



**Presented at the FIG Congress 2018,
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3D CITY MODELS FOR LAND ADMINISTRATION IN TURKEY



Base Map Production in GDLRC

In order to complete rural **cadastre**, **1/5000** scaled **base map production** has been carried out for **480.000 km²** area after **1955** by **photogrammetric method** ...

Digital Orthophoto production has been started after **2007** for cadastral renovation and update works for the purposes of decision-support, quality control and establishing legal basis ...



Need for Oblique Photogrammetry Technology

- Orthophotos are essential information source particularly for decision-making mechanisms
- From orthophotos, just 2D information can be obtained. Also additional information from different angles can be required such as structure of building facade, land use etc.
- In order to meet this requirement, Oblique Photogrammetry Technology has been developed.
- The use of orthophotos and 3D city models obtained by oblique photogrammetry can provide more effective execution of land administration functions for Sustainable Land Administration.

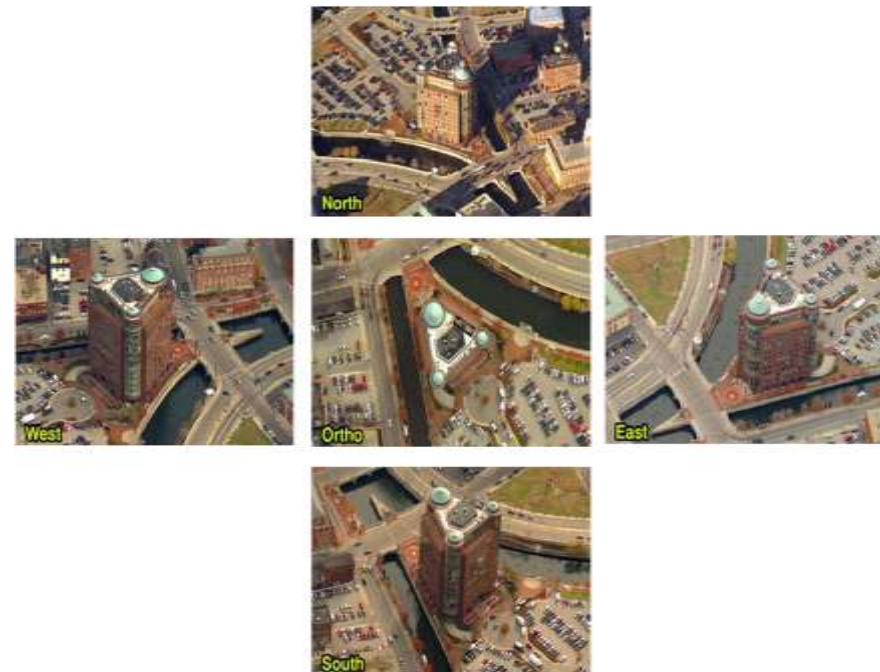
Oblique Photogrammetry for 3D Models

- **Oblique Photogrammetry** is a photogrammetric method, which combines conventional nadir images together with oblique images to build 3D city models with texture data obtained from oblique images.

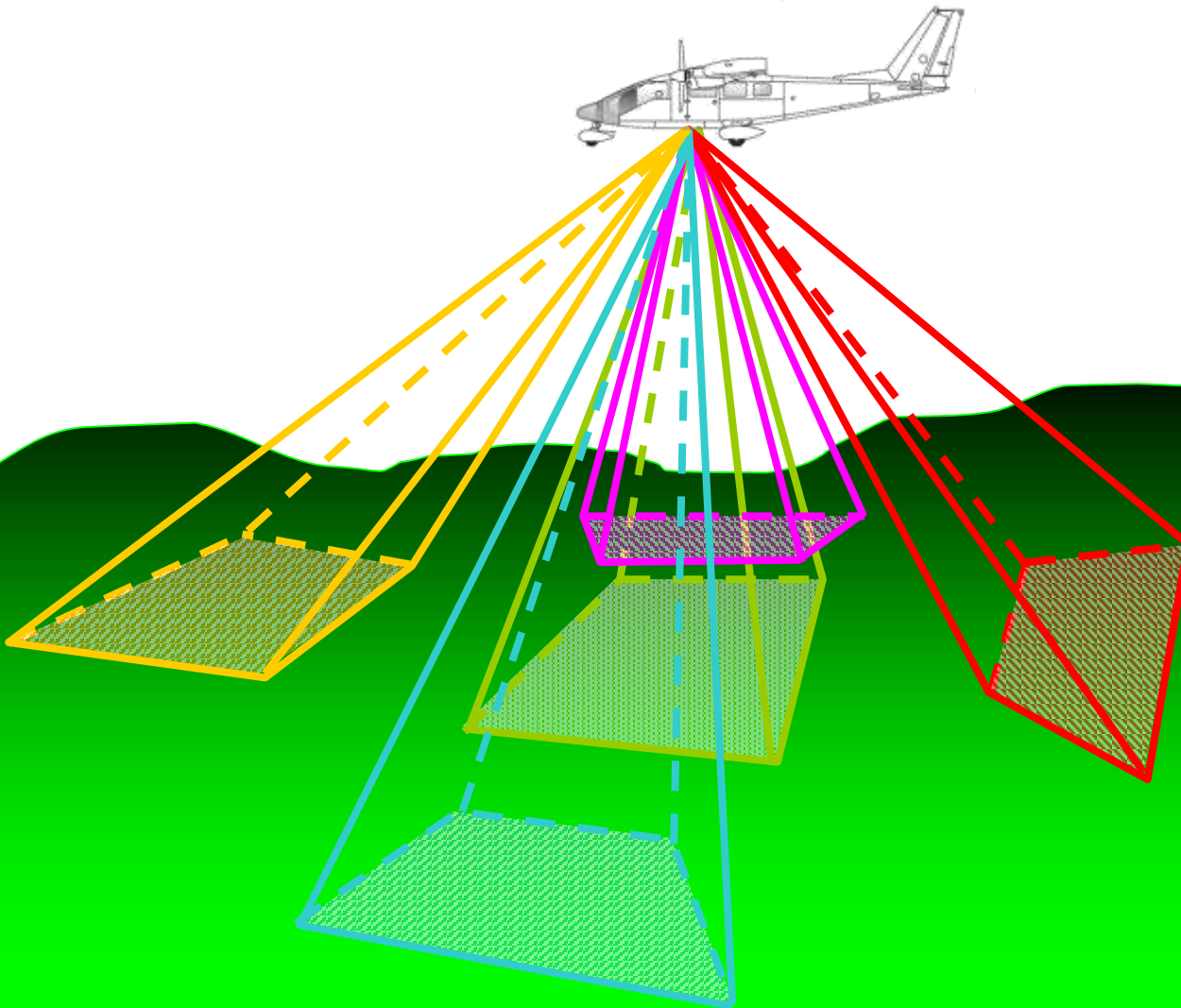


Oblique Aerial Images and Produce 3D City Models

Oblique views are taken from the air by camera systems that are formed by a vertical camera in the middle and oblique cameras placed at approximately $40^\circ - 45^\circ$ north, south, east and west directions. With a five-camera system, a minimum of 12 and a maximum of 36 images per point are provided. The average flight height is 1000 m, vertical images have a resolution of 8-10 cm and oblique images have a resolution of 10-15 cm.



Simultaneous Images



The Aim of 3D City Model Project

Purpose of the project: To produce high-resolution three-dimensional (3D) city models and orthophoto maps, from oblique aerial images in urban areas by the General Directorate of Land Registry and Cadastre.

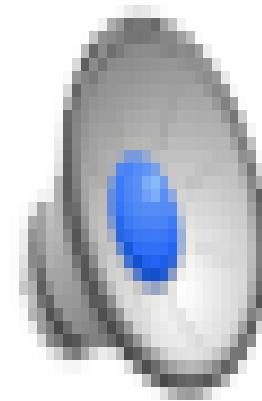
To create a base for the geographical projects of public institutions and organizations with 3D City Models produced.

Applications of 3D City Model Project



3D Cadastre

- 3D Cadastre
 - registers and gives insight into rights and restrictions not only on parcels but also on 3D property units
- 3D GIS
 - acquisition of 3D data and creation of objects
 - visualization and navigation in 3D environment
 - 3D analyzing and editing



Property Valuation

- Accurate measurements of distances, heights and areas
- Real building facades



Urban Development Planning

- Realistic 3D city models obtained with texturing oblique data are used as an effective tool for 3D planning projects and provide convenience in urban planning.



By Using Products of *Oblique Photogrammetry* together with Orthophotos;

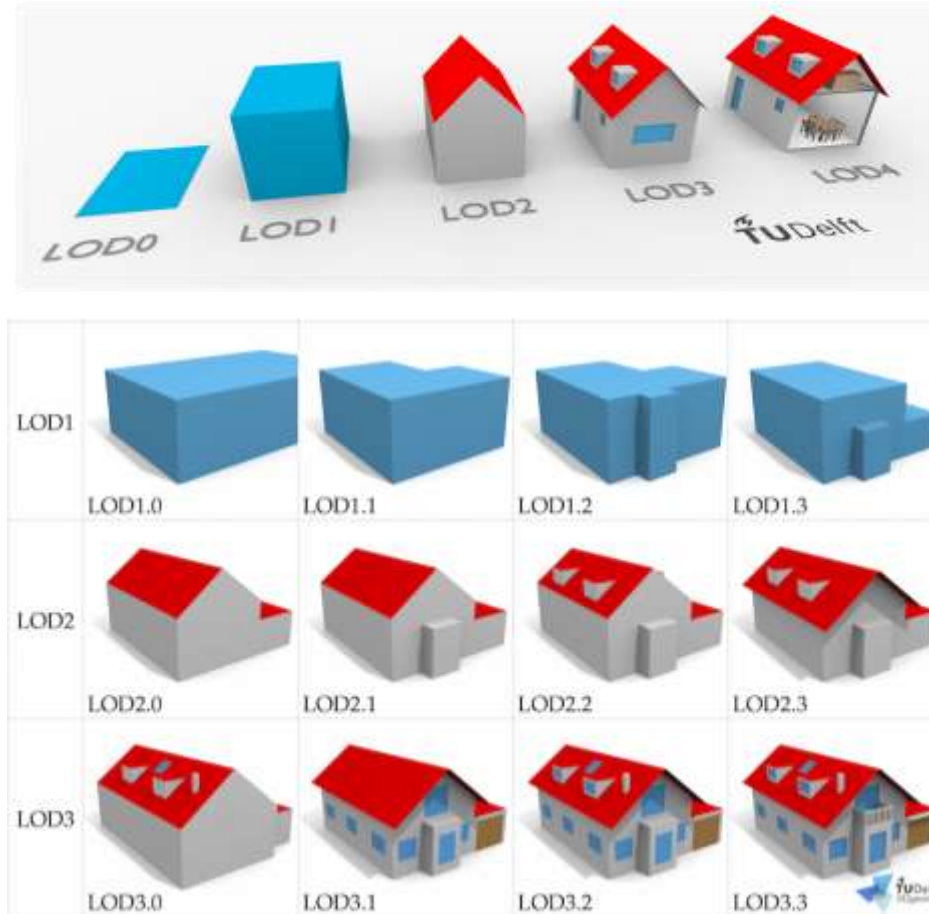
- Imaging all sides of structures
- Performing accurate measurements
- Exposing blind spots
- Determining objects that are hard to see in orthophotos such as lamp posts, telephone poles etc.
- Visualising 3D GIS data

can be achieved.

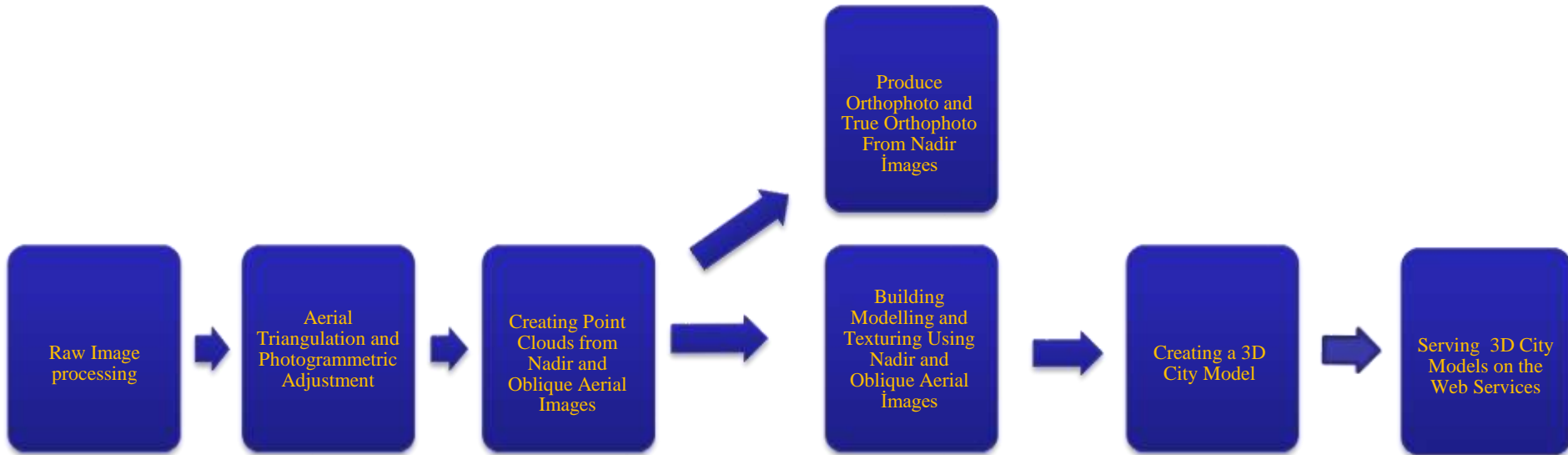
Oblique Aerial Images and Produce 3D City Models

3D City models, produced using nadir and oblique aerial images in urban areas; are three-dimensional models in which the surface of the land and the details of the structure such as the building, vegetation cover, infrastructure and city furniture are displayed as coordinated,

The standards for 3D city models are created by the **OGC (Open Geospatial Consortium)** as part of the **CityGML (City Geographical Markup Language)** modeling language.



3D City Model Production Stages

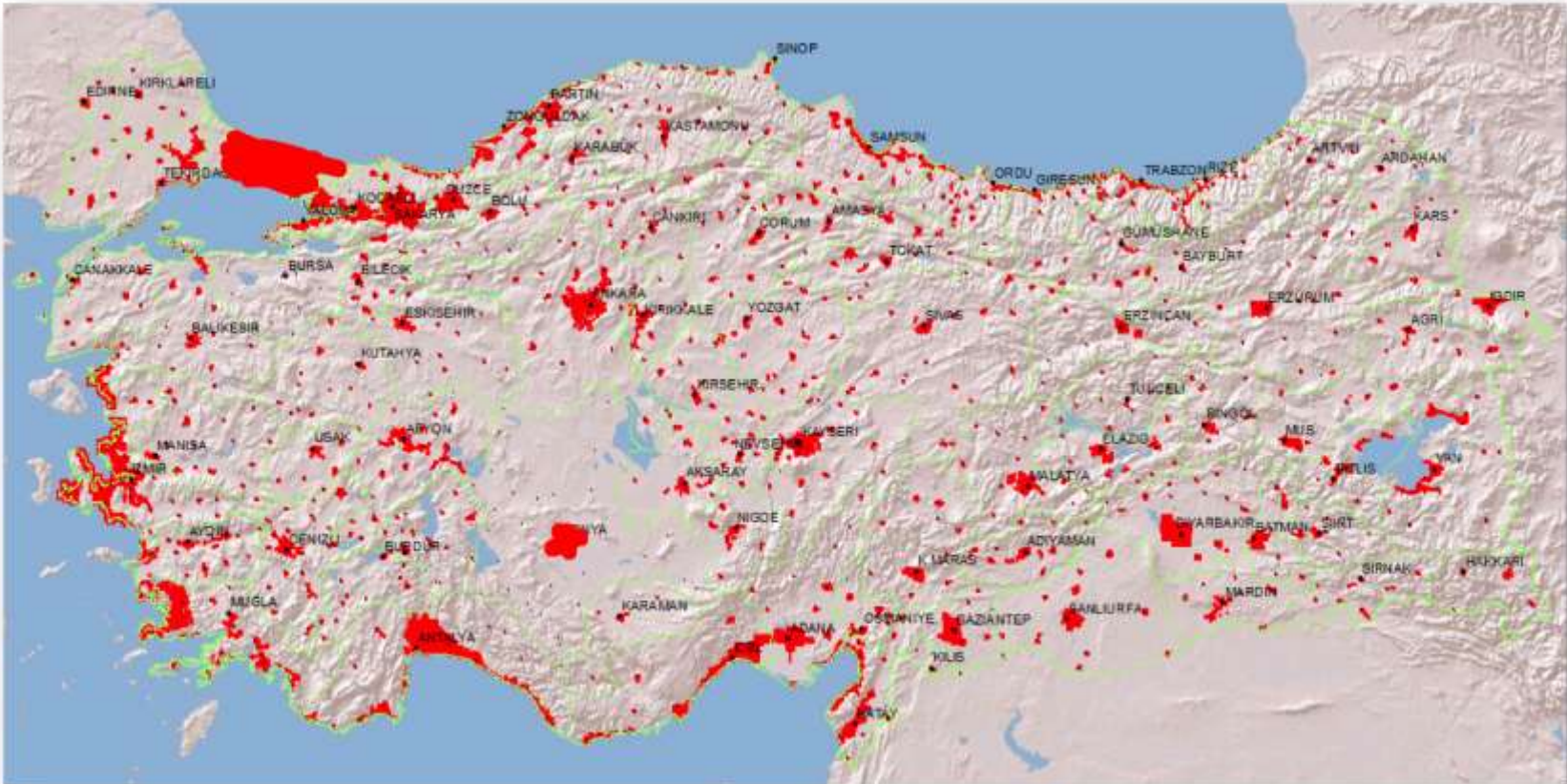


3D City Model Production Project by GDLRC



3D City Model Production Project

Our aim as an institution is to finish 3D city models of 40.000 km² urban area in 4 years at LOD2.2.



3D City Model Production Project

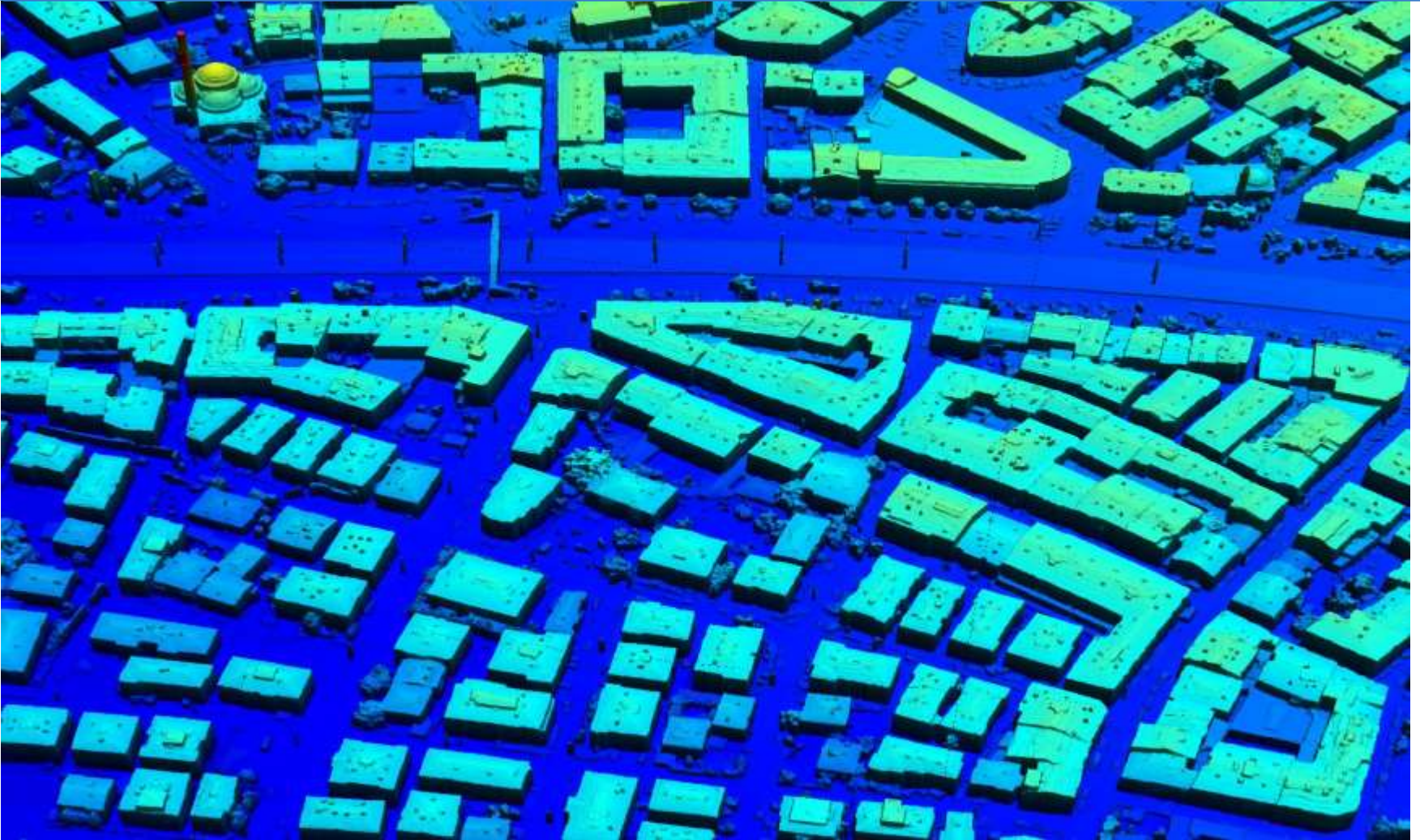
In project scope;

- Required software and hardware were provided,
- Staff training was completed,
- Flight was made to a pilot area of 50 km²,
- Orthophotos, Point clouds, mesh models, digital surface, model and digital terrain model were produced,
- 3D building models were created and textured ,
- Serving of the 3D buildings models have been started via WMS,
- Works on the integration of the 3D city model with land registry and cadastral information have been started.

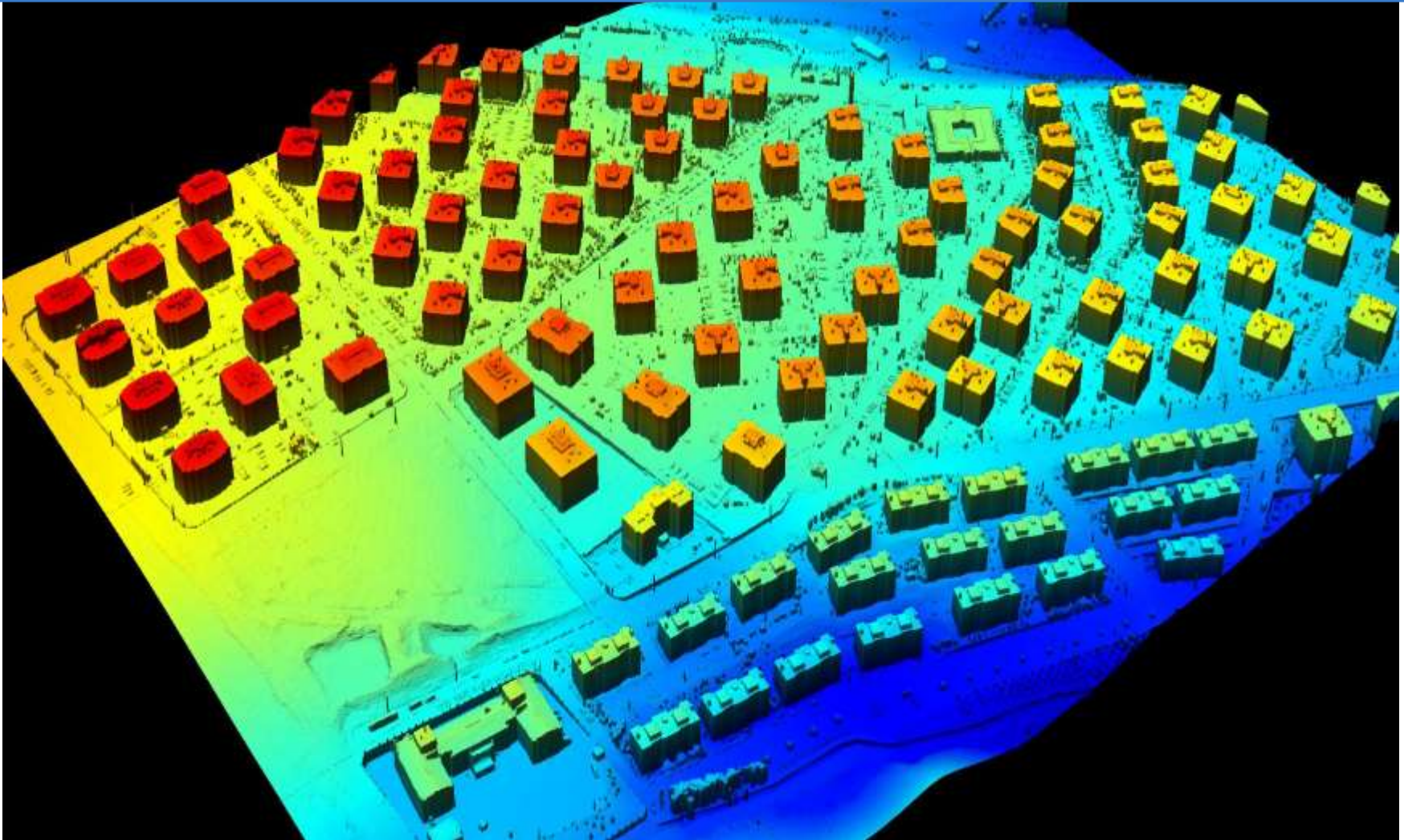
3D City Model Production Project



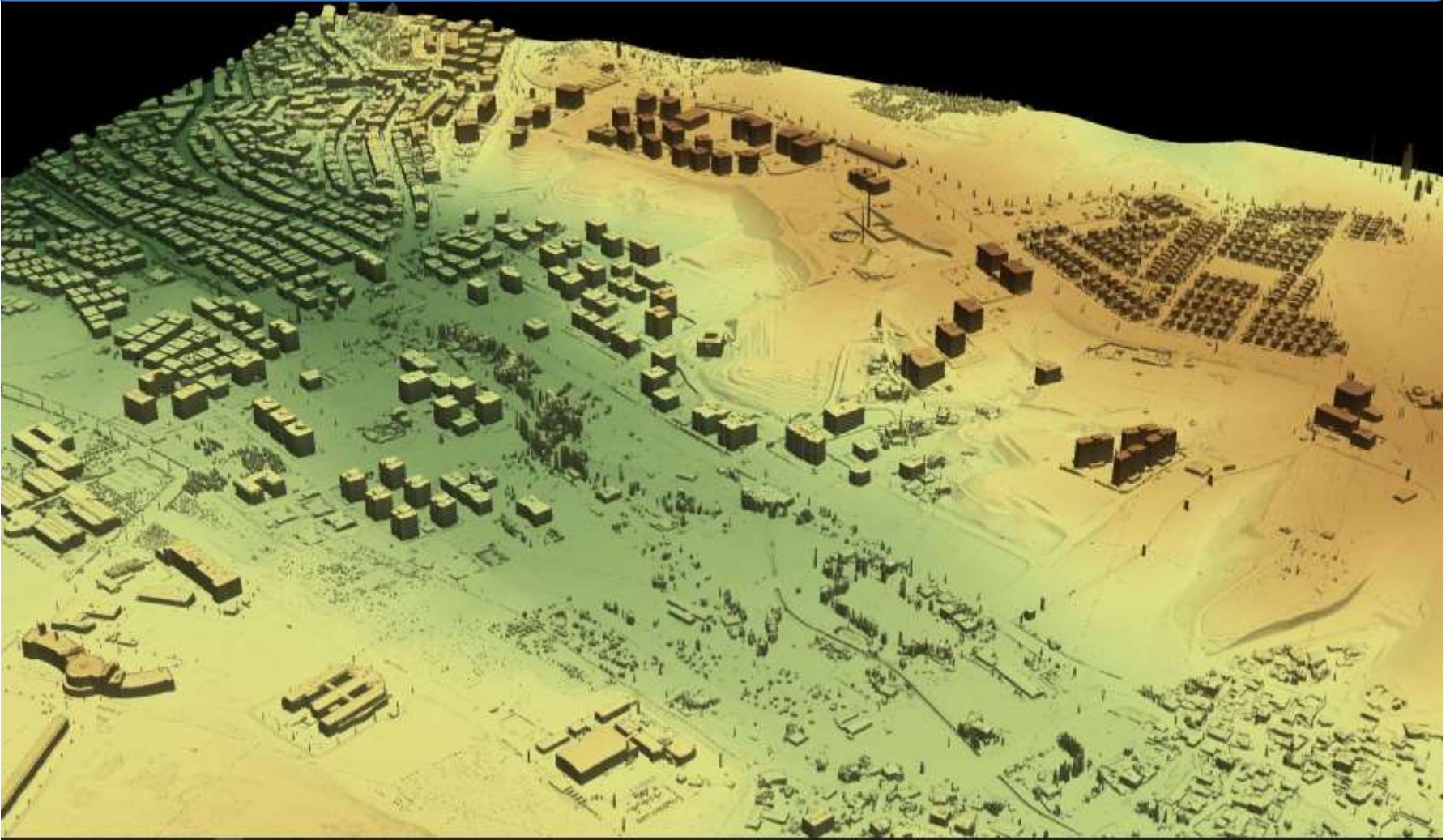
3D City Model Production Project



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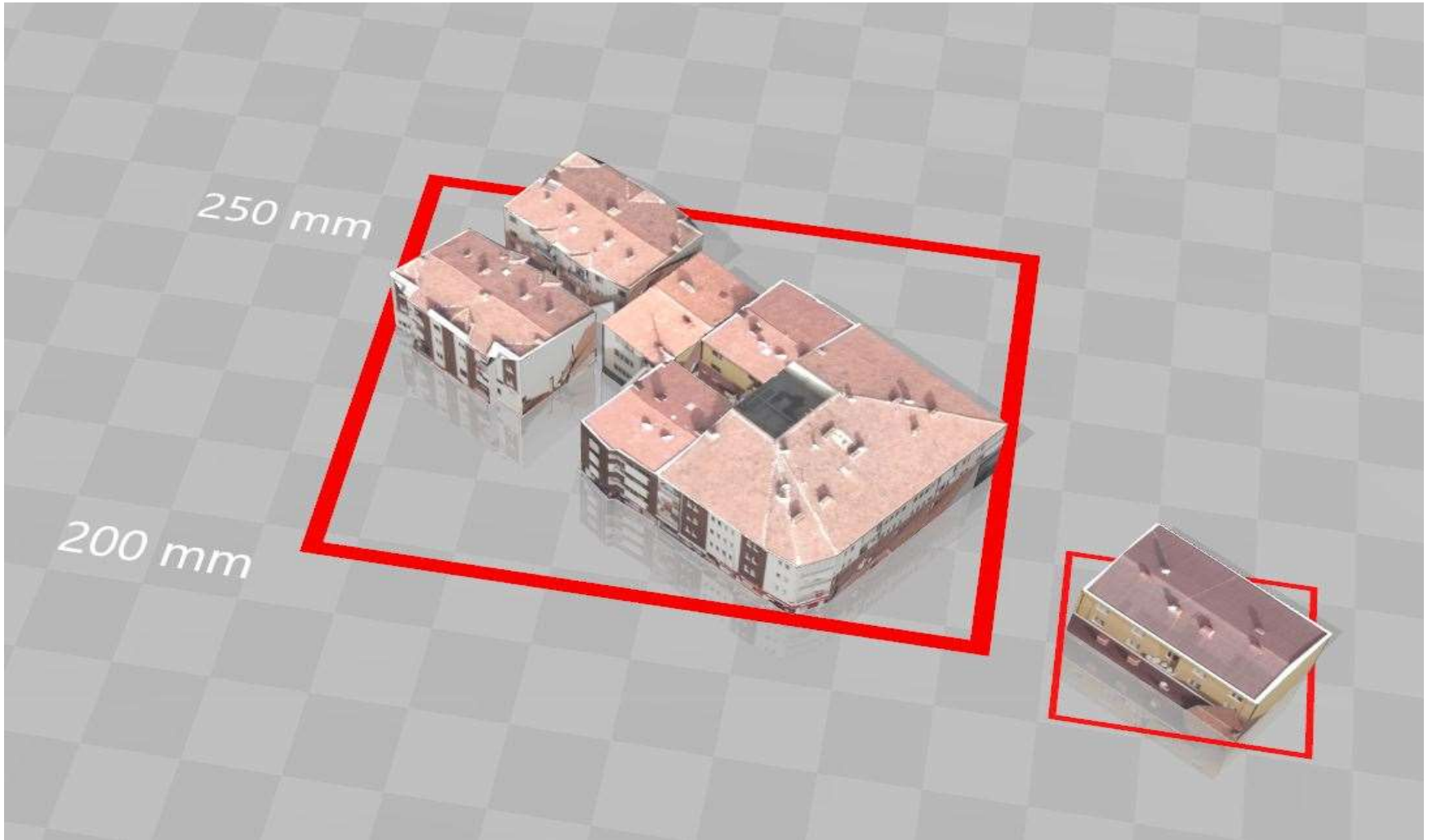
3D City Model Production Project



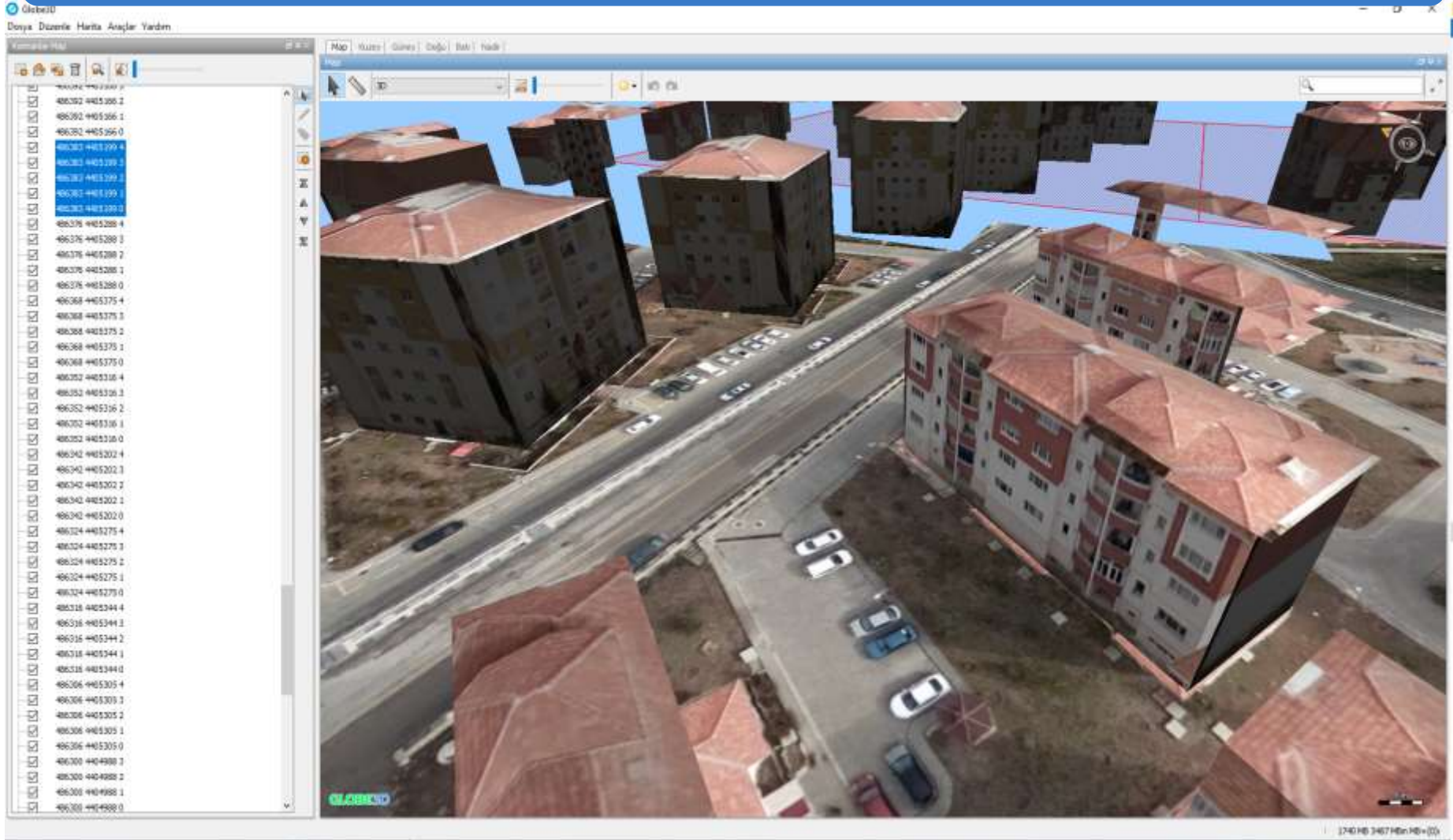
3D City Model Production Project



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3D City Model Production Project



Colored Oblique Image in 1965 by GDLRC





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THANK YOU ...