



**Building
City
Dashboards**



National Centre for Geocomputation
An tionad Náisiúnta Georíomháireachta



**Social
Sciences
Institute**



**Maynooth
University**
National University
of Ireland Maynooth



3D Data Hack Dublin

Unity Starter Guide



dashboards.maynoothuniversity.ie
[@dashbuild](mailto:dashboards@mu.ie)



3D Data Hack Dublin

- The following guide has been prepared as part of the Building City Dashboard project, a Science Foundation Ireland initiative based at Maynooth University, Ireland.
- The guide outlines how the resources provided for the 3D Data Hack Dublin can be used with a game engine to facilitate real-time interaction and visualization.
- Following the guide is expected to take between 45 mins and 1 hr 30 mins to complete.
- This guide is not intended as a comprehensive instruction manual.
- It has been provided to help those who are new to real-time, interactive visualisation to get up and running quickly so that they can start exploring their own ideas.
- Suggestions for next steps are provided toward the end of the guide.

NOTE: This guide was tested with Unity version 2019.1.0f2. As functionality and menu options can change between versions, please be prepared to refer to online help:

- Documentation: <https://docs.unity3d.com/Manual/index.html>
- Forums: <https://forum.unity.com/>



Download the 3D Data Hack Dublin Resources

Organisation

Transport and Infrastructure

Manage

PRIVATE Give feedback on dataset

3D Data Hack Dublin Resources

Resources for the 3D Data Hack Dublin Updated Mapping and Modelling of environment from stereoscopic aerial photography dated 2018 to LOD 2. Plus buildings added to LOD3 level from various planning data sets 2015 / 2018.

Data and Resources

Move_File_ITM.txt	Preview	Download	Edit
SDZ_Model_ITM_20190424.FBX	More information	Go to resource	Edit
SDZ_Model_ITM_24.max	More information	Go to resource	Edit
SDZ_Model_ITM_Textures_20190424.zip	More information	Go to resource	Edit

3D Data Hack Dublin

What is it? Locational Data are a vitally important components of applications across the fields of Planning, Transportation, Logistics, Healthcare, Financial Services and... [read more](#)

Openness

★★★★★

Social

3D Data Hack Dublin Resources are available in the following location:
<https://data.smartdublin.ie/dataset/3d-data-hack-dublin-resources>



3D Data Hack Dublin Resources

- Contents
 - **SDZ_Model_ITM_20190424.FBX** – The 3D model we will be using in this guide. This file is suitable for use in many 3D modelling packages such as 3ds Max or Blender, but also in game engines like Unity or Unreal Engine.
 - **SDZ_Model_ITM_Textures_20190424.zip** – A folder containing textures that can be used to enhance the FBX model's appearance.
 - **SDZ_Model_ITM_24.max** (Not used in this guide) – The original Autodesk 3ds Max project used to assemble the 3D data in the FBX file.
 - **Move_File_ITM.txt** (Not used in this guide) – A file describing the spatial offset (in metres) which has been used in the 3ds Max project to bring original survey data in the Irish Transverse Mercator (EPSG:2157) coordinate projection system to the world origin in 3ds Max for modelling.

Technical Note:

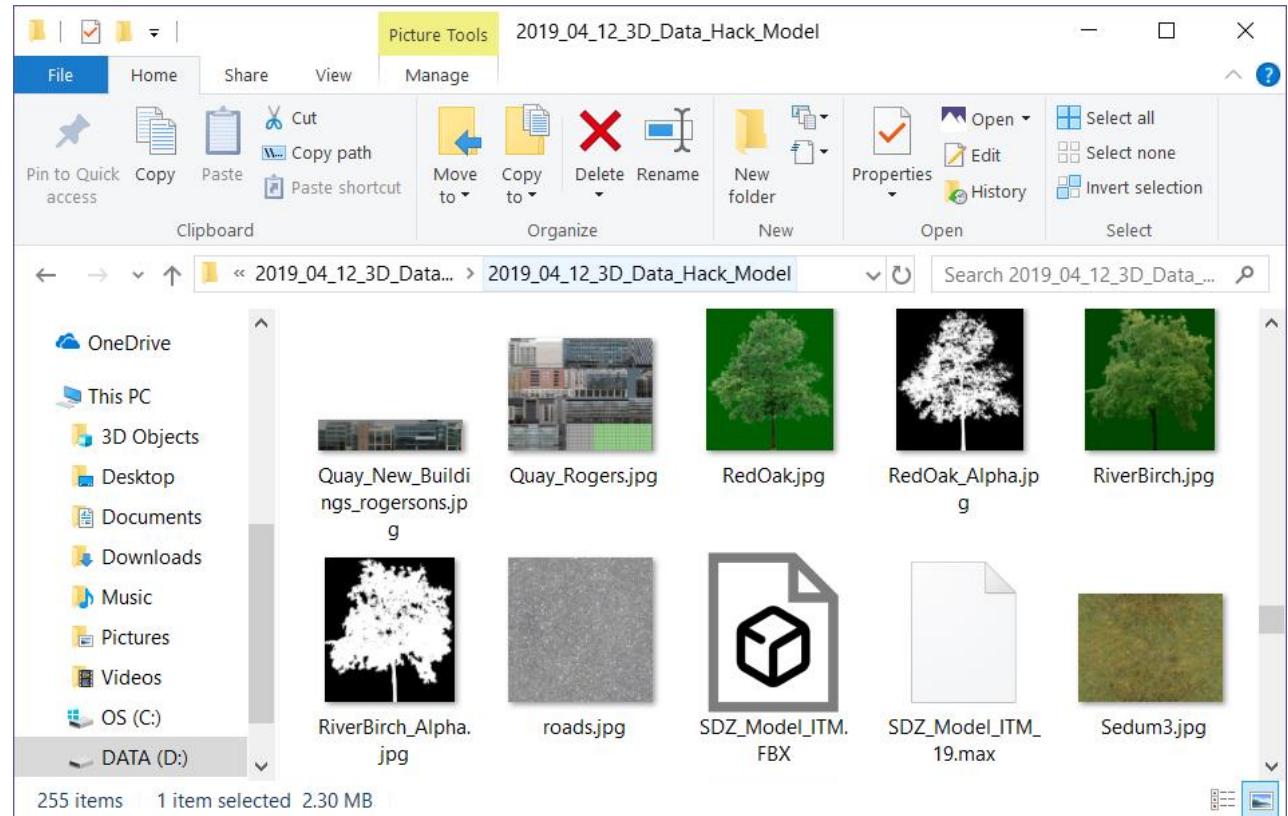
The spatial offset described by the move file can be used to determine the real world coordinates of objects that have been placed in the 3ds Max project. The offset is required because 3D modelling and visualisation software has tended to use a single precision floating point number format to describe spatial location: https://en.wikipedia.org/wiki/Single-precision_floating-point_format. This is commonly done to help improve computational performance, but entails a tradeoff in loss of spatial precision as objects move further away from the world origin (0,0,0). Simply put, single precision floating points do not provide sufficient precision over great enough distances to describe real world geographic coordinates. Attempting to do so can result in visible jitter of objects due to spatial uncertainty, or else their failure to render, resulting in a blank screen. One solution to enable rendering of objects with positions described in a real world geographic coordinate system is to apply an offset to their coordinate position that brings them back toward the world origin.



Preparing your files for this tutorial

- Download the FBX file and the zip file containing the textures.
- Unzip the textures.
- Place the FBX and textures together in the same folder on your computer (any location of your choice is fine).
- Remember the location of the folder as you will need to access it later to import the 3D model into Unreal Engine.

NOTE: You can download the other resources but they will not be used in this guide.





How to get Unity

The screenshot shows the Unity website homepage with a dark background featuring a blue owl and a brain. At the top, there's a navigation bar with links for Products, Solutions, Made with Unity, Learn, Community, Get started, Asset Store, and a user profile icon. The main headline reads "Unity for all" in large white letters, followed by a subtext: "Start bringing your vision to life today. Unity's real-time 3D development platform empowers you with all you need to create, operate, and monetize." Below this, there are two buttons: "Get started" (highlighted with a red arrow) and "Learn more". There are four cards below the buttons: "Games", "Automotive, Transportation & Manufacturing", "Film, Animation & Cinematics", and "Architecture, Engineering & Construction".

Unity: <https://unity.com/>



Select a Licence

Whether you're a professional team or freelancer, a hobbyist, or a total beginner, there's a Unity plan for you.

Not sure which to choose? [Let us suggest an option for you.](#)

FOR HOBBYSTS

Plus
~\$25 per month with 1 year, prepaid or \$35 paid monthly

For hobbyists who want to accelerate their learning & development

[Subscribe](#) [Learn more >](#)

[Hide benefits](#)

Support to accelerate learning & development

Benefits with Prepaid plan only:

- Learn the essentials of game development with 12 months access to Unity Game Dev Courses (\$144 value)
- Get 25GB Unity Cloud Storage (\$60 value)

Benefits with all Plus plans:

- Attend monthly Expert Live Sessions. Speed up your development with technical know-how from Unity engineers (\$240 value)
- Learn directly from our Customer Success Advisor: get help finding the tools and resources you need to succeed
- Collect valuable device information in real-time such as crashes, exceptions, and user feedback at all times
- Save 20% on top-rated assets in the Asset Store*

Financial eligibility:
I or my company generate annual revenue or funds raised of \$200k or less

FOR TEAMS AND FREELANCERS

Pro Best value
\$125 per month

Includes priority access to Unity experts, Success Advisors & Customer Support

[Subscribe](#) [Learn more >](#)

[Hide benefits](#)

\$800+ in powerful benefits included

Advanced support for professional creators

- Join two exclusive Expert Live Sessions per month with our Unity experts. Get answers to your advanced technical problem-solving. Ask questions and chat directly with our experts (\$480 value)
- Get priority access to a Customer Success Advisor, who can help you get the most from your investment with Unity
- Get faster license and account support with Priority Queue for Customer Service

Advanced features for team and project efficiency (\$108 value)

- Save, share and sync your projects easily with your entire team
- Get more cloud storage for bigger projects, so it's backed up and accessible anywhere
- Save time by streamlining how you create and deploy builds across multiple platforms
- Notifications available through seamless integrations with your preferred collaboration tools like email, Slack, Discord, and JIRA

Advanced features for game performance

- Get total visibility into what is happening when users are in your game
- Collect valuable device information in real-time such as crashes, exceptions, and user feedback at all times

Reduce costs with access to free professionally produced art content

- Get free access to comprehensive AAA art packages that include characters, animations, environments, UI, audio, scripts, code, source files, trailers, and concept art created by top-talent industry icons

20% off in the Asset Store

- Get 20% off time-saving plugins and assets from the Unity Asset Store to help you create more efficiently*

Unity t-shirt

- All Unity Pro purchases include a free limited-edition "Prefabulous" t-shirt while supplies last

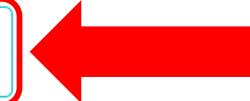
Financial eligibility:
No limits on revenue or funding

FOR BEGINNERS

Personal

Available to use if your revenue or funding (raised or self-funded) does not exceed \$100K per year.

[Try Personal](#)



[Hide info](#)

A free version of Unity for beginners. Does not include additional support, training and services.



Accept the Terms and Download Unity

unity Store

Get Started with Unity Personal

Download Unity to start creating today and get access to the Unity platform and ecosystem – your one-stop solution for real-time content creation.

Are you a hobbyist aspiring to boost your skills and create faster with Unity? Get 12 months of Unity Game Dev Courses included free and get direct access to Unity experts through monthly Expert Live Sessions and our on demand Unity Success Advisor chat portal. Click to see all the other time-saving benefits with Unity Plus. [Learn more](#).

Accept terms

By clicking, I confirm that I am eligible to use Unity Personal per the [Terms of Service](#), as I or my company meet the following criteria:

- Do not make more than \$100k in annual gross revenues, regardless of whether Unity Personal is being used for commercial purposes, or for an internal project or prototyping.
- Have not raised funds in excess of \$100K.
- Not currently using Unity Plus or Pro.

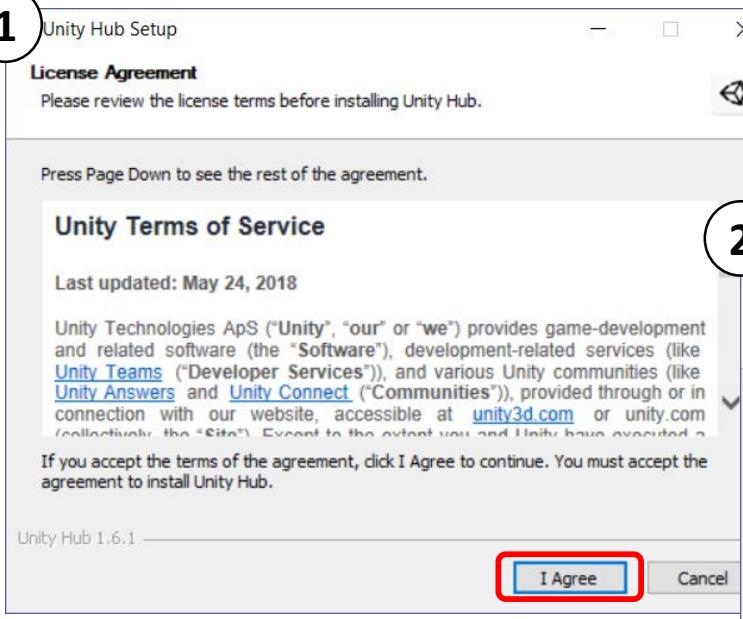
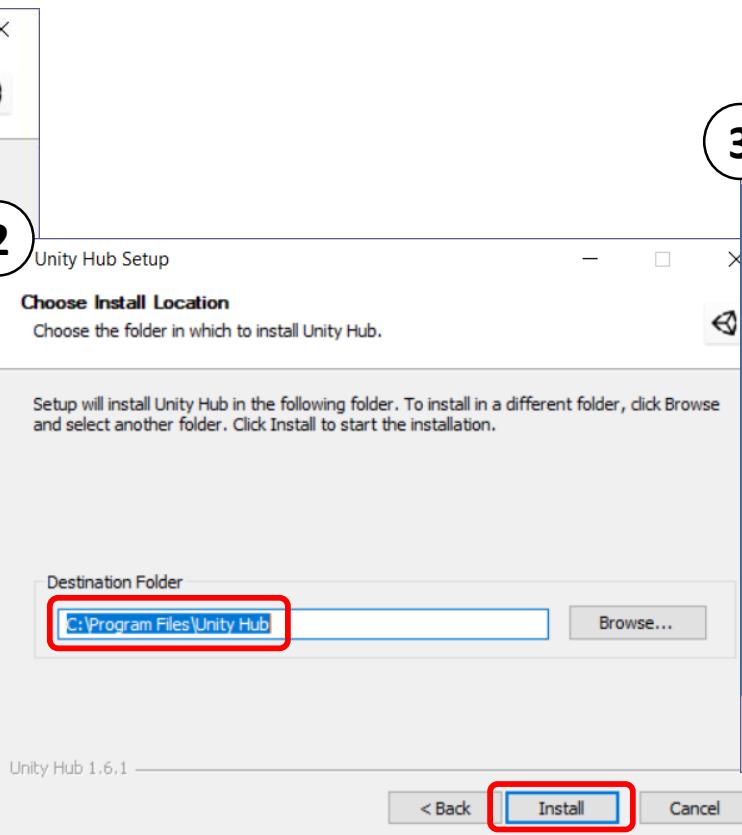
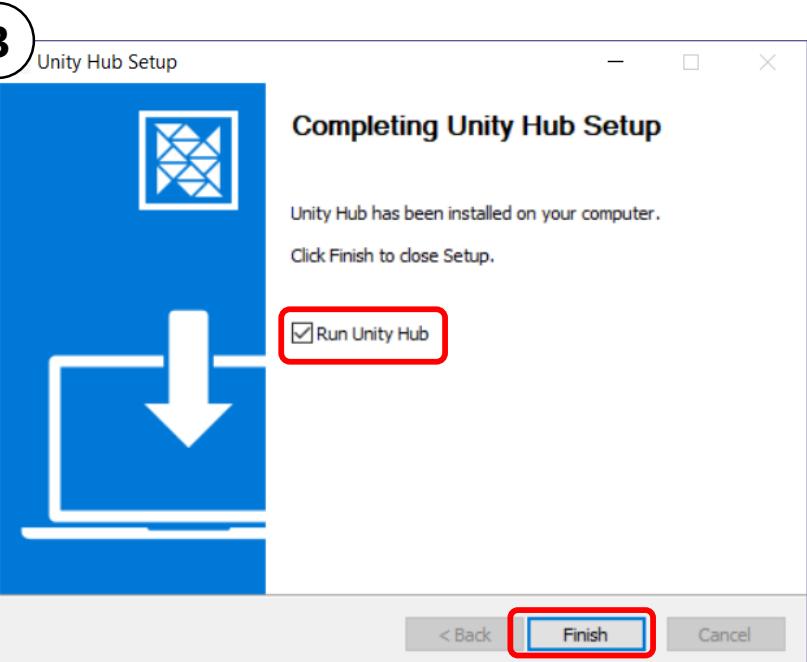
If you are not eligible to use Unity Personal, please [click here](#) to learn more about Unity Plus and Unity Pro.

Download Unity Hub

Looking to download Unity Hub for Mac OS X?
[Choose Mac OS X](#)



Install Unity Hub

- 1** 
- 2** 
- 3** 



Install the latest version of Unity

1 Unity Hub 1.6.1

Projects Learn Installs

New Open My account

On my machine

Official Releases

Beta Releases

Setup Unity to begin creating

Download & install a new release or Locate a previously installed version

Locate a Version Download

Find other versions in the Unity download archive

2 Unity Hub 1.6.1

Projects Learn Installs

New Open My account

On my machine

Official Releases

Beta Releases

Unity 2019.1.0f2

Unity 2018.3.14f1

Unity 2018.2.21f1

Unity 2018.1.9f2

Unity 2017.4.26f1 LTS

Unity 2017.2.5f1

Find other versions in the Unity download archive

Download

Download

Download

Download

Download

Download

Unity Hub is useful for managing your projects and multiple versions of the Unity Editor.



You can select components to install

Unity Hub 1.6.1

Projects Library

On my machine

Official Releases

Beta Releases

Find other versions: [Unity documentation](#) [archive](#)

Add components to your install

	download size	install size
<input checked="" type="checkbox"/> 2019.1.0f2	765.0 MB	2.4 GB
<input type="checkbox"/> Android Build Support	481.4 MB	2.0 GB
<input type="checkbox"/> Android SDK & NDK Tools	891.8 MB	2.8 GB
<input type="checkbox"/> iOS Build Support	895.9 MB	3.6 GB
<input type="checkbox"/> tvOS Build Support	328.4 MB	1.4 GB

Total space required: 4.6 GB
Space available: 47.4 GB

Cancel Done

My account

Download

Download

Download

Download

Download

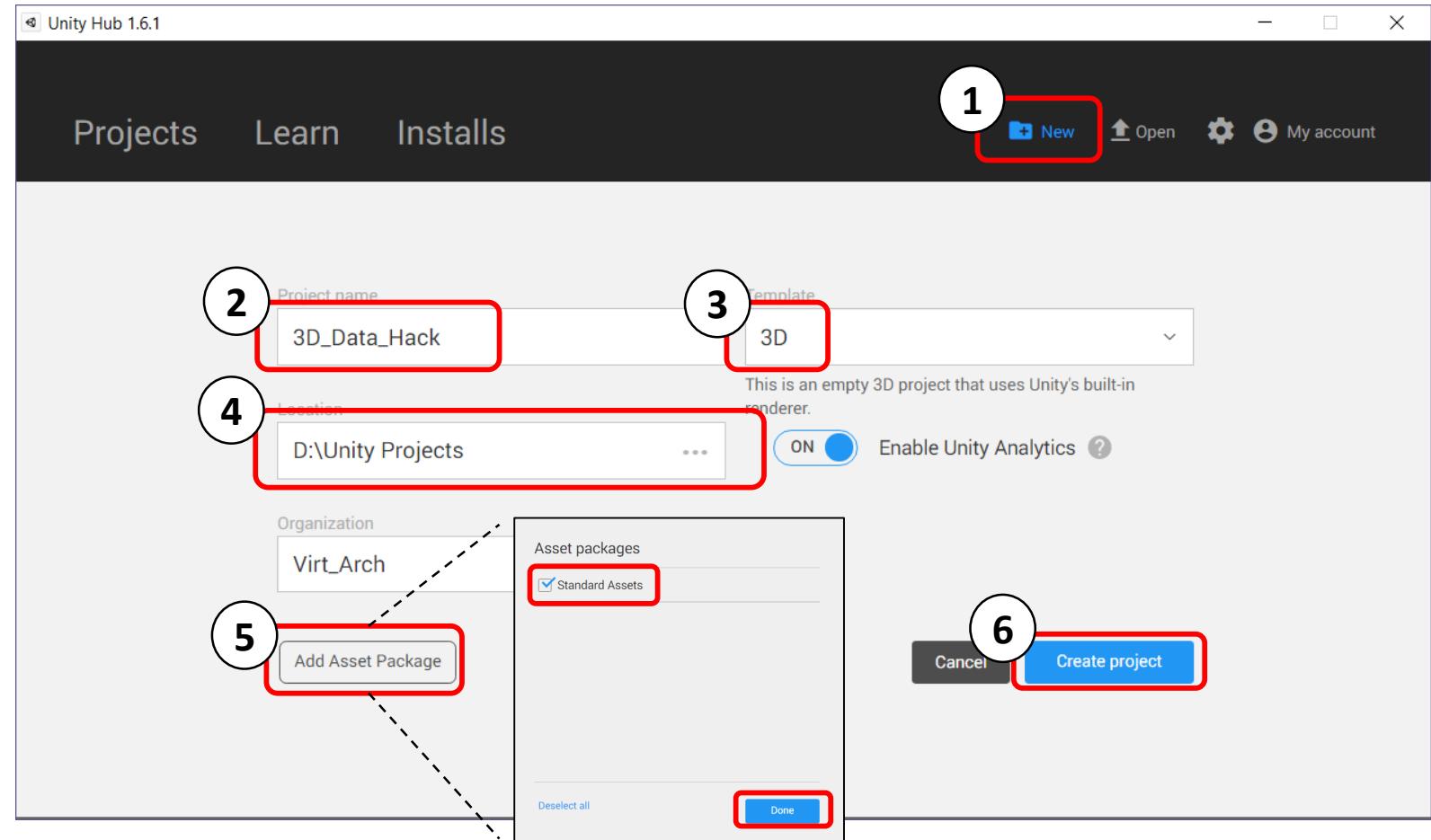
Download

Unity allows you to add components to build apps for different platforms. You can accept the defaults for now as you can always add more of these components later.



Create a new project

1. Start a 'New' project.
2. Give the project a name.
3. Choose the '3D' project template.
4. Specify the location on your computer to store the project.
5. Click 'Add Asset Package', tick 'Standard Assets' and then click 'Done'.
6. Click 'Create Project'.





The Unity User Interface

The screenshot shows the Unity Editor interface with several panels highlighted by red boxes:

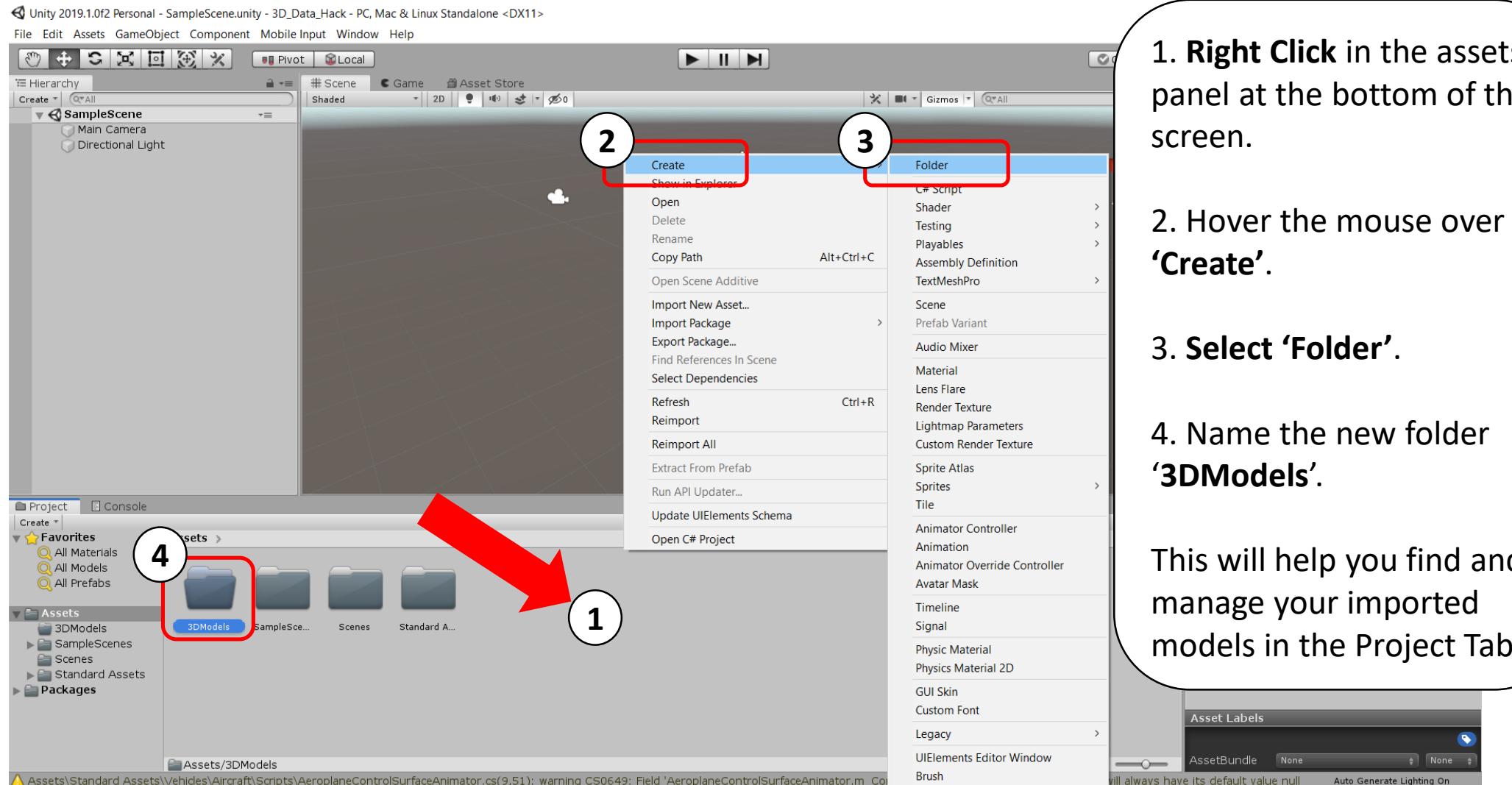
- Hierarchy Panel**: Lists the contents of the current scene or 'level'. It is located at the top left.
- Scene View**: The main workspace where you arrange and view game objects. It features a 3D grid, a sun icon, and a camera icon.
- Play Button**: Located in the top center toolbar, it switches to the Game View and allows you to test your scene.
- Project Tab**: Used to manage your project and provides a view of your **Assets** folder where 3D models, textures and other game content are stored. It is located at the bottom left.
- Inspector Tab**: Displays the properties of selected game objects. It is located at the top right.

Callouts provide additional information about each tab:

- Hierarchy Panel**: lists the contents of the current scene or 'level'.
- Scene View**: is the window where you arrange and view game objects in your scene.
- Play Button**: switches to the Game View and allows you to test your scene.
- Inspector Tab**: displays the properties of selected game objects.
- Project Tab**: is used to manage your project and provides a view of your **Assets** folder where 3D models, textures and other game content are stored.

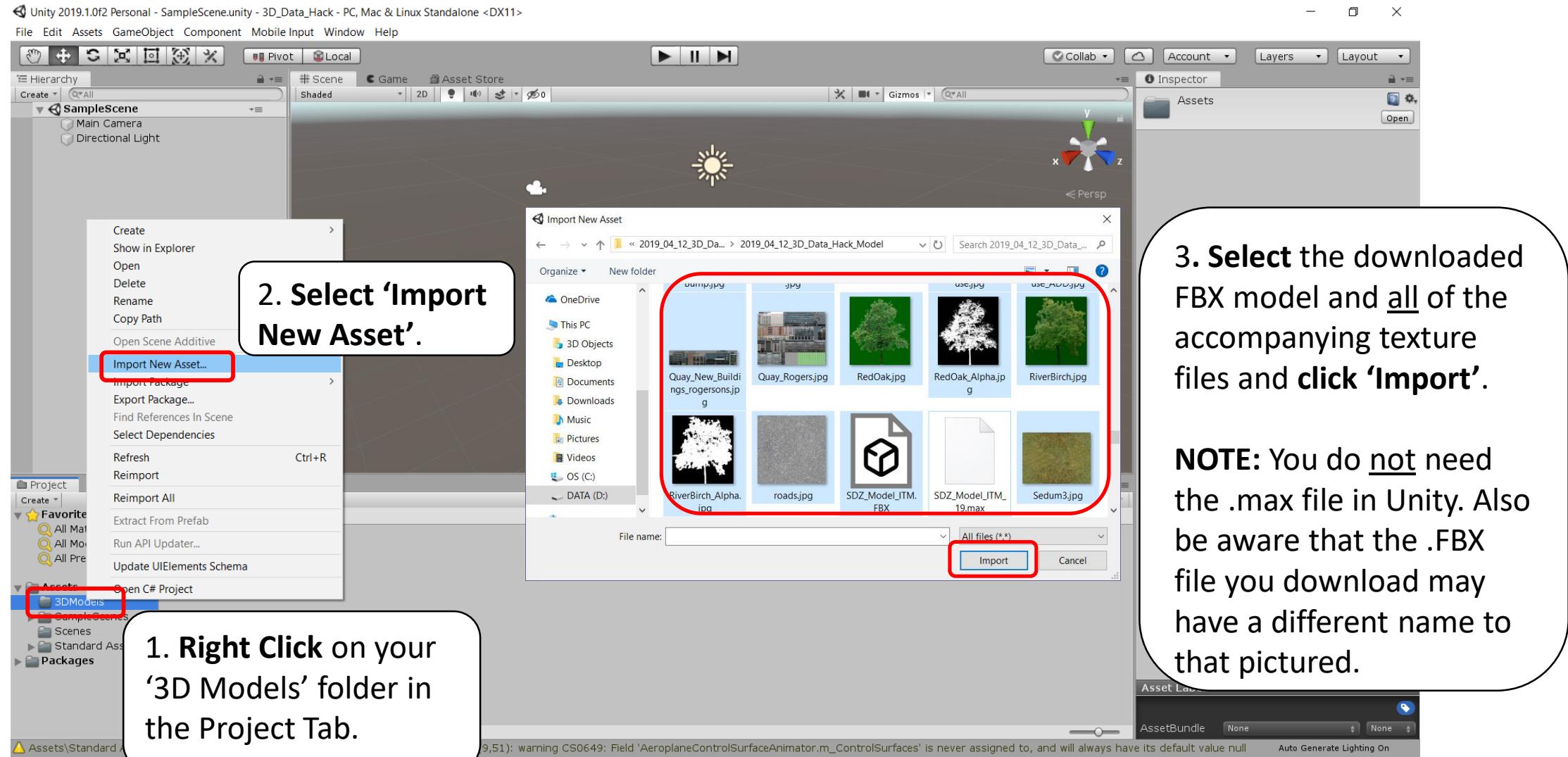


Create a new 3DModels folder



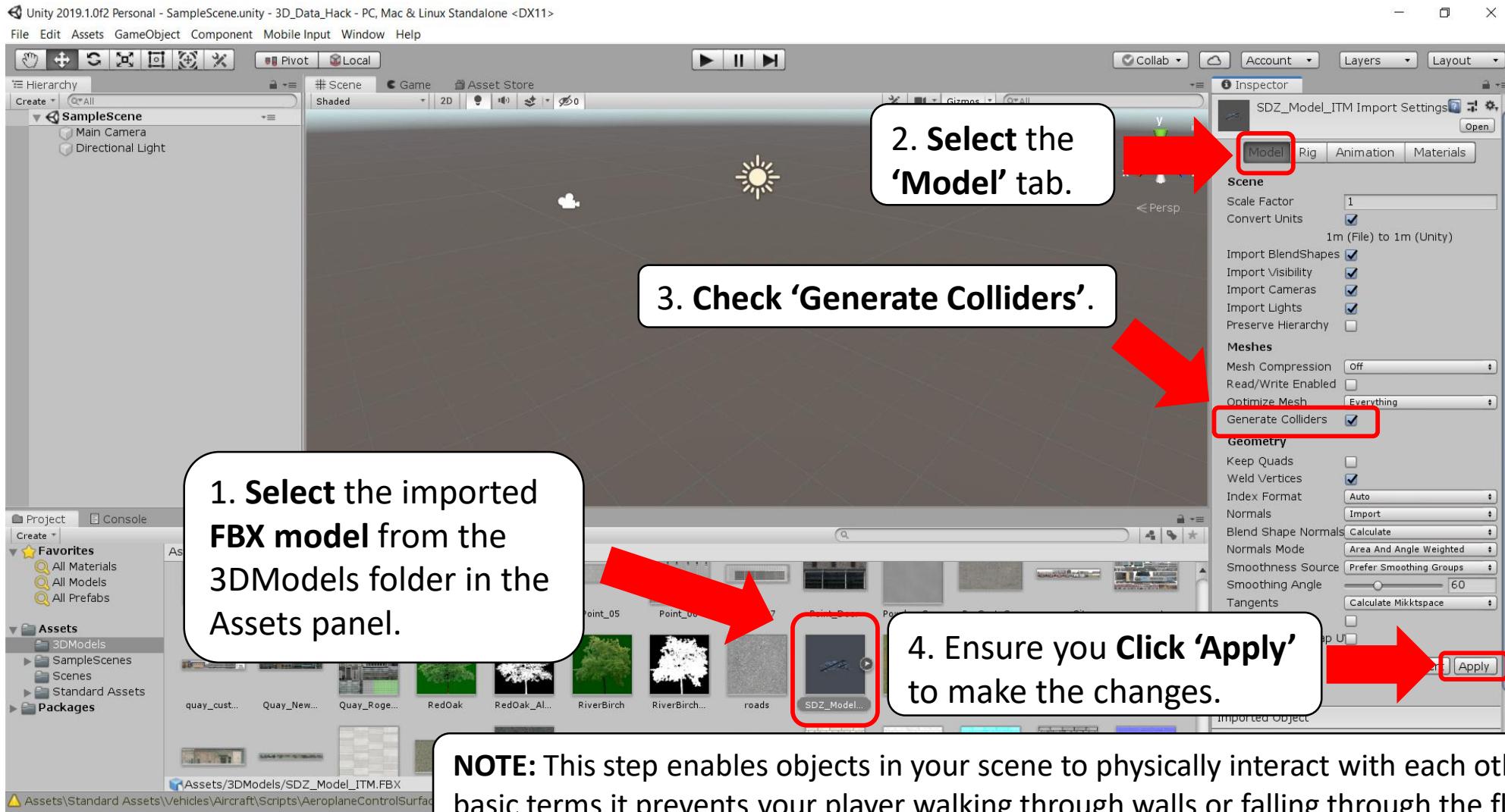


Import 3D Model



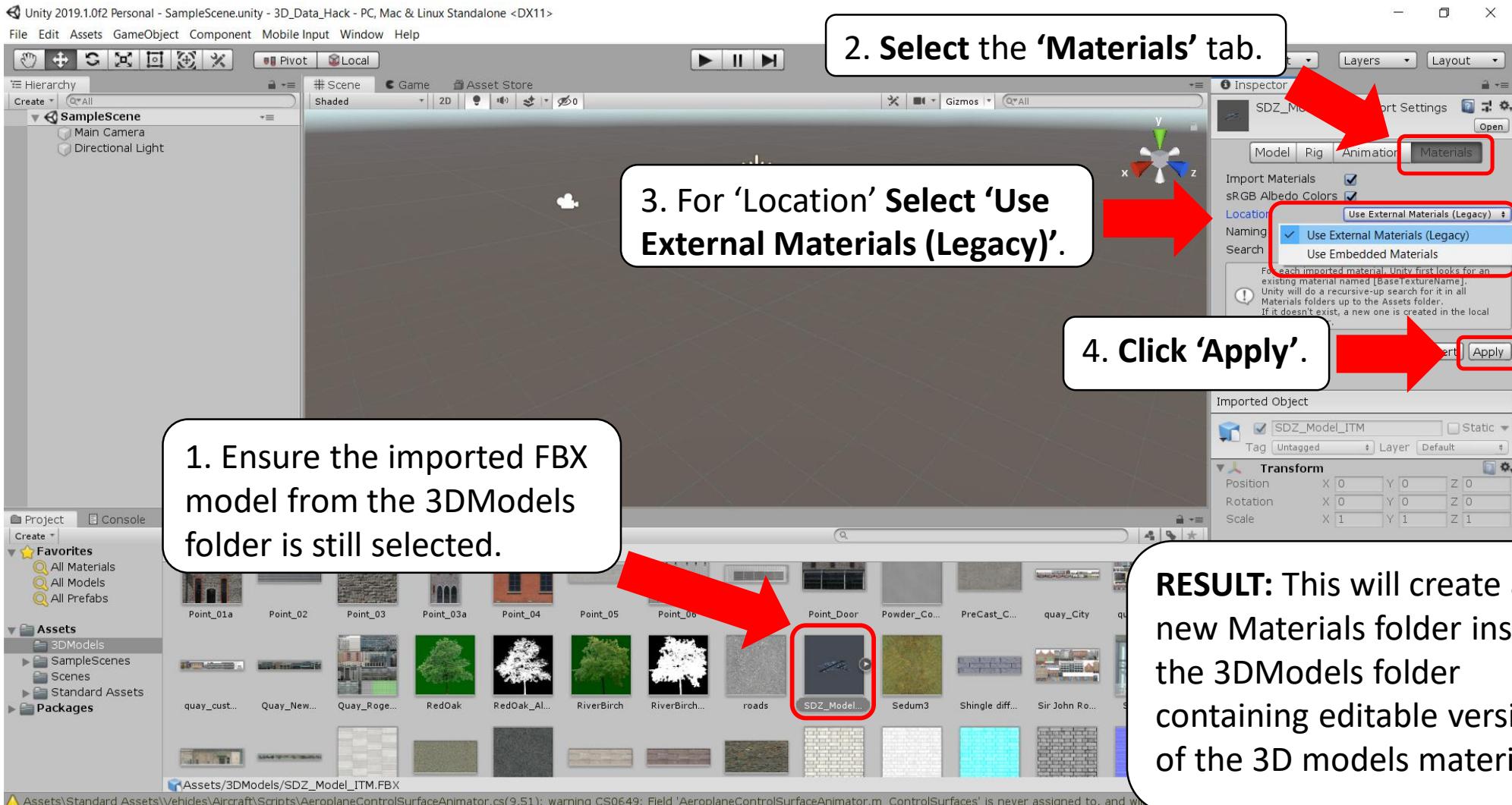


Generate Colliders for the model geometry



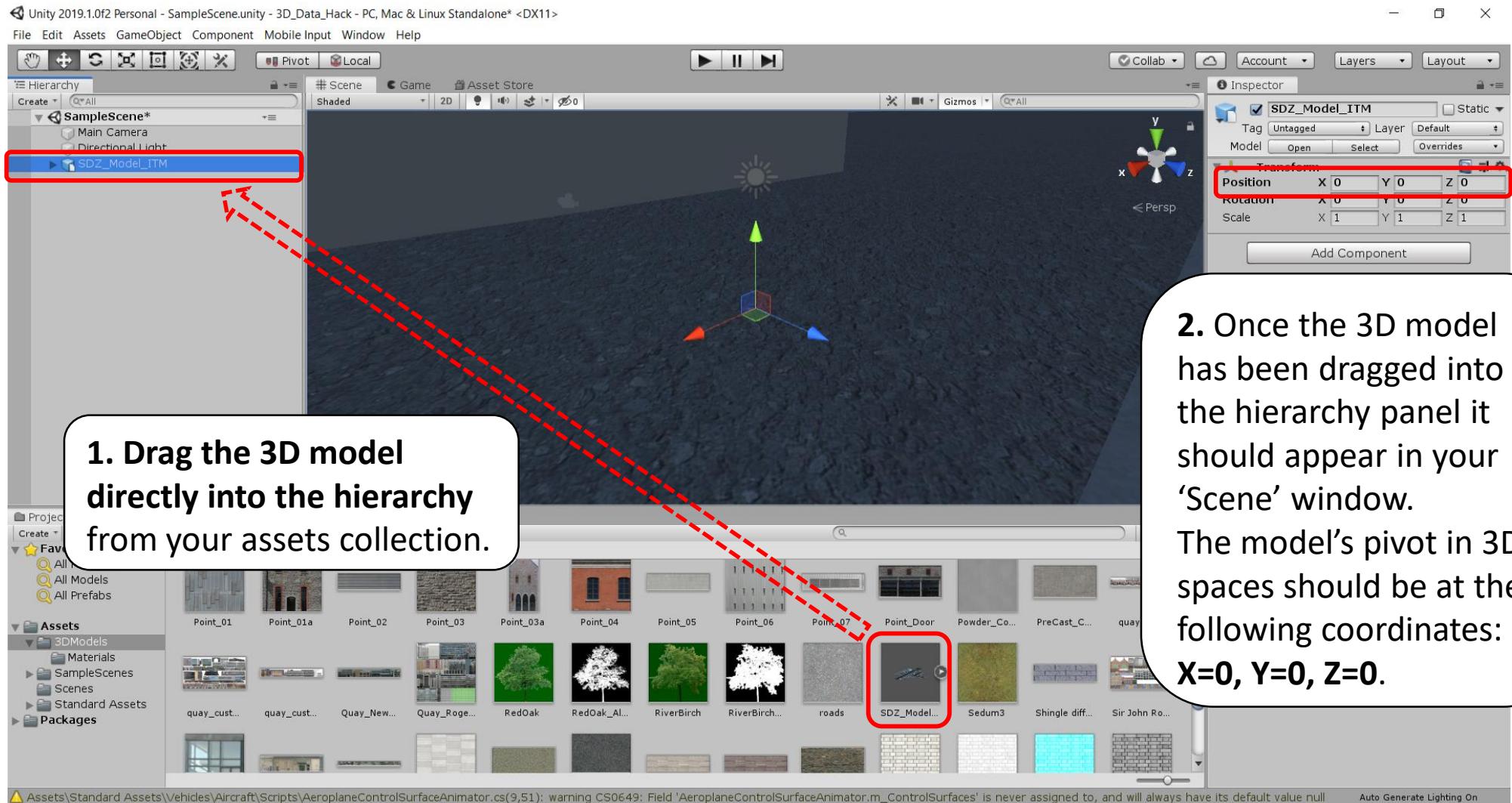


Unpack the materials embedded in the model





Drag the 3D Model into your scene hierarchy





Add the first person character to your scene

The screenshot shows the Unity Editor interface with a 3D scene of a city street. The Hierarchy panel on the left shows objects like Main Camera, FPSController, and Directional Light. The Inspector panel on the right shows the FPSController component with transform values X: -28, Y: 4, Z: -182. The Scene View shows a camera icon with red, green, and blue arrows indicating rotation and position controls.

- 1. Delete the 'Main Camera' from the hierarchy as the first person character will have its own camera attached.**
- 2. Navigate the Standard Assets folder to find the FPSController prefab.**
- 3. Drag-and-drop the FPSController prefab into the Hierarchy.**
- 4. Ensure the FPSController prefab is placed above the ground plane otherwise it will fall through the floor. You can position it by entering coordinates in the Inspector Panel or by dragging the object directly in the Scene View using the red, green and blue arrows.**



Press Play to test your scene

Unity 2019.1.0f2 Personal - SampleScene.unity - 3D_Data_Hack - PC, Mac & Linux Standalone* <DX11>

File Edit Assets GameObject Component Mobile Input Window Help

Hierarchy Scene Game Asset Store

SampleScene*

SDZ_Model_ITM

Directional Light

Display 1 Free Aspect Scale

Maximize On Play Mute Audio VSync Stats Gizmos

Collab Account Layers Layout

Transform

Character Controller

First Person Controller (Script)

Is Walking

Walk Speed

Run Speed

Runstep Lengthen

Jump Speed

Stick To Ground Force

Gravity Multiplier

Mouse Look

Use Fov Kick

Fov Kick

Use Head Bob

Head Bob

Jump Bob

Step Interval

Footstep Sounds

Jump Sound

Land Sound

Rigidbody

Mass

Drag

Angular Drag

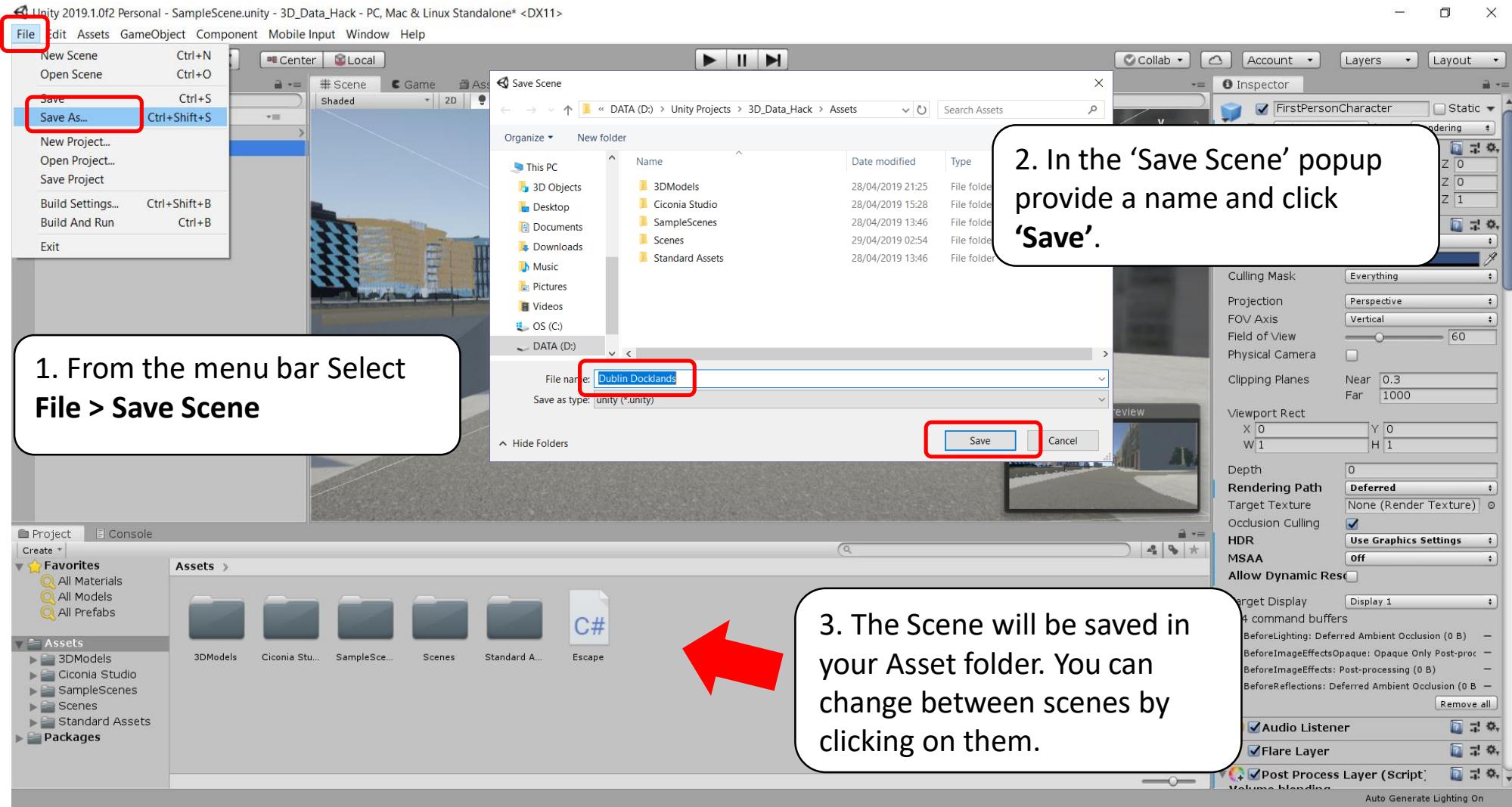
Auto Generate Lighting On

Press 'Play' to test your scene.
Pressing the 'Esc' key will allow
you to press the play button
again to exit play mode mode.

While in play mode you can
navigate your scene using
WASD keys, cursor keys, and
the mouse.

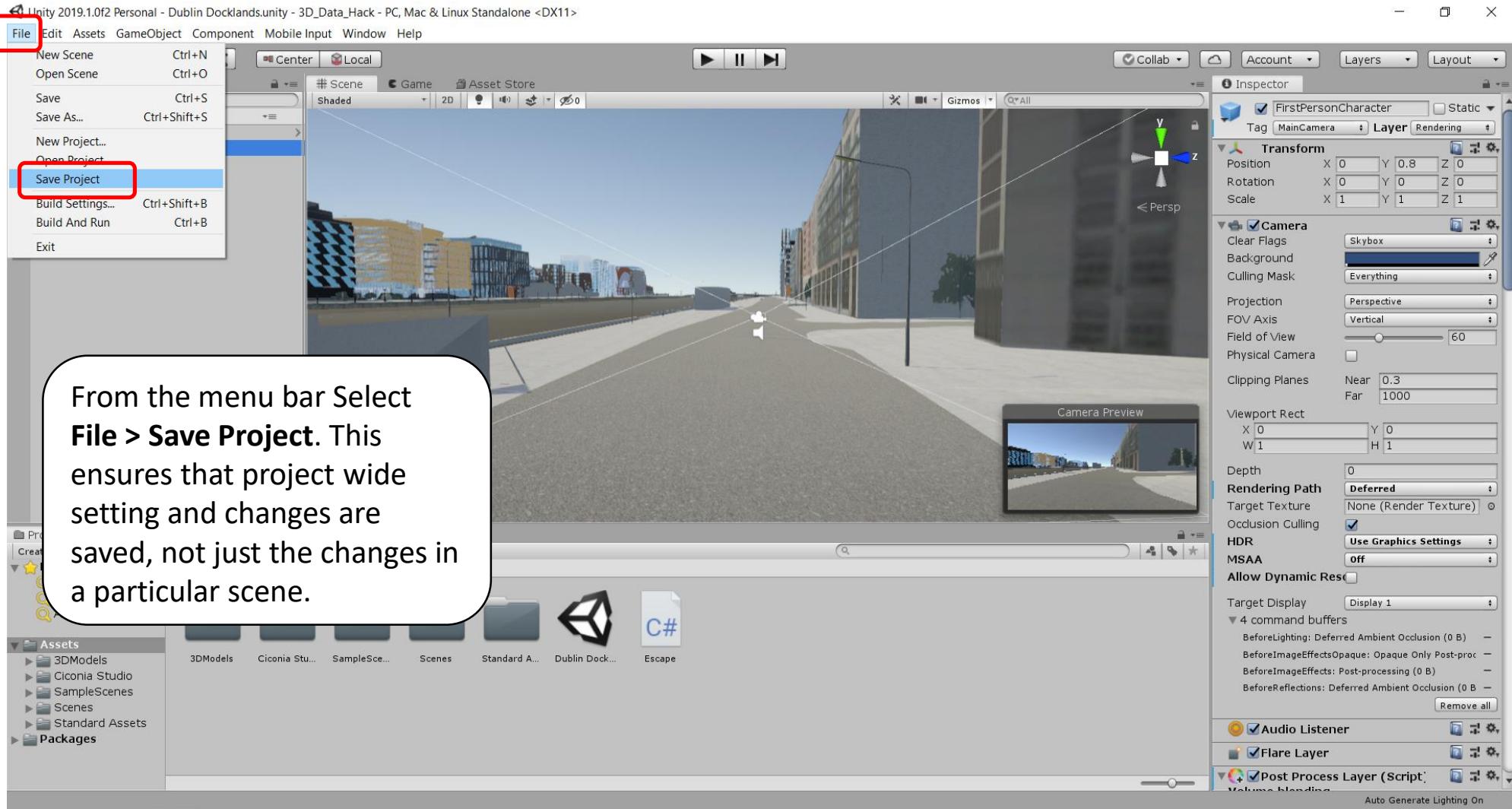


Save your Scene(s) as you update them



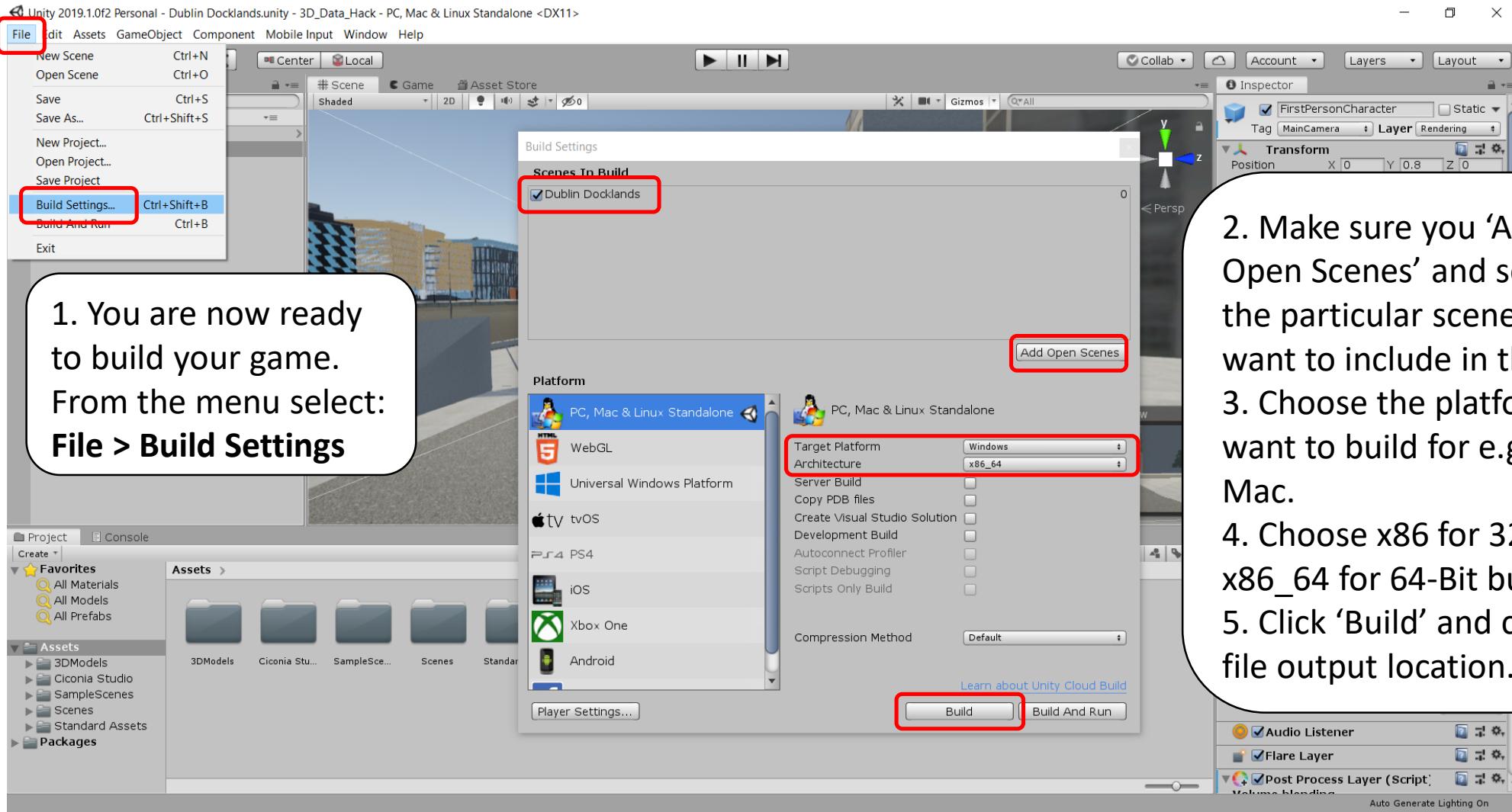


Save the Overall Project



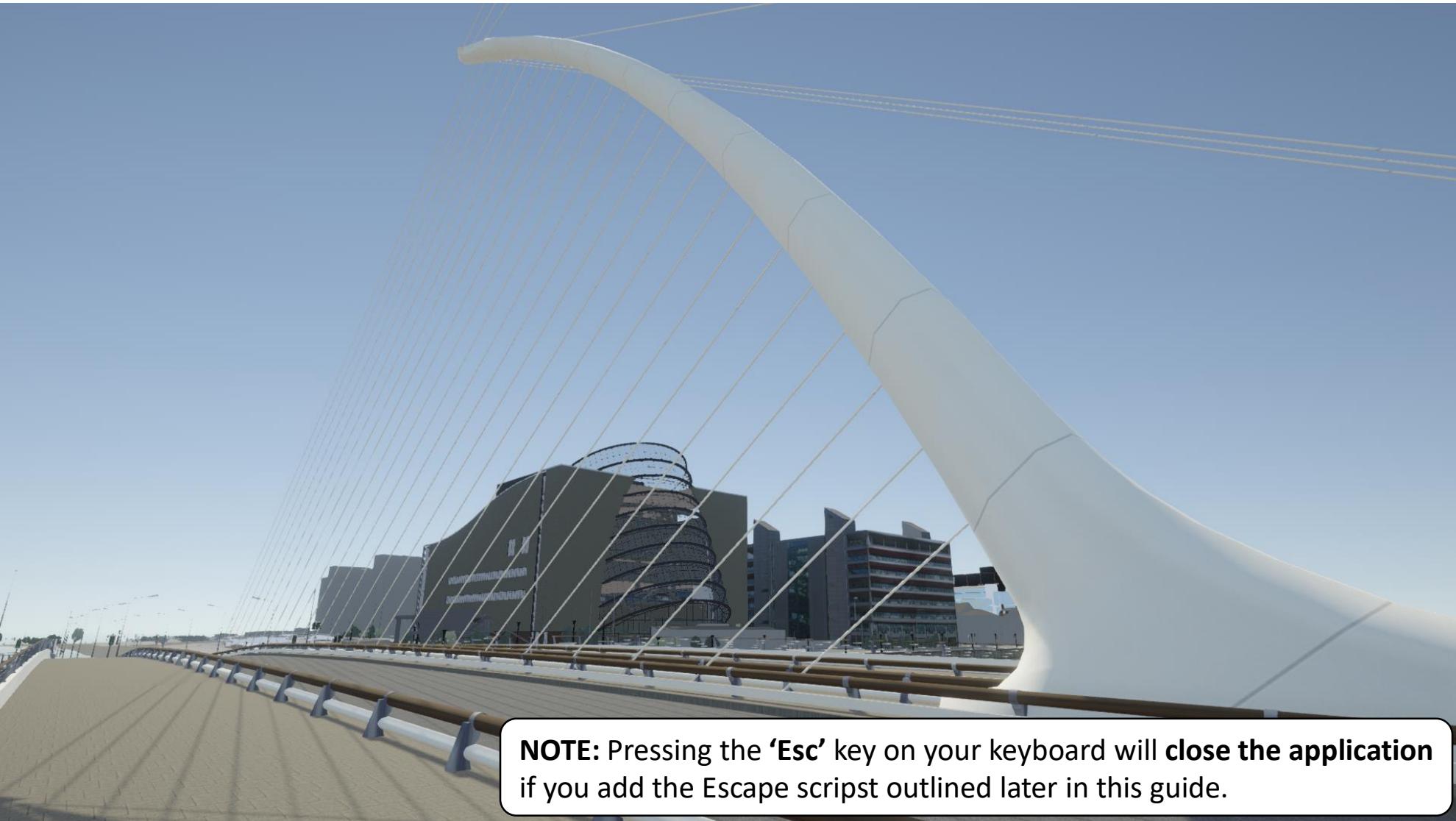


Save the Overall Project





Run your application .exe to test



NOTE: Pressing the 'Esc' key on your keyboard will **close the application** if you add the Escape script outlined later in this guide.



Trouble Shooting

- My character controller passes through the floor or walls when I press play
 - Ensure that the character controller is positioned fully above the ground plane.
 - Check that you correctly generated colliders for your models when you imported them as indicated earlier in the guide.
- I can't exit the application I built
 - Add the 'Escape' script to your project that is outlined further on in this guide.
- The model doesn't look how I'd expect
 - Experiment with the Unity Post Processing Stack as outlined later in this guide.
 - Try adjusting the model's materials and experiment with the 'Normal' maps provided for some of the textures:
<https://docs.unity3d.com/Manual/StandardShaderMaterialParameterNormalMap.html>
- I can't edit the materials on my model or they appear to be missing
 - Not all of the buildings in the model have photoreal textures for their facades.
 - Ensuring that you selected 'Use External Materials' when you imported the model should ensure the inclusion of any textures for those buildings that do have them. This will enable you to edit and adjust all of the materials that come with the model:
<https://docs.unity3d.com/Manual/Shaders.html>
- Trees and Railings look like billboards when they should be transparent
 - Use the process for adding transparency outlined later in this guide.
 - Alternatively you could try to create your own shader.
- My Trees or Railing are only visible from one side
 - Apply a double sided shader like the Ciconia Double Sided shader indicated later in this guide.

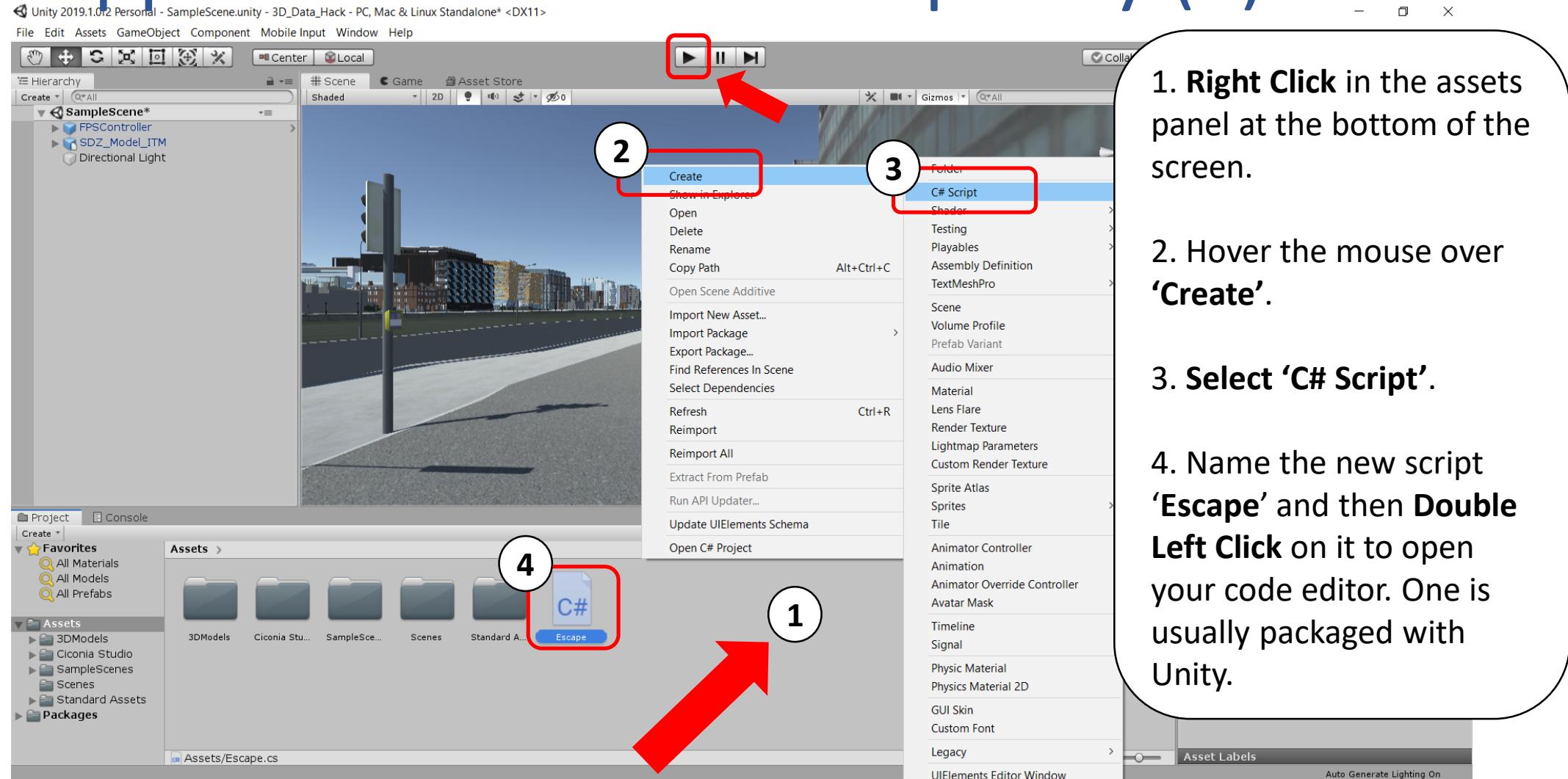


Further ways to enhance your scene

- Look at the other assets in the Standard Assets collection and use them to enhance your scene: <https://assetstore.unity.com/packages/essentials/asset-packs/standard-assets-32351>
- Use other free assets from the Unity Asset Store: <https://assetstore.unity.com/>
- Use shaders and take advantage of the Unity Post Processing Stack to improve the visual appearance of your scenes. Examples follow in subsequent slides.
- Add interactivity and further functionality through scripting in the C# language. A very brief but useful example follows on the next slide.
- Experiment with AR and VR in Unity.
- Make use of the extensive learning materials and tutorials provided on the Unity website: <https://unity.com/learn>



Add a script to close your built desktop application with the Escape key (1)





Adding a script to close your built desktop application with the Escape key (2)

The name of the class has to match the name of the script file, otherwise there will be an error.

```
using UnityEngine;
using System.Collections;

// This script exits the application upon pressing the Esc key
public class Escape : MonoBehaviour {

    // The default Start function is used for initialization
    private void Start ()
    {

    }

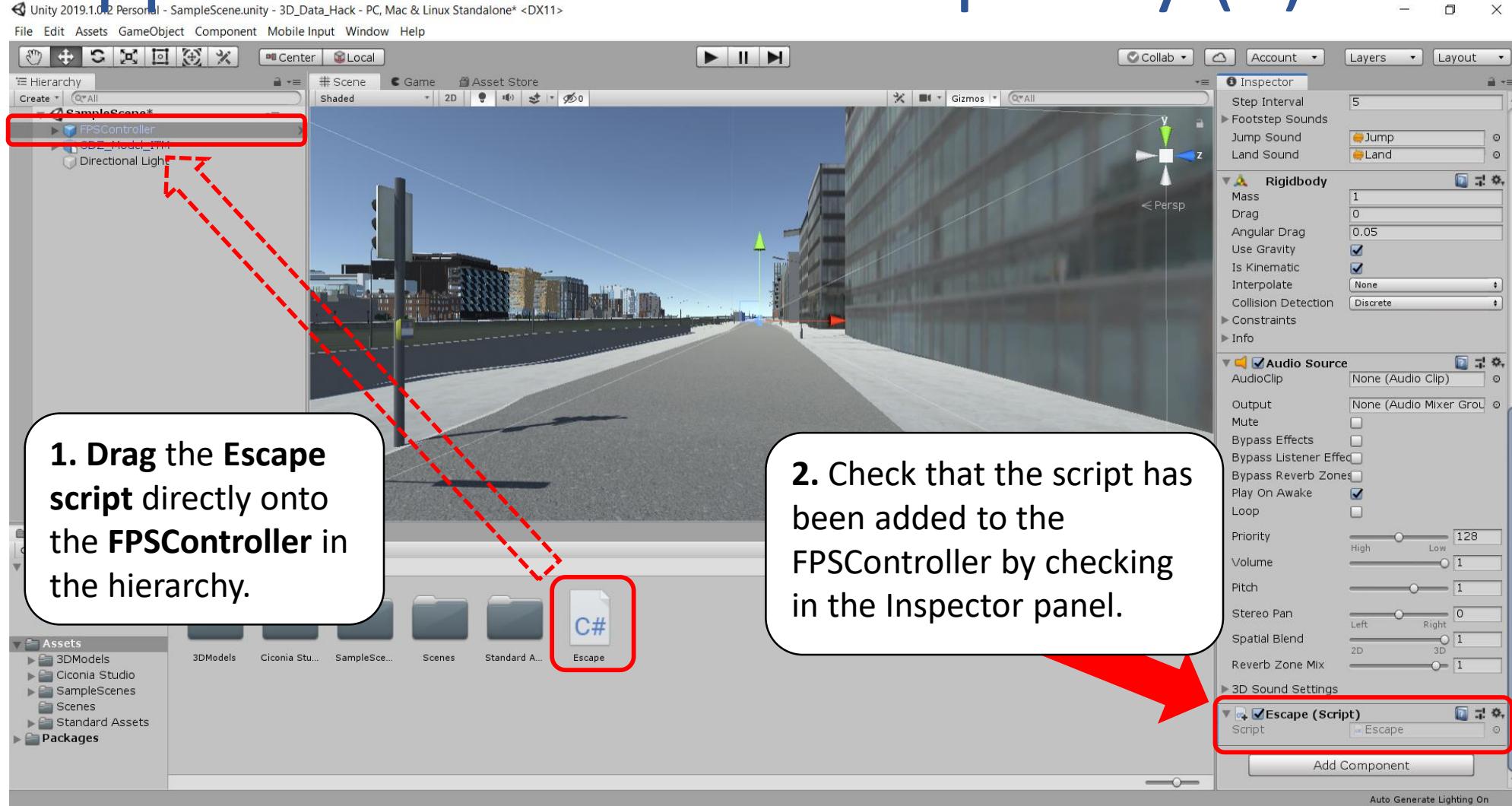
    // The Update function is called once per frame
    void Update ()
    {
        if (Input.GetKeyDown(KeyCode.Escape))
        {
            Application.Quit();
        }
    }
}
```

The code in the Update function waits for the Escape key to be pressed and then quits the application.

NOTE: Make sure to save changes to your script before adding it to a game object in your scene or pressing play.



Add a script to close your built desktop application with the Escape key (3)





Quick solution for transparency on trees and railing textures (1)

NOTE: The next few steps require external image editing software that can save a PNG file with alpha transparency. Alternative solutions would involve creating your own shaders which is not covered here.

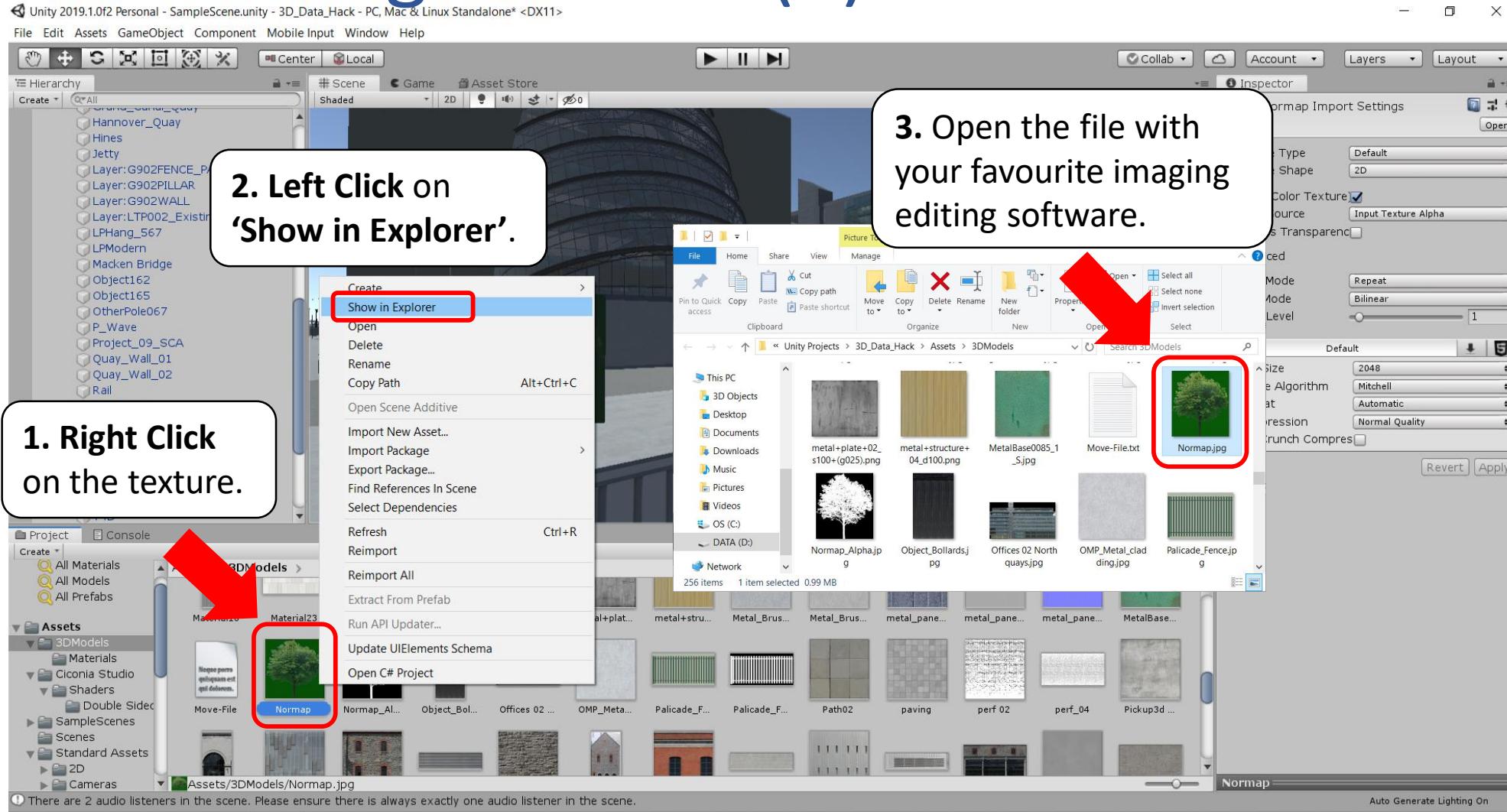
1. Left Click on one of the features to be edited e.g. a tree.

2. Left Click on the 'Albedo' texture that needs editing.

3. Unity will automatically find and highlight the texture you need to update.



Quick solution for transparency on trees and railing textures (2)





Quick solution for transparency on trees and railing textures (3)

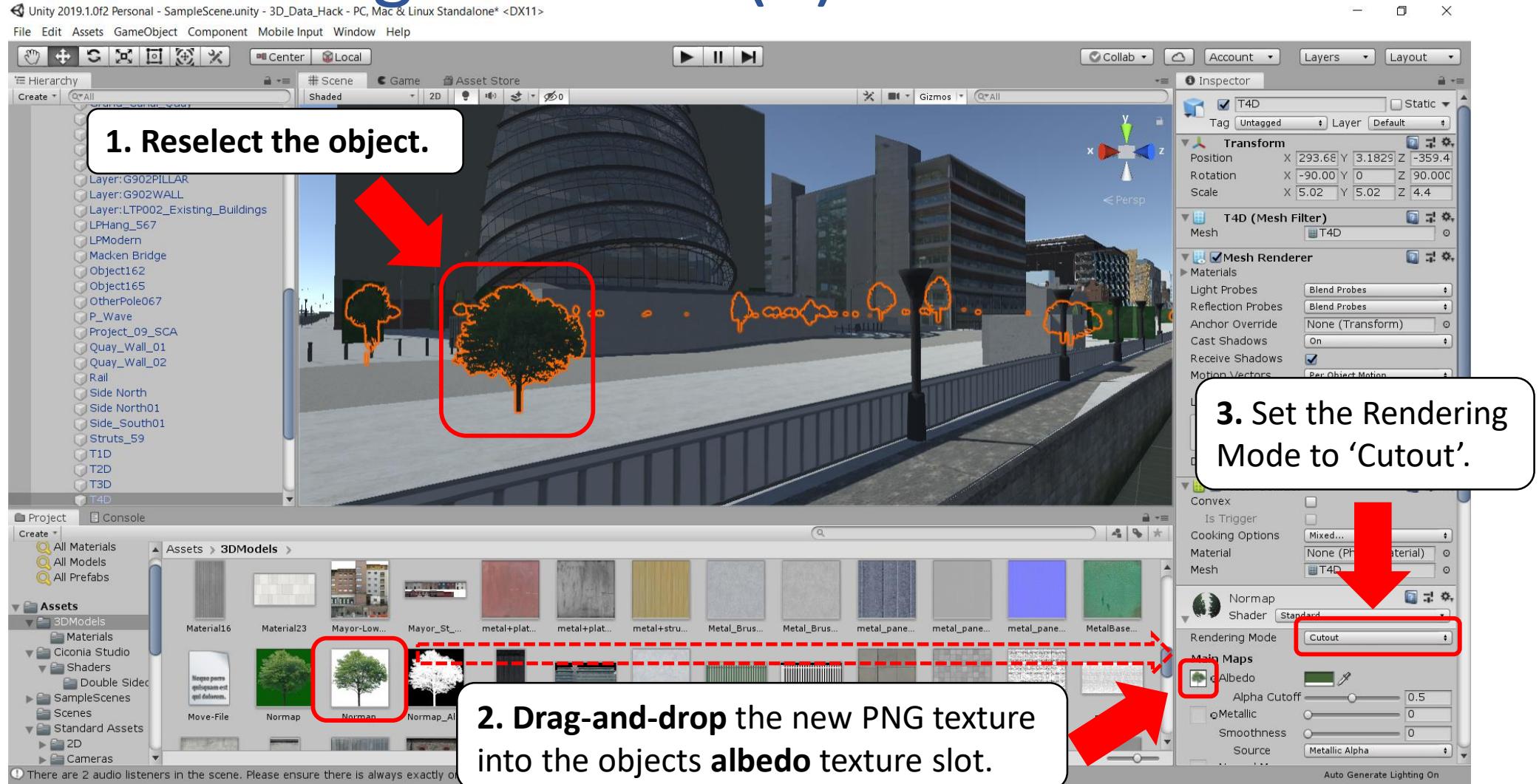


The precise process here will depend on the software you use. Suitable choices include Photoshop or the FREE & Open Source GNU Image Manipulation Program (GIMP). Generically the steps are:

(1) Import the JPEG image; (2) Select the background pixels by colour; (3) Delete the background pixels; (4) Add the background to a transparent alpha channel; (5) Export the file with alpha transparency as a PNG file; (6) Save it in the same location as your other model textures.



Quick solution for transparency on trees and railing textures (4)





Download a FREE double sided shader

1. Click on the 'Asset Store' tab.

2. Search for 'Ciconia Studio Double Sided Shaders' in the input field.

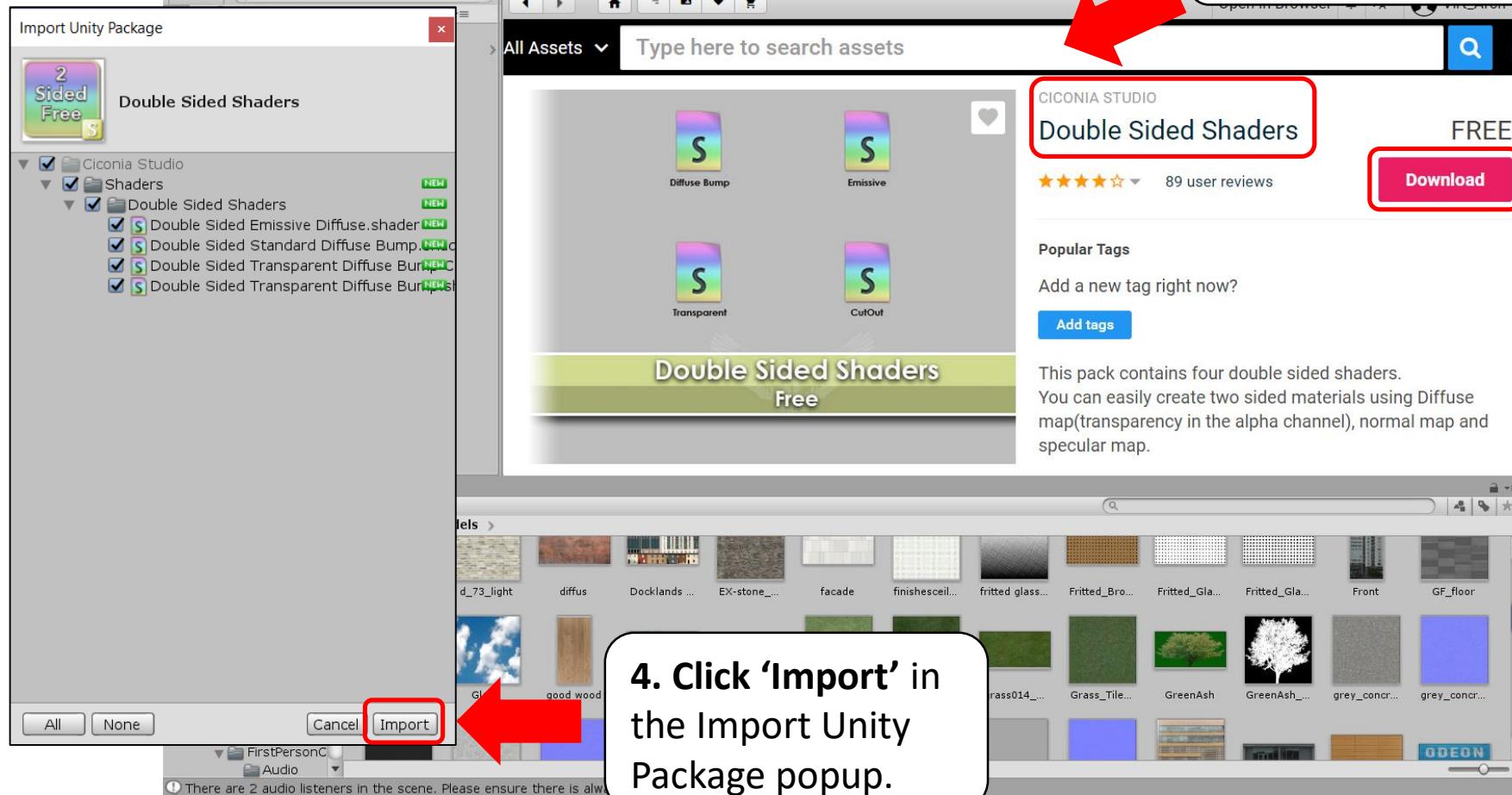


Download

3. Click 'Download' and then 'Import' when prompted.

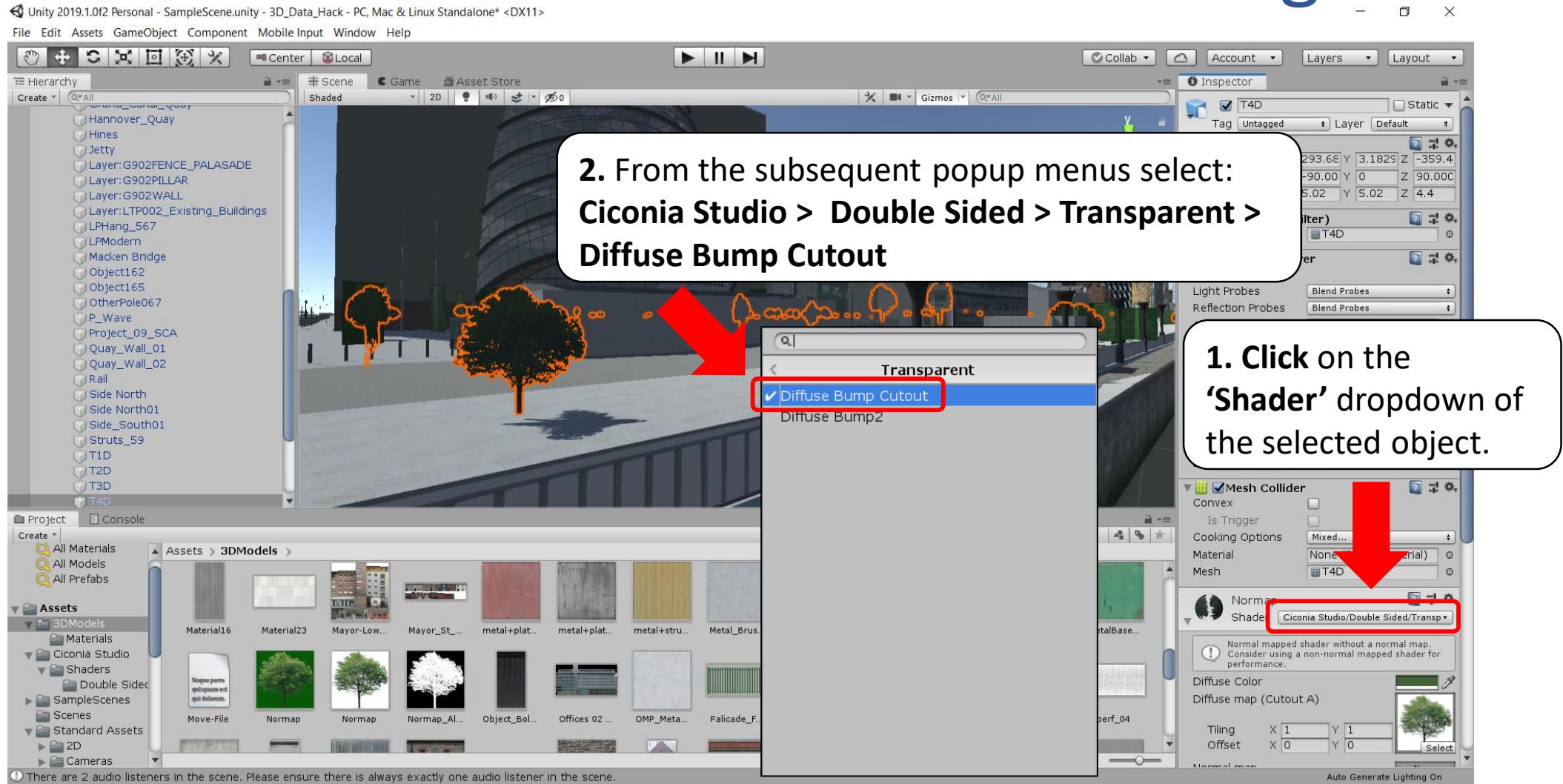


4. Click 'Import' in the Import Unity Package popup.



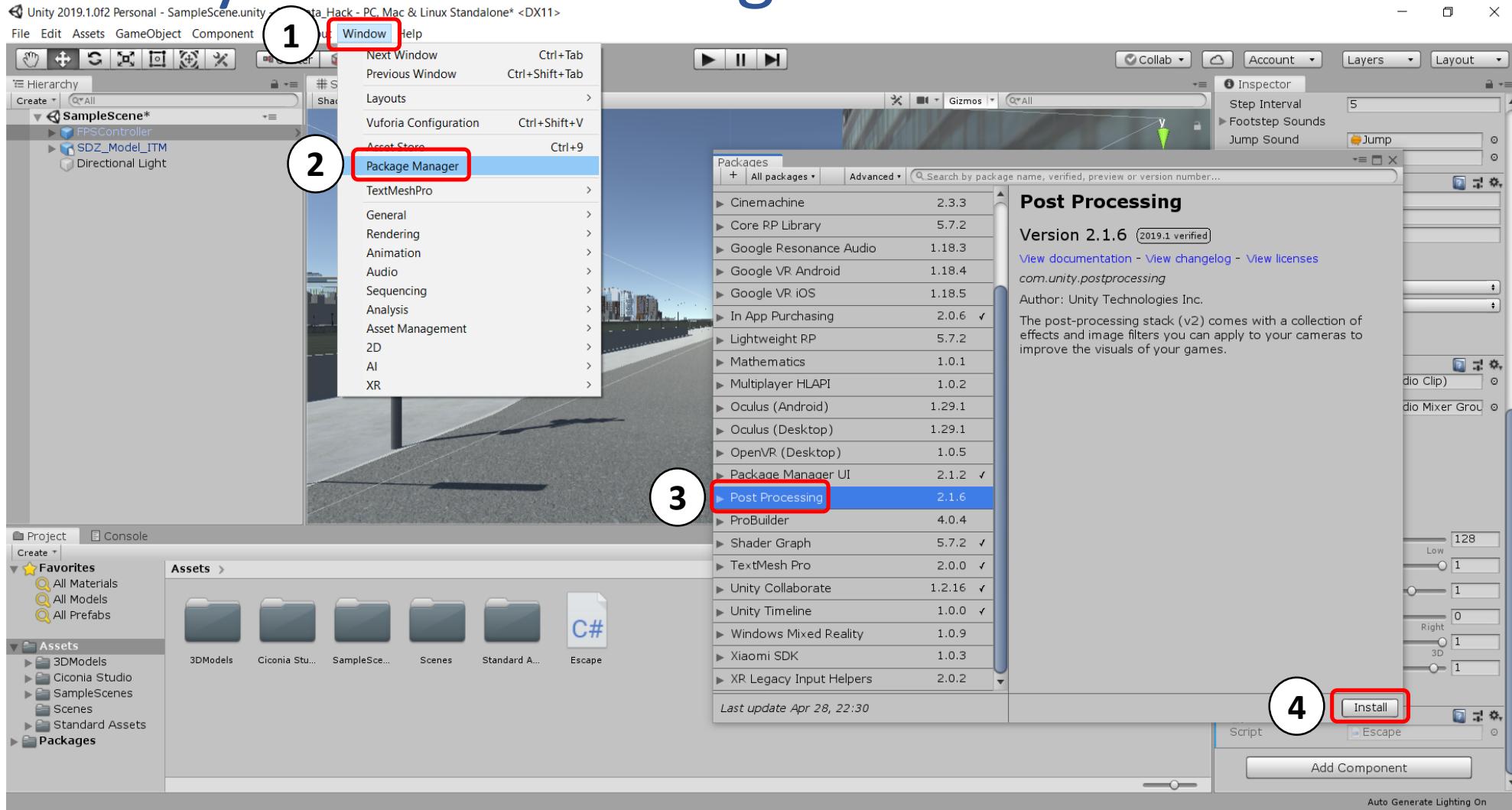


Add the double sided shader to features that need it like the trees and railings



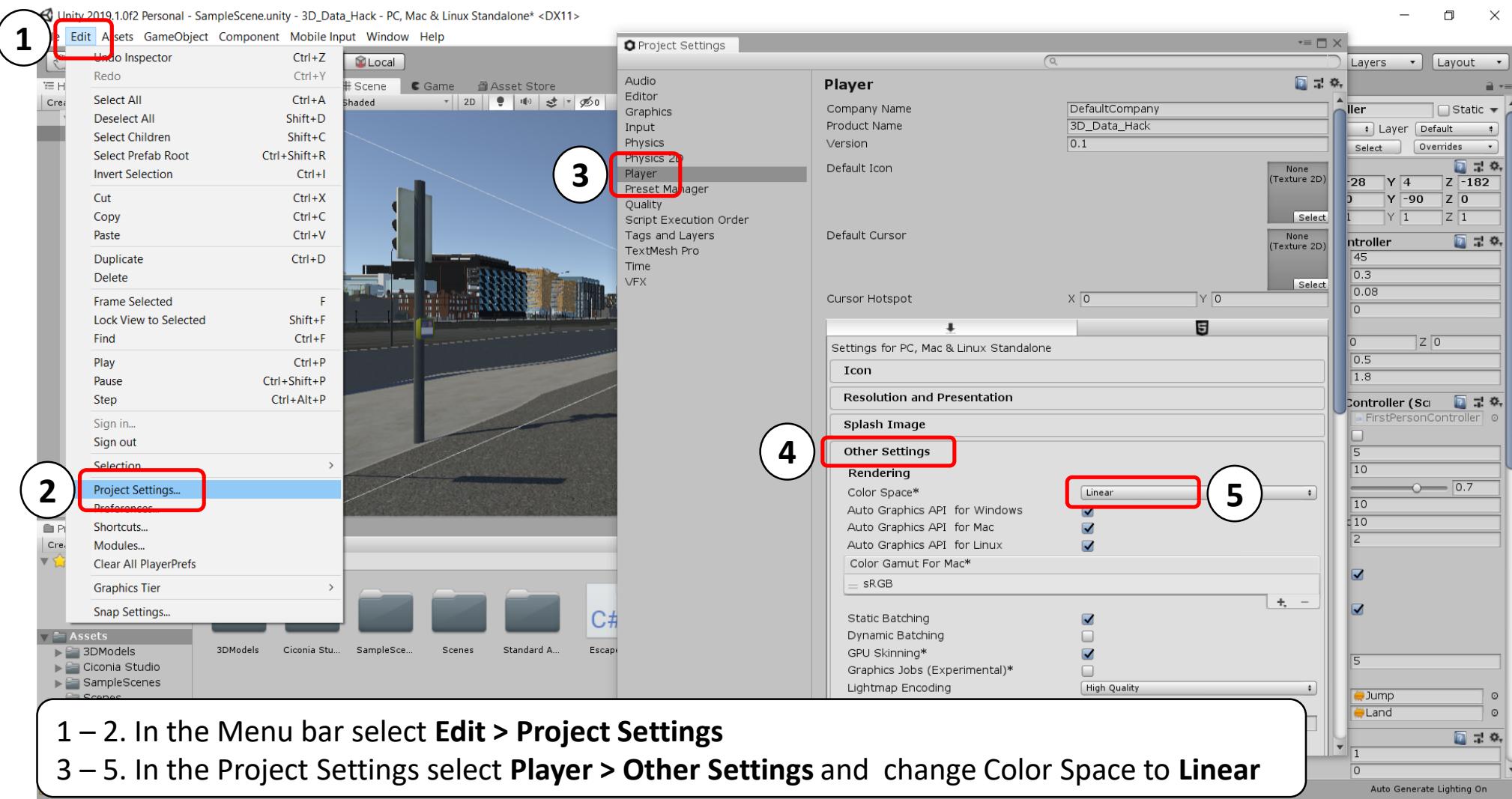


Enhance the look of your scene with the Unity Post Processing Stack



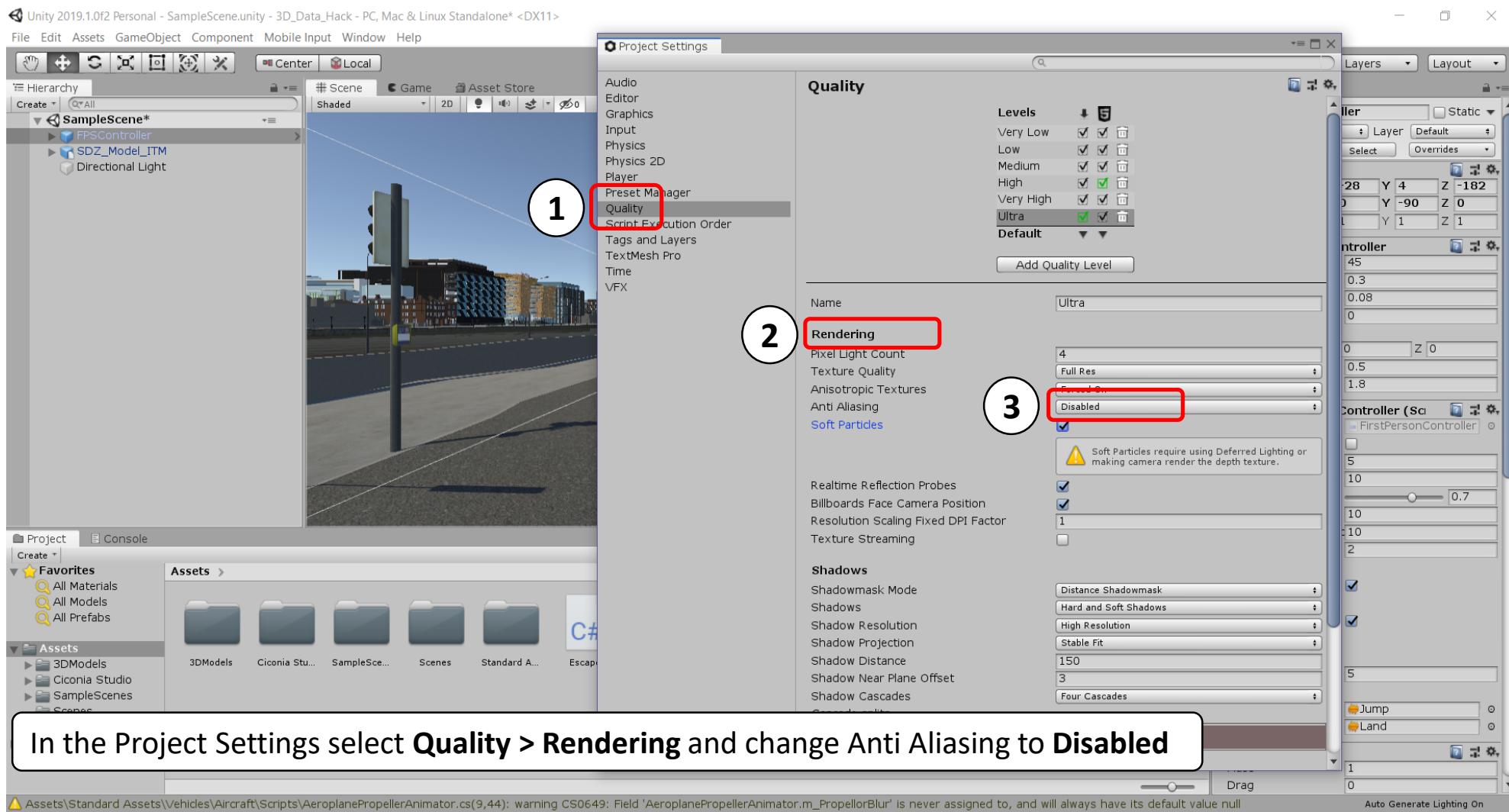


Change project colour space to Linear



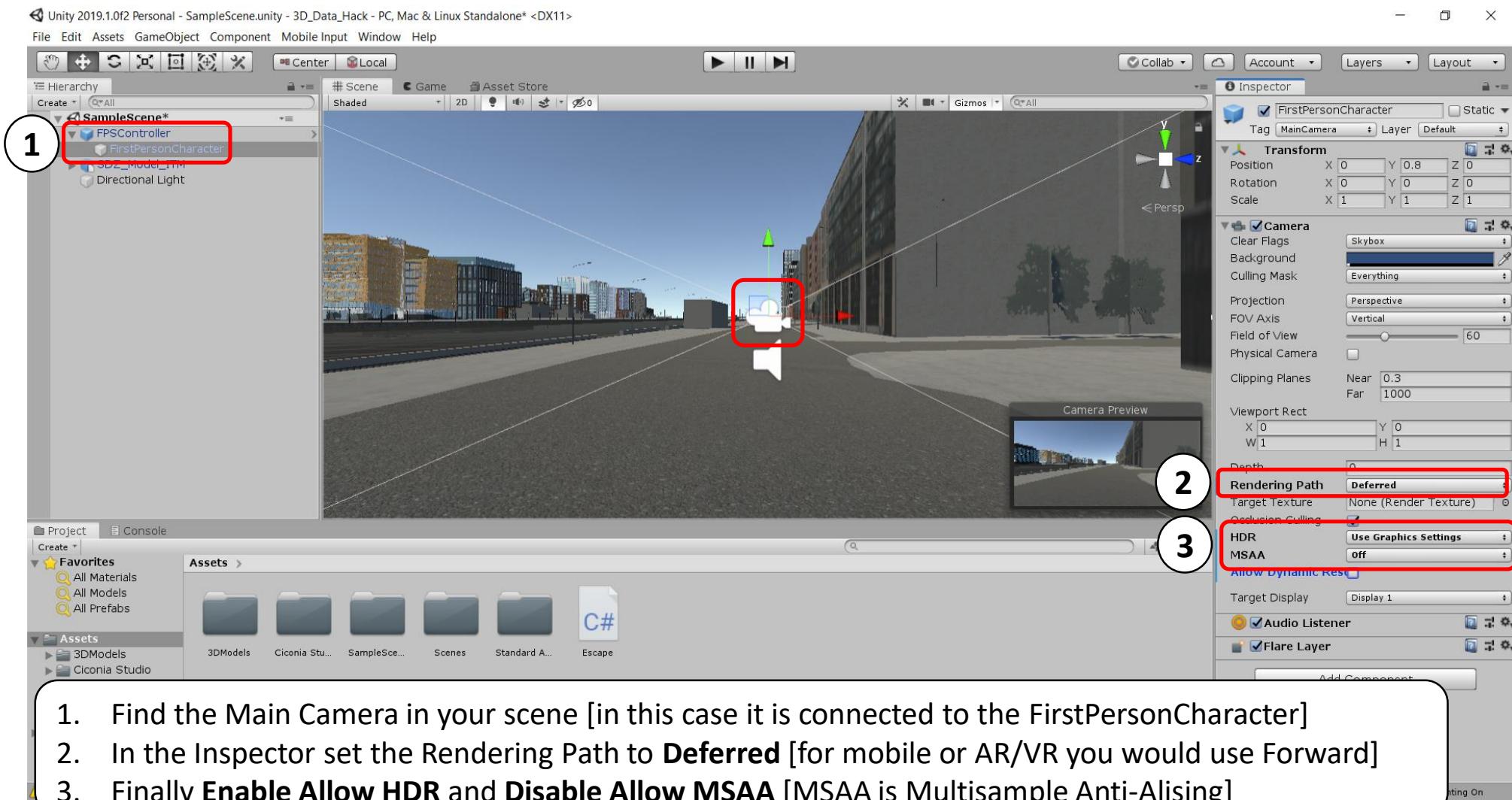


Disable Anti Aliasing (to be reapplied later)





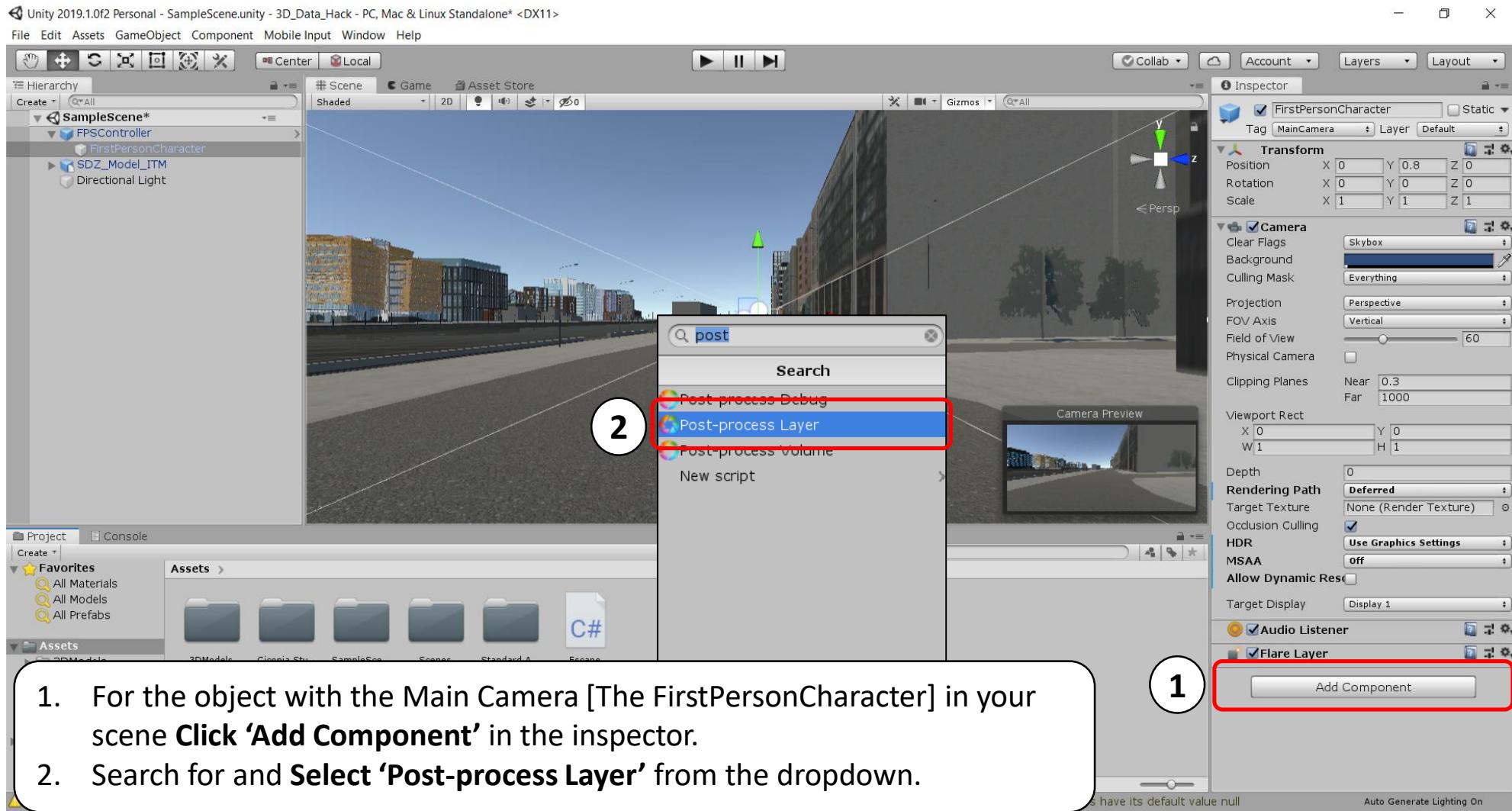
Set Rendering Path to Deferred (For Desktop)



1. Find the Main Camera in your scene [in this case it is connected to the FirstPersonCharacter]
2. In the Inspector set the Rendering Path to **Deferred** [for mobile or AR/VR you would use Forward]
3. Finally **Enable Allow HDR** and **Disable Allow MSAA** [MSAA is Multisample Anti-Aliasing]



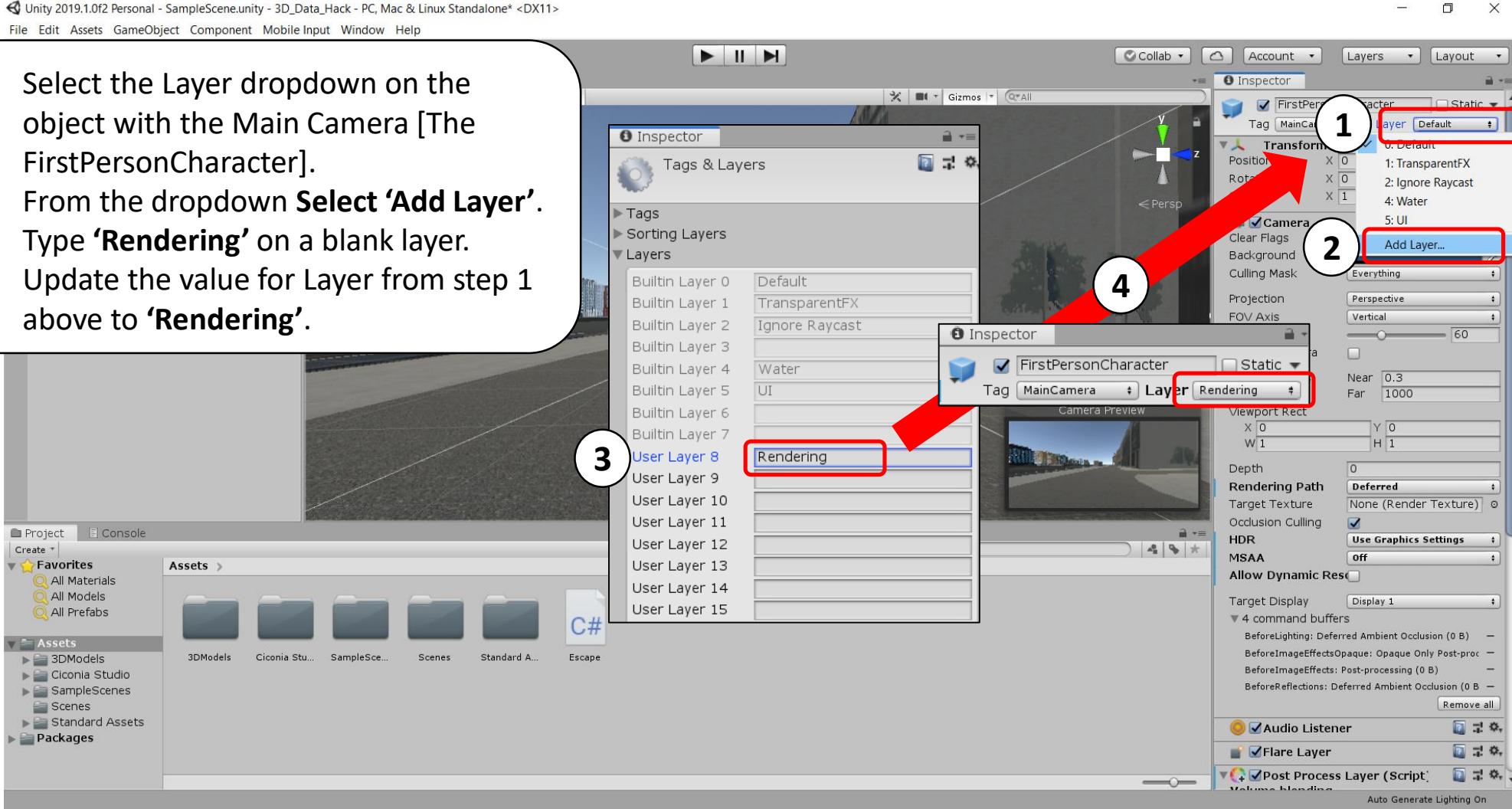
Add Post-process Layer to Main Camera





Create a new 'Rendering' layer

1. Select the Layer dropdown on the object with the Main Camera [The FirstPersonCharacter].
2. From the dropdown **Select 'Add Layer'**.
3. Type '**Rendering**' on a blank layer.
4. Update the value for Layer from step 1 above to '**Rendering**'.





Setup Post Process Layer and add Volume

The screenshot shows the Unity Editor interface with the following elements:

- Hierarchy Panel:** Shows the scene structure with objects like `SampleScene*`, `FPSController`, and `FirstPerson`.
- Scene View:** Displays a 3D city street environment with buildings, trees, and a camera.
- Inspector Panel:** Shows the configuration of the `Post Process Layer` component.
 - Step 1:** The `Layer` dropdown is set to `Rendering`. (Red box)
 - Step 2:** The `Anti-aliasing Mode` is set to `Temporal Anti-aliasing (TAA)`. (Red box)
- Post Processing Volume Component:** Shows the configuration of the `Post Process Volume` component.
 - Step 3:** The `Is Global` checkbox is checked. (Red box)
 - Step 4:** The `Profile` dropdown is set to `New`. (Red box)
 - Step 5:** A red circle highlights the `New` button in the `Profile` dropdown. (Red box)



Try experimenting with the following effects and settings

The image displays three panels from a software interface for applying post-processing effects to a scene. Red boxes highlight specific settings across all three panels:

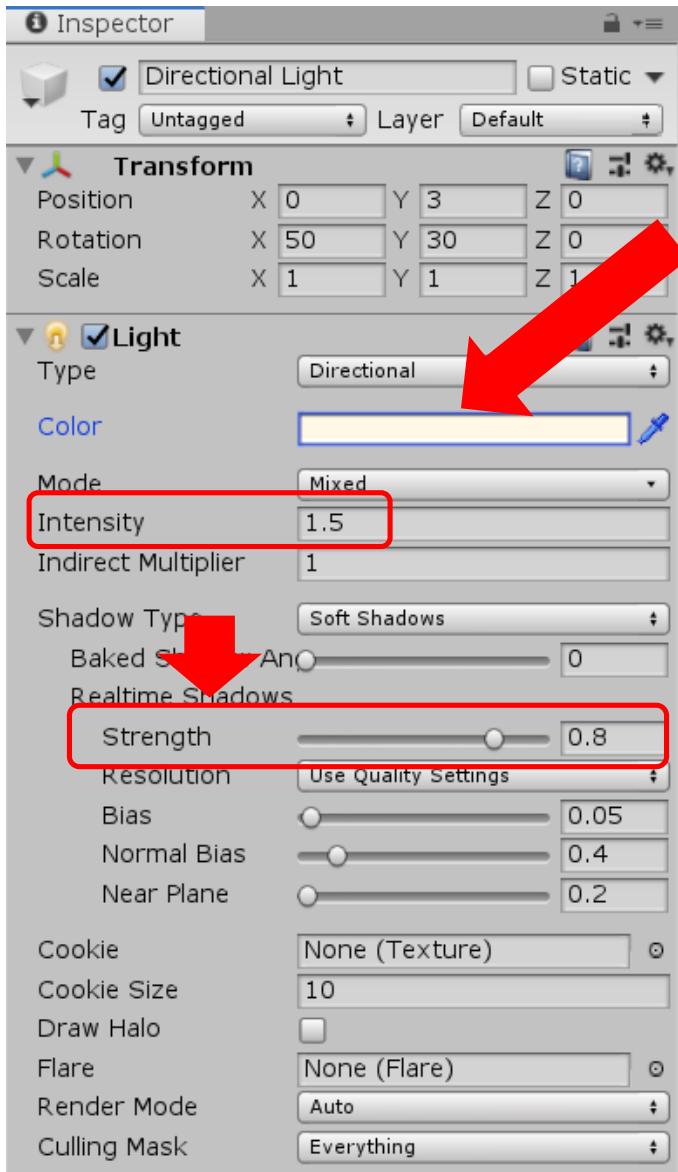
- Color Grading Panel:**
 - Color Grading**
 - Mode** (set to **Neutral**)
 - Post-exposure (EV)** (set to **0.6**)
- Bloom Panel:**
 - Bloom**
 - Intensity** (set to **2**)
 - Threshold** (set to **1**)
- Ambient Occlusion Panel:**
 - Ambient Occlusion**
 - Mode**
 - Intensity** (set to **0.3**)
 - Color**
 - Ambient Only**
- Vignette Panel:**
 - Vignette**
 - Mode** (set to **Classic**)
 - Color**
 - Center** (X set to **0.5**, Y set to **0.5**)
 - Intensity** (set to **0.2**)
 - Smoothness** (set to **0.4**)
 - Roundness** (set to **1**)
 - Rounded**

NOTE: Appropriate values for post-processing depend entirely on the nature of your scene and the effect you intend.

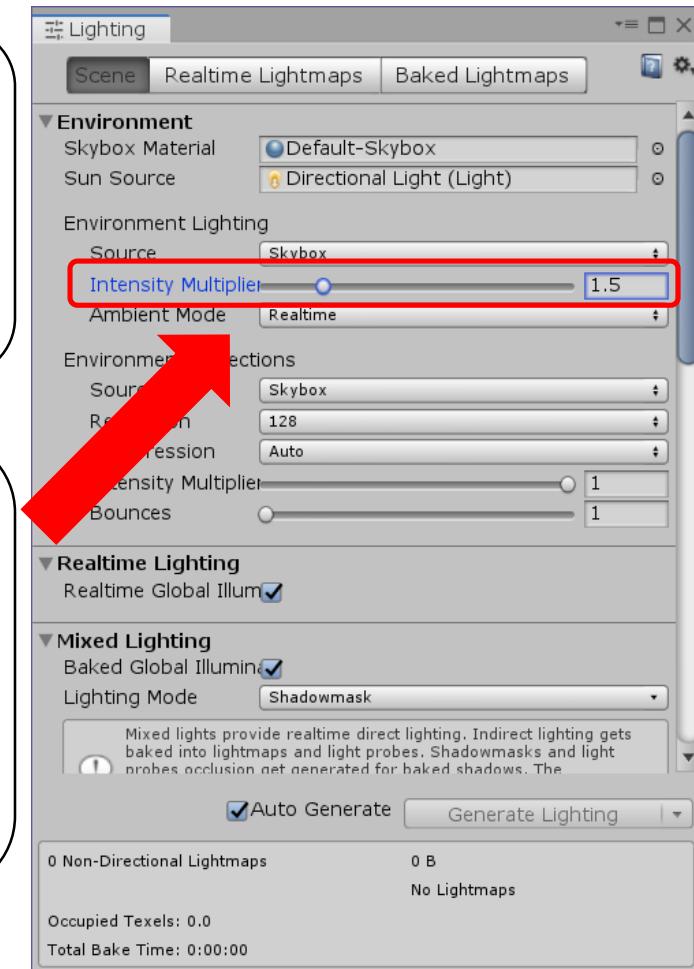
You may also need to adjust lighting and brightness levels (SEE NEXT SLIDE)



Experiment with the following values for lighting



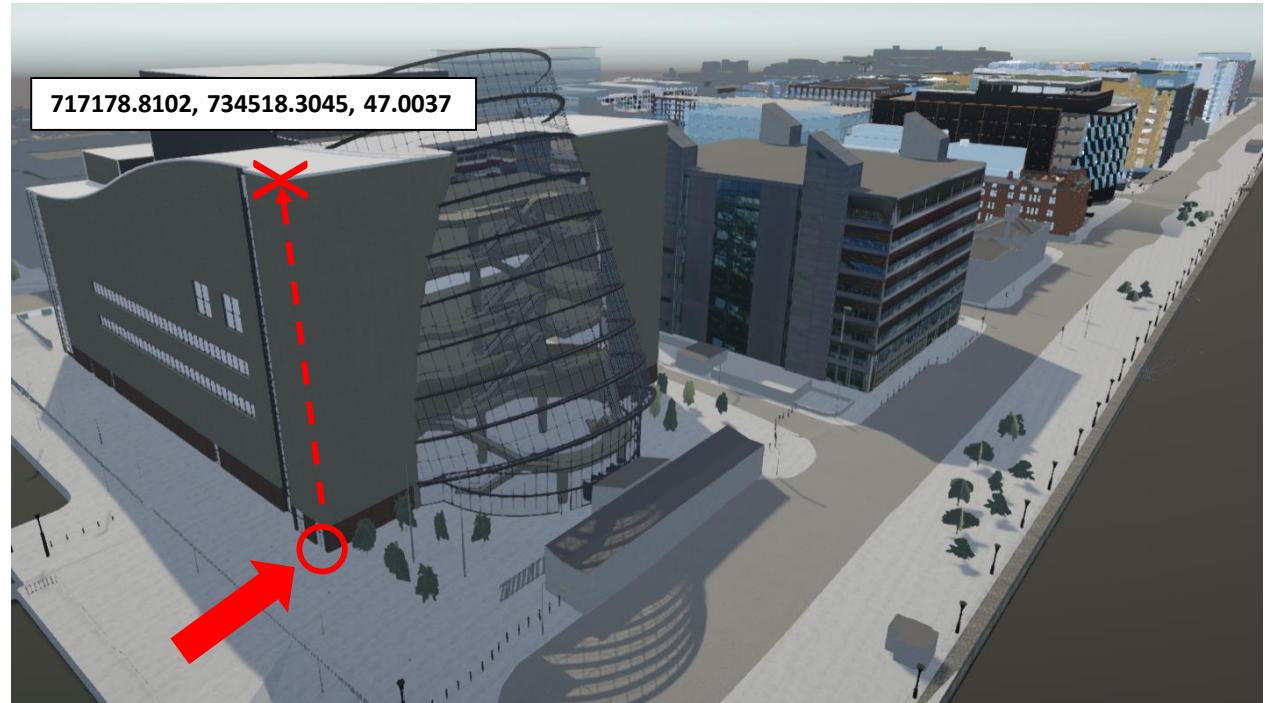
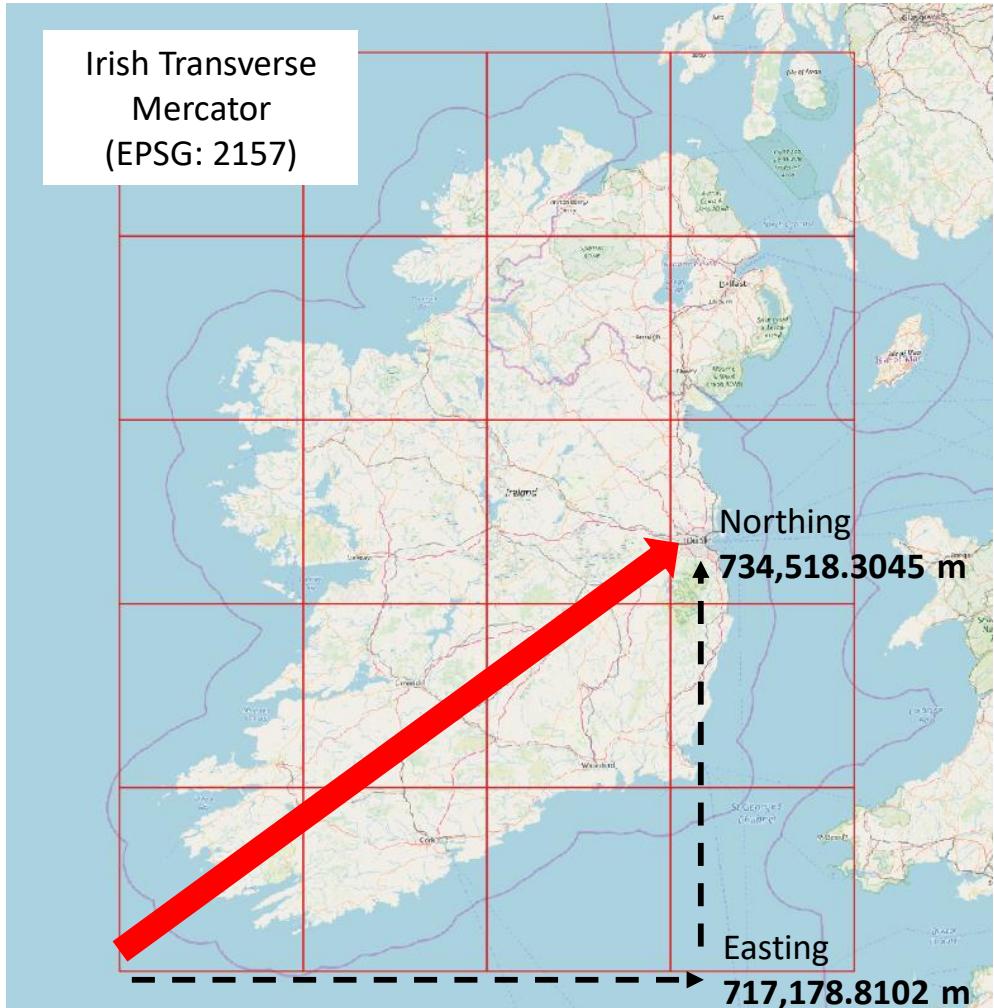
1. Go to main Directional Light and adjust Light Intensity
2. Slightly turn down shadow strength



3. Go to lighting settings
Window > Rendering > Lighting Settings
3. Turn up the Environment Lighting Intensity Multiplier



A spatial reference for geolocating data



Coordinates for the roofline on the south east corner of the Convention Centre Dublin (CCD) in ITM (EPSG: 2157) are:

E: 717178.8102 m / N: 734518.3045 m / Alt: 47.0037 m

See: https://en.wikipedia.org/wiki/Irish_Transverse_Mercator



Building City Dashboards

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