



# AUTODESK UNIVERSITY 2015

AV10763-L

## Beautiful Structure: Rendering Structural Revit® Models with 3ds Max®

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### Learning Objectives

- Discuss Revit® Structural Modelling strategies for improved 3ds Max® renderings.
- Learn to quickly import, apply materials, and adjust lighting settings with Autodesk® 3ds Max®.
- Render Revit® structural models with Autodesk® 3ds Max®.
- Create architectural enhancements to the structural rendering using 3ds Max®.

### Description

How does your structural engineering firm stand out? Structural engineering firms must also promote and market ourselves as specialist and leaders in BIM. Today we work, collaborate, and compete in the visual arena. Appealing renderings are not restricted to just the architects bag of tricks; structural renderings can be used for websites, cover sheets, proposals and magazine articles. Structure is the beautiful yet rarely seen building bones of every project and will be the highlight of this rendering lab. We will import a revit structure model and quickly create materials, lighting, and structurally prominent renderings with 3ds Max®. A picture is worth a thousand words and this class is about using the collaborative visual power of Autodesk® 3ds Max® rendering to illustrate our expertise and become highly BIM visible in today's competitive structural engineering atmosphere.

### Your AU Expert

*Tina is a Senior Structural Technologist and BIM Leader for the offices of Herold Engineering on Vancouver Island, British Columbia. Tina is an avid Autodesk Revit Structure user and promoter as well as Autodesk Expert Elite Member. She is Chair of the BIMbc Victoria Revit Users group and member of the CanBIM Designers Executive Committee placing her well in the community to share her skills and experience of Revit Structure. Tina has presented on the topic of Revit Structure at Autodesk University and the Revit Technology Conference. Tina has been involved in teaching Revit Structure through workshops, user group sessions and formal instruction since 2006. Her experience and teaching capabilities make her a valuable resource for this very specialized software and popular speaker and presenter nationwide on not only the software but also the process and methods of utilizing the software in the AEC industry.*

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## Section 1: Prepare the Revit Structural Model for Rendering

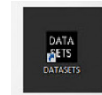
In this section you will edit the structural revit model from its current standard setup of optimised 2d drawing production to an enhanced 3d environment for rendering in Autodesk® 3ds Max®. It is a good idea to do these changes in the software you're most familiar with so we will start in Revit. A few of the items that will need to be revised prior to exporting a 3d view for into 3ds Max® are:

- Materials
- Cameras
- Rendering settings
- Export the scene

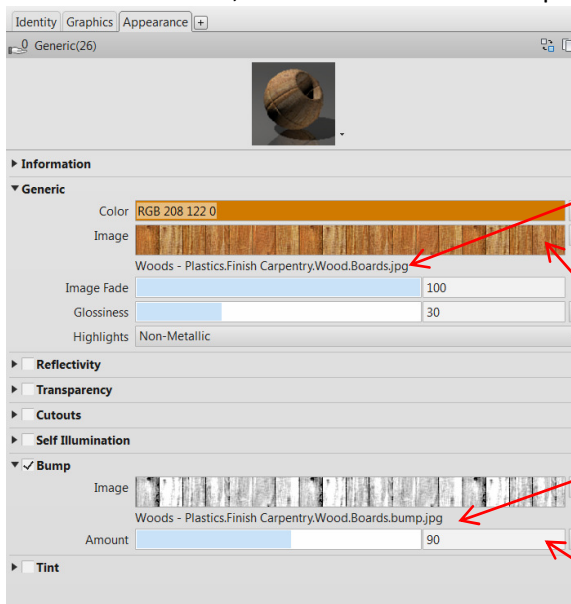
### Materials

First we will review and customize material appearances in Revit® for rendering.

1. Open Autodesk® Revit® 2016, select the desktop shortcut Datasets, and open the revit file AV10763-L Structural.rvt in the session folder AV10763-L Beautiful Structure.



2. In 3d Realistic view, select a main glulam roof beam and under Materials and Finishes, select the Structural Material, Wood – Glulam Main Sloped Beams for editing.



3. In the Material Browser, Select the Appearances tab.

4. Select the image link and in the class folder browse to the Materials folder change to **Woods & Plastics.Finish Carpentry.Wood Boards.jpeg**

5. Select Color and change to: Red **208**, Green **122**, Blue **0**

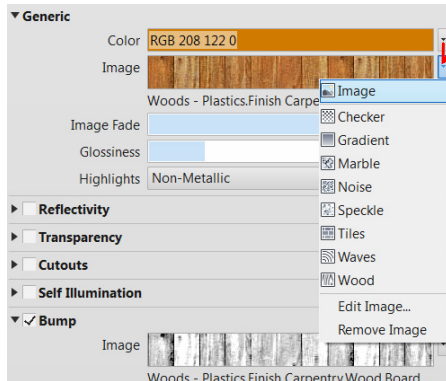
6. Check Bump, image link to **Woods & Plastics.Finish Carpentry.Wood Boards.bump.jpeg**

7. Set Bump Amount to **90**.

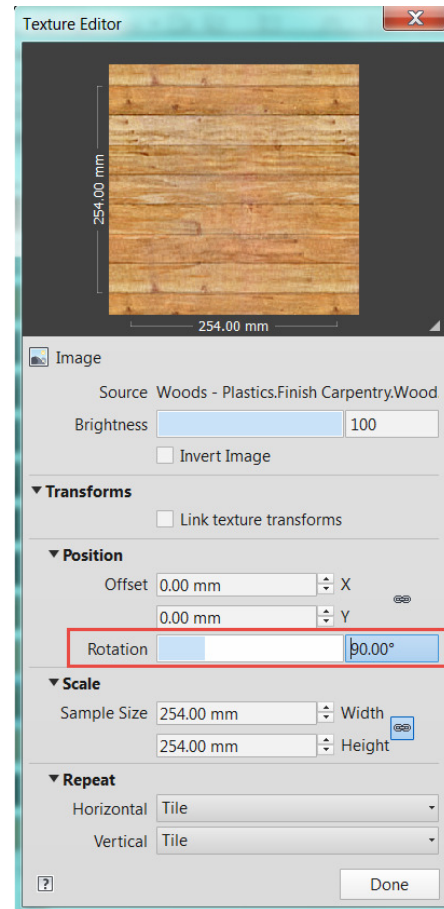
8. Click Okay to finish appearance changes.
9. Zoom in to see the new glulam material. We can see the new material but the board lamination pattern along the sides of the beam is orientated in the wrong direction.



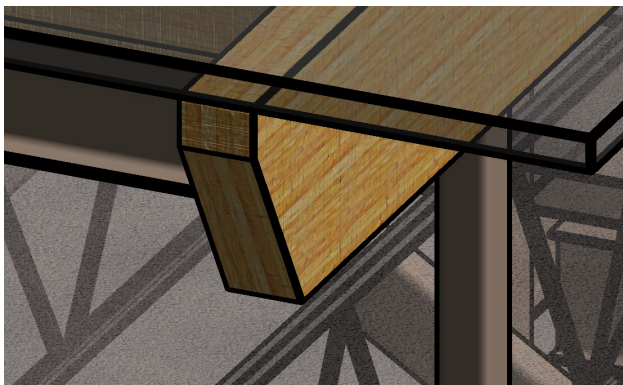
- Once again, select the glulam roof beam and under Materials and Finishes, select the Structural Material, Wood – Glulam Sloped Beams for further editing. Select the Appearances tab, and select the image pulldown and choose Edit Image.



- In the Texture Editor set the rotation of the image 90° under the position options. Click Done, then Okay, and exit the Material Editor and check your work.



The glulam beam now has lamination running in a direction consistent with what we would expect for the main length of the beam, though now there are issues end cut laminations. This is an issue we will address in Autodesk® 3ds Max®.

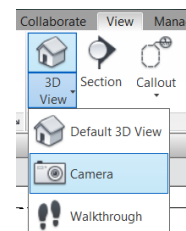


Review of the other major elements will show that the glulam beams are very much the only custom structural element in this project. The structural elements in use in this project were not setup for downstream 3d rendering and we can see that the majority of the main structural elements are unaltered out of the box (OOTB) material appearance settings. We will however, leave their preset element material appearances at this time.

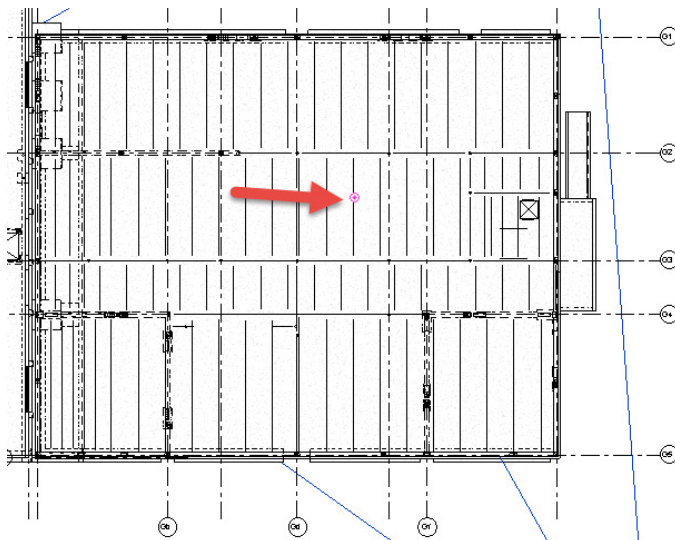
## Cameras

Create a camera view. The export file (.fbx) from Revit® must contain at least one camera view. We will create an exterior camera view for our project.

- In the project browser, select and open the Main Floor plan.
- Zoom in so that you can see the Eastern most wing of the school where the grids are prefixed G.
- From the View Tab, Create Panel, Select the 3d View drop down and choose Camera.



- Left click to place the camera in the lower right corner of the east block and left click again somewhere inside the east block to finish the camera view. Revit will create and open this camera view. This view will be active with properties box and modify camera panels ready.

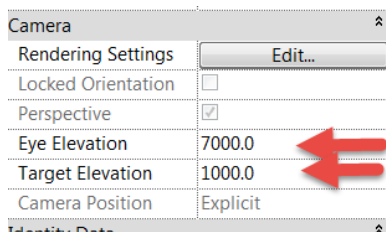


- In the Properties dialog box, rename the new camera view to Exterior.

- Also in the Properties dialog, Uncheck the Far Clip Active so the camera can see beyond the clip plane.

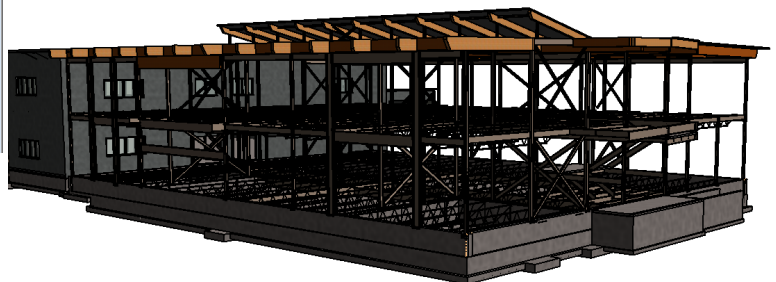
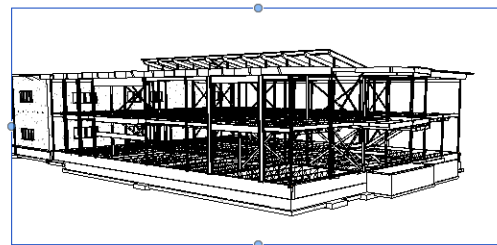
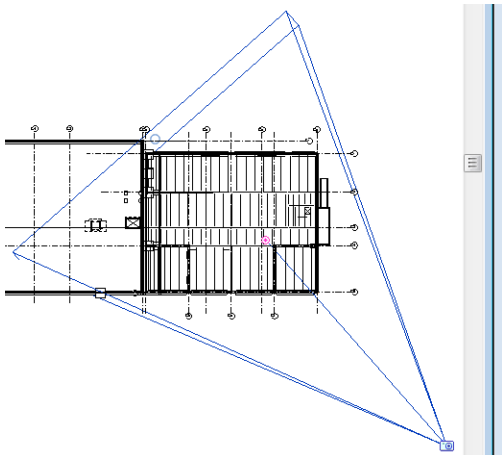
- You may wish to adjust how the building sits within the Exterior view, use the Steering wheel to adjust the camera view.

- Also adjust the Camera Eye Elevation / Target Elevation in the Camera Properties Dialog.




Target Elevation in the Camera Properties Dialog.

- Use the Navigation wheel to adjust the camera angle as desired. You can also edit the camera angles in the Main Plan view. Tile the windows and edit camera settings until you are happy with the 3d Exterior View. Change the visual style to Realistic.



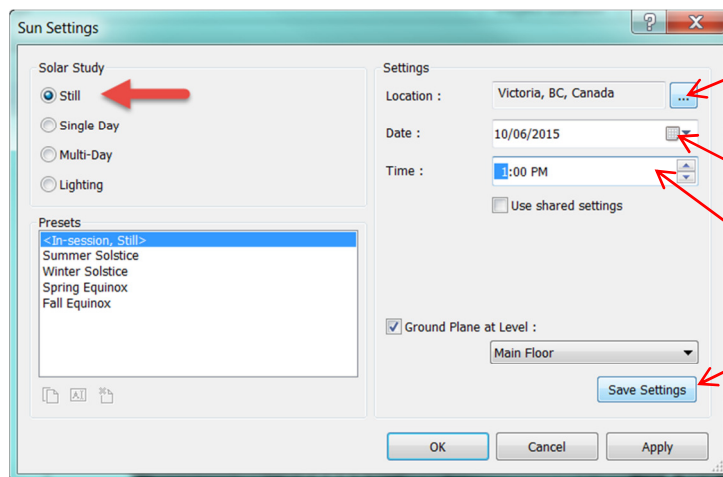
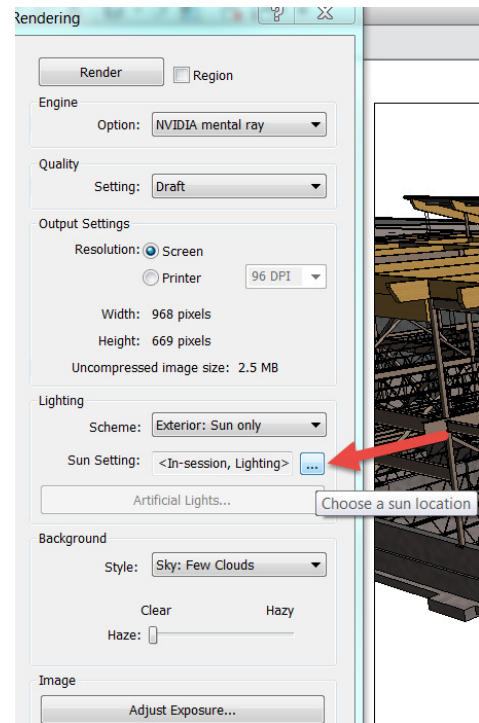
## Rendering Settings

Setup the basic settings for the rendered view. Maximize the 3D Exterior view.

1. From the View Tab, Graphics panel, select Render to open the Rendering dialog box. Or from below the view, select  Show Rendering Dialog.

Because we are rendering a model with structural elements only, the default lighting scheme of Exterior: Sun only will be acceptable and we will merely adjust the Sun setting / position.

2. Under Solar Study, select Still.

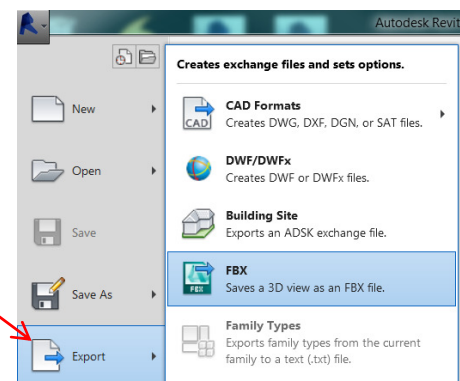


3. Enter the location, Victoria BC Canada. Select Continue with entered address.
4. Change the date to June 10<sup>th</sup>.
5. Time to 1:00 pm.
6. Save Sun Settings as **Victoria Summer**. Click Apply and OK.

## Export the scene

The new camera view you have created will be exported from Revit® in .fbx file format.

1. Open the 3d view: Exterior.
2. From the Application menu, select Export, then FBX.
3. Save the file, **AV10763-LStructure-3DView-3DExterior.fbx** into the class folder.





## Section 2: Rendering the Revit® Structural Model in 3ds Max®

In this section you will edit the structural revit model in Autodesk® 3ds Max®. A few of the items that will need to be revised prior to exporting a 3d view for into 3ds Max® are:

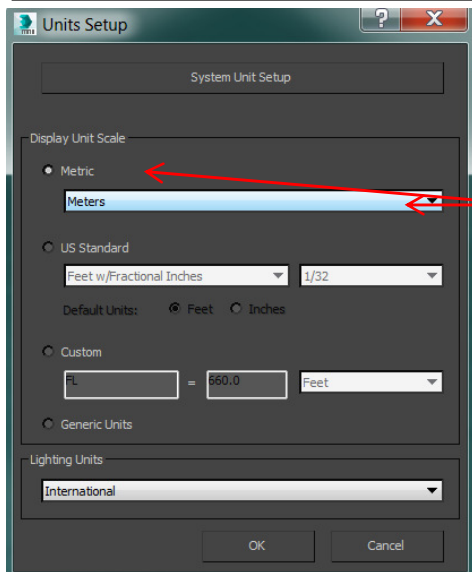
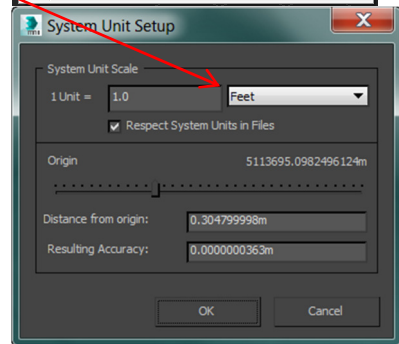
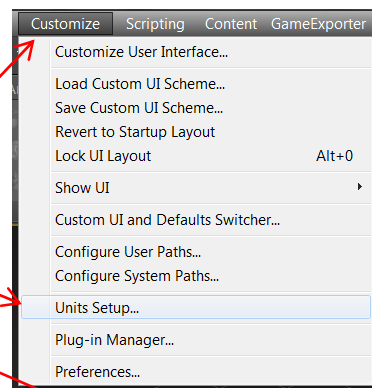
- 3ds Max® Import Settings
- Edit Revit® Materials and Create New Materials
- Add Grass Terrain
- Adjust the Daylighting System
- Review / Modify Rendering Settings
- Add a Custom Background (Sky) Image
- Render the Scene

### 3ds Max® Import Settings

First we will review and customize material appearances imported from Revit® for rendering.

1. Open 3ds Max®, close out of the start-up dialog box.
2. Main menu, choose Customize, then Units Setup.
3. In the System Units Setup, change Inches to Feet and select OK.

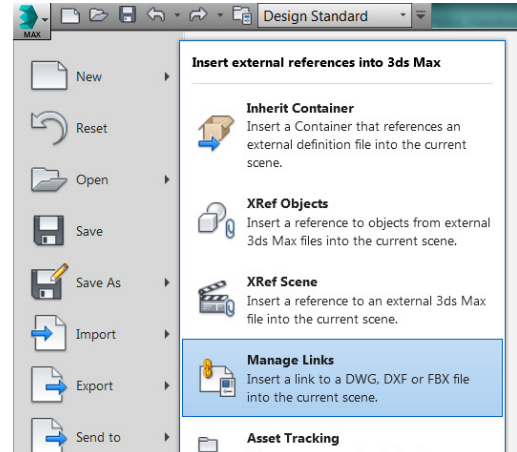
NOTE: Revit® exports FBX files with feet as the unit. To avoid having 3ds Max® rescale the model at import you have to set the scale to match the FBX file.



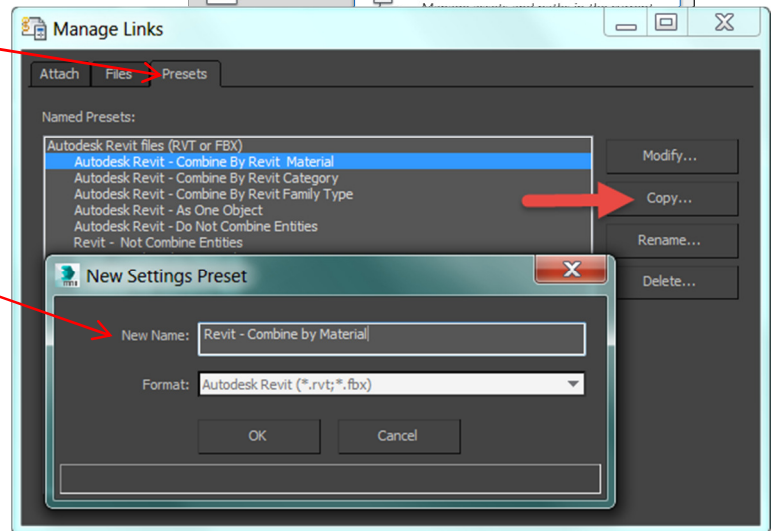
4. On the main units setup dialog in the display unit scale group, choose metric. Unlike the system unit scale, display units only affect how units are displayed in 3ds Max®. For this project we will use metric values.



- Link the FBX file. From the application menu, choose References, Manage Links.



- In the Manage Links dialog box, select Presets tab.



- Click to highlight the Autodesk Revit - Combine by Revit Material, Select Copy.

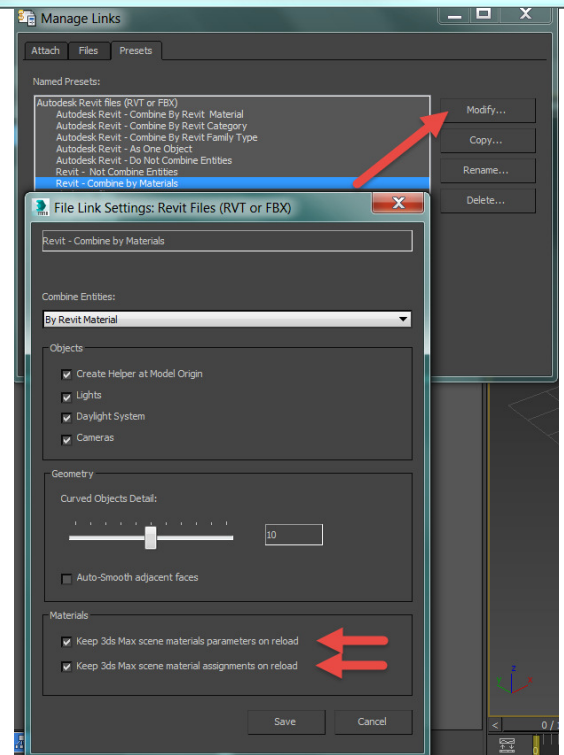
- In the New Settings Preset, type **Revit – Combine by Materials** and click OK.

- Click to highlight the preset just created and select Modify.

- On the File link setting, Revit Files (RVT or FBX) click to turn on both the options in the Materials group, and then click Save.

- On the Attach Tab, Select File and browse for the file exported from Revit, **AV10763-LStruct-3DView-3DExterior.fbx**

**OR** from the Progress folder Load **AV10763-LStructure-3DView-3DExterior.fbx**



- Under preset, use the drop-down menu to choose Revit - Combine by Materials that we created.

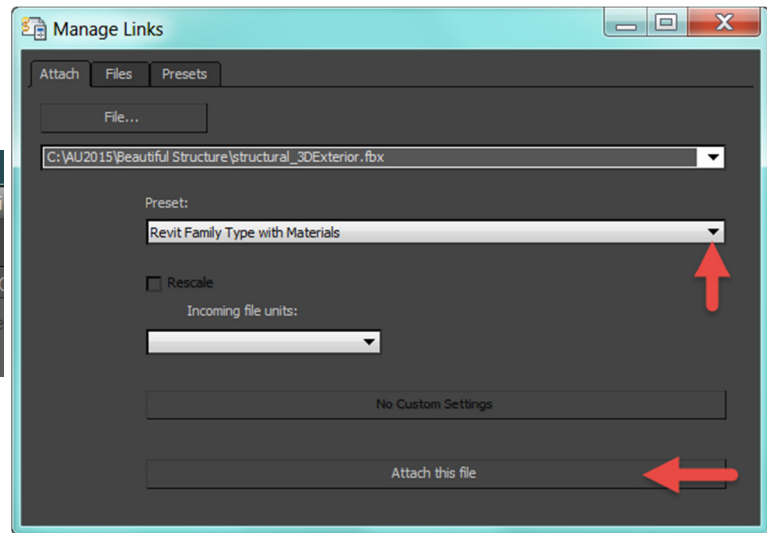
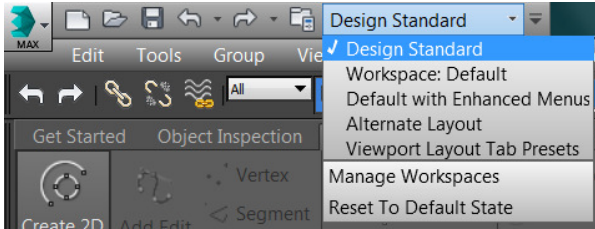
- Click Attach this File.

- When 3ds Max® prompts you to add an exposure control. Click Yes.

- Close the Manage Links dialog.



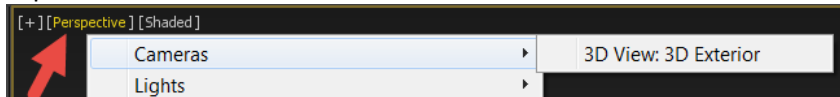
- From the Quick Access Toolbar, select the workspaces drop down list and Choose Design Standard.






## Edit Revit® Material and Create New Materials

### Revit® Material Edits

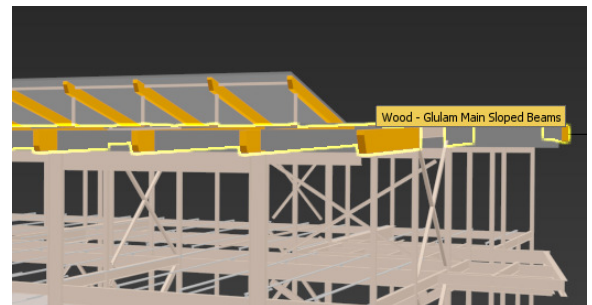
- In the Perspective viewport. Left Click the POV (Point of View) viewport label Perspective, in the top left corner of the frame and select the 3D Exterior view from the Camera flyout.



- Should you wish to adjust the camera's view, use the Field of View , and Pan View  buttons, animation control tools on the lower right toolbar.
- When you are satisfied with your camera frame, click the POV (Point of View) viewport label again, switch back to Perspective. Or while in the frame, hit P on the keyboard.
- From the main toolbar, Left click the Select object tool .

- Left click within the frame on the building structure, to propagate the Scene Explorer. You can browse and select from the scene Explorer the Wood-Glulam Main Sloped Beams.


OR

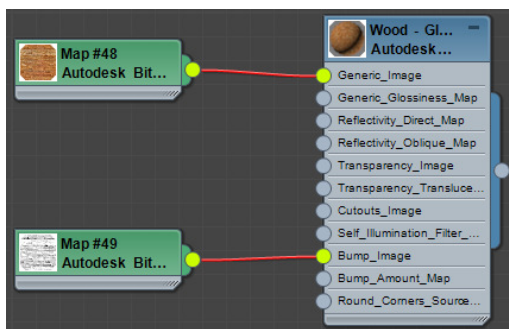
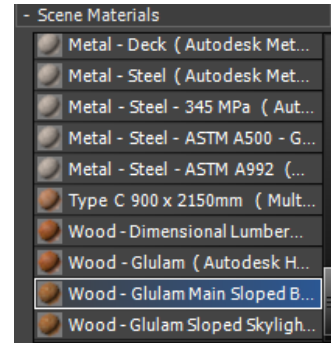





- Scroll in the view and Left click to select the main roof beams we edited previously in Revit.

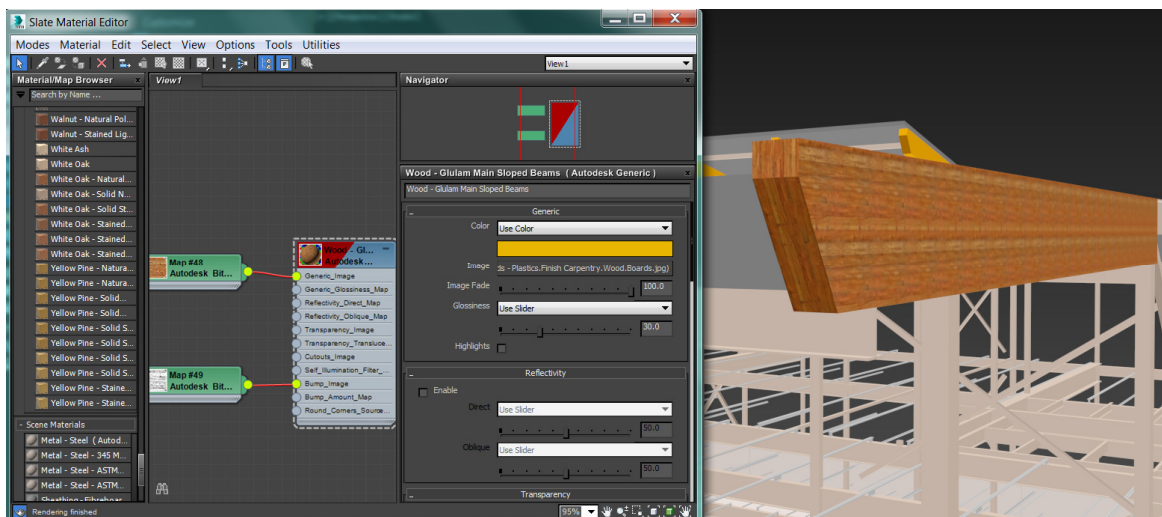





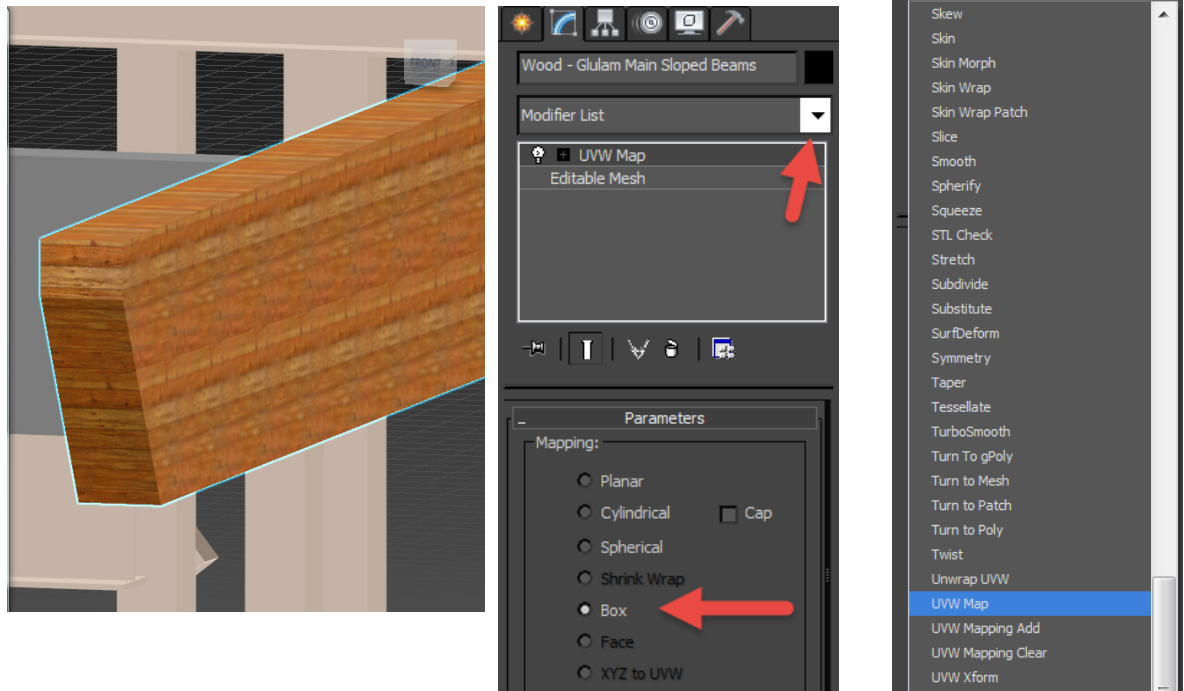
7. From the main toolbar, Select Material Editor , or press M on the keyboard. Resize the Editor if necessary to view all sections.
8. From the MaterialMap Browser, scroll all the way to the bottom of the list to Scene Materials.
9. Scroll down to the bottom of Scene Materials to find Wood – Glulam Main Sloped Beams.
10. Left click, drag and drop Wood-Glulam Main Sloped Beams Material into the Material view. Click OK to the request for Copy by Instance Method. Click L within the view space to fit the material and maps within the view.



11. Double Click Wood – Glulam Sloped Main Beams material to make it active.
12. Select Show Background in Preview .
13. Select Show Shaded Material in Viewport . Use the Field of View  to zoom in on the end of the Glulam beams. The glulam material / laminations are now visible.

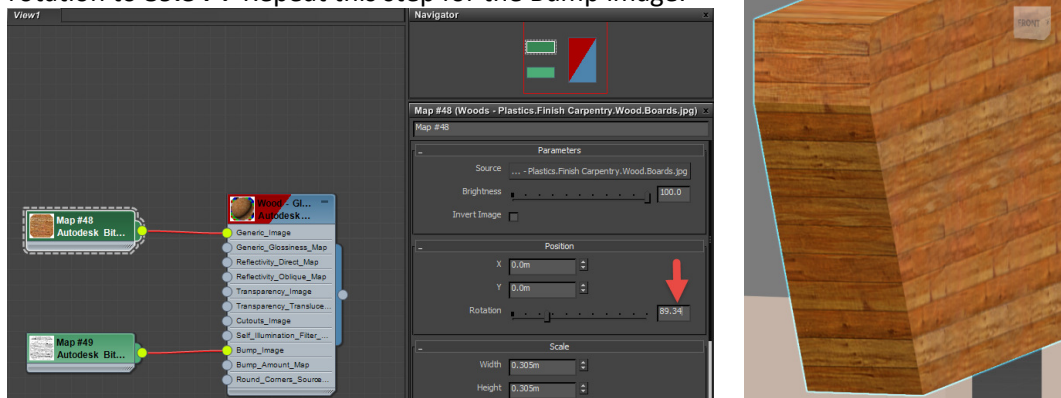


14. From the command panel tabs, Select Modify , and from the Modifier List pull-down Select UVW Map.



15. Under the Parameters section of UVW Map, Select Box. The application of the box wrap to the glulam beam changes the lamination direction at the end cuts of the glulam beams. In addition, the top of the beam is changed and the beam laminations along the beam.

16. In the Material Slate Editor, Double click to activate the Generic Image Map and revise the rotation to **89.34°**. Repeat this step for the Bump image.





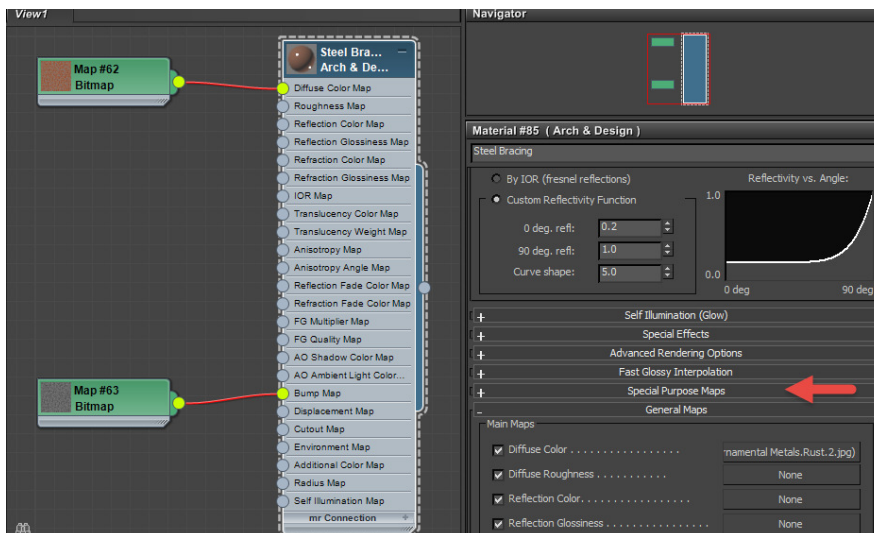
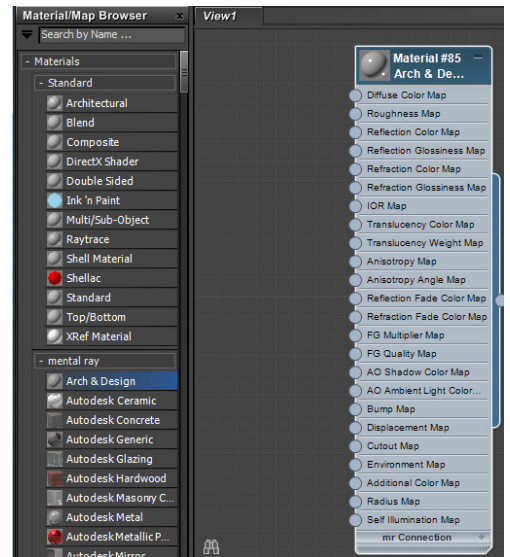
You will now have the beam laminations for the end cut and side cuts as desired.

The age old question remains here, how much time and effort do you put into the material accuracy? Will the end result reflect the time and effort spent for minor accuracy improvements? You could proceed with editing with Unwrap UVW and edit each face to get the perfect look, but for our purposes the end cut / side laminations will be perfectly suitable for the render frame today.

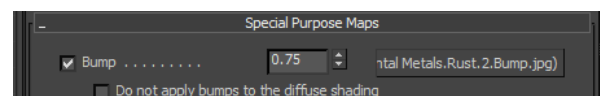





## New Brace Material

1. From the main toolbar, Select Material Editor , or press M.
2. To clear the view space, press Ctrl + A to select all, then Delete Selected . Note this will remove the selections from the working materials view, not delete them from the project.
3. Scroll back to the top of the Material Browser. From mental ray Materials drag and drop Arch & Design material into the view panel. Double Click the material and name it **Steel Bracing**.
4. From Map Browser, drag and drop a Bitmap into the View Panel. This will automatically open dialog to select a bitmap image. In the class directory - Materials folder, select **Metals.Ornamental.Rust2.jpeg**.
5. Left click and drag the right node of the bitmap to the node of the Diffuse Color Map on the Steel Bracing material.
6. From Map Browser, drag and drop a Bitmap into the View Panel. This will automatically open dialog to select a bitmap image. In the class directory Materials Library, select **Metals.Ornamental.Rust2.Bump.jpeg**.
7. Left click and drag the right node of the bitmap to the Bump node on the Steel Bracing material.







8. In the Parameter Editor, Select the Special Purpose Maps roll-down and edit the bump amount to **0.75**.

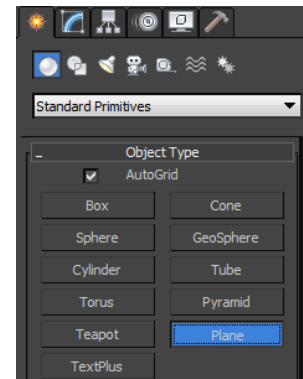
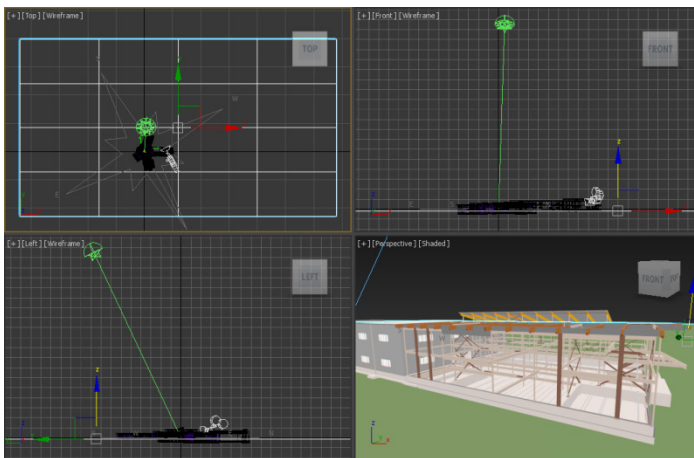




9. Left click on any brace in the Perspective view.
10. Double click the Steel Bracing material in the Slate Material Editor to activate.
11. Select Show Background in Preview .
12. Select Show Shaded Material in Viewport . Use the field of view to zoom in on the end of the Glulam beams. The glulam material / laminations are now visible.
13. Select Assign Material to Selection  then minimize the Slate Material Editor to view the bracing.

## Add a Grass Terrain

Continue in the scene or Open **AV10763-LStructure-3DView-3DExterior2.max**

1. Click the Viewport Toggle  and Zoom Extents All Selected  in the bottom right corner viewport navigation tools. Then go to the Top View.
2. Left click in the Top View and zoom out.
3. Select Create , Geometry , and Plane.
4. In the top view, left click at the top left, drag and left click to the bottom right.




5. On the main toolbar, choose Select and Move , and in the Left or Perspective view, adjust the height of the new plane geometry just created by dragging the Y axis of the Grass Terrain. The Plane should sit just above the footings and below the slab on grade.
6. Left click to select the Plane and go to the Modify  and change the name of the plane to Grass Terrain.





7. Add Material to the Grass Terrain geometry.

Press M for Material Slate Editor or  from the Main Toolbar.

8. Drag and drop Arch & Design Material from the Material Browser into the view panel. Double click the material and name it **Grass Terrain**.

9. From Map Browser, drag and drop a Bitmap into the View Panel. This will automatically open dialog to select a bitmap image. In the class directory Materials Library, select **Sitework.Planting.Grass.StAugustine2.jpeg**.

10. Left click and drag the right node of the bitmap to the node of the Diffuse Color on the Grass Terrain material.


11. From Map Browser, drag and drop a Bitmap into the View Panel. This will automatically open dialog to select a bitmap image. In the class directory Materials Library, select **Sitework.Planting.Grass.StAugustine2.Bump.jpeg**.

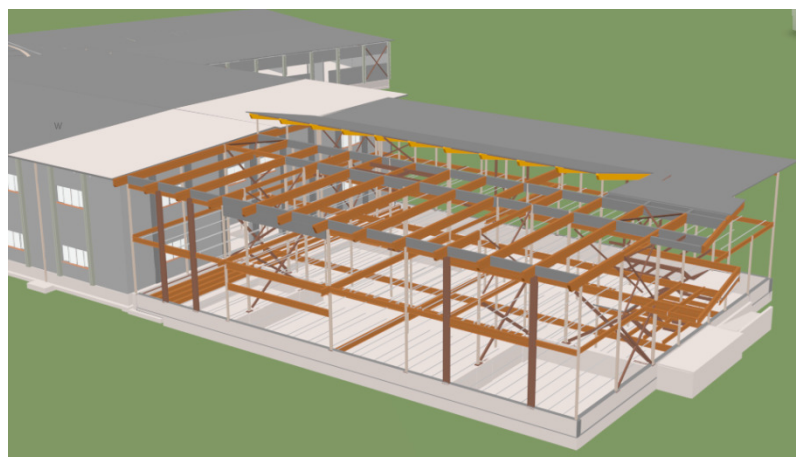
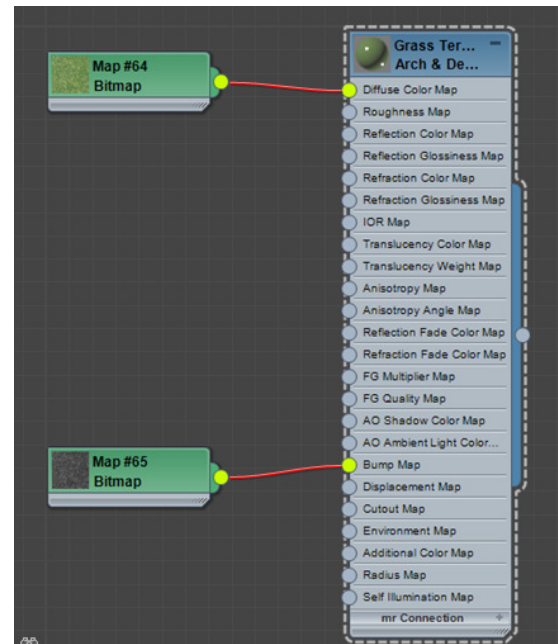
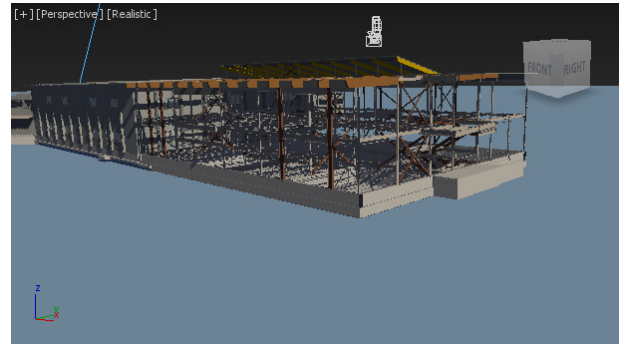
12. Left click and drag the right node of the bitmap to the Bump node on the Grass Terrain material.

13. Double click the Grass Terrain material to activate. Drag the output node on the Grass Terrain and drop it onto the Grass Plane **OR**

14. Select Show Background in Preview .

15. Select Show Shaded Material in Viewport .


16. Select Assign Material to Selection  then minimize the Slate Material Editor to view the frame.

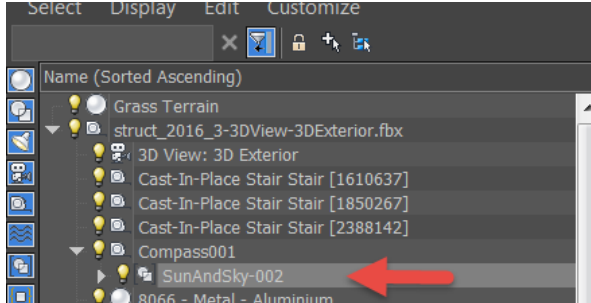






## Adjust the Daylighting System

Continue in the scene or Open **AV10763-LStructure-3DView-3DExterior3.max**


1. Set POV to 3dExterior view, in the Scene Explorer and maximize the viewport . Left Click on the building to propagate the scene explorer and then highlight the SunandSky-002 object, under Compass001.



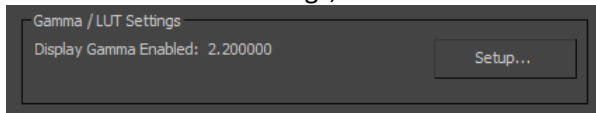
2. Go to the Motion panel , in the Control Parameters rollout, change the North Direction to 275. Use the Maximize Viewport Toggle  to view the movement / placement of the SunandSky light.

3. If not set, Set Location to Victoria, BC, Canada.

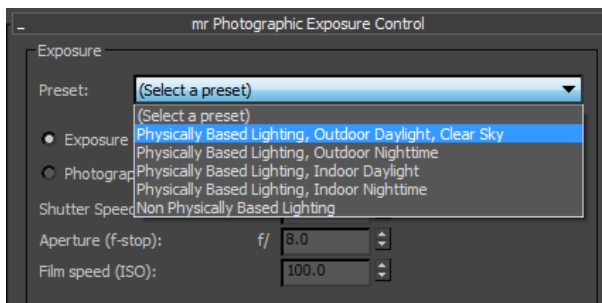
4. On the Main toolbar, click Rendered Frame Window .

5. Click Environment and Effects Dialog .

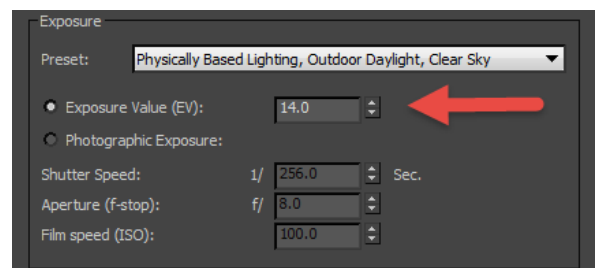
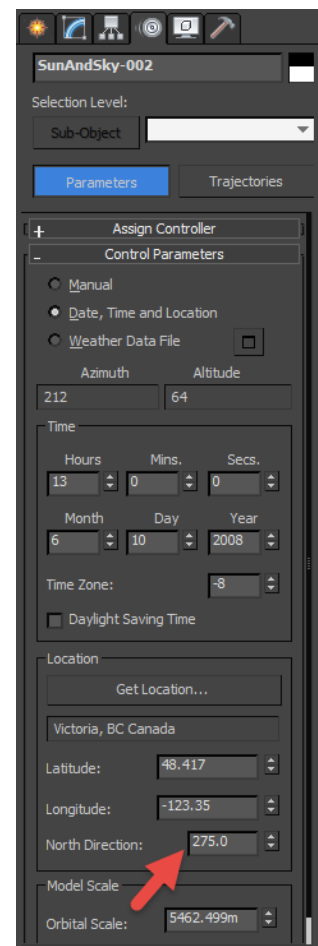
6. Under mr Photographics Exposure Control, scroll down to Gamma / LUT Settings. If not enabled, click Setup. Select Enable Gamma. Select both Color and Material settings, and set Gamma to 2.2. Click OK.



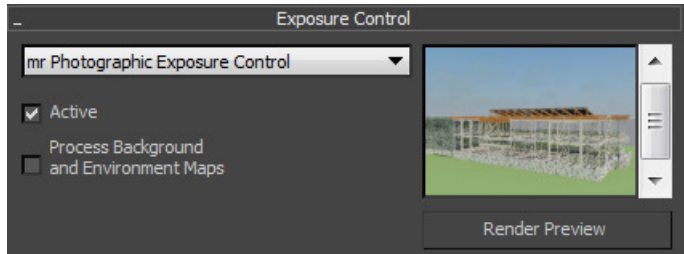
7. Also in the mr Photographics Exposure Control, Select Exposure, Preset to Physically Based Lighting, Outdoor Daylight, Clear Sky.



8. Set the Exposure Value to 14.0



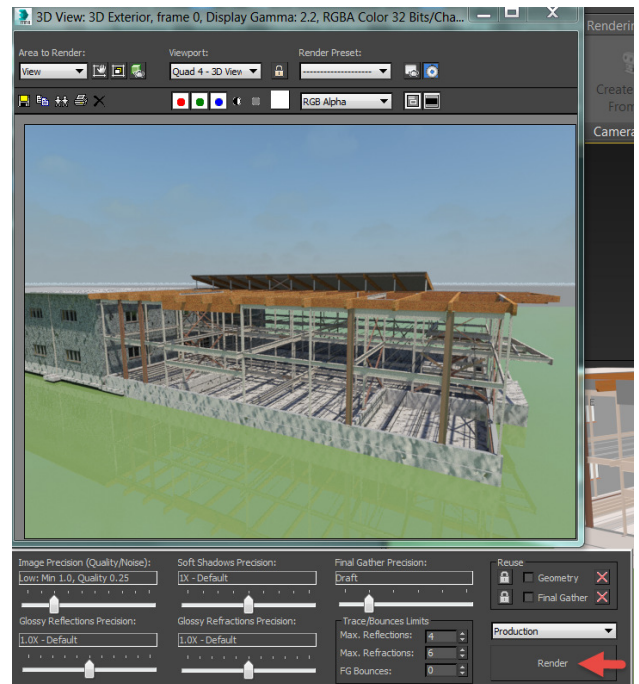
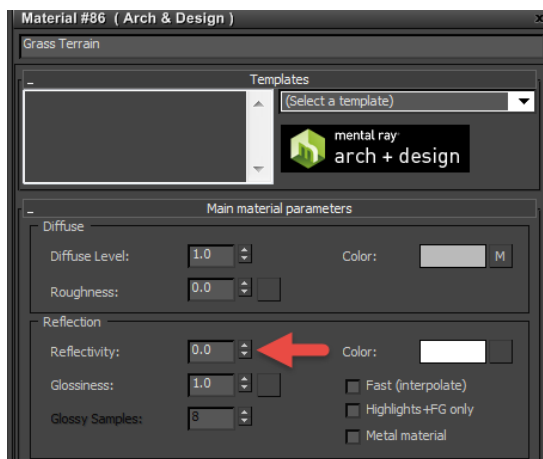
9. Select Render Preview.




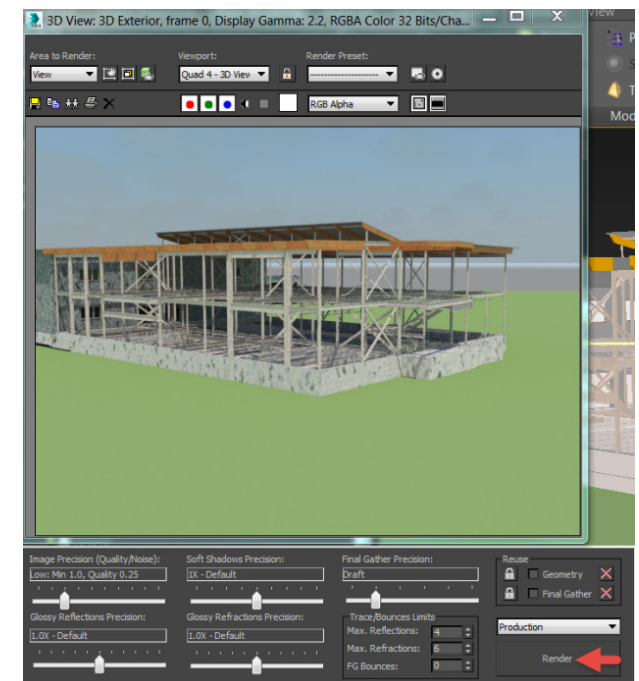
10. If the Render Preview looks good, go ahead and hit Render in the Render Frame Window dialog. Accept the Low Image Precision setting and other default settings.

You will see from this render that the grass terrain is reflecting in a manner similar to the surface of still water.

11. Type M to open the Material Editor and change Reflectivity for the Grass Terrain material to 0.




12. Minimize the Material Editor and from the Main toolbar, click Rendered Frame Window  and Render again.



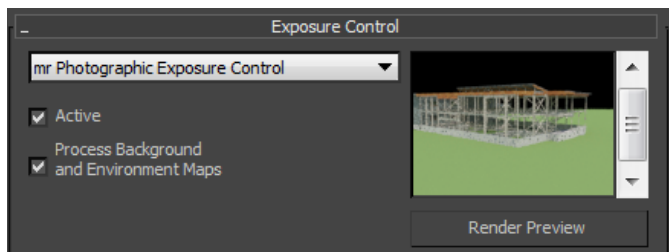
## Adjust a Custom Sky Background

Continue in the scene or Open **AV10763-LStructure-3DView-3DExterior4.max**

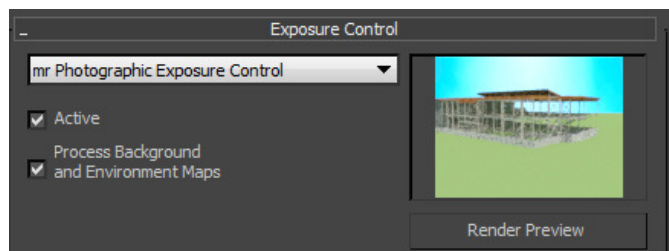
1. On the Main toolbar, click Rendered Frame Window .


2. Click Environment and Effects Dialog .

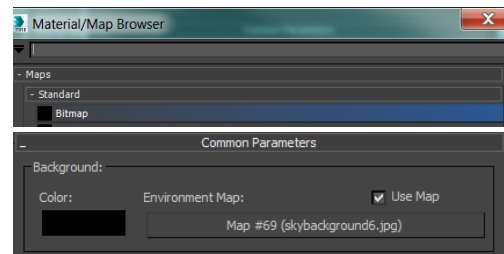
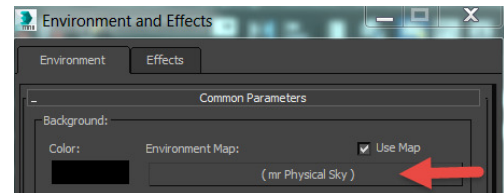
3. Under Common Parameters, Background, Left click and select mr Physical sky to open a Material Map Browser dialog. Under Standard, double click the Bitmap, browser from Image selection will automatically open, select skybackground6.jpeg from the AV10763-L Materials folder.



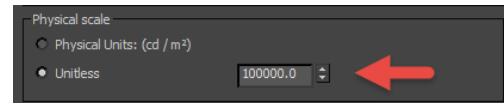
5. Scroll down the Environments and Effects dialog to Physical Scale. Select Unitless and enter **100000**.



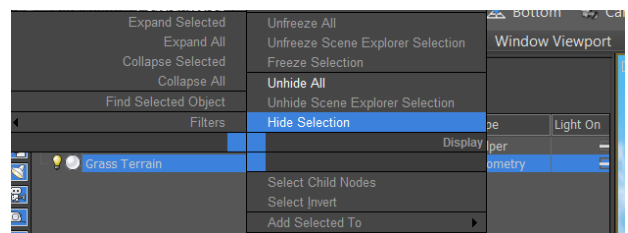
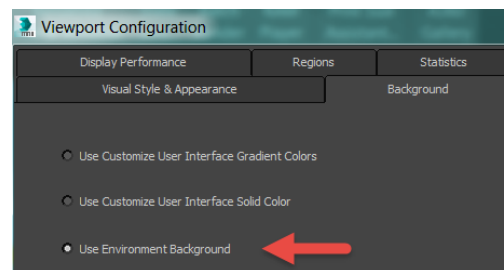
7. To see the sky background in the viewport, minimize the render viewports and left click in the viewport, hit ALT+B on the keyboard. Check Use Environment Background.
8. Use the Select Object tool from the main toolbar and Select the Grass Terrain in the scene. In the scene editor, right click and select Hide Selection.
9. Press M for Material Slate Editor or  from the Main Toolbar



4. Select Render Preview. The sky image is actually all black in the background.



6. Run Render Preview again. We can now see the image we've chosen, but it needs further editing.

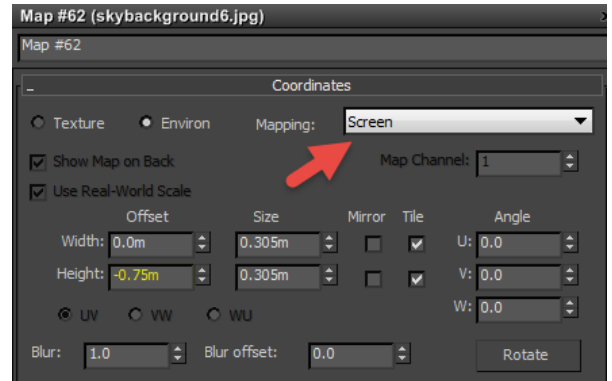


10. Maximize / Open the Environments and Effects Dialog. Drag and drop the skybackground6.jpeg bitmap from Environment and Effects into the working view of the Material Editor. Minimize the Environment and Effects Dialog.

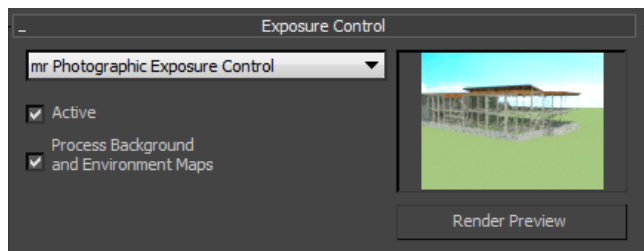
11. Double click to activate the map properties.

Under Coordinates rollout:  
change Mapping to **Screen**  
change Offset - Height to **-0.75m**

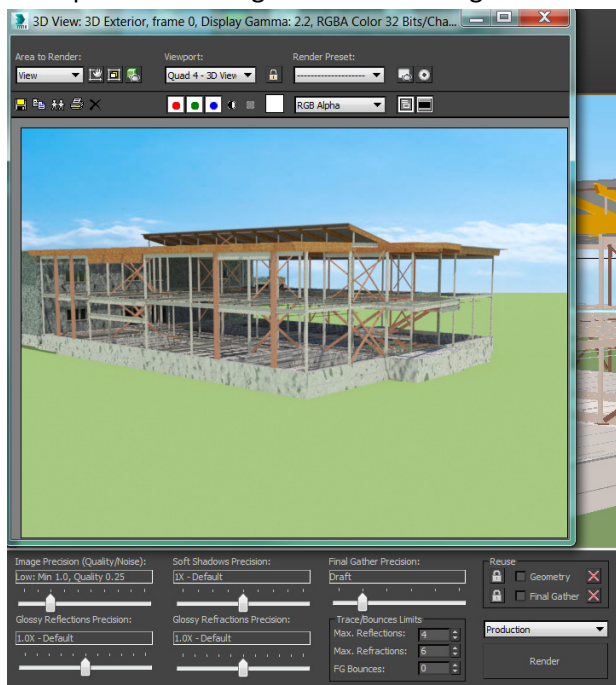
The height setting may vary slightly for your camera angle. So hide the terrain to help place the sky background at a logical height.  
Select the Grass Terrain once again and Unhide All once you've placed your sky background.



12. Minimize the Material Editor and go back into the Environment and Effect dialog, Run Render Preview again.




13. If the Render Preview looks good, go ahead and hit Render in the Render Frame Window dialog. Accept the Low Image Precision setting and other default settings.




## Add a Sky Portal Illumination



Continue in the scene or Open **AV10763-LStructure-3DView-3DExterior5.max**

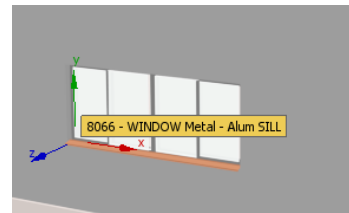
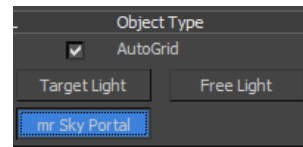
1. Set POV 3D Exterior to Perspective view. Zoom in to the windows on the front of the building.

2. Render the scene .


3. On the rendered frame window, make a clone of the scene .



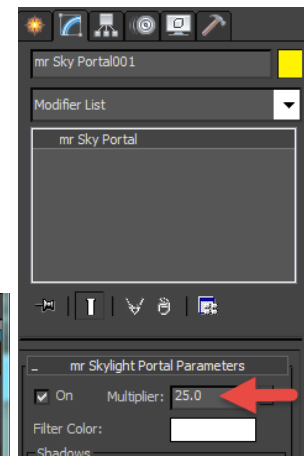
4. Select Create panel , Select Lights , on the Object Type rollout, Select AutoGrid and mr SkyPortal.




5. Position the mr Portal z axis perpendicular to the Window.
6. Create the portal by left clicking and dragging lower left to upper right corner then release. Right-click to finish the sky portal.
7. In Scene Explorer, left click on the new skyportal object **mr sky portal 001** and select modify in the command tab. Under mr Skylight Portal Parameters change the Modifier to **25.0**.

8. Render the scene .

9. Compare the scene to the last one.





10. Set POV to 3dExterior view, in the Scene Explorer and maximize the viewport .
11. Minimize the Material Editor and go back into the Environment and Effect dialog, Run Render Preview again.
12. If the Render Preview looks good, go ahead and hit Render in the Render Frame Window dialog. Accept the Low Image Precision setting and other default settings.



### Section 3: Enhancing the Structural Render with Architectural

While you can take the Structural render in 3ds Max® further with greater precision, material enhancements, color and lighting modifications, another way to enhance the structural render is to add an architectural wrap around the structure. Linked models can also be brought into 3ds Max® and modified to create an enhanced Structural Render. Use the techniques within this lab to create combined renders that will look great on any website, proposal, or marketing brochure.

See the PowerPoint presentation for the final renderings.



## Tips and Tricks

Here are a few TIME-SAVING tips:

1. Always begin with your framed camera view and change to perspective for working purposes. This way any panning and field of view work you do will not alter your set camera view.
2. Generic models tend to cause errors in A360 rendering. If you're having an error completing rendering in A360 you may need to delete them.
3. If you've got splotches on your materials input from Revit®, just make a new material in 3ds Max®.
4. If you find yourself fighting the horizon, add a custom sky background. Use a 360° image for sky backgrounds.
5. For this session we used an EV value of 14.0 only. This was the setting used for the Revit® rendering and so it was used again for comparison purposes. For Typical Exterior Daylight Settings in Environment and Effects Dialog, use EV=13.0 -13.5. Shadows =0, Midtones = 0.7, Highlights=0.13, and override the brightness of the sky in the Material Editor to 2.

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