SplineStreetConstructor
by TracMax
Version 1.64 (2017-01-03)

Purpose:
Road building can be so easy: just mark the course of the road with a few markers and the SplineStreetConstructor connects these points with cubic splines and creates a continuous road with uphill and downhill gradients. Roadsides can be designed with up to 12 segments; This means that complex structures such as sidewalks, delimiting walls or even bridges are also possible.
An i3d file in Giants Editor format 5.0.1 is generated as output. Knowledge of mapping with the Giants Editor is a prerequisite for using the generated roads.

Use:
The program was written to the best of our knowledge. It may be used free of charge for private purposes. Commercial use is prohibited. Any guarantees are excluded.

The created objects may be used freely when mapping. A mention in the credits would be desirable.

Quick start Guide:

Method A
1. In the map, place objects (shapes) in a TransformGroup (TG) that mark the course of the road
2. Export the TG
3. Start SplineStreetConstructor
4. Enter the road parameters or load them from an ini file
5. Import the TG under Spline Points
6. Specify output file
7. GO

Method B
1. Start SplineStreetConstructor
2. Enter the road parameters or load them from an ini file
3. Enter the spline points
4. Specify output file
5. GO

Detailed description
All parameters can be entered directly:

Below the main interface screenshot, the following descriptions appear:

i3d-File calls dialog for input of i3d file to be created; the file name then becomes entered in the adjacent field. The file name can be edited later.

```
D:\TracMaxX\Streets\test.i3d
```

Filename of the i3d file. Existing files will be overwritten without warning.

Go Generate I3d file (possibly existing file will be overwritten).

Roadway parameters:

☑ erzeugen Set a checkmark if a lane is to be generated. In case you just needs a margin, omit the hook.

Road Geometry:

Breite 6,5 m The width of the lane (z=0) is entered here.

☑ Schleppkurve 10 If a check mark is set here, the road will be in curves widens. The larger the parameter, the greater the change in width. The change in width is smaller on the inside than on the outside. The values of the parameter must be tried.

☑ Kurvensturz 1 A curve superelevation (steep curve) can be set here. The superelevation is limited by the value specified in the "Settings". Pictures are further back.

Road Texture:

Datei road_diffuse.dds 📁 The file name of the road surface texture is entered here. Over the button calls up a dialog for opening. The path of the texture becomes**not**transferred to the i3d file; if the i3d and the textures are in different directories, the path must be entered manually in the i3d using an editor.

Länge 20 Length of the texture in meters. If the road is longer than the texture, will periodically continued. Very short textures are continued by reflections and folds in such a way that UV errors are avoided as far as possible. However, a guarantee for objects free of UV defects cannot be given.

Texturbreite 0 pxl The width of the texture in pixels (integer) can be entered here.

Start 0 0 pxl The coordinates of the left edge of the texture are given here. Values greater than zero mean that part of the texture is omitted. Alternatively, you can also specify the pixel value from which the texturing of the road should begin (from version 1.64).

Ende 1 0 pxl Coordinate of the right edge on the texture. For values smaller one, parts of the texture are left out on the right. Alternatively, you can also specify the pixel value at which the texturing of the road should end (from version 1.64).
This function can be used, for example, to omit road edges from the texture.

☑ zufällig spiegeln 0,15 If this is checked, the texture will be mirrored randomly. The The frequency of such mirroring is set with the parameter, which should be between 0 (no mirroring) and 1 (mirror every time). Frequent reflections increase the number of vertices. They are only useful if a structured road texture is used to avoid excessive periodicity. See below for examples.

☐ Rücksetzen statt spiegeln If this is checked, the texture will be increased by an integer pushed to around -7 when the road gets so long that there is a risk of UV errors. To do this, the vertices at the reset point are doubled, once with the texture end coordinates for the previous segment, and once with the offset texture coordinates. Random reflections
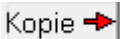
are not possible when resetting.

TexL0 `0` ⟳ The initial value of the texture can be entered here. When running from "GO" is the value at the end of the road. In this way, the texture can be continued seamlessly on subsequent roads, especially on textures with changing surfaces. The button with the exclamation mark resets the value to the initial value.

Strecken bei Gefälle `0` If a value greater than zero is entered here, the texture at Stretched downhill and shortened uphill. Negative values   reverse this behavior. A value of 1 will stretch the texture twice if the slope is 90°.
The purpose of this parameter is that a scroll shader moves the texture "faster" the longer the mapped texture is on the object. This should make it easier to create streams and rivers that are even more realistic, in which the waves run faster the higher the gradient.
The textures from the Giants folder naturals/stream can be used. In the final map, the road texture (materialIds=""..") must then be replaced with the stream material (editor). The SplineStreetConstructor cannot (yet) create complex materials.

Parameters for the borders:

The parameters for both margins have the same meaning. However, two different borders can be created.

☑ **linken Rand erzeugen** Tick   if the respective border is to be created.

Kopie ➡ Copies the border parameters from the left border to the right (or vice versa).
Copy function can be incomplete (todo for next version), so please check all segments in the target border.

Datei `verge_diffuse.dds` 📂 The file name of the border texture is entered here. On the button calls up a dialog to open.

Länge `20` m Length of the texture in meters. Is the road longer than the texture, we periodically continued. Very short textures are continued by reflections and folds in such a way that UV errors are avoided as far as possible. However, a guarantee for objects free of UV defects cannot be given.

Breite `0` m `0` pxl Width of the texture in meters and specification of the texture width in pixels (from version 1.64). With the switch **Breite -> U** are according to the length of the segments UV values   ("End") are calculated and entered in the respective "End" parameter. The starting point for the calculation is segment 0.
For textures that are periodic in the x-direction, this can make it easier to adjust the "end" values. If the exact position of the texture coordinates is important (eg when adjusting curbs, walls...) you should not use this function.

☐ **Rücksetzen statt spiegeln** Same function as for road.

The "Start" parameter has been moved to the border segment zero.

Randsegmente links: 2 Here the edge segments are defined and parameterized (no limitation of the number more).

1 Selection of the segment by entering the number or using the arrow keys. The button inserts another segment at the current position (the current one values are copied), adds another segment at the end, the button removes that current segment (no longer the last).

Breite 1,50748 m Specifies the width of the border segment. All edge segments are like a folding ruler connected to each other.

Winkel -5,7106 specifies the angle of the edge segment in relation to the roadway. 0 means it is a continuation of the roadway. 90 goes up 90 degrees from the roadway.

Ende 0,2 0 pxl specifies the texture coordinate of the end of the segment. Alternatively you can also specify the number of pixels, then the texture coordinates are calculated from the pixel width and this information (from version 1.64). The texture coordinate of the beginning of the segment is determined by the texture end of the previous segment, the segment beginning of the first segment is set in segment 0. If the value is less than that of the previous end, the texture is mirrored accordingly. UV errors are not intercepted here, please make sure that all values are in the interval [-8,8].

☑ Normale manuell 180 If the hook is set here, you can change the normal of the end point enter manually. The normals affect the lighting characteristics in the game; for hard edges it is recommended to insert a short segment (length eg 0.03 m=3cm) to adjust the normals. If the check mark is not set, the normal is automatically aligned to the bisecting line between the segments. At the end segment, the last normal is perpendicular to the line.

For the bridge below, the right part is created with manual normals and intermediate segments, the left part with automatic normals. The edges on the right appear much more angular, on the left they appear rounded. The geometry of the edges is identical.

Error Messages: Warnings are issued
- if a segment has zero length → would result in triangles with no area
- if the "end" texture coordinates of two consecutive segments are the same

Spline Points:

Here the points are entered or imported that determine the course of the road.

Datei SplineSource03.i3d 📁 The spline points can be imported here. See for details further back.

1 ▲▼ +📋 — ＋ Selection of the spline point by entering the number or via the arrow keys. The button +📋 inserts another point before the current position, the knob ＋ adds another dot at the end, the button — removes the current spline point.

X	0	Xrot	0
Y	0	Yrot	0
Z	0	Zrot	0

The spline points can be entered and/or changed here. The rotation around the Z-axis is also possible since version 1.6.

Miscellaneous:

☐ TransformGroup erzeugen If a check mark is set here, the generating spline Points attached to the road as sub-objects (TransformGroup). With this you can continue streets seamlessly, if you either put the next street in the end transform group or copy the coordinates of the TG into the next street.

☐ Stirnfläche füllen If a check mark is set here, the face will be filled with a texture. This is interesting for bridgeheads, for example.

Parameter für Stirnfläche
Textur [ ] 📁
Texturbreite [2] m
Texturhöhe [2] m
☑ Breite / Höhe vertauschen

The parameters can be found under "Settings", a texture and its width and height must be specified.
With "Swap width/height" the texture is rotated by 90°.

TrafficSplines
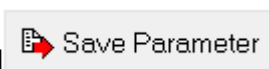☐ in der Mitte
☐ rechts [50] %
☐ links [50] %

Depending on the hook, TrafficSplines (from LS17 also Zugsplines) can be generated. The percentage is relative to the lane width, ie at 50% the spline is in the middle of the lane, at 100% at the very edge of the lane, at 0% in the middle and at over 100% outside the lane.
The latter could be useful, for example, to use the GE script "SplinePlacement" (www.marhu.net) to place delineators or roadside greenery.

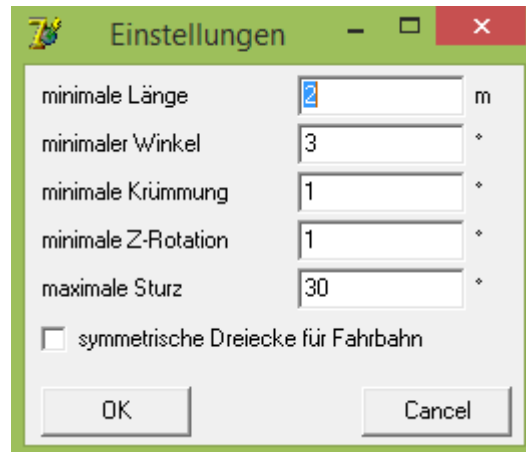**Load Parameter** and **Save Parameter** This allows all entries in an INI file be copied or restored from it.
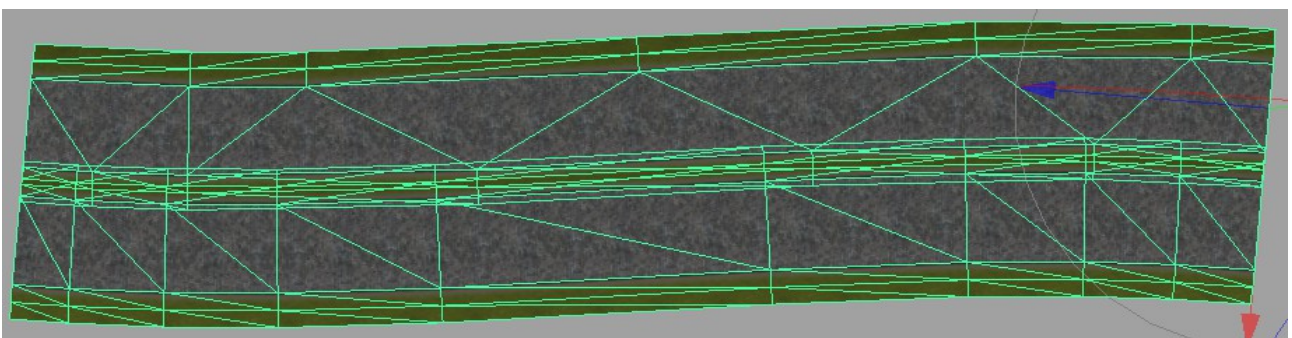
Parameter geladen aus Fatian_road.ini Specifies the INI file currently loaded or saved. This display is retained when the parameters are modified (possibly ToDo in the next version).

Einstellungen opens a dialog for setting additional parameters, mainly the number of the subdivisions of the object. The smaller the values, the finer the road is subdivided and the more vertices and triangles the structure contains.

- minimum length: smallest length of a subdivision (but can be undercut if other criteria are violated)
- minimum angle: subdivision of the structure when the angle change becomes larger than this value.
- minimum curvature: Subdivision of the structure when the slope change becomes larger than this value.
- Minimum Z rotation: subdivision of the structure when the rotation change around Z becomes larger than this value.
- Maximum camber: maximum angle for banked turns
- symmetrical triangles: if the check mark is not set, the upper structure (see image below) is created, if the check mark is set, the lower structure (possibly has more triangles).
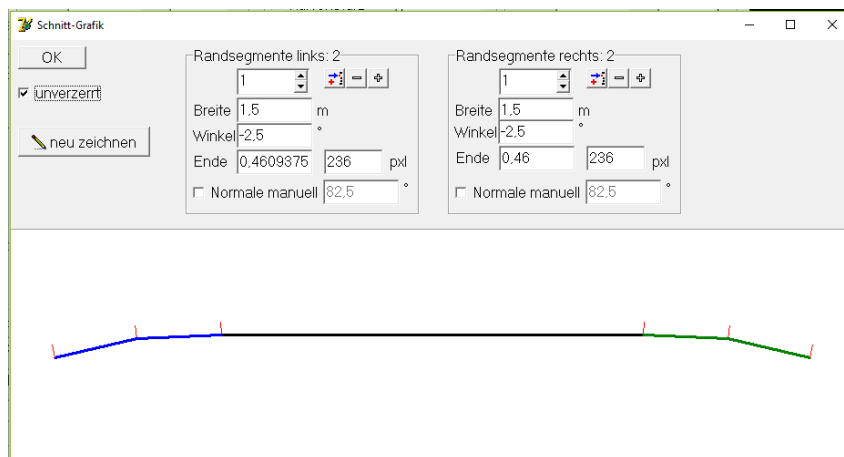
Grafik Schnitt shows a cross-section of the road (black) and the edge segments (green and blue) on. The red dashes are the normal ones. In this way, complex edge geometries (e.g. bridge profiles) in particular can be assessed.

The display is still quite rudimentary at the moment, you can only switch between the distorted view that fills the window and an undistorted view.

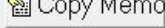The pictures show a bridge profile as an example.

As of version 1.64, the boundary parameters can be modified in the graphics window - you can now see what you have set more quickly. Drawing with the mouse does not work yet.

The memo box at the bottom shows debug information, the coordinates of the edge segments and the lengths and gradients between the spline points. It can safely be ignored. At

In the case of malfunctions, the content can provide clues as to what went wrong. With ![Copy Memo] will the
Content is copied to the clipboard and can be copied from there to the editor, for example. For the coordinates of the edge segments, the output is (example)

point 6: length=0.05; angle=-125; x=-0.029; y=-0.041; x0=1.506; y0=-0.341; normal man angle=-70; U=1.145

Longitude and angle (same as input), x and y are the segment's Cartesian coordinates, x0 and y0 are the Cartesian coordinates measured from the origin, the normal angle is specified as "man" or "auto" as it is came about. Finally, the UV coordinate U is displayed.

The output for the spline points is:

Spline 1-2: lane length = 32.4388 m -- average gradient = 0.0000° -- minimum gradient = 0.0000° - maximum gradient = 0.0000°

The incline information is of particular interest for MoreRealistic maps, since steep inclines cannot be mastered by weak tractors with full trailers. Here one should not go beyond 10°.
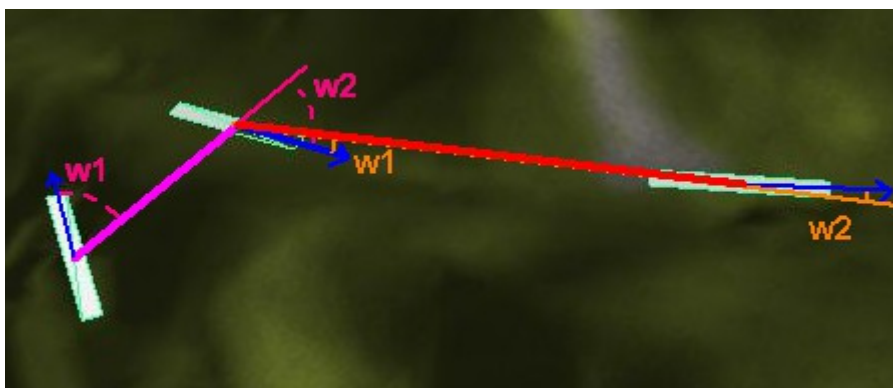
Program settings (SplineStreetConstructor.ini):
The settings are also saved in this file. In addition, the window position of the program is saved in "ScreenPos_Top=..." and "ScreenPos_Left=..." If the window is outside the visible screen area, you can make the window visible again by entering 1 in both parameters or die INI file deletes.

Function of the splines:
(possibly a bit math-heavy)

Every two spline points are connected with a straight line, which is taken as the x-axis of a cubic parabola ($y = ax^3 + bx^2 + cx + d$). This parabola is calculated in such a way that the direction (Y-rotation) specifies the angles at the beginning and end of the line. The X-rotation is used analogously for the gradients. Therefore, the angle between the connecting line and the spline direction must be between -90° and +90°. If this is not the case, the program issues a warning and does not produce an output file.
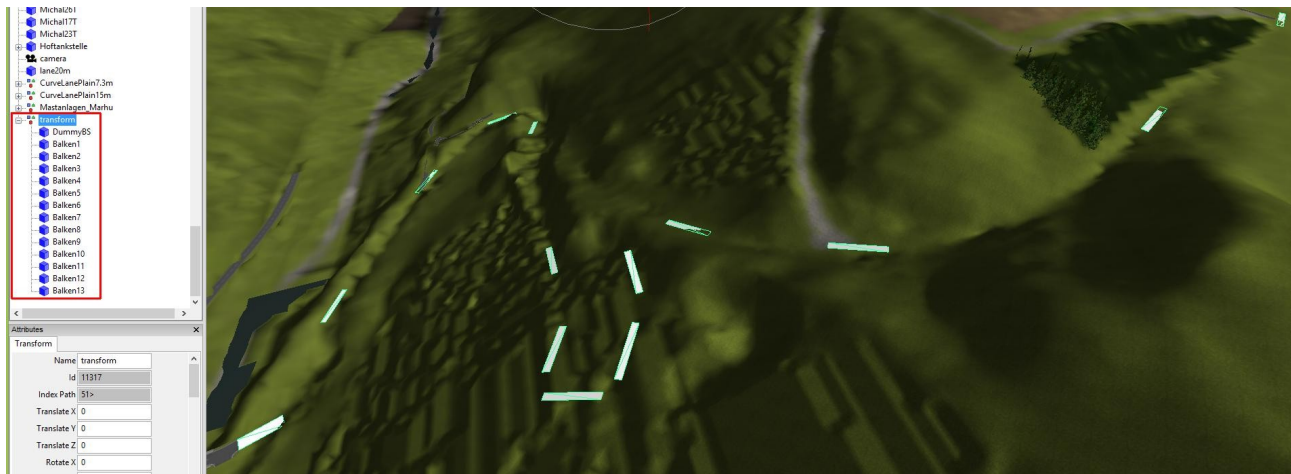

In the following image, two routes are marked in magenta and red as an example. The angles w1 and w2 (magenta and orange respectively) belong to each segment. The direction of the generating object is drawn as a blue arrow (Z-direction).
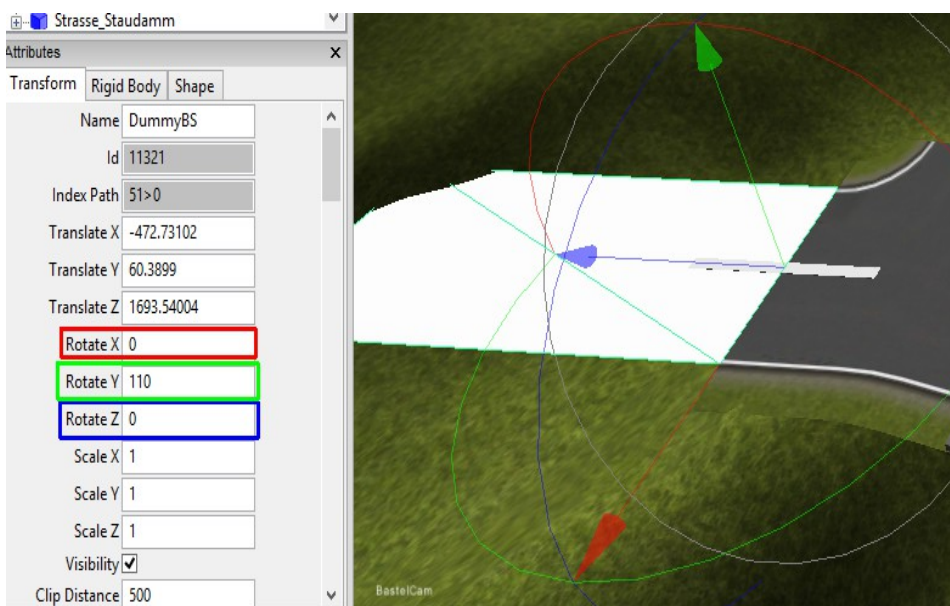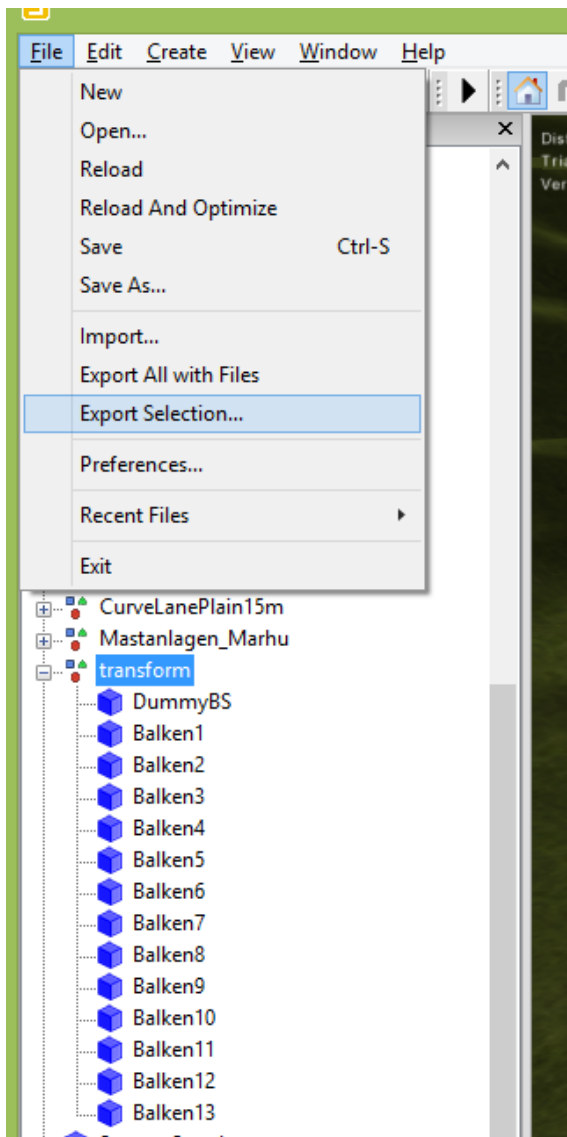
Import the spline points from the map:

The spline points can be imported from the map.
To do this, you put objects in the map (I use a kind of bar) that are combined in a TransformGroup.

The direction of the road to be created is specified by the z-axis, ie the blue arrow must point in the direction of the road. The angle of the road is specified with Rotate Y (green), the incline with Rotate X (red) and the twist with Rotate Z (blue). Caution: when rotating the shape with the mouse buttons, Rotate X and RotateZ are often changed at the same time, which is undesirable when creating roads.

The TransformGroup with the objects it contains is exported to a new i3d file with "Export Selection". This file can then be read in with the SplineStreetConstructor.
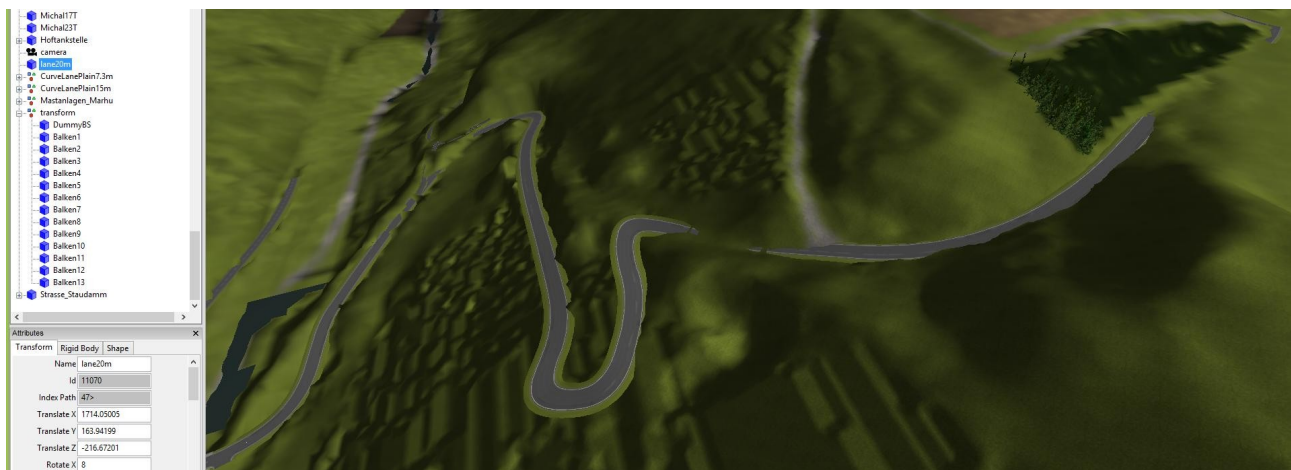
How the import works:
First, SplineStreetConstructor searches for the keyword "<Scene>" in the i3d file, then for "<TransformGroup". From there, the values from translation="..." and rotation="..." are read from all subsequent objects (keyword "<Shape"). The hierarchical level of the objects is not taken into account, so subgroupings should be avoided at all costs.

After importing the road, terrain adjustments may be necessary. In difficult terrain, it may be necessary to readjust the spline points. I wish you success!

The number of spline points is no longer limited since version 1.6.

Reading in the i3d file is ended with the keyword </Scene>; unexpected results may occur if there are multiple transformgroups containing <Shape> . Therefore ideally only one transform group in the generating i3d.
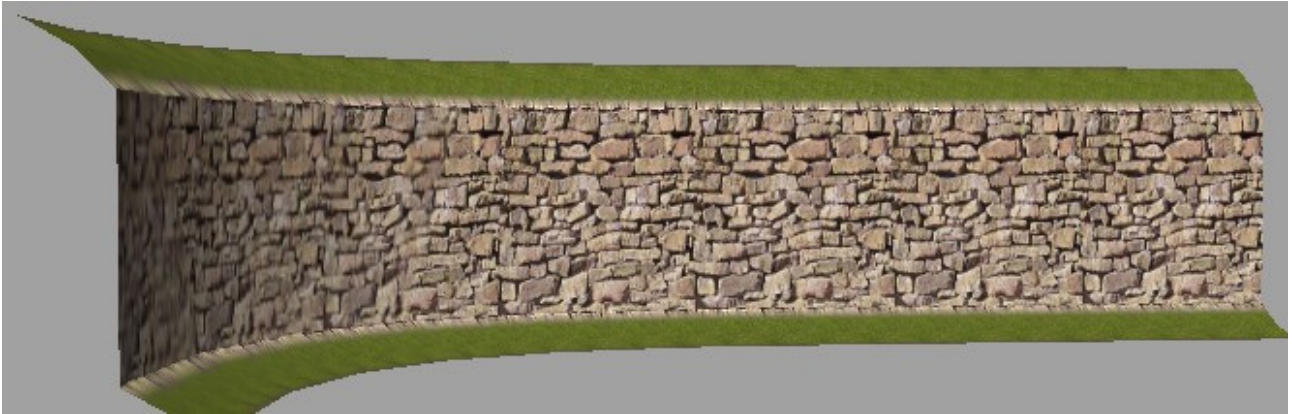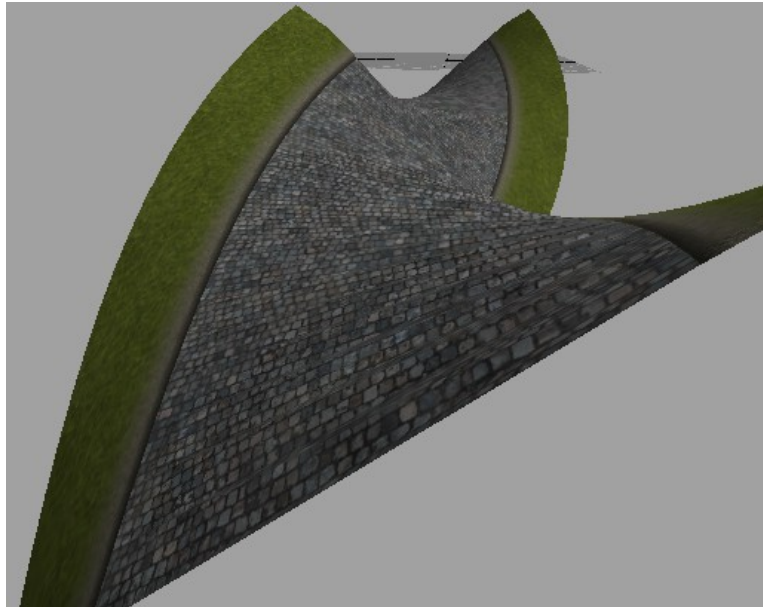
Z rotation

The rotation around the Z-axis is linearly interpolated between the spline points, which is why there are kinks in the (continuous) structure when the rotation changes. The subdivision of the structure is controlled with the parameter "minimum curvature" (see "Settings").
When rotating by 90° you can now also create walls. The textures published in my wall kit have to be rotated by 90° (e.g. with PaintNet).
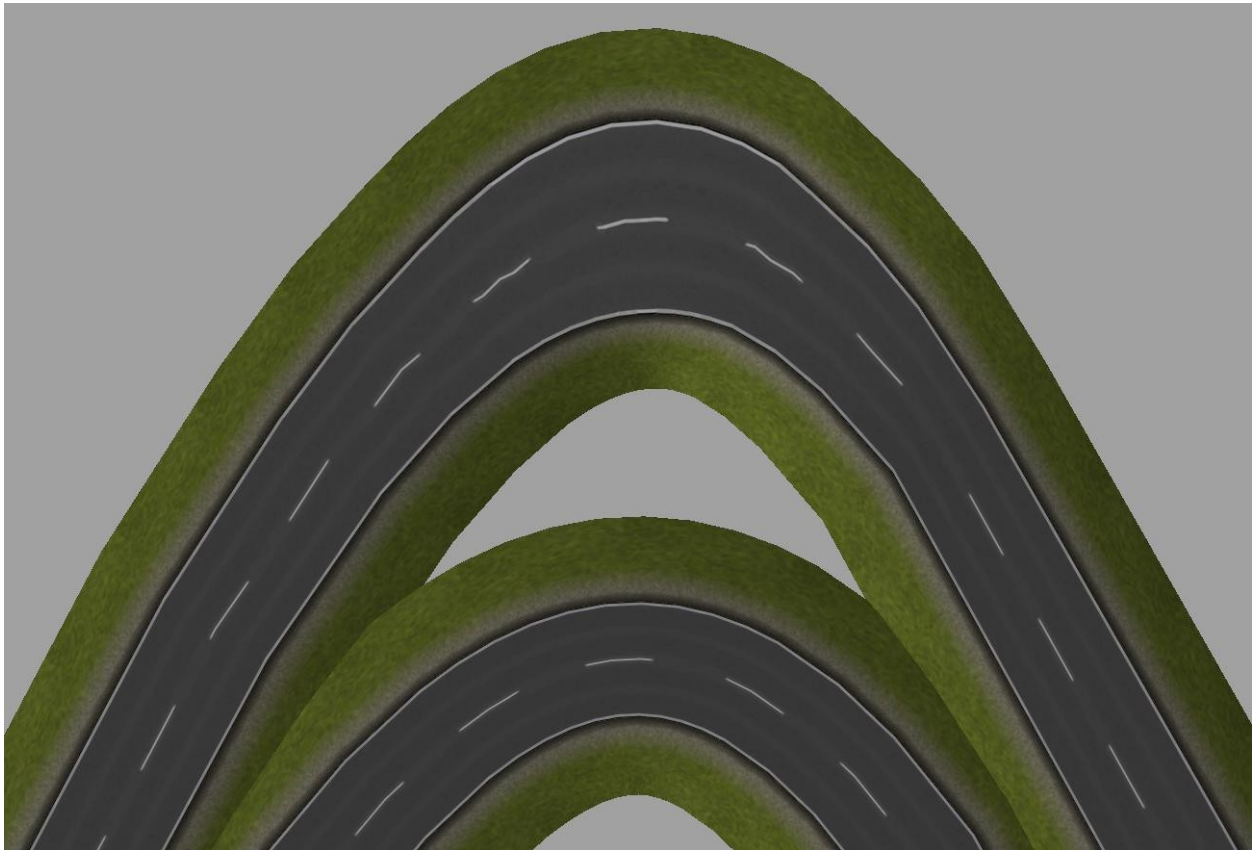Maybe someone will build a roller coaster too...

drag curve and camber

Drag curves make it easier to drive through tight curves with long vehicles by widening the roadway. The SplineStreetConstructor takes this into account with the drag curve parameter. This parameter is arbitrary (i.e. not a meter value). The larger the parameter, the wider the road will be. The image below shows a road with swept curve = 10 on top and no swept curve on bottom. If the values   are too large, a dent can appear on the inside.

For structures that should be closed (e.g. bridge profiles), you should switch off the drag curve or ensure an appropriate overlap at the edge (but this can lead to flickering).
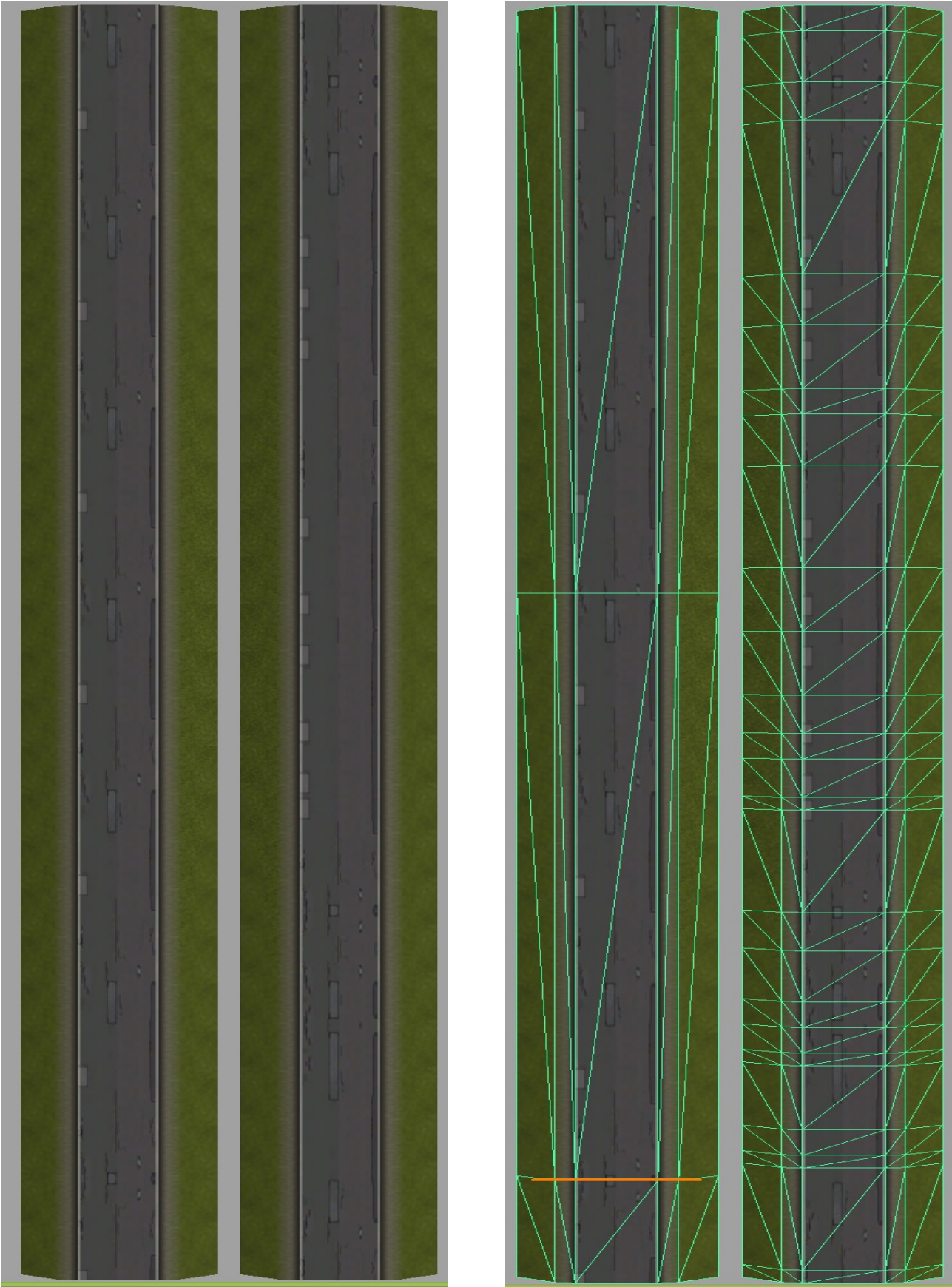
If you allow a fall, "steep curves" are created. The curve increase is proportional to the narrowness of the angle (mathematically: curvature of the curve) and is limited via an arctan function with the maximum torsion angle (see settings). The picture shows a road on the left with a camber and on the right without. Everyone has to find out the optimal appearance of the road by changing the parameters "tow curve", "camber" and "maximum" camber.
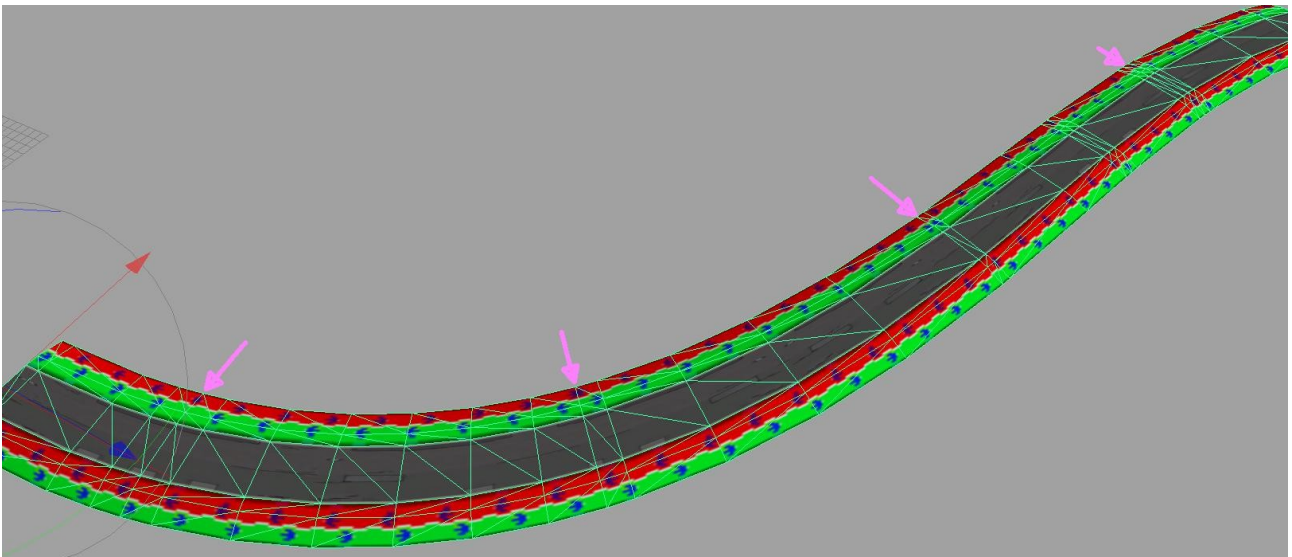
refolds

The street on the left is generated without and the street on the right with random refolding (length of street: 100 m, length of texture: 15 m). On the left you can see the regular sequence of "touch-ups". On the right, flip random has been set to 0.2. As a result, individual elements often appear one after the other, but more irregularly. The image on the right shows that this increases the number of subdivisions. If you look closely, you can see the reflection at each subdivision. In the case of the left road, the reflection takes place on the orange line; this avoids UV errors.

Reset instead of mirroring

After Giants restricted the texture mapping range to [-8;8], there are only two ways to map a short texture onto a large object.
   1. the texture is mirrored
   2. the texture is shifted by an integer multiple
In the image below, the top border is created with mirror and the bottom border is created with reset (move). You can see that the upper edge changes direction at the marked points.

Miscellaneous

The limitations on the number of resets from previous versions have been removed with version 1.6.

Have fun with lots of new roads, also in mountainous terrain, and other creations for Farming Simulator

TracMax