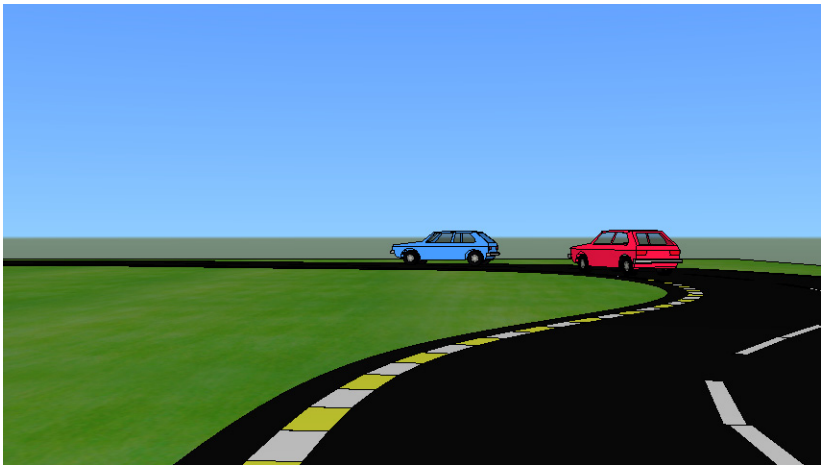
Actor List: carcam

10 In the Script Camera dialog, set the Start Time to 0 and click OK.

The camera is on starting at Frame 0.

11 In the Animator Preview dialog, preview the animation in View 8.

The cars drive away, leaving the viewer standing on the race track.



12 Return the animation to frame 0.

The animation camera placed with the Create Animation Camera tool is a built-in Actor which is not attached to the car yet. Use the Attach Actor tool to attach it so it moves around the race track with the car.

➔ **Exercise: Attach the camera actor to CAR1**

1 Continuing in 07_car_race.dgn, from the Animation tasks, select the Attach Actor tool with the following tool settings:

Actor list: carcam

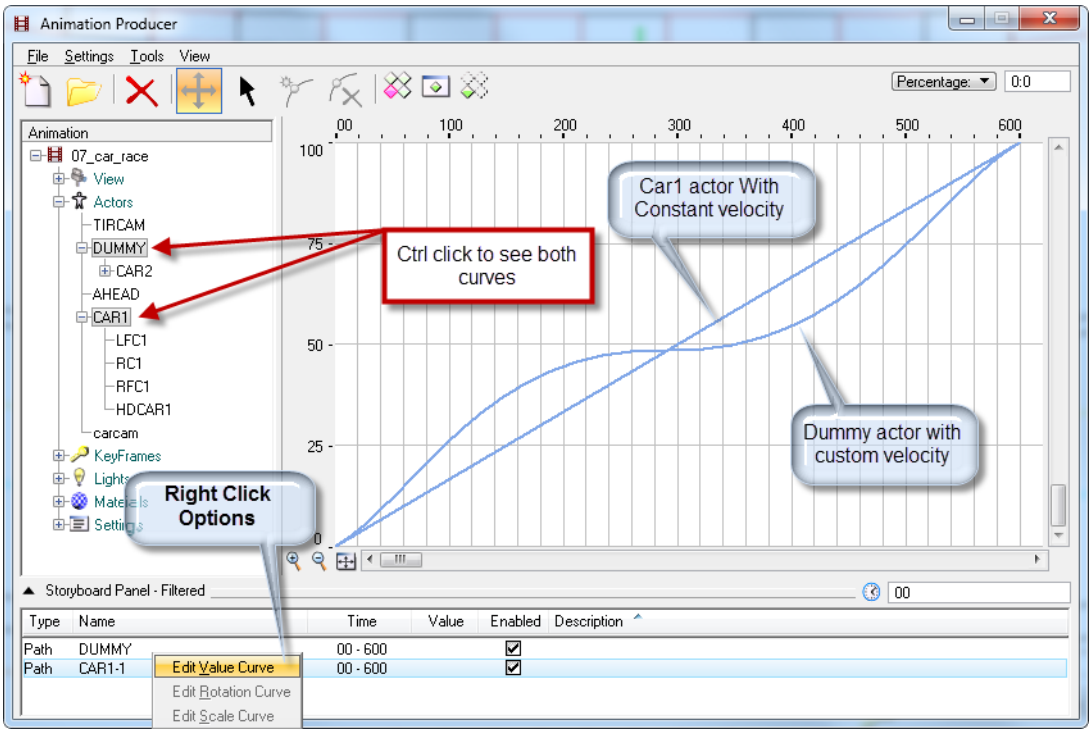
2 In View 1 enter a data point on CAR1 to attach the camera, and then another data point to accept.

Hint: To attach an actor to another actor you can simply drag the actor that you want to attach on to the actor that you want to attach it to in the Animation Producer dialog.

3 In the Animator Preview dialog, preview the animation in View 2.

You are looking out the window of CAR1 as it moves around the track and you pass CAR2, the DUMMY Actor, around the halfway point.

You can also compare the velocities of the two race cars by sending the other car's path to the velocity graph and getting a better idea graphically where CAR1 passes the DUMMY.



Also, if you were in a real race, CAR1's driver might look at CAR2 as they pass by. To accomplish this, you only need a minor addition to the existing script. The animation tools let you enable and disable targets to provide a smooth transition from looking at a target, to looking straight ahead, or looking back to target.

➔ Exercise: Compare velocities and script target

1. With the Animation Producer dialog in Velocity Graph mode, press and hold the Ctrl key, and then click on DUMMY and CAR1 in the Animation pane.

   CAR1's velocity is a straight line, indicating constant velocity. The curved line is CAR2 (the DUMMY Actor). The curve crosses the line near the midpoint, around frame 300 of the 600 frame animation. This is where CAR1 overtakes CAR2.

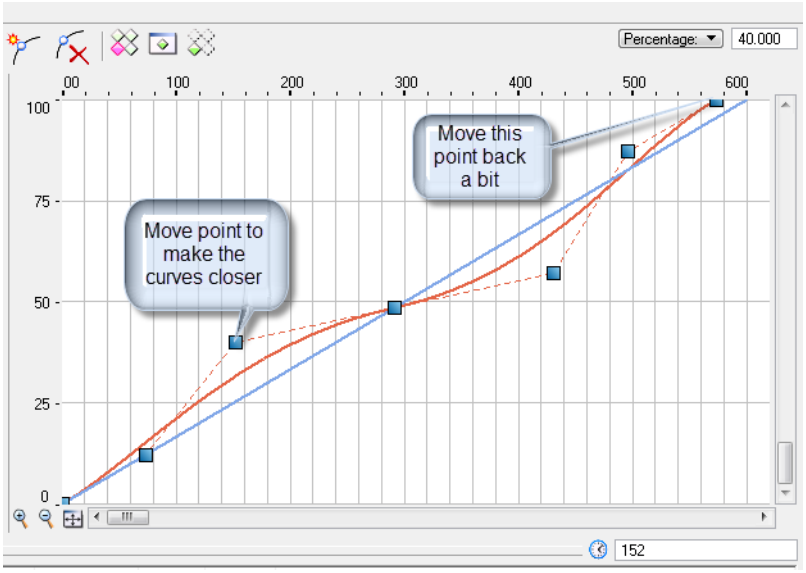
2. In the Animation Producer dialog click the Select Curve icon, and then click on the DUMMY actor's velocity curve.

   This makes the DUMMY curve the active curve so you can make modifications.

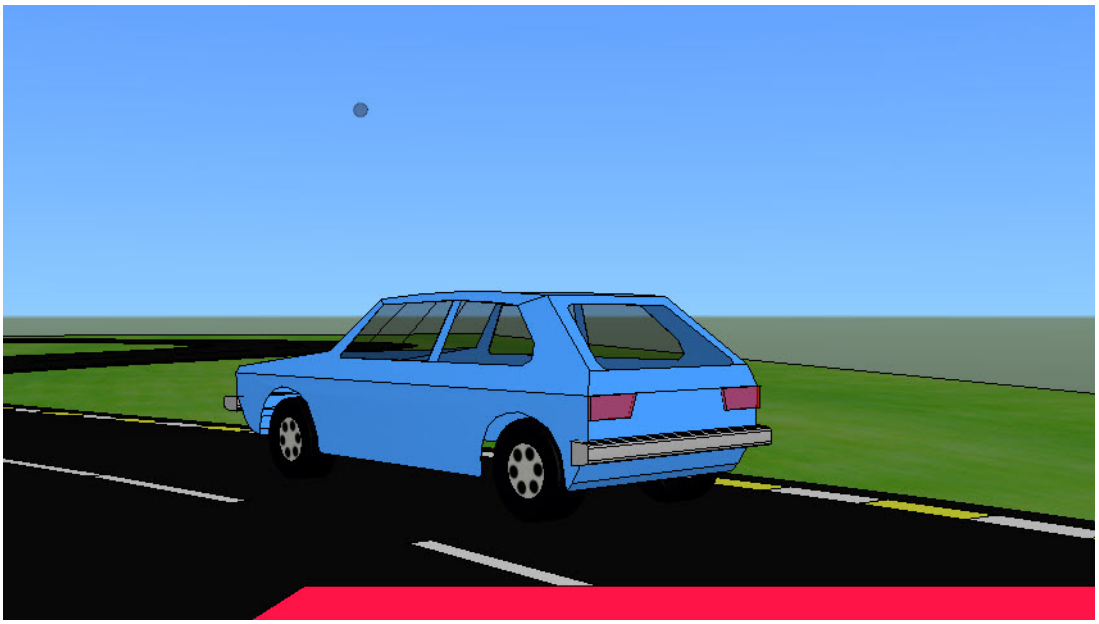
3. Click the Move Point icon and move the end point back a few frames so that the DUMMY actor wins the race.

4. Also, move the points to bring the curves a little close together.

   This will make it a much closer race.



5 Using the Animator Preview dialog's slider, move the progress bar until CAR1 is along side CAR2, at about frame 239.



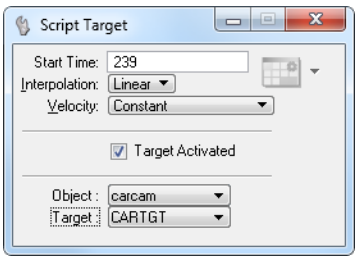
Frame 239

6 From the Animation Cameras toolbox, select Script Target with the following tool settings:

Start Time: 239 (or the value where your slider is located)

Object: carcam

Target: CARTGT

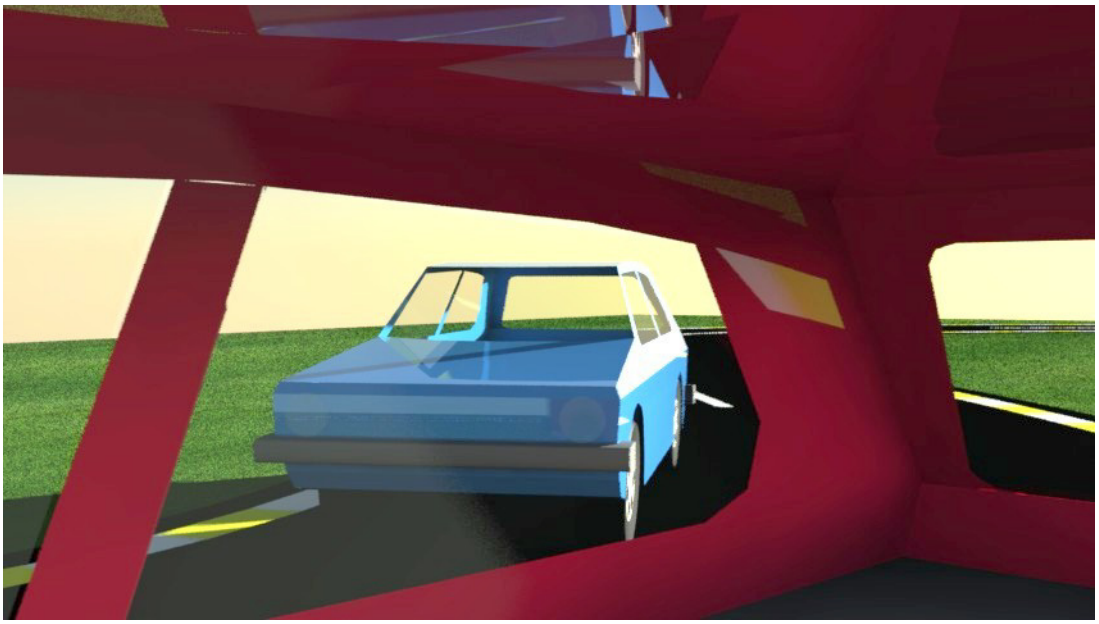


The CARTGT actor is located in the DUMMY actor's hierarchy, where the drivers head would be as the target for the carcam camera.

7 Enter a data point in any view to add this item to the script.

8 In the Animator Preview dialog, preview the animation in View 2.

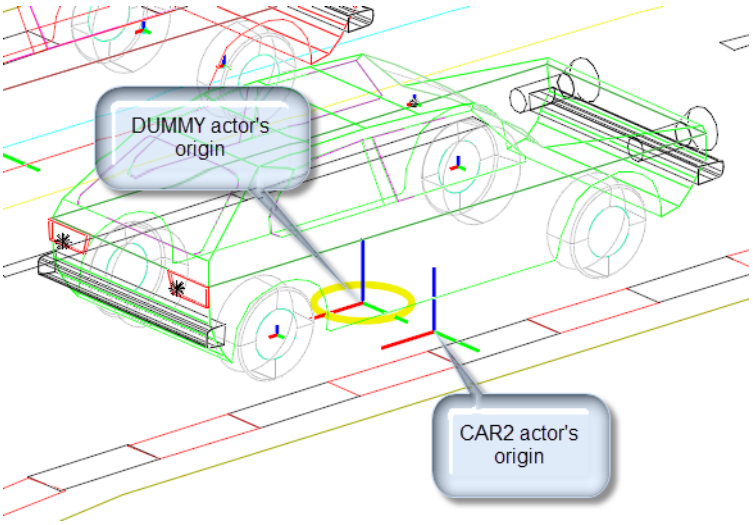
You turn to look at CAR2 car when you pass it and remain focused on the CARTGT actor until the end of the movie.



Luxology rendering of frame 344

The DUMMY actor provides an additional level of hierarchy. The top level DUMMY actor will drag the lower level hierarchy actor CAR2 around the track. This lets you script KeyFrames of CAR2 in a down position then in a rolled up position so you can roll the car up onto two wheels at any point.

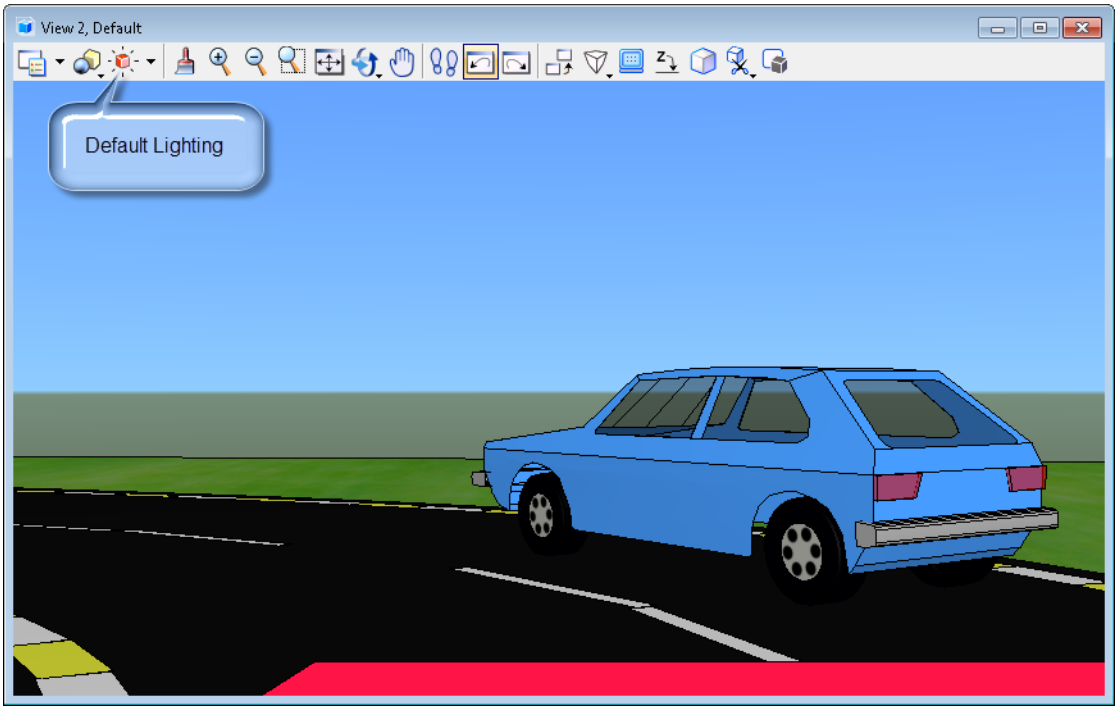
CAR2's origin, or coordinate system, is located on the right side where the tires make contact with the road.



In the following exercise, the KeyFrames for CAR2 are named DOWN and ROLL. ROLL rolls the car up on two wheels and it moves back down when the DOWN KeyFrame is used.

➔ **Exercise: Script CAR2 to roll up on two wheels**

1 Continuing in 07_car_race.dgn, in the Animator Preview dialog, move the progress bar to the right until CAR2 is in front and going into the curve.

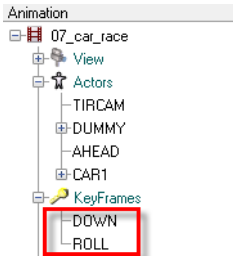


Around frame 93 Display Style Illustration: Gradient Sky

2 Depending on your acceleration curve this could be different than shown. Don't worry about the time being exact, just move the progress bar until the DUMMY car is close to the position shown.

3 In the Animation Producer dialog, select *View> Timeline* to switch back to timeline view.

4 In the Animation pane, expand the KeyFrames by clicking the + sign.

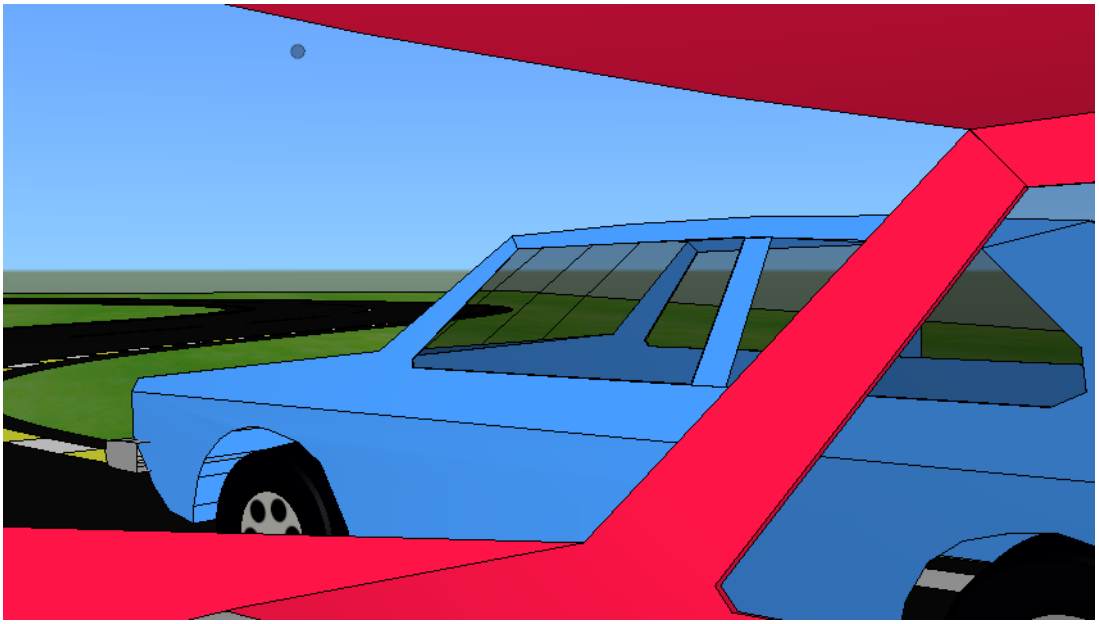


5 Right click the DOWN KeyFrame and select Script.

6 In the Script KeyFrame dialog, set the following, and then click OK:

Start Time: 93 (or the value where your slider is located)

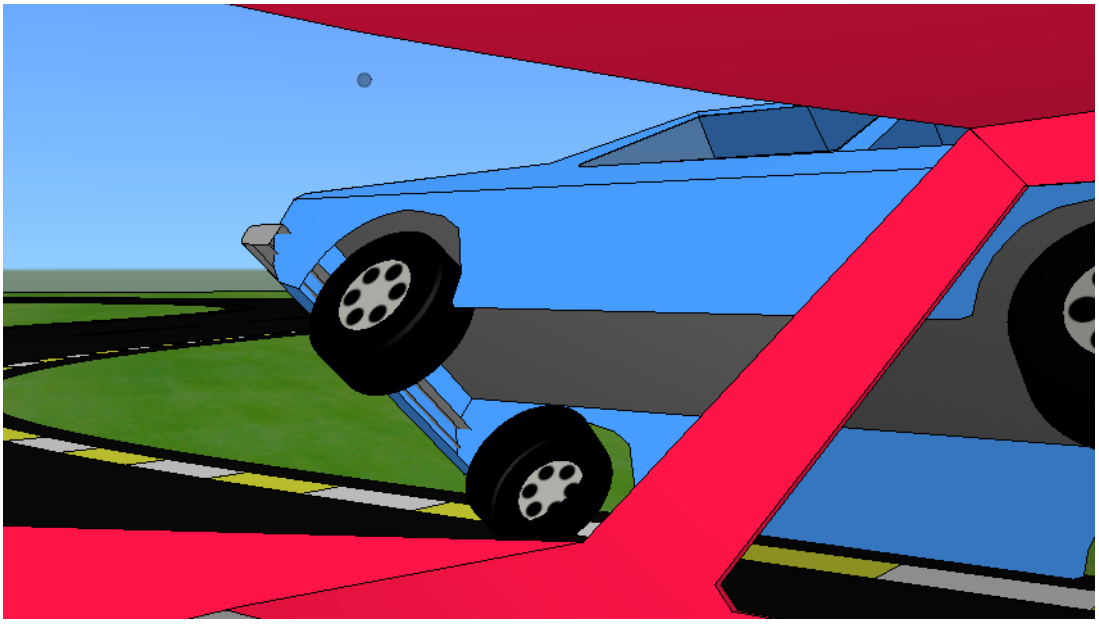
7 Move the Animator Preview progress bar until the Dummy is to the right of the CAR1.



8 Right click the ROLL KeyFrame and select Script.

9 In the Script KeyFrame dialog, set the following, and then click OK:

Start Time: (the value where your slider is located around 278)



Position of slider at ~ 278 after ROLL KeyFrame added

10 Move the progress bar to the right so that a little more time passes and CAR2 is farther down the road.

This will be the point at which it comes back down and all four tires are back on the road.

11 Right click the DOWN KeyFrame and select Script.

12 In the Script KeyFrame dialog, set the following, and then click OK:

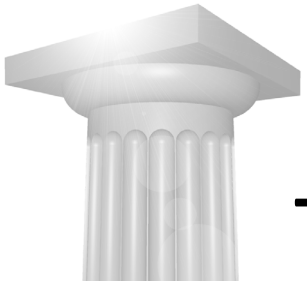
Start Time: 300

Now the Actor gradually comes back down during this time.

Hint: From the Animation Producer's timeline view you can click and drag a KeyFrame to move it in time and change where the KeyFrame occurs. This makes changing a script very easy.

13 In the Animator Preview dialog, preview the animation.

Hint: If the preview is too fast, you can scale the script up by a factor of 2 or 3 to increase the number of frames and slow down the action.



Traffic Simulation

Module Overview

This module describes how to script a traffic simulation using the new Traffic Simulation tools that were first delivered with MicroStation V8i SELECTseries 3.

Module Prerequisites

- Understanding of 3D view controls
- Understanding of basic MicroStation procedures

Module Objectives

After completing this module, you will be able to:

- Create a vehicle library
- Script lane traffic
- Link entrance and exit lanes
- Link inside lanes to main lanes
- Preview animation
- Add vehicle to lane
- Add camera attached to vehicle

Traffic Simulation

MicroStation SELECTseries 3 includes a new set of tools to simulate traffic on highways as part of the Animator. These tools enable the creation of a road network for placing and animating vehicles. The following is an overview of how to use these tools to easily create an animation with moving traffic.

Setting up Lanes

In order to animate the vehicles along the road or highway a series of paths need to be defined for the vehicles to follow. These paths are used by the animator for calculating the points on the road surface that the vehicles move along. Therefore they don't need to be accurately placed on the road surface. In most cases anywhere above the road surface is suitable. You can even reference in a 2D layout file with the path information and then use this as a basis for the lane paths. In the case where a single lane goes under a bridge and then curves around and crosses itself as for example a clover leaf highway exit the lane, then a path will need to be defined in 3D such that it is above the correct part road surface as the road curves around over itself.

There are 2 tools for adding lane information to the traffic simulator. These are:


I*Script Single Lane Traffic*

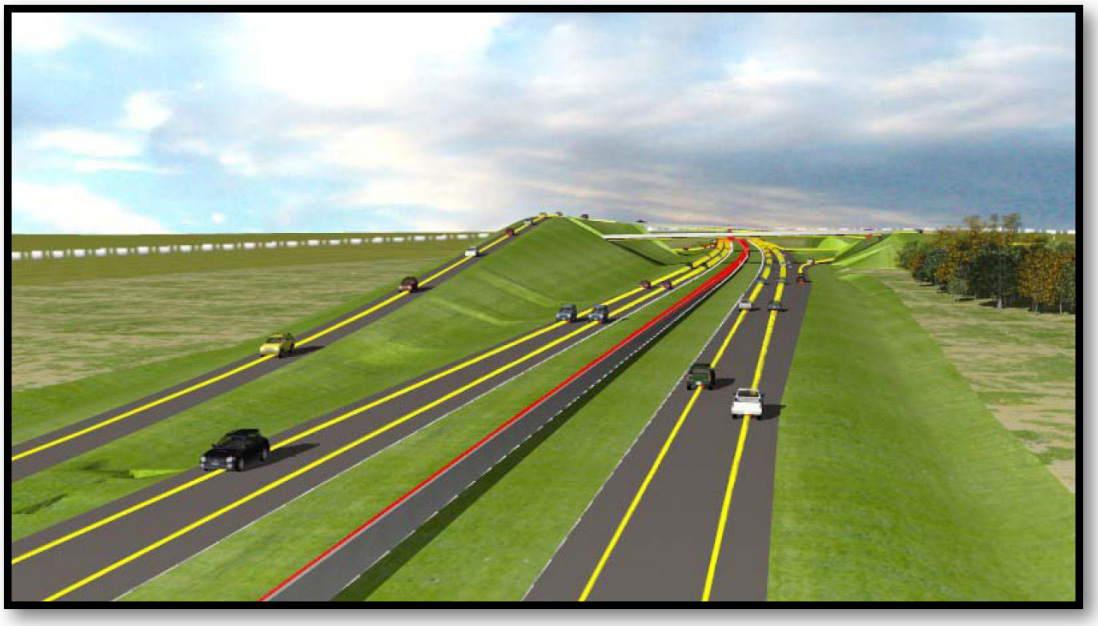

I*Script Multi-Lane Traffic*

The place single lane of traffic tool is used when there is a single lane center line element defined per roadway lane. This tool will place and animate a single lane of vehicles along this path.

The place multiple lanes of traffic tool will allow multiple lanes of traffic to be defined using a single path or alignment.

In the image below the yellow lines can be used for defining single lanes of traffic along the roadway and the red line can be used for defining multiple lanes of traffic. Once the lanes have been setup they can then be linked together so that

vehicles can join and leave from one lane to another and they can also overtake based on their differing velocities.



Entrance and exit ramps

When defining lanes for exiting and entering a highway the lane paths should not be joined together. The centerline of the lane should be maintained along the center line of the lane. The entrance and exit lane paths should then run parallel to the main lane for some distance. The traffic simulation system will automatically perform the merging of the vehicles from exit or entrance lanes on to or off the main highway. This is based on the vehicles in the lane being merged by taking into account both their speed and the speed of the vehicles entering or exiting.

Creating Vehicle Set

In order to add vehicles you will need to add the vehicles that you intend to use to a library. In MicroStation V8*i* SELECTseries 3 by default the installer will download and install some very useful visualization content. This includes a library of cars and trucks from Marlin Studios, a sample of Trees from Xfrog and a sample of more detailed vehicle models from Dosch Design. These files are delivered by default to C:\ProgramData\Bentley\SharedContent, here you should find the following folders:

Dosch_Design

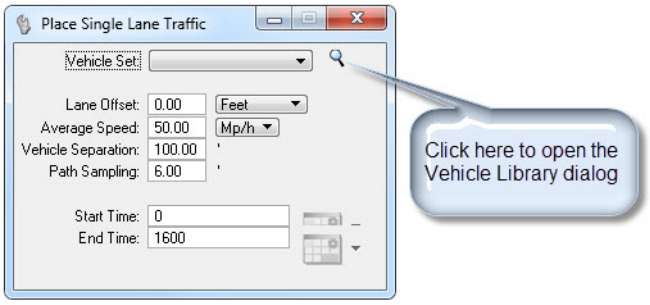
Marlin_Studios

Xfrog_Samples

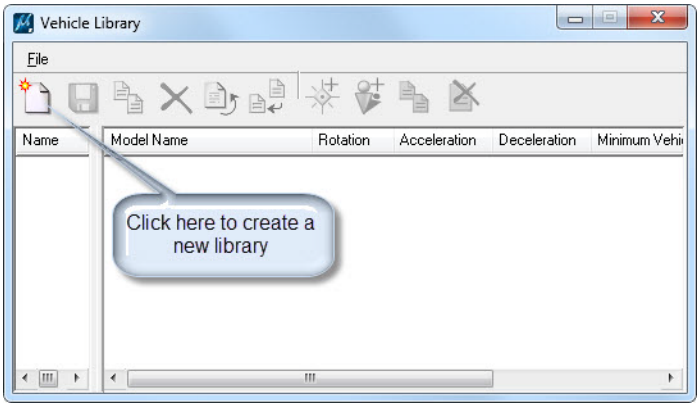
➔ **Exercise: Create Vehicle Set**

1 Open the File Interchange.dgn

2 Select the *Script Single Lane Traffic* tool (E+1)



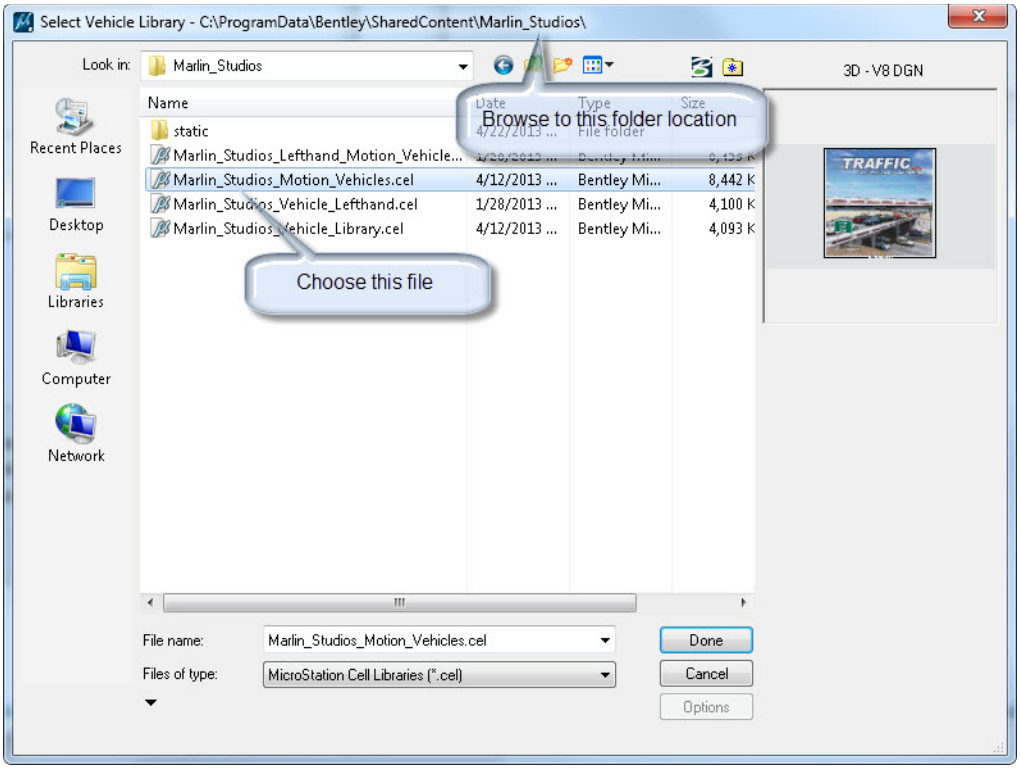
3 Click on the Browse icon to open the Vehicle Library dialog.



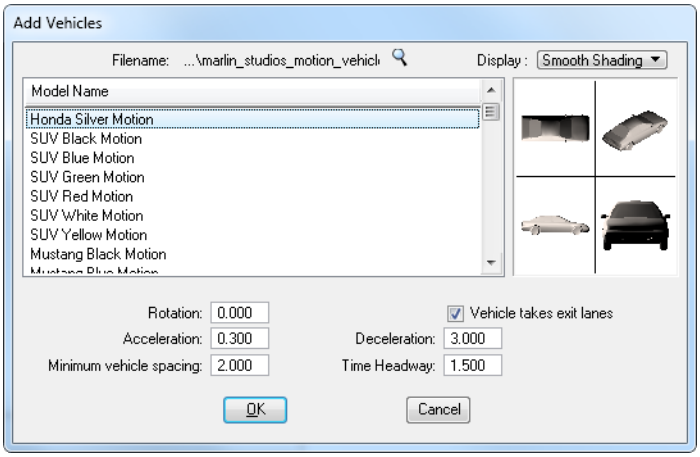
4 Enter Cars for the Library name.

5 Click on the Add vehicles from (cel, dgn, dgnlib) icon. The Add Vehicles dialog appears.

6 Click on the Browse icon in the Add Vehicles dialog. The Select Vehicle Library appears.



7 Browse to C:\ProgramData\Bentley\SharedContent\Marlin_Studios and Double click on *Marlin_Studios_Motion_Vehicles.cel* to choose this file. The Add Vehicles dialog appears.



You will need SELECTseries 3 version 08.11.09.459 or later installed to have this library, if you don't have this version installed you can just choose the Marlin_Studios.cel library instead.

Note: The motion libraries have people in the cars and trucks and the textures for the wheels all have radial blurs so that they will appear to be spinning. The non motion libraries have static wheels and no people, these are intended to be used in parking lots.

8 Click and drag select all of the cars in the Add Vehicles dialog but do not select the trucks and click OK.

You have used the default settings for adding the vehicles the following is and explanation of the settings:

Rotation - This is the angle to rotate the contents of the model such that the vehicle is facing in the positive x direction. Typically if the model should be located such that the origin is at the center of the vehicle on the same plane as the bottom of the wheels.

Vehicle takes exit lanes: When checked the vehicles will randomly take exit lanes for large semi tractor trailer rigs you should turn this off because the vehicles do not articulate and could look bad especially on tight turns.

Acceleration: Vehicle acceleration in m/s^2 a typical value for a car is 0.3 and 0.25 for a truck.

Deceleration: Vehicle deceleration in m/s^2 a typical value for a car is 3.0 and 2.0 for a truck.

Minimum Vehicle Spacing - This is the minimum allowed spacing between vehicles. When a vehicle slows down because it cannot join an entrance lane then the vehicle behind it will also slow down. If the vehicle comes to a stop then this value represents the distance maintained between them.

Time Headway - This is the safety time in seconds between vehicles in a traffic system. Typically this varies between 0.8 and 2.0, more careful drivers will have a larger time headway. This also means the traffic system can support less volume.

9 Click on the Save icon to save this library.

10 From the Vehicle Library dialog click on the Create New icon and change the Untitled-1 name to Trucks.

11 Click on the Add vehicles from (cel, dgn, dgnlib) icon. The Add Vehicles dialog appears.

12 Click on the Browse icon in the Add Vehicles dialog. The Select Vehicle Library appears.

13 Browse to C:\ProgramData\Bentley\SharedContent\Marlin_Studios and Double click on Marlin_Studios_Motion_Vehicles.cel to choose this file. The Add Vehicles dialog appears.

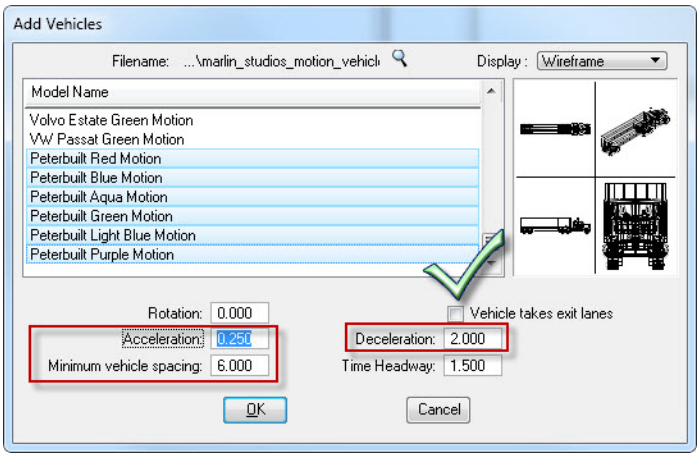
14 Click and drag select all of the Peterbuilt truck models in the Add Vehicles dialog but do not select the cars and set the following:

Vehicle takes exit lane: Disable

Acceleration: 0.250

Minimum vehicle spacing: 6.0

Deceleration: 2.000



15 Click OK to add the trucks to the library.

16 Click on the Save icon to save this library.

Script Single Lane Traffic

The operation of this tool is to place a set of vehicles along the lane defined by the parameters and add a script entry to the animator for animating the vehicles. The tool uses data point entry to select the lane, define the direction of vehicle travel and preview the vehicles on the road. This allows you to see the vehicle spacing which can be adjusted prior to accepting the settings.

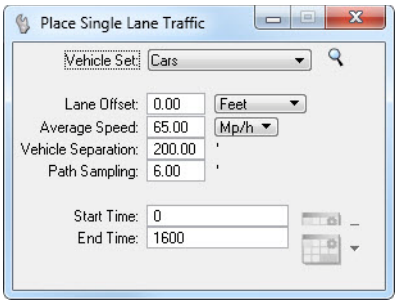
➔ **Exercise: Script Single lane Traffic**

1 Continuing with Interchange.dgn, make road surface the active level and in View 1 turn off all other levels except for the Bridge, Lanes and Vehicles levels. You may also just attach the saved view *Script Lanes* to View 1.

Note: When you use the Script Lane tools a depth mesh is created in memory so that the positions and orientation of all the vehicles can be computed. You should limit the geometry visible in the view where you place them to just those elements that will receive the vehicles. This can be achieved by using levels or DisplaySets. Failing to do this could result in MicroStation running out of memory and possibly crashing. In addition if you limit what is visible to that geometry receiving vehicles the tool will work much faster. The Populate Contents tools works the same way so for adding trees and other content to your scene you should limit the visible geometry to just the elements that are receiving the content.

2 Select the *Script Single Lane Traffic* tool (E+1)

3 Set the Settings as you see below:



You are setting the speed for the lane and the vehicle separation. The smaller the separation the more vehicles you will have on the lane.

Lane Offset - If the path for the vehicles to travel down is not in the center of the lane then this value allows you to set the distance from the lane path element to the center of the lane. The option button allows the choice of the units to use.

Average Speed - This the average speed of the vehicles in this lane as expressed in the units defined in the option button next to it.

Vehicle Separation - This is the distance between adjacent vehicles in the same lane.

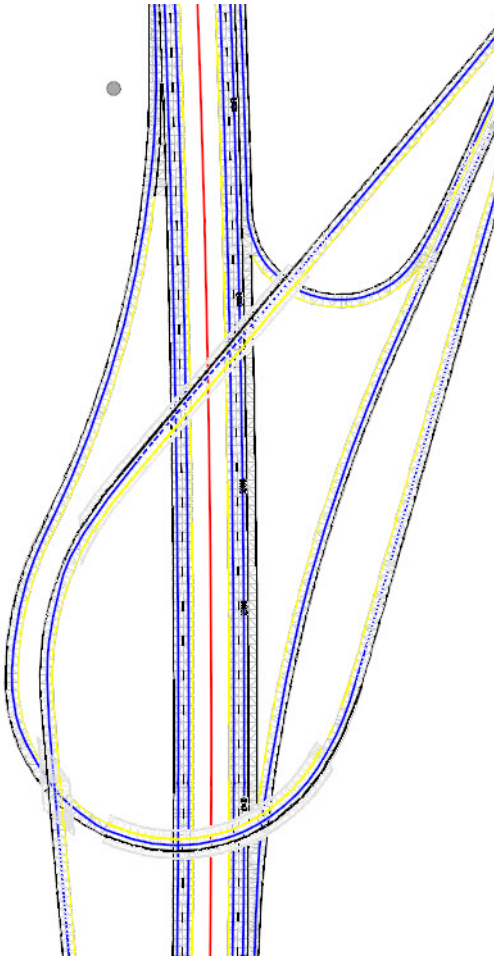
Path Sampling - This is the sampling distance along the lane path element that the road surface information is calculated at. A value of 2 meters is usually sufficient for smooth highways. If the road surface contains speed bumps then a lower value should be used.

Start time - This is the animation script entry start time, expressed in the current animation scripts time code.

End Time - This is the animation script entry end time, expressed in the current animation scripts time code.

4 In View 1 (Top View) select the right Lane as seen in the figure below, position your cursor to give it a traffic flow toward the top the direction arrow should be red and accept. Make sure you don't select the exit lane you don’t want to be exiting at 65 miles per hour.

You can see the vehicles show up in the right lane at the spacing that you have set in the dialog box.If you wanted to change the separation you could do this after the vehicles appear and prior to accepting by just changing the value

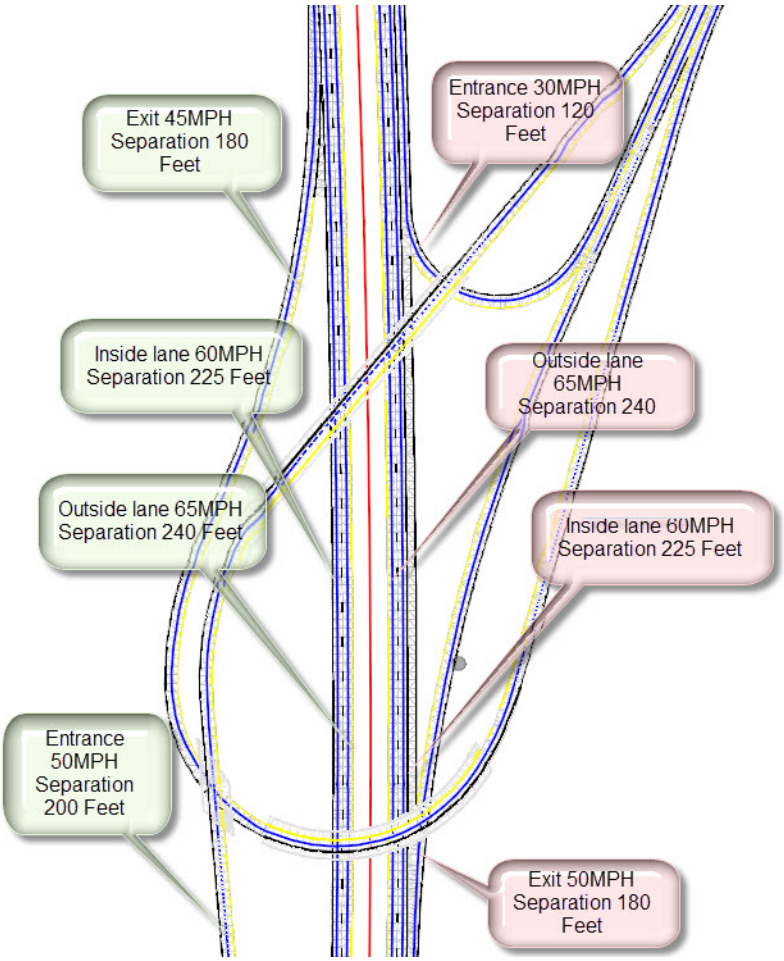


5 Select that same tool except change the settings to:

Average Speed: 50

Vehicle Separation: 180

6 Select the exit lane as shown (lower right) and give it a traffic flow toward top of screen red indicator arrow and accept.



7 Use the map show above to script the other lanes with the speed and separations shown.

In the interchange map (provided you are scripting for right hand drive) all of the lanes on the right will require that the direction indicator be red and the onces on the left will be toward bottom of the screen and appear in green.

For left hand drive vehicles just reverse the direction when scripting the lane.

TIP: *If you by mistake and have a lane with traffic flowing in the opposite direction than what you intended, you can use the Delete Lane tool to delete the lane and then script it again with the vehicles going in the direction that you need.*

8 Use the Preview tool to preview the animation in View 1, you can zoom in out or pan view the view while the animation is playing.

Linking Lanes

Notice how the cars appear out of nowhere at the beginning of the exit and entrance lanes. This is because the traffic repeats and the cars are recycled and used again. What you really want to happen is for the cars to move from the main lane to the exit and entrance lanes. For this to work you will need to link the exit lanes and entrance lanes to the main lane.Linking Lanes.

Once a set of lanes has been created it is possible to create a road network by linking lanes together and defining the types of lanes in the file. There are 4 main types of lanes.

Exit Lanes - These are lanes which vehicles can change to in order to leave a main carriageway. This tool links two lanes together. Following the prompts you will first be asked to select the lane which is the lane entering the carriage way. Then you will be prompted to identify the main carriageway. Once accepted the cars will move from one lane to the other.

Entrance Lanes - These are lanes which vehicles can change from to join a main carriageway. This tool links an exit lane to a main carriage way lane. Following the prompts you will first be asked to select the lane which is the lane exiting the carriage way. Then you will be prompted to identify the main carriageway.

Outside Lane - This is a lane which is closer to the central reservation of a road than the lane you are currently in. This lane links two single lanes together such that the first is the outside lane and the second is the inside lane. (Note: if you use the place multi lane traffic tool then inside and outside lanes are automatically calculated)

Inside Lane - This is a lane which is further away from the central reservation of a road than the lane you are currently in. This lane links two single lanes together such that the first selected is the inside lane and the second is the outside lane. (Note: if you use the place multi lane traffic tool then inside and outside lanes are automatically calculated)

Show Lane Links - When selecting a lane this tool will draw the links this lane has to other lanes in the views. Using the icon on the tool will zoom the active view to the area where the linking occurs.

Delete Lane Link - This tool will delete individual links from lanes. Firstly identify the lane to delete the link. Now identify the transient which represents the link to be deleted. You can use the zoom icon on the tool settings to animate the active view between the links for a given lane.

➔ **Exercise: Linking Lanes**

1 Continuing with Interchange.dgn, click on the Link Exit Lane tool, it will prompt you to select the exit lane first and then the main lane. Click on the exit lane then click the main on the main lane then accept with a data point to complete the lane linking.

2 Repeat the steps for the other exit lane.

3 Using same procedure use the Link Entrance Lane tool to link the two entrance lanes to the main lane.

4 Use the Link Inside Lane tool to link the inside lanes to the outside lanes. Enter a data point on the inside lane and then a data point on the outside lane and one more data point to accept.

You will need to use the tool twice once for North bound traffic and once for South bound traffic. Once you have done this the vehicles will randomly change lanes to overtake slower cars.

Note: You could have accomplished the same thing by using the Link Outside Lane tool, the difference being that you pick the outside lane first and inside lane second both.

5 Select the animation preview box, change the active view to view 1 and run the preview.

The vehicles should now enter and exit by changing lanes not appearing out of nowhere and you may see some cars changing lanes on the main highway.

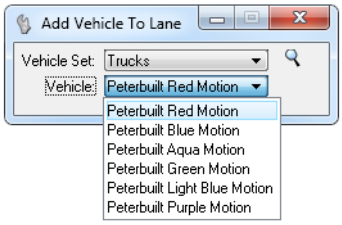
TIP: *Even though the vehicles are randomly placed from the library you could occasionally have two or more identical cars in a row. You can use MicroStation's place cell tool to open the cell library then make one of the other cars of your choice a red mustang for example the active cell. Now just use the cell replace single tool to change the car or truck for the new vehicle without loosing your script.*

Adding a Vehicle to a Lane

Let's say that you want to add a couple more cars or maybe a few tractor trailer rigs to your traffic simulation. This can easily be added using the Add Vehicle to Lane tool.

➔ **Exercise: Adding a Vehicle to a Lane**

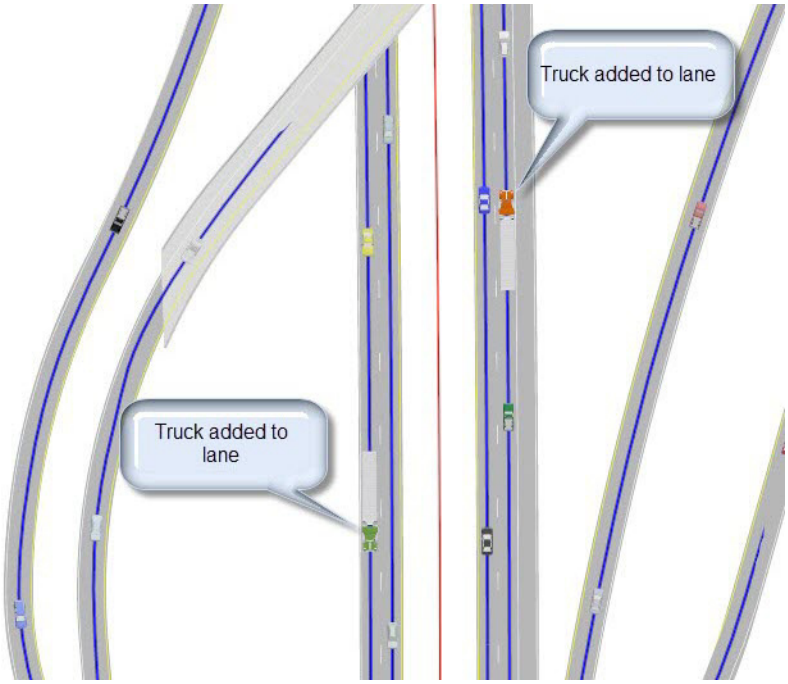
1. Click on the Add Vehicle to Lane tool. The Add Vehicle to Lane tool box appears.
2. In the Vehicle Set drop down choose Trucks and in the Vehicle drop down choose Peterbuilt Red Motion.



You can see that the Prompt for the Tool says Add Vehicle To Lane > Identify Lane Center Line.

3. Pick one of you main lanes in View 1 and enter a data point, to identify the lane and one more data point to accept the lane, now the truck will appear and you can move the truck forward and back on the lane centerline by moving your cursor to position the vehicle.
4. Enter a data point to accept the position of the newly added vehicle.

5 Repeat the steps to add another truck to you simulation.



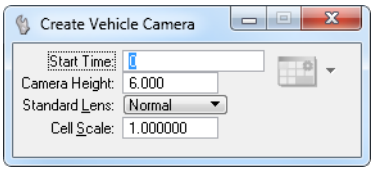
Create Camera Attached to Vehicle

Now that you have your traffic animating down the highway you may want to see the roadway from the vantage point of one of the vehicles. This is very simple to do with the Create Camera Attached to Vehicle tool.

➔ **Exercise: Attaching a Camera to Vehicle**

1 Continuing in Interchange.dgn,Fit View 1, then window in on the roadway at the bottom of the view where the main highway begins.

2 Click on the Create Camera Attached to Vehicle tool.



Set the Following:

Start Time: 0

Camera Height: 6.0

Standard Lens: Normal

Cell Scale: 1.0

3 Enter a data point on the first car you see in the Northbound outside lane to pick this car and another data point to accept.

4 Click on the Animator Preview tool and preview the animation in View 2.

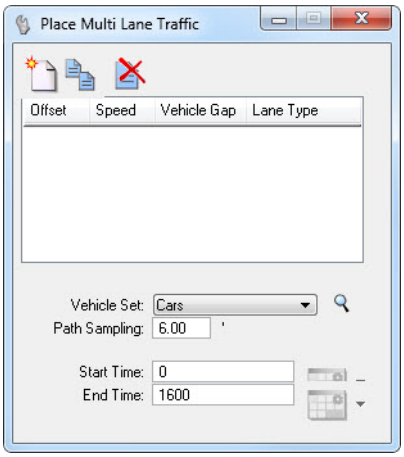
You can see in the preview that you are moving down the highway with the car that you chose at a height of 6' above the highway.

TIP: *You really should alway use a Normal lens when creating vehicle cameras. The Normal lens viewing angle is near that of human vision and you want to see what a person would see, so don't use Wide Angle or Telephoto lens for this camera.*

Place Multi Lane Traffic

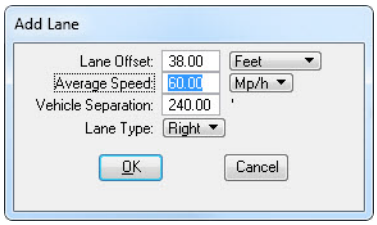
In addition to being able to script a single lane of traffic using lane centerlines as in the previous exercises you can also script multiple lanes using the Place Multi Lane Traffic tool.

The *Place Multi Lane Traffic* tool settings appears as:



Add Lane Entry - Clicking this icon will open the Add Lane dialog, you will need to create a lane entry for each lane, in the interchange example 4 lanes are added 2 right and 2 left lanes.

You can use the *Add Lane* dialog to set the lane parameters for Lane Offset, Average Speed, Vehicle Separation and Lane Type.



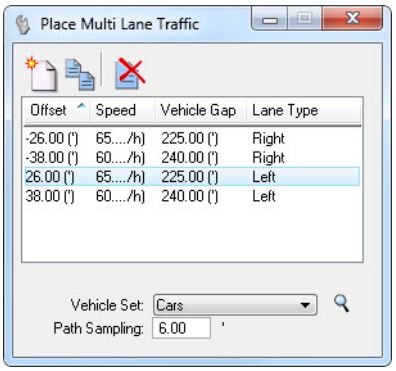
Copy Lane - You can use the copy lane icon to copy a lane and its parameters.

The operation of the *Place Multi Lane Traffic* tool is similar to the *Place Single Lane Traffic* tool they differ in that this tool use a single path and relies on offsets to create multi-lane traffic. The set of vehicles used can be selected from the Vehicle Set which allows you to choose from a list of named libraries that have been defined. The tool uses data point entry to select the lane and define the direction of travel of the vehicles and preview the vehicles on the road so the vehicle type and spacing can be seen and adjusted before accepting the settings.

Place Multi Lane Traffic List box and icons

The list box and icons allow you to create and manage a set of lanes associated with the lane path element. The add icon allows you to insert entries into the list with the data regarding lane offset, speed, vehicle separation as in the single lane tool described above. It also allows you to specify if the lane is a left or right hand lane. This is so the direction of the vehicles can be set correctly.

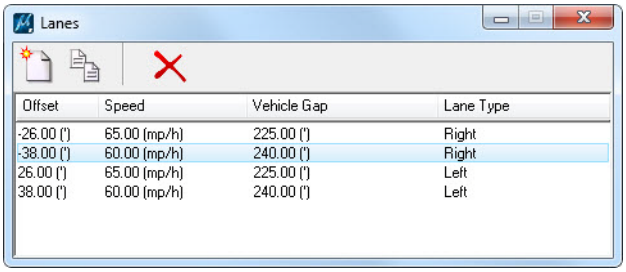
Here are the tool settings completed for the above design file with the lane offsets, based on the red center line in the file.



Note: When defining the offsets for the lane +values are used for the lanes which are to the left of the path element. To change the gap of placed vehicles just move

the vehicles with the move tool (with the animator running) they will snap to the correct position on the path and delete the excess vehicles.

Edit Lanes - The edit lanes tool allows you to edit a selected lane and opens a dialog enabling the editing of the lane data. Here is the resulting dialog for the lanes placed above. You can only edit the offset and speed.

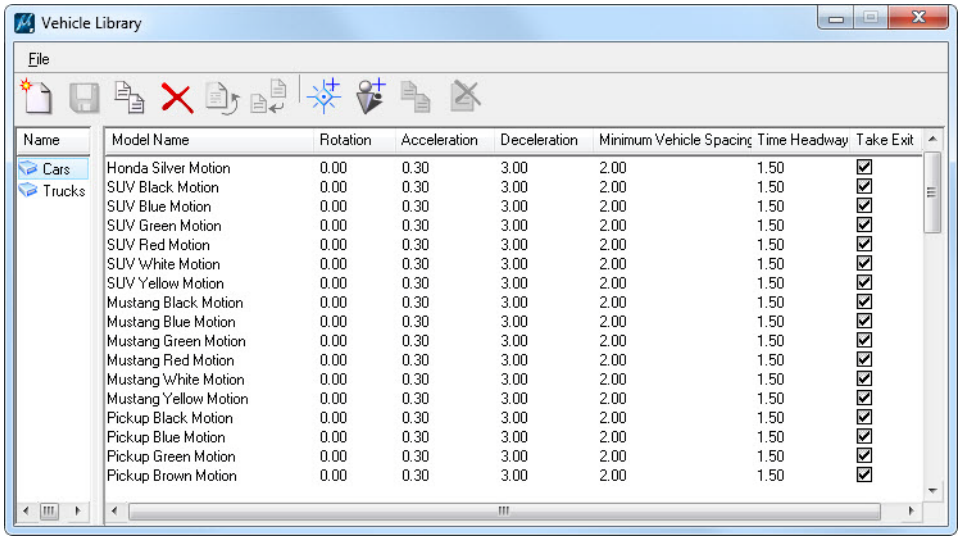


Once the edit is accepted then the lane data is updated.

Delete Lane - This tool will delete a lane and all the vehicles associated with that lane. Simply select and accept the lane to delete but be aware that deleting a lane also deletes the lane links associated with it.

Vehicle Library

A library system has been implemented for maintaining sets of vehicles to use in the traffic simulator allowing the creation, editing, and deletion of vehicle lists. These lists can also be maintained and moved from project to project via the dgnlib system.



New Vehicle List

This icon will create a new entry in the vehicle list column allowing the user to set the name of the entry.

Save Vehicle List

When the contents of a vehicle list have been changed the changes are saved to file when this icon is used.

Copy Vehicle List

This icon will copy the currently selected list of vehicles to a new list with a different name

Delete Vehicle List

This icon will delete the currently selected list of vehicles.

Reset Vehicle List

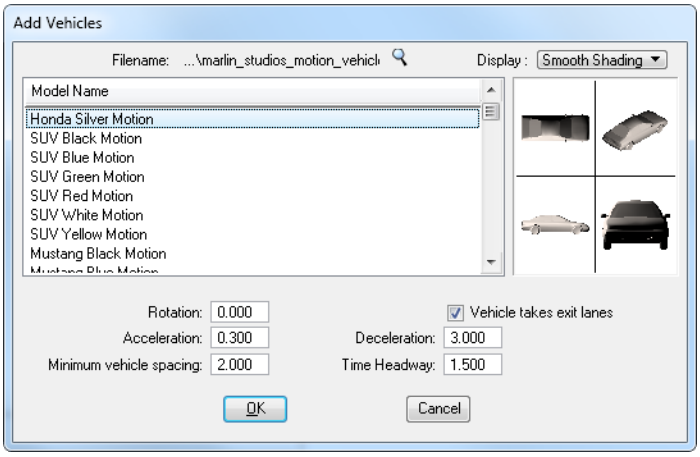
This icon will reset the currently unsaved changes to the list.

Update From Library

If the origin of this list of vehicles is from another file such as a dgnlib and it is different in the active file from the originating file this icon will reset the list to the state that the list is in the library.

Add Vehicles

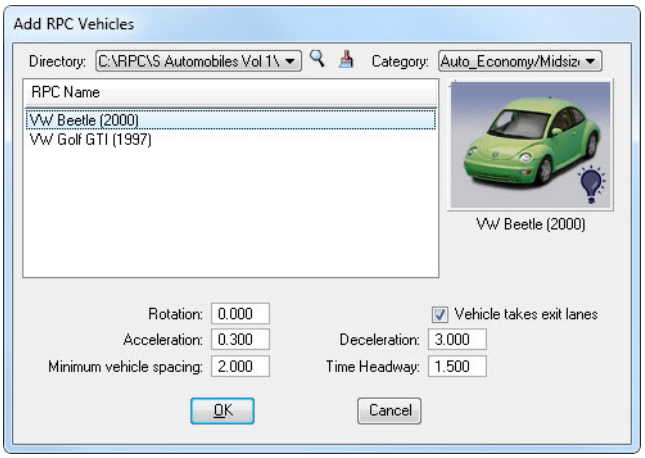
This icon will open the following dialog.



This dialog allows the user to open .dgn,.cel,.dgnlib etc. files and select a series of models within that file for use as vehicles. The user has the option of selecting one or more of the entries in the list and these will then be added with the associated options into the vehicle list of the main vehicle library dialog.

Add RPC

This icon opens the ADD RPC Files dialog. This dialog allows the addition of Rich Photorealistic Content (RPC) vehicles into the system. The settings at the bottom of the dialog are the same as the Add File dialog. This is simply for RPC cells.



Browse Icon - To select a directory where the RPC are located select this icon. Once the directory has been selected the category option button will be populated with the categories of RPC which are available to use.

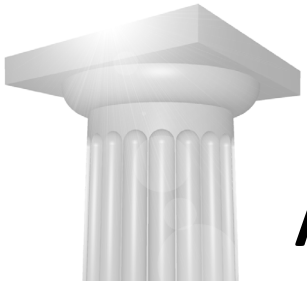
Refresh Icon - Using this icon will search the current directory list and update the lists of RPC available.

Copy Entry

This icon will copy an entry in the list of vehicles.

Delete Entry

This icon will delete an entry in the list of vehicles.



Animating Materials and Lights

Module Overview

In this module you will learn how to animate materials and lights, including solar time. You will learn how to use the Animator's tree view and timeline editor to edit animation scripts.

Module Prerequisites

- Knowledge about 3D view controls
- Knowledge about saved views
- Basic understanding of scripting
- Some knowledge about MicroStation lights

Module Objectives

After completing this module, you will be able to:

- Animating materials
- Animating source lights
- Animating sequential images
- Animating using Saved Views
- Animating of Solar time

Animating Materials and Lights

In this module you will learn:

- How to animate materials over time to create effects like running water.
- How to animate source lights by changing the color and intensity of lights over time.
- Learn how to use the Animator's Tree View and Timeline editor to graphically see the animation scripts and more easily edit them.
- Learn how to use saved views to create camera animations.
- Learn how to use the Animator to animate Solar time and also learn how to use a special utility called Solar Study to animate the Solar time over extended periods of time.

Animating Camera using Saved Views

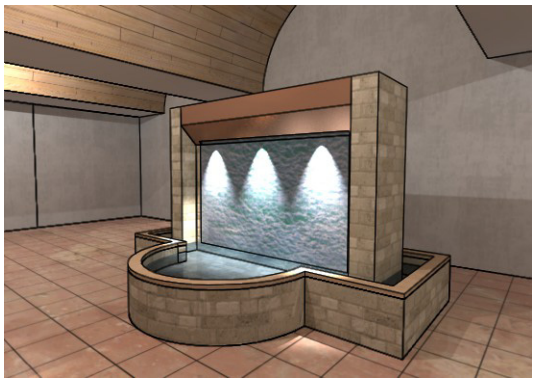
You can animate between any two saved views, whether orthogonal (non-camera) or with perspective. The path is linear between two views, but can be interpolated as a B-spline when three or more views are used and B-spline interpolation is selected. You can even animate from a non-camera orthogonal view to a perspective camera view.

You must figure out the actual path the camera would take, since you cannot graphically see the path. However, once you see how it works, you will find this method useful for animating in small areas like interior spaces.

➔ **Exercise: Animation using saved views**

1 Open 08_lobby fountain.dgn.

This DGN file contains saved views. The two you will work with here are shown here rendered with Luxology with Visible Edges Overlay.



2 Select the Animation Producer tool in the Animation tasks.

3 In the Animation Producer dialog select *Tools > Saved Views*.

4 In the Script Saved View dialog, set the following, and then click OK:

Start Time: 0

Interpolation: Linear

Velocity: Constant

Saved Views: v1 left

5 In the Animation Producer dialog select *Tools > Saved Views*.

6 In the Script Saved View dialog, set the following, and then click OK:

Start Time: 200

Interpolation: Linear

Velocity: Constant

Saved Views: v3 right

Click OK to add to the Storyboard Panel

7 Click play in the Animation Preview dialog to view the animation in View 2.

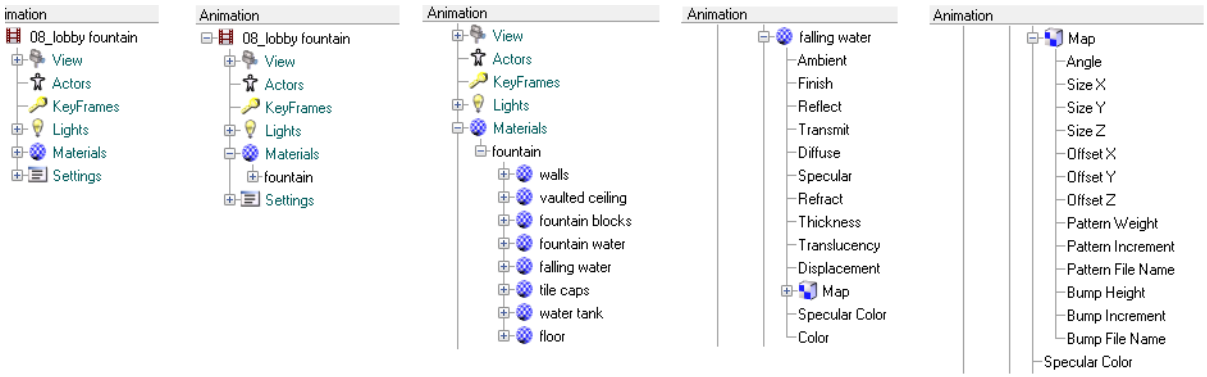
The animation transitions using tweening from saved view v1 to saved view v3.

Animating Running Water

Next you will learn how to animate the properties of a material over time to achieve the effect of water running down the wall of the fountain.

➔ **Exercise: Animate running water**

1. Continuing in 08_lobby fountain.dgn, in the Animation Producer dialog, expand Materials in the Animation pane, expand fountain palette, falling water, then expand Map.



2. Right click Offset Y and select Script.
3. In the Animate Settings dialog set the following, and then click OK:

   Pattern Y Offset: 0

   Start Time: 0

   Interpolation: Linear

   Velocity: Constant
4. Right click Offset Y and select Script.
5. In the Animate Settings dialog set the following, and then click OK:

   Pattern Y Offset: 4

   Start Time: 200

   Interpolation: Linear

   Velocity: Constant
6. In the Animation pane, repeat the previous steps and except this time expand fountain water, then expand Map.
7. Right click Offset Y and select Script.

8 In the Animate Settings dialog set the following, and then click OK:

Pattern Y Offset: 0

Start Time: 0

Interpolation: Linear

Velocity: Constant

9 Right click Offset Y again and select Script.

10 In the Animate Settings dialog set the following, and then click OK:

Pattern Y Offset: -0.5

Start Time: 200

Interpolation: Linear

Velocity: Constant

Storyboard Panel

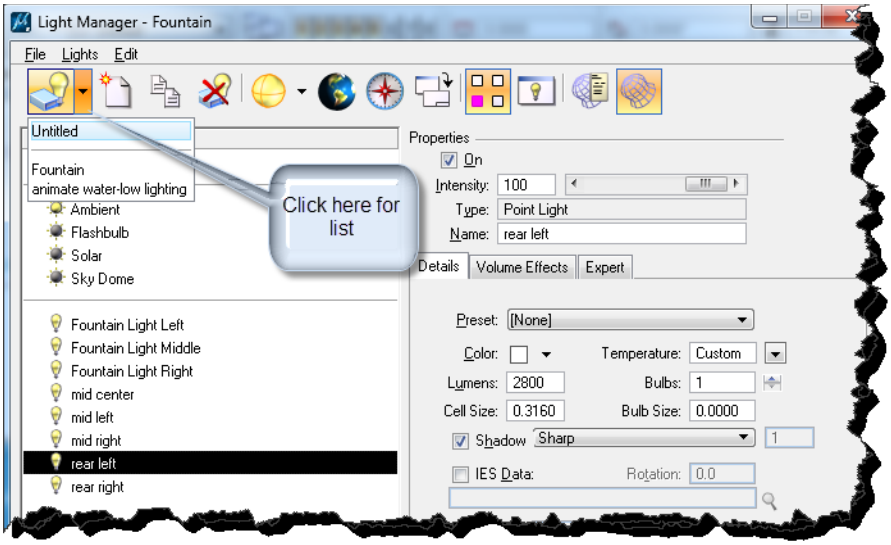
Type	Name	Time	Value	Enabled	Description
View	v1	0		☑	
Material	fountain water:Pattern Y Offset	0	0.0	☑	
Material	falling water:Pattern Y Offset	0	0.0	☑	
View	v3	200		☑	
Material	fountain water:Pattern Y Offset	200	-0.5	☑	
Material	falling water:Pattern Y Offset	200	4.00	☑	

11 Click play in the Animation Preview dialog to view the animation in View 2.

Note: You will need smooth shading applied to view in order to see the that the textures maps are animated.

12 To view the animation in a different lighting mode, select the Light Manager tool in the Animation tasks Render toolbox and set the following:

Light Setups: animate water-low lighting



13 Click play in the Animation Preview dialog to view the animation.

You can change the value in the Storyboard Panel of the Animation Producer to modify speed of moving water.

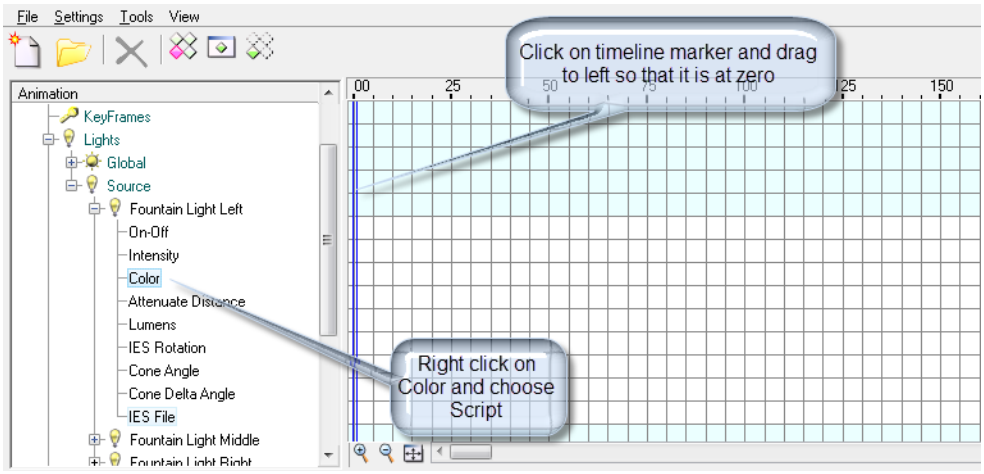
Animating Source Lights

To add a little mood effect to the lobby fountain you will add a few more items to your script to change the color of the spot lights over time. This will be much more interesting and dramatic than just animating the falling water as you will soon see.

➔ **Exercise: Animating source lights**

1 Continuing in 08_lobby fountain.dgn, in the Animation Producer dialog, expand the Lighting, and then Source in the Animation pane.

Note: You can click and drag the blue timeline marker to the time or frame number then when you choose script the time will already be set to match that timeline marker position.



2 Expand Fountain Light Left, right click Color, select Script, set the following, and then click OK:

Color: 255,255,255 (White)

Start Time: 0

3 Expand Fountain Light Middle, right click Color, select Script, set the following, and then click OK:

Color: 255,255,255 (White)

Start Time: 0

4 Expand Fountain Light Right, right click Color, select Script, set the following, and then click OK:

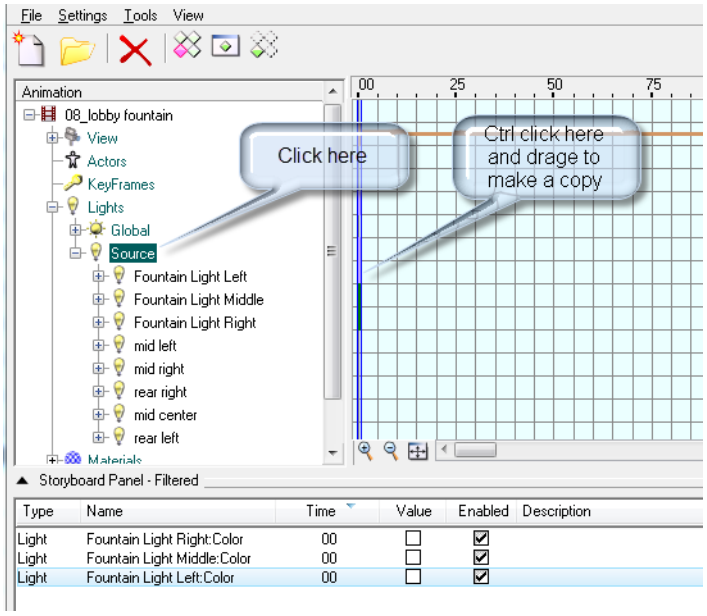
Color: 255,255,255 (White)

Start Time: 0

Now that you have the initial light color entries, you can animate the spot lights to change color over time, and then back to white at the end of the movie.

5 Collapse the Fountain Lights in the list and then click on Source.

6 Hold Ctrl key and click on the green symbol for Fountain Light Left in the timeline, and then drag it to Frame 50.

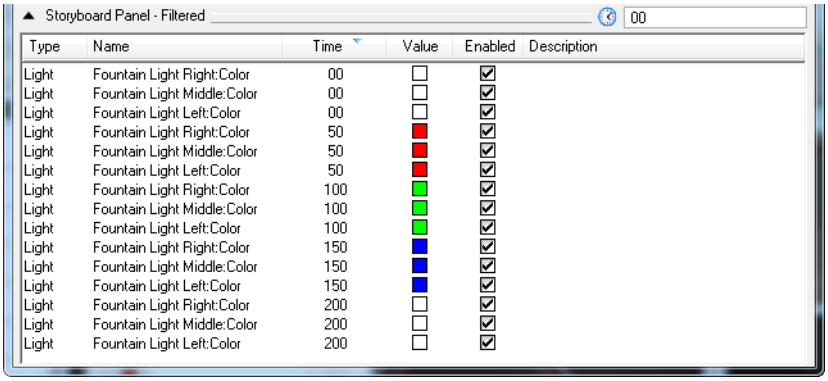


7 Repeat this process for Frames 100, 150, and 200 by holding Ctrl key, clicking and dragging to make copies.

8 Now do the same for Fountain Light Middle and Fountain Light Right. You may need to expand the light to in the list to Ctrl click on the color key in the timeline.

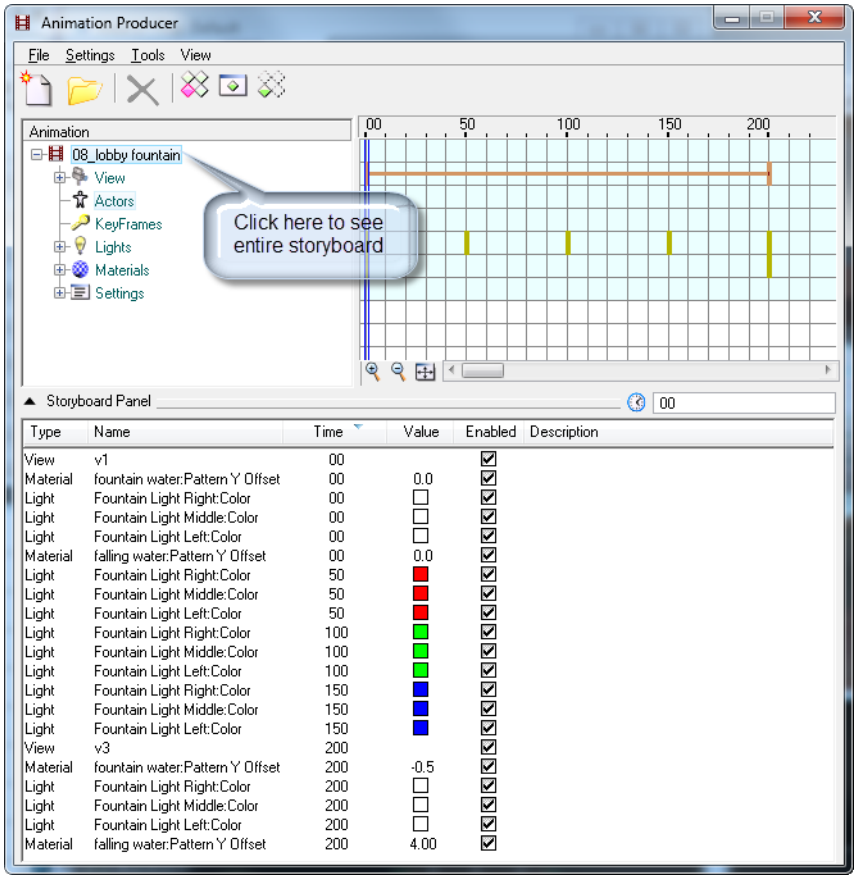
9 In the Storyboard Panel modify the color of each Fountain Light for frames, 50, 100, 150 and 200 by clicking on the color icon under the value column and selecting colors red, yellow, green and white.

You can make the lights any color like and in any order in the below example the lights animate from white to red, then green and then blue and finally back to white.



10

Click on the 08_lobby fountain item at the top of the list view to see the entire animation script in the storyboard panel.



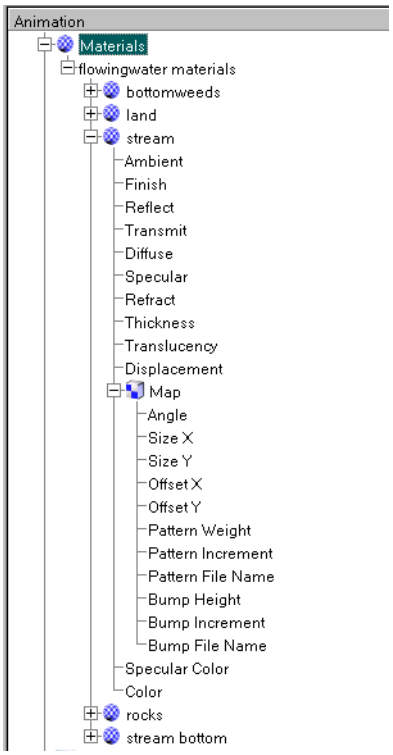
11 Click play in the Animation Preview dialog to view the animation smooth shaded in View 2.

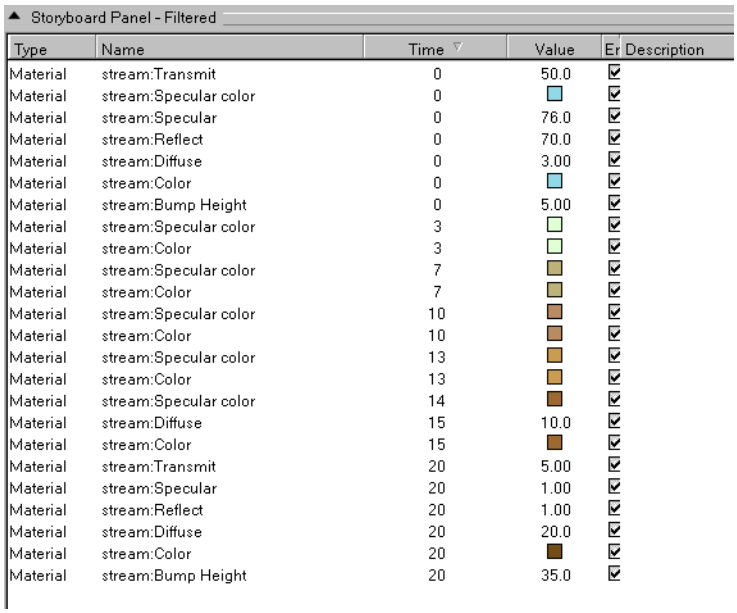
12 Try editing colors and modify your Story Panel to see different effects.

Have Fun!

Animating Textures

The Animation Producer lets you to animate any defined materials properties over time. The various animation properties and Storyboard modifications are as follows.





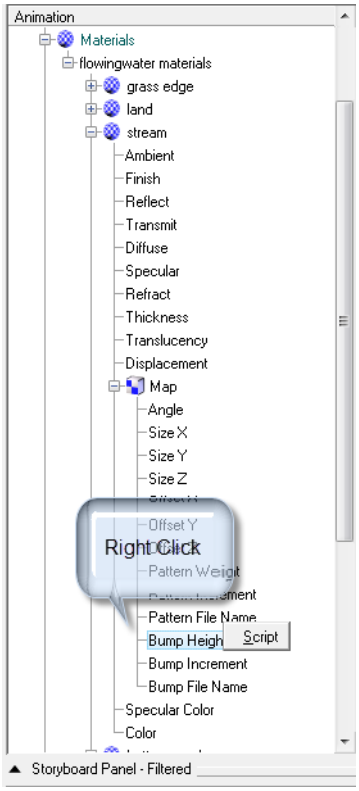
Type	Name	Time	Value	Er	Description
Material	stream:Transmit	0	50.0	☑	
Material	stream:Specular color	0		☑	
Material	stream:Specular	0	76.0	☑	
Material	stream:Reflect	0	70.0	☑	
Material	stream:Diffuse	0	3.00	☑	
Material	stream:Color	0		☑	
Material	stream:Bump Height	0	5.00	☑	
Material	stream:Specular color	3		☑	
Material	stream:Color	3		☑	
Material	stream:Specular color	7		☑	
Material	stream:Color	7		☑	
Material	stream:Specular color	10		☑	
Material	stream:Color	10		☑	
Material	stream:Specular color	13		☑	
Material	stream:Color	13		☑	
Material	stream:Specular color	14		☑	
Material	stream:Diffuse	15	10.0	☑	
Material	stream:Color	15		☑	
Material	stream:Transmit	20	5.00	☑	
Material	stream:Specular	20	1.00	☑	
Material	stream:Reflect	20	1.00	☑	
Material	stream:Diffuse	20	20.0	☑	
Material	stream:Color	20		☑	
Material	stream:Bump Height	20	35.0	☑	

Next you will modify various textures assigned to the water in a scene. Due to the time involved in calculating these animation sequences, an animation video is supplied so you can see the results after you have completed the scripting. The file is named 09_textureanimation.wmv, and is included in the data set provided for this course.

➔ **Exercise: Modify bump height**

1. Open 09_textureanimation.dgn.
2. Open the Animation Producer dialog.
3. Expand the Materials in the animation pane, then flowing-water, stream material and Map properties.

4 Right click on the Bump Height property and select Script.



5 In the Animate Settings dialog, set the following, and then click OK:

Bump Height: 10

Start Time: 0

6 Repeat, with following settings:

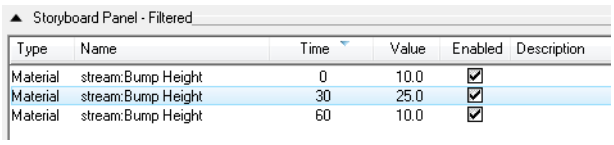
Bump Height: 25

Start Time: 30

7 Repeat, with following settings:

Bump Height: 10

Start Time: 60

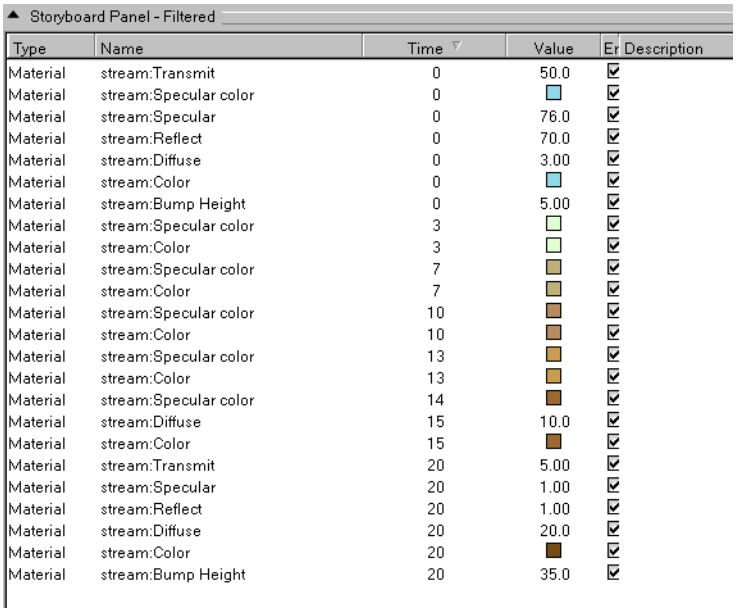


➔ **NOTE:** ***These frames must be rendered with Luxology in order to see the effects of the bump map being animated. Smooth shading can produce***

shadows but not bump mapping, displacements, reflections etc. you will need to render the frames to animate these effects.

8 Open bumpheight.wmv in from the data set Movies folder with Windows Media Player to play the rendered animation.

The same process can be used for other properties on any material in the design file. Displacement, bump maps, etc., require the animation to be rendered using Luxology from the Record Script dialog since Smooth shading will not display these properties.


Storyboard Panel - Filtered

Type	Name	Time	Value	Er	Description
Material	stream:Transmit	0	50.0	☑	
Material	stream:Specular color	0		☑	
Material	stream:Specular	0	76.0	☑	
Material	stream:Reflect	0	70.0	☑	
Material	stream:Diffuse	0	3.00	☑	
Material	stream:Color	0		☑	
Material	stream:Bump Height	0	5.00	☑	
Material	stream:Specular color	3		☑	
Material	stream:Color	3		☑	
Material	stream:Specular color	7		☑	
Material	stream:Color	7		☑	
Material	stream:Specular color	10		☑	
Material	stream:Color	10		☑	
Material	stream:Specular color	13		☑	
Material	stream:Color	13		☑	
Material	stream:Specular color	14		☑	
Material	stream:Diffuse	15	10.0	☑	
Material	stream:Color	15		☑	
Material	stream:Transmit	20	5.00	☑	
Material	stream:Specular	20	1.00	☑	
Material	stream:Reflect	20	1.00	☑	
Material	stream:Diffuse	20	20.0	☑	
Material	stream:Color	20		☑	
Material	stream:Bump Height	20	35.0	☑	

Animating Solar Time

You can use the Animator tools to animate the sun's movement across the sky during a single day. If you want to perform a solar study over a period of days or months, you can use the Solar Study utility. This utility lets you animate the solar time over extended periods. For instance, you could render a building every day at 2:00 PM for a year.

You can display the current Solar Time and Date information while rendering a view. When used in conjunction with the Solar Study utility, or in an animation, you can display the Solar Time and Date information for each frame of the sequence.

View Time Display

New in MicroStation V8i (SELECTseries 3) is the View Time Display option. This option allows you to turn on the display of the date and time in the view during the preview of an animation or a schedule simulation, or while recording a movie.

View Time Display

The View Time Display is set in the Animation Settings dialog. In this dialog, you can select the format and location of the time display. Once the style is set, you can add the time and date to the preview, change the format of the display and use the Display Active Task during Preview tool to see the list of tasks and the percentage of completeness.

The View Time Display replaces the Solar Time Stamp feature, which will be removed in a future release.

Solar Time Stamp

To display solar time and the date in the rendered view, you first place the cell SLRTIM in a convenient place in the view that is being rendered. This cell is located in the cell library animator.cel in the \Workspace\system\cell folder. After placing the cell, you can edit the Enter-Data field of the cell to display the string you want. The format of the string is that used by the C function “strftime”. By default, the cell contains the string “%c”, which displays the Date and Time.

Addition Date and Time formats are as follows:

Format	Description
%c	Date and time appropriate for current locale
%x	Date for current locale
%y	Year without century (00 — 99)
%Y	Year with century (such as, 2010)
%b	Abbreviated month name
%B	Full month name
%m	Month as number (01 — 12)
%d	Day of month as number (01 — 31)
%a	Abbreviated day name

Format	Description
%A	Full day name
%H	Hour in 24–hour format (00 — 23)
%I	Hour in 12–hour format (01 — 12)
%M	Minute as number (00 — 59)
%S	Second as number (00 — 59)
%p	Current locale's AM/PM indicator for 12–hour clock
%z, %Z	Time-zone name or abbreviation; no characters if time zone is unknown

Typical examples are:

Displays	String
%c	08/14/06, 2006, 10:20:35 AM
Date is %c	Date is 08/14/06, 2006, 10:20:35 AM
Time is %I:%M:%p	Time is 10:20 AM

Next you will use the Animator to create a script and render frames animating solar time over 10 hours, rendering frames every 10 minutes.

The design file you will be using has the Solar Time Stamp cell placed in the file so you can see how it works. If you prefer not to see it you can just turn off the level where the SLRTIM cell is located in the design.

Note: the Compass tool in the Light Manager was used on this data set to reset the North direction for the model so that the physical sun would appear to rise from behind the building.

➔ **Exercise: Animating solar time**

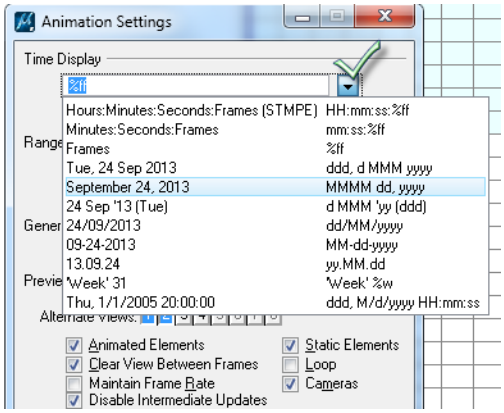
1. Open 10_Solartime.dgn.

The design file opens with four open views. You will be using View 2 to animate the solar time.

2 Open the Animation Producer and select *Settings* > *General*.

3 In the Animation Settings dialog, set the following:

Time Display: Change %ff to MM-dd_yyy (click the arrow)

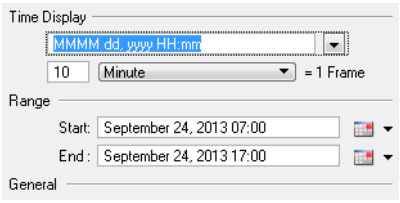


After the MM-dd-yyyy format, type a space, then type the following for hours and minutes to display: HH:mm

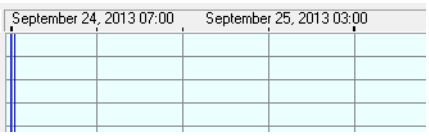
Set 10 minutes = 1 Frame (click the arrow to select minutes)

Range: Start time: Click the calendar, select a Start date, type 7:00:00AM

Range: End: Click the calendar, select an End date, type 5:00:00PM



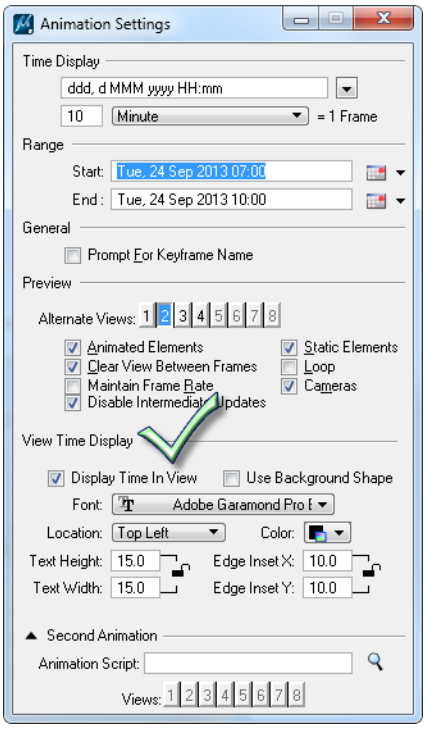
When a date format is changed in the Animation Settings dialog the headings also change in the Animation producer.



Unlike the other procedures using the Animation Producer, you do not need to add any items to the script to animate the global solar time. Once you set the Animation Producers Time Display to be over a long period of hours or days we assume the purpose is a solar study.

By setting the Start Time to 7:00AM and the End Time to 5:00PM the animation will be over a period of 10 hours. Since you also specified that 10 minutes is equal to 1 frame the animation will require 6 frames/hour for a total of 60 frames to be rendered.

4 In the Animation Settings enable the Display Time in View option with the options for format as show below.



5 Click Preview Play and move the scrub bar in View 2 to see the Display Time in View.

6 In the Animation Producer, select *File Record > Script*.

7 Set the following in the Record Script dialog, and then click OK to begin recording:

Output File: should be 10_Solartime.000.bmp by default

Aspect: NTSC (720X485)

Gamma: 1.70 (Use this value for Luxology renderings)

Format: Windows BMP

Render Mode: Luxology

Render Setup: Exterior Good

Light Setup: Solar Study

Environment Setup: Physical Sky

8 Use the Movie player (*Utilities > Image > Movies*) to playback the rendered frames after the rendering of 60 frames.

9 Using Window Media Player open the SolarStudy.wmv file and play the previously rendered example movie.

Note: This example movie's script animates the sun rising in the Physical Sky where 30 seconds equals 1 Frame. This animation covers 3 hours of time from 7:00am to 10:00am, which is 180 minutes of time. The frames are rendered at 30 second intervals (time lapse) so that the total number of rendered frames is 2X180 or 360 frames.

You could add items to change the Solar Color beginning yellowish at sunrise, changing to white at noon, and then reddish as the sun sets. This is one of the many advantages of using the Animator's tools to animate solar time, as this could not be done using the Solar Study Utility. You could also animate the camera view during this same period of time.

Solar Study Utility

The following steps show how you would use the Solar Study utility to animate solar time over a period of days rather than hours.

➔ **How to create a multi-week solar study demonstration:**

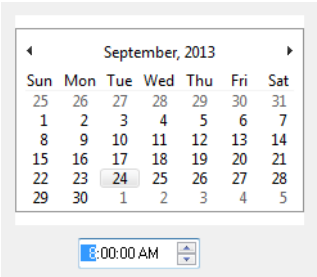
1. Continuing in 10_Solartime.dgn, in the Animation Producer choose Settings > General.

2. To reduce the number of frames for a longer period solar study, set the Time Display to 1 Day=1 Frame.

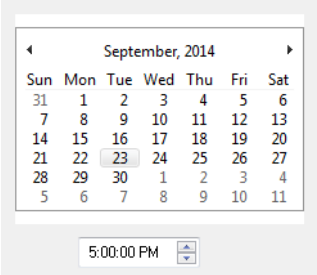
3. Click on the calender icon for Start and set the following in the following:

Solar Time: 08:00 AM

Start Time: Enter start date and time



4. Click on the calender icon for End and click on the right arrow by the month until you are on the one day earlier 1 year later.



Note: Because we are only going to render one frame for each day at 8:00am, the end time does not matter as long as it is later than 8:00am.

10 Set the following in the Record Script dialog, and then click OK to begin recording 365 frames:

Output File: should be 10_Solartime.000.bmp by default, but you can change the name to prevent overwriting the previously rendered frames with the same name to 1year000.bmp.

Aspect: NTSC (720X485)

Gamma: 1.70 (Use this value for Luxology renderings)

Format: Windows BMP

Render Mode: Luxology

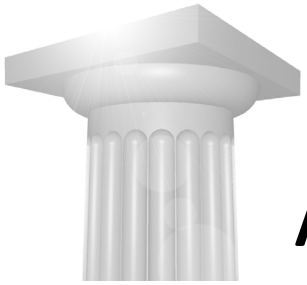
Render Setup: Exterior Good

Light Setup: Solar Study

Environment Setup: Physical Sky

11 Use the Movie player Utilities > Image > Movies to playback the rendered frames after the rendering is completed.

12 Using Window Media Player open the SolarStudy_1Year.wmv in your data set Movies folder and play the previously rendered example movie.



Animation Outputs

Module Overview

This module shows how to include previously created animation scripts in a final animation. It provides a description of the Record Script dialog as used with the Luxology Rendering tool, network rendering, and how to generate PDF output.

Module Prerequisites

- Knowledge Luxology and visualization techniques
- Basic MicroStation V8*i*
- Completion of prior modules of the Animation course

Module Objectives

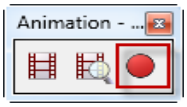
After completing this module, you will be able to:

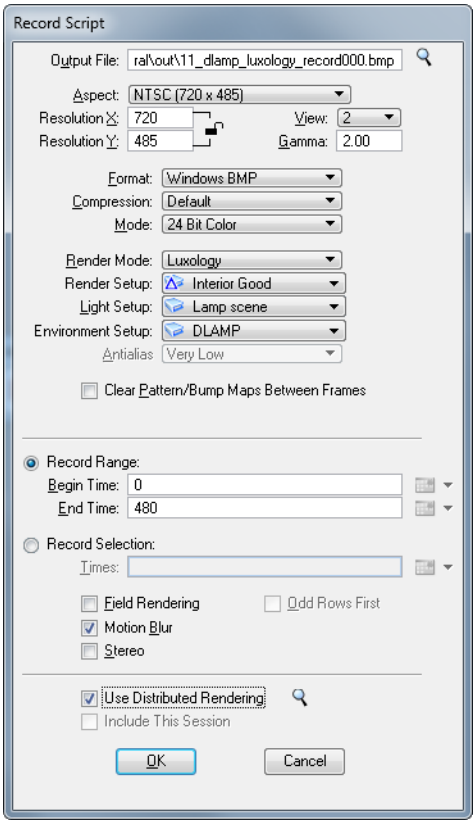
- Create an Animation movie of a script using Luxology
- Set up process for Rendering an animation across a network
- Create an animation inside a PDF document

Recording Scripts

After you have created, reviewed and are satisfied with a completed script, you use the Record Script dialog to create the final renderings of each frame of your animation sequence. By recording individual frames you will have the flexibility to re-record individual or a sequence of frames, to improve your final production.

The Record Script tool is located in the Animation Settings tools of the Animation Tasks.





The basic steps and settings used to create a recording, are as follows.

- **Output File**- Click on the magnifying glass to select the path and directory you want to use for storing the rendered frames. The default location is C:\ProgramData\Bentley\MicroStation V8i

(SELECTseries1)\WorkSpace\Projects \Untitled\out. The output directory can be set in MS_IMAGEOUT.

- **Aspect** - Select the Aspect Ratio from a list of standards or select set your own value from one of the active views for creating the renderings.
- **View** - Select the view displaying the animation from the option list.
- **Gamma** - Set the Gamma value to match the one in the Light Setup which can be found on the Brightness Tab of the Light Manager typically 1.7 for Luxology renderings.

Warning: The default setting is 1.0, but you should match the settings from your Light Setup If you do not modify this setting for a Luxology rendering, the lighting may be too dark. If this happens you can use the Tone Map Animation Frames utility to fix this and other brightness issues.

- **Format** - There are numerous options for Format. TIFF (Tag Image File Format) is one of the most popular.

Hint: It is recommend that you a lossless format such as TIFF or BMP for rendering your animation frames rather than a lossy format such as JPEG. The process of creating a media file AVI, WMV, MP4 etc. will introduce some noise artifacts and using JPEG will make your movies have even noisier.

- **Compression** - When you select a format the system selects the optimum compression application for the selected format. You can override these settings.
- **Mode** - Typically 24 Bit Color is used, but others are available including gray scale and monochrome.
- **Render Mode** - Standard display mode (wireframe through Smooth rendering) is available and is very fast. Photorealistic rendering through Luxology rendering takes the longest time but this depends on the capabilities of your hardware. Selecting Luxology also provides the ability to select Render, Light and Environment setups.

Note: If not already familiar with the Luxology rendering tools you should take the Visualization course.

- **Clear Pattern/Bump Maps Between Frames** - Only enable this function if you have a number of different pattern images used between frames. If using a number of very large animated patterns.

RPC files are a special third party image format from ArchVision® and supported by MicroStation. RPC Libraries can be purchased directly from ArchVision at www.archvision.com.

- **Record Range**

  Begin Time - set the frame number of the start of your animation sequence.

  End Time - set the frame number of the end of your animation sequence.

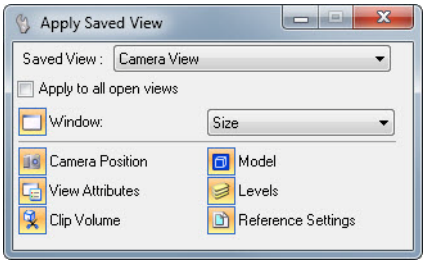
  Note: Record Range is dependent on what settings you have in the Animation Settings dialog.(minutes, days, weeks, etc.).

- **Record Selection** - Selecting this option lets you record from a specific time.
- **Field Rendering** - Typically this option is off. This option is used to render interlaced video frames for NTSC video (30 frames/second) or PAL (25 frames/second) to be played back on and old analog television.
- **Motion Blur** - Luxology Only typically, this option is turned on.When enabled, Luxology will take time samples forward and backward from the rendered frame blending them together to create the blur effect. Depending on the strength of the effect or the speed of motion in your frame, you may find it necessary to increase the number of antialiasing samples. Adjustments to Blur Length (like adjusting the exposure time for more or less blur) and Blur Offset can be found on the Advanced tab of the Render Settings dialog.
- **Use Distributed Rendering** - If enable and Distributed Rendering Process Controller is running a Distributed Rendering process with be used to package up the required files and start the job. Be sure to have the Process Controller running on at least two machines to take advantage of multiple computers on your network (see Network Rendering later in this chapter for details).
- At this point you are ready to click OK and save the animation frames to disk. However, due to time constraints, you will not have time to render these files during the instructor led course.

➔ **Exercise: Recording an existing script**

1. Open 11_dlamp_luxology_record.dgn.

2 Apply the Saved View Camera View to View 2 using Window Size option.



3 In the Animation Producer dialog, select *File > Record Script*, set the following, and then click OK:

Output File: Use Default location

Note: If you change the name of the output file, be sure to add the correct number of zeros. If the animation is less than 1000, add 3 zeros. If more than 1000, add 4. If more than 10,000, add 5 etc.

Aspect: 640X360

View: 2

Gamma: 1.7

Format: Tag Image File Format

Render Mode: Luxology

Render Setup: Interior Good

Light Setup: Lamp Scene

Environment Setup: DLAMP

Begin Time: 0

End Time: 480

By default, the name will be the same as that of the design file and begin with the frame number set by the Begin Time and End Time option. In this case, the name is 11_dlamp_luxology_record000.tif. If this were final output for an actual project, it is recommended you use either TIFF or Targa as the file format. These formats take up considerably more disk space but they are uncompressed and will look better when compiled into a movie using formats such as MPEG1, MPEG2, AVI or MOV.

Note: The Use Distributed Rendering option located in the bottom portion of the Record Script can be automatically started and participate in rendering the animation frames to disk.

Playing Back the Results

Once you have the frames rendered to disk you can use MicroStation's Movie player to load and playback the sequentially named frames.

You can also use the Movie player to save the Movie as a Microsoft AVI movie. For best results, use a non-linear editing package for adding effects such as transitions or sound and for saving with a variety of video CODECs (compression de-compression) options for playback on modern systems.

In the next exercise you will play the movie based on the script you just completed. The movie was rendered to frames then compiled into a WMV movie format ready to be played back using Microsoft's Media Player.

➔ **Exercise: Playing back a pre-recorded animation**

1. Using Microsoft Media Player, open the file 11_dlamp_record_script_video.wmv from the class data set and play the movie.

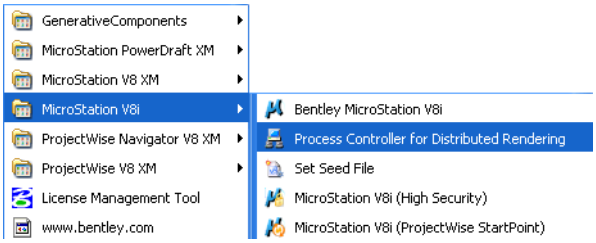
   This movie made use of some of Luxology rendering materials containing displacement, bump maps, opacity and a background image in the Environment setting.

Distributed Rendering

You can use several machines to do one rendering or animation by using Distributed Rendering. 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 for saving the frames.

Simplified setup for Distributed Rendering

Setting up this new version of Distributed Rendering is simple. 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.

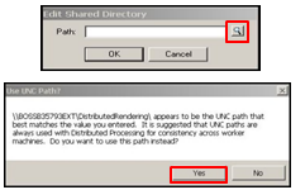
.Varning: The Process Controller needs to be running on all the machines that will participate in the network rendering and they should all be using the same version of MicroStation.

Distributed Rendering Work Flow

Step 1
Create a shared rendering directory on the Design computer.

Step 2
From Start Menu select All Programs\Bentley\MicroStation V8i (SelectSeries \Process Controller for Distributed Rendering

Step 3
•Enter the path and name for the shared rendering directory. By selecting the magnifying glass and picking the shared directory from the displayed list, will give you the local path to the shared directory.
•The system will ask you if you want to use the UNC (Uniform Naming Convention, \\server\volume\directory\file) path for the shared directory, click the Yes button.

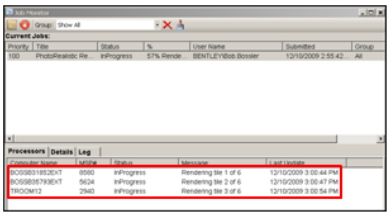


Step 4
Repeat step 3 for all machines that will be used for the distributed rendering process.

Step 5
Repeat Step 2 for each machine pointing to the Shared Directory. Confirm that each computer has the Bentley Distributed Processing Scheduler in the system tray.

Step 6
Render the model using the Begin Network Rendering Tool in the Luxology Rendering window. If you click on drop down arrow, you can enable the Include Current Session and this will include your local computer in the rendering process.

Step 7
Distributed rendering begins and the first preprocessing and illumination are accomplished on the local machine then the other machines will complete the rendering process.



➔ **How to set up Distributed Rendering:**

1. From the Start menu, select *Bentley > MicroStation V8i(SELECTseries 3) > 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.

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

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.

Luxology Network Rendering

Selecting the Begin Network Rendering tool in the Luxology Rendering dialog, creates a distributed rendering job that renders a new solution of a selected view or, if a fence is present in the view, the fence contents.

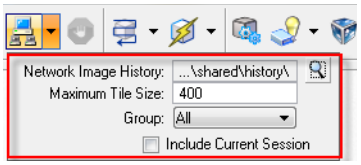
Note: When using distributed rendering from the Luxology dialog to render a high resolution still image, it is not necessary to have design and workspace resources shared on the network. These assets are converted to a render-optimized format and copied to the distributed rendering shared directory for use by other distributed render machines. The machine that submits the job has to complete the preprocessing phase and package the design resources by itself. After that, one machine handles the illumination computation phase by itself (if Irradiance Caching is turned on in the active render setup). Once there is no more illumination passes to compute, all the other machines join in the rendering job to contribute by rendering portions of the scene called buckets.

Note: When sing Distributed Rendering is used to compute animation frames an entire frame is rendered by each contributing computer or node. In this case each of the contributing nodes will compute the irradiance passes and render the frame before moving on to the next one on the sequence.

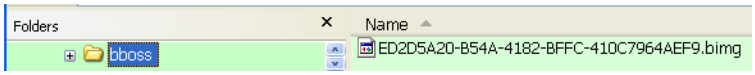
After submitting a distributed rendering job from the Luxology dialog, clicking Cancel in the Luxology dialog cancels the distributed rendering job for all machines. Closing the Luxology dialog while the distributed rendering is active only causes the active session to stop previewing and participating in the distributed rendering job. If there are still other machines working on the distributed rendering job, the final result is placed in the Network Image History folder.

Luxology Network Rendering Options

Clicking the arrow next to the Begin Network Rendering tool will display the network rendering options.



- Network Image History specifies the folder in which the files created by Luxology distributed rendering are placed.



- This is different from the Luxology history folder because that directory may not be accessible to other machines that participate in distributed rendering jobs. If this directory is not accessible by other machines, Luxology distributed rendering jobs may not succeed.
- Maximum Tile Size specifies the largest size for each distributed rendering tile. In general, larger tile sizes offer better performance making them too small will result in slow down as you are waiting on the network. Use a smaller tile size only if there are many machines participating in the distributed rendering job to ensure that each gets its own tile on which to work.
- Group specifies the distributed rendering that will be allowed to participate in this job.
- Include Current Session specifies whether or not the current session will also work on the distributed rendering job. If this option is checked, the current session handles the illumination computation phase of the rendering. This is an easy way to ensure that the most powerful machine in a distributed rendering farm handles this phase, which is important since this is the longest portion of rendering an image that cannot be distributed across multiple machines.

Saving 3D Content in PDF Files

With the release of Adobe® Reader® 9.0, Adobe´s PDF format supports the embedding of 3D content within documents. In MicroStation, the creation of PDF documents with 3D content is similar to printing a standard 2D document.

Where 3D content is included, it will contain any visualization data and settings that already exist within the design file, such as lights, materials, texture maps, and animation or camera movement (flythroughs). Additionally, Saved Views are included in the 3D content.

Any 3D content within a PDF document is stored in “Universal 3D” (U3D) format. This format was introduced by the 3D Industry Forum (http://www.3dif.org/) as a means for transferring three dimensional data from CAD systems to mainstream applications such as marketing, training, sales, technical support, and customer service. MicroStation lets you export geometry directly to U3D, or to seamlessly create PDF documents with embedded U3D objects.

Adding 3D content from design models

From a 3D design model, you can add 3D content to a PDF file simply by selecting Bentley Driver and enabling the Print to 3D setting in the Print dialog.

3D Plotting Options

Settings that control the 3D content are found in the 3D Plotting Options dialog (*Settings > 3D Plotting*, in the Print dialog). These settings, which are saved in the user preference file, are retained between sessions.

Animation in 3D content

Animation scripts created with MicroStation’s Animation Producer (*Utilities > Render > Animation*) can be used to specify geometry or camera motion that can be exported to U3D and viewed dynamically within the PDF document. When a model is saved to U3D the script currently loaded in the animator, is used to specify the U3D animation. In Adobe Reader, the animation can be started or paused by selecting the 3D object and then selecting the Start Animation or Pause Animation buttons from the tool bar.

Creating 3D content in PDF

To demonstrate this feature, in the next exercise you will create a PDF file that contains 3D content. The data set that you will use also includes an animation script for a simple fly around of a building. The animation script is provided for you to see this functionality when creating the PDF file. Details on the creation of the animation, however, is beyond the scope of this course.

➔ **Exercise: 3D in PDF from a design model**

1. Set the following in the File Open dialog:

   User: examples

   Project: General

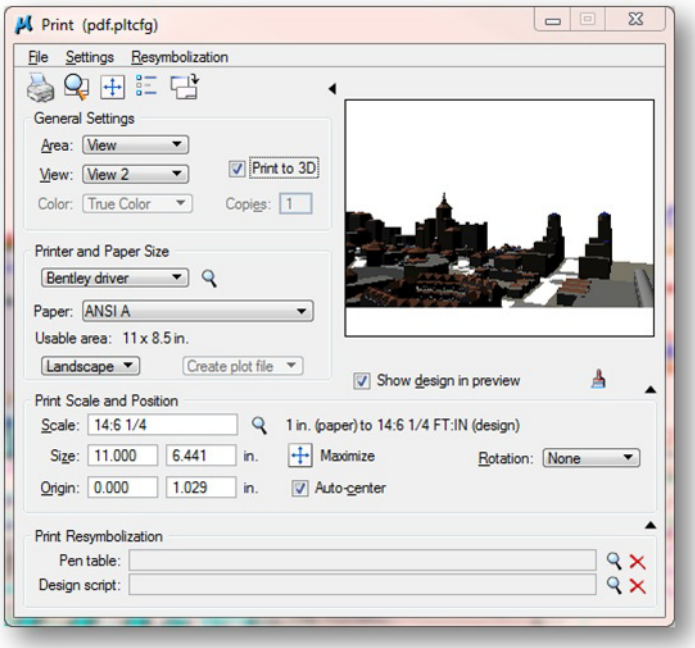
2. Open Animation.dgn, and then open the model Actor Targets.

3. From the main menu bar, select *File > Print* to open the Print dialog.

4. Set the Printer to Bentley Driver and select pdf.pltcfg as the printer driver.

5. In the Print dialog, enable Print To 3D.

6. In the Print dialog, select *Settings > 3D Plotting*.



7. In the 3D Plotting Options dialog, set the following:

   Convert Animation: Enabled

Automatically Activate Animation: Enabled

8. Click OK in the 3D Plotting Options dialog.
9. In the Print dialog, click the Print icon or select *File > Print*.
10. Set the Directory in Save Print As dialog to C:\.
11. Click OK to save the Animation-Actor Targets-000.pdf file to the hard drive.

    A progress bar appears at the bottom of MicroStation application window, indicating the percentage of completion. Once the PDF is finished you will see message Finished Creating Print at the bottom of screen.

The 3D content in the Adobe PDF file will be displayed using smooth shading. For best results you may need to adjust your materials to look their best using smooth shading. For instance a glass material that looks great ray traced may appear too transparent when smooth rendered.

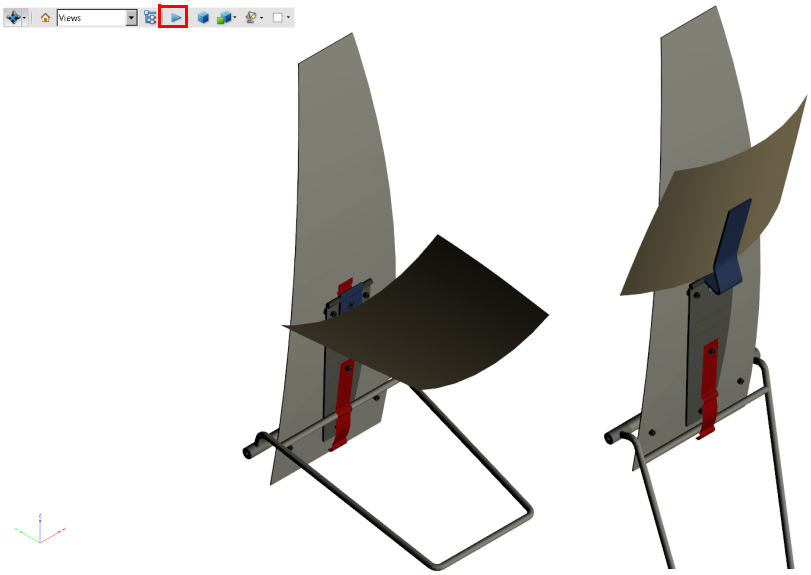
Note: The design file used for this exercise has an associated Animator script, and the animation will playback on startup from Adobe Acrobat Reader 9.

Interacting with 3D content in Adobe Reader

In order to open the PDF file generated in MicroStation, it will be necessary to download and install Adobe Acrobat® 9.0 or later version, if available. Currently, you can download the software from http://www.adobe.com/products/acrobat/readstep2.html.

Once a PDF document containing 3D content is created from MicroStation, it can be opened with Adobe® Reader® 9.0 in the same manner as a standard PDF file. Inside the PDF file, clicking on a 3D object will activate a toolbox with a set of tools for navigating within the scene. The standard Adobe Reader tools (Rotate, Navigate, Zoom, and Pan) are documented in the Adobe Reader Help. Saved Views are available from the Views menu entries. The following are two images

from the Adobe animation. Remember to click on the play button to start animation.



MicroStation V8*i* for Animation Assessment

Assessment is often equated with evaluation, but the two concepts are different. Assessment is used to determine what an individual knows or can do.

Complete the assessment to see what you have gained from reviewing this module or course (access to surveygizmo.com is necessary).

Note that assessments are for classroom or virtual classroom learning, and not for OnDemand learning.

Take Assessment