

User Guide:

for Procedural City Generator

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Four stages:

Terrain Generation

Road network generation

Street network creation

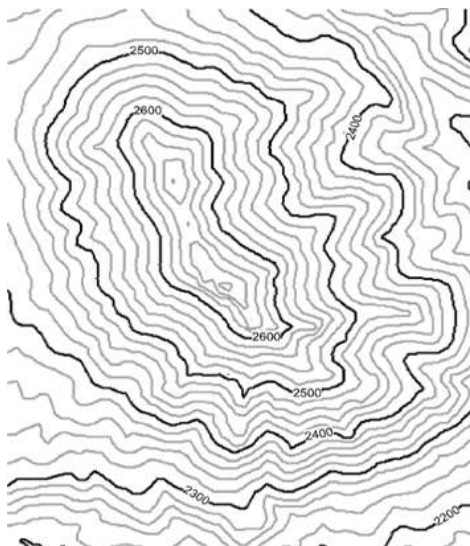
Building Distribution

Terrain Generation:

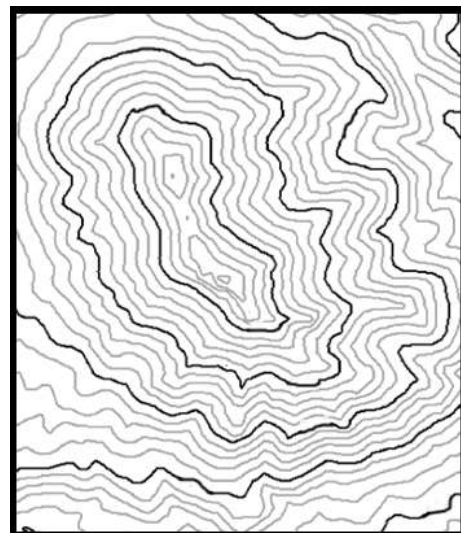
Terrain can be generated either from a contour map or from a grey scale map. IPK_Terrain node which generates the terrain however uses grey scale map for generation. This Procedural City Generator comes with an asset which converts contour map into grey scale map which can then be used to generate the terrain for the city.

a) Contour map to Grey Scale map:

Clean up the contour map and its worth going through how contour map works.



Contour Map



Clean Contour Map

Erase the numerical value in the contour map and close all the open circles.

- Create an instance of IPK_Contour_Heightmap
- Load the contour map
- Enter the lowest and highest altitudes and contour interval.
- Now enter the contour details
- Each contour line in the map is a primitive in view port now.
- In the map, index contour lines are the lines that has numerical value written on top it.
- Find out the corresponding primitive in the view port.
- Enter the total number of index contours in the map as "Number of Groups"
- Enter the primitive number of each index contour line in the Primitive Number tab below the Number of Groups tab
- Followed by its altitude
- Then the primitive numbers that are in between the current primitive number and the next index contour line's primitive number are entered in the column below the altitude
- These are groups of primitives whose altitude is calculated from its index contour line's altitude.
- Its really worth reading how the contour maps work before filling these parameters.
- On entering all such index contour primitive and their groups, click generate grey scale map toggle which is at the bottom end of the parameters tab.
- Contour map will be changed into grey scale map.
- Follow the procedure given in the grey scale map to create terrain.

b) Grey Scale Map to Terrain:

- Create IPK_Terrain node.
- Enter the size of the terrain and their rows and columns.
- Load the greyscale map now.
- Click "Apply Heightmap" toggle on.
- Terrain will be generated.
- This process may take some time based on the size of the terrain.
- Once the Terrain is generated, a pond map can also be uploaded but its optional.
- If a pond map is loaded, which is just a black and white map where the ponds are represented in white color. The size and scale of the pond map should be equal to that of grey scale map's.
- Turn on "Visualize pond" options to view the pond.

It is advisable to save the terrain geometry to the disk now as a bgeo and in the further development of the city, this bgeo can be used.

Road Network Generation:

- Using a File sop, load in the terrain geometry.
- Create an instance of IPK_road.
- Connect the input of the IPK_road to the output of the file sop.
- Feed the junction point map to the IPK_road.
- Junction point map is nothing but a white sheet with black dots on it and the black dots represents the important junctions in the city and the road network will be created based on these points.



Junction Point Map (Ignore the blue region)

- On feeding the map, road network will be generated which will not more than a second.
- Turn on the "Consider ponds for computation" toggle on if the terrain had ponds on it.
- Change the parameters like number of samples, max branches, angle of deviation and seed to get different road network patterns.
- Roads can be added between any two points manually by choosing "Add roads" option from "No Customization" menu.
- Once this option is selected, view port displays nothing.
- Turn on the "Display Points" which will be in one of the sidebars of Houdini view port's GUI.

- Now the junction points will be visible and enter the point numbers of the junction points between which a road segment has to be added.
- Follow the same for the delete roads option.

.Road segment can be generated between any two points other than junction points by creating an instance of "IPK_RoadSeg" asset.

.Just like IPK_road, feed its input to the output of File sop that reads in terrain geometry.

.Click "Select Positions" button and now the start and the end position can be selected using the mouse in the view port.

.Road segment will be generated between the selected points.

.Once again, its advisable to save the terrain along with the road network as a bgeo file which can be used for further generations.

Street Generation.:

- Using a File sop, reads in the bgeo file that as the terrain, ponds(optional) and road network.
- Group the primitives which are going to be a street.
- Create an Instance of IPK_StreetGen.
- Connect it to the output of Group node.
- Enter the name of the group node to which it is connected in the "Group" tab of IPK_StreetGen node.
- Pattern will be generated.
- As a default, it creates Organic pattern.
- Then select the pattern required and play with the parameters until the desired pattern is achieved.
- Save this street pattern to a disk which will be called in when distributing the building.
- Now delete the group node created and group another set of primitives which forms another street in the city.
- Follow the same process until enough streets are generated in the city.
- Now merge all the street bgeos and the remaining terrain region to see the subdivided terrain. This is just see the whole pattern.
- No where the whole pattern will be used as such.

Building Distribution:

- Using a File sop, read in a single street pattern.

- In the obj level, create an instance of "IPK_Instancer"
- Go through the help file of the node, to understand what every parameter does.
- Enter the building bgeos and tree bgeos.
- Click "Create Node" button to generate the geo and delayed load set-up.
- Turn off the visibility flags of the created geo nodes.
- Now click "Create Asset" in the asset parameters tab. The location should have been specified before clicking it. The location is the path where the street pattern file is. It will be something like "obj/geo1".
- IPK_BuildNetwork asset will be created in the specified path. Connect its input with the output of the file sop that reads that street pattern.
- User selected buildings will be distributed and this process is explained in detail in the thesis and also in the help file of the asset.
- Write the render file and the display file.
- Read in the render file back using a file sop. Turn the visibility on for it. To visualize the city with bounding boxes, use display file. But at the time rendering keep the render file visible.
- Get back to obj level and Click "create instance" button in the parameters list of IPK_Instancer.
- Instance node will be created.
- Now click the render button in the view port, and see the buildings distributed in the street.
- Follow the same pattern for all the streets.
- Keep merging the render file of each street in the geo level.
- Dont delete the IPK_buildnetwork asset once the display and the render file are written because the IPK_buildnetwork node still has the point group data which is very important for instancing.

For more information on individual parameters of each asset, refer the help page of each asset.