AUTODESK UNIVERSITY 2014

Rendering Workflows between Revit, 3ds Max, and iRay

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VI6141 - This class will describe how to do renderings from a Revit software model inside of 3ds Max software. Maximizing on the connecting power between 3ds Max software and Revit software, you will learn how to efficiently create a pipeline between the 2 applications, and you will discover some effective ways to maximize on the 2 applications in specific situations. You will also learn how to create realistic renderings with very minimal effort thanks to the simplicity, accuracy, and speed of the NVIDIA iray rendering engine. All of this combined will create a workflow that will enable you to create and iterate renderings of your designs in a demanding work environment.

Learning Objectives

At the end of this class, you will be able to:

- Effectively set up models in Revit for rendering
- Set up a direct link between Revit and 3ds Max
- Manage lighting, cameras, and materials inside of 3ds Max
- Effectively output quality renderings and iterate multiple options

About the Speakers

Scott DeWoody has been an artist for almost all of his life. He started in 3D illustration in early 2001, and M. Arthur Gensler Jr. & Associates, Inc., hired him in 2007 to do internal architectural visualization. Since then he has worked on hundreds of projects, including commercial office buildings, corporate campuses, law firms, restaurants, and massive city centers.

Suzanne Miks joined Gensler in 2004 working on the restack of ChevronTexaco (now Chevron) in the iconic Enron Tower. In her tenure with Gensler, Suzanne has worked on a variety of projects types including planning, education, retail, hospitality and corporate interiors. Some of the most notable work was for a non-profile organization known as KIPP: Knowledge Is Power Program. KIPP is a national network of free, open-enrollment, college-preparatory public schools dedicated to preparing students in under-served communities for success in college and in life. Work Hard. Be Nice.
She has a shoe collection that could rival the Kardashians. In her spare time she likes to collect an assortment of witty post-it notes, roller derby, compete on the ¼ mile track in her 2012 Mustang GT California Special, spend quality time at the gun range and brew (not distribute) a selection of alcohol.

Chapter 1: The End Goal

What do you need to accomplish?

- I need to be able to render fast and make changes on the fly. There will be lots of iterations.
- I need to take my designer's files, and create renderings from them fast and efficiently.
- I want to go FAST like Ricky Bobby.

Two types of renderings:

- ***Design/Production Rendering***
  - Used to figure out design problems, and show design options.
  - You, or your lead designer, will be making changes about 5 minutes before the client walks in the door for the biggest presentation of your career.
- ***Marketing/Beauty Renderings***
  - Assumes a majority of design work is completed.
  - No plans to make updates. These renderings will be most beautiful renderings of your life, and will be in every magazine.

IMAGE 1-1: This is an example of what a Design/Production rendering might look like for a project. It can be a very isometric view showing possible furniture, finishing, and lighting layouts.

IMAGE 1-2: This is an example of a possible "Beauty" rendering for a client presentation.

Chapter 2: Revit Setup

View Setup

- ***View Classifications:***
    - Visualization – Scene (Simple Workflow)
        - This is best for speed, and has the least amount of work in 3ds Max.
    - Visualization – Export (Advanced Workflow)
        - This is best for flexibility, but requires the most work in 3ds Max.
- ***Hide objects not seen for rendering for optimization:***
    - Views will only export what is visible.
    - Not everything will be needed. This is up to what you will be rendering.
    - Helps optimize RAM and file size.

Visualization Scene (Simple Workflow):

- Set up a Camera for the view you want to render.
- Make sure lights are visible, and on.
- Make sure elements you do not need are hidden.
- Best for small scenes.
- Make a Duplicate View and show only railing and curved objects.
    - This is only if needed.
    - This must be exported as DWG.
    - Railing and Curved objects need to be hidden in the main view.

Visualization Export (Advanced Workflow):

- Multiple Views for Export
    - FBX: Base Building, Interiors, Core, etc
    - FBX: Curtain Wall and Mullions (Must Filter Out Walls)
    - FBX: Furniture
    - FBX: RCP + Lighting Fixtures
    - DWG: Railings and other curved objects
    - FBX: Site and Entourage
- Make sure unneeded elements are hidden in all views.
- Make sure elements are not visible in more than one view.

Why do the Advanced Workflow over Simple?

- ***File Organization:***
    - Able to “archive” exported versions of your project.
    - Able to organize large projects inside of 3ds Max easier.
- ***Protect against File Corruption***

- By splitting exports you can reduce losing all your work when 3ds Max decides it doesn't want to work on a Saturday.

- ***Multiple people working on the project at once.***
- ***Best way for 3ds Max to handle large scale projects.***

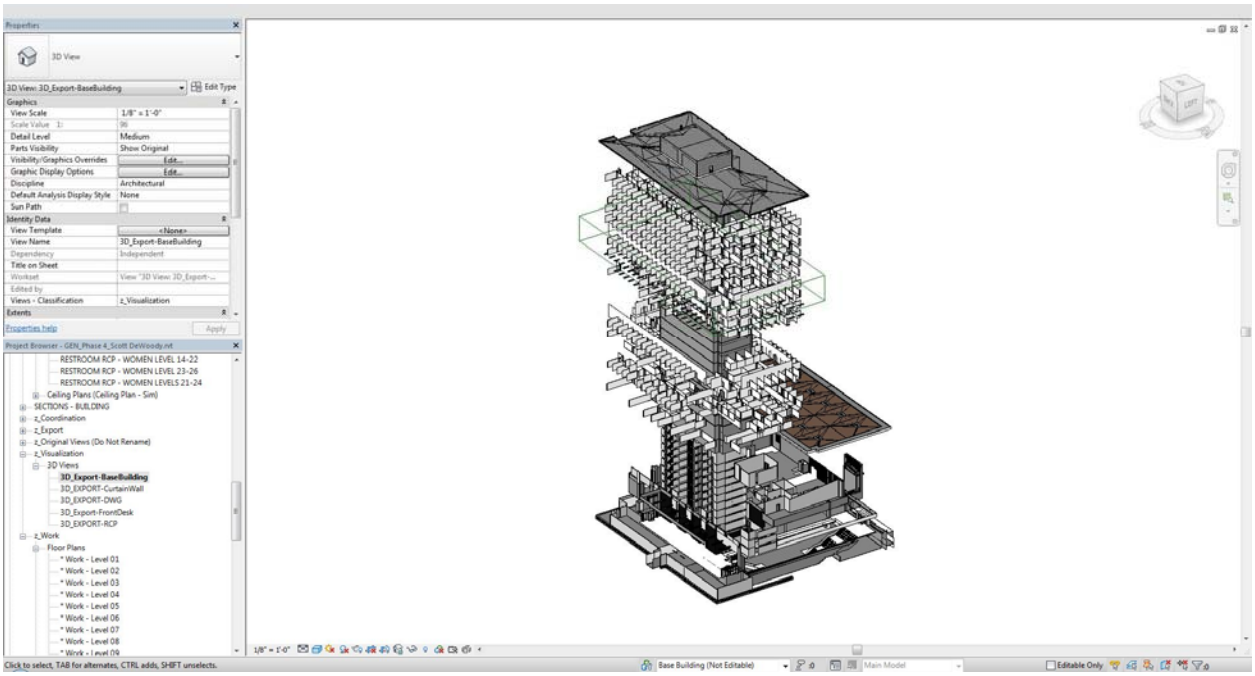

IMAGE 2-1: This is an example of what a "Base Building" view would look like.

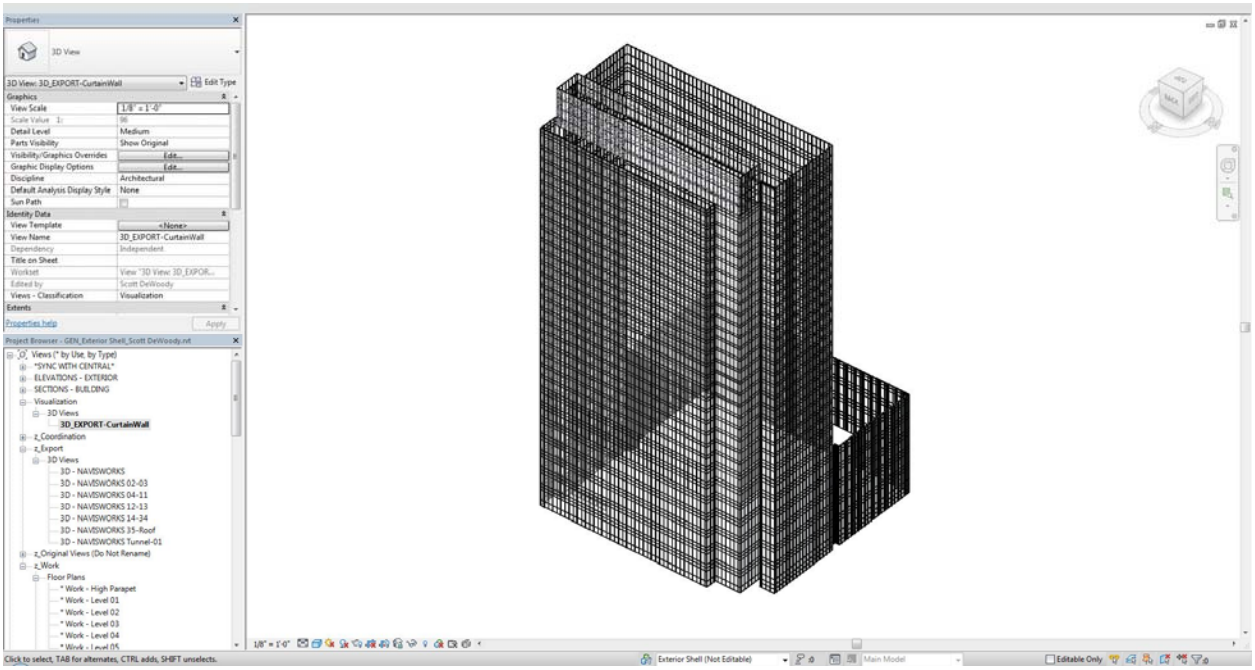

IMAGE 2-2: This is an example of what a "Curtain Wall" view would look like.

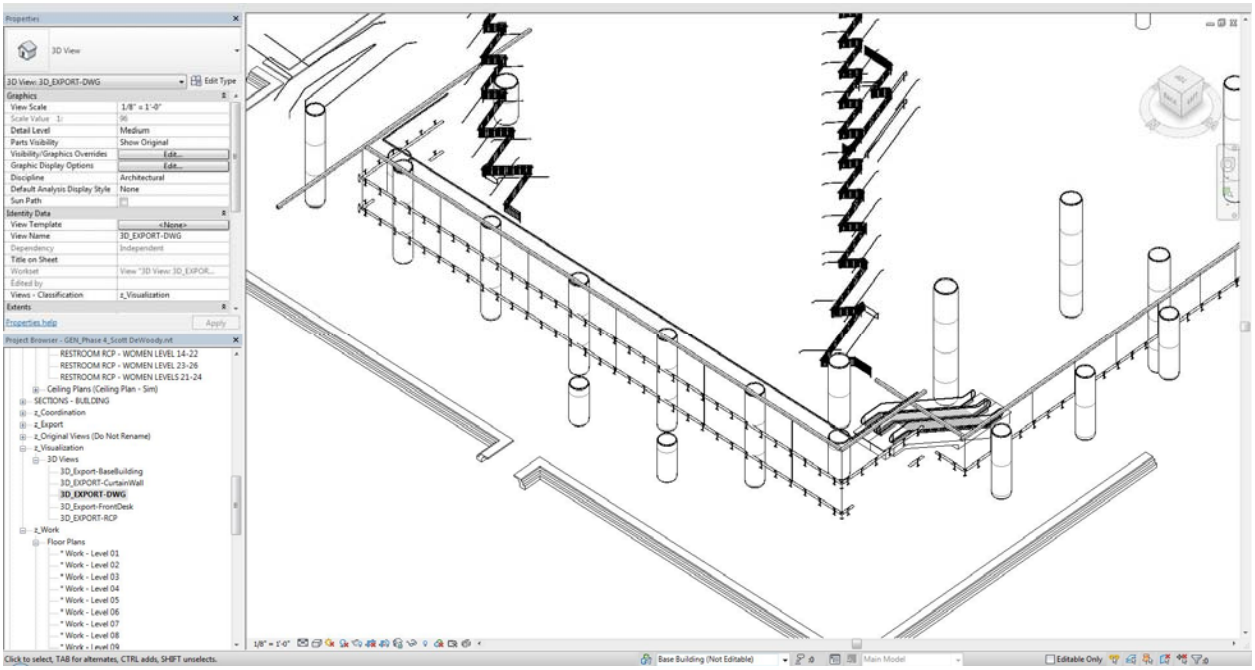

IMAGE 2-3: This is an example of what a "Curved Object" view would look like.

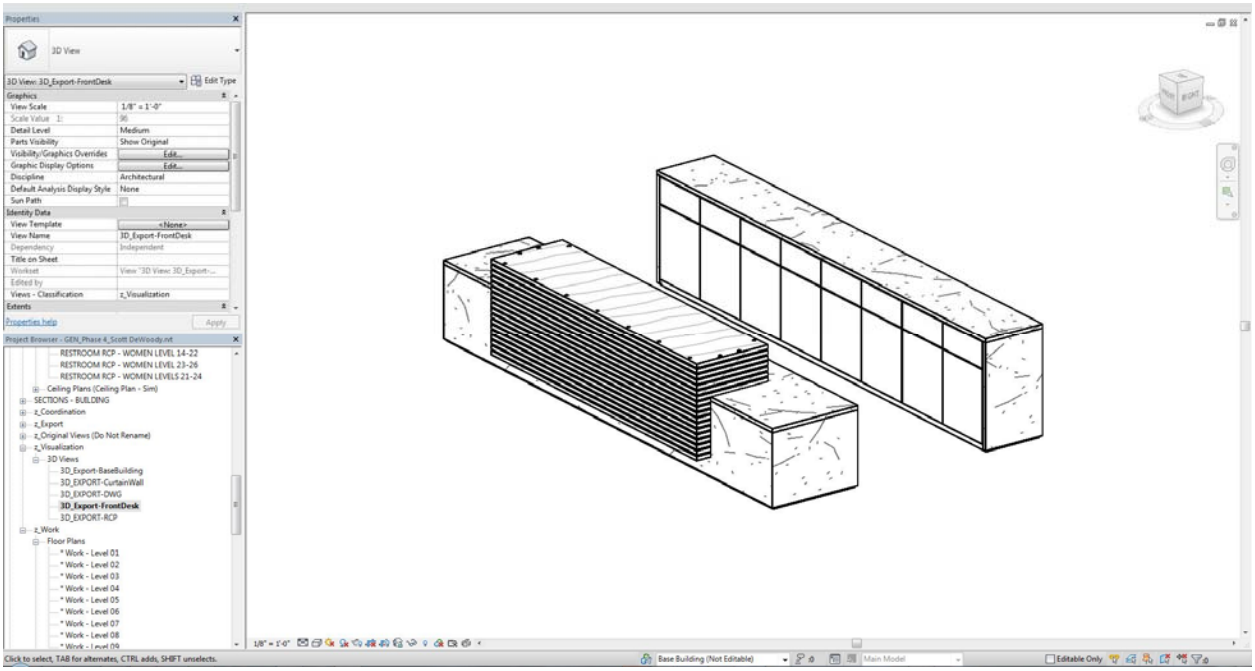

IMAGE 2-4: In this view I wanted to export just the front lobby desk.

IMAGE 2-5: This is an example of what a "RCP and Lighting" view would look like.

Materials

- ***Name your materials!***
  - Consider using a naming convention for all your materials for optimal organization.
- ***Make sure all objects have materials.***
  - Review imported families from 3rd parties. They can sometimes not have any materials applied, or their own names.
- ***Set material properties in Revit.***
  - Only needed if you want to edit materials in Revit instead of doing it inside of 3ds Max.
- ***Graphics Tab does not affect 3ds Max, only Revit.***

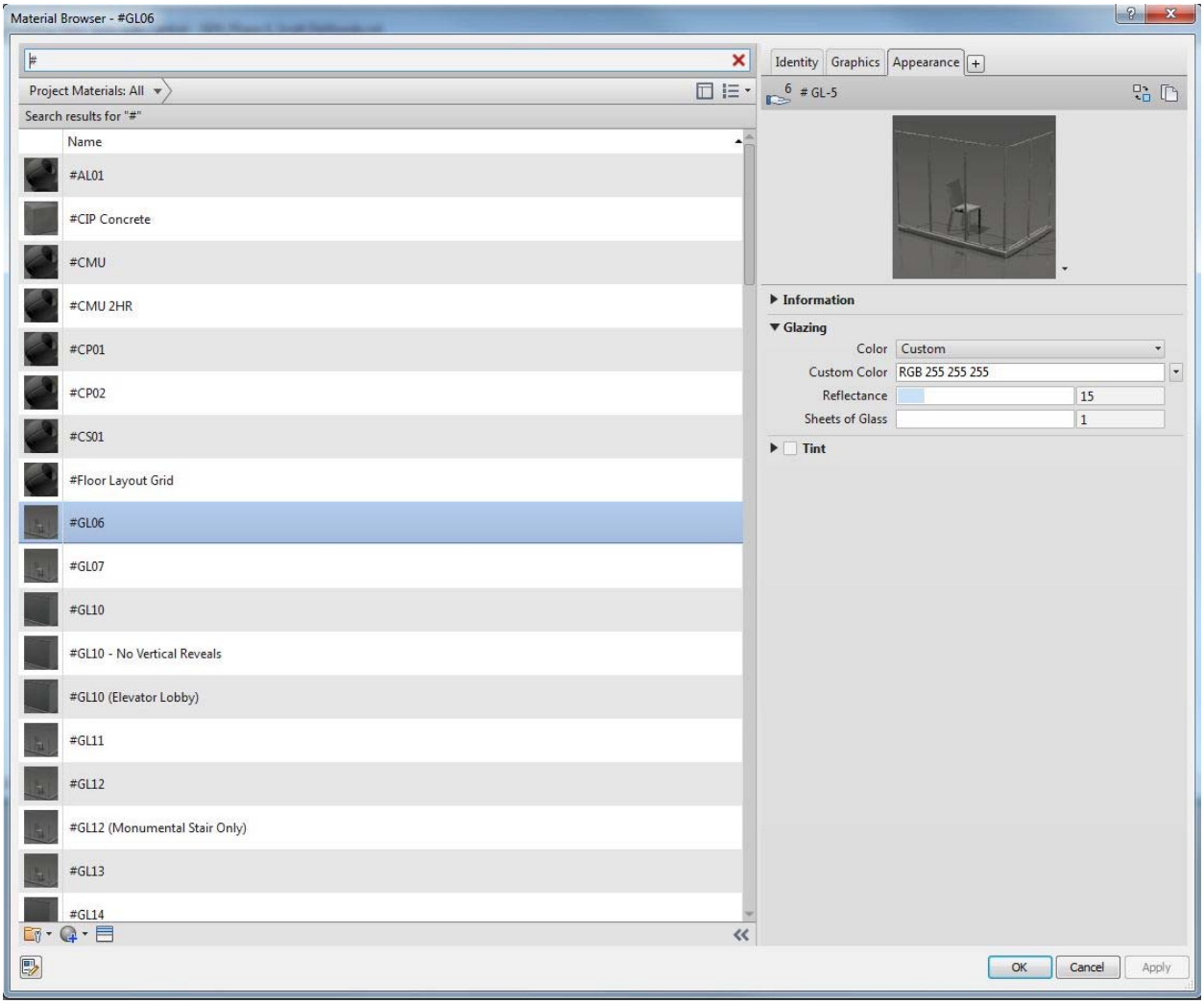

IMAGE 2-6: This is an example of what a Material Browser looks like in one of my projects. Notice the # in front of all the names for easy searching and organization!

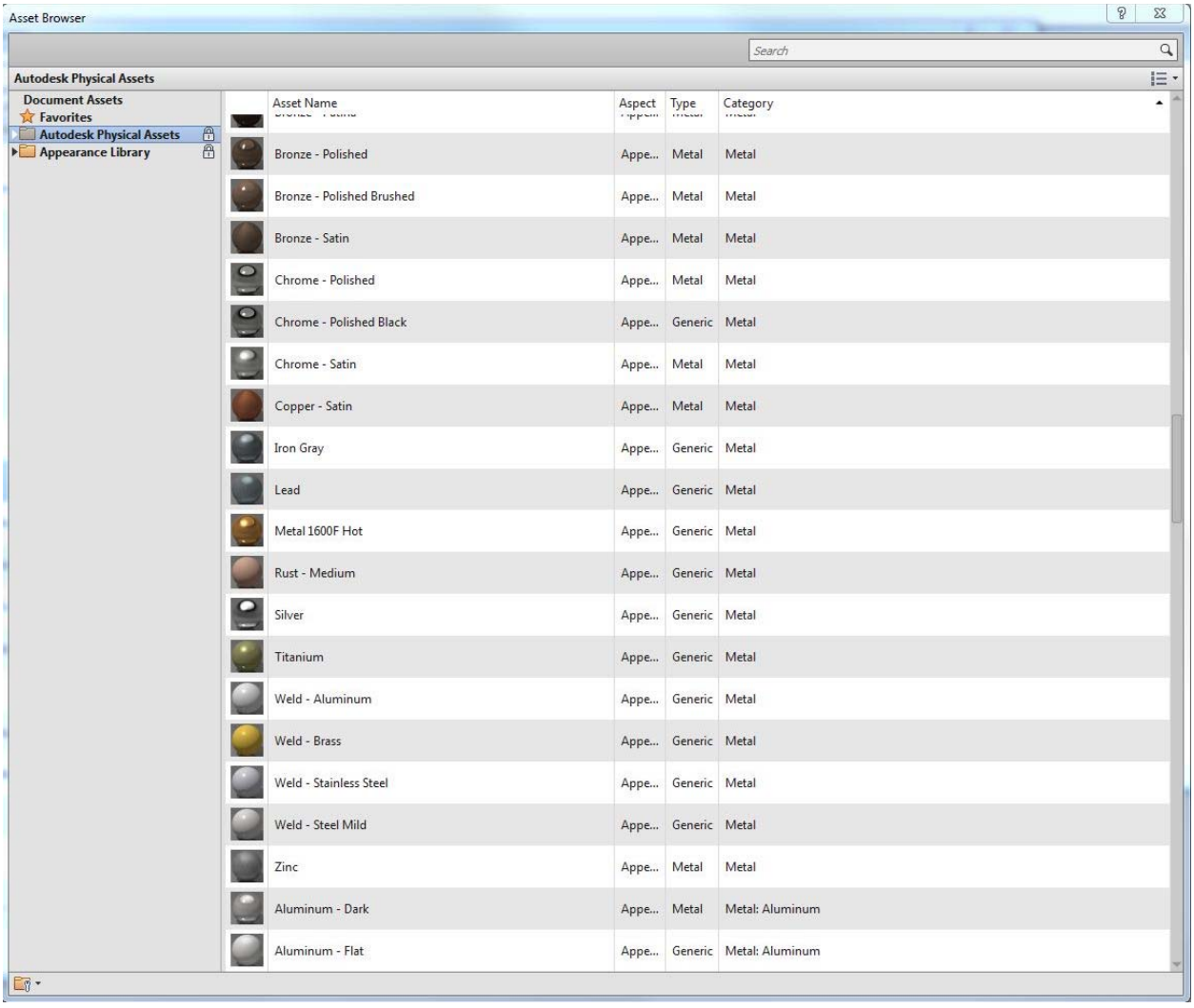

IMAGE 2-7: This is a screen shot from the Asset Browser inside of Revit. There are tons of premade materials for you to select from for your project. All of them will transfer 1:1 to 3ds Max and can be used in either Mental Ray, or iRay.

Families

- ***Make sure Families are optimized for Revit***
  - Poorly created families can have bad performance in Revit, and crash 3ds Max during iRay rendering
- ***Keep track of families with lots of curves***
  - Curved objects need to be exported via DWG.
  - This only applies to curved objects that are created natively in Revit.
- ***Name Families for organization***
  - Use a naming convention that works for you
  - Add and Remove any meta-data in the families that you need
- ***Poorly Created Family Example:***

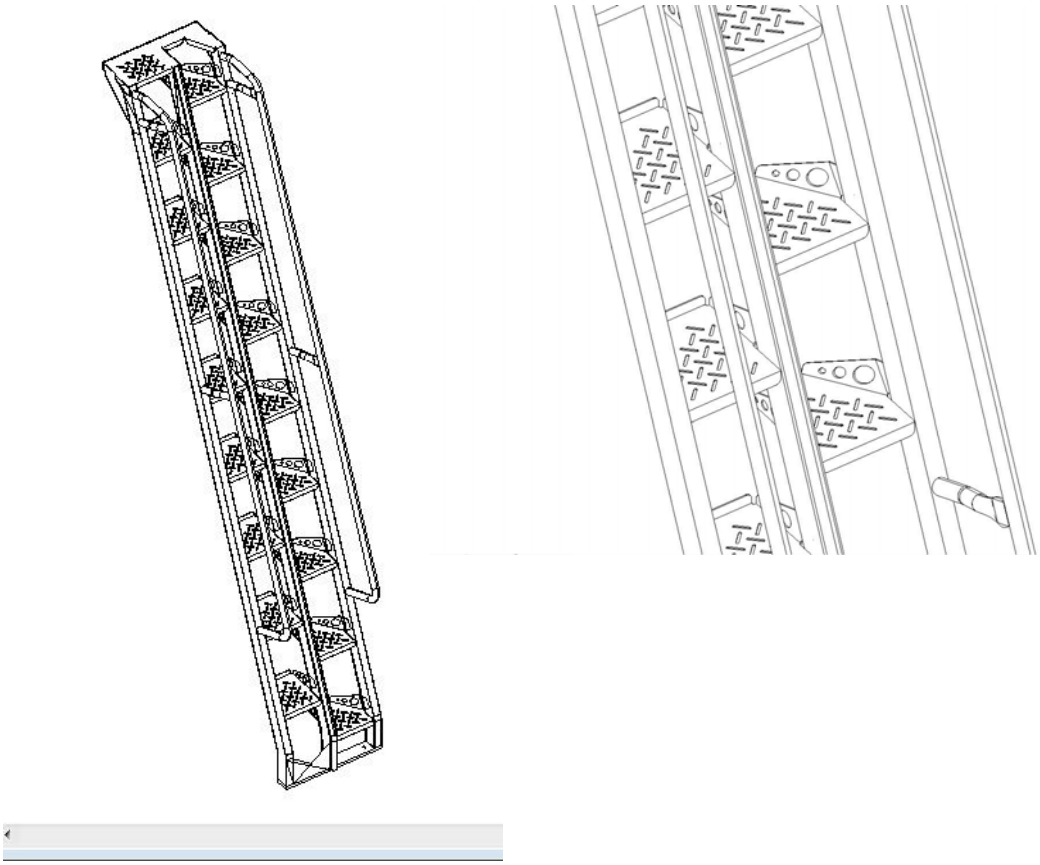

IMAGE 2-8: This is an example of a poorly created family. It has way too much complicated detail for your Revit model, and will slow it down. When this family was exported to 3ds Max, it constantly crashed iRay. If you need a model of this detail, use 3ds Max to create it for optimal performance! Use both pieces of software for their Pros, not their Cons!

Lighting Fixtures

- ***Add Lighting Objects to Lighting Fixture Families***
  - Make sure not to place Lighting Objects inside of the family
- ***Add IES files to the Lighting Objects***
  - This will mimic real-world fixtures, and will add a higher level of realism to your renderings
  - Make sure to set a proper lumens value to the light, if no IES file is available
- ***Use a naming convention to organize lights***
  - Add/Remove any meta-data that you might need

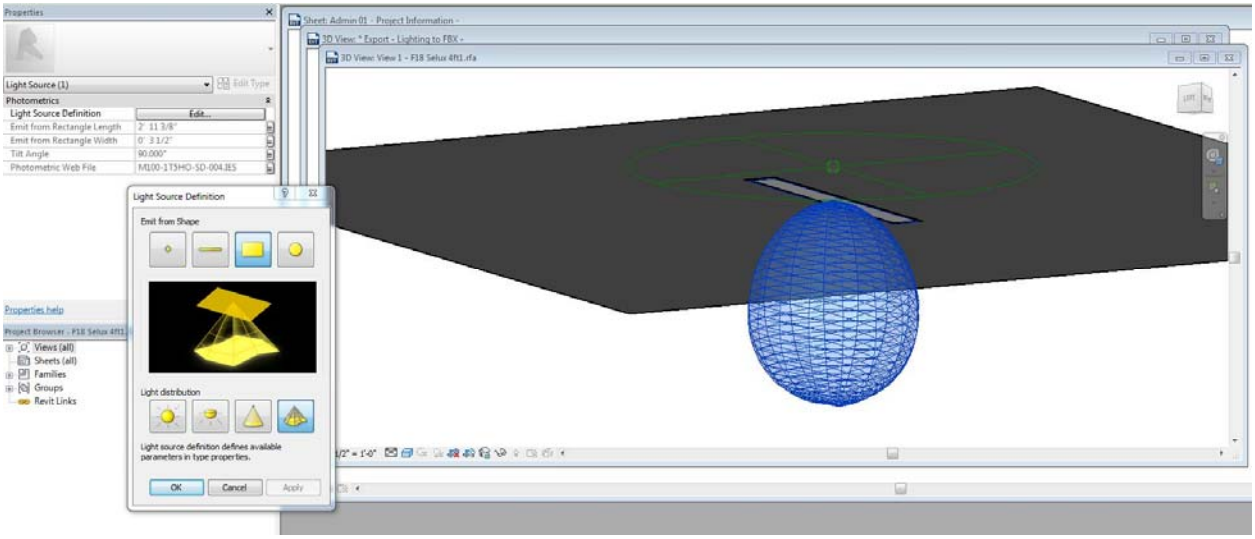

IMAGE 2-9: This is an example of what an IES file with a Lighting Fixture Family looks like. Make sure not to play the light source INSIDE of the light. This will not render properly inside of 3ds Max and iRay. Although IES files are not needed, they add that extra bit of detail to the renderings! You can find IES files from all the major lighting manufactures on their websites!

Chapter 3: Export and Link to 3ds Max

File Link Benefits

- ***All changes done in Revit update to 3ds Max***
  - Super-fast and easy! Just save your files and hit "reload"!
  - Editing geometry in 3ds Max is not advised with linked objects
    - This can cause issues when updating the link
- ***Materials can be edited in either Revit or 3ds Max***
  - *Note*: You can only edit materials in either Revit or 3ds Max
  - 3ds Max has more advanced Materials
- ***People working in Revit and in 3ds Max can work together almost seamlessly.***
  - Communication between team members is the key!

Export File Formats

- ***Export as FBX***
  - Base Building/Interiors
  - Curtain Wall and Mullions
  - RCP
  - Lighting Fixtures
  - Furniture
  - Site and Entourage
- ***Export as DWG***
  - Railings
  - Anything with curved surfaces
  - Example: Cylindrical Columns, Louvers, etc.
  - Objects created outside of Revit will retain their topology

Filter Curtain Wall and Mullions Only

- ***You need to use a filter to only see Curtain Walls and Mullions in their own view.***
  - This is applied in the Visibility Graphics Settings under "Filter".
    - You do not need to do this in Revit 2013 and below.

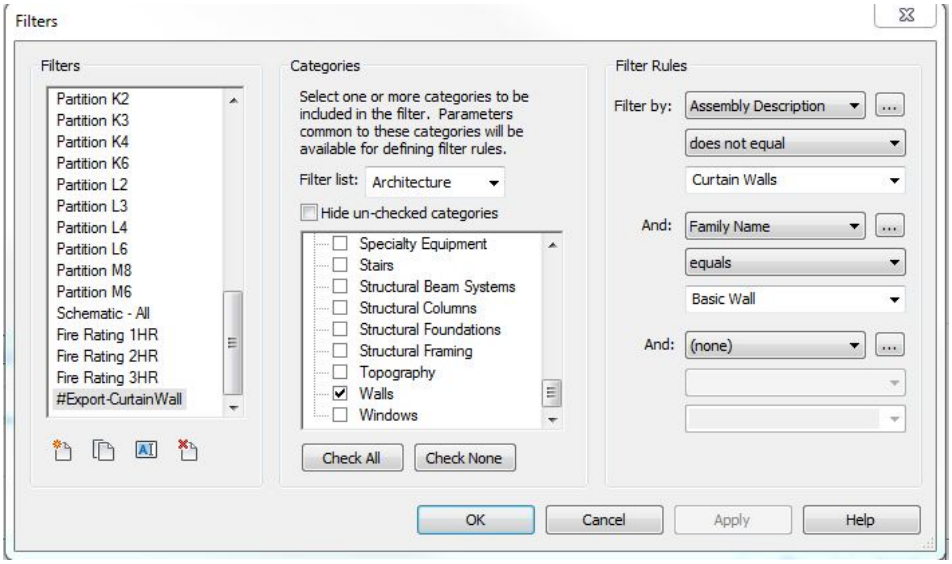

IMAGE 3-1: This is the filter so you can separate the Curtain Wall by itself.

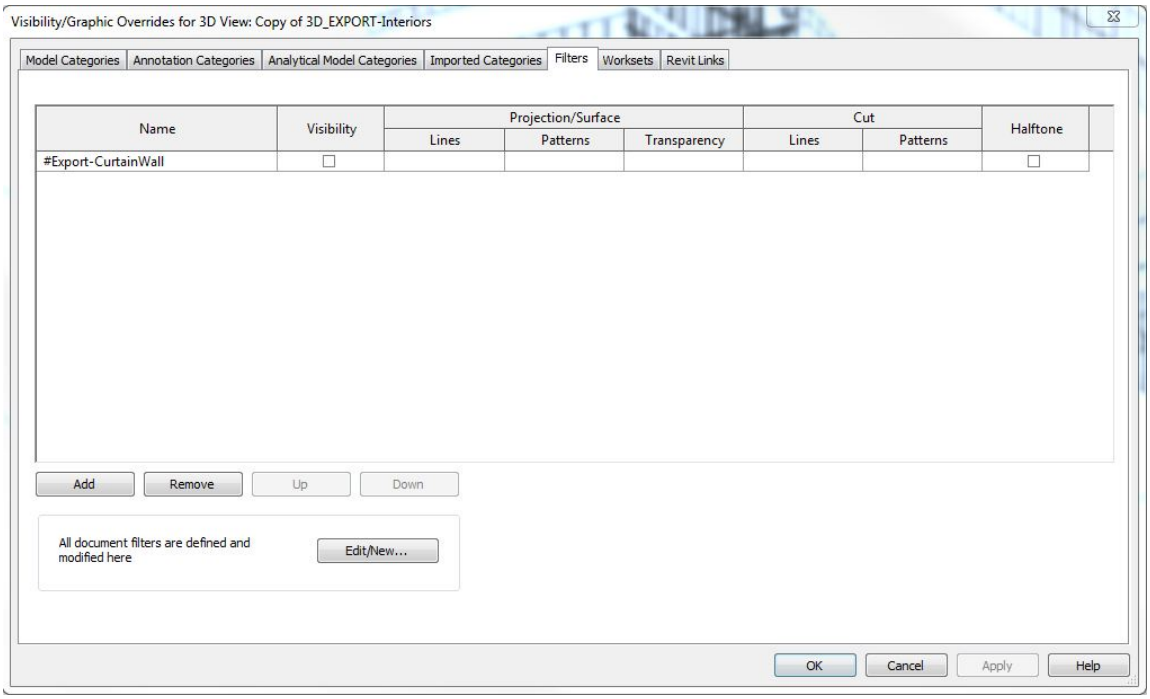

IMAGE 3-2: Make sure to turn the Visibility off by unchecking the box.

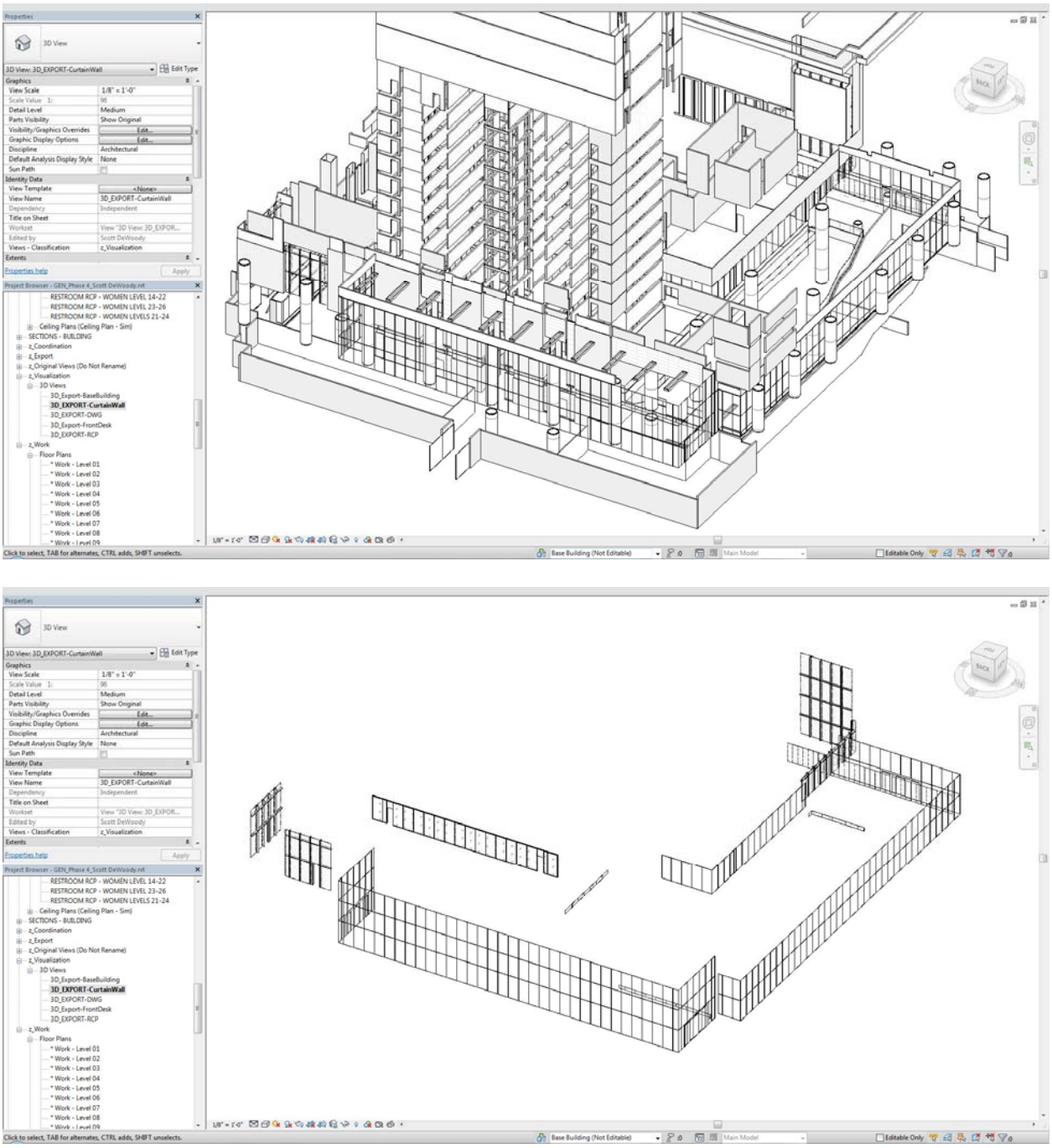

IMAGE 3-3: This shows the before and after implementation of the Curtain Wall Filter.

Exporting Railings and Curved Objects

- ***Export DWG as ACIS***
  - This is located in the export DWG settings under the “Solids” tab.

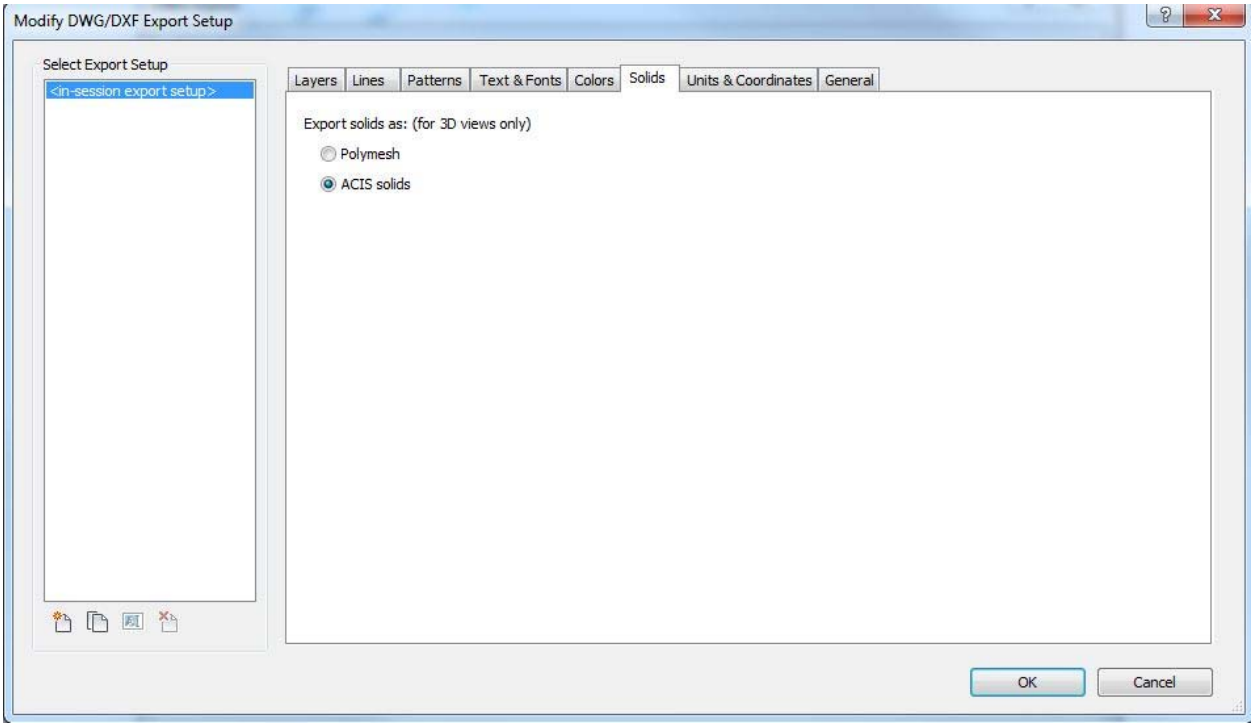

IMAGE 3-4: Make sure to export your DWG files as ACIS Solids. It is Polymesh by default!

FBX Export of Curved Objects

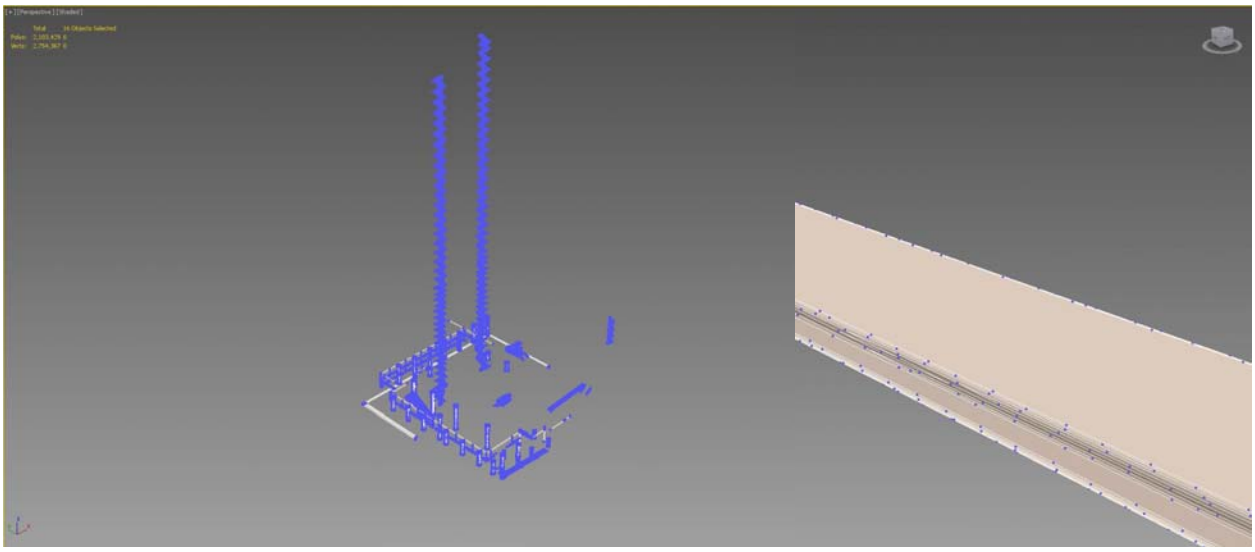

IMAGE 3-5: This shows a curved object imported via FBX. It has over 2 million vertices!

DWG ACIS Export of Curved Objects

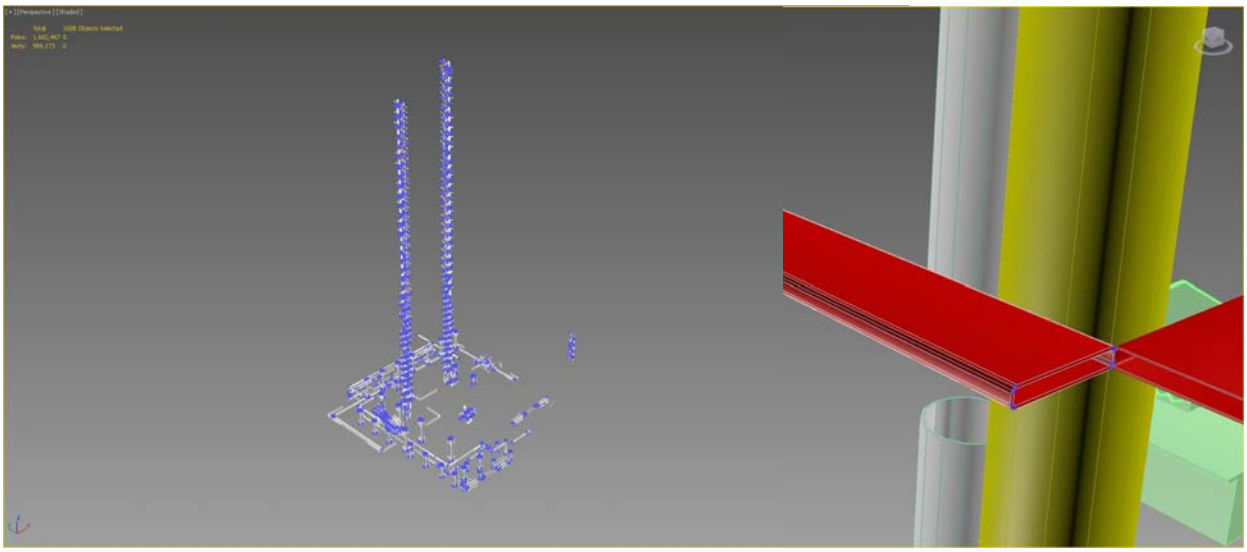

IMAGE 3-6: This shows a curved object imported as a DWG as ACIS solids. It has less than 1 million vertices!

File Units and Import Tips

- ***3ds Max system units need to be set to Feet.***
  - FBX exported from Revit only comes in properly when you use Feet.
    - You will experience issues with modifiers and UVW if you do not.
- ***DWG Files export by default in Inches. This can be changed in the export settings in Revit. If you forget, all you need to do is rescale the DWG on import.***
- ***If directly importing FBX, use the Entertainment Preset when importing for more import options***

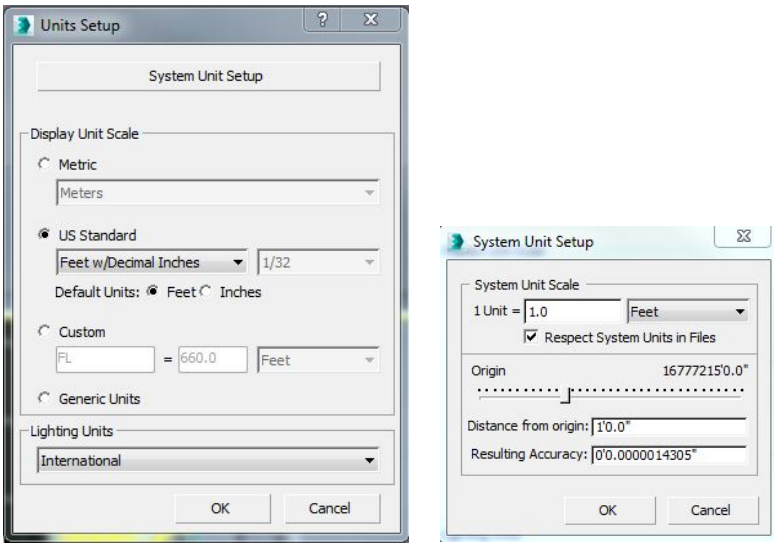

IMAGE 3-7: This shows you what your Display Units, and System Units, should be.

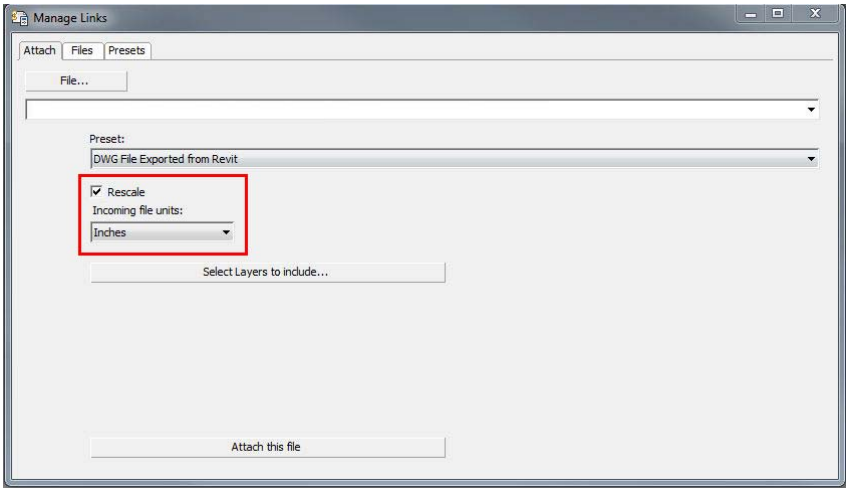

IMAGE 3-8: Make sure to rescale your DWG if you need to! You cannot do this with FBX during a file link. You can rescale a direct import of a FBX file when you select the Media and Entertainment preset.

IMAGE 3-9: This is an example of miss-matched units on import.

FBX/Revit Link Settings

- ***Combine By Materials:***
  - Base Building / Interiors
  - Curtain Wall and Mullions
  - RCP
- ***Do Not Combine (Optional):***
  - Furniture
  - Site and Entourage
  - Railings and Curved Objects
  - Lighting Fixtures

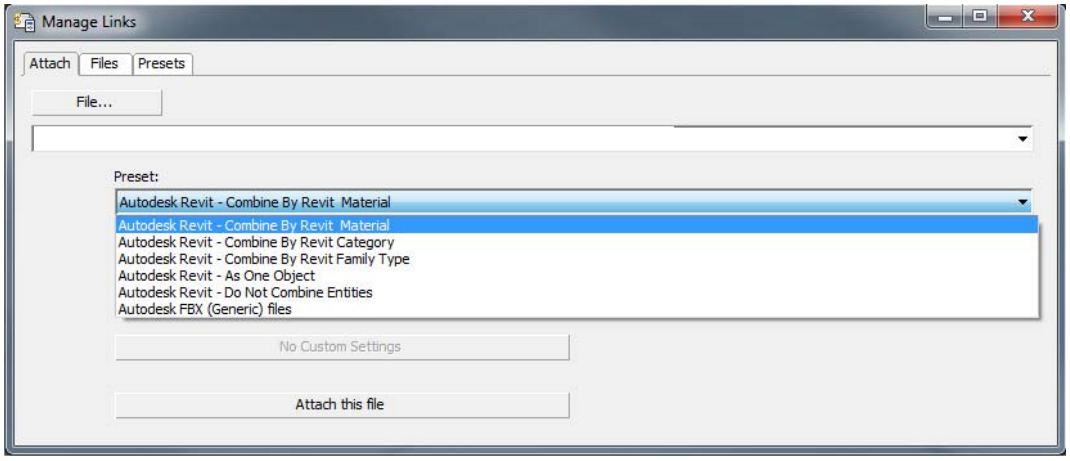

IMAGE 3-10: These are the default presets. You can make your own, or tweak these!

FBX/DWG Link Preset Settings

- ***FBX***

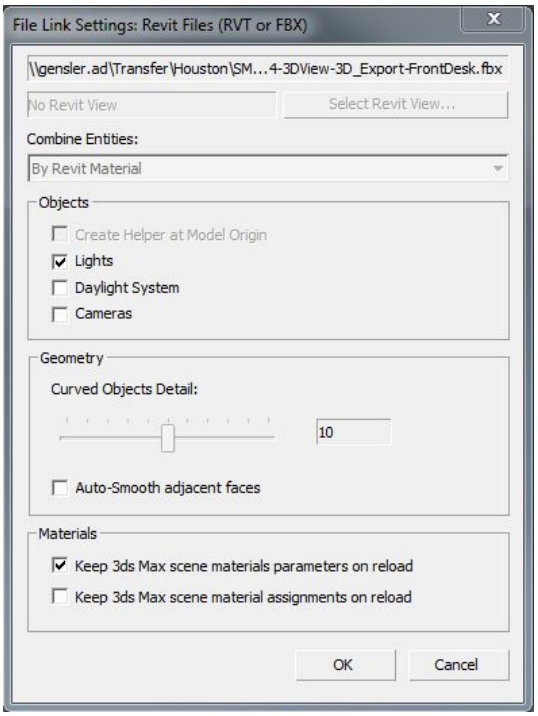

IMAGE 3-11: This is how I set my FBX Import Settings. Make sure to check the second option under Materials if you plan on re-assigning materials in 3ds Max!

- ***DWG***

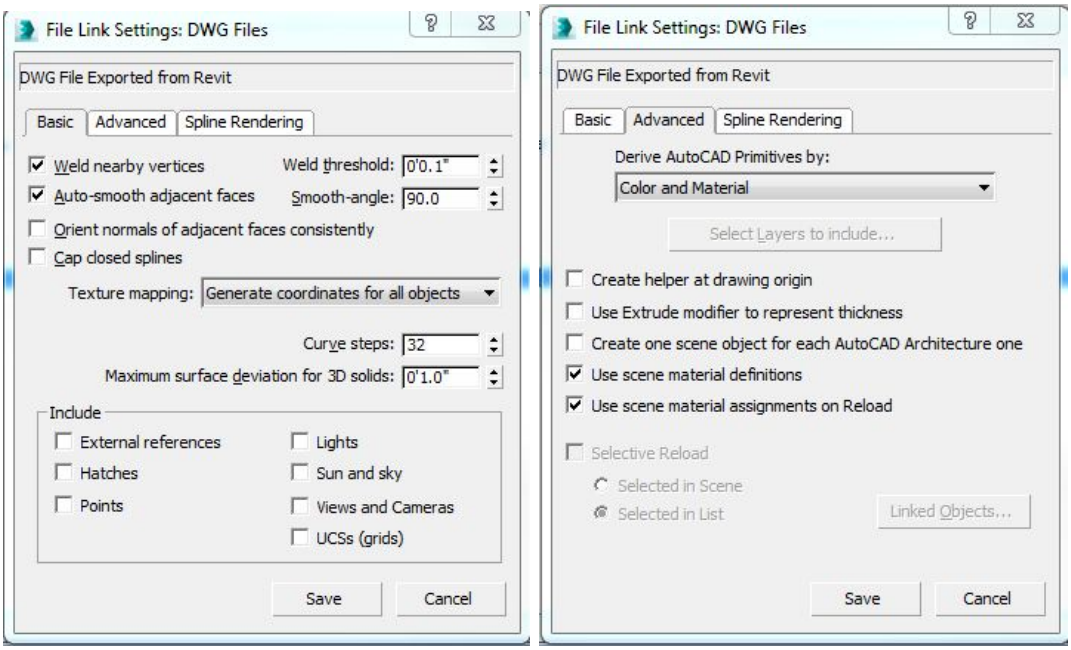

IMAGE 3-12: These are my DWG import settings.

Xref into a "Master" file

- ***Import your multiple FBX and DWG files into their own 3ds Max Files***
- ***Xref all the files into one main "Master" file***
  - Less chance of losing all your work
  - Easier to swap parts in and out
  - Allows multiple people to work on the same project
  - Multiple "Master" Files can be created for different scenarios
  - "Testing" materials and lighting is a little more tedious
    - Create a test file for faster testing, then apply to the main model

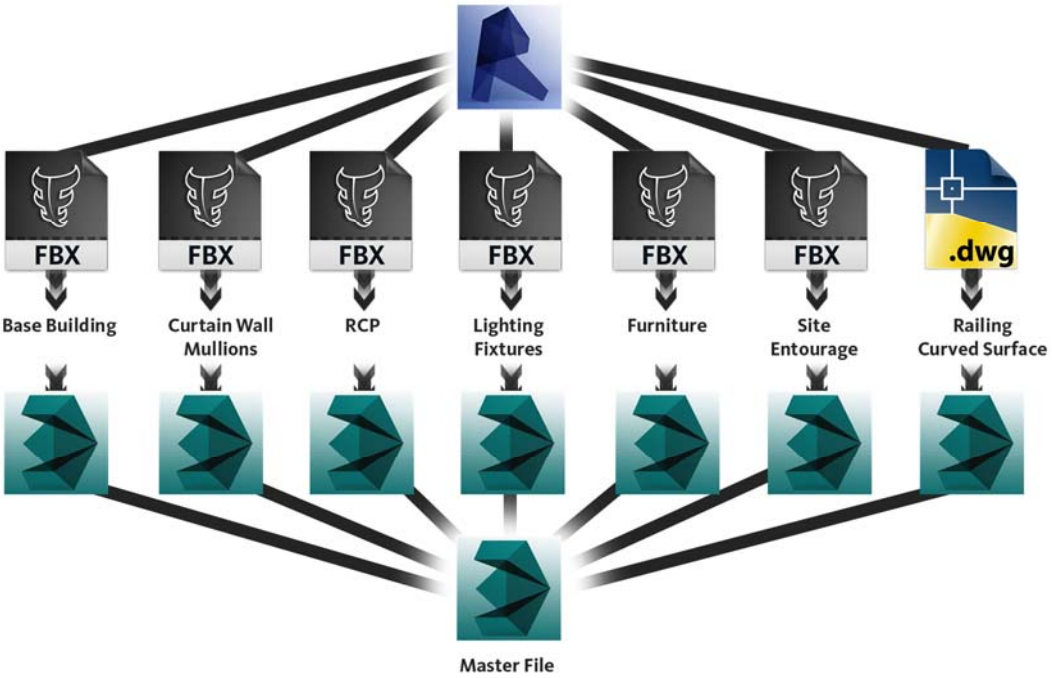

IMAGE 3-13: This is a diagram of my file-link workflow. You can consolidate this if your scene file is small, but I find this to be the best break up. Large project files could require more. A current project of mine has up to 13 different exports, but I only have five 3ds Max files link into the Master.

Chapter 4: 3ds Max Settings

Gamma Settings

- ***Make sure Gamma is enabled and set to 2.2.***
- ***Use the following equation to convert RGB Values into linear values for 3ds Max and iRay.***
  - ((rgb/255)^2.2)
  - When you have a number rollout selected in 3ds Max, hit Control+N to bring up the Numerical Expression Evaluator.

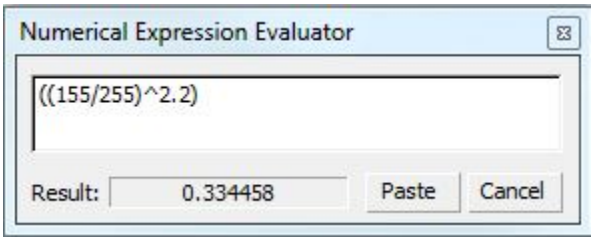

IMAGE 4-1: This is the Numerical Expression Evaluator. It will do math for you

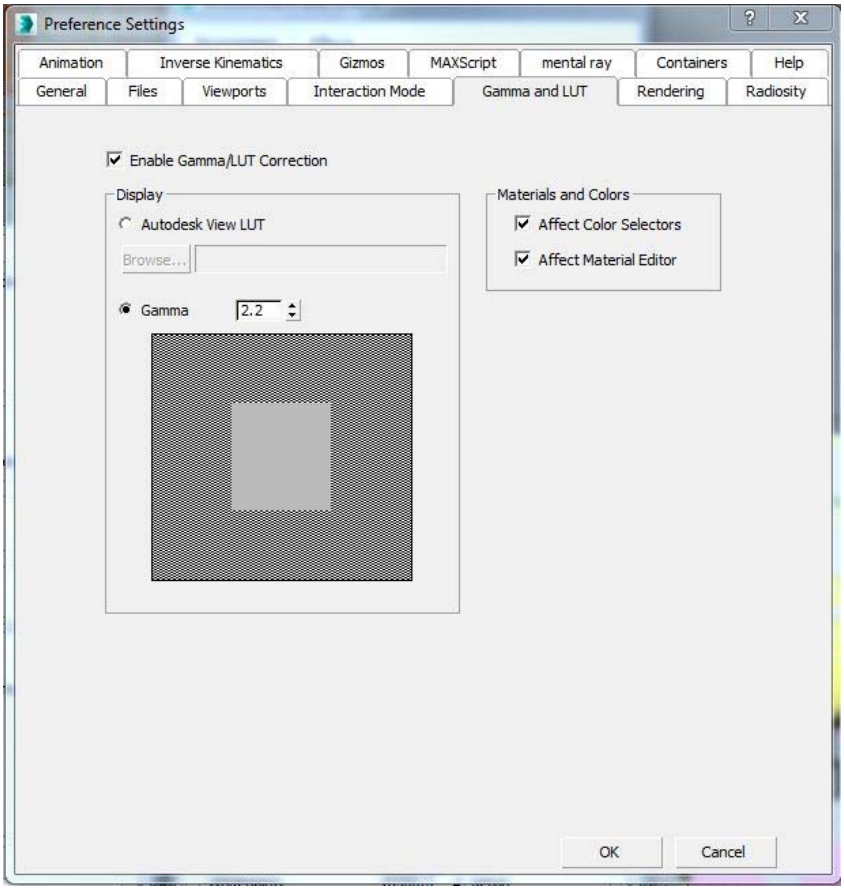

IMAGE 4-2: Here are what your Gamma/LUT settings should look like.

Materials

- ***Compatible Shaders:***
  - Autodesk Materials
    - If you set your material properties in Revit, these will be good to go.
    - Quick and Easy
  - Arch & Design
    - Extremely Powerful, Flexible, and Customizable.
    - Lots of Presets
    - Special Functions
      - Curved/Beveled Edges

iRay Shader

- ***Optimized for use in iRay***
- ***Must download from NVIDIA directly. Not supported by Autodesk.***
  - Download Free at http://blog.irayrender.com/
  - You will also have to install this on all of your render nodes.
- ***Amazing quality and presets.***
- ***Powerful and easy to use.***
- ***Multiple "Coats" for complex, reflective, materials.***

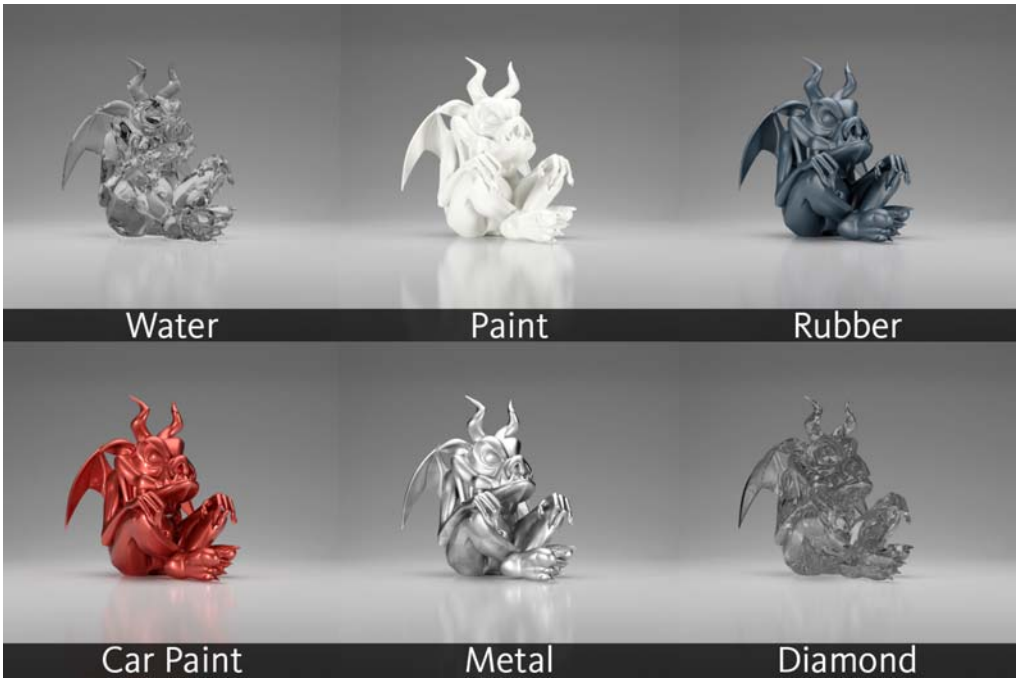

IMAGE 4-3: These are just a handful of examples of different presets in the Arch + Design Shader and the NVIDIA iRay Shader.

Lighting

- ***Use the Daylight System for Sunlight and Skylight***
  - Make sure to add mrSky into Environment Map slot.
  - Control Sun Location and Time via the Motion Tab
- ***Use Photometric Lights for optimal quality and performance***
  - Standard lights not fully supported
  - Lights added in Revit will transfer in
  - Use color temperature for a more realistic look
  - Number of Lights does not affect performance

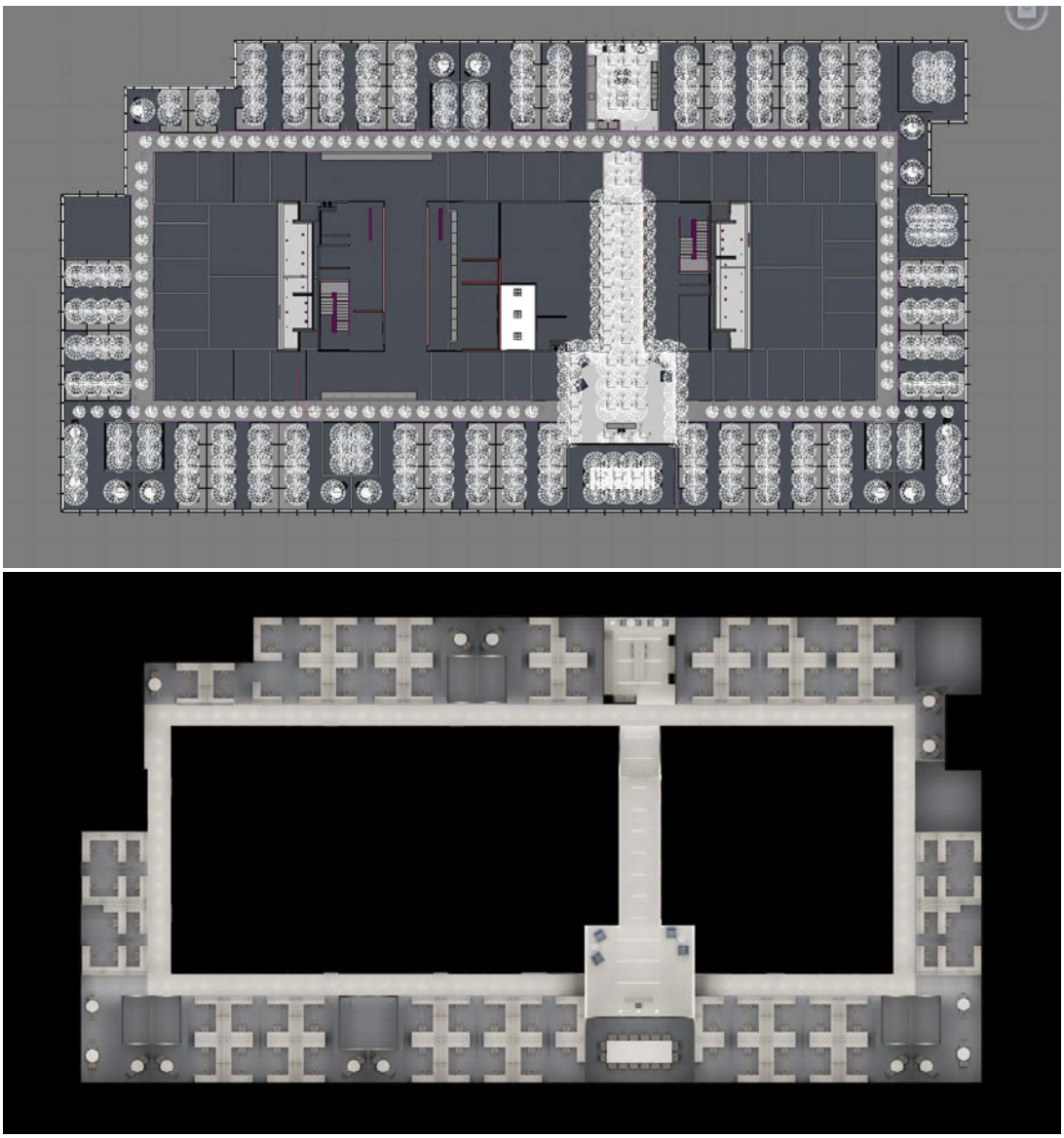

IMAGE 4-4: The top image shows 400+ lights rendered in the scene below it.

Exposure Settings

- ***mrPhotographicExposure***
  - Enable this under Environment
  - Use the EV scale for quick and easy settings
  - Use the Camera Settings for more advance control
    - Try to use real world exposure values for more realistic quality
  - Set Highlight and Shadow settings to 0
    - Better to crush these settings in post, and not the render
  - Make sure to set the White Balance to match your lighting

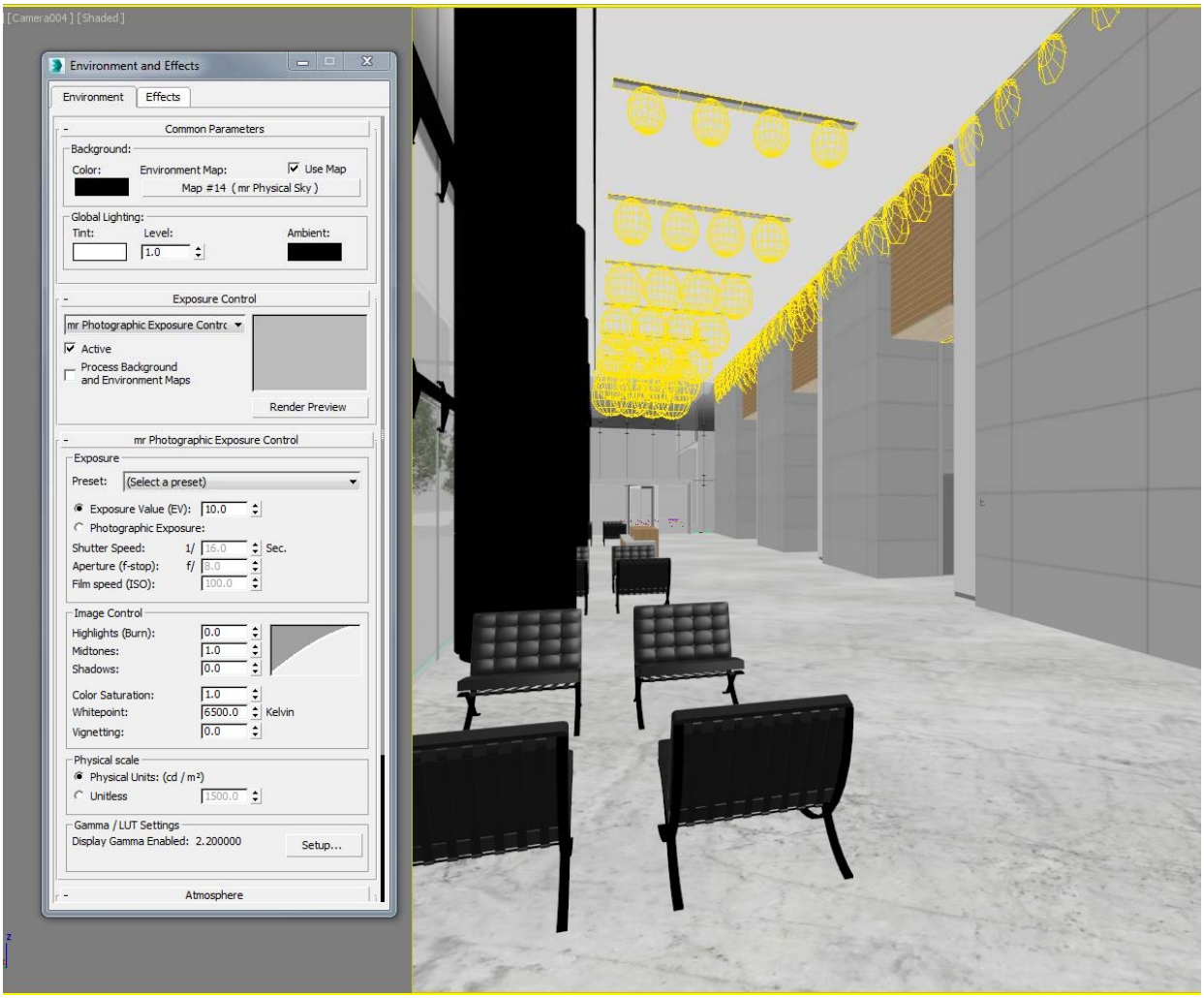

IMAGE 4-5: This is an scene example showing what the Exposure Settings I used for one of the beauty renderings done for this project. An EV Value of 10 was used, with Highlights and Shadows set to 0.0. The White balance is set to 6500K due to the massive amount of daylight coming into the space.

IMAGE 4-6: This is the final output from the previous rendering done in iRay!

Chapter 5: GPU Rendering

GPU Rendering

- ***Photo-Real 3D Render with a strong parallel to Photography.***
- ***Progressive Rendering (Develops like a Polaroid)***
- ***Physically based (Unbiased)***
- ***Interactive***
- ***Floating Point (32-bit)***
- ***GPU rendering is extremely dependent on RAM.***
    - ***If you cannot load the entire scene on to the card, it will not render.***
    - ***You are only as good as the weakest card in your system!***

IMAGE 5-1: The image on the left was rendered with iRay, and the image on the left was the Photo taken for reference. It's very hard to tell the two apart! (Images provided by NVIDIA.)

GPU Recommendations

- ***K2200 ($)***
  - *Entry Level*
- ***GTX 970 ($)***
  - Entry Level
- ***GTX 980 ($$)***
  - Best Bang for the Buck
- ***Titan Black ($$)***
  - Super-Fast
- ***Titan Z ($$$)***
  - Stupid Fast
- ***K6000 ($$$$$)***
  - Top Card

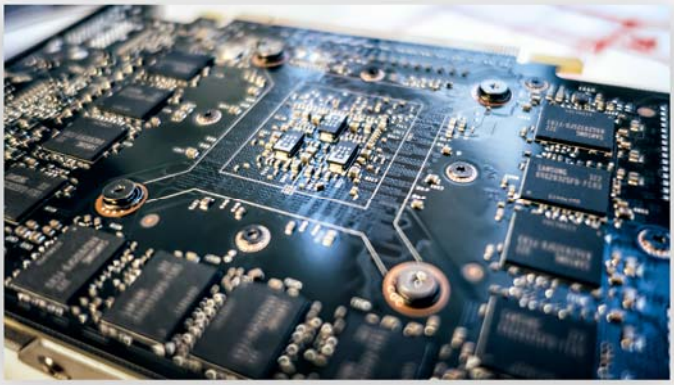

IMAGE 5-2: This is what the GTX Titan chipset looks like!

GTX Vs Quadro

- ***GTX***
  - Built for gaming
  - Run SUPER HOT
  - HIGH Power Consumption
  - Decent Viewport Performance
  - Cheaper than Quadro
  - Not much RAM on entry level cards
- ***Quadro***
  - Built for CAD Applications
  - More Energy Efficient
  - Excels Viewport Performance
  - More dependable than GTX
  - Lots of RAM
  - K6000 @ 12GB

GPU Configurations

- ***It is recommended to have at least 2 GPUs for interactive rendering.***
  - Interactivity will need one GPU set for Windows only.
  - Do NOT put GPUs in SLI Mode for rendering.
- ***Optimal Configuration:***
  - GPU 0 – Windows (Quadro K2200, K4200, K5200, K6000)
  - GPU 1 – Rendering (GTX Titan, GTX Titan Z, K6000)
  - GPU 2 – Rendering (GTX Titan, GTX Titan Z, K6000)

Chapter 6: iRay

Render Settings Overview

- ***Enable iRay in both Production and Active Shade***
- ***Setting Rendering Calculations:***
  - Time – How long to render (Best to control time)
  - Iterations – How many calculations (Best for consistent quality)
  - Unlimited – Go until I say stop. (Best in Active Shade)
- ***Set Hardware Resources:***
  - Set the number of CPU Cores to render with
  - Set which GPUs will do the rendering
    - Disable GPU-0 (Windows) in AcitveShade for better performance

iRay Production Mode

- ***Enable all CPUs and GPUs.***
  - Shake and Bake!
- ***LPEs are only available during Production Rendering.***
- ***Best for rendering animations.***
- ***Optimal Iterations for quality:***
  - Exterior: 3,000 – 5,000 Iterations
  - Interior: 10,000 – 15,000+ Iterations

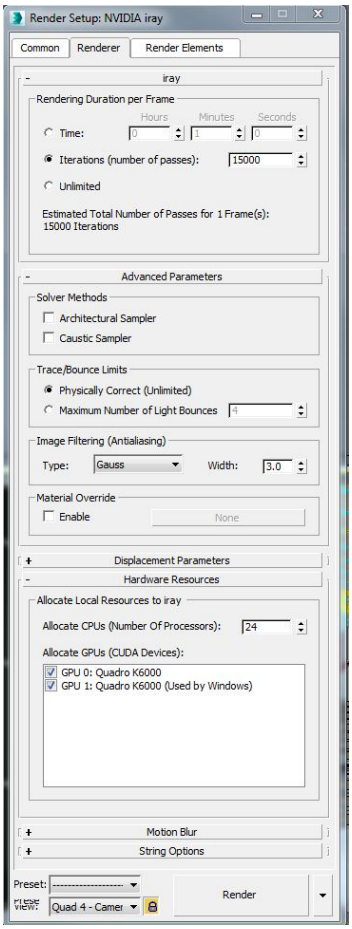

IMAGE 6-1: These are all the settings for iRay! It's not that much!

iRay Active Shade

- ***Interactive Features:***
  - Material Changes
  - Camera/Perspective Changes
  - Exposure Changes
  - White Balance Changes
- ***Non-interactive Features:***
  - Creating Lights
  - Changing Light Intensity
  - Moving Lights

IMAGE 6-2: This is an example of what ActiveShade rendering with iRay can look like. You can do ActiveShade in it's own window (Recommend) or you can turn a viewport into ActiveShade.

Chapter 7: Organization for Iterations

Organizing and Rendering Options

- ***Tools to help you iterate, and create, options:***
  - Xref
    - Organize on a File Level
  - Layers
    - Organize on a Scene Level
  - State Sets
    - Quickly switch between options
    - Record different settings for each option
    - Batch Render Locally

State Sets

- ***Records Everything You Change***
  - Object Settings and Locations
  - Render Settings
  - Material Settings
  - Lighting Settings
  - Environment Settings
  - Layer Settings
  - Xref Settings
  - Camera Settings and Locations

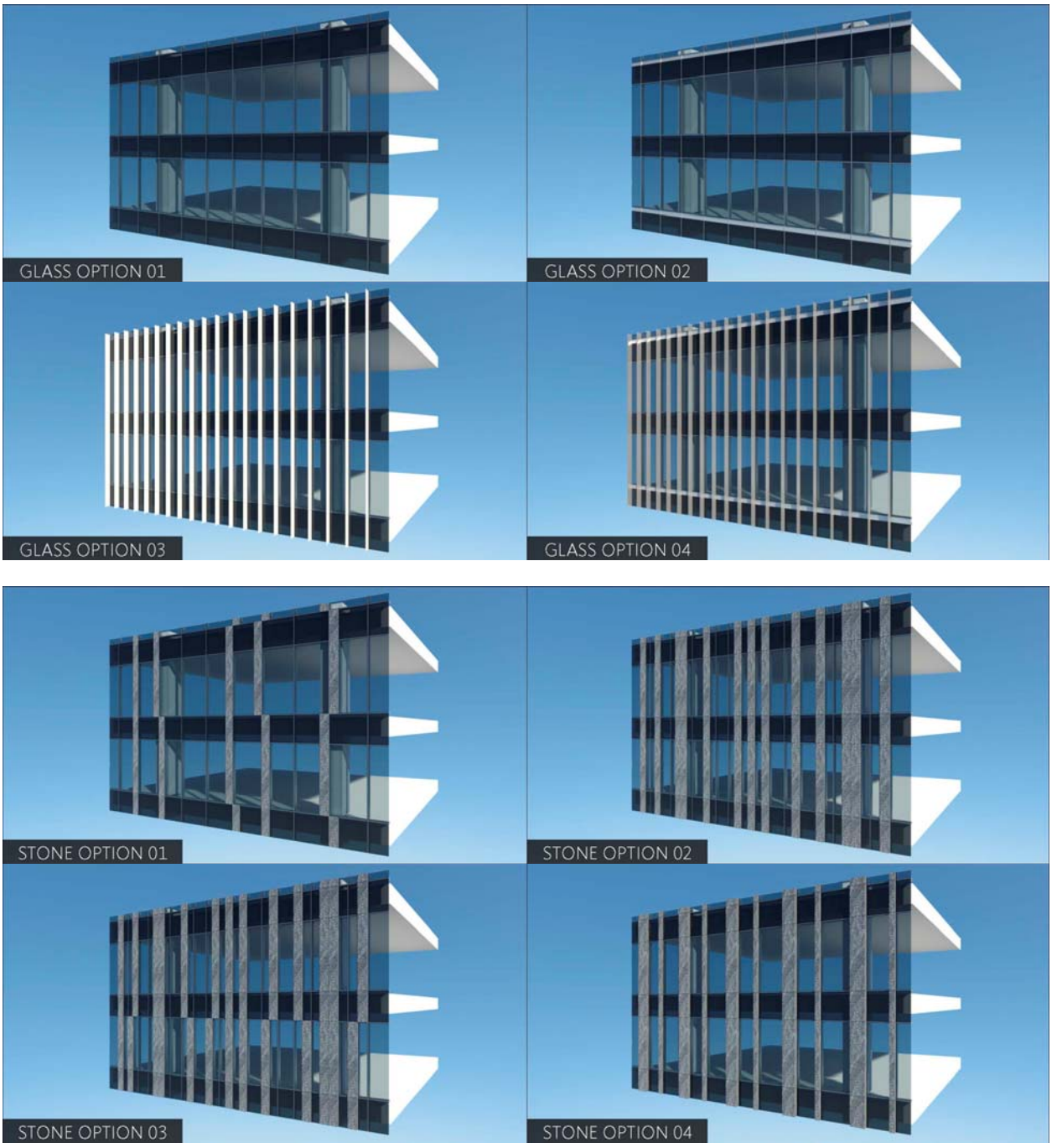

IMAGE 7-1: These multiple façade options were set up via State Sets using each option on a different layer. These were batch rendered out at 1 minute an option!

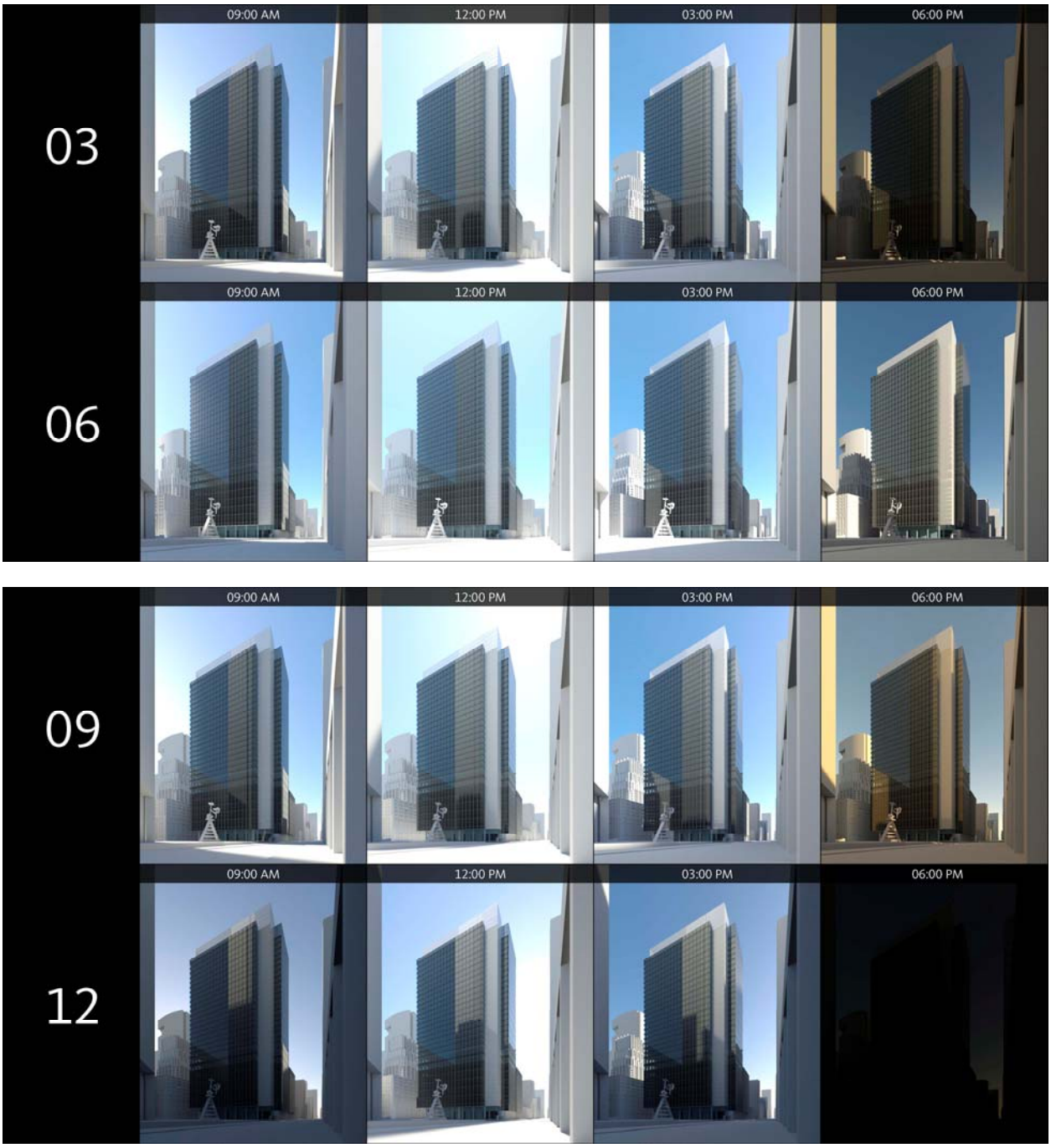

IMAGE 7-2: This Day Lighting Study over the course of a year was created using State Sets. Each rendering set the Sun to a different time of the day and year. Once each option was set up, the options were Batch rendered at 3 minutes an option!

Chapter 8: LPE and Post Production

LPE (Light Path Expressions)

- ***Mathematical Equations that can pull specific elements out of the buffer for compositing in post.***
- ***Known as A Regular Expression Language (REGEX)***
- ***You can write your own LPEs***
- ***Visit NVIDIA's iray blog to follow and discuss more on LPEs***
  - *http://blog.irayrender.com*

LPE Examples

- ***I want the whole "beauty pass":***
  - *BP=<L.*E>*
- ***I want to see only environment rays:***
  - *Env=<Le.*E>*
- ***I want only indirect illumination (two bounces):***
  - *Indirect=<Le.{2, }E>*
- ***I want only reflections:***
  - *Reflections=<Le<RS>E>*

IMAGE 8-1: This shows LPEs in action. The first image is just the rays that hit the white wall, while the second image are all the other rays in the render. When compiled, you can change the color of the wall in post-production without re-rendering! (Images provided by NVIDIA)