Modelling of track and surroundings

Note: Update 3. 5. 2009
Note: This text won't teach you how to use 3D Studio MAX, it only points to some features you will use.

After making neccessary documentation and preparing textures, you get to another niggle job. To create a good track model takes a good time. Of course, it much depends on the track (how complex and how long it is).

For the next part of creation, you must be familiar with these MAX features: move, rotate, scale, copy, cut, editable mesh/poly, Unwrap UVW/ UVW map, soft selection, attach/dettach, weld and maybe align. Further knowledge would be an advantage. See more in Modelling of track and surroundings.

Track model creation can be divided to these parts: 1) Creation of basic „templates"
2) Creation of track in 2D
3) Shaping the track in 3D
4) Final touch

1) Creation of basic „templates"

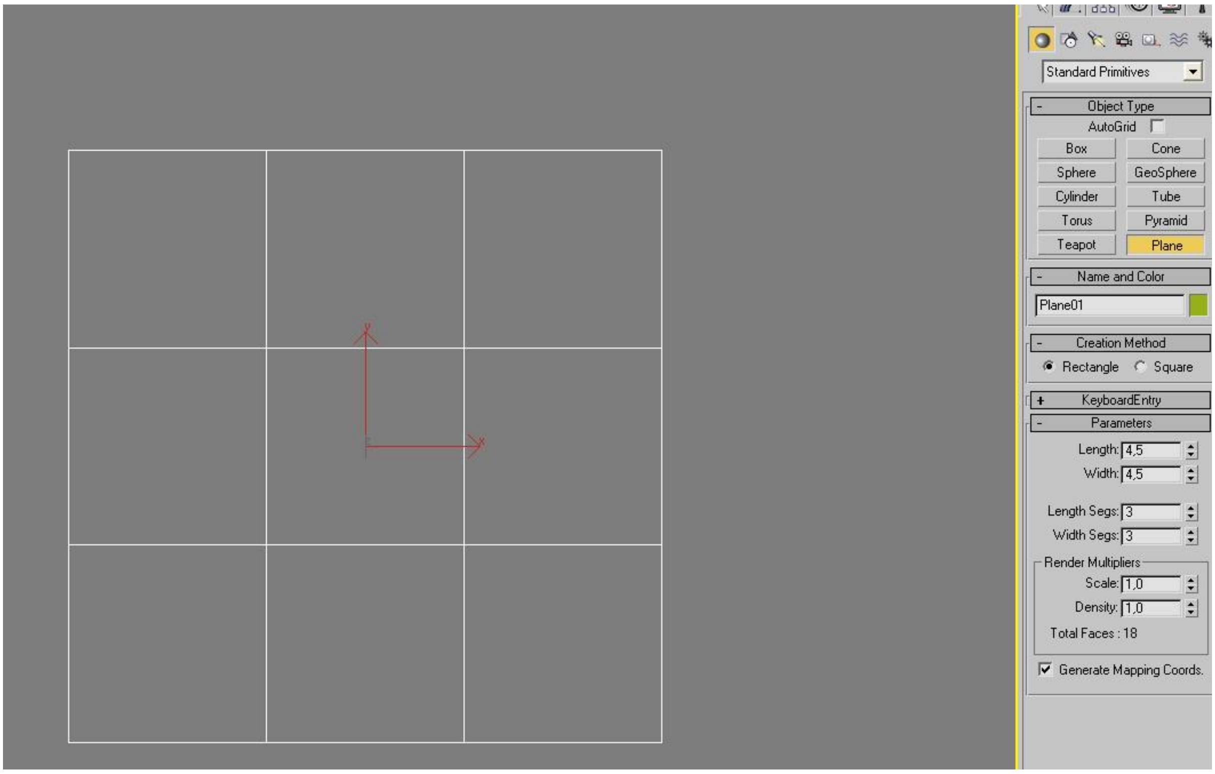
In brief, it means a creation of elements from which the track will be built. You can have as much templates as you want. It's possible to create virtually every elemnt of track.
To make such elements has some pros:
- you can save your time by simply copying a basic element
- you can avoid problems with texturing (mapping, joining elements)
- regular polygon grid

The polygon grid is quite important. For conversion to RBR is really important to choose a right size of polygons and their regularity. It's impossible to do it every time, but the more you stick to regular polygons, the less problems you encounter during track conversion to RBR.

Regarding size and shape of polygons:
- try to make square polygons. It's couse of later shadow generating.
Note: It's imposible to avoid triangle polygons. But less number means less editation during shadow generating. Don't be scared after import in editor – every squere polygon is defined by two triangles (that's normal). This note is valid for alone triangles in meshes.
- I recommend to have a square size from 0.75 to 2m – it depends on the track surface, the smoother the track is, the bigger the polygon can be (for 4.5m road it means 3-6 polygons). When the track is really flat, 2 polygons are enough (original Joux Plane is a good example).
- for ditches, make polygons of the same size as for road (to 4-6m from the road edge)
- for near neighbourhood (about 12m), make polygons of size 4m (= size of texture in tracktextureplateopaque.dds)
- for distant neighbourhood the size is not much important, it could be from 12 to 20 meters, but even 50 meters could do (depending on texture)
- these numbers are not imperative; you cannot avoid making polygons of various sizes and shapes
- my recommendation is to create an extra plane of 32x32m, split it to 64 fields (8x8) with texture from tracktextureplateopaque.dds (you can see the result and you have a total view, for modeling isn't need).
- from those segments you can build track elements (I recommend to make elements of various lengths, 4,8,30,60m). Don't forget to randomly change variants of track and ditch textures, it makes your track look as a real one!
- You can form those elements in Z-axis, road is usually a bit concave and edges are lower than the road (more unique shapes we trim at final touch). The pre-shaping in Z axis is not mandatory, I did that at last.

The example of making a basic element of road + edge:

1) create a plane of size 4.5x4.5 (polygon of size 1.5x1.5)

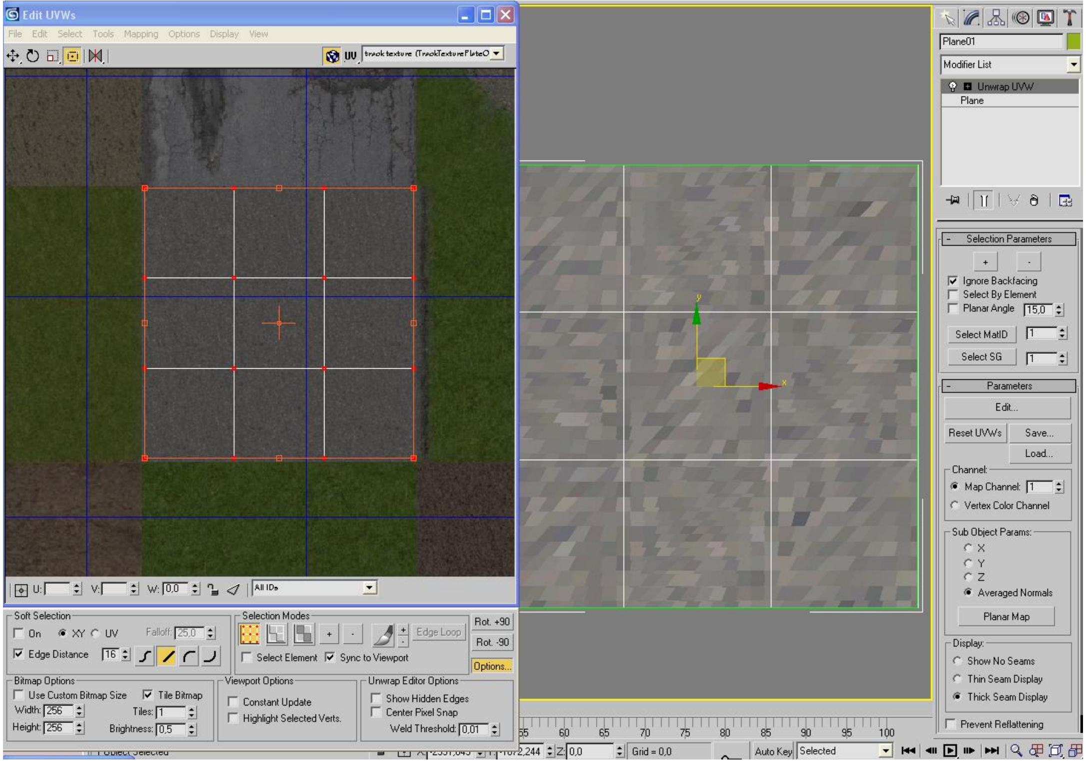


Plane01

● Rectangle ○ Square

Length: 4,5
Width: 4,5
Length Segs: 3
Width Segs: 3
Scale: 1,0
Density: 1,0
Total Faces : 18
☑ Generate Mapping Coords.

2) texturing (drag planned texture to plane) and plane mapping (using modificator Unwrap UVW or UVW map)



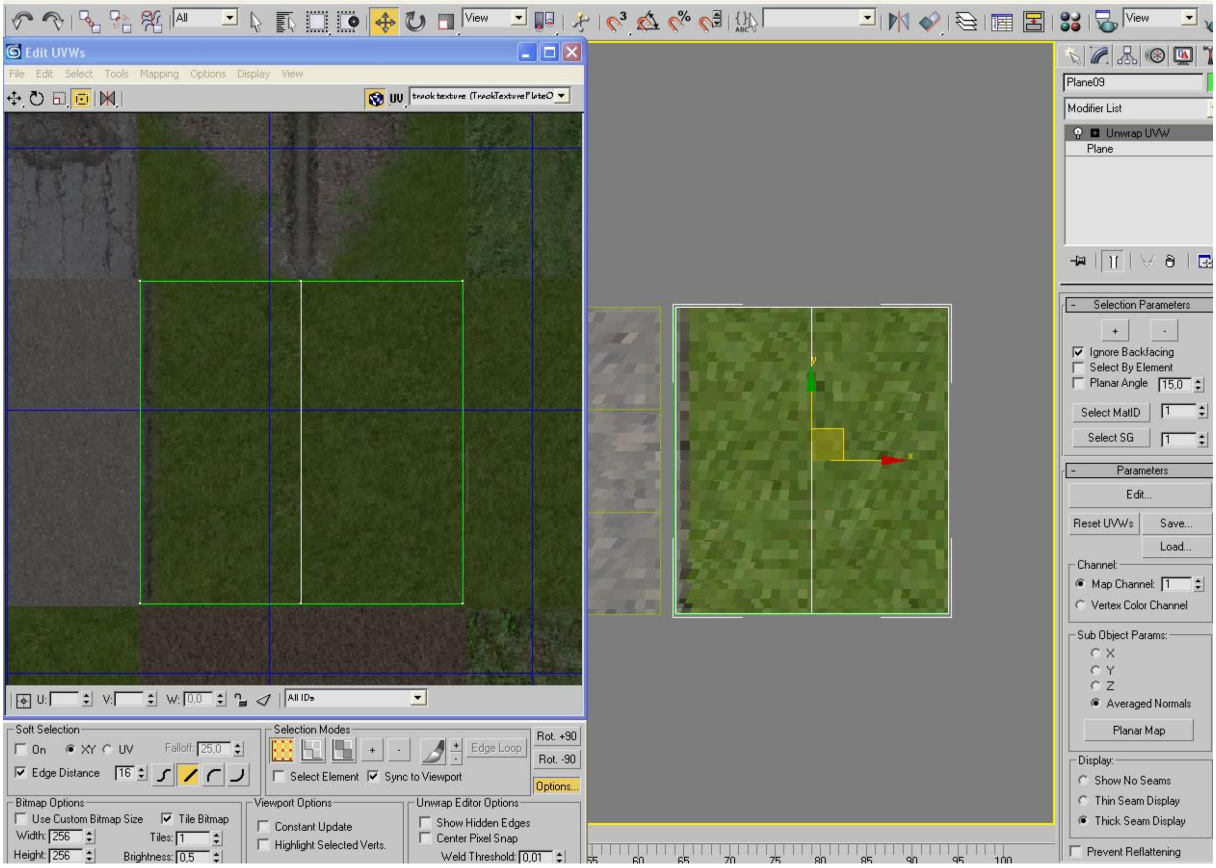
Plane01

□ On ● XY ○ UV Falloff: 25,0
☑ Edge Distance 16
□ Select Element ☑ Sync to Viewport
□ Use Custom Bitmap Size ☑ Tile Bitmap
Width: 256 Tiles: 1
Height: 256 Brightness: 0,5
□ Constant Update
□ Highlight Selected Verts.
□ Show Hidden Edges
□ Center Pixel Snap
Weld Threshold: 0,01

☑ Ignore Backfacing
□ Select By Element
□ Planar Angle 15,0
Select MatID 1
Select SG 1
● Map Channel: 1
○ Vertex Color Channel
○ X
○ Y
○ Z
● Averaged Normals
○ Show No Seams
○ Thin Seam Display
● Thick Seam Display
□ Prevent Reflattening

Z: 0,0 Grid = 0,0

3) repeat previous steps for grass (plane 4.5x4.5m; 2 polygons – depends on you, you can do it more smooth)



Selection Parameters: ☑ Ignore Backfacing, □ Select By Element, □ Planar Angle 15,0, Select MatID 1, Select SG 1

Channel: ● Map Channel: 1, ○ Vertex Color Channel

Sub Object Params: ○ X, ○ Y, ○ Z, ● Averaged Normals

Display: ○ Show No Seams, ○ Thin Seam Display, ● Thick Seam Display

□ Prevent Reflattening

U: V: W: 0,0 All IDs

Soft Selection: □ On ● XY ○ UV Falloff: 25,0; ☑ Edge Distance 16

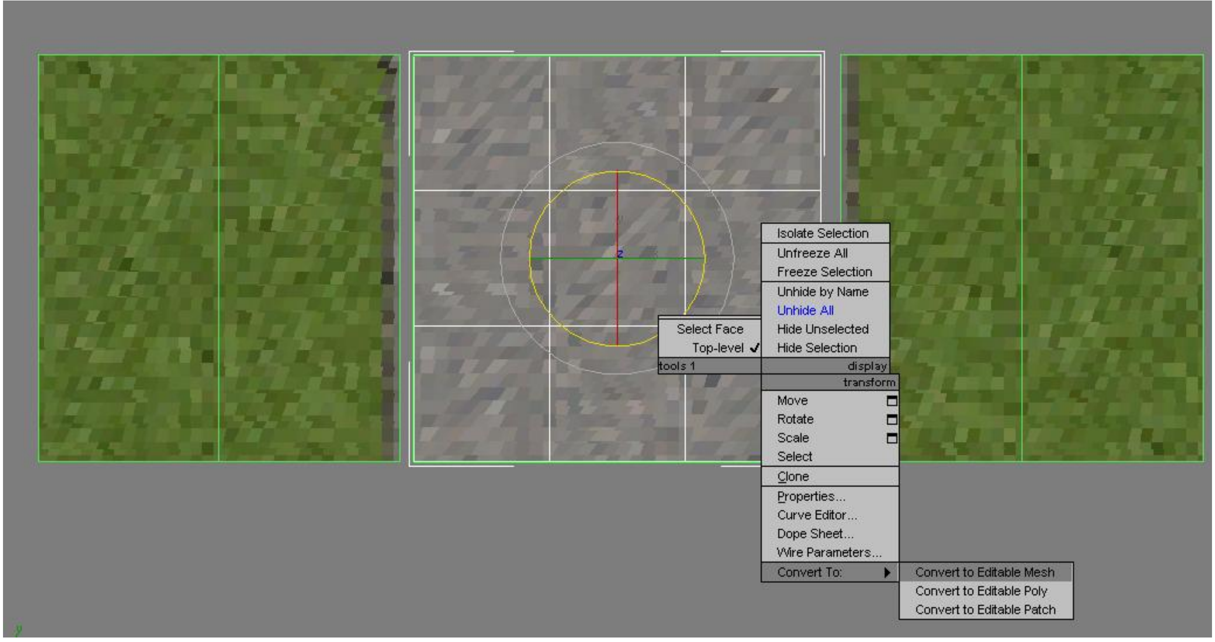
Selection Modes: Edge Loop; □ Select Element ☑ Sync to Viewport

Bitmap Options: □ Use Custom Bitmap Size ☑ Tile Bitmap; Width: 256 Tiles: 1; Height: 256 Brightness: 0,5

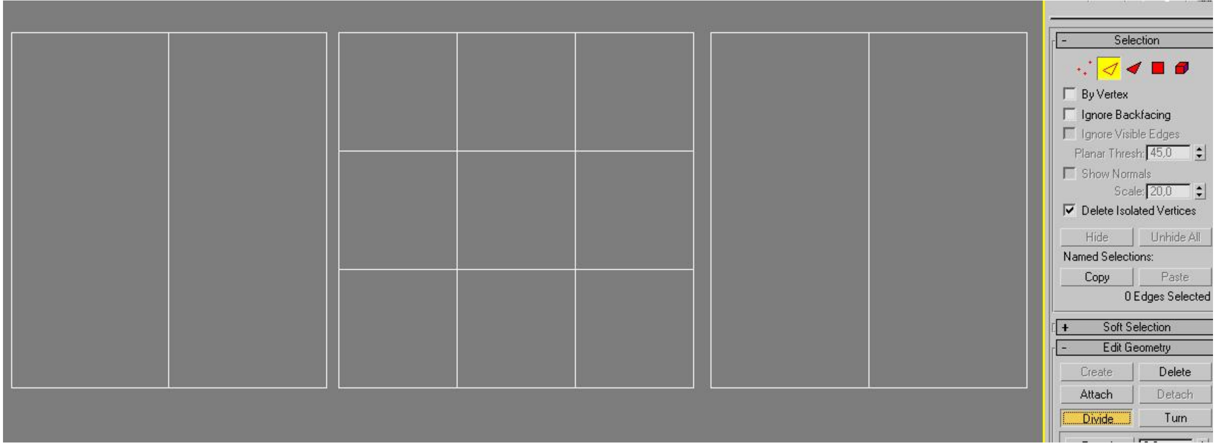
Viewport Options: □ Constant Update □ Highlight Selected Verts.

Unwrap Editor Options: □ Show Hidden Edges □ Center Pixel Snap; Weld Threshold: 0,01

4) copy grass (shift+ move) to the other side and turn around (rotate 180°)

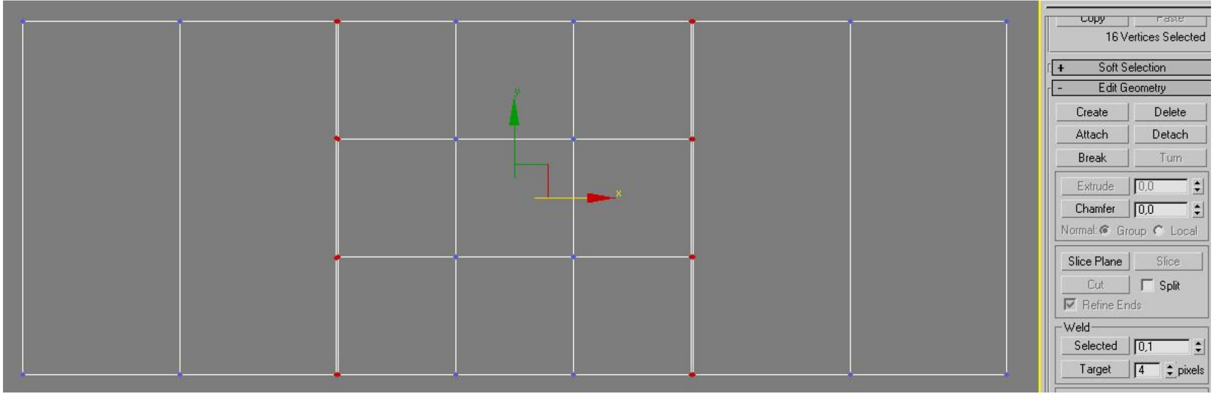


5) convert to „Editable mesh“ (or „Editable Poly“), attach and create missing vertexes (divide)



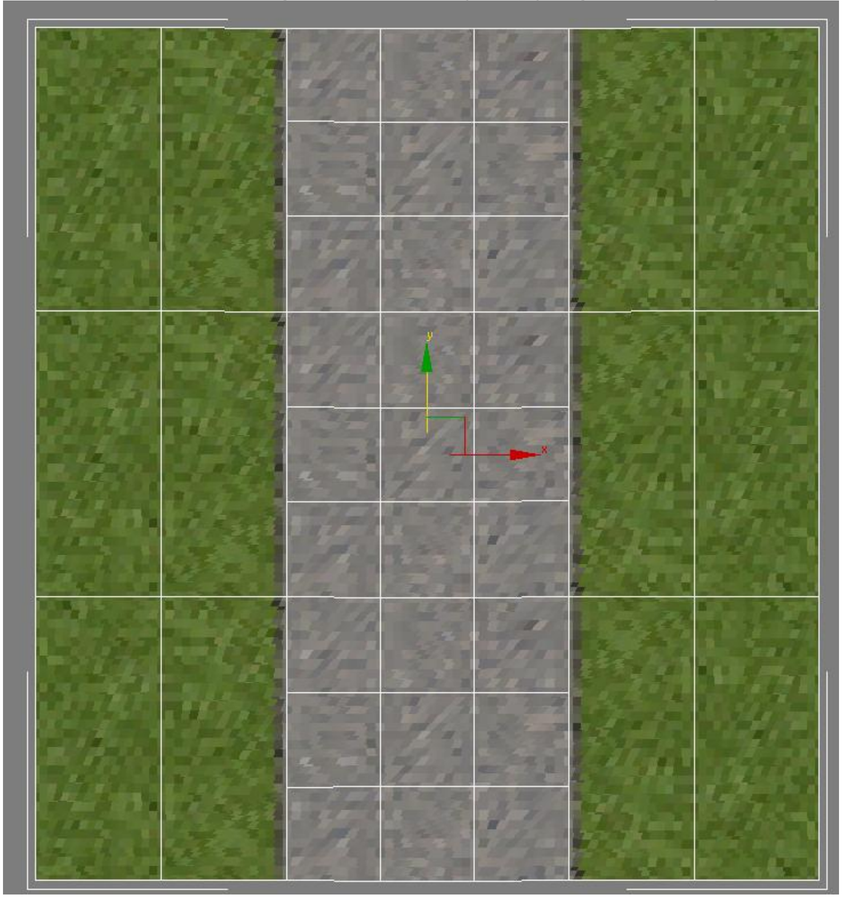
☐ By Vertex
☐ Ignore Backfacing
☐ Ignore Visible Edges
Planar Thresh: 45,0
☐ Show Normals
Scale: 20,0
☑ Delete Isolated Vertices
0 Edges Selected

6) weld



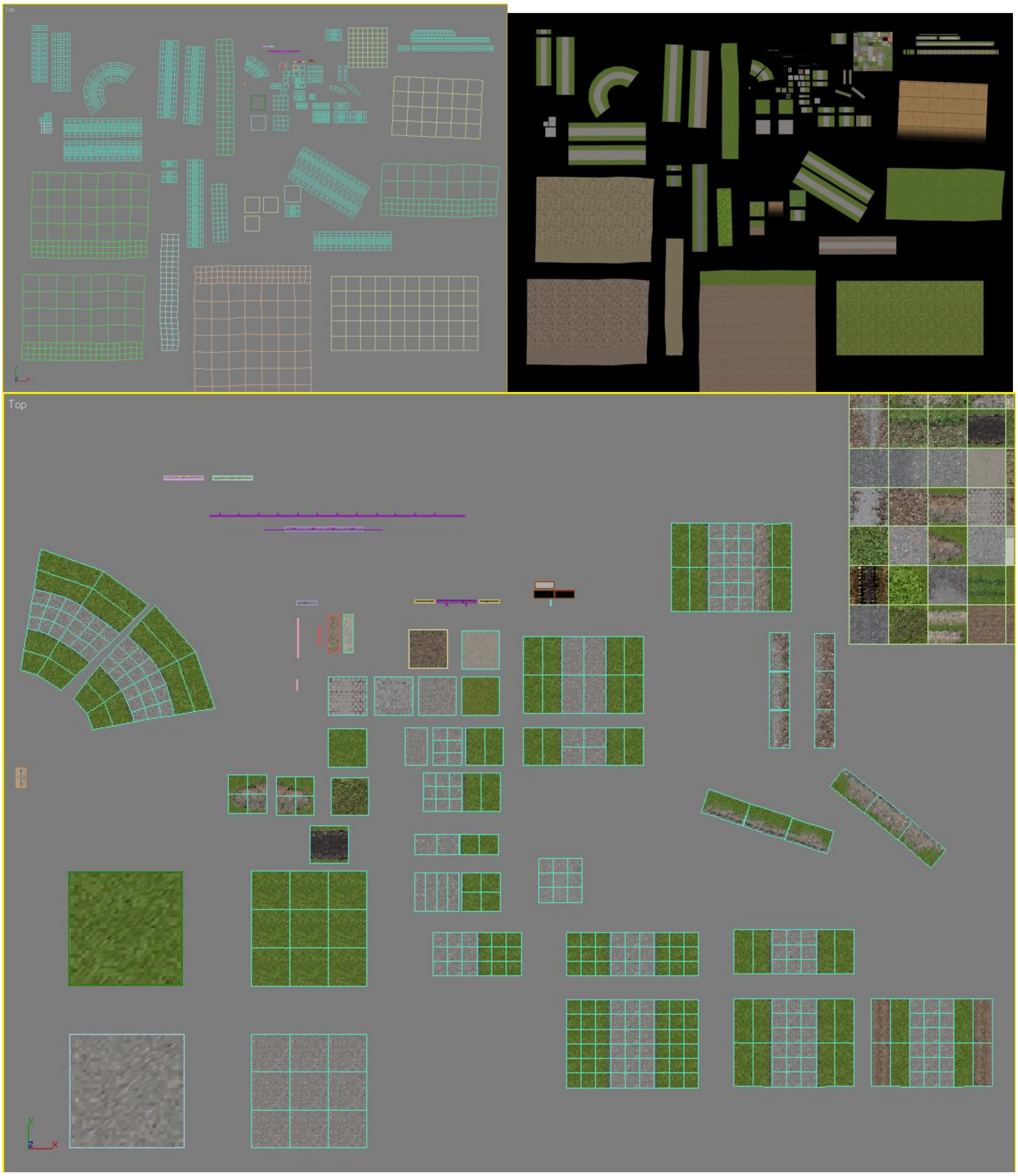
16 Vertices Selected
Extrude 0,0
Chamfer 0,0
Normal: ● Group ○ Local
☐ Split
☑ Refine Ends
Selected 0,1
Target 4 pixels

7) optional: create larger elements by copying, attaching and welding



You will use features mentioned above very often. You can convert anything to Editable mesh at almost any time. If you texture something badly, it’s not a big problem now (unless it is 1000 times copied basic element), you can add modificator Unwrap UVW and change mapping.

My set of basic track elements:

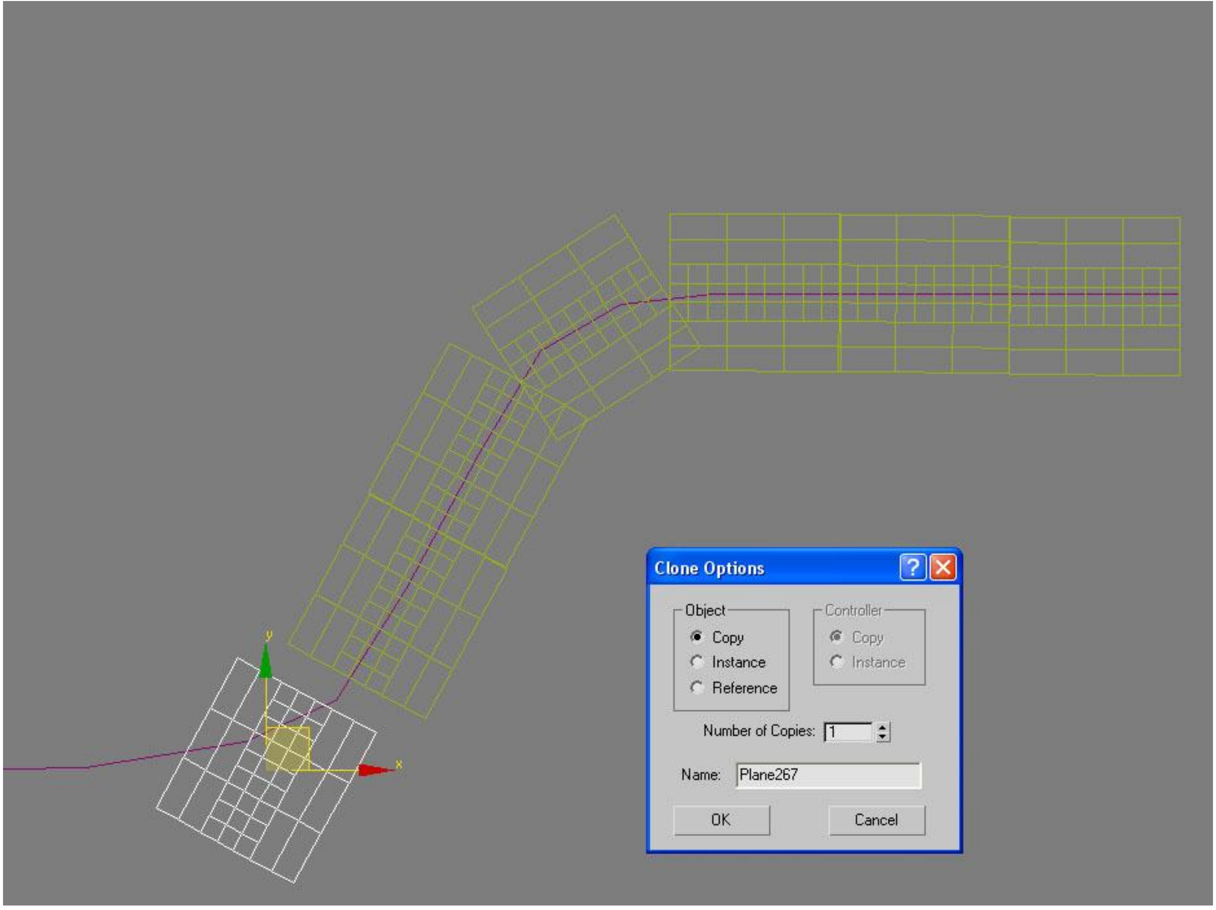


2) Track modelling in 2D

After creating some basic elements (road with ditch of length 4,8,12,60m; grass 4x4, 12x12m etc), you can start modelling the track in 2D. You should have a GPS spline or aerial maps available, so you can use it to align track elements of road. Create the road first, surroundings later. When you finish the part you are making, join all road and grass polygons to their planes. Finally, join road with surroundings. It’s not recommended to join everything into single plane. You can join it every time, you can split it too, but it is more difficult and takes a time. Sometimes, you can join sme parts only after 3D modelling (e.g. hairpins).

Example of making a part of road and neighbourhood:

1) Place elements around GPS spline


Clone Options

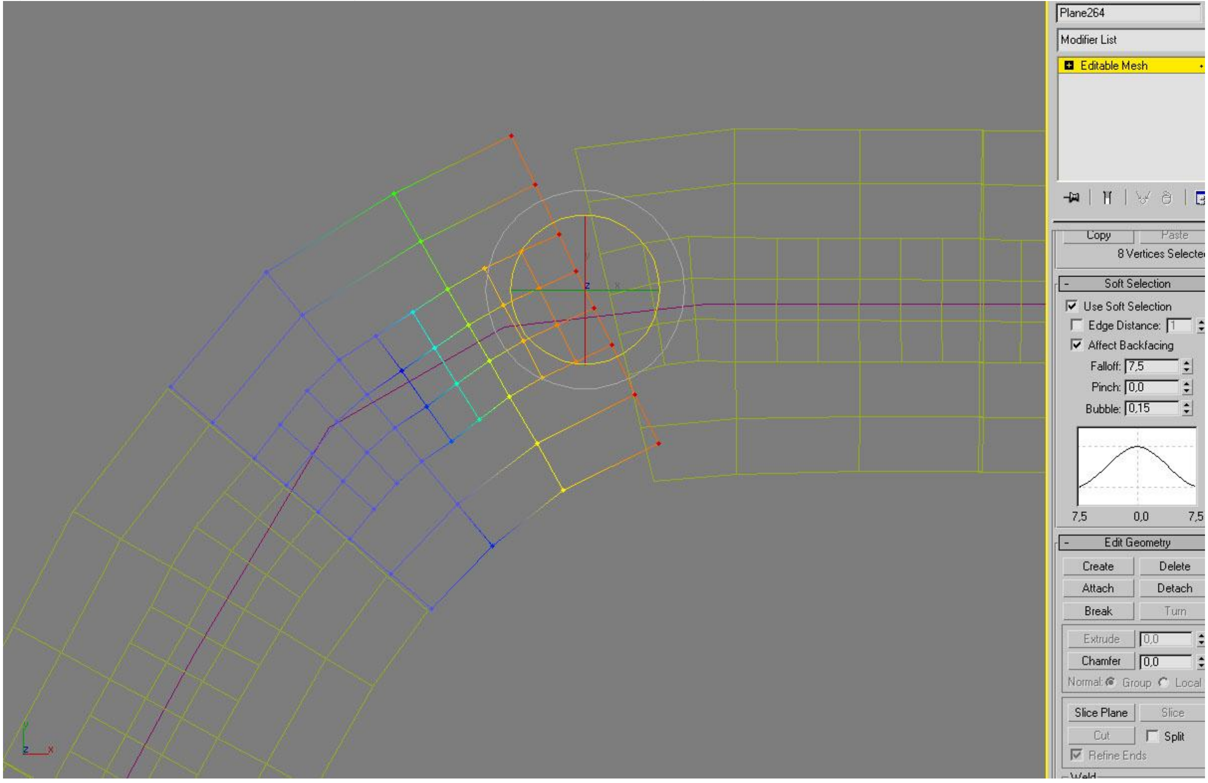
Object
● Copy
○ Instance
○ Reference

Controller
● Copy
○ Instance

Number of Copies: 1

Name: Plane267

2) Edit elements in curves (rotate, move, soft selection)


Plane264

Modifier List

Editable Mesh

8 Vertices Selecte

Soft Selection

☑ Use Soft Selection

□ Edge Distance: 1

☑ Affect Backfacing

Falloff: 7,5

Pinch: 0,0

Bubble: 0,15

Edit Geometry

Extrude 0,0

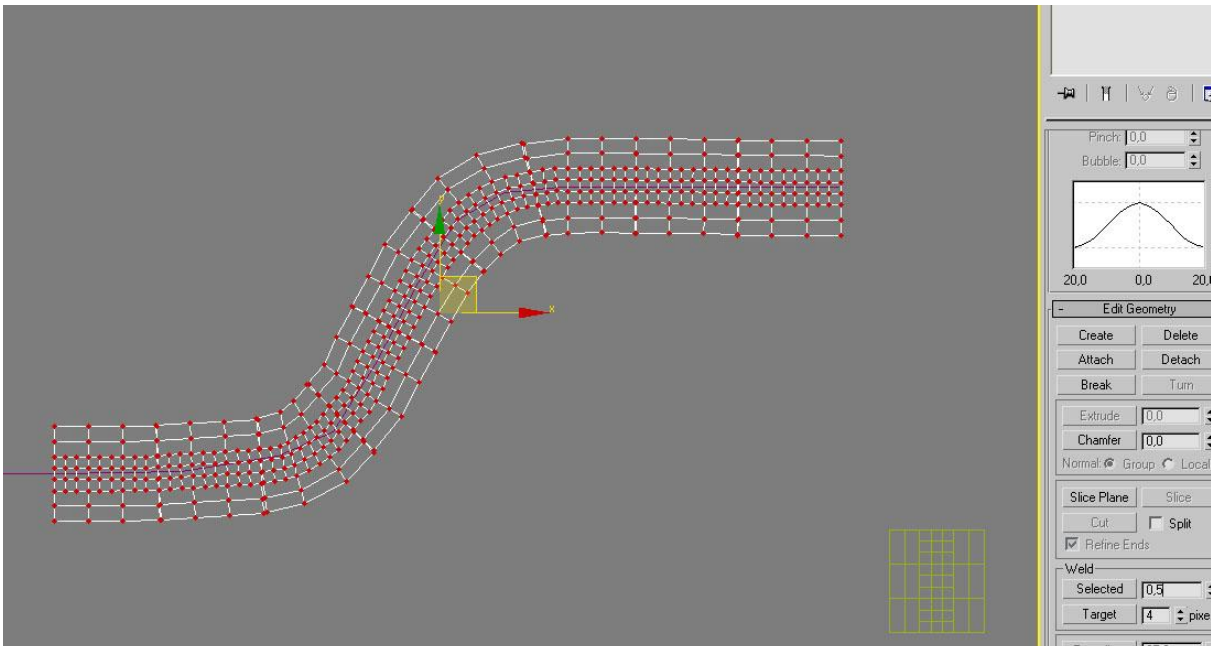
Chamfer 0,0

Normal: ● Group ○ Local

□ Split

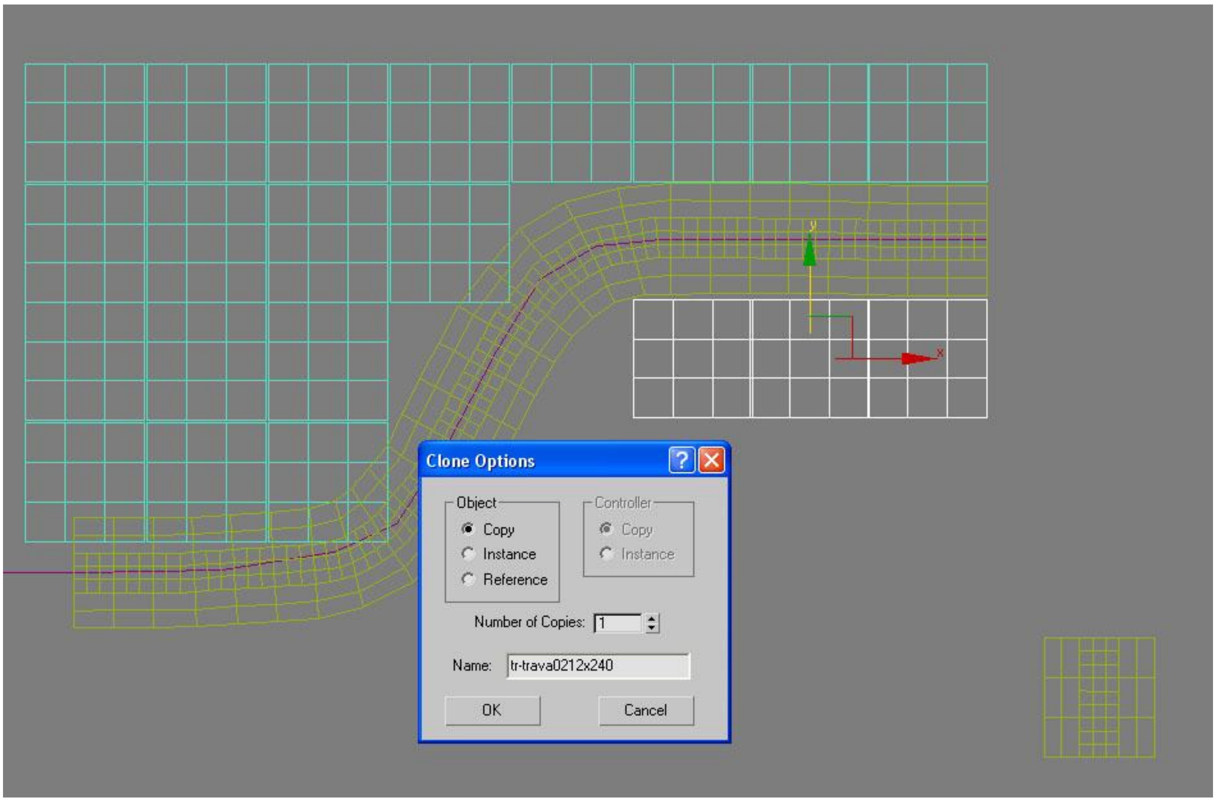
☑ Refine Ends

3) Weld road into one piece (properly value set for „weld selected“)



Pinch: 0,0
Bubble: 0,0
Extrude 0,0
Chamfer 0,0
Normal: ● Group ○ Local
□ Split
☑ Refine Ends
Selected 0,5
Target 4 pixe

4) Plant grass elements



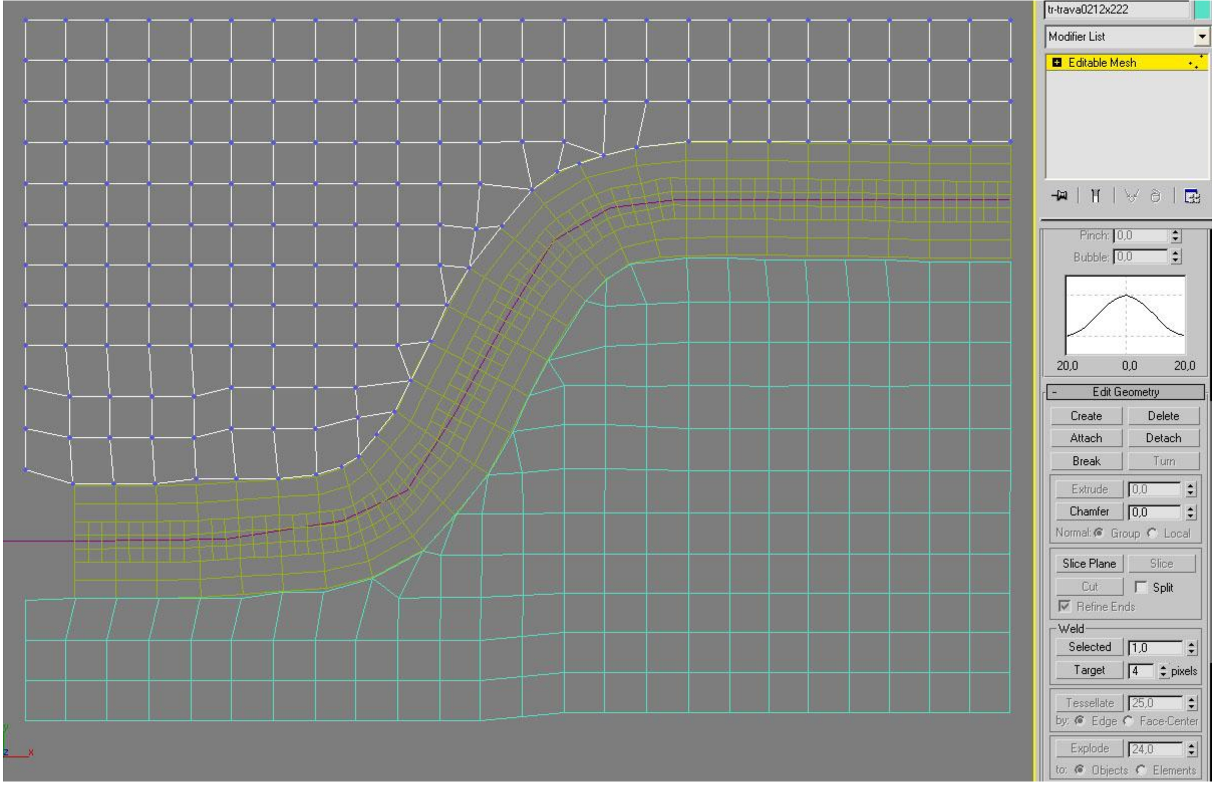
Object
● Copy
○ Instance
○ Reference

Controller
● Copy
○ Instance

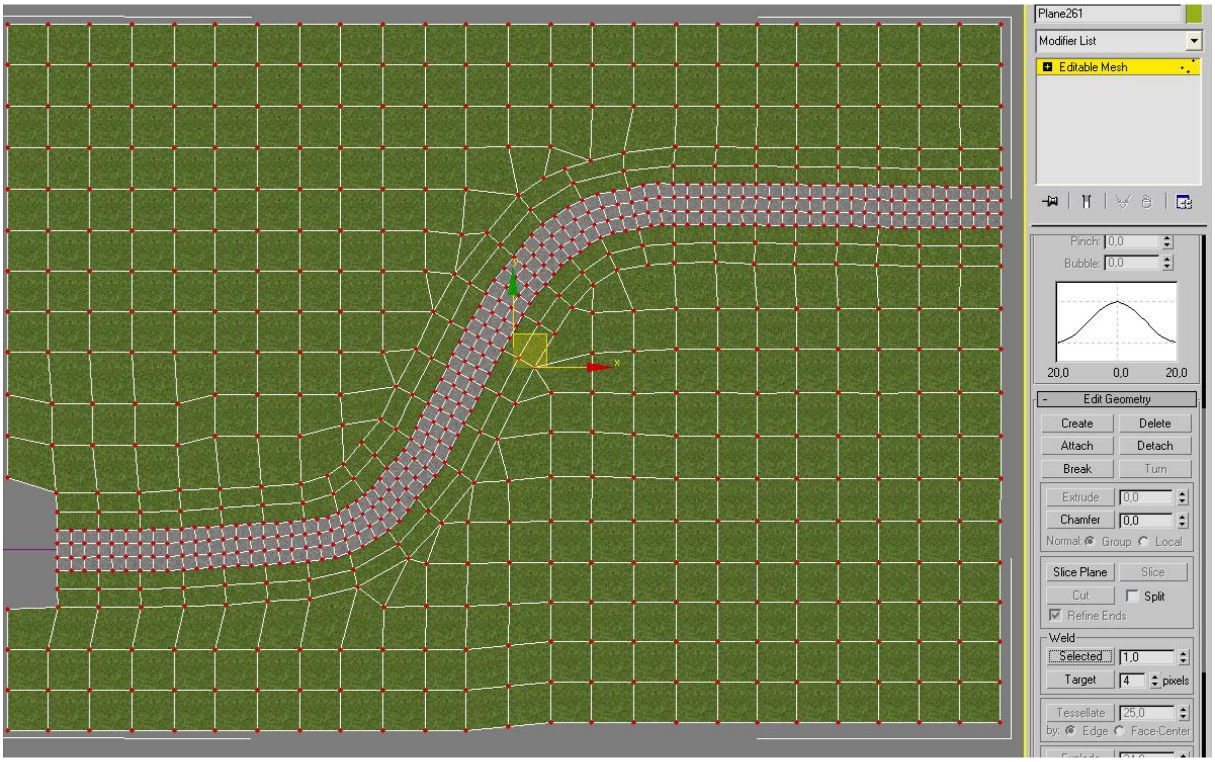
Number of Copies: 1

Name: tr-trava0212x240

5) Weld grass together and edit it (cut redundant polygons)

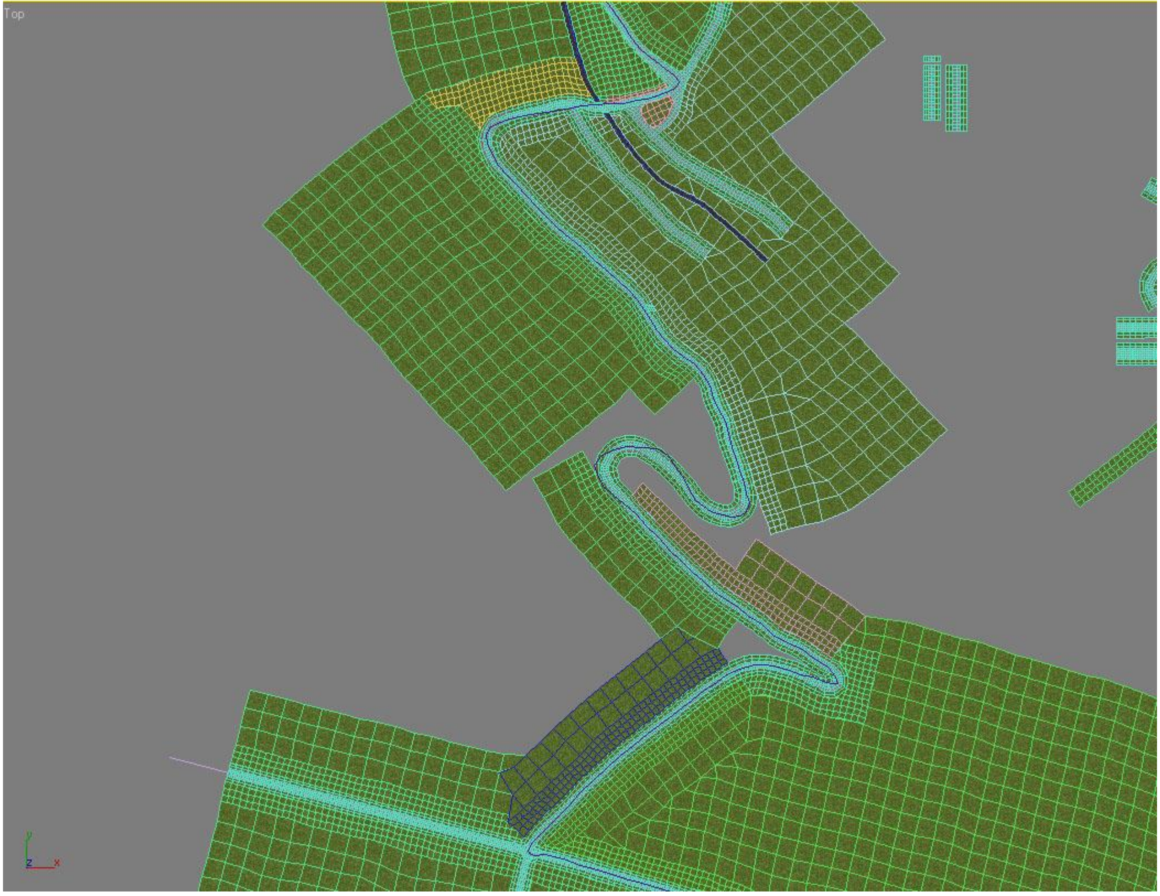


6) Join road and surroundings together (add vertexes if road and surrounding has different number of vertexes)



Do this for the most parts of track. You can make ditches using a particular basic element, or simply remove some polygon(s) and replace it with another one.

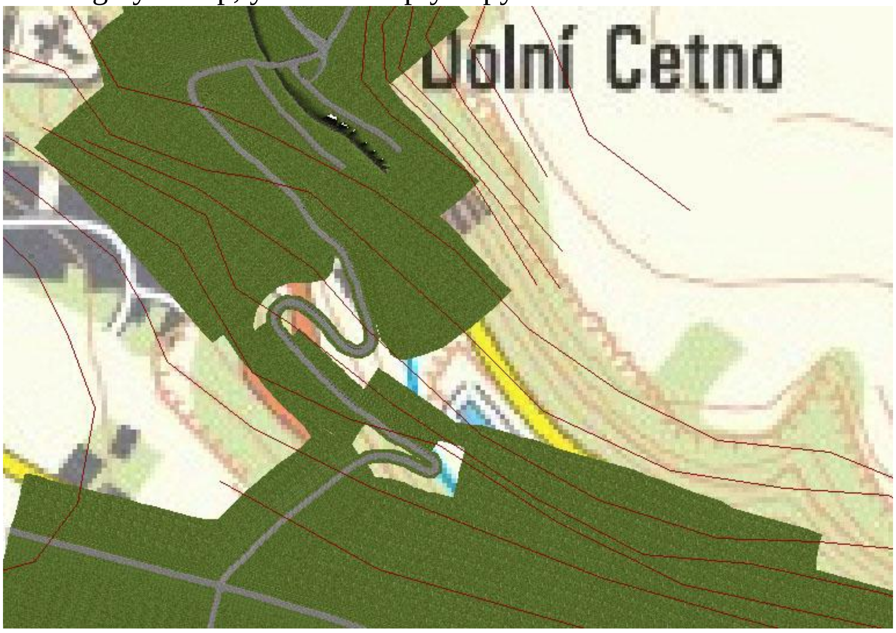
Example of 2D track (not yet welded), ready for 3D editing:



You can notice that there is no surrounding around hairpins. It’s because of later 3D editing, which is not easy especially around hairpins. Now weld it (to larger pieces, borders as much as possible on flat parts), draw contour lines (by map), shape in 3D and then add missing surroundings in hairpins. It’s good to have aerial maps on background (as a textured plane or real background – but take care of measure!)

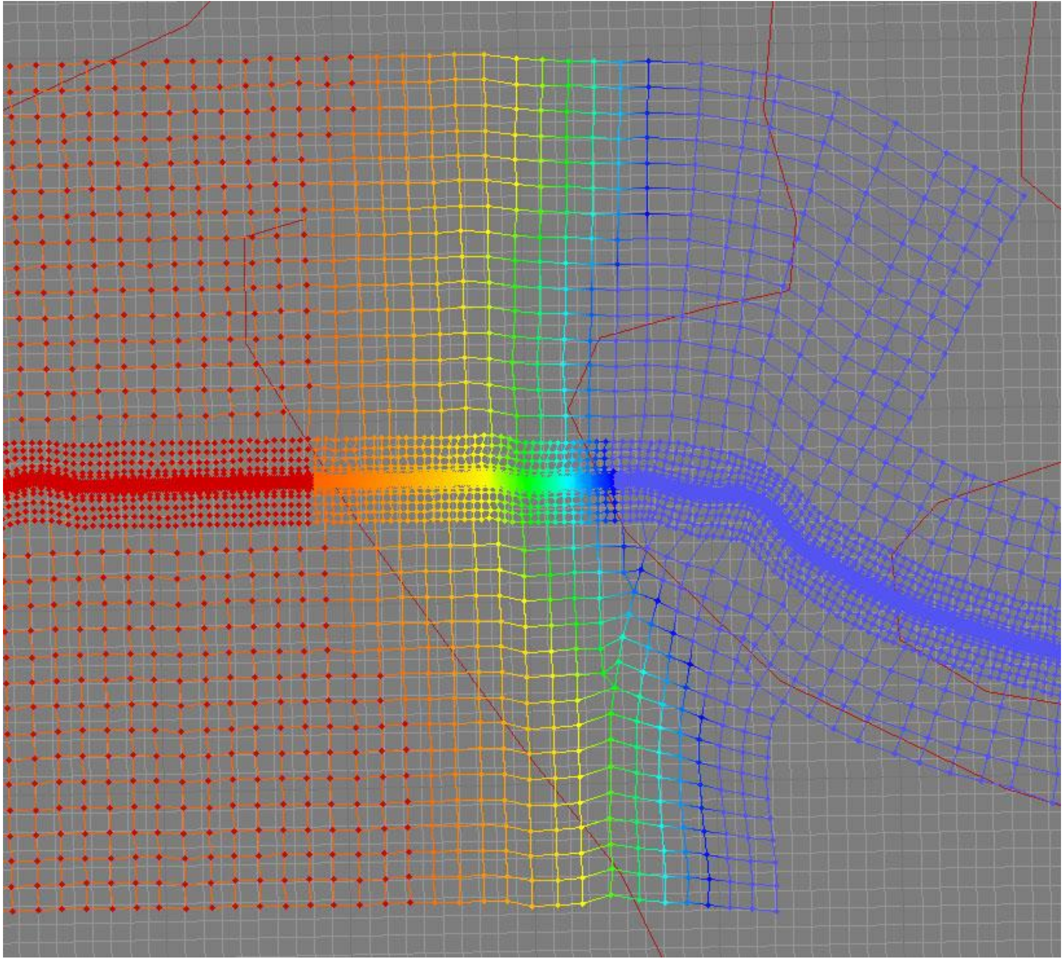
3) Shaping in 3D

This part is less time-consuming than 2D modelling. But it’s neccessary to stick with some practices – it will spare you of some annoying mending. First, draw contour lines from your map (you can put them into their absolute height). The map will not exactly reflect your GPS spline, so it’s neccessary to customize contour lines to GPS spline – guess where the lines would lead after deformation. In case that you are drwaing by a map, you can simply copy them.

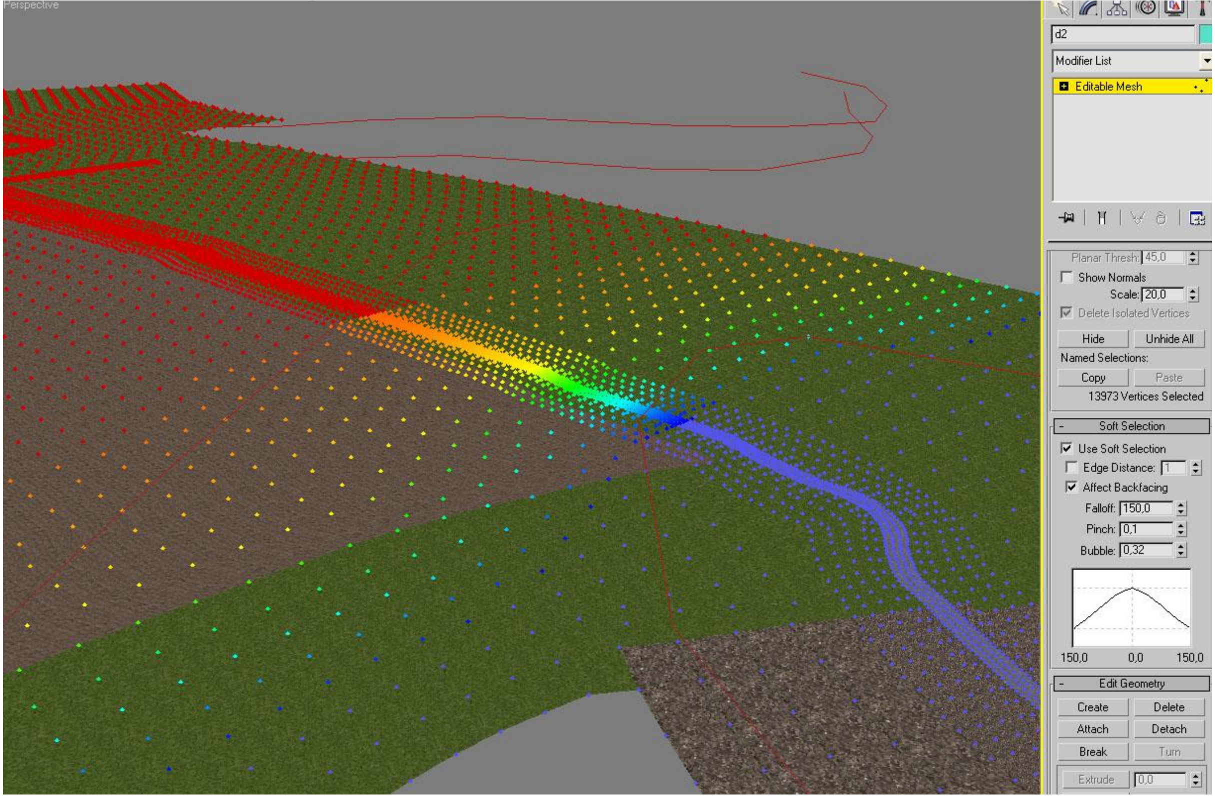


In shaping, we are using mighty „Soft selection“. Set a proper effective distance, shape of gauss curve and by moving selected elements (vertex, plygon, edge) we shape the track. Remember: first shape the road, then surroundings.

It can be shown best on a straight part:



Select rquired points (up to contour line), set parameters to affected area reach to another contour line and raise (lower) the track by difference between track contures.



d2

Planar Thresh: 45,0

□ Show Normals

Scale: 20,0

☑ Delete Isolated Vertices

Named Selections:

13973 Vertices Selected

☑ Use Soft Selection

□ Edge Distance: 1

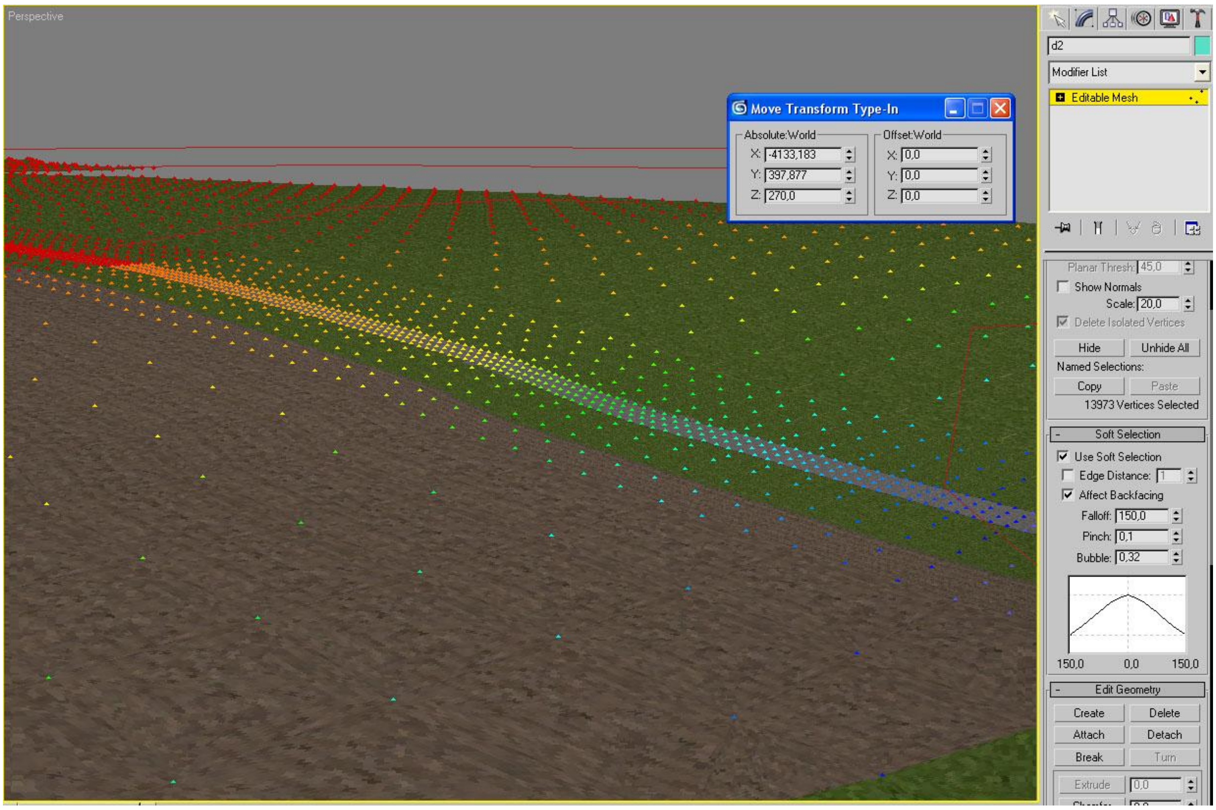
☑ Affect Backfacing

Falloff: 150,0

Pinch: 0,1

Bubble: 0,32

Extrude 0,0



Absolute:World
X: -4133,183
Y: 397,877
Z: 270,0

Offset:World
X: 0,0
Y: 0,0
Z: 0,0

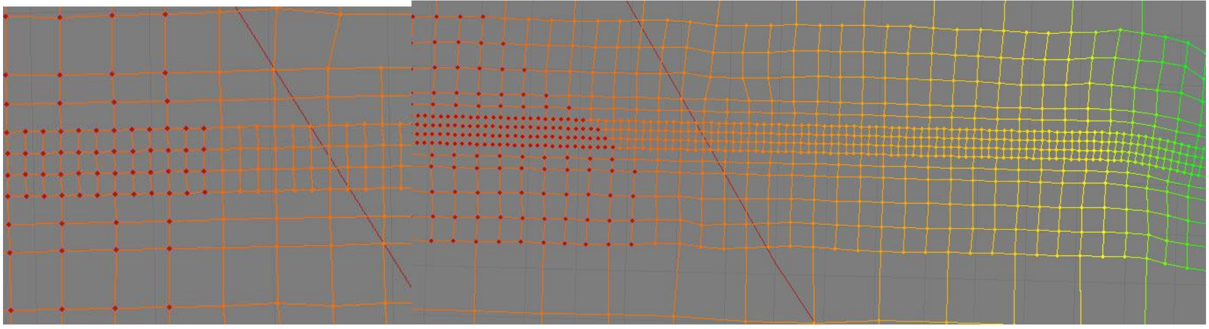
d2

Planar Thresh: 45,0
□ Show Normals
Scale: 20,0
☑ Delete Isolated Vertices
Named Selections:
13973 Vertices Selected

☑ Use Soft Selection
□ Edge Distance: 1
☑ Affect Backfacing
Falloff: 150,0
Pinch: 0,1
Bubble: 0,32

Extrude 0,0

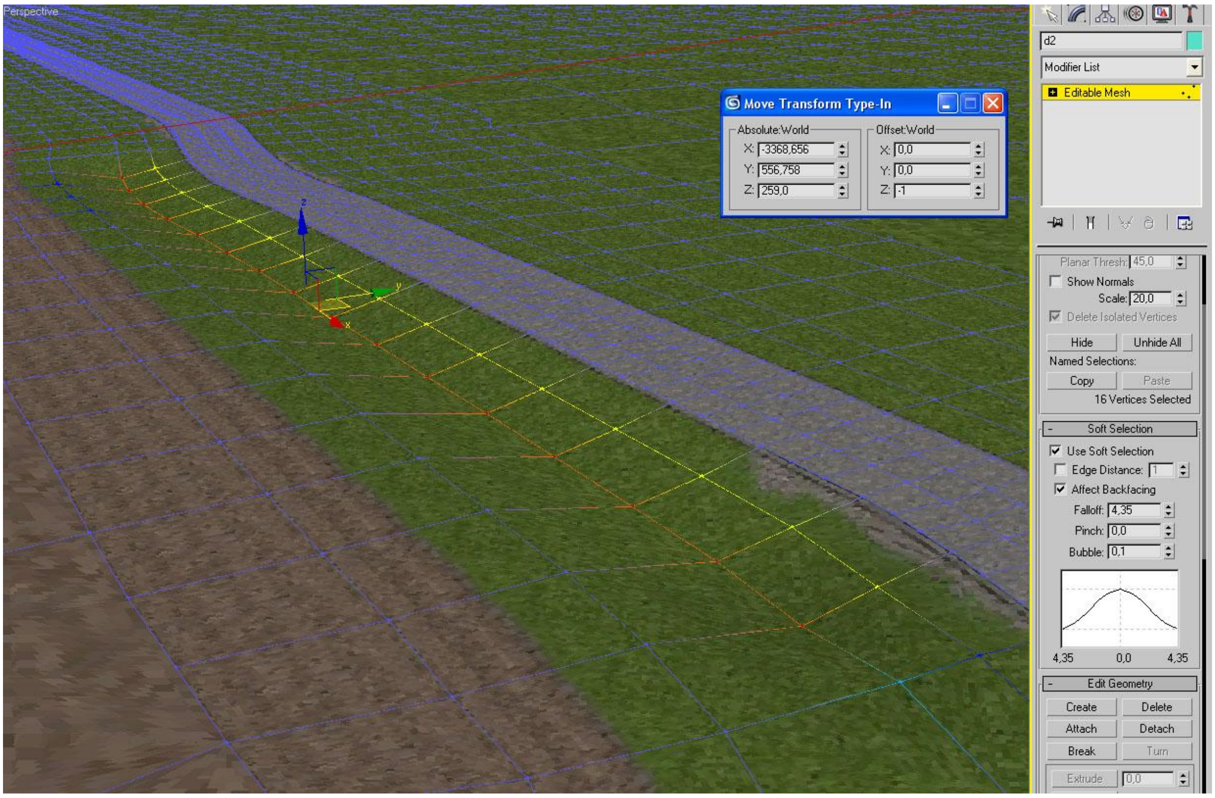
Then, it’s a good practise to select vertexes to the next contour line, again shape the curve and raise track again. It’s important to select vertexes on the road perpendicular to GPS spline, otherwise the road edges would have different height. You cannot avoid that in curves, so it’s neccessary to raise/lower road edges in curves using soft selection.



You can see right selected vertexes on the left and wrong selected vertexes on the right. The same color means the same height.

Another imporant thing is to have a good transitions. In an ideal case, a tangent to beginning of Gaussian curve has the same direction as a tangent to apex of the next used curve – you would then get a smooth transition. In the other case, you would get a „bump“ which can be mended using Soft selection or „make planar“.

Modelling of surroundings is easier, the only thing you must avoid is to destroy the road you have already shaped. An example of making a ditch:



d2

Absolute:World
X: -3368,656
Y: 556,758
Z: 259,0

Offset:World
X: 0,0
Y: 0,0
Z: -1

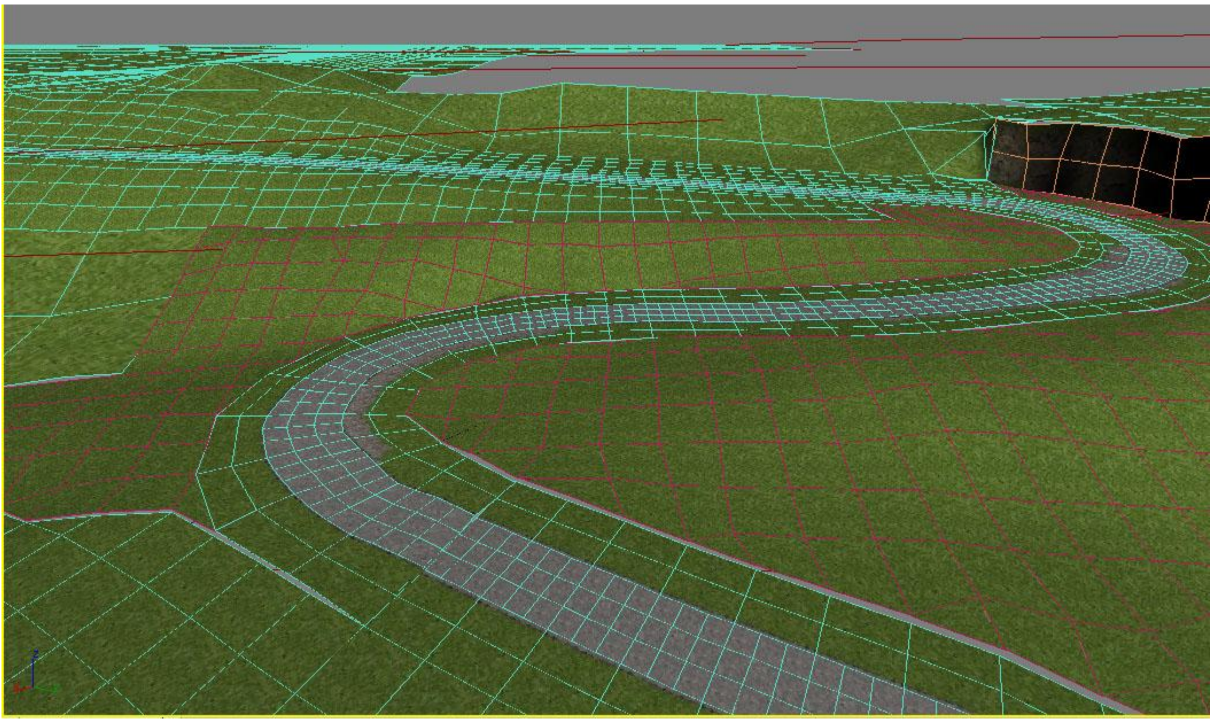
Planar Thresh: 45,0
□ Show Normals
Scale: 20,0
☑ Delete Isolated Vertices
Named Selections:
16 Vertices Selected

☑ Use Soft Selection
□ Edge Distance: 1
☑ Affect Backfacing
Falloff: 4,35
Pinch: 0,0
Bubble: 0,1

Extrude 0,0

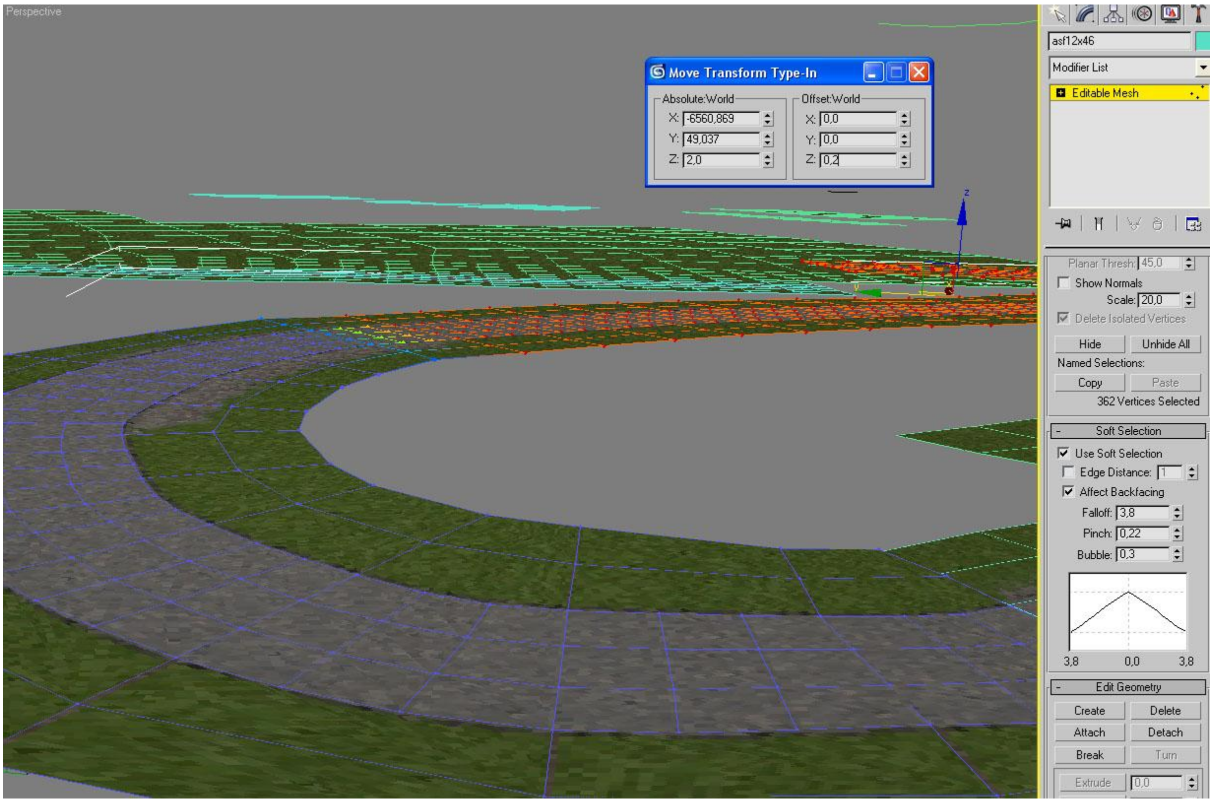
If you need to get a smoother grid for the ditch, you should bear it in mind from beginning and make basic elements smaller, or you can use the cut/inset/tessellate feature on polygons. You can create bumps and ruts similarily.

One remark to hairpins. After modelling of surrounding between hairpins, raise and shape it using soft selection. Weld it at last.



pozn.: surroundings is in red

Modelling of hairpins and curves is difficult. I used to shape a straight part of track to hairpin and to gradually raise the track by a particular height relative to 4m of track. Or you can do it in the opposite way, first raise/lower track and then shape it. Finally, you mend the inner part of hairpin (camber).



Move Transform Type-In

Absolute:World
X: -6560,869
Y: 49,037
Z: 2,0

Offset:World
X: 0,0
Y: 0,0
Z: 0,2

asf12x46

Modifier List

Editable Mesh

Planar Thresh: 45,0

□ Show Normals

Scale: 20,0

☑ Delete Isolated Vertices

Named Selections:

362 Vertices Selected

Soft Selection

☑ Use Soft Selection

□ Edge Distance: 1

☑ Affect Backfacing

Falloff: 3,8

Pinch: 0,22

Bubble: 0,3

Extrude 0,0

Model the other special objects (bridges, hedges etc.) separately and weld them into track after 3D modelling during final touches. In any case, keep a backup of not-welded track.

Regarding number of vertexes, you should get around 10-20 thousands per 1 km. The less the better, but ground don't influence hardware requirements that much. Limiting element is mostly harware.

4) Final touch

What makes the difference between artificial and real track is the detailed shaping of bumps (in measure of 10-20m), track camber, bumps, ruts (on road and ditch – of length 3m and 4cm height – don't do sharp edges, but a round ones, RBR physics does not like sharp edges).

After complete modelling of terrain, there is still plenty of work to do – hedges, fences, buildings… After this, you will mend surroundings to new objects. Then you will try the new track in RBR and mend the track to „feel" good – camber, jumps, bumps… Then you will plant the vegetation and solving problems with track conversion into Wally's editor and later into the game.

I hope this few notes can help you in the very beginning and can spare you wasting your time reinventing the wheel. If have any questions or comments, please send them to vratahonzalek@seznam.cz.

Many thanks to Roman Barta and Vasek Sourek for their notes and comments.

Vratislav Honzálek (The Mask)