

SHELL MODEL REPRESENTATION AS AN ADDITIONAL LOD FOR 3D MODELING IN CITYGML

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CityGML defines a standard for ontology of buildings at LoDs. Its description comprises a categorization from LoD1 to LoD4, ranging from the coarsest block model to individual buildings with all their architectural details and interiors, stairs and furniture. However, It means the leap from LoD3 to LoD2 is too much and there should be at least some LoDs between them, so that a gentle transition along the scale space can be reached with respect to the visual impression of users. In this work, a new LoD is introduced as shell model which is exterior shell of LoD3 model, and the opening objects like windows, doors as well as smaller façade objects are projected onto walls. This paper presents an algorithm for extracting shell models of 3D buildings from the LoD3 buildings modeled by CityGML. Experiments show that shell model can reduce up to 90% storage of the original LoD3 model. Furthermore, a small user test was conducted for the representation of shell models against their original models. It shows that shell model can give user almost the same visual impression as the LoD3 model.

The algorithms for extracting SLoD3 from LoD3 models have been implemented using Matlab (version Matlab 7.4). The platform is a PC with Intel(R) Core(TM)2 Duo CPU, E8400 @ 3.00GHz, 2.00GB RAM, and Microsoft Windows 7 Professional x86 (32bit). The program has been tested on a number of 3D buildings modeled in LoD3 by CityGML. The average computing time is about 0.04 seconds for a single building.

Depending on how complexly a building is constructed, the required storage of CityGML file can be reduced to 20% of the original storage. But they give users the similar visual impression. In the following, three buildings modeled by LoD3 in CityGML are listed together with their shell models (Figure 1).

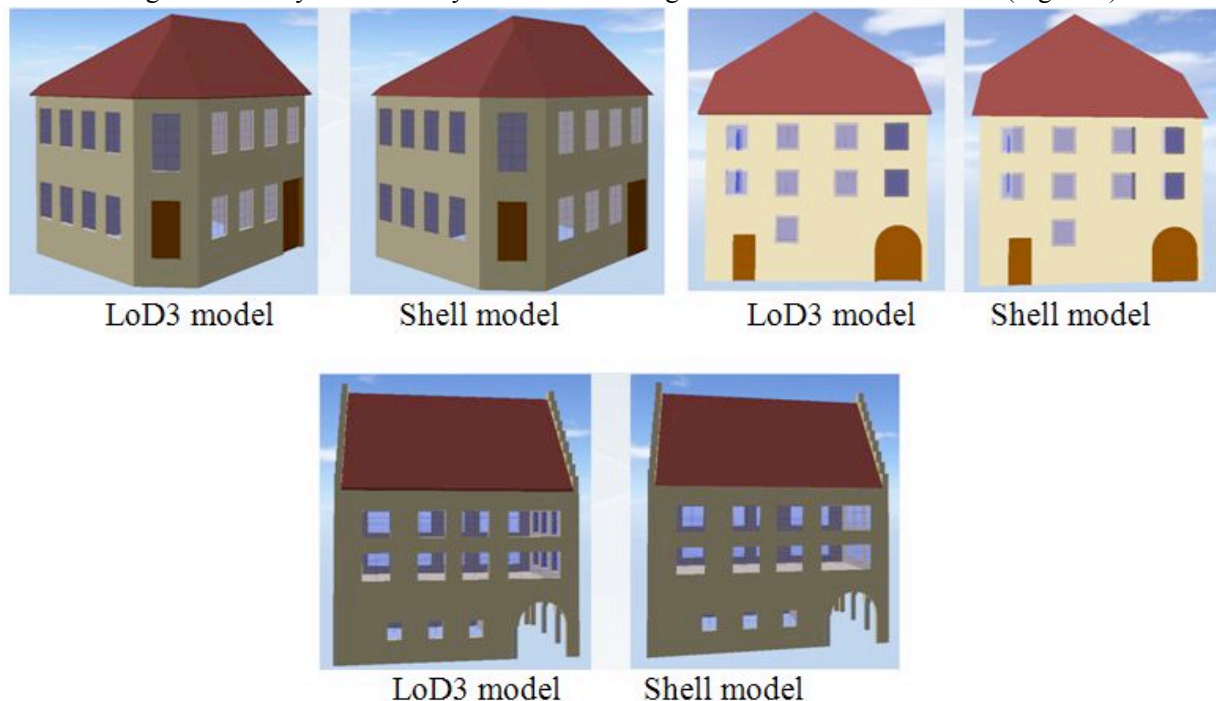


Fig.1. three example buildings modeled by LoD3 in CityGML with their shell models

In order to verify the abovementioned argument, a small user survey has been conducted at the Technical University of Munich, which will be described in the next section.

The user test is focused on the analysis of visual similarity between LoD3 models and SLoD3 models. The above listed three pairs of shell models and their original models are used in the user test.

The user survey was conducted in October, 2010, at Technical University of Munich in Germany. The participants are 15 master students with the age range from 22 to 28. The background of all of the participants is geodesy and geoinformatics.

The results showed that: (i) more than 60 percents of participants found that the SLoD3 façades are very similar (>90% of similarity) to the LOD3 facades with respect to the visual impression, and (ii) more than 90 percents of participants found that the SLoD3 facades are similar (>80% of similarity) to the LoD3 facades with respect to the visual impression. That means SLoD3 buildings can give user very similar visual impression in comparison to the LoD3 buildings.