

AS124016

# Non-Photoreal Architectural Rendering Using OSL Shaders in 3ds Max

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## Learning Objectives

1. Learn where to get and how to use OSL Shaders in 3ds Max 2019.
2. Discover how to use OSL shaders to create non-photorealistic materials.
3. Learn to configure a Physical Camera for proper exposure and composition.
4. Look at output options for saving rendered animation files.

## Description

Both mechanical and architectural design rely on visualization technologies to showcase designers' ideas. This class will look at how to incorporate the use OSL shaders in 3ds Max 2019 to render non-photorealistic images and animations. Learn where to find and how to use OSL shaders that can be loaded and used in a visualization. Use multiple shaders to create a unique look for your models. You'll also learn how to frame a shot using composition techniques like the rule of thirds, diagonals, and the golden ratio. Discover how to utilize Physical Camera controls to adjust the scene exposure and depth of field. Get ahead of the competition by learning to create visually compelling, non-photorealistic renderings using OSL shaders and compositional rules in a streamlined workflow.

## About the Speaker

Steven Schain is the post-production supervisor for all CADLearning products from 4D Technologies, as well as the content development manager of CADLearning's Media & Entertainment and Design products for Autodesk, Inc. software, including 3ds Max, Maya, Inventor and Fusion 360. In 1998, Autodesk recognized Steven as one of only 16 Autodesk Training specialists worldwide. He has since contributed to Autodesk's certified courseware for 9 releases of 3ds Max, was a co-developer of Autodesk's ACI Program and 3ds Max's fundamental standards and is currently an Autodesk Certified Instructor. As a premier Autodesk trainer, he has continued teaching end users, companies, and many others, including The Walt Disney Company, Guess, and the United States Army. As a 7-year veteran of Autodesk University and a featured speaker for AU 2018, Steven has taught classes ranging from creating particle fountains in 3ds Max, to classes on 3D printing and entrepreneurship.

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## Introduction

As an architect or designer, you can use Autodesk's Revit software to create buildable designs for anything from simple framed structures all the way to complex, multi-floor high-rise buildings. At any stage in the design process, you may need to share or present your design, and often, it is a requirement to render it using a method that provides photorealistic results. But sometimes, photorealism is not what you're looking for. And, while Revit is capable of high-quality renderings of your design, you may decide to use 3ds Max because of its flexibility, and its ability to render both photorealistic and non-photorealistic images.

Arnold is a rendering tool that provides an exceptional level of rendering quality and a true photographic view of your design. 3ds Max is the ideal environment for the creation of high quality renderings of your Revit designs. While 3ds Max can generate beautiful, realistic renderings, there are times when non-photoreal renderings of your scene would be better.

Creating unique renderings can be done using standard materials and the default shaders. Now, with the introduction of the Open Shading Language (OSL) shader and its greater compatibility, you can use a much larger variety of shaders for rendering, many of which can be used to create interesting non-photorealistic images of your scenes.

Controlling the camera's point of view is also a critical part of generating a compelling rendering. By using simple compositional rules, you can set up a camera view that will present a dynamic rendering of your design. Once you set your viewpoint, you need to decide what the output will be for the final rendered image.

In many cases, images are rendered to a file that will be used either for printing or digital presentation. The size and level of quality of the final rendering will usually be based on specific output requirements. For generating high-quality renderings using OSL shaders, you can use the Arnold renderer. If you're running a test to if the image looks the way you want it to, you can set the quality to a lower level to give you a shorter render time. Then, when it comes time to create your final, high-quality rendering, you only need to change a few settings in Arnold to render the image.

## Introducing OSL

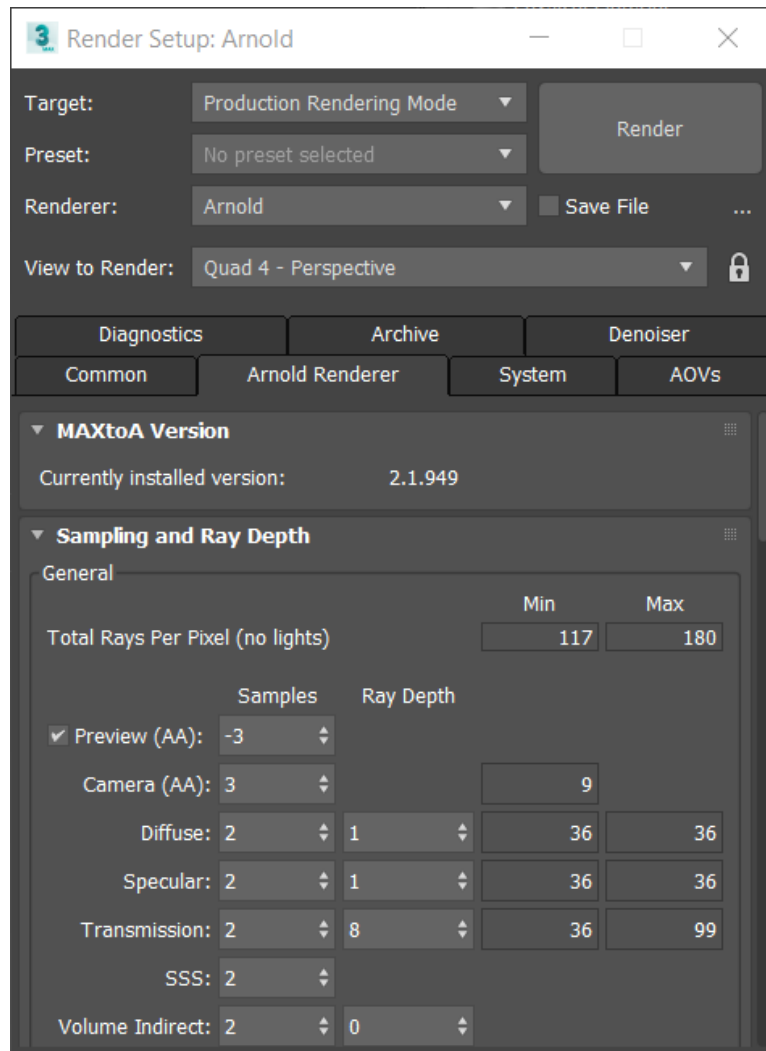
OSL, or Open Shading Language, is a programmable shading language for use in advanced renderers. The OSL language was created by Sony Pictures Imageworks as part of their in-house rendering pipeline for feature film animation production. OSL has been used on numerous feature films and has become a widely-used shading language in the visual effects industry. And, in 2017, Sony Pictures Imageworks won the Academy Award for Technical Achievement for the development of OSL.

OSL was released by Sony under the “New BSD” open source license, and the OSL documentation is released under the Creative Commons Attribution 3.0 Unported License. This allows you to use OSL shaders in both free and commercial productions, and you can modify the source code as you need to, with the stipulation that you keep the copyright notice.

## OSL Basics

At its core, OSL is a shading language that is designed for use with today's physically based renderers. With the introduction of Arnold 5.0, 3ds Max can make use of shaders written using OSL. One of the benefits of using OSL is that writing shaders for it is simpler than working with other methods, like C++. Since OSL provides a high-level coding language, writing shaders is much easier than other programming methods, making it more accessible to individuals not familiar with advanced programming languages.

The OSL implementation within 3ds Max is available only when using the Arnold renderer. One important note is that whichever version of 3ds Max you're using, you must be using 3ds Max 2016 or newer with Arnold 5.0 or newer. You also want to make sure you have the latest version of the Max to a plug-in for 3ds Max. The version number can be found on the Arnold renderer tab in the Render Setup dialog.

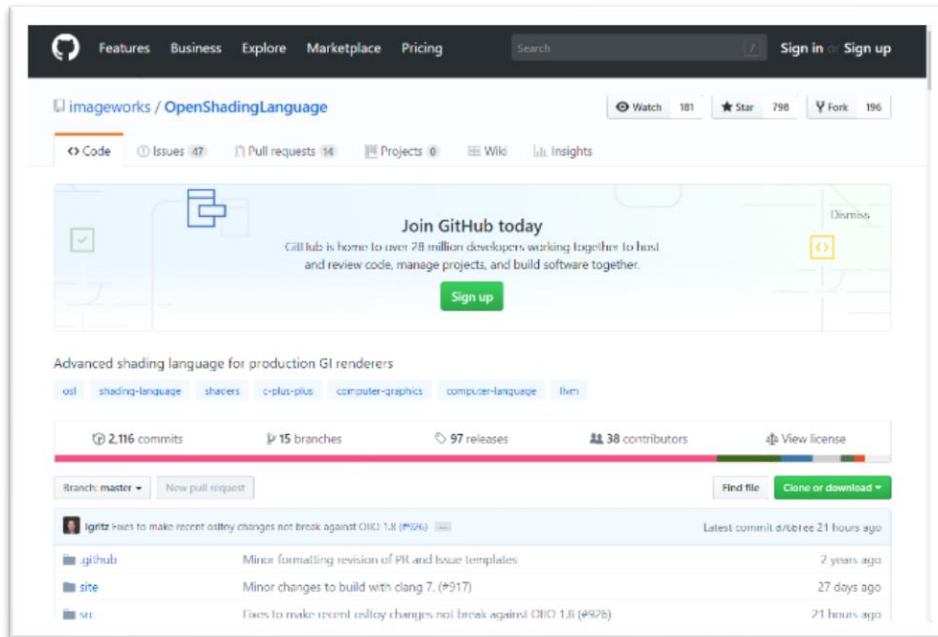


THE RENDER SETUP DIALOG SHOWING THE MAXTOA VERSION IN THE ARNOLD RENDERER ROLLOUT.

## Discovering OSL Shaders

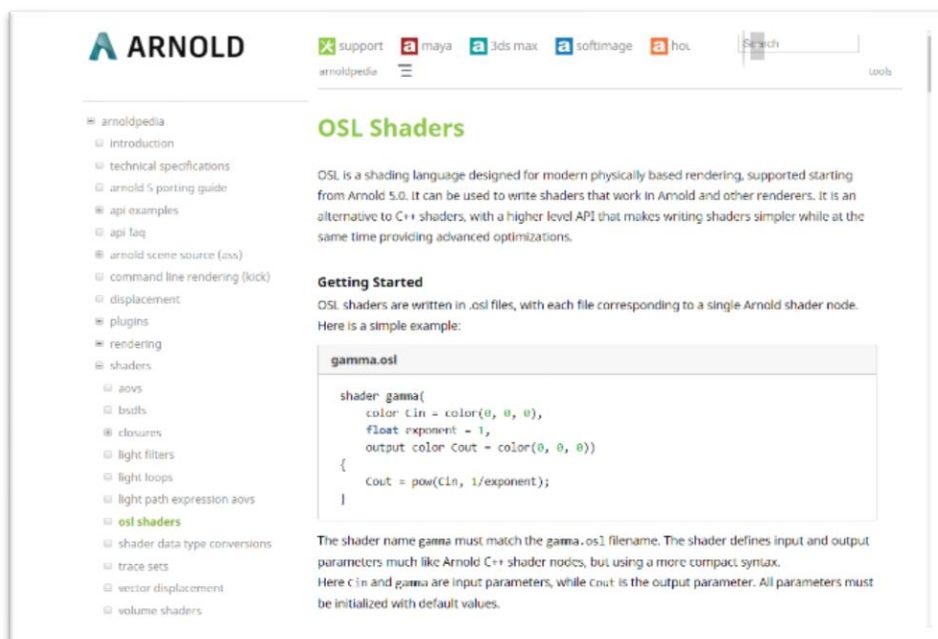
3ds Max comes with a number of default OSL shaders already available through the Material Editor. However, these are just a select few out of the numerous shaders that are available online. When looking for OSL shaders online, there are a number of repositories available.

The first place to start is Sony Pictures Imageworks' Open Shading Language page on github.com: <https://github.com/imageworks/OpenShadingLanguage>. This is the official page put up by Sony pictures Imageworks for those who want to dive deeper into OSL shader development. Here, you can download source code, as well as a few OSL shaders.



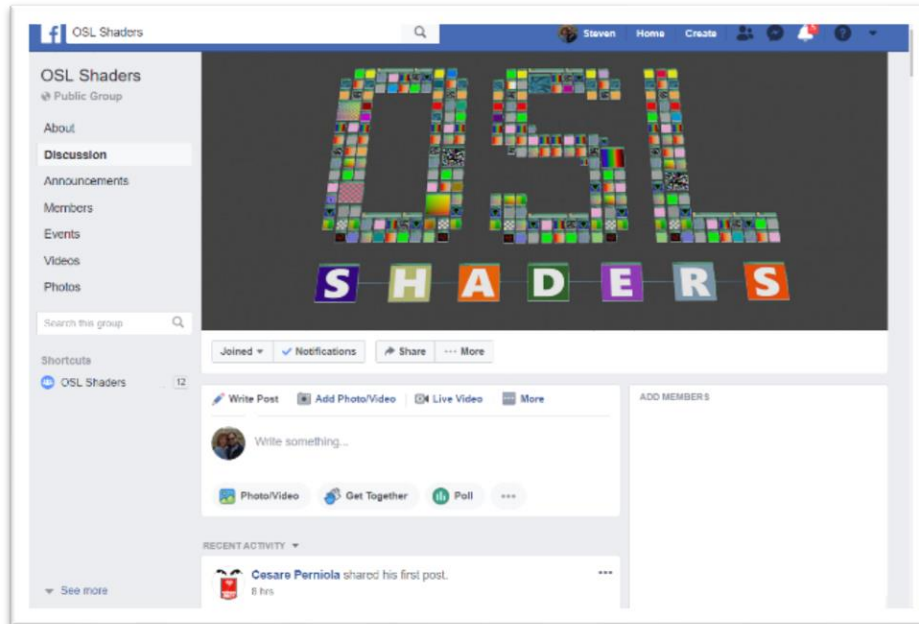
[HTTPS://GITHUB.COM/IMAGEWORKS/OPENSADINGLANGUAGE](https://github.com/imageworks/OpenShadingLanguage)

Another valuable resource is the OSL page in the online Arnold documentation:  
<https://docs.arnoldrenderer.com/display/A5ARP/OSL+Shaders>.



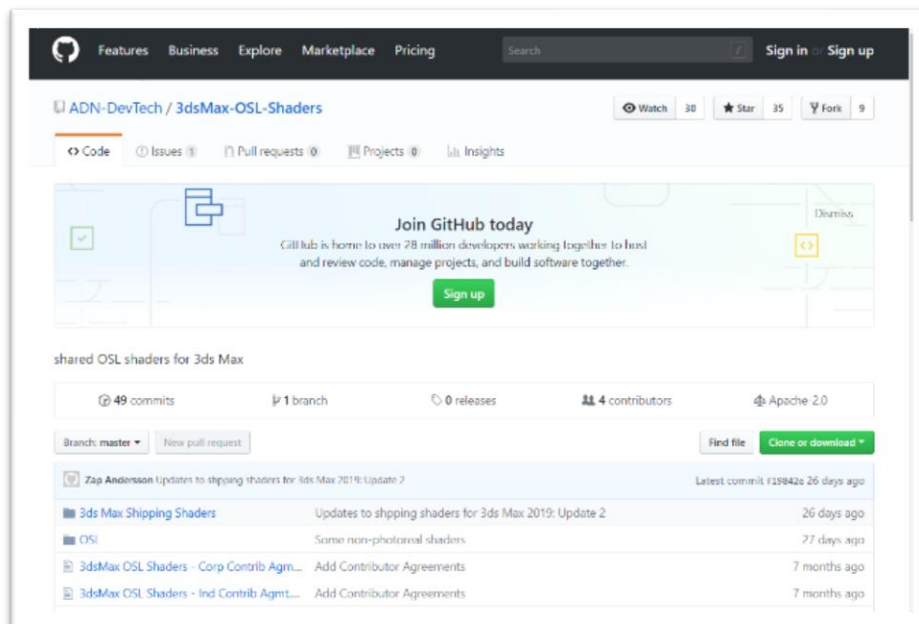
[HTTPS://DOCS.ARNOLDRENDERER.COM/DISPLAY/A5ARP/OSL+SHADERS](https://docs.arnoldrenderer.com/display/A5ARP/OSL+Shaders)

A third place to go if you're looking for help with writing shaders or are looking for links to shaders, is the OSL shaders group on Facebook:  
<https://www.facebook.com/groups/OSL.Shaders>. This is a public Facebook group with some of the top 3ds Max programmers as active members.



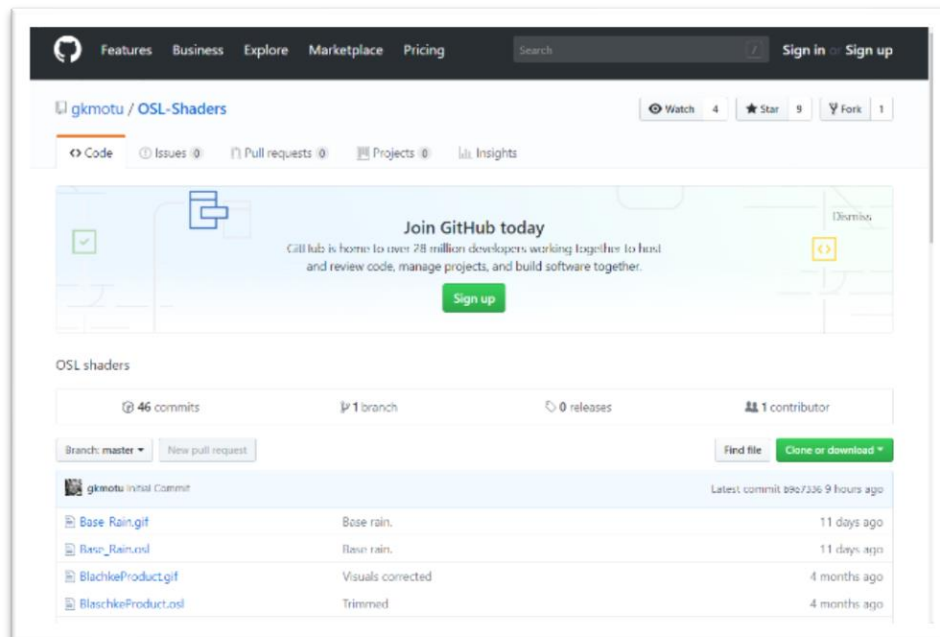
[HTTPS://WWW.FACEBOOK.COM/GROUPS/OSL.SHADERS](https://www.facebook.com/groups/OSL.Shaders)

If you're looking for specific shaders, there are several repositories available on GitHub and elsewhere: <https://github.com/ADN-DevTech/3dsMax-OSL-Shaders>



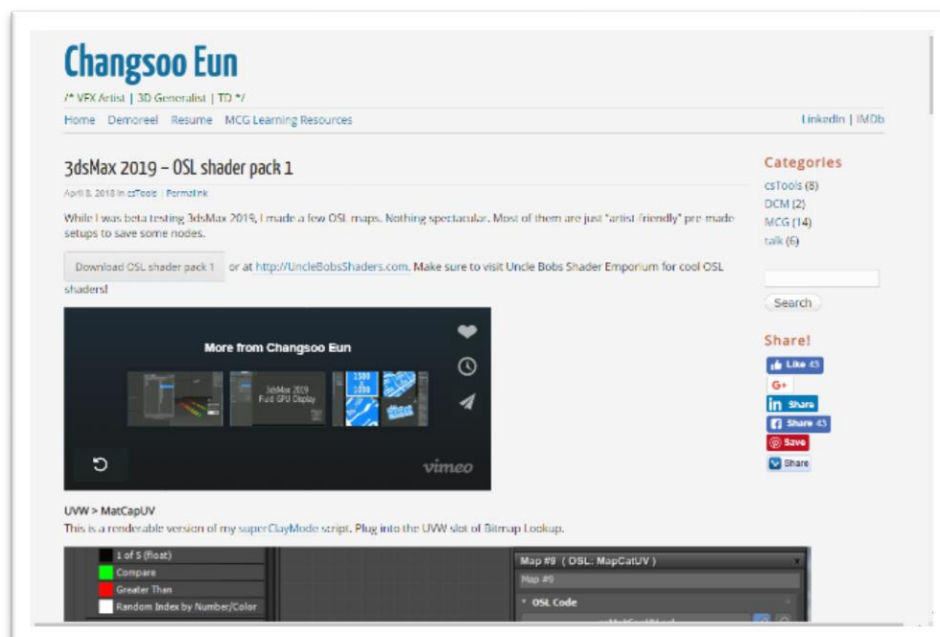
[HTTPS://GITHUB.COM/ADN-DEVTech/3DSMAX-OSL-SHADERS](https://github.com/ADN-DevTech/3dsMax-OSL-Shaders)

Some more GitHub shaders are available at <https://github.com/gkmotu/OSL-Shaders>



[HTTPS://GITHUB.COM/GKMOTU/OSL-SHADERS](https://github.com/gkmotu/OSL-Shaders)

You can also find OSL shader packs, such as this one created by Changsoo Eun: <http://cganimator.com/3dsmax-2019-osl-shader-pack-1/>.



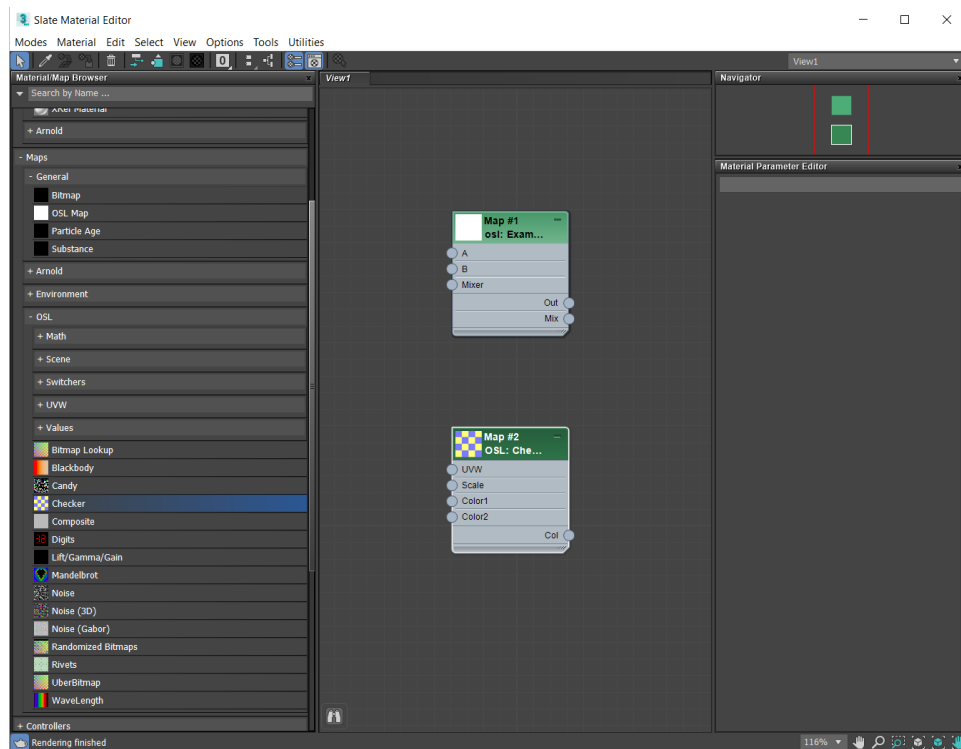
[HTTP://CGANIMATOR.COM/3DSMAX-2019-OSL-SHADER-PACK-1/](http://cganimator.com/3dsmax-2019-osl-shader-pack-1/)



While most OSL shaders you download from other locations around the Internet can be used, there are a few things to understand about OSL implementation in other renderers. This is because the implementation of OSL in 3ds Max has a few limitations. Shaders that use a *closure*, essentially a material, are not supported in 3ds Max. Neither are shaders that use an *#include* statement. If something needs to be included in the shader, find the code that needs to be included and copy and paste it directly into the shader.

## Using OSL Shaders

Working with shaders inside of 3ds Max can be handled two ways. They can be used directly by dragging them from the material/map browser into the Slate Material Editor (here, referred to as just the “Material Editor”). Or, you can use the OSL map and load shaders from there.



THE MATERIAL EDITOR SHOWING BOTH THE OSL MAP (TOP) AND THE CHECKER OSL SHADER (BOTTOM).

OSL shaders themselves cannot be used directly on objects and must be added as a map to an existing material. Depending on the shader that you use, some will have a single output, while others can have additional channels available to connect to a material. This is fully dependent on which shader is being used.

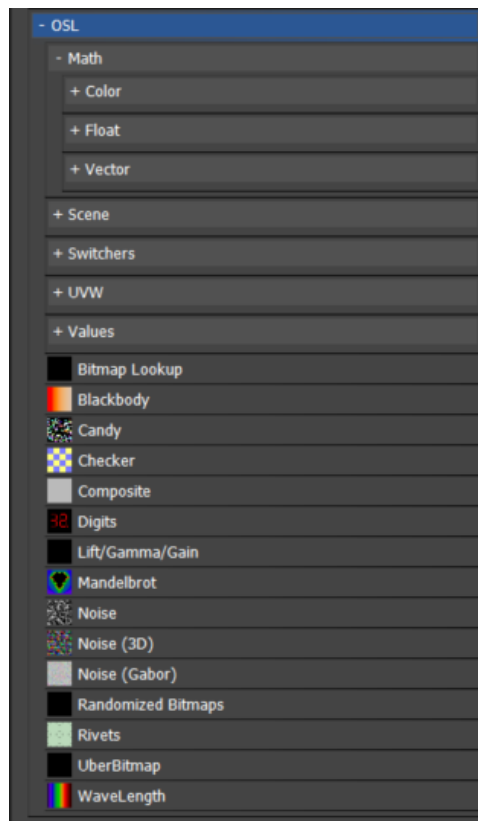
Once an OSL shader is loaded, whether by drag-and-drop or through the OSL map, you have the ability to edit the shader as you would like. If you are learning to write OSL shaders, you can edit them directly inside of 3ds Max. Once you write the shader, you can test-compile it directly in the editor. Once you're satisfied, you can save your file to a new OSL file, or if you're updating an existing file, you can simply overwrite it.

```

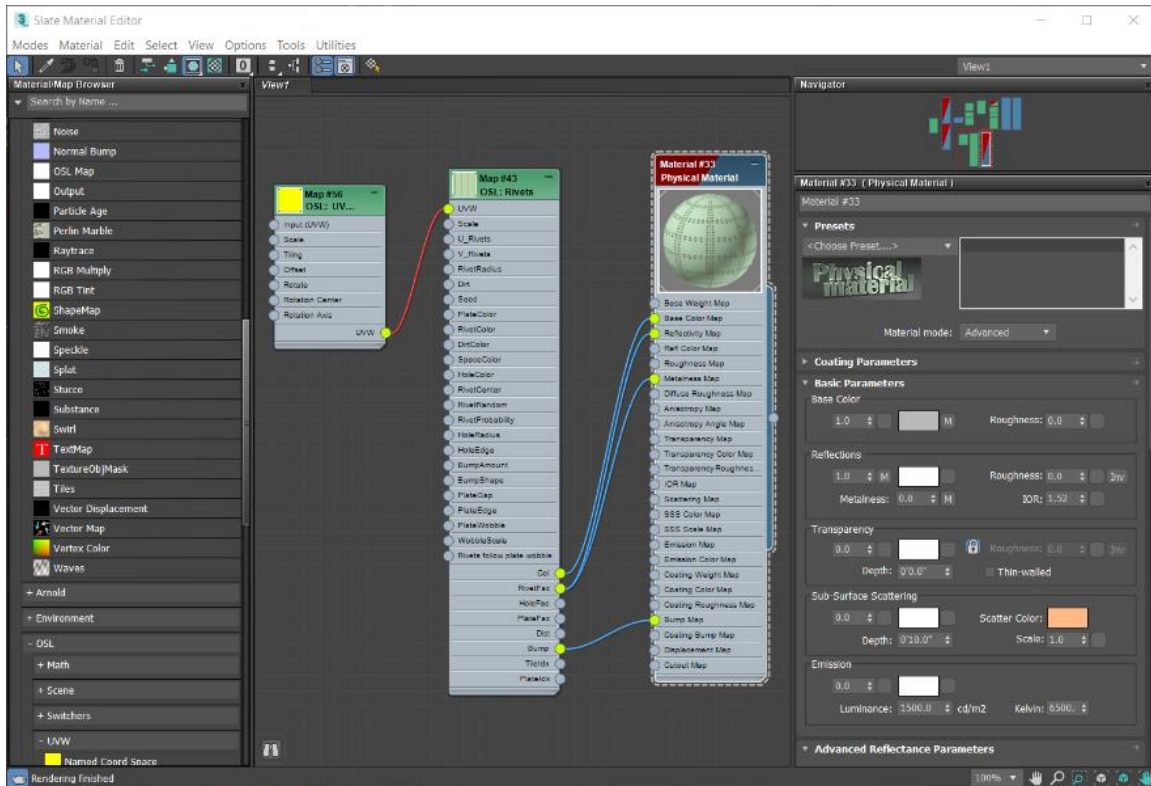
osl: Example (Map #167)
1 // Simple Example Shader with three inputs two outputs, to demo the syntax.
2 // For more information read the OSL Language Specification:
3 //   https://github.com/imageworks/OpenShadingLanguage/blob/master/src/doc/osl-language-spec.pdf
4 // The "More..." button links to the 3ds Max OSL shader Github page on ADN
5
6 shader Example
7   [[ string help="Example shader with three inputs and two outputs<br>",
8     string URL = "https://github.com/ADN-DevTech/3dsMax-OSL-Shaders" ]]
9
10  // Inputs
11  color Input_A = 0.5 [[ string label = "A"]],
12  color Input_B = 0.5 [[ string label = "B"]],
13  float Mixer   = 0.5 [[ float min = 0.0, float max = 1.0 ]],
14  // Outputs
15  output color Out = 0.0,
16  output color Mix = 0.0
17 {
18   Out = Input_A + Input_B;           // Sum
19   Mix = mix(Input_A, Input_B, Mixer); // Mix
20 }
21
  
```

Compile Shader OSL 1.8.14 Reset Parameters Save OSL file....

OSL shaders provide a great deal of flexibility and can be used for a broad range of applications. Looking at the 3ds Max **OSL** maps rollout in the **Slate Material Editor**, not only are there shaders for textures, but there are also shaders that can be used for other purposes, like mathematical operations, UVW modification, and more.



When applying OSL shaders to a model, you can use any compatible material, like the Physical Material or the Arnold Standard Surface Material. By connecting the output of an OSL shader to the appropriate input of a material, you can make use of one or more shaders at the same time.



*THE RIVET SHADER APPLIED AS BOTH THE COLOR AND BUMP MAPS IN THE MATERIAL EDITOR.*



*THE RENDERED VERSION OF THE OSL SHADER ON A PAINTED METAL SPITTOON.*

## The Project

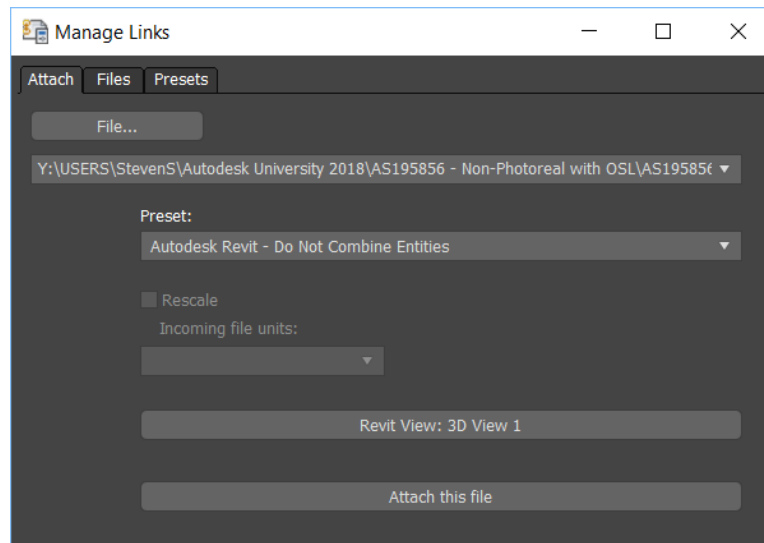
This project is based on a real-world design for a set of townhouses located in Washington state. The townhouses were designed in Revit and will be linked into 3ds Max. Once the Revit link is active in 3ds Max, additional geometry is added, as well as details like cars, fences,

power lines, trees, etc. And, instead of trying to generate a completely photorealistic rendering, the final version will make use of one or two non-photoreal OSL shaders.

**DEFINITION:** The term “non-photorealistic” as it pertains to this class refers to the use of maps that make the scene look like something other than a photograph, such as a halftone image, not techniques similar to cartoon rendering.

### Linking to a Revit Model

Often, it's better to link versus import a Revit file, because if the architectural design changes, you can reload it through the File Link Manager. The Manage Links dialog gives you access to the file link tools. You can choose what file you wish to link, choosing from DWG, FBX, and Revit. Once you link to a Revit file, you can choose from several preset options that control how the file is linked into 3ds Max.

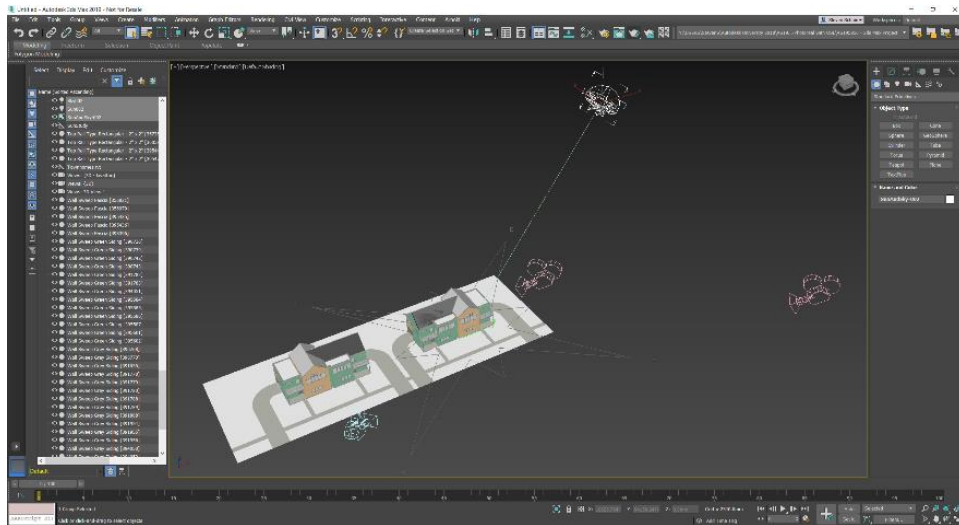


From the 3ds Max application button, click the **Import** option, and then click the **Link Revit File** option. You first need to select a **Revit View**, and once it is selected, the **File Link Manager** becomes available.

Enable the **Do Not Combine Entities** preset. This preset does not combine the model entities, which gives you the flexibility to organize your scene the way you want to.

Next, click the **Attach this file** button to link the Revit model. During the import process, you may see a Daylight System Creation dialog. This asks if you want to create a Daylight system in the current scene.

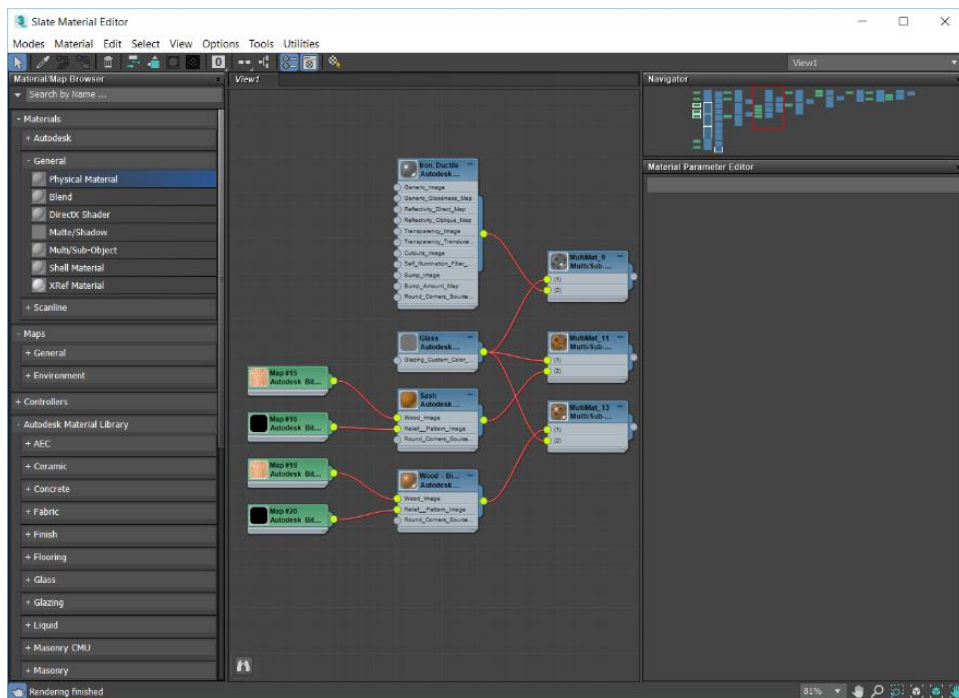
Once the import process is complete, you will see the File Link Manager and the linked model in the viewport.



*THE LINKED REVIT MODEL, AS SHOWN IN THE VIEWPORT*

## Converting the Scene

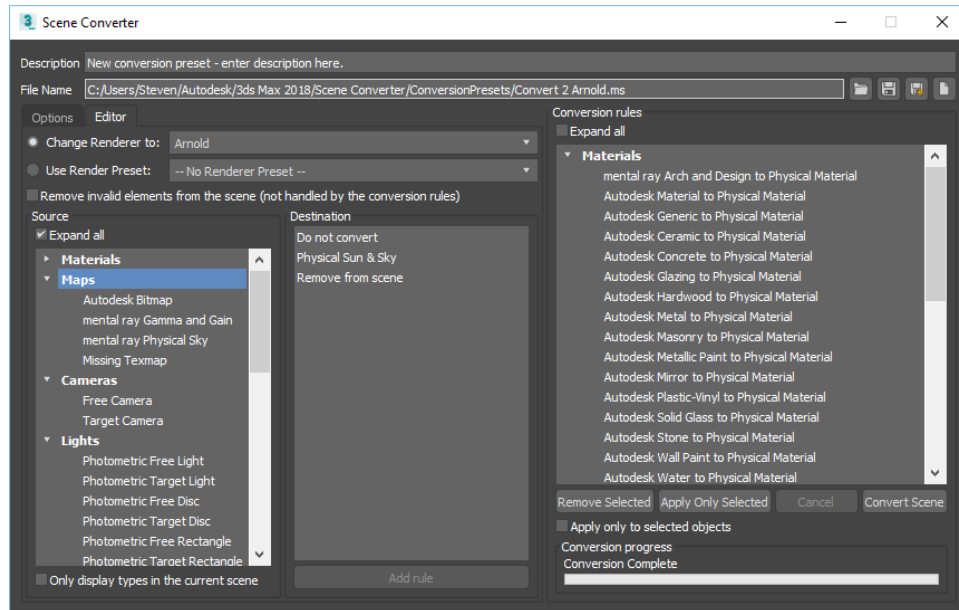
Now that the model is linked, the materials and daylight need to be converted so that they will work with the Arnold renderer. Linked Revit models, like other types of imported models, contain the materials that were applied to the individual objects within the Revit project. One problem with this is that the materials are imported as Autodesk materials and are not compatible with Arnold. To address this, the imported daylight system needs to be converted to a Sun positioner.



*MATERIALS SHOWN IN THE MATERIAL EDITOR FROM THE LINKED MODEL*

## The Scene Converter

An easy way to accomplish this is to use the scene converter. The **Scene Converter** is a tool that provides a straightforward workflow for converting lights, materials, and objects between different renderers. There are many presets available, and you can easily create your own, depending on your needs and the rendering tool you will be using.



THE SCENE CONVERTER DIALOG

While you can create a new conversion script from scratch, it is much faster to use a premade script file that can be loaded into the **Scene Converter**.

The **Convert 2 Arnold.ms** script has been preset to convert:

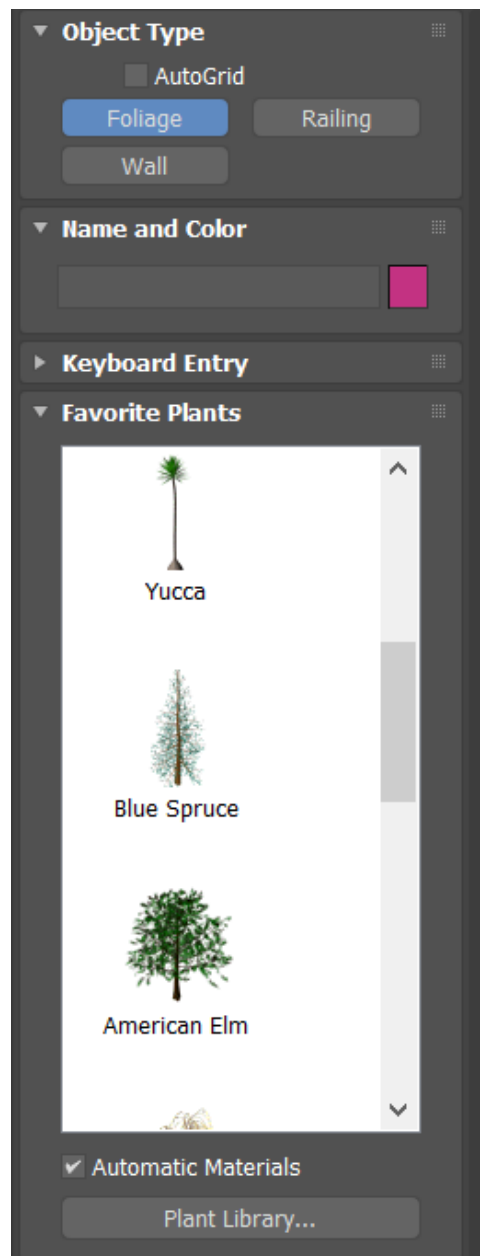
- all materials → physical materials
- bitmaps → Arnold compatible textures
- cameras → physical cameras
- the exposure control → the physical camera exposure control
- lights → Arnold compatible lights
- the Daylight System → a Sun Positioner using the Physical Sun and Sky as the environment map

Once the scene is converted, there is still some work that needs to be done. Even though all the materials are now Arnold-compatible, the conversion process does not maintain 100% of material properties. There may be cases where materials will need to be edited.

### Finishing the Scene

once the initial Revit design is brought into 3ds Max and converted, you can either use it as-is, or you can add to the scene and finish it out with additional scene elements. How detailed these elements are is entirely up to you and what your needs are for the final finished product.

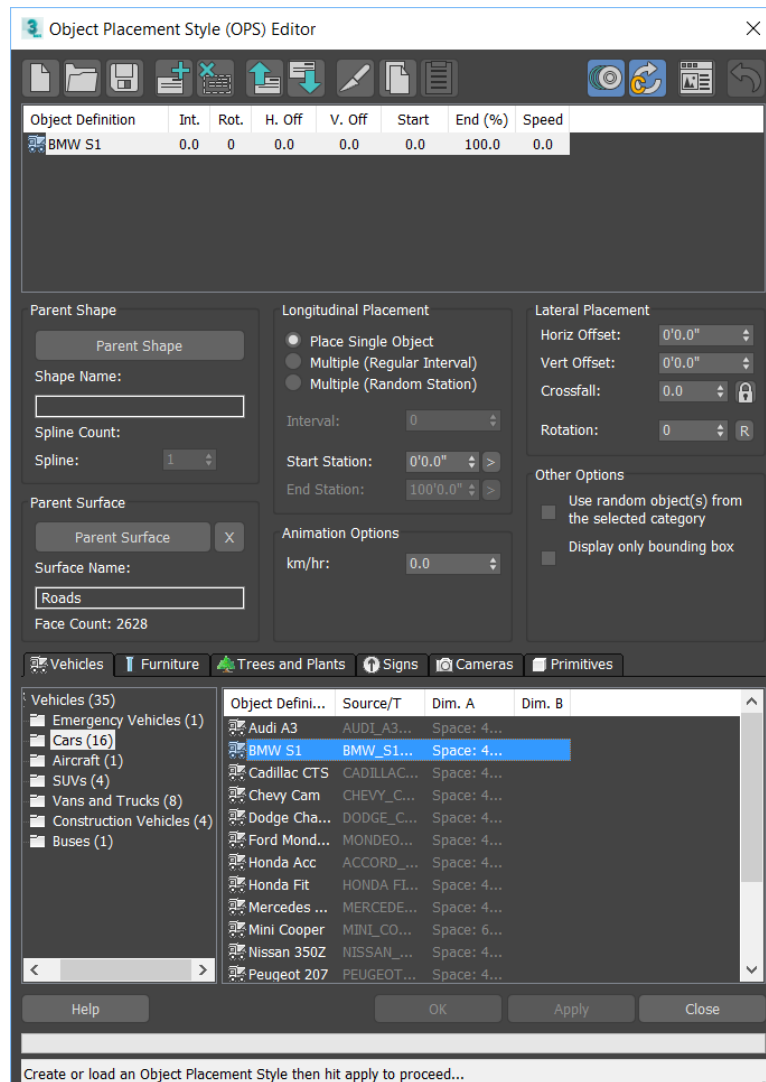
Some elements can be added very easily since they are already part of 3ds Max. For example, trees can be added into the scene using the AEC Extended, Foliage objects. With Foliage, you can choose from a variety of trees and shrubs. While there are third-party plant libraries available, if you don't have one, these work very well.



*THE AEC EXTENDED, FOLIAGE PLANT LIBRARY.*



Another way to add elements into the scene is to use the Civil View tools that are built into 3ds Max. By using the Object Placement Style Editor, you can add vehicles that include emergency vehicles, cars, vans, trucks, construction equipment, and others. What you bring in is entirely up to you. For this scene, only a few cars were added and placed around the environment where they would be seen in the camera view. Remember—if they don't show up in the camera view, you probably don't need to add the extra geometry.

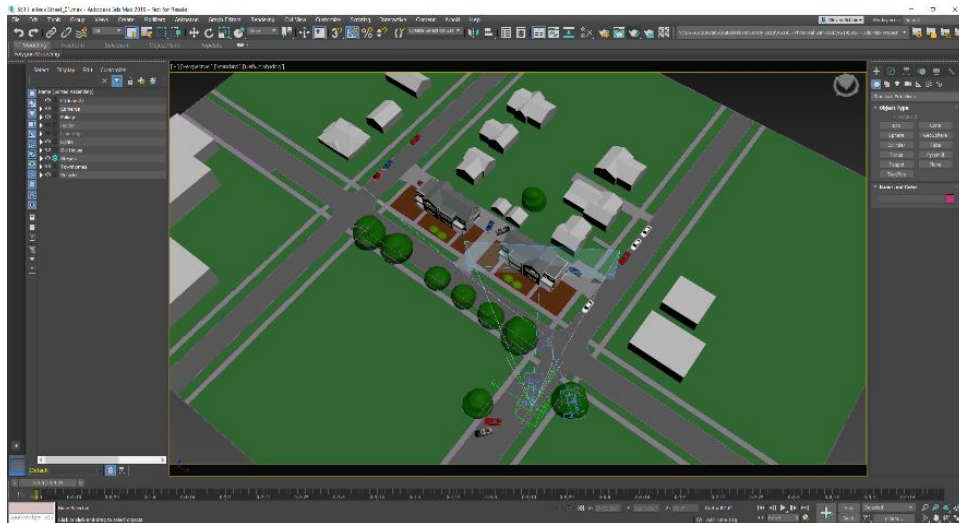


*THE CIVIL VIEW, OBJECT PLACEMENT STYLE EDITOR SET TO THE VEHICLES TAB.*

Once you've decided how detailed you need the scene, you can add additional geometry. That geometry can be for the roads, sidewalks, grass areas, and other scene elements. Again, the level of detail will be determined by what your needs are and should be decided before work on the project begins. Knowing the expectations will help you determine whether background objects will have any detail or will just be gray boxes. In this scene, the houses surrounding the



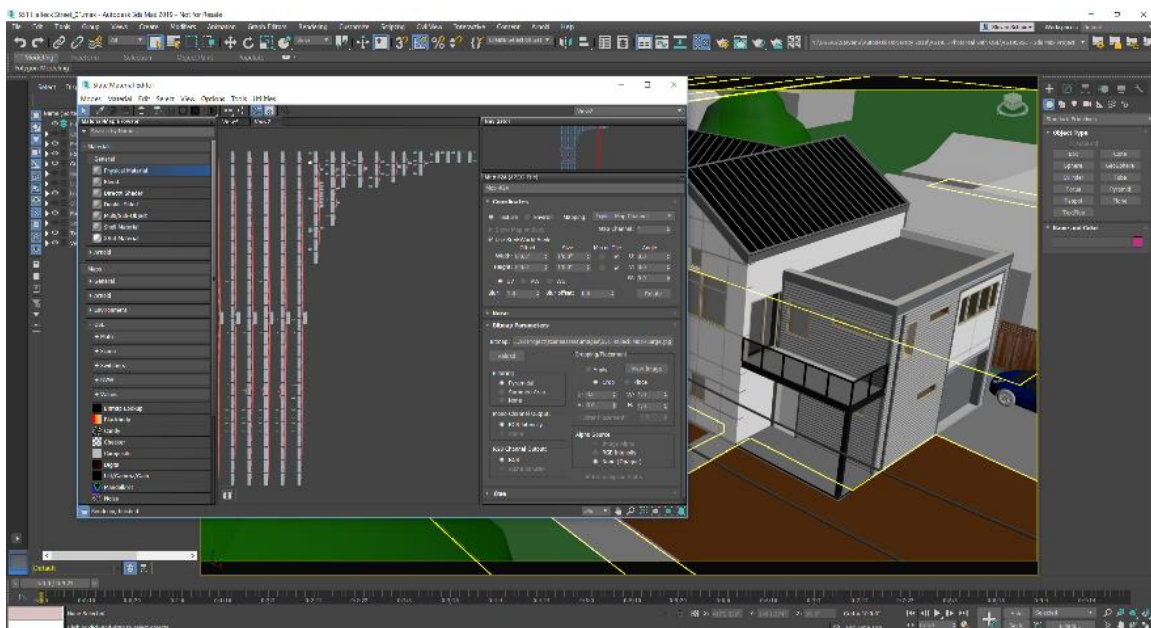
townhouses have minimal detail and are rendered with a simple gray color. Once the scene is complete, you are ready to move on to materials, lighting, composition, and rendering.



*THE COMPLETED SCENE WITH ALL THE NECESSARY EXTRAS FOR THE PROJECT.*

## Working with Materials

For this, you will work in the Slate Material Editor, since it gives you a good look at the overall structure of the material at a glance. To open the Slate Material Editor, from the **Material Editor** flyout, select **Slate Material Editor**. One of the nice features of the **Slate Material Editor** is the ability to have the **Material/Map Browser** available all the time. Once it is open, you can scroll to the **Scene Materials** rollout and open it. From there, you can view and select from an alphabetical list any material currently applied to objects in the scene.



*THE SLATE MATERIAL EDITOR SHOWING ALL THE SCENE MATERIALS IN ONE WORKSPACE.*

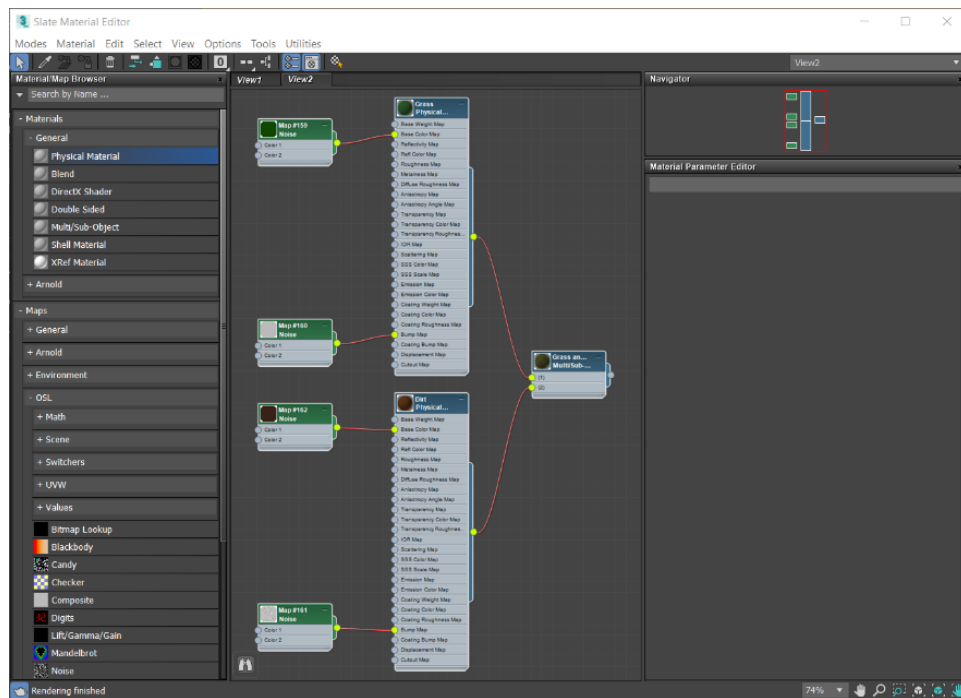
## Editing Existing Materials

To adjust the parameters of a material in your scene, you need to bring the material into the Material Editor. To accomplish this, you have two options:

1. Use the **Material/Map Browser** and click and drag a material into the work area.
2. Select an object and get the material from that object
3. Acquire the materials from the whole scene\*

\*This method may not be the best idea if you have a lot of materials in the scene. Working on one or two materials at a time is much easier.

To get a material, first, select the surface that uses the material. For this example, select the site **Grass and Landscaping**. Then, in the **Slate Material Editor**, **Material** menu, choose **Get from Selected**. This command will bring the material from the selected object into the work area of the Materials Editor.



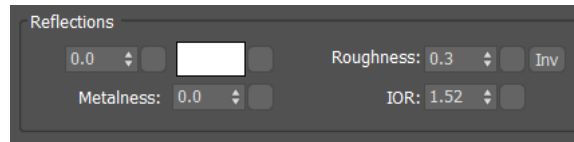
THE PHYSICAL MATERIAL THAT IS APPLIED TO THE GRASS AND LANDSCAPING IN THE SCENE

## Editing a Physical Material

When editing a material that is in the Material Editor work area and is assigned to an object or objects in the scene, making any change to it will affect all the objects in the scene that have that material applied to them. To access the material parameters, double-click the **Grass** material.

One of the side effects of the material conversion process is that some materials are converted to physical materials with their Reflections value set at 1.0. This will cause them to be a mirror

surface, fully reflective. Since this material is grass, it should have little to no reflectivity, and should be a little rough. In order to fix this, set the **Reflections** value to **0.0** and the **Roughness** value to **0.3**.



*NOTE: It is highly recommended that you review all the materials that are brought in with the link and converted using the Scene Converter. Not only will this let you verify that the materials are configured correctly, but also, you can make any changes you would like to the materials.*

In this case, since there are several materials applied across all the objects in the scene, it is often easier to get a material from the Scene Materials in the Material/Map Browser. One advantage to working with the Slate Material Editor is that you can have more than one material in the workspace at the same time. If you need more room in the workspace, use the middle mouse button to click and pan the work area.

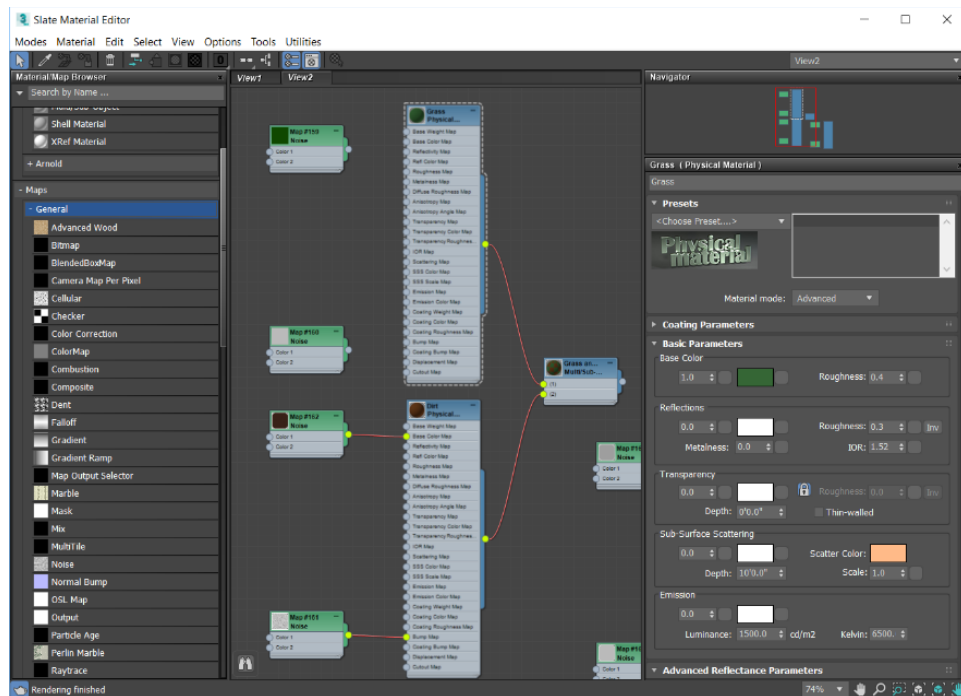
### Adding an OSL Map

Once the material is configured, you need to decide what kind of non-photoreal shader you want to use for the surface. In this case, it was decided that a halftone pattern would be used with a similar size, but different color on different surfaces. Other surface features like bump maps and image-based textures will be removed.

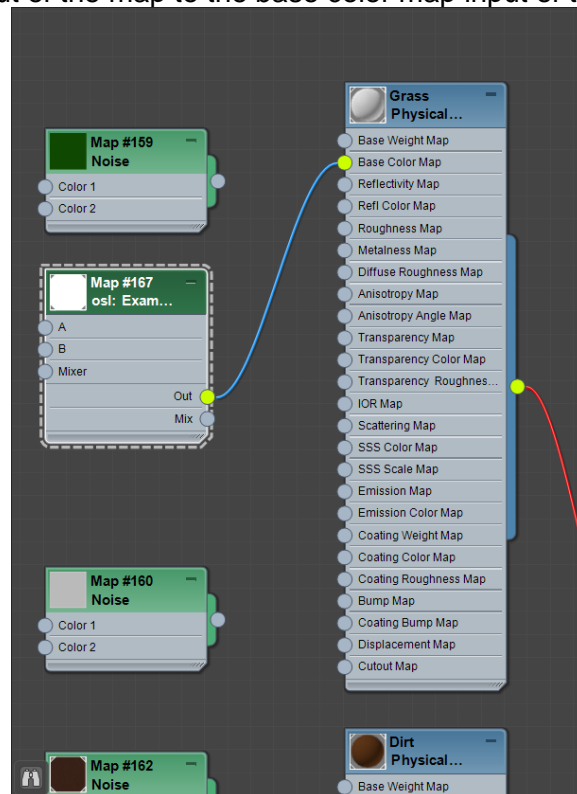
The colors for each material will be based on the colors required for that service. For example, the grass will be green, the dirt will be brown, and the concrete will be gray. However, some services will retain their transparency information, like the fence. Working one material at a time will make getting through the scene much easier, as there is no quick fix for editing materials.

Start with the grass material, which is part of a multi-sub object material applied to the Grass and Landscaping object.

1. Remove any maps currently associated with the material. If you don't want to delete the maps that are currently there, you can simply disconnect them.



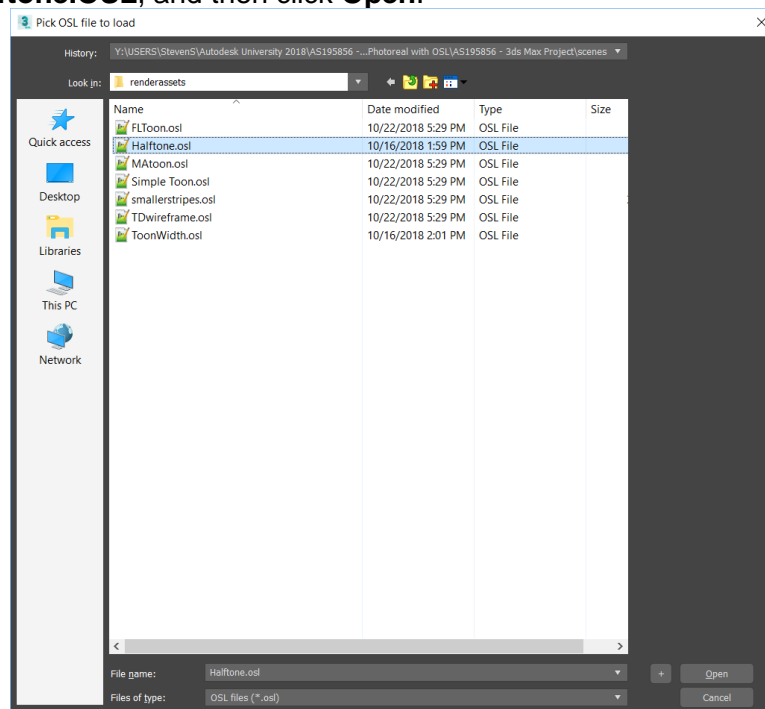
2. Then, drag an OSL map into the work area to the left of the grass material.
3. Connect the output of the map to the base color map input of the grass material.

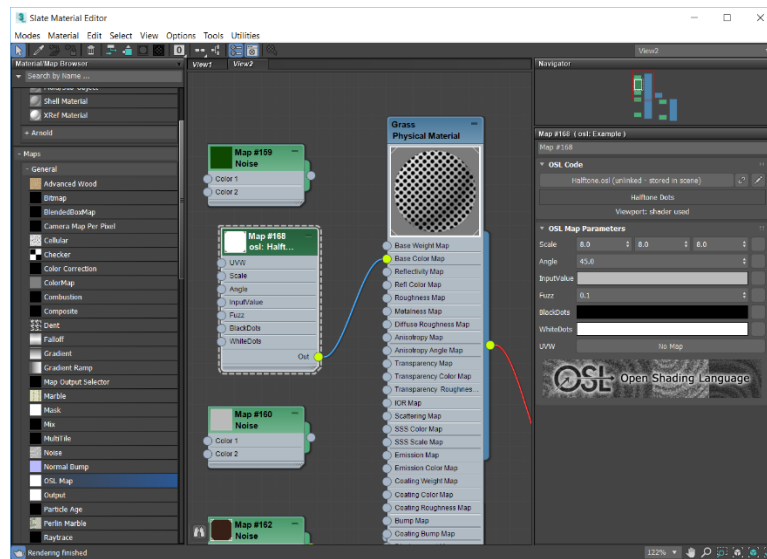


4. Double-click the OSL map to open the parameters.



5. Click the **file** option in the OSL code rollout.
6. From the **Pick OSL file to load** dialog box, navigate to the **sceneassets > renderassets** folder.
7. Choose **HalfTone.OSL**, and then click **Open**.





*THE HALFTONE.OSL SHADER ASSIGNED TO THE GRASS MATERIAL.*

This shader contains a limited number of parameters that deal with the color and size of the halftone dot pattern.

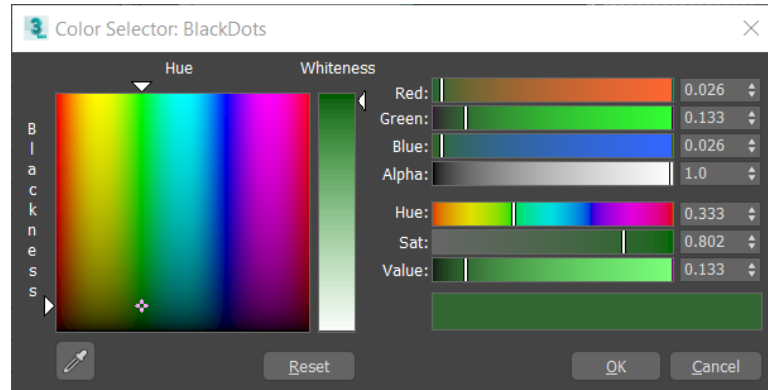
8. Set the **Scale X, Y and Z** values to **6** to scale down the overall size of the pattern.
9. Set the **Fuzz** value to **0.3** to increase the white area of the pattern.



Now you have an aesthetic choice to make—do you make the black dots the color for the surface, or the background/white dots the color for the background with the black dots over it? This will all depend on the aesthetic you want, and/or what the art director tells you to do. Here, the black dots will be the color of the surface, with the background staying white.

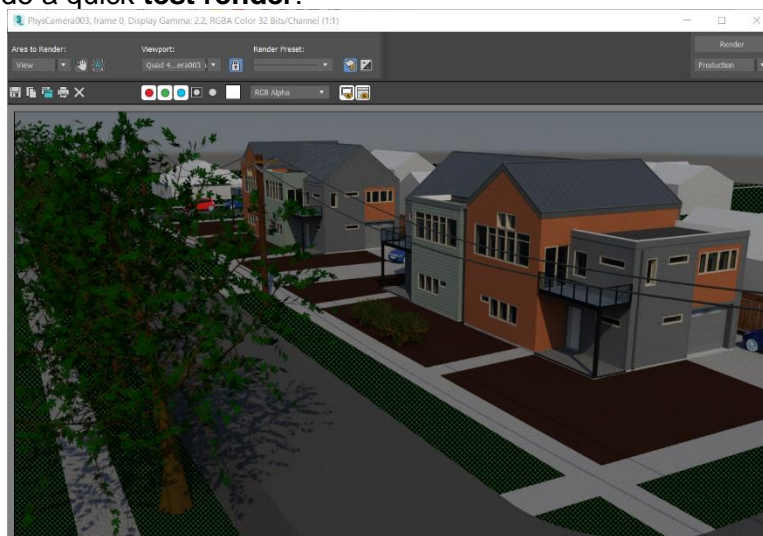


10. Click the **BlackDots** color swatch and set the **Red** value to **0.026**, the **Green** value to **0.133**, and the **Blue** value to **0.026**, and then click **OK**.



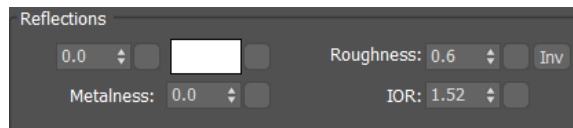
11. To better see the colors, make the background black. Click the **WhiteDots** color swatch and set the Value slider all the way to **0.0**.

Now, you can do a quick **test render**:

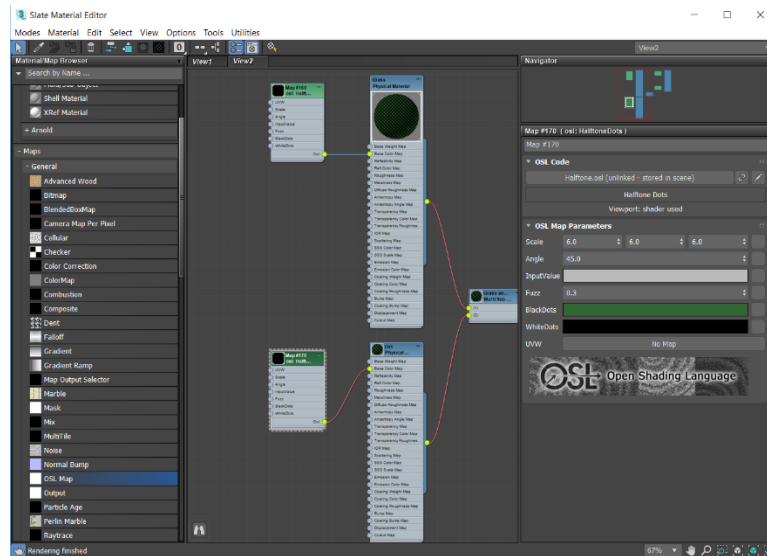


Pay close attention to the green grass areas that now have the halftone pattern applied. From this point, you can go through and review and edit the remaining materials in the scene. Keep in mind that you are not limited to using the halftone pattern with the same parameters throughout the whole image. You can specify different scales or different angles as well as different colors for other objects in the scene. For example, the ground can be made with a larger scale of the same pattern you see in the building, and it can be at a different angle. This way, you're conserving the amount of time you spend working on the scene, while ensuring the scene has some variety.

12. In the **Material Editor**, prepare the **Dirt** material by removing the maps from the material itself. Then double-click on the material to open the parameters.
13. Make sure the **Reflections** value is set to **0**, and then set the **Roughness** value to **0.6**.



14. In the workspace, select the **OSL Halftone** map applied to the **Grass**, hold the SHIFT key, then click and drag to make a copy of it. Place the copy near the Dirt material.
15. Double-click the **new map**, then connect the **output** to the **Base Color Map** input for the **Dirt** material.

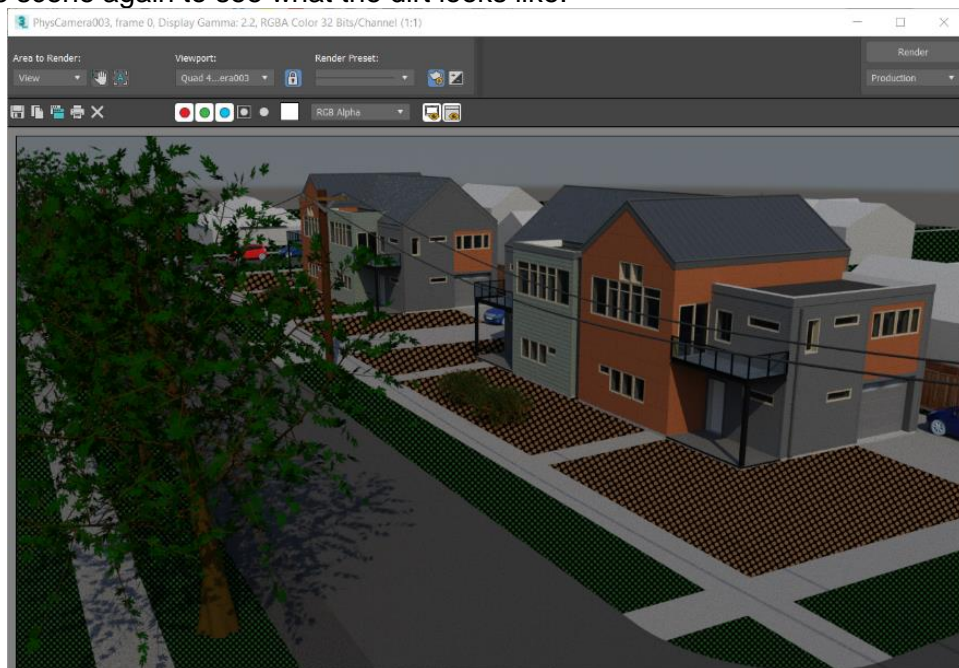


16. In the halftone map parameters, set the **Scale X, Y and Z** values to **7.5**.
17. Set the **Angle** to **30.0**.
18. Set the **Fuzz** value to **0.2** to increase the size of the black dots in relationship to the white dots.
19. Click the **BlackDots** color swatch and set the **Red** value to **0.278**, the **Green** value to **0.134**, and the **Blue** value to **0.053**.





Render the scene again to see what the dirt looks like:



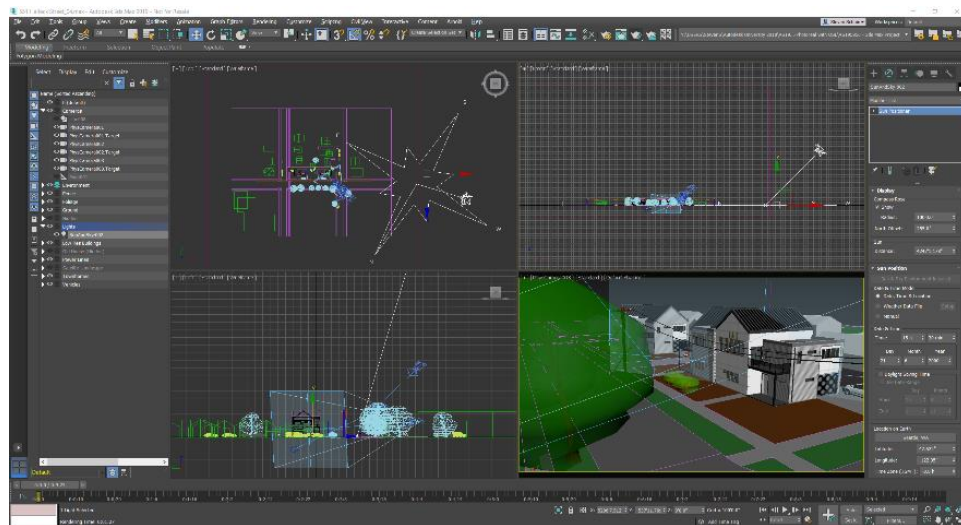
*THE GRASS AND DIRT SET UP WITH THE HALFTONE PATTERN.*

Now it's time to go through each scene material and apply the halftone OSL shader to them. The scale, angle, and fuzz can be based on purely aesthetic decisions by you or the art director. The colors can be applied more accurately based on the material requirements.

## Working with the Sun Positioner

One advantage of linking to a Revit file is that you can use the Daylight system that is imported through the link. The daylight system is a lighting system that is designed to simulate the effects of outdoor sunlight and skylight. The sunlight provides the direct illumination and direct shadows, and the skylight provides the light that is scattered by the atmosphere. When used in combination, the finished rendering can be visually accurate and highly photoreal.

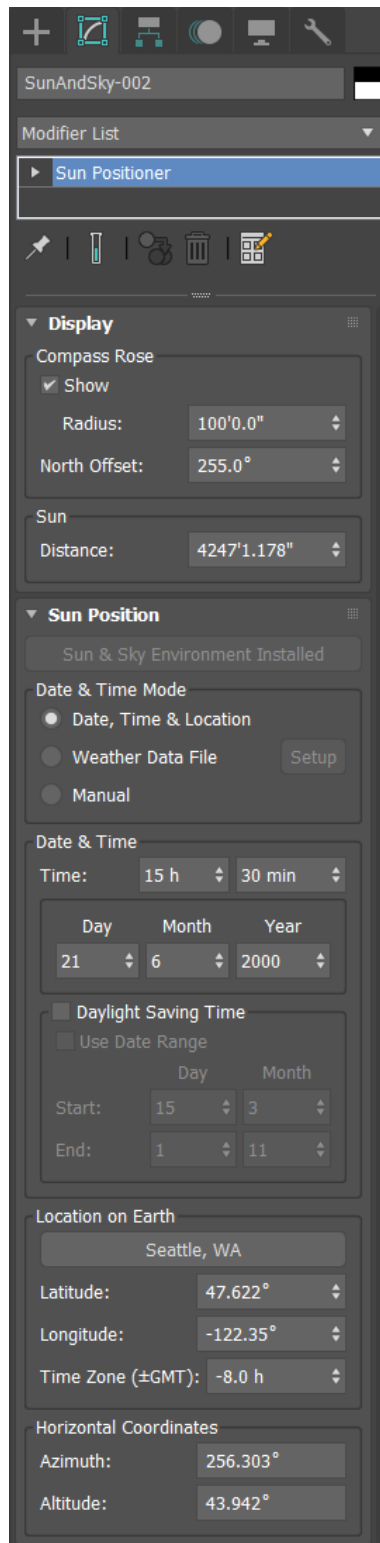
However, when the daylight system is converted using the Scene Converter, it is replaced by the Sun Positioner. The Sun Positioner also provides a simple interface for placing the sun in the sky in relationship to the scene. All you have to do is set the time of day, the date, and the location in order to accurately place the sun. Then, to orient the scene geometry, you can simply determine what the north direction should be and reorient the Sun Positioner to match that orientation.



*THE SUN POSITIONER*

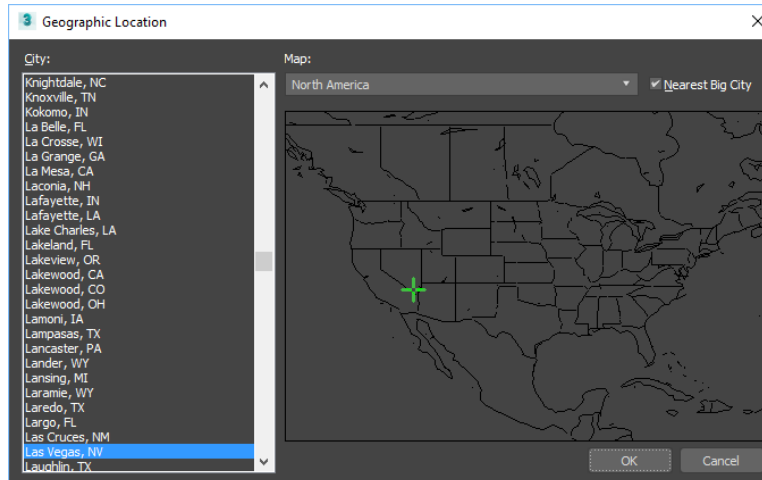
## Modifying the Time, Date, and Location

To edit the sunlight, select the **Sun Positioner** object in the scene, and then click the **Modify** panel. This is the key to the Sun Positioner, as it contains the time and location parameters. To change the time and date, enable the **Date, Time & Location** option, and then modify the parameters. Set the **Time:** in **hours** and **minutes**, and then set the date by adjusting the **Day**, **Month**, and **Year**. You can also specify whether Daylight Saving Time is active, and if you want to use a range of dates.



*THE SUN POSITIONER ROLLOUT*

You can also change the geographic location of the building. Click the **Get Location** button, which opens a dialog containing a map and city list.



*PICK A LOCATION ANYWHERE IN THE WORLD*

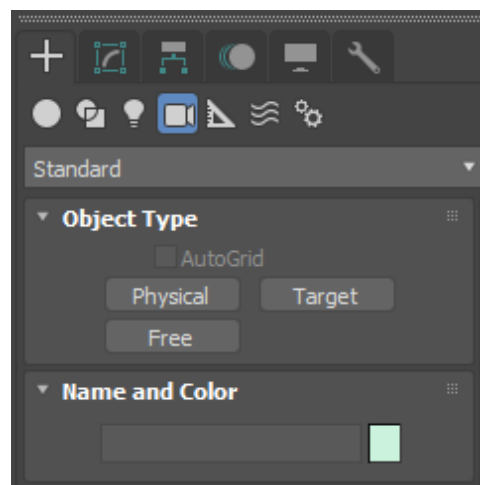
The last thing to do is determine the orientation of the building. To orient the building correctly, enter the required angle in the **North Direction** field, and then press ENTER.

## Establishing a Point of View

At this point, you are ready to establish a camera view. Choosing a point of view is not as simple as just placing a camera in the scene and rendering the scene. If you want a compelling image, it is important to understand and employ a few basic rules of image composition.

## Creating a Camera

There are three types of camera in 3DS Max: Physical, Target, and Free.

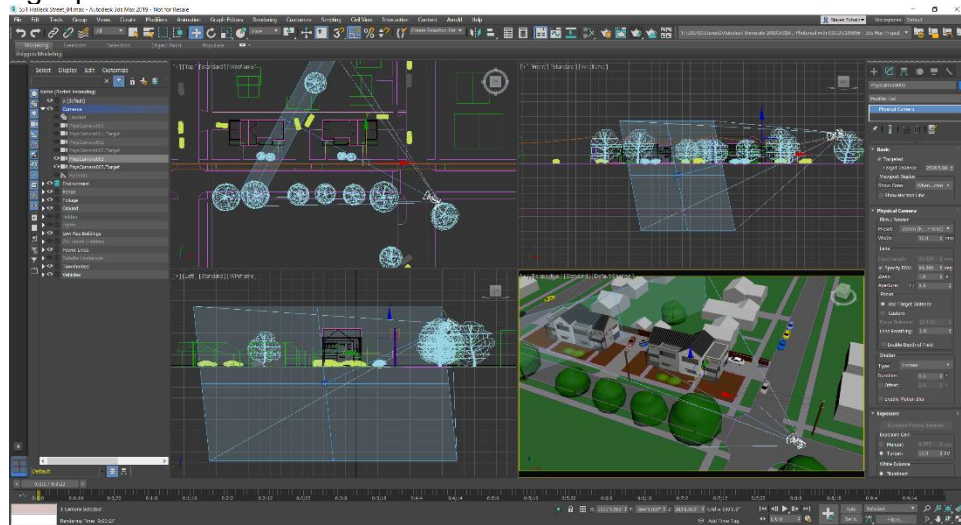


A **Physical** camera is designed to mimic a real-world camera within 3ds Max. It can either be free or targeted, and it contains advanced features like film / sensor size for simulating real cameras. Other parameters include the lens zoom, aperture, depth of field, type of shutter, and motion blur. The Physical camera also controls its own exposure, which means you can have multiple cameras, both indoor and outdoor, with different exposure values.

A **Target** camera is attached to a target, so it views the area around the target object. When you click and drag in a viewport and create a Target camera, you will create a two-part icon. The first icon represents the camera, and the second icon is the camera's target (displayed as a white box). The camera and the camera target can be animated independently.

A **Free** camera is a free-standing object that views the area in the direction that you have aimed the camera.

When you create a **Physical** camera, you see the **Physical** camera icon. This icon represents both the camera and its field of view (FOV). Once the camera is in your scene, the icon for the camera will look the same, regardless of whether it is set as free or targeted, but the free option does not contain a separate target. Free cameras are useful when you need to animate a camera along a path.



A NEW PHYSICAL CAMERA ADDED TO THE SCENE

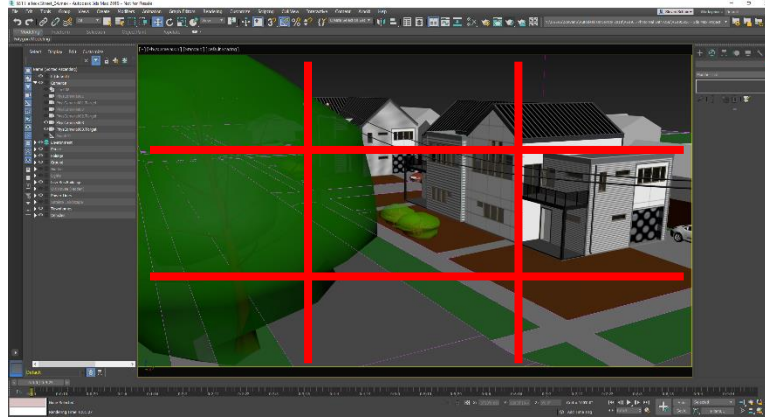
## Composition Basics

If you want a compelling image, it is important to understand and employ a few basic rules of image composition. Many of the rules of composition have been around for centuries. You are going to learn two simple rules that can easily be implemented to give you better-looking images immediately.

### Rule of Thirds

The first rule is the *rule of thirds*. This rule breaks the screen into three sections vertically and three horizontally. When composing a scene using the rule of thirds, you use the two vertical lines and the two horizontal lines to locate key horizontal and vertical image elements.

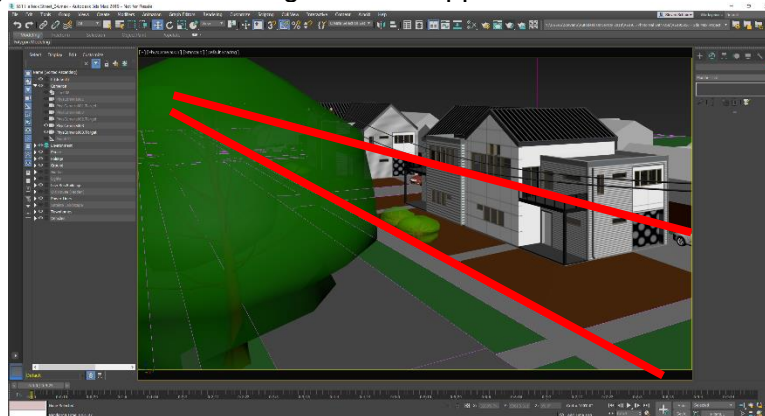
There are four key interest points that are created at the intersections of each of the one-third lines. When there is a particular object or scene element that is to be the focus, it can be placed at one of these intersection points. By using this rule, you can create an image with a more interesting composition.



THE RULE OF THIRDS

## Diagonals

The second rule is the use of diagonals within the image frame. By incorporating *diagonal lines* into any image, you can create a more dynamic image and lead the viewer's eye through the scene. Diagonals are easy to incorporate into a final image, and by using it in combination with the rule of thirds, you can create an image that will appeal to a much wider audience.



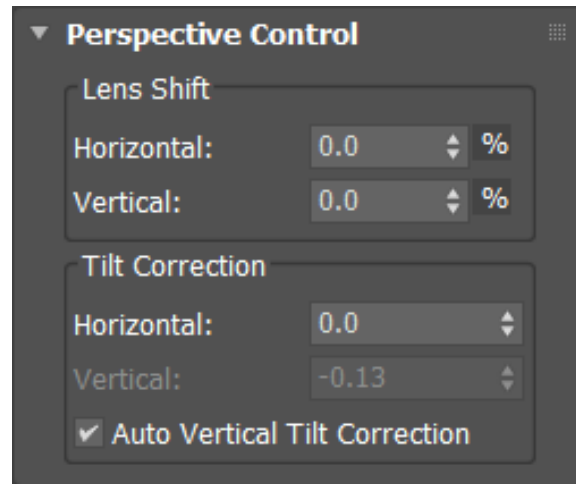
DIAGONALS

## Camera Correction

The last rule of composition to keep in mind is the use of *camera correction*. Since this is to be an architectural rendering, you want to make sure the vertical lines are all vertical. You can accomplish this by modifying the Perspective Control for the camera. In the **Modify** tab, **Perspective Control** rollout, use the **Tilt Correction** to set the correct amount of vertical



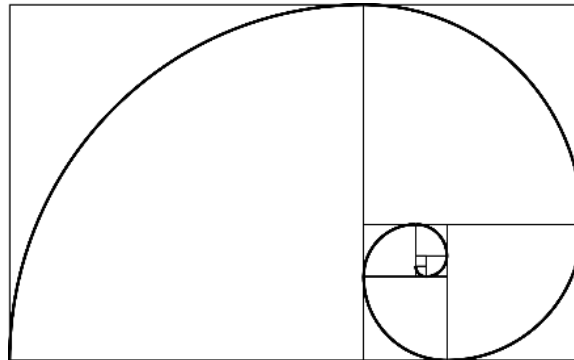
correction, or just click the **Auto Vertical Tilt Correction** option to obtain a 2-point perspective view.



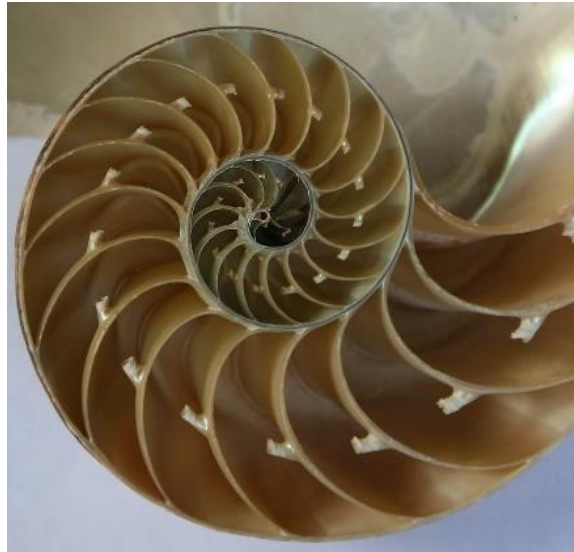
*CAMERA CORRECTION SETTINGS*

Once the proper value is entered, the camera view will have vertical object lines that are perfectly vertical.

## The Golden Ratio

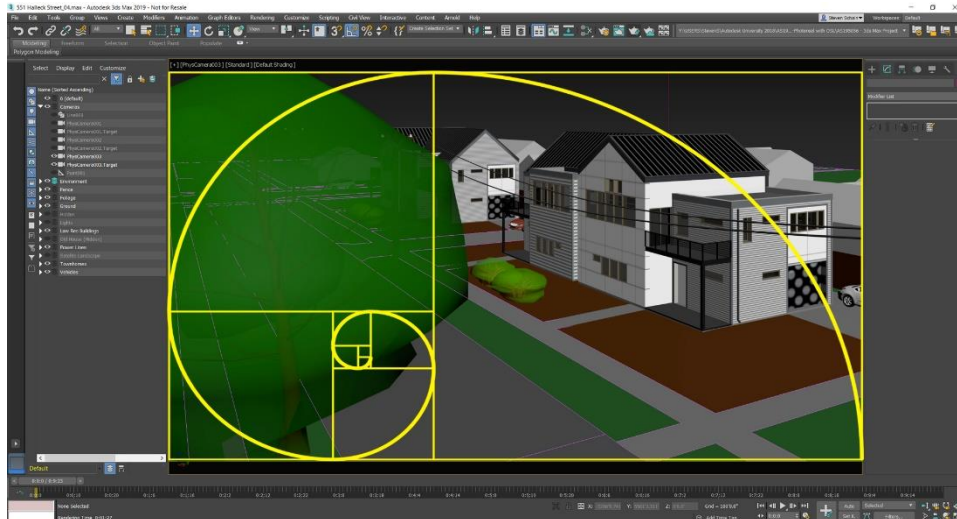


The *golden ratio*, also called the *golden mean*, defines two values, with the ratio of the sum equal to the two quantities. This ratio defines proportions based on length or area and has been used in architecture and art for centuries. The ratio also appears in nature, like the spiral pattern of a growing fern, or one of the many types of seashells.



*A NAUTILUS SHELL SHOWING DETAILS OF THE GOLDEN RATIO*

When the golden ratio is used for visual composition, it can create a powerful and dynamic image. Using this in your renderings can provide a balanced image from the viewer's perspective. This balance is more natural to human perception because it is seen in nature almost everywhere and adds to the visual harmony of the final image.



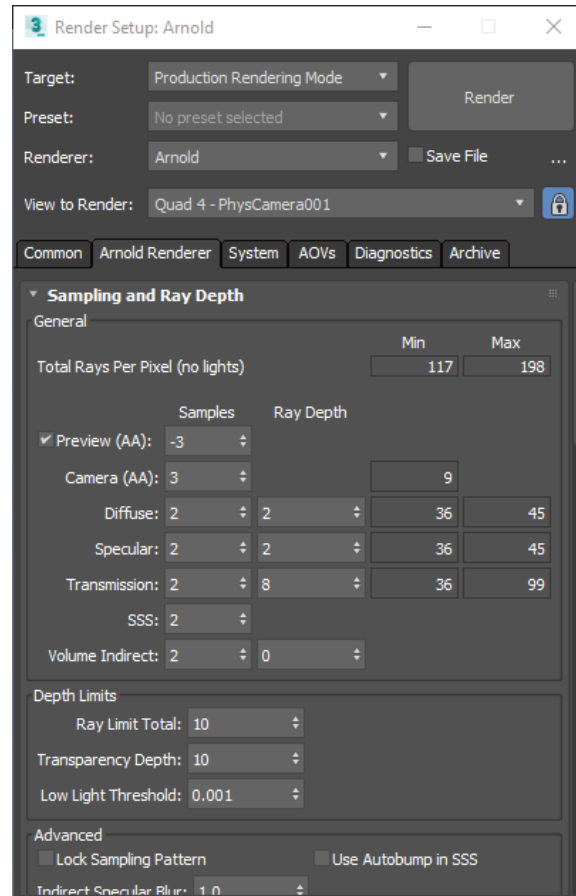
*IMAGE COMPOSITION USING THE GOLDEN RATIO*

## Rendering the Scene

Rendering a virtual photograph has become increasingly simpler as the quality and simplicity of advanced renderers have improved over the years. The rendering options in 3ds Max are no exception. The Arnold renderer is very simple to configure and needs only a few easy parameter adjustments in the Render Setup dialog.

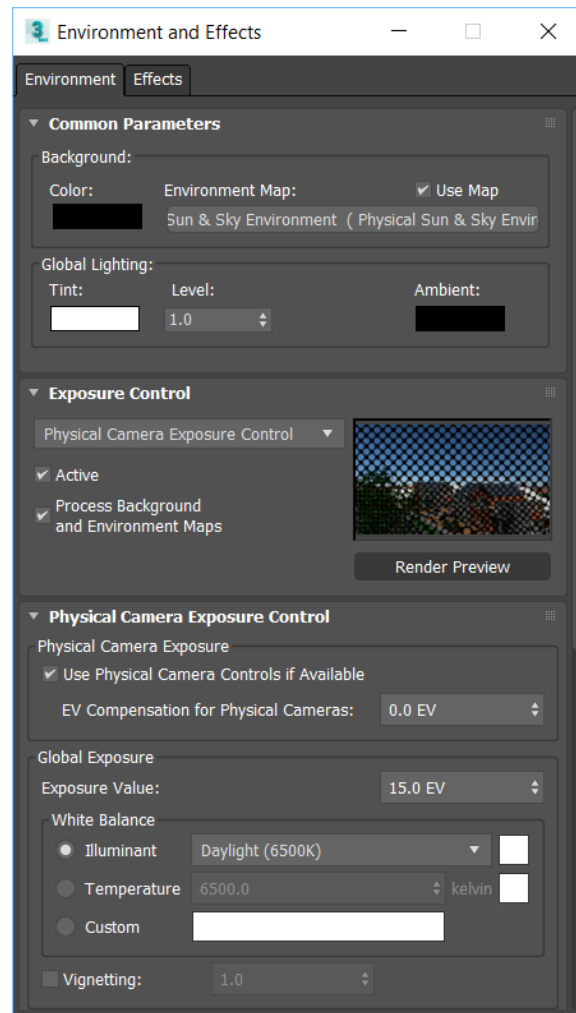


As already discussed, the Arnold renderer is a highly photorealistic renderer capable of generating physically accurate lighting, with very little worry about rendering settings. It does this by tracing the path of light through a scene.



*THE RENDER SETUP DIALOG SHOWING THE ARNOLD RENDERER PARAMETERS*

Once you set and configure the renderer, it is important to make sure the exposure is properly set. During the conversion process, the physical camera exposure control is set in the **Exposure Control** section of the **Environment and Effects** dialog. With this exposure control type, in conjunction with the physical camera, each camera can use an independent exposure value. Regardless, if you do not properly set the camera's exposure value, the final image may end up either too dark or too light. Once you set the proper exposure, you are ready to render the scene.

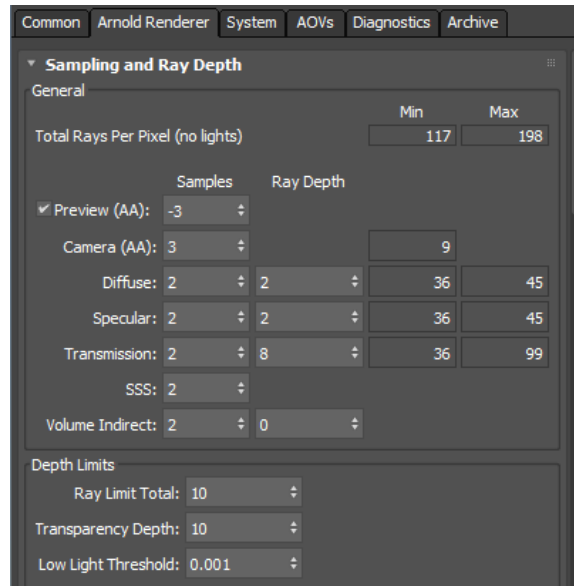


*THE ENVIRONMENT AND EFFECTS DIALOG SHOWING ENVIRONMENT AND EXPOSURE CONTROL*

## Configuring the Renderer

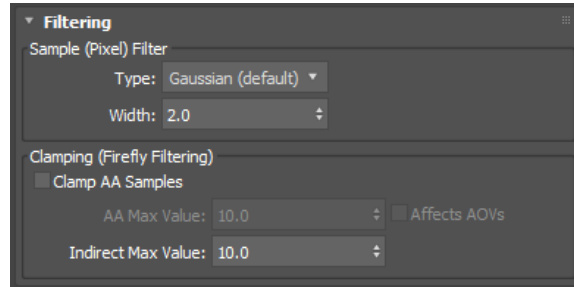
The Arnold renderer is another element that is configured through the Scene Converter. In the main toolbar, open the **Render Setup** dialog. In the Render Setup dialog, select the **Arnold Renderer** tab. Notice that there are only a few options for the Arnold render. Configuring the quality of an Arnold render is handled mainly in the **Sampling and Ray Depth** rollout. The **General** group contains parameters that control the **Sampling Ray** and the **Ray Depth** for different aspects of scene rendering. For example, the **Camera (AA)** only contains Samples, whereas **Transmission** contains both Samples and Ray Depth.

Under **Depth Limits**, you can limit the number of light bounces, which can speed up rendering time. This option can be helpful when you want to render a preview that doesn't have to have full and finished reflections or transparency. If you reduce the **Ray Limit Total** too low, scenes can appear darker than the final rendering with a higher Ray Limit. This is true especially for interior scenes, and exterior scenes that are lit from all around (typically by the sky).



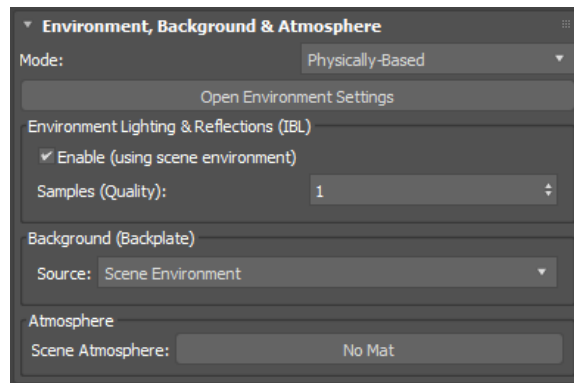
ARNOLD RENDERER PARAMETERS FOR SAMPLING AND RAY DEPTH

Under **Filtering**, you can select the **Type** and **Width** of the sample area. Increasing the Width value can soften the image, but may increase render time. You can also control **Clamping**, which can help reduce spots known as “fireflies.”



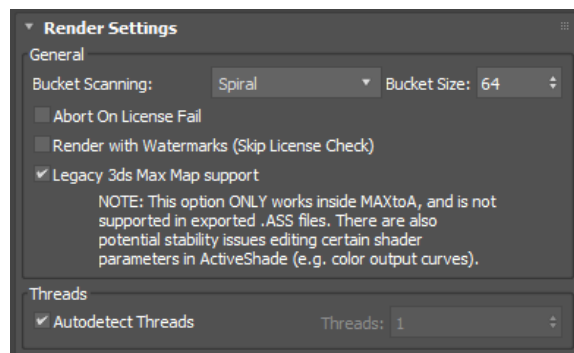
ARNOLD FILTER OPTIONS

In the **Environment, Background & Atmosphere** rollout, you can set the **Mode** for environment rendering. The **Physically-Based** option uses the current scene environment, or the environment set in the background source. This is calculated using a physically-based rendering approach. The **Advanced** option gives you more control over environment rendering and is there if you want to use a more artistic approach.



*THE ENVIRONMENT, BACKGROUND & ATMOSPHERE ROLLOUT*

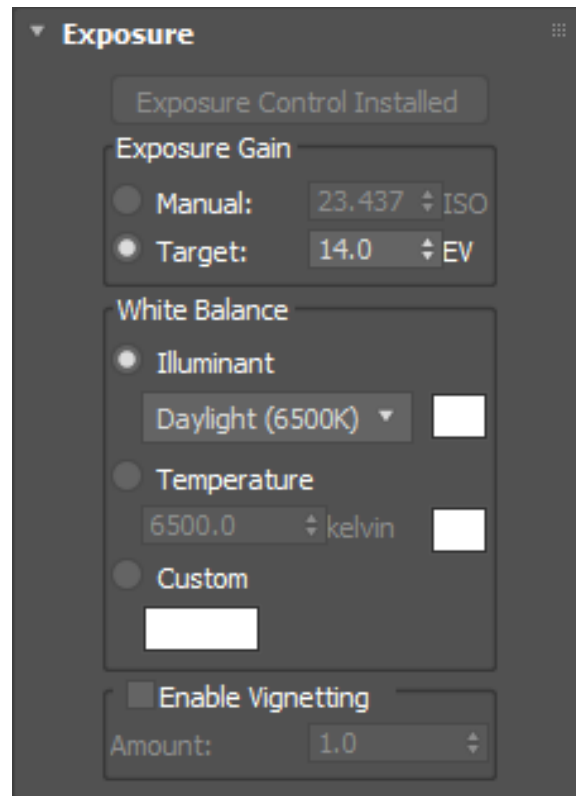
One option that is commonly set is under the **System** tab for the Arnold renderer. In the **General** group, enabling the **Legacy 3ds Max map support** option will allow you to use most of the traditional 3ds Max procedural texture maps, like noise and gradient ramp.



*THE RENDER SETTINGS ROLLOUT IN THE SYSTEM TAB*

## Adjusting Scene Exposure

Before you render a final image, you need to adjust the exposure of the scene. With the physical camera and physical camera exposure control, this is handled through the camera itself.



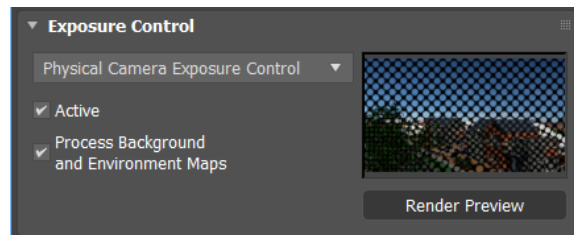
**Exposure Gain** allows you to modify your rendered images with controls similar to those used with real-world cameras. You can set a general Exposure Value, or, if you are accustomed to working with cameras, you can set specific film ISO, as you would with actual photography. It also gives you individual camera white balance, and the ability to add vignetting to the rendered image. The light levels of the scene do not change; only the sensitivity and amount of light entering the camera is changed.

For non-photographers, the EV value is easier to use. The single **Exposure Value** setting corresponds to a combination of three photographic exposure values: shutter speed, aperture, and ISO. Each increment or decrement in the EV value corresponds to halving or doubling, respectively. The general rule of thumb is that higher EV values result in darker images, and lower values result in brighter images. For example, an EV value of 15 would result in a darker rendered image than an EV value of 6 in the same scene.

The **Manual (ISO)** setting is the sensitivity of the camera film, expressed as an index. This setting works just like the Target EV setting, except, as the ISO value increases, so does the sensitivity of the camera to the light. This has the effect of brightening the scene.

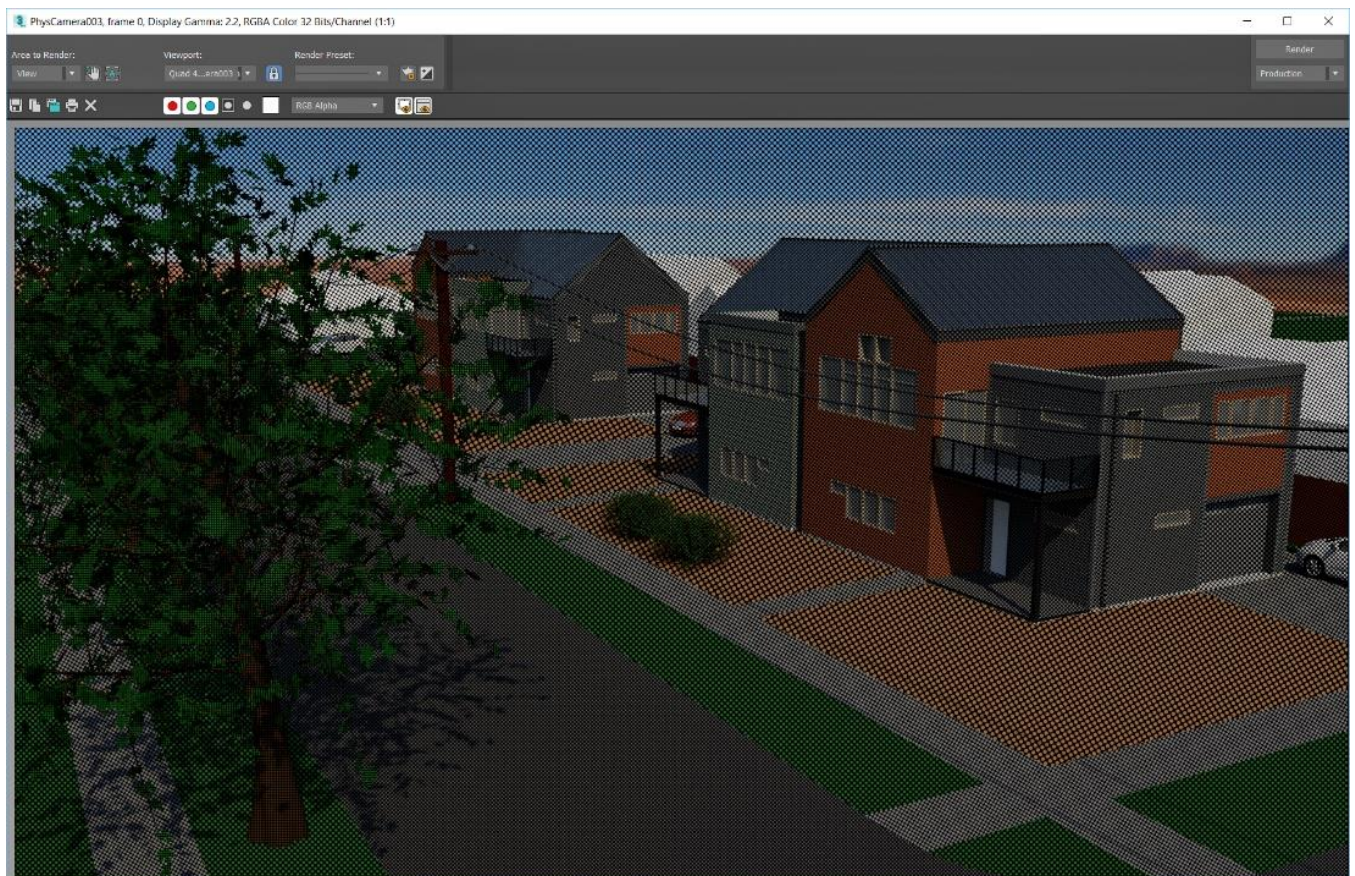
To preview the render to see what the current exposure looks like, click the **Render Preview** button. Once the preview render is complete, the Exposure Value can be modified as needed to increase or decrease the brightness of the final rendered image.





## Rendering a Final Image

To render the final image, you can either click the **Render Production** button on the **Main** toolbar or the **Render** button in the **Render Setup** dialog. Once the rendering is complete, you can see the result of the material changes, the lighting, and the exposure settings.



*THE FINAL RENDERING USING OSL SHADERS WITH ARNOLD TO GET A UNIQUE, STYLIZED LOOK.*





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