Output factsheet: Tools

Version 1

Project index number and acronym	CE906 BOOSTEE-CE
Lead partner	Fondazione Bruno Kessler (FBK)
Output number and title	O.T1.2 – Advanced 3D building models
Responsible partner (PP name and number)	FBK-PP1, EZVD-PP2, EUWT-PP12
Project website	http://www.interreg-central.eu/Content.Node/BOOSTEE-CE.html
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Summary description of the key features of the tool (developed and/or implemented)

The developed methodology creates 3D geometries of building (i.e. 3D building models) starting from the available data collected by project partners, harmonized and structured in geospatial databases. The proposed method was developed considering the availability of geospatial data in the project's pilot areas (PA). These include building footprints with attributes and LiDAR point clouds, two types of data not always accessible in small municipalities. Starting from these data, two methods have been adopted and upscaled in order to create the 3D building models necessary for the future activities of the project. The 3D reconstruction method relies on the available geodata:

1. Building footprint with attribute information: the shp files of the PA's topographic maps contain locations and shapes of buildings. Each building (or group of buildings) is characterize by a polygon (its footprint) enriched with a table of information (attributes). Among this information, we could find evidences of the building height or number of floors. Hence using extruding functions, a building model can be generated. These 3D geometric entities keep the attributes and, in a dedicated viewer, can be queried to retrieve information.
2. LiDAR point clouds with building footprints: the 3D point clouds feature a variable density of points, going from few per square meter to some dozen points per square meter. The point clouds describe quite decently the shape of the buildings and their roofs. In case of low-density clouds (few points/sqm), a geometric intersection of the point cloud with the available footprints allows to derive the highest point in the identified part of the cloud and extrude the footprint up to such height value. In case of denser clouds, after the intersection to separate the building of interest, geometric primitives are fitted onto the cloud to generate the 3D shapes.

The generated 3D building models (more than 300 in all Pas) are used for visualization and query purposes (e.g. retrieve energy audit certificate, display energy consumptions or flows, etc.) as well as for urban planning, noise propagation/pollution, dynamic lighting, photovoltaic (PV) potential estimation, etc. Any specific application requires a particular geometric model otherwise the estimation / computation / analysis is not correct.

NUTS region(s) where the tool has been developed and/or implemented (relevant NUTS level)

The generated 3D building models are related to the 8 pilot areas of the BOOSTEE-CE project, namely:

- Emilia-Romagna Region (Italy – NUTS region ITH5), with a focus on the city of Bologna;
- Judenburg (Austria - NUTS region AT22);
- Zlin (Czech Republic - NUTS region CZ07), with a focus on Kromeriz and Holesov municipalities;
- Tolna (Hungary - NUTS region HU23);
- Plonsk (Poland - NUTS region PL12);
- Koprivnica (Croatia - NUTS region HR04);
- Velenje (Slovenia - NUTS region SI01);
- the CZ-PL cross-border region (Poland - NUTS region PL51 and Czech Republic - NUTS CZ05), with a focus on Zacler (CZ) and Lubawka (PL) municipalities.

Expected impact and benefits of the tool for the concerned territories and target groups

The methodology and provided results are unique for the considered territories. Local stakeholders, target groups and policy makers can use the 3D results for other applications, such as noise propagation/pollution, calculation of photovoltaic potential of building roofs, display energy consumptions or flows, urban planning, dynamic lighting simulation, photovoltaic (PV) potential estimation, etc. The available data could be used to improve the actual/traditional planning/management and start advance/modern methods towards energy efficient cities.

Sustainability of the tool and its transferability to other territories and stakeholders

The proposed method relies on available geospatial data. The method is transferable and replicable in other locations given the existence of necessary data to generate the 3D building geometries. The 3D reconstruction pipeline is based on open tools, therefore it could be managed without proprietary software. The quality of the 3D geometries depends on the quality / resolution of the data. Nevertheless even 3D buildings produced only from footprints are suitable for many smart city applications.

Lessons learned from the development/implementation process of the tool and added value of transnational cooperation

The generation of 3D building models relies on particular geospatial data, such as building footprints (with attributes), LiDAR point clouds, etc. The procedure can’t produce 3D geometries without this data, which could be hardly attenable (or are out-of-date) in small municipalities. The transnational cooperation of BOOSTEE-CE allowed partners to understand how and where geospatial data could be found or obtained and how useful they are for better management and planning of urban activities.

References to relevant deliverables and web-links. If applicable, pictures or images to be provided as annex

The developed methodology for generating 3D building models from available geospatial data and the achieved results are presented in deliverables D.T1.2.2 and D.T1.2.3, respectively.
The outcomes of the methodology (i.e. 3D building models) are visible online in the project web viewer named OnePlace (https://oneplace.max.si/), in particular in its module called 3DEMS (described in deliverable D.T2.2.1).
In the annex, we report pictures of some generated 3D building models in some project pilot areas (fig. 1 – Zacler (Czech Republic), fig.2 – Lubawka (Poland), fig. 3 – Tolna (Hungary). Please note that those 3D buildings, when visualized and access thru OnePlace, will be queryable in order to retrieve heterogeneous information (e.g. building dimensions, functions, location, type of energy, etc.) stored in dedicated databases.