Condor V3 Airport construction

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Introduction

Airports with Condor 3 bring several fundamental new features:

- Longitudinal and cross-sectional profile of the airfield preserved, instead of a flat terrain
- 3D grass.

These new features only apply to the G file of airports that contain all the surfaces of an airport. The O file of each airport is built identically to Condor 2, and it contains all the superstructures of the airport.

For this it is necessary to use a finer support grid in 22.5 m and with precision lower than the meter in order to avoid bumps and edge effects with the visualization of the 3D grass. This grid in TR3F (F for Float) allows to create dedicated sub-textures.

All illustrations are made with the soft: ***Landscape Editor version 3.00***, ***Object editor***, from the Landscape Toolkit 2, ***Blender 4.2 LTS*** and ***The Gimp*** or ***Photoshop*** Wings 3D can also be used instead of Blender. ***LMB***, ***RMB***, ***MMB***, etc., are used for clicks with the ***L***eft, ***R***ight, ***M***iddle ***M***ouse ***B***uttons.

Condor 3 Sceneries are all linked to a UTM projection and divided into square Terragen tiles of 23040 m. This value is the result of 769 columns/rows of altimetry data spaced by 768 x 30 m wide intervals from SRTM data (768 x 30 = 23040 m). Terragen tiles are divided into 4 x 4 patches.

The patches have a fixed dimension of 5760 m on each side (192 x 30 m). The dimension of the texture in pixels of each patch is dependent on the quality of the texture applied, i.e. 1024, 2048, 4096, 8182, etc., pixels. Textures of patches including airports can have a larger dimension than the standard patches.

The standard for a Condor 3 patch is 2048 pixels, i.e. exactly 2.8125 m/pixel.

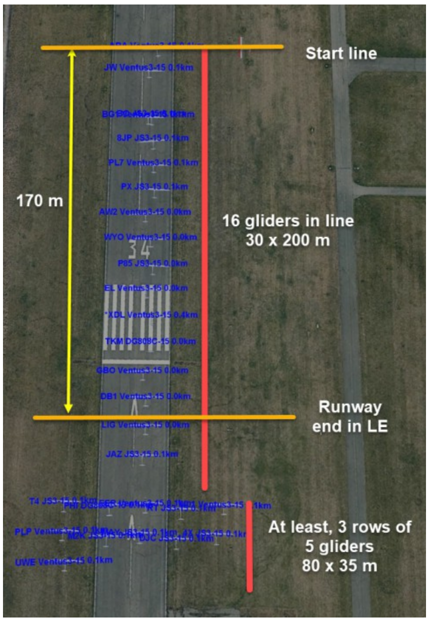
Airport smoothing

Most terrain on airfields is bumpy to begin with.

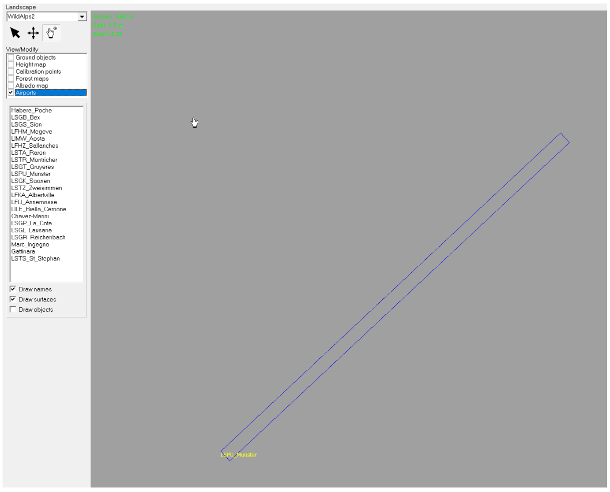
We must smooth this while preserving the general slope and the particular curvatures of the runway and its surroundings.

Also pay attention to the areas of the airfield that have parks and buildings.

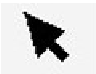
Also remember that today, the glider storage areas during multiplayer flights concern (Figure 1):
An area of 16 gliders in line, i.e. a rectangle of 30 x 200 m, from the start located 170 m from the end of the runway.
Adjoining this area is an area of 80 x 35 m where at least 3 rows of 5 gliders could be stored.

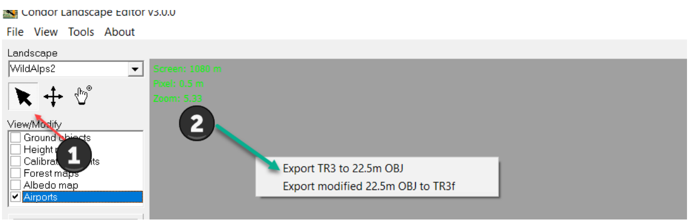


It may be necessary to flatten these areas as well. Open ***Landscape Editor (3.00)*** (Figure 2) Select the scenery you need. LMB on the drop-down arrow, then LMB on the scene name. Select the ***Airport*** checkbox. Create or search for the airport you want to process. Then zoom in so that it fills the window. After selecting the "hand" tool, LMB in the main window to zoom in, RMB to zoom out, LMB_M to move.



Select the arrow tool 1 (Figure 3):





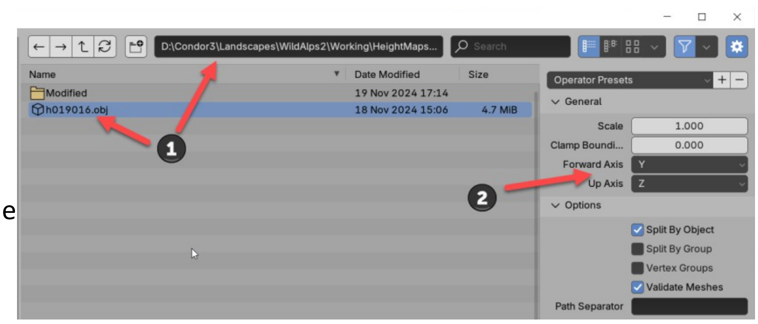
RMB in the main LE panel, in order to convert the corresponding patch (green arrow) of the airport.

A pop menu is displayed

Select "***Export TR3 to 22.5m OBJ***" 2. The 22.5m terrain file of the patch will be created in the folder:

Working/Heightmaps/22.5m of the scenery with the notation ***hxxxyyy.obj*** or ***hxxyy.obj*** depending on the chosen patches numbering.

Open Blender4.2 (Figure 4) ***import the "obj" file*** that was just created (***File > Import > Wavefront***) from the ***Working/Heightmaps/22.5m*** 1 folder,



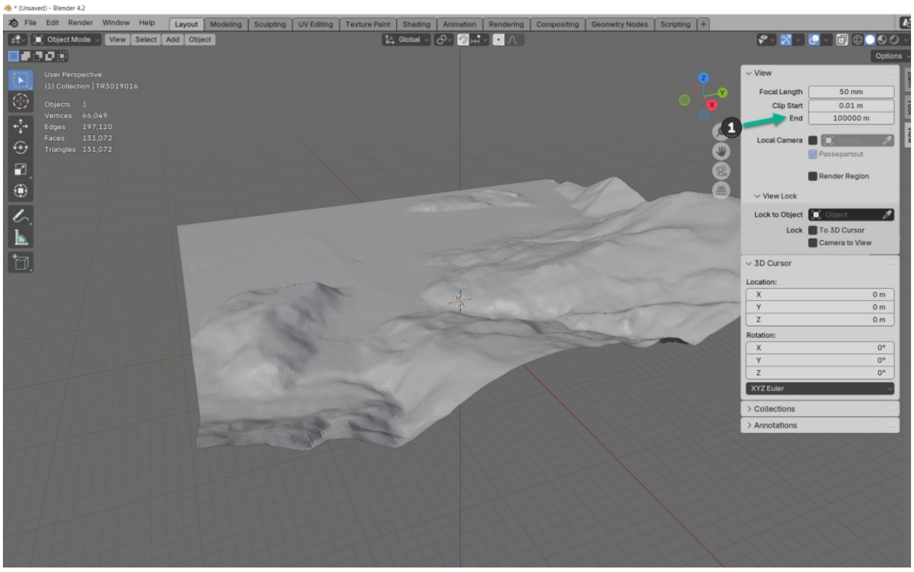
using the following parameters so that the top view is correctly displayed in the 3D Viewport:

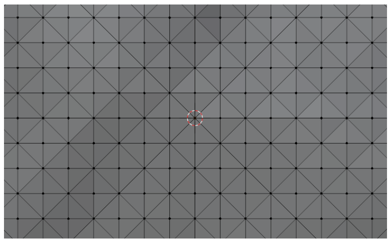
2 ***Forward Axis: <u>Y</u>,***

Up Axis: <u>Z</u>

Here is what it looks like in the 3D Viewport (Figure 5), as soon as the 1 ***Clip End is set at 100000 m***.

Access to the clip End by ***key N > View tab.***



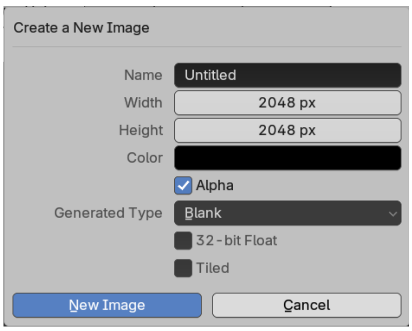


UV map the texture onto the terrain

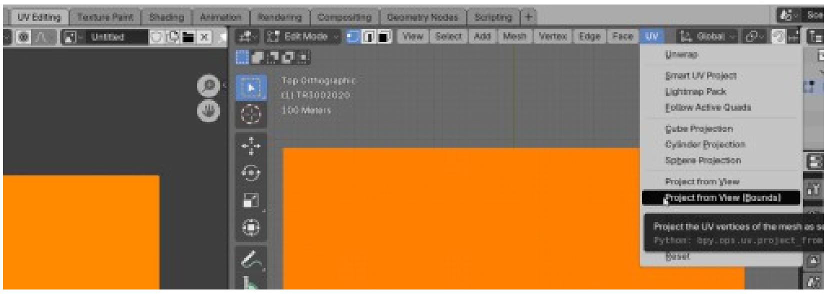
- Switch to ***Top Orthographic*** (orthogonal top view), ***7*** key ***NP***, and check that this view remains in this position throughout the operation.

- ***LMB*** on the ***UV Editing*** tab. In the right panel, ***3D Viewport***, which has automatically switched to ***Edit Mode***, zoom out with the mouse wheel to display the patch. It appears black and often truncated. The canvas is a tight grid (Figure 6). Again, set the ***Clip End*** to 100000 m.

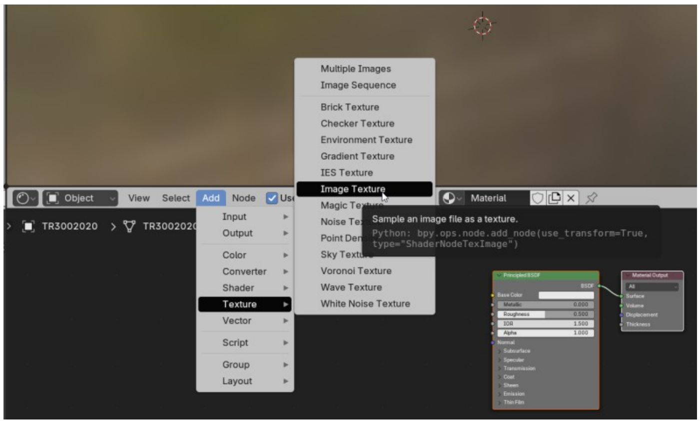
- In the left panel, ***UV Editor***, LMB on ***New Image***. Set the image definition according to the size of the airport patch in the panel ***Create a New image*** (Figure 7). The standard value is ***2048 x 2048 pixels***, but patches containing airports can be wide size.
  LMB on ***New Image***. A black image is created in the panel.



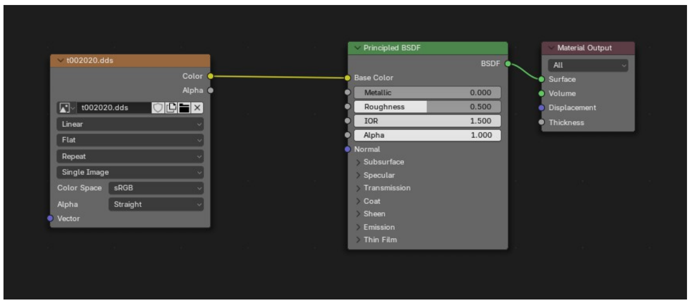
- Return to the ***3D View*** panel. Select the entire tile (***A Key***).
  In the menu bar (Figure 8):
  UV > Project from View (Bounds).
  The black image in ***UV Editor*** becomes orange and by zooming the 22.5 m canvas is selected and correctly mapped to the black image up to the bounds of the image.



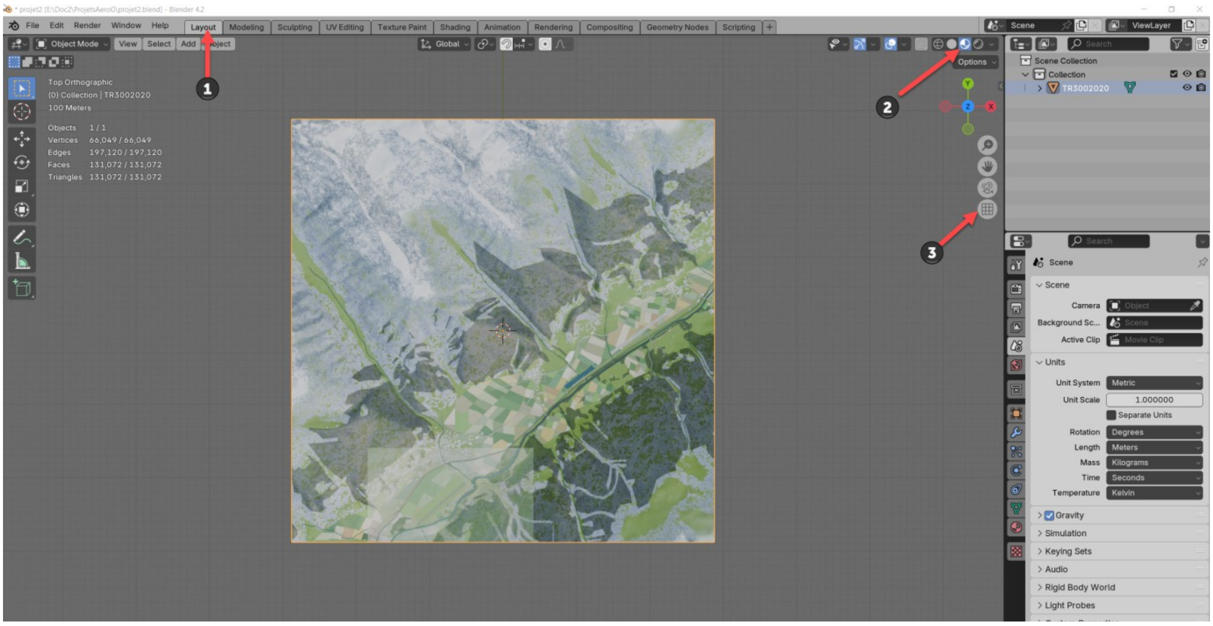
- ***LMB*** on the ***Shading*** tab. In the ***Shading Editor*** panel (at the bottom) ***LMB*** on ***New***. The ***Principled BSDF*** and ***Material Output*** nodes are automatically created and linked.



- In the menu bar (Figure 9): ***Add > Texture > LMB on Image Texture***.
  An ***Image Texture node*** is displayed. Link ***Color*** of Image texture with ***Base Color*** of Principled BSDF using an ***LMB_M*** between these two yellow points (Figure 10).



- In Image texture ***LMB*** on ***Open***. Select the patch texture corresponding to the location of the airport in the scenery, located in the ***Textures*** folder. It has the same number as the patch transformed into 22.5 m with the prefix ***t***: ***txxyy.dds***.
- ***LMB*** on the ***Layout*** tab 1 then on the ***Material Preview*** button 2. Check that you are still in ***op***

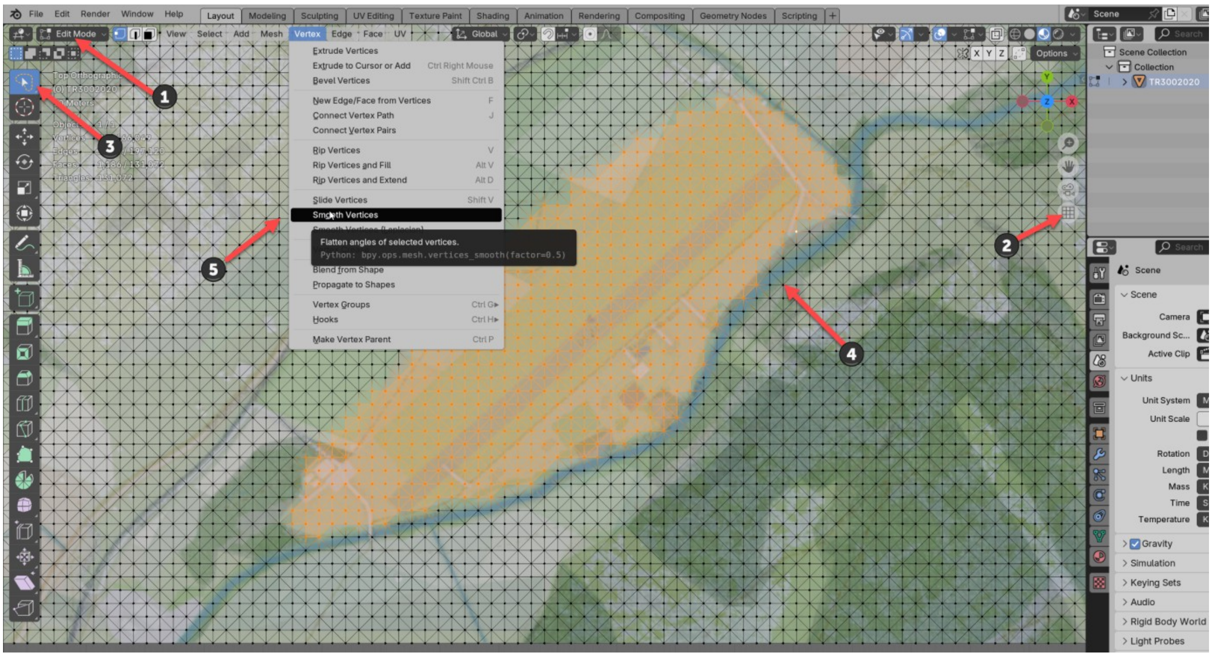


Orthographic 3 .The texture of the patch is then perfectly mapped on the patch grid in 22.5 m.

Airport Area Smoothing

Use Blender to flatten the areas you need. ***Smooth vertices*** function is quite effective (Figure 12).
In ***Edit Mode*** (1), still in ***Top Orthographic*** (2), move the ***3D Viewport*** view towards the airport

(***MAJ_MMB***, see the Status bar).and zoom in

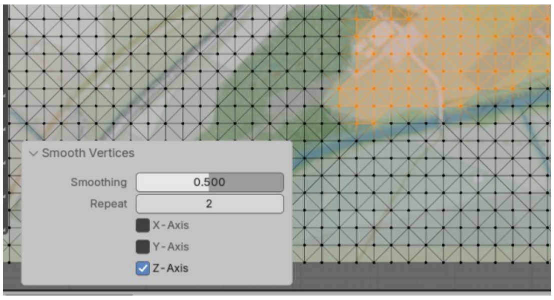


You will have to select an area at least 2x the width of the runway for this to work well and more if the airport zone has large grass areas where a landing is reliable. Use the ***lasso*** (3) to make the selection and

modify the selection until you get a suitable selection area (4).

Launch the smoothing operation with an LMB via the ***Vertex > Smooth Vertice*** (5) menu. At the bottom

right a ***dialog box must be open and set before any other action***. Indeed, only altitudes should be modified by the Smooth vertices tool. ***Z Axis only should be checked***, especially if the airport is near the edge of the patch or concerns several patches (Figure 13).



Export the file to Wavefront (.obj) from Blender using the following settings (Figure 14), and store it in: ***Working/Heightmaps/22.5m/Modified***. 1

Forward Axis: Y 2

Up Axis: Z

Triangulated Mesh: Notched 3

Airport Patch Name: hxxyy.obj 4

Then ***LMB on Export Wavefront OBJ*** 5

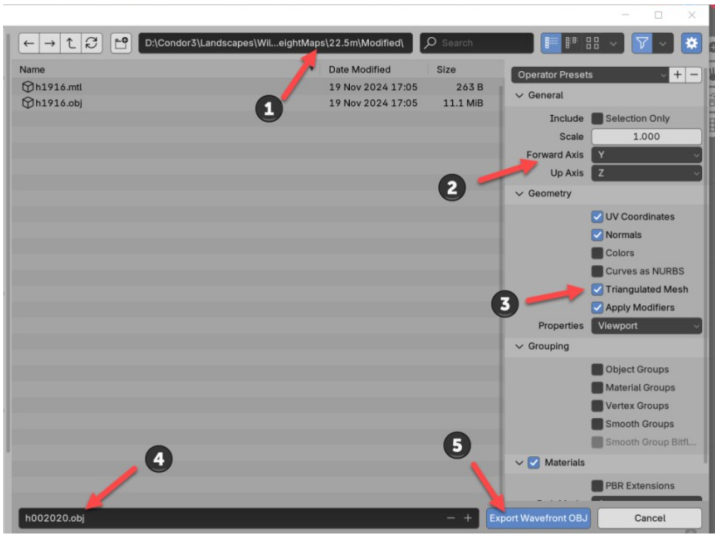
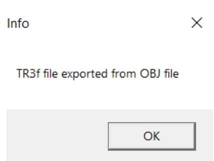


Figure 14

Back in ***Landscape Editor***, ***RMB*** on the airport in the main window, still with the ***arrow tool*** selected

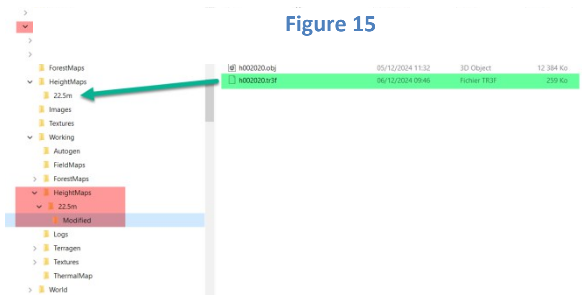
Select "***Export modified OBJ to TR3f***".

If the operation is successful, an Info panel is displayed.



In Windows Explorer, ***copy the TR3f file*** from (Figure 15):

Figure 15



C:\Condor3\Landscapes\Scene_Name\Working\HeightMaps\22.5m\Modified
To:
C:\Condor3\Landscapes\Scene_Name\HeightMaps\22.5m

Runway Alignment

In Blender, add a rectangular plane perpendicular to the Z axis, close to the dimensions of the runway. For example, 880 for Y and 40 m for X in order to generally remain in the orientation of the airports defined in Condor. Move and modify the plane so that it adapts perfectly to the runway. Use the ***Local*** coordinates of the plane if necessary. It can later be used as a support for the hard runway (Asphalt), or signs on the grass (Grasspaint) or signs on the runway (Asphaltpaint) etc.

Once the runway is perfectly aligned, select the rectangular plane. Bring the ***Scale back to 1*** by ***Object > Apply > Scale.***
(Figure 17)
Still with the plane selected 1, just read the information of ***Item*** in the ***Transform*** table which

corresponds to the characteristics of the geometric center of the plane, the yellow point 2.

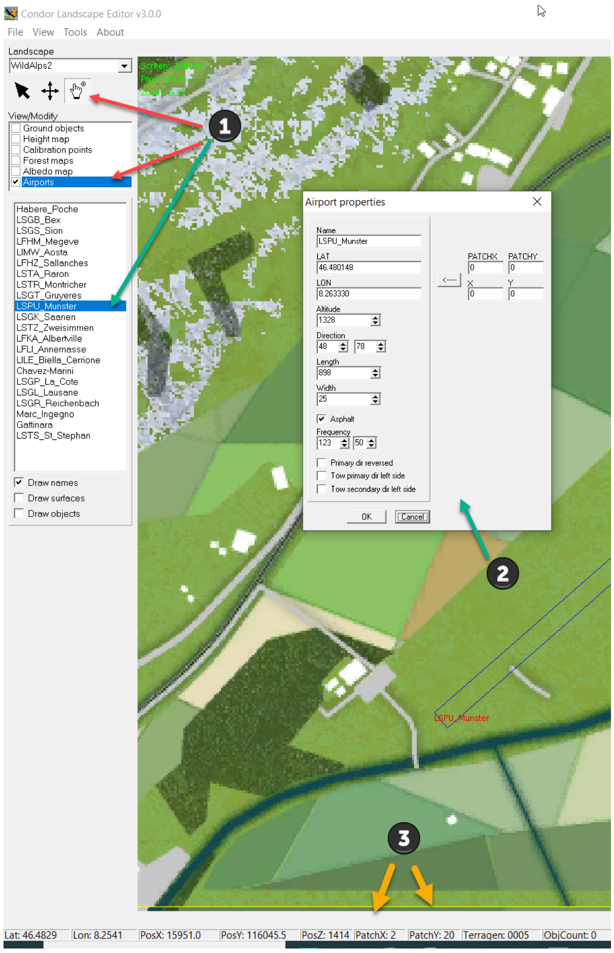
Position relative to the center of the Patch 3:

X = -847.35 m
Y = -2360.4 m

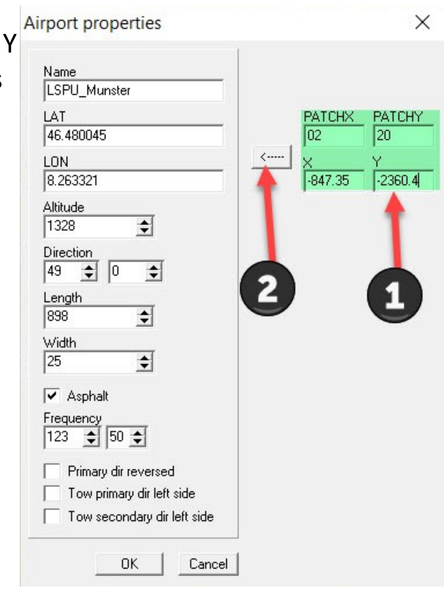
Rotation around the vertical Z axis relative to the horizontal Y axis:
Z = -48.781 °

Here we have a little difficulty because Blender uses the trigonometric direction (counterclockwise) while Condor uses the geographic direction (clockwise). We must therefore use +48.78 °.

Note these 3 values which will be useful later in this chapter.
Save the Blender file with an appropriate name (e.g.: Project_Name_aero).



Back in ***Landscape Editor*** (Figure 17)
Hand tools selected, ***Airport*** box checked, Zoom on the airport to be processed and ***LMB*** on the name of the Airport in the corresponding list. The airport is highlighted 1. ***RMB*** on the highlighted airport. A pop-up menu is displayed, ***LMB*** on ***Properties***.
The floating ***Airport properties*** 2 panel is then displayed with the values that had been registered when creating the Airport. At the bottom in Landscape Editor the values of Patch X and Patch Y are displayed 3. These are those of the patch where the center of the airport is located. They correspond to the same values as those of the patch that was flattened previously.

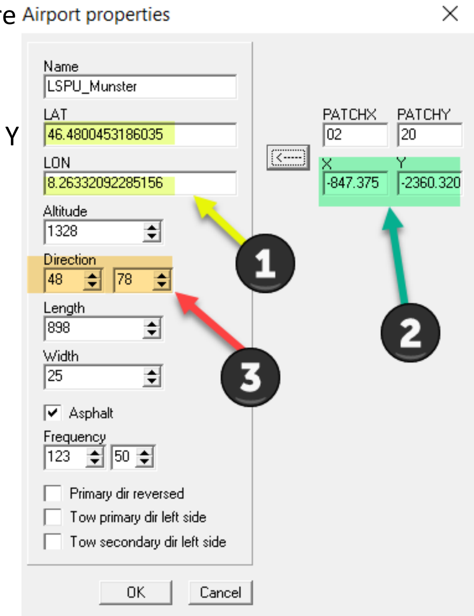


To definitively fix the positioning of the airport, you must copy the ***X and Y values*** of the central location into the X and Y fields of the airport properties in Landscape Editor. Copy the values of ***Patch X*** and ***PatchY*** into PATCHX and PATCHY corresponding to the center of the airport (Figure 18).

This allows to calculate the airport coordinates in the UTM coordinates of the scene and then to calculate the coordinates of the Latitudes and Longitudes in the WGS84 projection.

Then press the <----- button 2.

This will set the latitude and longitude of the airport , but more importantly, it will adjust the X and Y fields to the optimal values for runway placement. You now need to use these revised X and Y values back into Blender for the runway center .



Note the new values of:
Xr = -847.375 m
and
Yr = -2360.32 m
you will need them later.

Copy the calculated direction of the airport runway ***48.78 °*** into the *Direction* box .

LMB on ***OK*** of ***Airport Properties*** to save the changes and close the panel.

Rebuild the Terrain safety file

File > Export Terrain hash (THA)

Save the scenery:

File > Save landscape

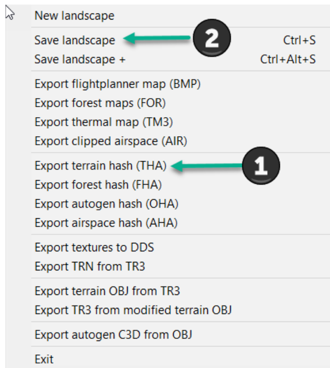


Figure 20

Making the airport surfaces

Preparing the terrain

With non-flat runways, the surface objects creations requires more work and must be done quite precisely.

Each surface object in the airport G-file must have a reference altitude set to an altitude of 0 m, and it must be generated by extracting a section of the terrain from the patch with the correct shape and contours.

We must first make a copy of the patch with the reference plane in Blender, then move, rotate and adjust the height so that the runway is precisely aligned in X and the center of the runway on the patch is at altitude 0.

(Figure 21) Switch to ***Object Mode*** and ***Top Orthographic*** 1, select the ***Patch*** 2, the values displayed in ***Transform*** for the Patch are ***X = 0, Y =0*** 3.

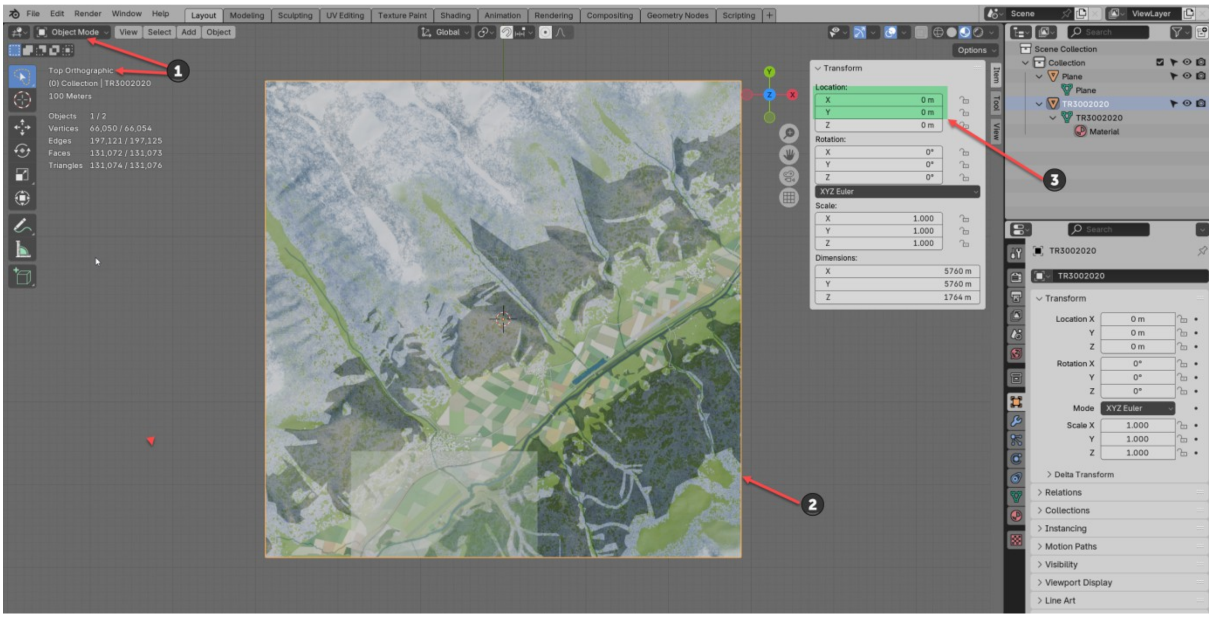
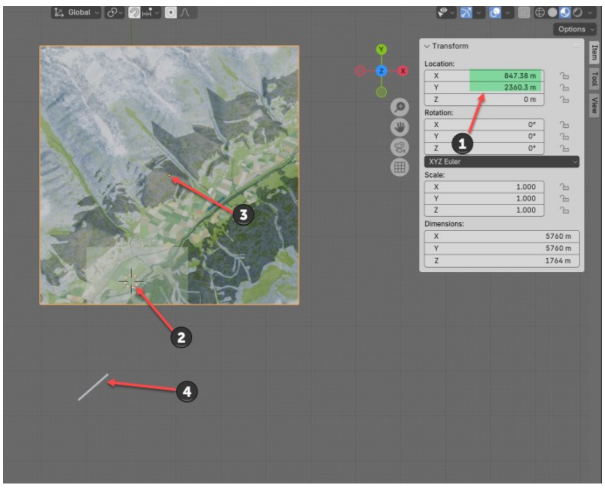


Figure 21

Using ***the negative Xr and Yr values*** 1 ,we saved earlier, move the terrain patch so that the 3D ***Cursor*** 2 is located on the ***Airport Center***.

Enter the ***negative Xr and Yr values*** in the ***X*** and ***Y*** location boxes of the ***Transform*** panel.



The ***Geometric Center of the patch*** 3 and the ***plane representing the runway*** 4 ***have not moved***.

Set the Geometric Center of the patch to the 3D Cursor by ***Object > Set Origin > Origin to 3D Curs***or. You will then see that the X, Y values in the ***Transform*** panel are set to zero.

Figure 23

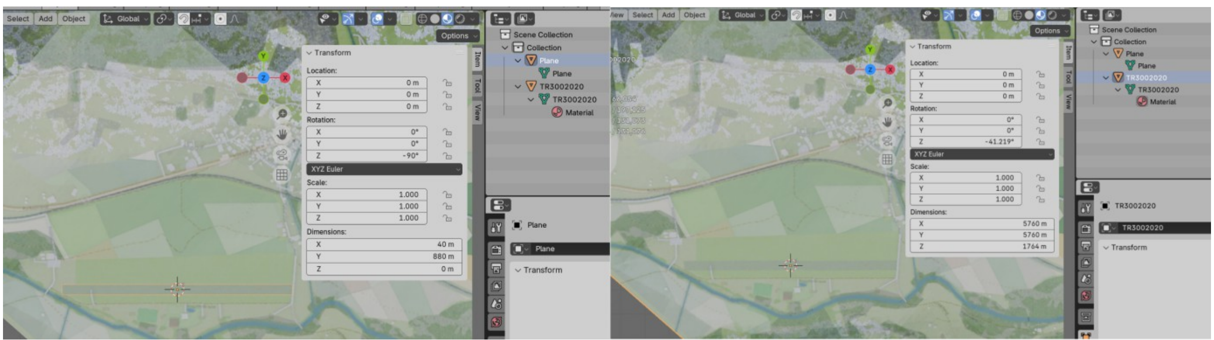
Select the ***plane representing the runway*** (Figure 23). The ***Transform*** panel displays the initially calculated ***X, Y*** coordinates and not the corrected ***Xr*** and ***Yr*** values. This is normal, because in Blender the center of the plane representing the track has not been corrected.
To move the plane representing the runway to the center of the world 2, the 3D Cursor, simply replace these values with ***X=0, Y = 0*** 1 in the ***Transform*** panel.

Rotation around Z:

In Condor 3, the runway axis is located on the X axis. So you have to rotate the patch and the plane of the complement to - 90° of the track orientation, or: -(90 – 48.781) = ***-41.219°***. Also note this value.

As the patch and the plane representing the runway both have their geometric centers on the Center of the World, it is easy to perform this rotation in one go.

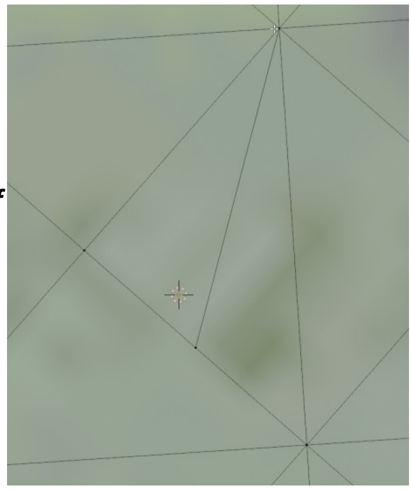
In Object Mode, select all the objects with the A key and do the keyboard command: ***RZ n.nnn***.
That is RZ -41.219. Here is the result of the Z rotation (figure 24) in Transform if you select the plane (Rot. Z = -90°) or the Patch (Rot. Z= -41.219°). ***The runway is then perfectly aligned on the X axis***.



Now we need to measure the precise height of the track center.

In Blender, in ***Edit mode*** and ***Top Orthographic***, zoom in so that the isosceles right triangle of the patch containing the 3D Cursor is contained in the ***3D Viewport***. This triangle is flat, but its 3 vertices are at different altitudes.

To know the exact altitude of the track center, we will make a provisional assembly of edges and vertices.



Select the edge which is close to the Center of the World to minimize errors and divide it in two:
Keyboard key 2 > LMB on edge > Edge menu > Subdivide > Number of cuts 1

A median vertex is created.

Connect this median vertex to the opposite vertex of the triangle (figure 25):
Keyboard key 1 > Select the 2 vertices > J to join

Select the median vertex and slide it along the edge of the triangle so that the created edge intersects the Center of the World (figure 26).
Keyboard key 1 > Vertex Menu > Slide Vertex

Repeat the division operation with the created edge. Select the vertex and drag it along the edge so that it occupies the Center of the World (figure 27).

With this vertex still selected 1, read the altitude ***Z*** in ***Transform*** 2,

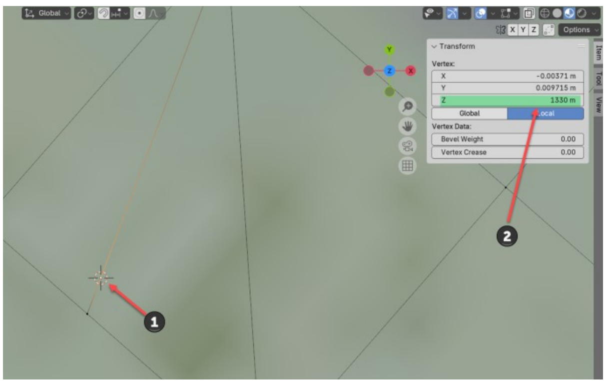
and check that ***X and Y are close to the zero value, 0***. Otherwise, adjust the position of this vertex more precisely.

Z = 1330 m

Note the value. Delete the edges and additional vertices that were used to perform the measurement. Use ***Dissolve*** for the vertices and edges.

Select the patch and move it along ***the Z axis by the negative value of the altitude read*** (- 1330 m), directly in the ***Transform*** panel.
After bringing the Geometric Center of the patch back to the World Origin, the centered and oriented patch must have the coordinates, X = 0, Y = 0 and Z = 0, in the ***Transform*** panel.

Save the Blender file that will be used to make the cuts in the patch.



Making the surface objects

Now that we have the terrain surface prepared, making the surfaces is relatively simple.
We just need to create cutter objects in the horizontal plane X, Y for each type of surface. Then using it on a copy of the patch, cut the required surface.

Or if you prefer, starting from the airport drawing described by as many flat surfaces as necessary, we create the bumpy surfaces from the patch that will be used in the airport G file.

In Blender 4.2, the ***Knife Project*** function has become easy to use, to perform this cutting operation.

It works like this:

- Place this cutting surface above the patch, checking that the patch does not interfere with the cutting surface.
- Switch to ***Object Mode*** and ***Top Orthographic***.
- Select the patch by an ***LMB***.
- Switch to ***Edit Mode***, select the cutting surface in ***Outliner*** by ***CTRL_LMB***.
- Perform the cutting: ***Mesh > LMB on Knife Project***.
- Separate the two meshes: ***Mesh > Separate > Selection***.
- Rename the new ***mesh*** in ***Outliner*** according to the type of cutting surface made. For grass, name it Grass3D.

Surfaces

Asphalt
Runways and taxiways, and optionally parking, paths and building bases.

AsphaltPaint
White paint markings on Asphalt.

AsphaltPaintYellow
Yellow paint markings on taxiways. Uses the same white texture as AsphaltPaint, but with material RGB settings 0.6, 0.6, 0.0.

GrassPaint
Paint marks on grass.

Grass and Grass3D
Short runway with real grass with GrassPaint and Asphalt cut after all other objects have been made.

Gravel
This is a new texture for gravel paths, etc.

It may be a good idea to have Grass encompass all Asphalt surfaces, and Gravel surfaces, and initially take the shape of the overall outline of the airport.
Indeed, the different surfaces have a nested appearance.

Grass is cut first. Then inside Grass we cut Asphalt, Gravel and GrassPaint.
Grass is then in its final form and becomes Grass3D.
AsphaltPaint and AsphaltPaintYellow should NOT be cut out of the runway surface but projected on top.
You can create all the lines and marking above the runway and use a shrinkwrap modifier in the Z direction to project the lines onto the runway surface. After you have finished the lines, make sure to apply all transformations. This is important later for the UV-mapping.

Note that all the signs, numbers and lines applied thanks to AsphaltPaint and GrassPaint are standardized as well as their position relative to the axis, center, or end of the runway.
This data is described in ***ICAO Annex 14 aerodromes. Book I***. Book II is dedicated to heliports.
You will easily find a free version on the Internet.
Chapter 3 pages 99 to 122, Chapter 7 ages 211 to 214, for the 2018 version.
Here is a copy to illustrate the shape and the scaling, concerning numbers and letters 9 m high and 3 m wide except for the numbers 6 and 4.

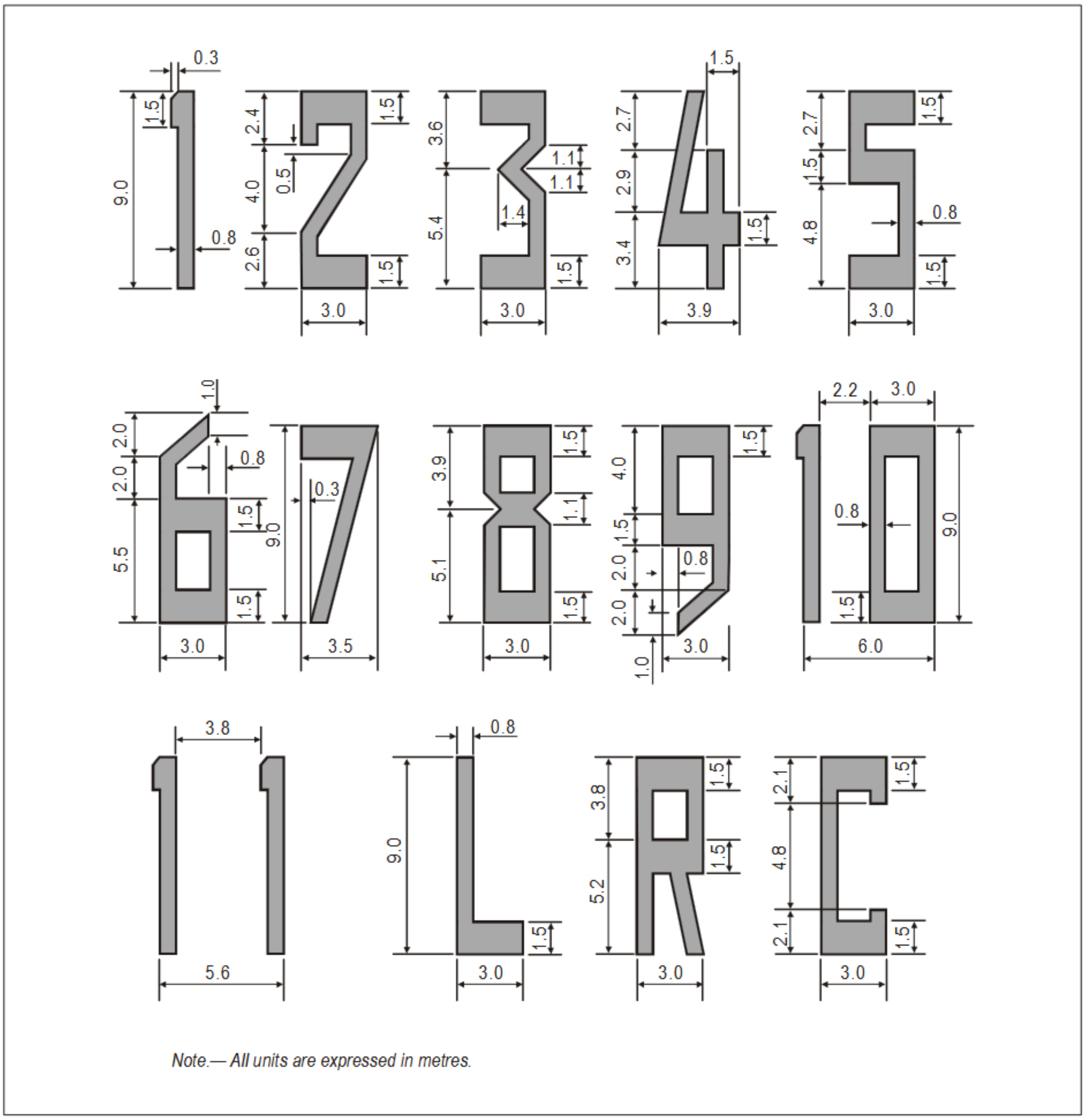


Figure 28

It is wise to create a library of all surface markings.

The G file of an airport contains at least one of the surfaces that have just been listed. These surfaces do not cause any collision with gliders. They can also include frangible objects.
Similarly, the O file of an airport contains all the buildings that cause the destruction of the glider in the event of a collision. The G file is mandatory in Condor 3. Its absence results in a blue screen. A windsock with its mast constitutes the minimum of an O file. Buildings, hangars, etc. can be added to it. Assets (static gliders, car trailers, planes, 3D trees, etc.) common to most airports can be integrated into each airport with Condor 3.

Here is an example of the creation of the G file of Munster airport in Switzerland which corresponds to the preparatory work carried out previously.

Creating Plane Surfaces

Starting from planar square primitives and subdividing the edges and then moving the vertices. It is easy to build the different surface elements of the Airport in Top Orthographic. Save this file which may be useful to place and create the buildings.

Then import these surface elements, in a copy of the last Blender file, then move these surfaces along the Z axis. So that they are located above the patch (Figure 29)

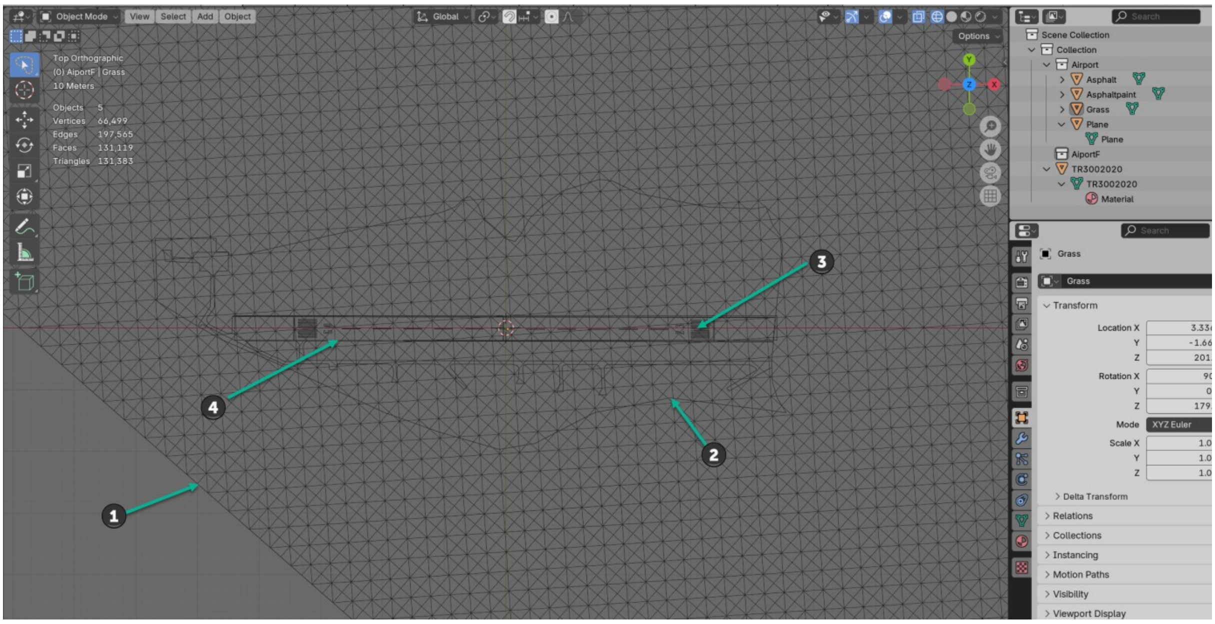


Figure 29

Patch 

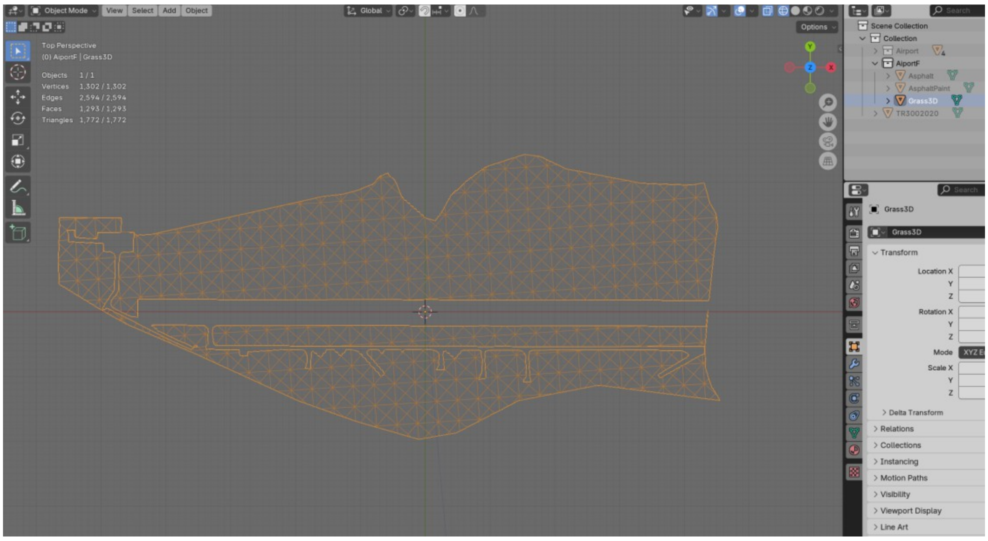
Grass 

AsphaltPaint 

Asphalt 

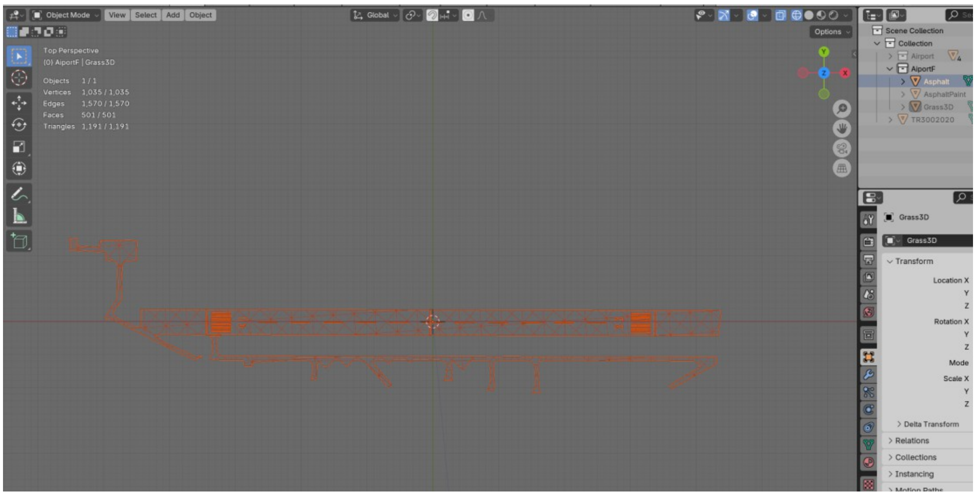
You can also create its surfaces directly in a copy of the Blender file. Then you have to cut each surface as indicated previously and group the different surfaces in a collection.

Grass3D

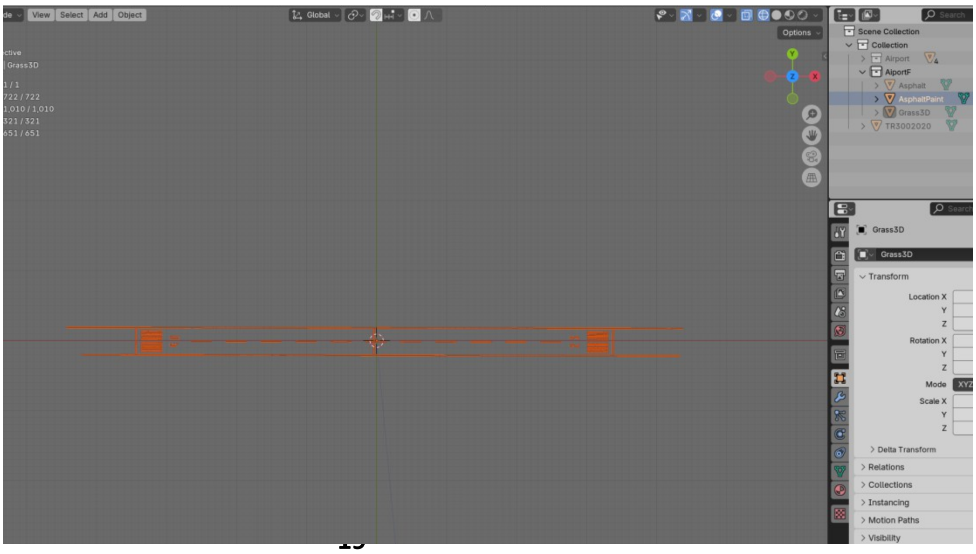


Asphalt

Note: Asphalt paint should not be cut out of the runway



AsphaltPaint



Sub-Surface texture

As in Condor 2, textures are applied automatically for Grass3D and Asphalt.
The difference in Condor 3 is that we have a new sub-texture that is applied to Grass3D and Asphalt to affect the colors and make them blend properly when approaching the airport from a distance.

The sub-texture is a dds file, extracted from the texture of the patch surrounding the airport, and Grass and Asphalt. You must use The Gimp or Photoshop.

It is best to extract this sub-texture from the patch containing the entire airfield, with a square shape to avoid distortions in the UV Map and simplify its alignment. The dimensions of this image must also be a multiple of 4 to be able to be saved correctly with an Alpha channel.

Before UVMapping make sure all transforms are applied (Object -> Apply -> All Transforms)

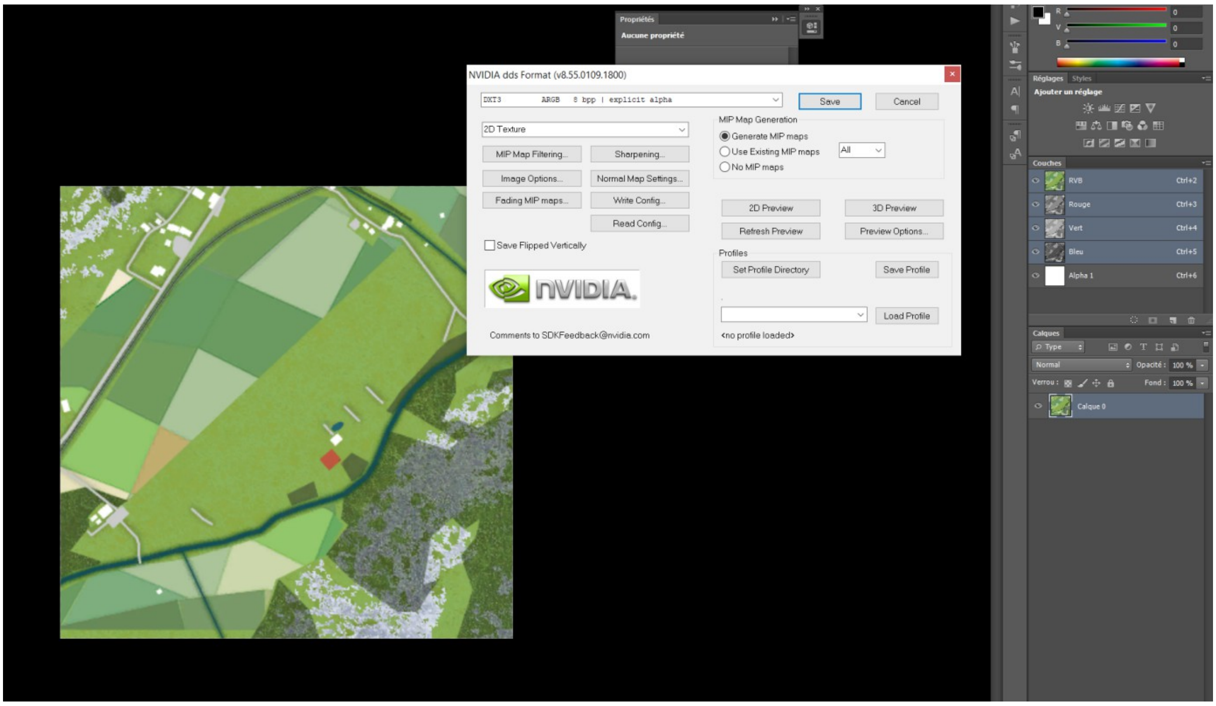


Figure 33

You must then perform the UV mapping of the Grass3D, Asphalt, GrassPaint, AsphaltPaint and AsphaltPaintYellow surfaces on this sub-texture. It is important that all these surfaces are mapped at the same scale for the subtextures to show up correctly. Alternatively Asphalt and its paint can also be mapped to a muck texture. Here you can add skidmarks and colour variations in the asphalt:

In Blender with the last file where the surface textures are isolated, LMB on the UV tab.

In the left panel ***UV Editor*** load the sub-texture by:
Image > Open >

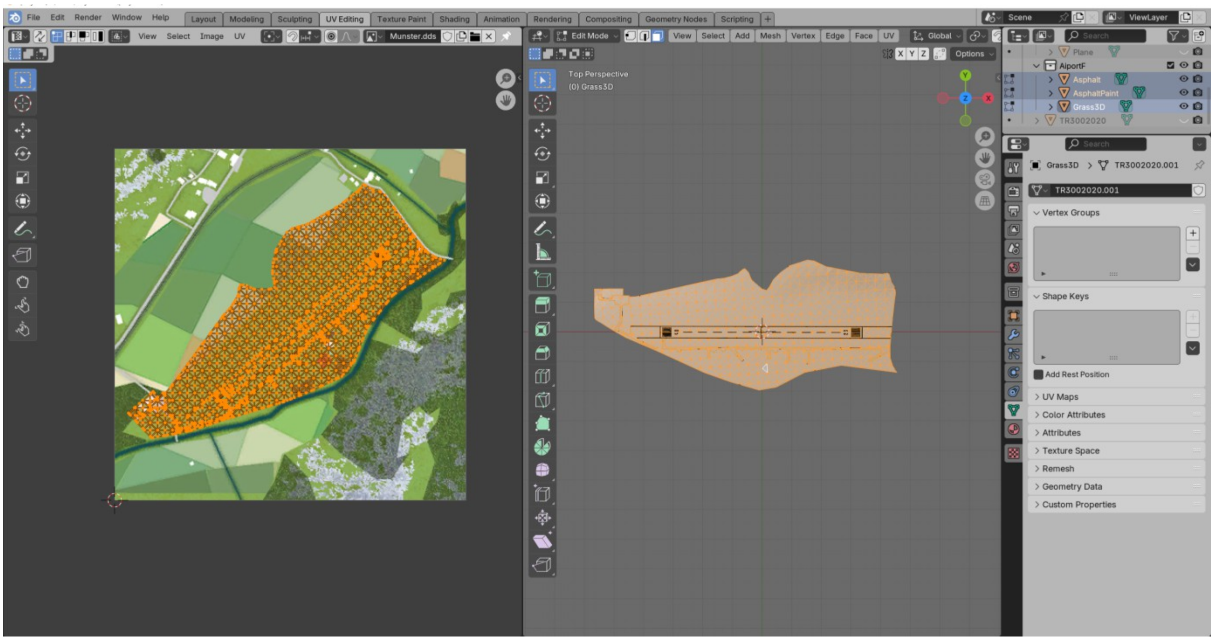
In the right 3D Viewport panel select in ***Object Mode*** Grass3D and Asphalt, then switch back to ***Edit Mode*** and check that you are still in ***Top*** Orthographic.

Proceed with the UV mapping by:
UV > Project from View

The UV mapping appears in the UV Editor, horizontal panel and probably not at the right scale.

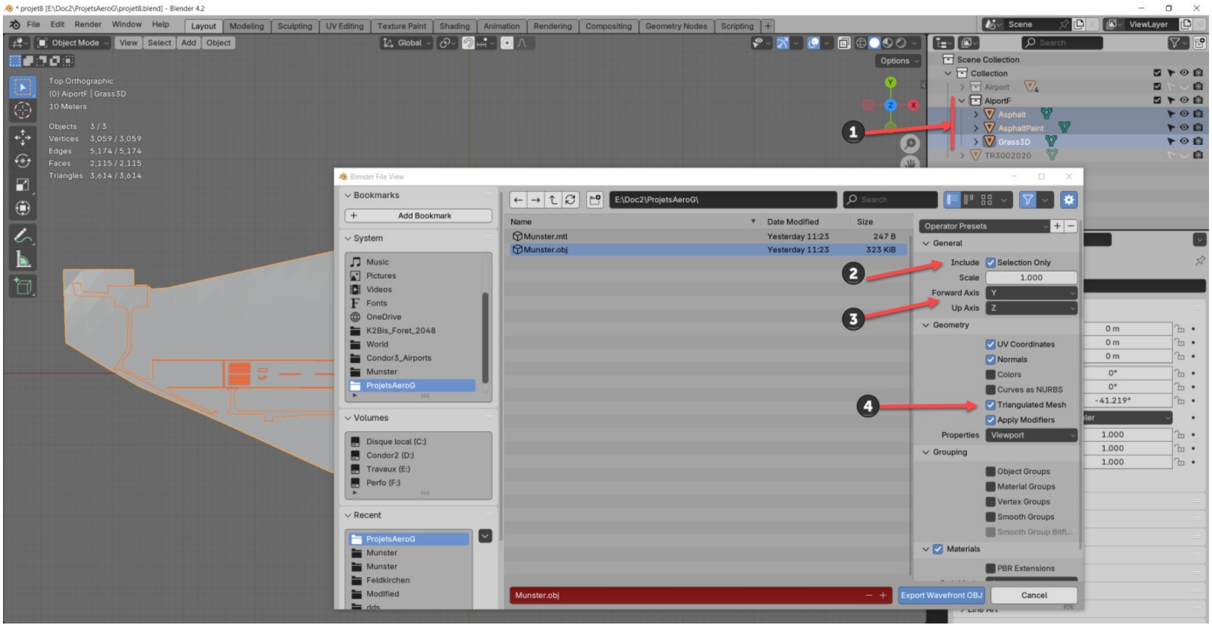
At First, in the ***UV Editor*** panel rotate from ***the negative value of the complement to -90° of the orientation angle of the airport calculated previously. In this case + 48.219°***. ***Your UV Map is then perfectly oriented, and above all do not modify this orientation any more***.

Now, in the ***UV editor*** panel with ***the S key for Scale*** and ***G to move***, adjust the ***UV Map*** of the airport in the ***image***. Use if necessary the zoom (mouse wheel) and the hand to move the view to perfect the location of the UV map (figure 34).



T

hen, after saving your Blender file, you need to export the selected airport surfaces to Obj format with the following settings (figure 35):



•All selected airport surface objects 1

• Include: Selection Only checked 2

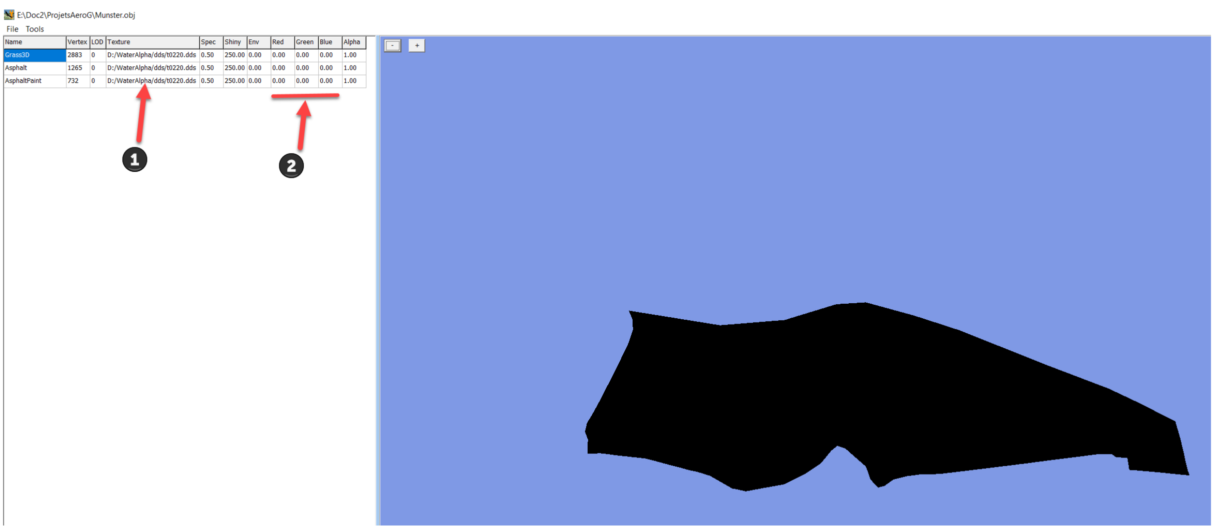
• ***Forward Axis : Y*** 3

Up Axis : Z

• Triangulated Mesh checked 4 .

Now open Object Editor Toolkit 2's and open the airport's Wavefront (.obj) file.

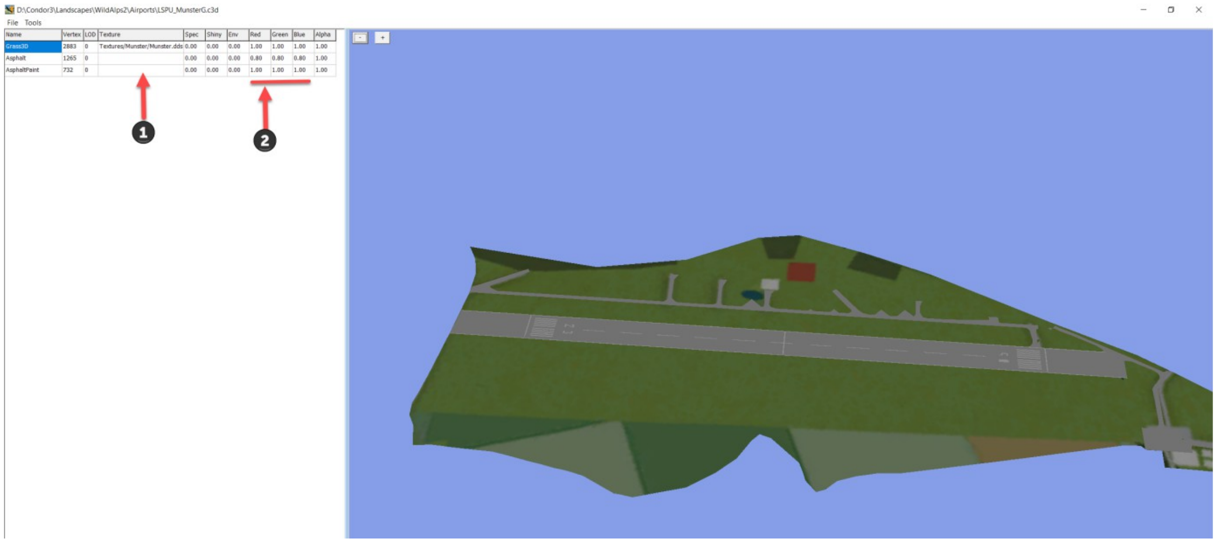
Usually the airport shape appears black (figure 36). This is usual, because the texture paths are not correctly identified 1 and the RGB colors are all 0 2 .



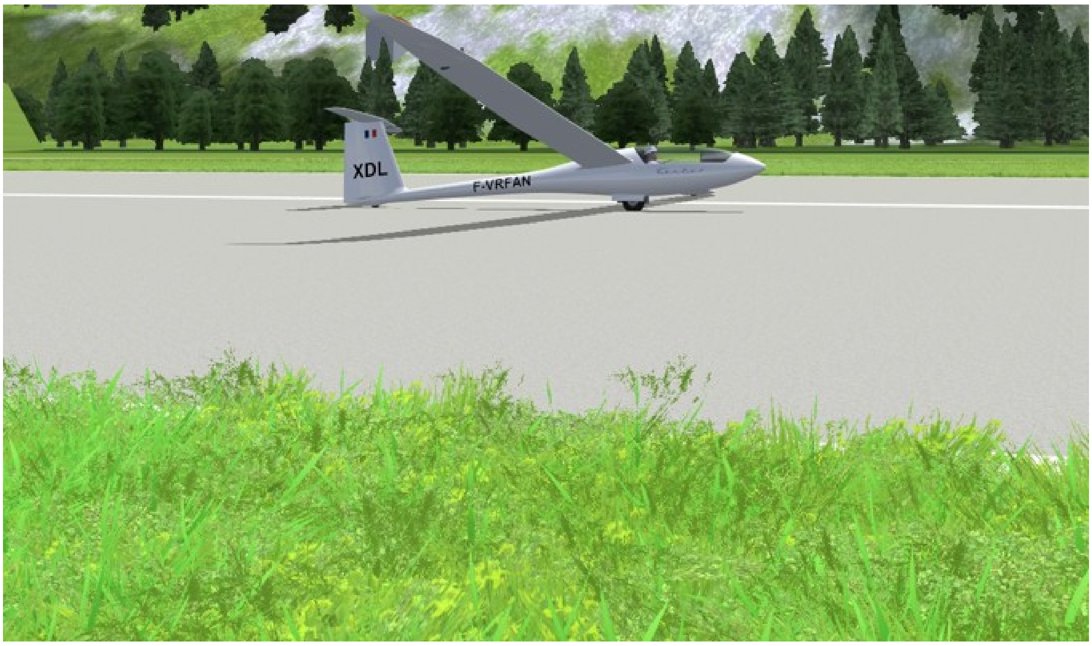
Start by copying your sub-texture into the correct directory of your scenery and any specialized textures you may have created for the tyre marks on the runway, frangible objects, etc. into a _muck file.

Then save your file in C3D with the correct name and in the Airport folder of your scenery.

Open this file again in C3d and make the necessary changes to the texture paths and the appropriate colors: for example 0.8 for Asphalt and 1 for AsphaltPaint. Where there is a peculiar texture the RGB colors should be set to 1. You can experiment with other values and even use the Alpha channel for transparencies (Figure 37).



At this point you get in Condor 3 tall 3D Grass (figure 38).



In Condor3 we have some realistic 3D grass. The length of this grass is controlled by the alpha channel in the sub-texture. The white areas are long grass, and 50% of the grey areas are short grass. This DDS file should be saved in 8.8.8.8 ARGB format to prevent colored artifacts from appearing.

To get shorter grass, go back to The Gimp or Photoshop and select the Alpha channel and fill it with black with the paint bucket (figure 39).

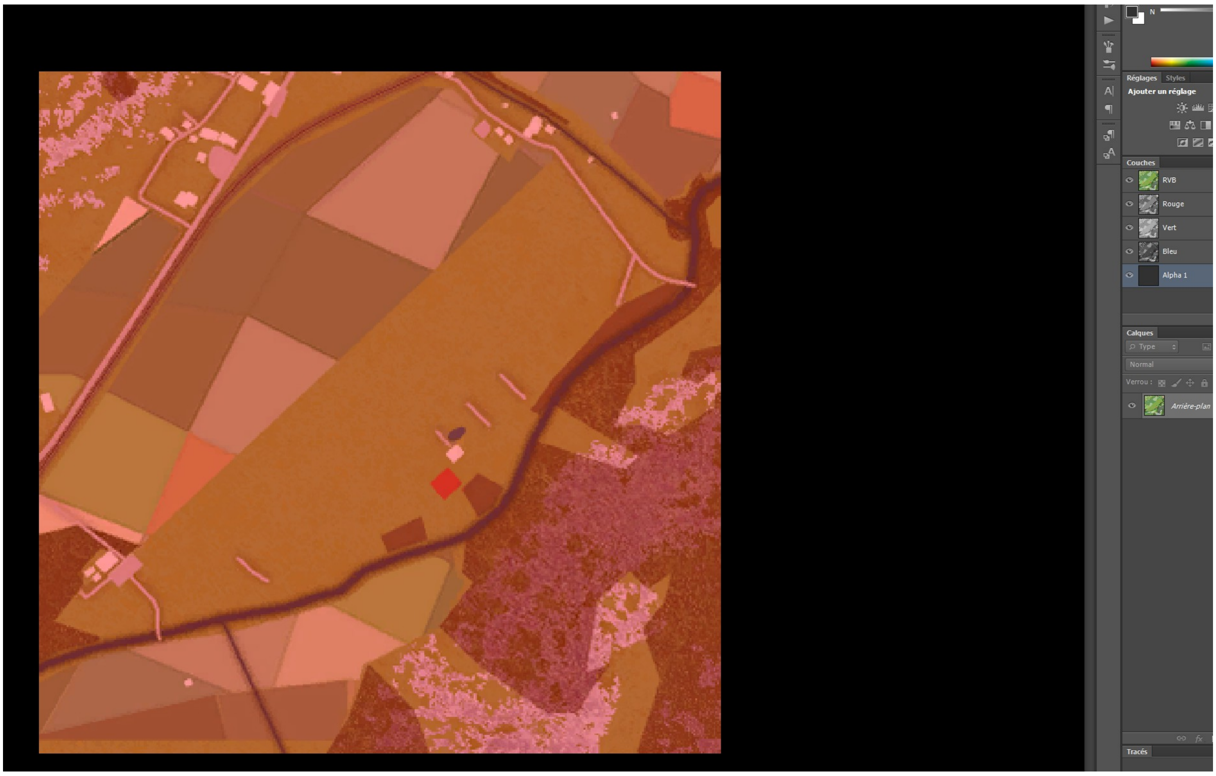
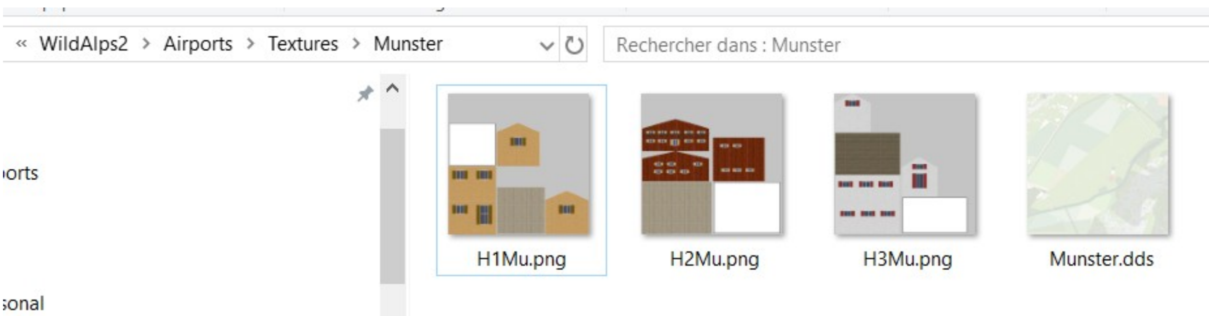


Figure 39

In reality the sub-texture, here named Munster.dds, does not become red but greyed once saved (figure 40).



And in Condor 3 (figure41):

Figure 41

Of course you can experiment to achieve the desired effect. Also note that the color of the grass depends on the underlying color of the sub-texture (figure 42).

Figure 42

The new feature of Condor 3 is that it is possible to replace all the surface textures of each airport. Add your own version in the airport texture folder, linked to the G file in C3d and it will be used instead of the default texture.

Condor 2 Style Airports

Flattened airports from Condor 2 will work in Condor 3 without changes. But, if you want the 3D grass, then you must create and map the sub-texture as described above. To use AsphaltPaint, you must also have Asphalt. Similarly to use GrassPaint you must have Grass.
If the Asphalt runway is white, it is because the RGB colors are at 1 in the c3d file.
Replace for Asphalt color, 3 equal values for red, green and blue, between 0.5 and 0.8, and for AsphaltPaint 3 equal values between 0.8 and 1.