

3D real-time visualization and 3D printing model specifications

Viinikanlahti competition – The second phase

Dear Viinikanlahti competition participant,

The second phase evaluation will utilise both real-time 360 panoramic 3D model viewing and printed 3D models. Because of these special use cases, we must instruct the participating teams to produce a sufficiently accurate 3D model for this dual need. A typical rendering 3D model is far too detailed and heavy for this purpose and cannot, unfortunately, be accepted nor utilised here. Instead, a separately prepared simplified semantic model is needed. The good news is that this model is only visualized in a city scale. The closest viewing distance is 100 metres above the ground. No ground level views of the model will be used.

Contents and the level of details of the schematic model

The proposed design should contain all newly designed buildings and structures as well as all existing buildings and structures that will be preserved within the competition area. A complete (modified) terrain piece cut to the boundaries of the competition area must be included in the delivery. Do not include any underwater sections.

All geometry outside the competition area must be removed.

Small details should be removed from the model, including:

- Small visualization objects, such as people, vehicles, and minor vegetation
- Street furniture, such as benches, light fixtures, and fences
- The interior of buildings, including the interior parts of exterior wall 3D geometry
- Facade and balcony details, railings, perforations, etc.

The level of details of the proposed competition entry should be LOD2.0 – LOD2.2. (No roof colouring).

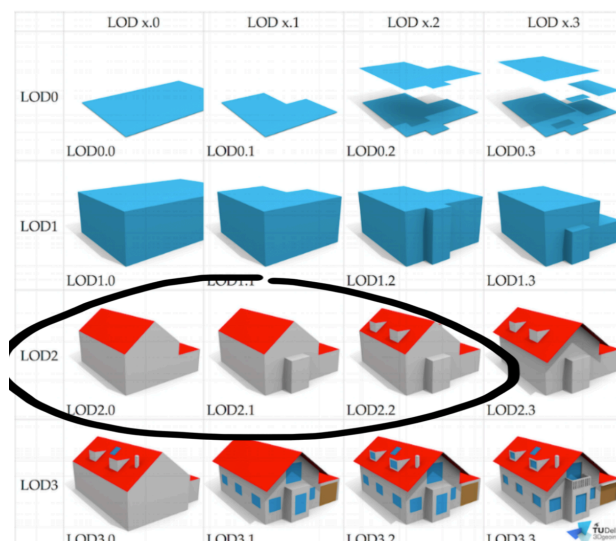


Image courtesy of TU Delft 2018

Semantic levels

Every object or part of the geometry should fall into one of the following categories:

Primary categories:

- Terrain area
 - A generic, not specified area of the land
- Building
 - The exterior of a proposed building

Optional categories may be used, but are not necessary:

- Transportation area
 - An area for public transportation or vehicles, not for pedestrians.
- Vegetation area
 - Parks, trees, and other green areas
- Pedestrian area
 - An area reserved principally for pedestrians, could be residentially used for some traffic
- Water area
 - Lakes and ponds
- City Structure
 - A special city structure, such as a retaining wall or bridge structures.

If optional categories are not used, all geometry must be included into one of the two primary categories.

Content specifics

Buildings must be modelled as schematic volumetric outer shell objects (“solids”) with very limited detailing.

A terrain model should be delivered and should only contain the competition area. The level of details of the terrain model geometry should be very low; the maximum triangle edge length is 1 metre. Existing terrain areas should be excluded from the model. If the proposal contains terrain areas that are to be preserved intact within the competition area, those surfaces should not be delivered.

Trees should be visualized as very simple models, indicating only the type of the tree (coniferous or broad-leaved). The height of the tree model should match trees that are 8 years old. The tree geometry should only visualize the maximum tree canopy and a very simple stem. Branches or multiple stems are not to be modelled. Please note that bitmap textures must not be used.

The lake water elevation (Z-axis) should match the source data; the elevation is 77.6 metres, which is the mean of the highest and lowest water levels described in the infrastructure appendix of the competition programme.

Geometry type

The model geometry type used should be triangulated mesh. Solid geometries and surfaces or NURBS must be triangulated before delivery.

The total triangle count of the whole model should optimally be less than 500,000 triangles. Up to 1 million polygon models can be delivered.

Excessively heavy models will be simplified automatically by Tietoa, for which reason it is preferable that the contestants create an optimal model themselves. Automatic simplification may erase some fine details.

Water surfaces must be planar.

Colours and materials

The only visual cues allowed in the model are diffuse colours.

Pre-defined materials should be used, following the diffuse colours of RGB accurately:

- Building masses: 175,175,175
- Terrain: 150,120,80
- Water: 0,0,255
- Glass: 240,240,240
- Vegetation surfaces: 40,80,10
- Pedestrian areas: 100,50,50
- Traffic areas: 20,20,20

All other colour values will be represented as 50% grey (128,128,128).

Tietoa will unify the models submitted by the contestants in the second phase.

The colour unification process is as follows: all object materials are set to 50% grey. Pre-defined colours found in the model are set and the model is visualized. **Do not use customised colours or materials, as they will all be represented as 50% grey.**

Bitmap textures are not supported. Shaders and customised materials are not supported.

Coordinate system and units

A local coordinate system must be used as described in CAD package 2.

The model should match the source data provided. The unit is metre.

The positive Y-axis points to the north and the positive X-axis points to the east. The Z-axis represents elevation.

The format and name of the delivery file

The primary 3D-object format to be used is .OBJ with an accompanying .MTL file.

https://en.wikipedia.org/wiki/Wavefront_.obj_file

Alternatively, the FBX format can be used.

Formats that are **not** supported are: IFC, DWG, DGN, RVT, PLN, PLA, SKP, NWD, XYZ, LAS, LAZ, TIN, TIFF, JPG, PNG, BMP, and GIF.

The model has to be in one file (sidecar files like .MTL and .OBJ are ok).

Quality assurance of the model before delivery

Contestants should preview their models outside the design software environment early on during the process and perform at least a very basic level quality assurance before delivery.

Triangular meshes can be created and visualized in many free software packages including Blender and CloudCompare. Online tools such as <http://3dviewer.net/> can also be used.

As part of quality assurance, please check the following;

- That the orientation, scale, and transformation of the model match the source data
- That the water level matches the source data
- That the colour values match the pre-set values and no additional colours or materials are used
- That buildings are located on a land area
- That there are no overlapping triangles.

Example preview pipeline

A ready-to-use quality assurance pipeline is provided. Components include:

- CloudCompare software for windows, <https://www.cloudcompare.org/>
- A source model scene that the proposed model must match.

The use is straightforward; open the provided .BIN file in CloudCompare, then import your proposed design as an OBJ-model (with an .MTL sidecar file), and check if the orientation, scale, and transformation match.

Model preview

Contestants can upload a version of their model for test publishing preferably weeks before the deadline. In this process, Tietoa checks the model for any technical issues and proposes measures to fix any problems observed. To deliver a test model, please use the Submit feature on the competition website and include a text file containing your email address.