

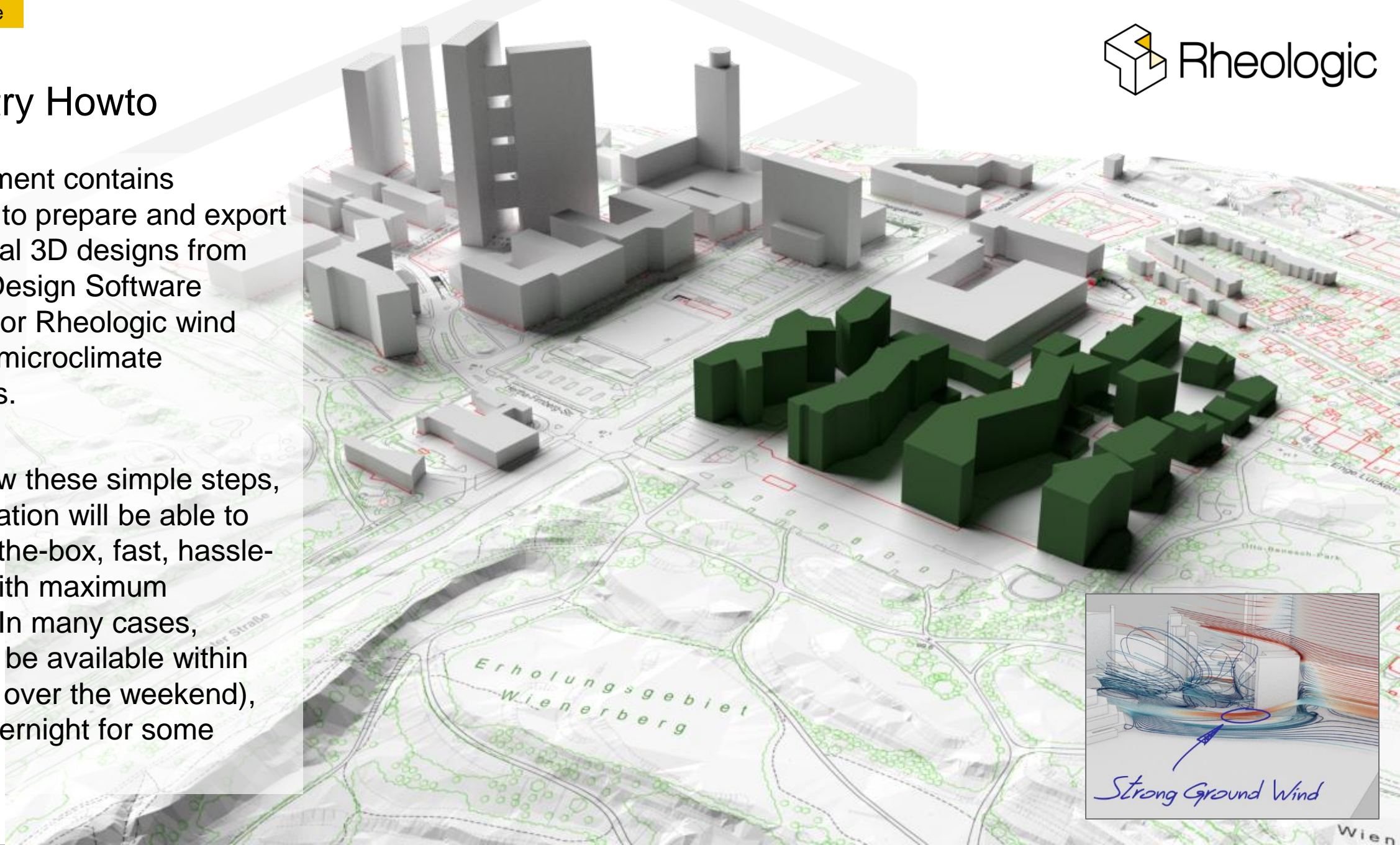
Architecture Geometry Howto



Geometry Howto

This document contains guidelines to prepare and export architectural 3D designs from BIM / 3D Design Software efficiently for Rheologic wind comfort & microclimate simulations.

If you follow these simple steps, your simulation will be able to run out-of-the-box, fast, hassle-free and with maximum efficiency. In many cases, results will be available within days (also over the weekend), or even overnight for some projects.



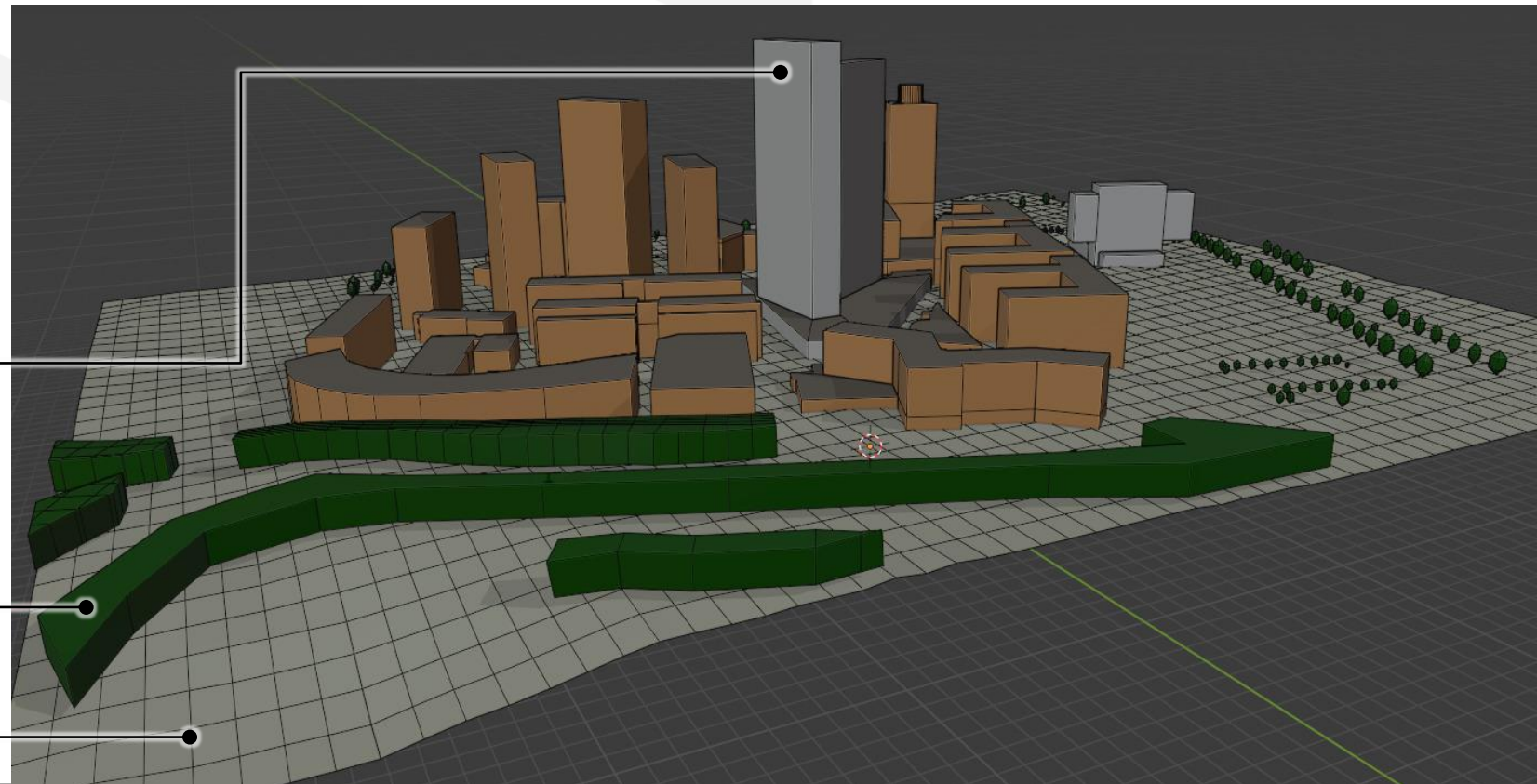
In a Nutshell

1. Simplify your geometry to a *Level of Detail (LoD)* of 0.2-1 meters, omit all interior geometry.
2. Make sure buildings are “water tight” and building bottoms extend into the terrain.
3. Check mesh quality (remove double vertices, no unmarked intersections of faces or edges)
4. Export buildings, terrain (optional) and trees (optional) separately into one of these formats: **obj**, **stl**, **dwg**, **step**, **iges**, **ifc**, **blend**

Building layer

Vegetation layer

Terrain layer



What to provide

We distinguish three different basic mesh layers for most simulations for the build environment / architecture:

Buildings: containing all buildings existing or planned

Terrain: the actual or planned terrain of your project

Trees: all leafy plants from single trees to contiguous bushes

These three categories are typically handled as three different files in one of the listed file formats (see below) sharing a common geometric origin.

For all of this files, keep the mesh as low poly as you can, with a level-of-detail (LoD) in the range of decimeters (0.2m - 1.0m, with 0.5m usually offering the best tradeoff).

Make sure to avoid the following:

- ▶ double vertices / edges / faces - any features that share the same space in the virtual geometry
- ▶ edges / faces that intersect without a point / edge at the intersection - whenever a edge / face intersects something, the intersection needs to be a point or edge
- ▶ unconnected vertices / edges / faces - unconnected vertices as well as edges that are not connected to faces and faces that do not form a 3-dimensional structure are not permitted

Buildings

Our simulations only ever work on the outer shell of a building, interior features are not necessary and might cause errors. All buildings must be "water tight" 3-dimensional objects. Ideally the outer building shell is a single surface without any "unintentional" gaps. For example, there should be not gaps for doors, windows and between the body of the building and the roof.

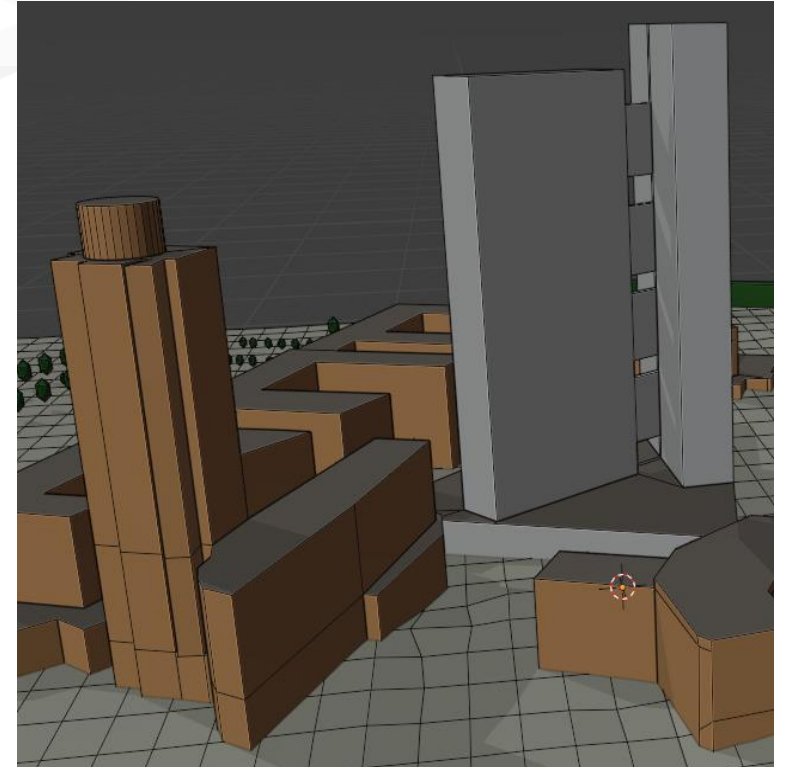
It is however absolutely fine to have intentional opening in a structure, like for example an open terrace-level in a high-rise building. Also in this case the building itself must be a "water tight" body.

The shape of buildings is not restricted in any way. You are free to use curved structures, openings, pillars, bridges, thoroughfares etc.

Thin structures like walls, awnings and similar, must also be 3-dimentional bodies and cannot be comprised of a single face with a front- and backside.

The floor of buildings can be left open, for buildings that continue into the terrain (see below), so that the intersection of terrain and building forms a water tight body.

The building layer should contain your planned building and can include existing buildings / structures surrounding your project if you want to include their influence. This might - for example - be important if a high-rise building exists in vicinity of your planned project. For a fee we can include existing structures from OSM-data (Open Street Map) if these kind of data are available and of sufficient quality.

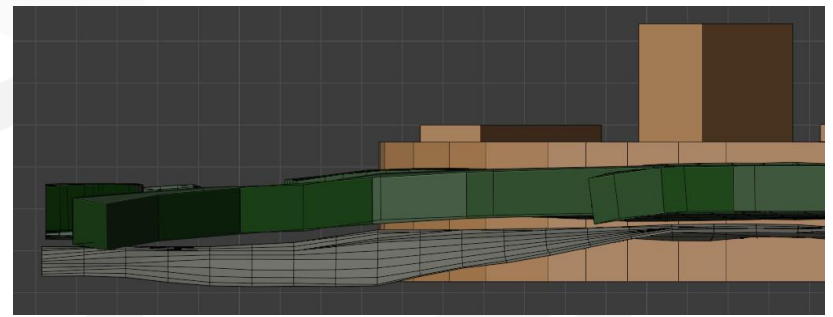


Terrain

Different than buildings, the terrain should be a single surface mesh, and not a 3-dimensional body. It should only consist of faces with a front- and backside.

Any structures that penetrate into the terrain will automatically intersect with the terrain for the simulation. It is not necessary to perform this intersection before. Usually the best approach is, to simply extrude your building downwards a couple of meters so that all walls completely intersect with the terrain.

Obviously the terrain should ideally include any earth movement that is planned. If no terrain is available we can provide a terrain from satellite data for a fee. In that case please make sure to include exact coordinates and a map, so that we can place your buildings correctly on the terrain. Also make sure that you let us know at which height your buildings will intersect with the terrain (e.g. highest point of roof is x meters above ground).

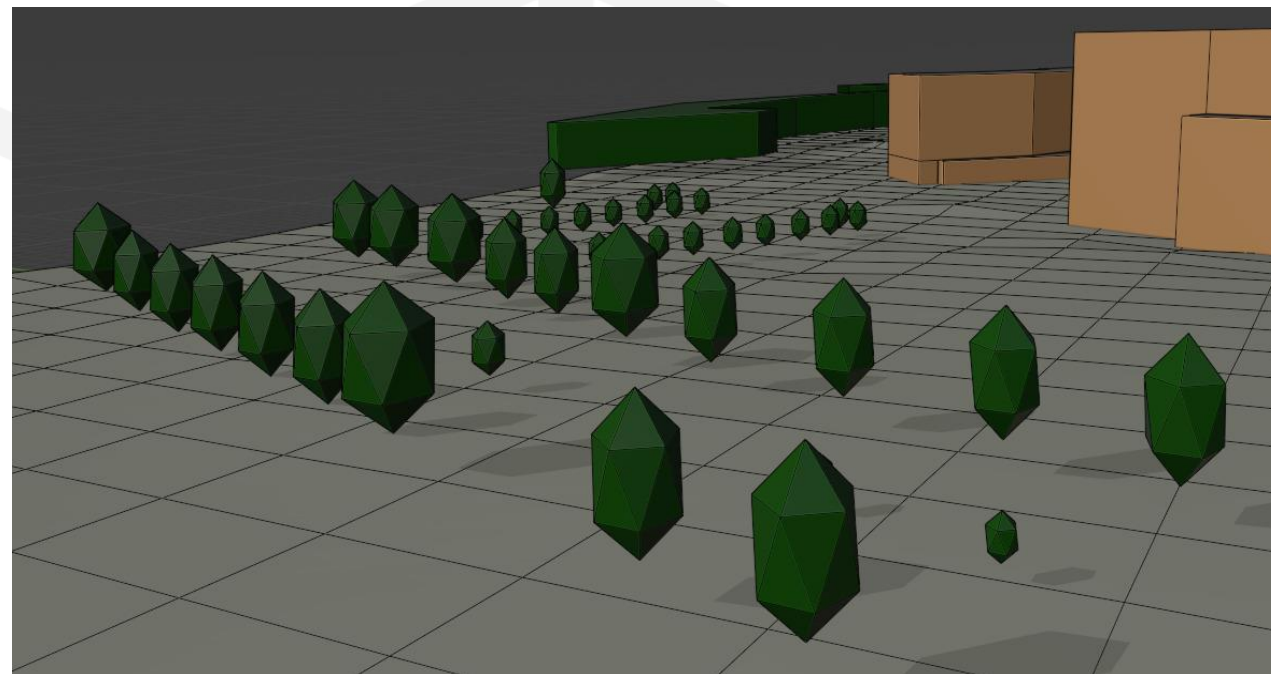
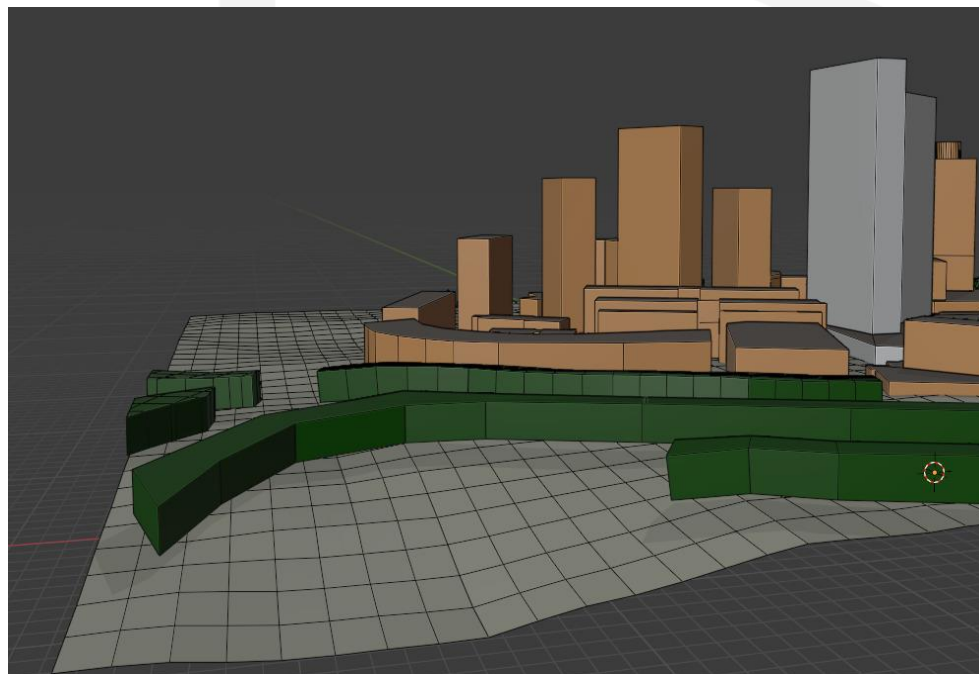


Trees

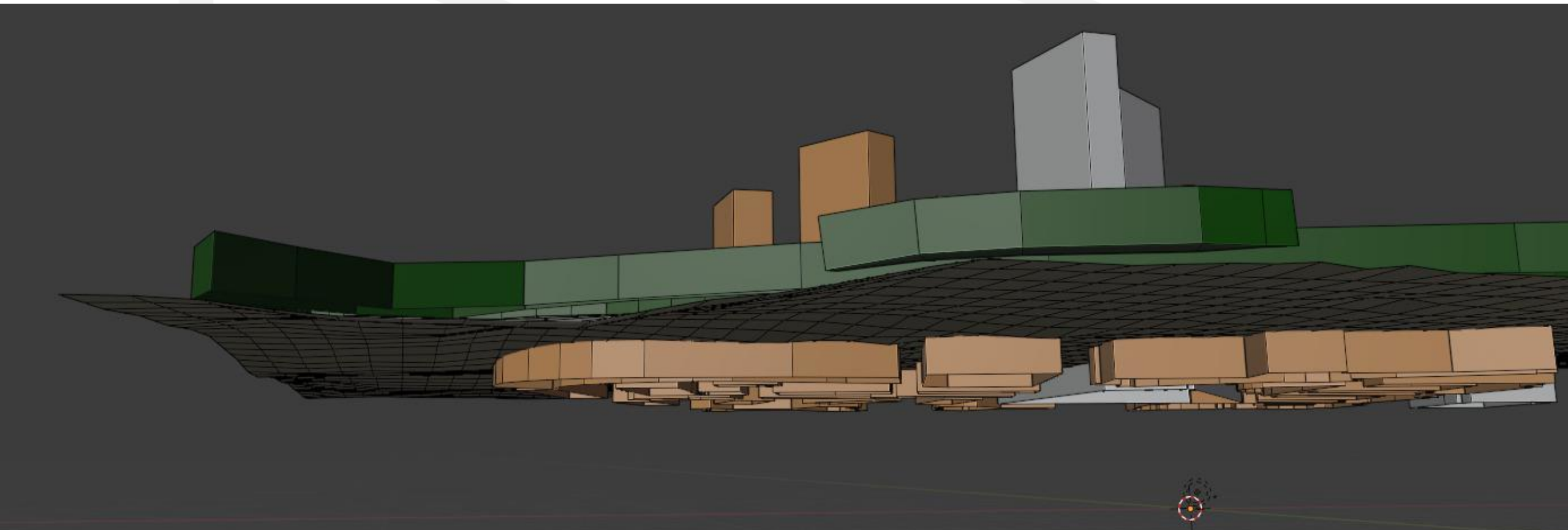
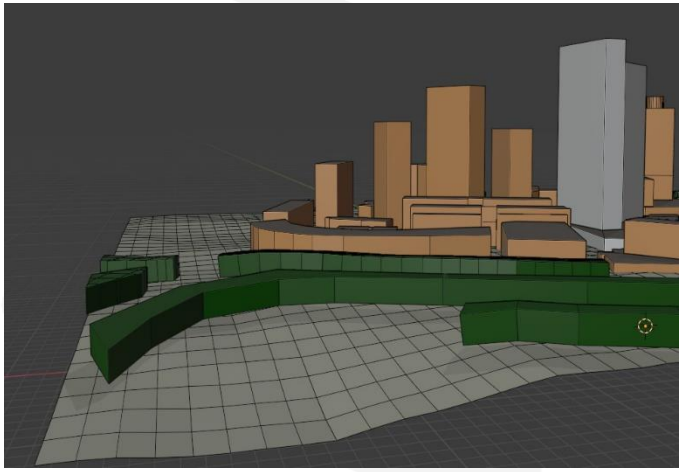
Similar to buildings, trees are represented as 3-dimensional structures. These can either be single trees or larger, forested areas. Trunks should not be included.

Unlike buildings tree structures have less strict requirements for being "water tight" as they are simulated as areas that can be penetrated by air and slow down its velocity. Obviously these structures usually do not intersect with the terrain.

The tree layer may be omitted.



The screenshot below shows a view from below the terrain. The terrain itself is a single body. Buildings intersect with the terrain, so that there are no gaps between buildings and terrain, while trees may have a gap between the leaved area and the terrain.



Contact

Rheologic GmbH
Liniengasse 40/12
1060 Vienna, Austria

E office@rheologic.net
T +43 699 8190 3236
W <https://rheologic.net>

VAT-ID: ATU 67986478
BIC: GIBAATWWXXX
IBAN: AT88 2011 1822 3513 9700
Company number: FN393458s

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