

Terrain Procedure for UE4 “Real Places”

Preface:

The following is a method for creating large scale terrains using tiling Static Meshes in Unreal Engine. The original geometry and imagery are exported from Global Mapper. Knowledge of Global Mapper is part of the process but you don't have to be a GIS guru to use it for this purpose. This document does not include a hands-on, step-by-step walkthrough of importing and exporting content from Global Mapper. The next part of the process involves editing the geometry in 3ds max using a custom maxscript I developed specifically for this purpose. Finally, export from 3ds Max and import into Unreal Engine. ***Please read the companion “DAS_GlobalMapper-DXFImport_3.0-Help” file for details on the maxscript used below.***

In Global Mapper:

1. Find the Lat and Long Coords of the location you wish to use. Google Earth can help.
2. Copy these to a text file and save. Leave the file open
3. In GM Import Terrain Data within 4 miles maximum (or your choosing) of these coords. It's easy to copy the data from the text file into the fields in GM. I recommend USGS 3DEP. Free to use without restrictions.
4. Similarly in GM, import Image data within the same distance of this location. (I recommend World Imagery or NAIP/NED). NAIP is free for all uses including commercial. The result will be an area approx.. 8 m x 8 m (4 m on each side of the point indicated by your GPS coordinates). This is actually not true. I usually get an area substantially larger than expected. 4 m from central point can yield an area closer to 10 miles on each side, bigger than we would want.
5. R-Click and get “Metadata” from the Terrain layer and note the “Upper Left X” and “Upper Left Y” (Easting and Northing) distances and paste into text file. Will need the negative of these numbers for offsets in the next step.
6. Enter the negative of the Easting and Northing into the “False” categories in GM “Tools/Configure/Projection/Parameters”. You need to do this before exporting or you'll end up with double-precision floating point problems in Max because the terrain is so far from world zero. This step will place the upper left corner of your combined terrain at world zero. You can of course move it from there to wherever you want in Max after import.
7. If you export DXF grid format to 8 tiles (or your choice depending on the size of your overall terrain), best resolution (“Sample Spacing”) should be kept to no more than 3 meters. This distance represents the size of each square polygon on the imported mesh. At this size, a single tile can contain more than 400K polygons. Multiply by 64 and that's a lot of polys! However, even with severe optimization for LOD0, this resolution can create problems with border seams between tiles. If we go to an even higher resolution it usually creates more mesh resolution than we want. In fact, I find 10 meter sample spacing to be ideal with 8 tiles where each represents approx. 1 mile. Then, when we optimize, we can keep border points identical for the 1st two LOD's, avoiding seams. I would like to keep the total of all tiles combined below 1 million polys for LOD 0. Another consideration is that Max can lock up trying to import DXF files greater than about 20 MB. Even if it doesn't lock up, the exponential increase in import time is not worth it. Experiment to find your own cutoff line. Apparently, the 32,767 vertex limit on DXF files is not an issue for Global Mapper export or Max import.

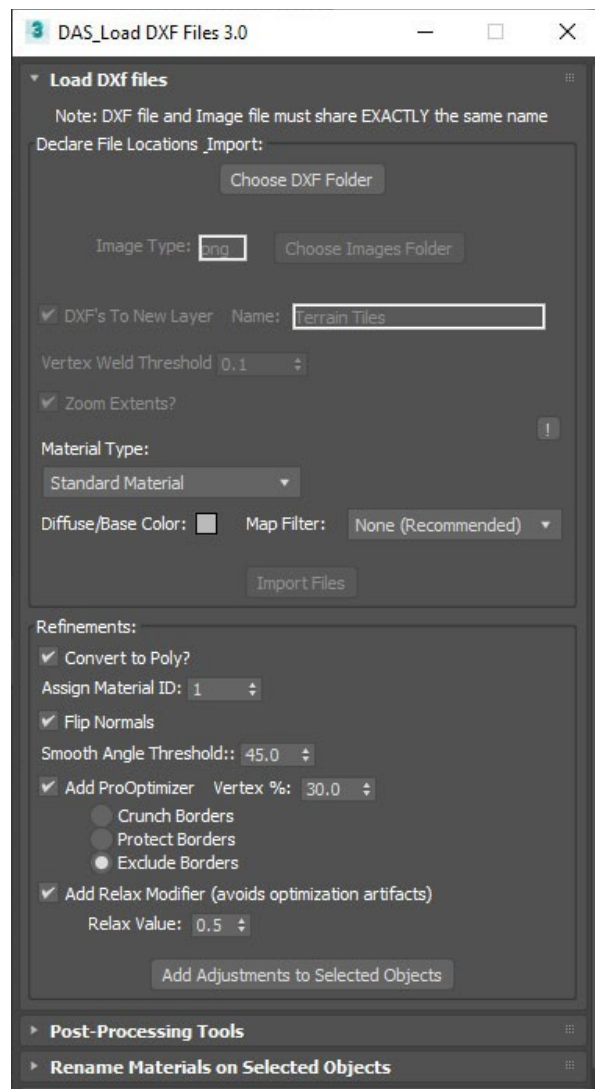
A couple of additional thoughts: Likely the terrain is not the sole hero entity in your Unreal scene. It should not take up all the resources, so a lower mesh resolution is of course advantageous. Exporting the tiles from Global Mapper is the key to getting these large areas into Unreal as “Static Mesh” objects, each with LODs as opposed to a single gigantic mesh. Though the FBX export from Global Mapper looks like a nice, easy option, it

does not natively support tiles, only a single mesh. You could conceivably divide up the fbx mesh later in 3ds Max but this creates a lot of extra work not to mention the problems with mapping the tiles correctly.

8. Export Imagery to 24 bit png, 8 tiles (or a matching choice to the dxf grid tiles) at 0.3048 resolution if possible. This is one foot/pixel if the imagery supports it. Tends to give a file close to 4096 px. NOTE: In order to use the maxscript I created for this process below, the image file name MUST match the DXF terrain file name exactly! For example, when exporting tiles from Global mapper you choose "Terrain" as your base file name for the DXF terrain tiles. GM will export 64 tiles (8 rows x 8 columns) with each tile named "Terrain_A1.dxf", "Terrain_A2.dxf", "Terrain_B1.dxf", etc.. Your image files must also be named "Terrain", creating matching files for each terrain tile name "Terrain_A1.png", "Terrain_A2.png", etc.. When these are all imported via the maxscript, it will create a proper material for each terrain tile based on the naming convention. The script will not work if your terrain dxf's and your image png's have different base names.

In 3DS MAX:

1. Set System units to meters
2. Use the DAS_GlobalMapper-DXF Import maxscript to Import all Files. Choose the initial settings you want. Typically the defaults are sufficient. Note that the import can take **a very long time** depending on the resolution you chose for your DXF tiles from Global mapper. This is not an issue with the script, simply how long Max takes to import dxf's.

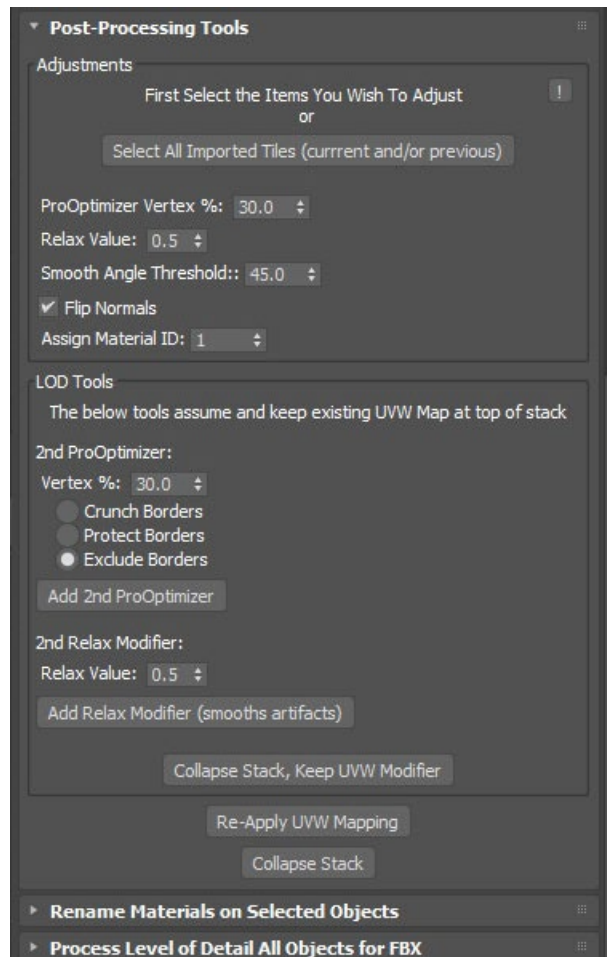


DXF Import and Initial Refinements

3. Use the “Refinements” section to refine the raw imported DXF mesh to your liking for what will be LOD 0.
 - a. Processing of the Optimization can take some time during which the script may appear to have locked up.
 - b. “Relax” Modifier can of course subtly alter the terrain elevation. Be cautious, but the optimization can introduce artifacts and Relax can clean those up.
 - c. All these changes can be updated before collapsing the mesh using the “Post-Processing Tools/Adjustments” in the script’s next rollout.
 - d. If you have 64 tiles, you’ll want to keep each tile’s LOD0 to about 15K polys or less in order to keep the entire combination under 1 million. This is a lot of optimization but your polygon count goal can be whatever you want.
 - e. I use the “Exclude Borders” options in the Pro-Optimizer Modifier settings on this 1st mesh reduction.
4. Use Max’s Rename Objects Tool to rename meshes (typically to remove the asterisk).
5. Use the script’s “Rename Materials” rollout to rename Materials to match Objects (also remove asterisk).

Steps for creating LODs:

6. When satisfied with your mesh resolution, Collapse Stack, Keeping UVW’s (you will be repeating this operation but the 1st time will be LOD0). This option is located in the Post-Processing Tools rollout. Note, this operation cannot be undone. Make very sure before continuing and at least save a version of your max scene at this point. All subsequent operations can be achieved via the script without having to redo the initial DXF import.
7. Duplicate all tiles. These new ones will now be modified to create the next LOD



Post Processing Tools: Adjustments and LOD Tools

8. I recommend placing each group of tiles on a new layer and rename them (i.e. "xxx_LOD0" and "xxx_LOD1".....You will be changing the copied tiles into LOD1)
9. Apply 2nd ProOptimizer, Exclude Borders (No apparent gaps should exist between tiles).
10. Add 2nd Relax Modifier
11. Repeat 6 -9 Twice (I recommend using Protect Borders on the 3rd iteration) to create 4 LODs. Use Exclude Borders on the final iteration created from the 3rd.
12. Unhide all Tiles.
13. If you need to, select all and move the collection to a central location, or a specific location if you have one in mind.
14. Apply 3 UVW map Modifiers with all selected. Set to Box style and sizes to 1 Meter, 10 M, 100M, map Channels 2,3,4 respectively. This is for future detail texturing on the ground surface using UE4's mesh paint feature. Needs to be done now if you are going to do it. With all selected, the UVW's will match across all tiles so you can paint seamlessly in Unreal across multiple tiles if needed.
15. Set System Units to centimeters then use "Rescale World Units" utility in Max to scale up the entire scene by a factor of 100. "System Units" are Centimeters in Unreal and rescaling keeps everything the same after changing.
16. I recommend you move the collection of tiles so that the lowest point is equal to world Zero Z but that depends on your needs.
17. Run Group and Level of Detail command from script.
18. Use the Rename Groups option to properly name the group heads based on the material assigned to the tiles in the group. A prefix is recommended for use once the content has been imported into Unreal. Commonly this is "SM" for "Static Mesh".
19. Your terrain tiles, with LODs properly grouped should now be ready for export to FBX for use in Unreal!

Critical Note on Naming Conventions for Unreal Import: Upon FBX import, Unreal uses the base name of all entities (textures, meshes, materials) without extensions. None of your entities can share the exact same name or you will have conflicts upon import. Therefore, Your Materials should have a prefix or suffix such as "M", meshes prefixed/suffixed with "SM" and textures with "T". The script and Max's "Rename Objects" tool are your best friends here, but it is up to you to name your textures appropriately. After all, the textures had to be named exactly the same as the terrain dxf's originally. If you have a lot of textures, there are some Windows utilities for renaming files in explorer. Generally a good idea to have one of those installed anyway.

Export to FBX for Unreal:

The best resource for easy export of multiple FBX files for unreal, especially if you have multiple LOD groups prepared with Max's Level of Detail utility, is this excellent macro script by Anders K. Nielsen:

"Mass Export FBX to UE4.mcr" <http://www.mcgreed.dk/maxscripts.html>

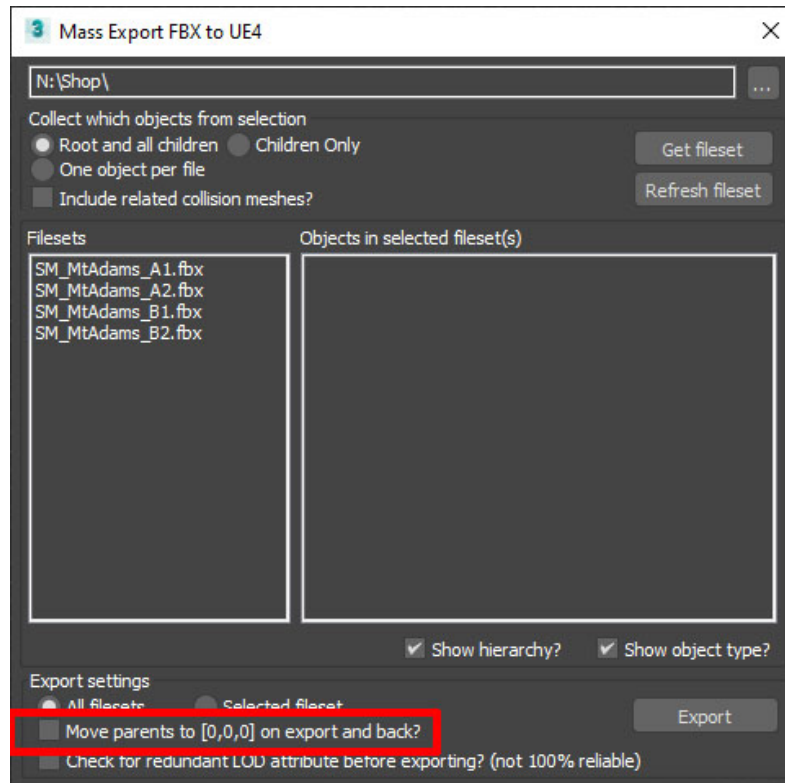
Basic Instructions:

1. Set a file path where the FBX exported content will go.
2. Select all the entities you want to export then press "Get fileset" on the script.
3. Make sure and uncheck the option to move parents to world zero.

When you press "export" the standard FBX export dialog will appear for you to choose your settings and options. This will only happen once upon initial export. Of course you need to choose the "Animation" option for objects with LOD's.

Anders has several other maxscripts at his site worth exploring. Thanks!!

Note: I have included a regular ".ms" version of Anders macroscript at the DAS website so you don't need to set it up as a macro in order to execute it.



Anders K. Nielsen's "Mass Export FBX to UE4" macroscript

UE4:

Import into Unreal is the same as with any other resources. After import and once placed into your scene, just make sure and set the "Location" of each Static Mesh in Unreal to world zero to keep them all aligned. Remember, they were already located where you wanted inside of Max.

Tips:

1. At Import or later in the Static Mesh Editor you will likely want to uncheck "Auto Compute LOD Distances" and set these to your liking.
2. Once you set one Static Mesh tile to your liking in the LOD settings, you can select that tile in the Content Browser then R-Click and choose "Level of Detail/Copy LOD" at the top of the fly-out. Now select all the other tiles and do the same things except choose "Paste LOD" to quickly duplicate your LOD settings across all the Static mesh tiles.

Additional note:

I hope to soon include my workflow for creating Normal maps from the Aerial imagery. It's a complicated operation in Photoshop and though the Normal Map created through this process is not the most truly accurate, it certainly helps the look of the terrain. My workflow compensates for shadows and foliage though not always very accurate. Still it works OK for the bulk of the terrain surface.