AV9938 - Construction Animations

Description

Learn how to create construction-sequencing animations in 3ds Max software using data from Revit software and Navisworks software.

This class will show you how to prepare data export from Revit and Navisworks to get the best results for lighting, rendering, and animating in 3ds Max software.

Learn how to set up the imported data to reflect different types of construction sequences on a timeline, including appearance, movement, and scaling simulations, while also using 3ds Max data for vehicle and crane simulations.

See how this software workflow can help you market your construction project to a broader range of stakeholders and win new prestigious projects for your organization.
Learning Objective 1

Learn about data preparation for rendering and animation

Revit
Navisworks (56 formats)
3ds max

Learning Objective 2

Learn about lighting and rendering setups

Daylighting
Artificial lighting
Global illumination

Learning Objective 3

Learn about basic animation sequencing

Cameras
Move/scale/rotate
Visibility

Learning Objective 4

Learn about animation outputs

Render engines
Single frames /movie
Post production
Learning Objective 1

*Learn about data preparation for rendering and animation*

**Revit**

working with BIM data

Sending Revit Data to 3ds max – Suite workflows (need the other applications installed to work)

Settings for interior vs exterior settings – use exterior or all the artificial lights will come through
Items that you may not want for a construction animation & could do better in 3ds max

1. Furniture
2. Lighting
3. Vehicles
4. Divide and parts
5. Site works

When the model is in 3ds max you’ll need to decide if you want to maintain the link back to Revit or bind it. If the Design team has finished designing its best to bind it. *note, if you don’t bind and try delete objects from the model you won’t be able – instead convert to editable mesh/poly then you can delete the vertices/faces

Go to the main menu dropdown/references/manage links – select bind (note this will also highlight the temp location of the fbx file)

Next, we want to inspect the geometry.

Hot f4 to bring up the wireframe overlay and 7 to view the polygon count.

Here I have a lot, so I could rebuild a quick site using a 3ds max plane, and reduce the polygon count using modifier tools like pro-optimize.
Here I've created a plane, converted to an editable poly and am using soft selection to replicate the site.

For example, the cellular beams have a number of vertices.
Go to pro-otimser in the modifier stack and hit calculate. By reducing it down to 55% we can reduce the polygon count by 100,000 polys.
If you have a lot of curved geometry and need to keep it in max, consider rebuilding key components using 3ds max polygon modelling. The newer Revit to max workflow does keep the curves lite.

However, if you go through Navisworks this will convert the data differently.
Navisworks (opens 56 variations of file formats)
We can also use other file formats and export them to fbx via Navisworks

Opening other file formats is easy. Even if it’s an assembly type file like this solid works model it will load in all the components into the selection tree on the left and read them in the window.
We can also test render and texture in Navisworks before exporting to 3ds max

Export as an fbx (with options on embedding textures or referencing a location for the maps)
It comes through to max with selection tree as well.

By bringing up the material editor we can quickly texture grab with i-drop tool.
Now a test with quick default renders with no texture or lighting set up. Shown below are:

- i-ray
- mental ray
- ART (Autodesk labs)
- default scan line

Best results out of the box – iray 1minute render 720x405 pixels
3ds max

Lean modelling

If you don’t have access to a high spec computer, and don’t want to wait long times for rendering it’s a good idea to consider lean modelling in max.

Revit is a great tool for producing the BIM data but can create large files which can affect the performance of 3ds max.

Below is a wall from Revit with divide and parts settings giving us 276 polys.
By doing this we drop the count from 276 to 166 polygons – so this is a simple wall, but if this was a high rise tower this technique could save you a lot of time (and stress!)
There are a lot of excellent polygon modelling tutorials out there – many will teach you the basics in 10 minutes.
*note, you can also copy the wall as an instance so if you change 1 wall they all update
Learning Objective 2

Learn about lighting and rendering setups

Lighting can be tricky to set up and it’s always best to try and keep it simple. Materials, environments and detail can affect lighting calculations so keep these in mind if your note getting the desired results.

For this class we will focus on Mental ray & I-ray as the rendering engine however there are a number of great 3rd party render engines out there such as v-ray which can be incredibly fast once mastered.

Daylighting

When we use the suite workflows to export the Revit model to 3ds max, it will transfer through the mental ray based daylight system.

If you right click on the [realistic] text in the upper left hand corner of the screen and navigate to lighting and shadows/illuminate with scene lights it will start to display the lighting in real time. As you move the sun around, the lighting and shadows will calculate in the display.

*note – if you have a heavy model, and an average graphics card avoid doing this!

With the sun selected you will be able to see its properties in the modifier stack on the right. Check the sunlight and skylight are set to mrsun and mrsky (can use the IES settings if working with i-ray)

If you want real world daylight settings click on the date, time and location and choose you country, then city. If needed you can also add latitude and longitudes.
For a quick test render hit ‘c’ to take you to the camera view & hit ‘alt+w’ to bring up the camera view as full screen. Hit ‘f9’ to render or click the middle teapot simple in the ribbon

This is OK, but it was 4.30mins to render this frame (640x480) on a i7-4900MQ CPU @2.80GHz with 32GB ram and an Nvidia Quadro K4100M card.
This is too slow if we want to animate say 4000 frames, so we need to get the frame size up and the render time down.
*note – now you can render from max on the cloud so this could help your productivity, and also currently on Autodesk Labs is ART render which allows you to render 1000 frames of animation.
Artificial lighting. If you’re rendering interiors with artificial lighting this can really slow your render times. The more lights you have, the more calculations are needed as the rays need to bounce off reflective surfaces, and pass through refractive objects (glazing)

*note – for interiors, if you don’t see the item in the view, hide it as it will slow your render times

When transferring the data from Revit with the suite workflows, ensure you tick the lights box to bring through the light source data as displayed.
* note – turn off the lights that don’t affect the scene

When you select the light in the scene ensure it’s turned on and check that it has an IES file as shown

For the test render, we are going to adjust the environment lighting by hitting ‘8’ to bring up the environment and effects menu
Click render preview in the exposure control section (this could take a minute).
You will now get a thumb nail view of the lighting result. You can then tinker the exposure controls to get
the desired shot.
These would be my typical settings to start with for an interior day light scene
And one for a night time scene with the background environment & sun/sky turned off.
The results of the night time internal render with 1 light illuminating the interior.

I’ve used low settings to render this view hence the blotches on the ceilings showing where the light photons have bounced around the space.
Global illumination

You'll notice that when we opened the environment (hit 8) that in the common section there was background environment map called ‘mr physical sky’

This provides the blue sky type background that illuminates the scenes environment. If you want to adjust this, you can drag and drop it to the materials browser (hit m) and adjust the ground color, horizon height etc.
We can also load in our own custom environments such as HDR files. You can buy HDR files from 3rd party sites, and some will also provide you with sample files.  
*Pete Guthrie site* [http://www.pg-skies.net/](http://www.pg-skies.net/)

We can also fake this by increasing the rgb levels in a jpg image.  
*Alex Roman workflow* - watch from frame 8:30  [https://vimeo.com/8217700](https://vimeo.com/8217700)

First, to see the background hit Alt+b and select Use Environment background.

![Viewport Configuration](image)

Next hit ‘m’ to bring up the materials browser and click the get material symbol (top left) then navigate down to maps/standard/bitmaps.
Then navigate to your textures folder and choose a sky image. Ideally you want a panorama image like this.

Load it in then:
1. Make it a spherical environment
2. Untick the V-tile and set the V offset to 0.45
3. Pan down the menu to the output and set the output and RGB levels to 200 (pushes light into image)

Then finally, drag the image into the environment slot (select instance) and then UNTICK the ‘process background and environment maps’ in the exposure control to see the new jpg image in the background BUT turn this back ON for the render!
With a few adjustments you can get some good results – here’s one with a different background and adjusted exposure settings.

To see this a bit better we can render the windows with a different overcast jpg.
Learning Objective 3

Learn about basic animation sequencing

Cameras

Moving cameras around the model is going to be the simplest way to start an animation, but avoid getting too carried away with complex camera paths. It can sometimes be too much to fly a camera around the model from start to end, so instead do one area at a time to communicate a function, space, feature etc.

To create a new camera, go to the create tab and select target camera with an 18mm lenses, then place it in your plan view and adjust the heights to suit.

Then we need to set up the animation times by setting the frames. Click the time configuration button in the bottom right corner and then click re-scale time. Let’s say we want to create a 60 second animation with 24 frames per second – we need 60x24 = 1440 frames.

Therefore we set the END TIME to 1440 (need to wait a few seconds) you’ll now notice that the time line down the bottom of the screen has increased from 100 frames to our desired 1440.
Next we need to decide how many seconds of footage we want our camera to run for – I typically do no more than 6-10 seconds.
For 10 seconds, this would = 240 frames

1. Select the camera and click the auto key button in the bottom right so the key frame section highlights RED
2. Type in 240 into the box to the right of the auto key button, and the slider will move to 240
3. Move your camera to the desired location
4. Turn off the auto key button

Now we see 2 key frame points have been created indicating that we have animated the camera. Hit the play button in the bottom right to test that this has worked*note – before rendering all frames, run a few test renders to check the frame times
Move/scale/rotate

This is where it gets a bit more complex and it’s a good idea to create perhaps a story board with a focus on what you are trying to visually communicate.

Check out LOR’s leaden hall move here https://youtu.be/XT4VFGUk-b8

To keep it simple I’m going to focus on a small part of the building and move/scale/rotate components into place. This will be the buildings corner core

* Note, there are numerous scripts out there to automate these type of animations

Moving objects – like the camera movement, we simply select the items, turn in Auto key an move the item to its location.

*note – use the transform type in to accurately move items around, or use the snaps for accuracy

Scaling objects

Same principal, but we may want to scale in one direction.

For this technique I’ve converted the BIM data to an edit poly and attached them together, then have isolated the object in the view. Use the Non-uniform scale button and right click on it to bring up the
transform type in

In the z-offset type .01 – before you click the auto key, as this is our start point

Then use auto key like before to scale the object back up over 240 frames

To scale it back up to its original height we type in 100,000 in the z value
Now hit play to test – this may require some testing to get exactly right if it’s using BIM data

**Rotating objects**

Before you start rotating the object you may need to check where the pivot point is. Find this by going to the Hierarchy tab and select ‘Affect pivot only’ and move to the desired center point
Finally – go back to your camera view and run them together
Visibility

Select the objects you want to work on and right click top bring up its properties. Make sure your auto key is on and the slider is at 0

Set the visibility to 0 and hit return – you’ll see red selection brackets indicating that it’s captured a key frame
Now click ok, go to frame 240 then right click again to bring up object properties and set it back to 1.

Finally – play the animation to test.
Learning Objective 4

*Learn about animation outputs*

Render engines.

As we are using mental ray as the render engine it will be key to ensure the materials and lighting are set up to work well with the render engine calculations.

The default Autodesk materials that come through from Revit are fine for mental ray renders, however for best results use the Arch & Design materials.

To bring the existing materials into the Material editor use the i-dropper – this one has come in as a Multi/sub-object material.

Simply drag the sub object materials into separate material slots and change to arch & design (make sure you instance them)

Use the Arch & Design pre-set materials as starters (glass, chrome etc) – use Matte finish if unsure
The key thing to focus on is render times – Try not to add reflections to your materials where possible. Only do this when you're using glass (it's hard to fake)! Also, when using texture maps keep them under 1024px unless you have a high spec machine. Try and keep the textures local on your C: drive – Networks can be slow at times.

For textures, a good site to use is CG textures, or there are professional sites like Arroway (8000x8000px PNG files).
Basic texture map above with a simple diffuse texture.

For more advanced textures we can add bump maps and reflection maps. Here’s the settings for painted steel with a small amount of noise for the bump.
Once you have set up your textures run some test renders (1280x720) is a decent HD size for animations (or smaller)
This render ran for 7:55 minutes with the pre-set ‘low’ in Metal ray render (this is rendered on a laptop)

Single frames /movie
the quickest way to get a movie outputted is to render out as an mov or avi file, but sometimes this can be risky, as if the computer crashes you lose the file.

If you render out single frames you can then use the ones that you get in a post-production application to stitch them together. Make sure you save these to a folder and have animation sequence turned on.
Post production

There are several applications out there for post-production. Adobe after effects and Premiere work well for color grading, adding light effects etc.

To understand this better, check out Alex Romans 3min video here on compositing. [https://vimeo.com/8200251](https://vimeo.com/8200251)

A simple workflow to get started here is to use Autodesk Pixlr express. (Note – this is for single frame only)

Go to Autodesk’s free cloud site here [https://pixlr.com/express/](https://pixlr.com/express/) and browse to the image you want to upload. (Not all image file types work, so best work with jpeg)
My Raw render

quick Autofix
Focal adjustment to create some depth of field

Color adjustment to de-saturate the strong yellow and lighten a small amount
From the Subtle effects I use the Ingrid effect at 75% to sharpen and enhance.

And finally from the overlay section a vignette to add some small black edges.
So, when we see these side by side the post produced one jumps out a bit more.