Photogrammetric technologies for creation of 3D geospatial base of Digital Reality

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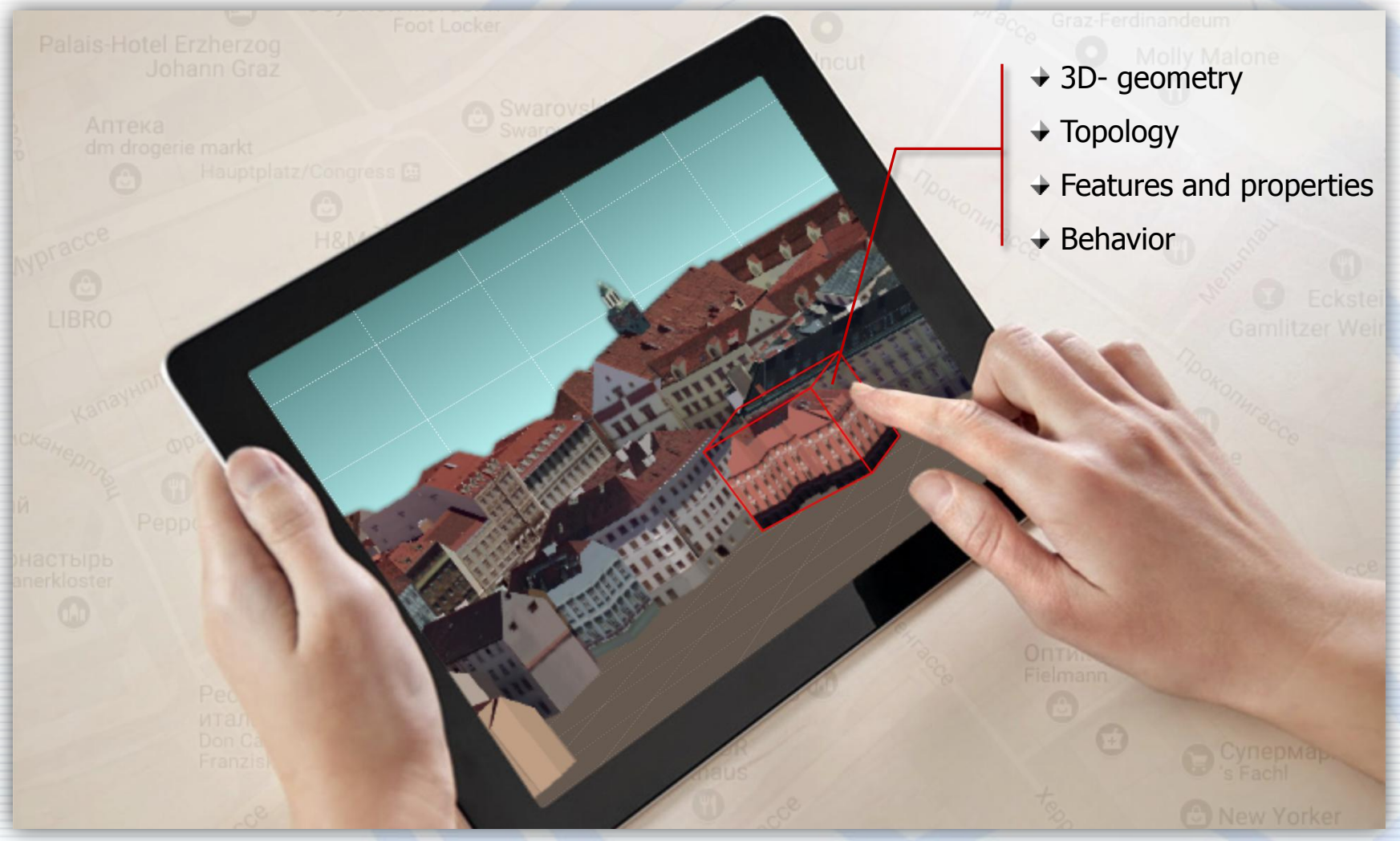
- 4Th Industrial Revolution and 3D world
- 3D models characteristics
- Photogrammetric technologies of 3D models creation
- Data sources
- Dense point clouds
- 3D vector models
- Automation and productivity
- Applications

Digital reality

3D geospatial base of Digital Reality



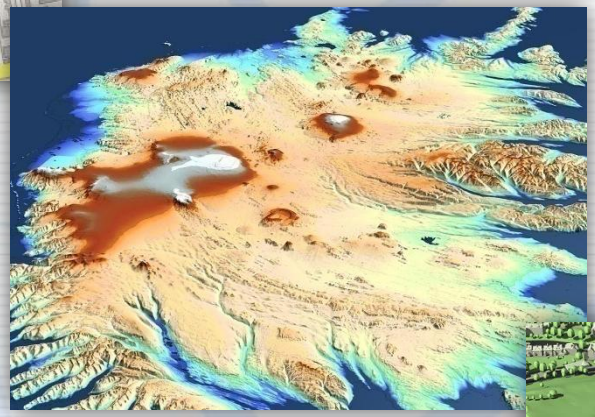
We live in three dimensions

2-dimensional representation

3D landscape advantages :

- Geometric quality and accuracy of data
- Plausibility
- Completeness
- Up-to-date data
- High automation level

2.5-dimensional representation



3-dimensional representation

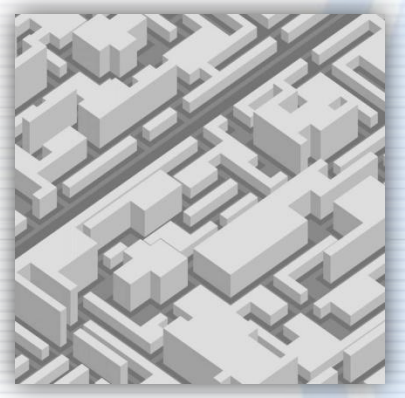
3D models advantages :

- Accurate photorealism
- Rich, real-time, comprehensive visibility
- Advanced analysis

3D georeferenced models types

Levels of details

LOD 1

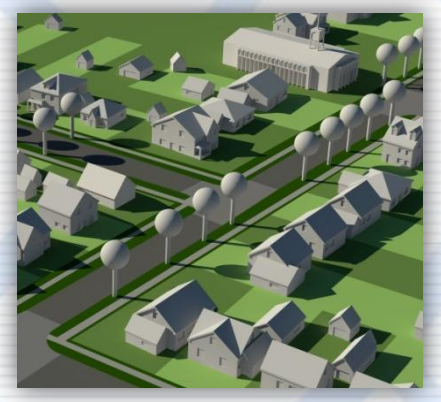


Buildings represented by block models

LOD 2

Building models with standard roof structures

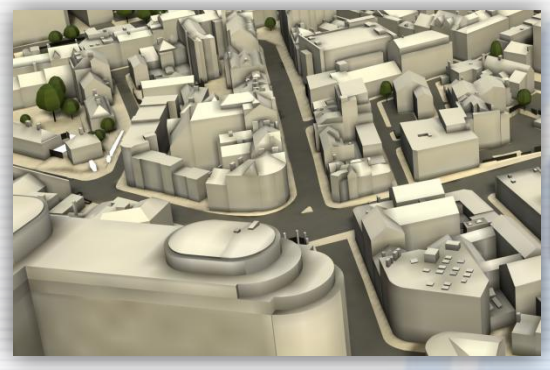
LOD 3

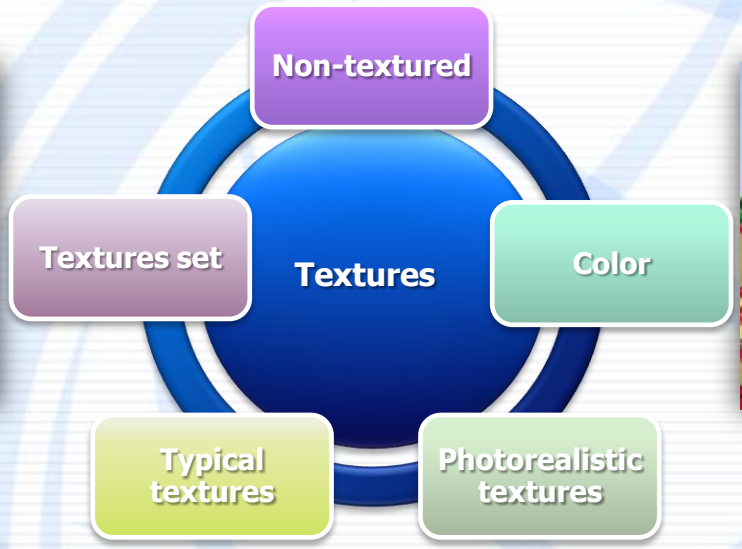


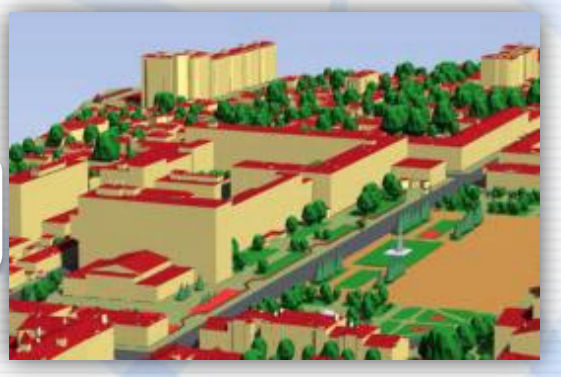
Detailed (architectural) building models

3D georeferenced models

Textured and non-textured models







Technologies

3D georeferenced models

2D to 3D Model Extrusion

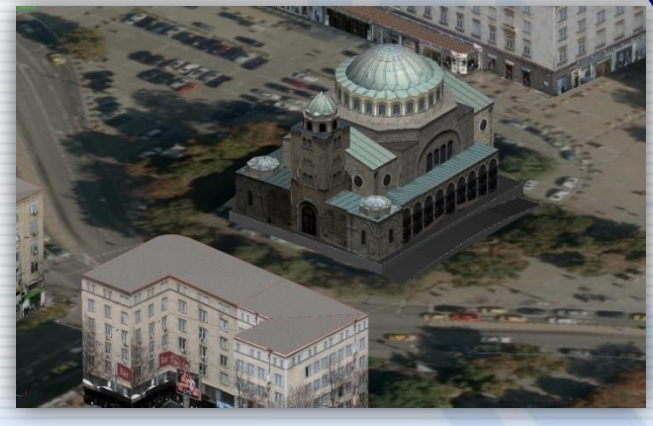
LOD 1

3D models from 3D Laser Scanning

LOD 3-4

Photogrammetric technologies

LOD 1-4

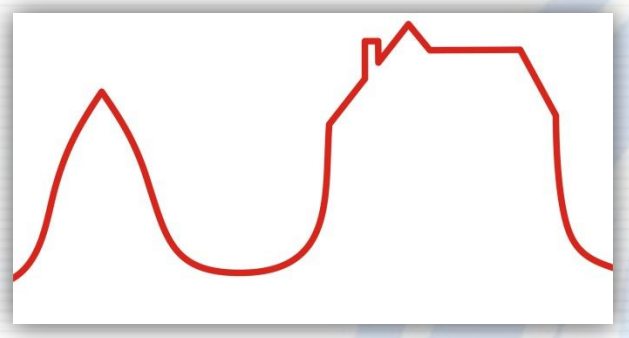


Architectural 3D modelling

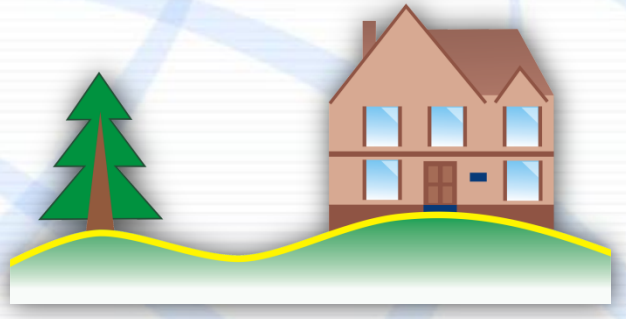
LOD 1-4

3D georeferenced models types

Continuous surface models (points clouds, DSM)



Object-oriented ("separated") models (DTM / DSM + vector objects)



Generation technology

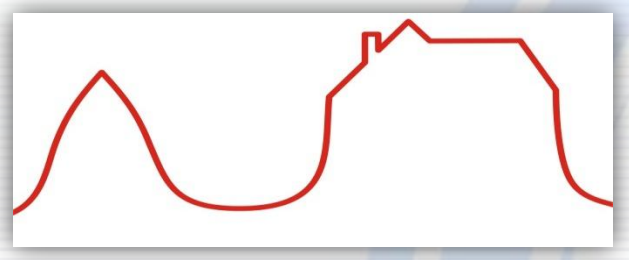
- Full automation
- Semi-automatic or manual generation

Application areas

- Telecommunication engineering
- Disaster management
- Landscape visualization
- Military applications
- Noise, pollution and visibility analysis
- 3D GIS + databases
- Smart city and road planning
- Territory management
- Municipal improvements and landscaping
- 3D cadastres

Types of models compare

Continuous surface models (points clouds, DSM)



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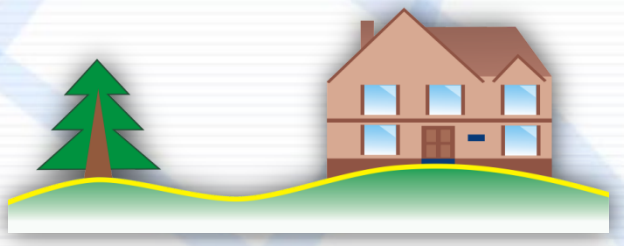
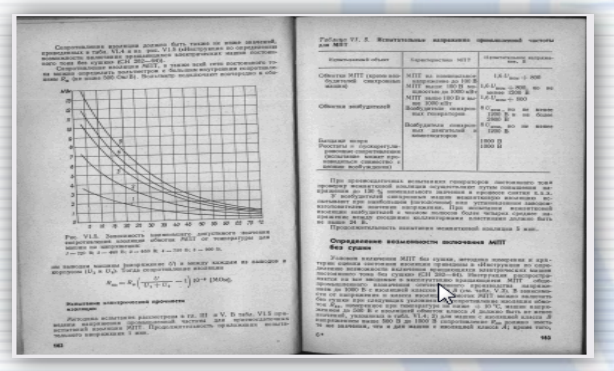
Object-oriented (“separated”) models (DTM / DSM + vector objects)

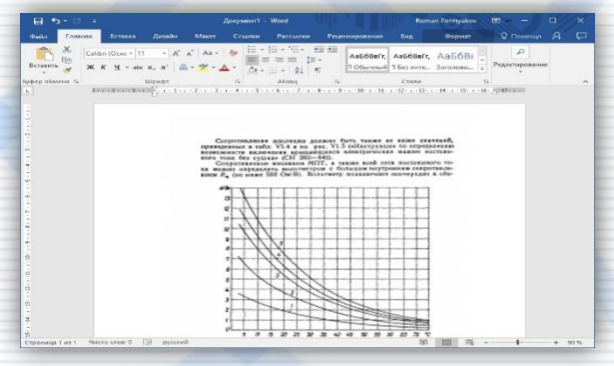


Scanned text



Optical character recognition

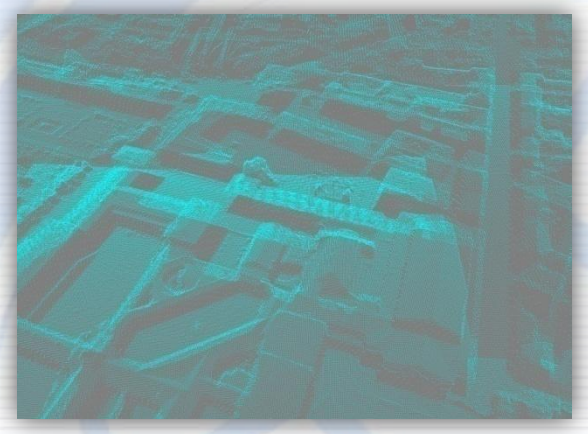
Editable text



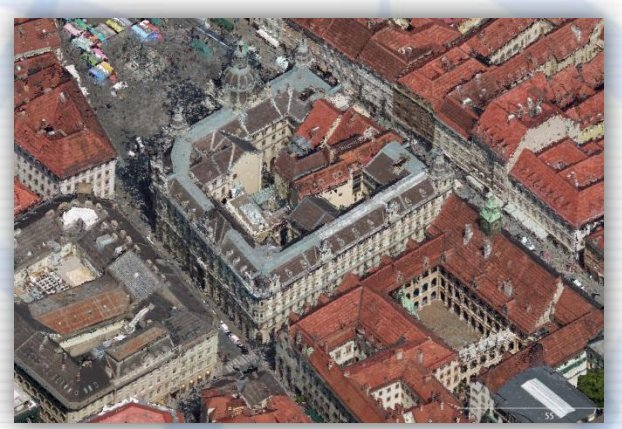
Photogrammetric technologies (DPW PHOTOMOD)

Dense digital surface models (point clouds)

Digital surface model

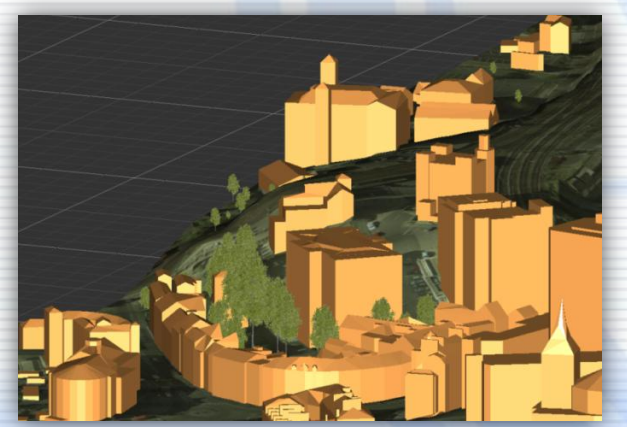


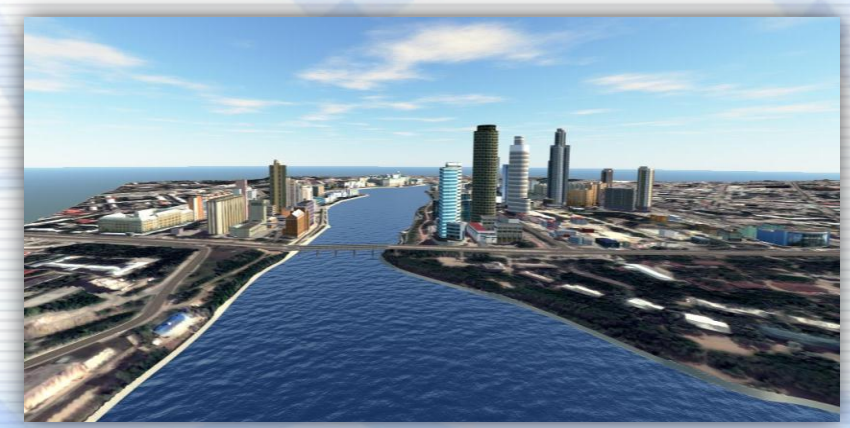
3D point cloud



3D textured model

Vector object-oriented models





Source remote sensing data for 3D georeferenced modeling

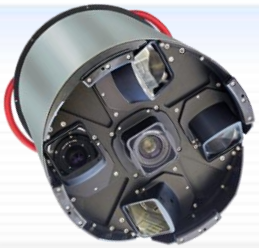
	UAV images	Aerial photos	Satellite scanner images
Images to a 1:1 scale			
Accuracy and models scales	RMSE ~ 5 cm (1:500 - 1:2000)	RMSE ~ 3-20 cm (1:500 and smaller)	RMSE ~ 50 cm (1:5000 and smaller)

3D model (dense point cloud)

UAV data processing

Camera Canon IXUS 125. Ground sample distance (GSD) - 3 cm ,
DEM cell size - 10 cm, LAS -20 cm.
Airport Le Bourget, France

3D model (dense point cloud)



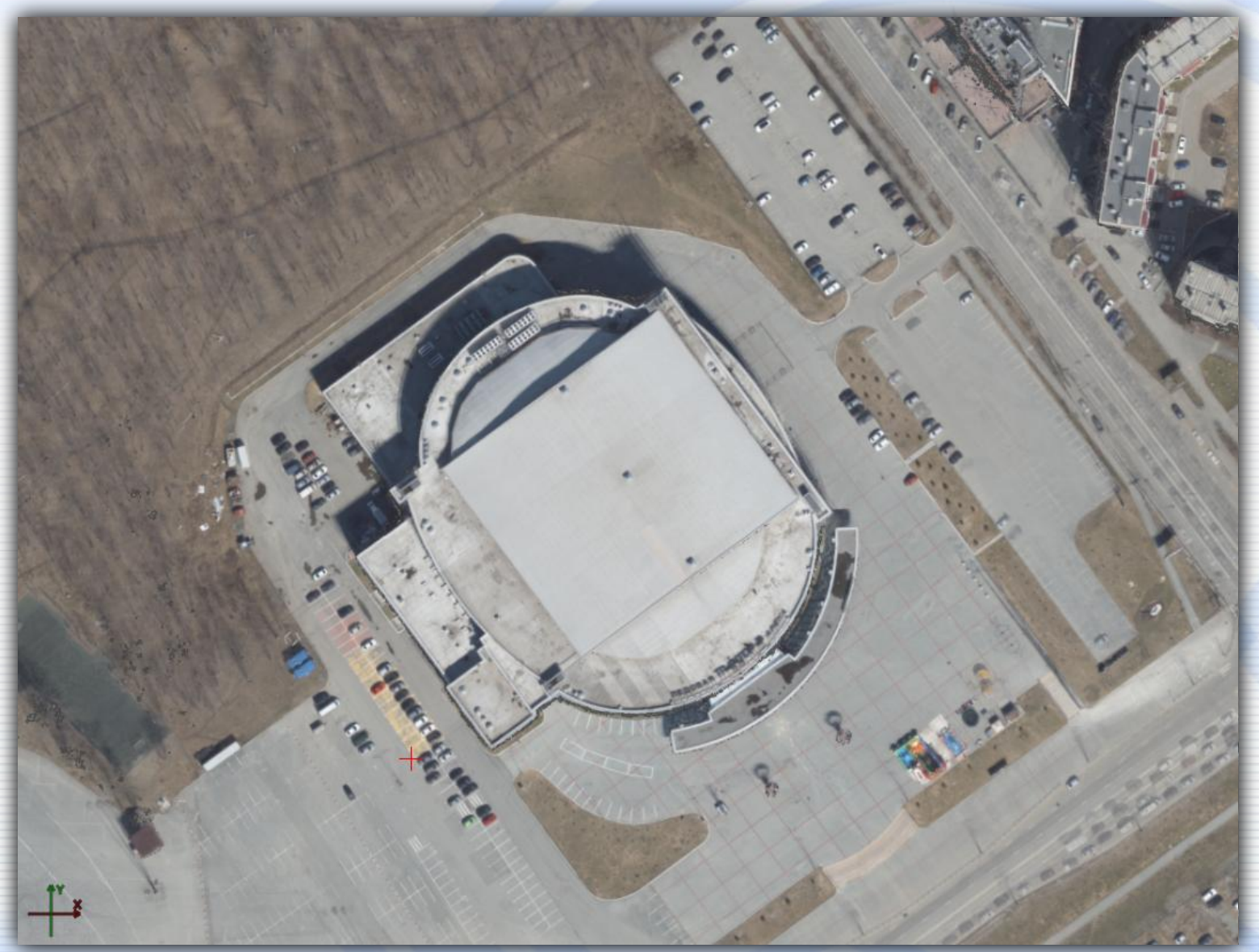
Oblique aerial cameras systems data processing

Aerial camera Leica RCD30 Penta Oblique.
Ground sample distance (GSD) – 8 cm, DSM (LAS) cell size – 20 cm.
Chelyabinsk, Russia

3D model (dense point cloud)

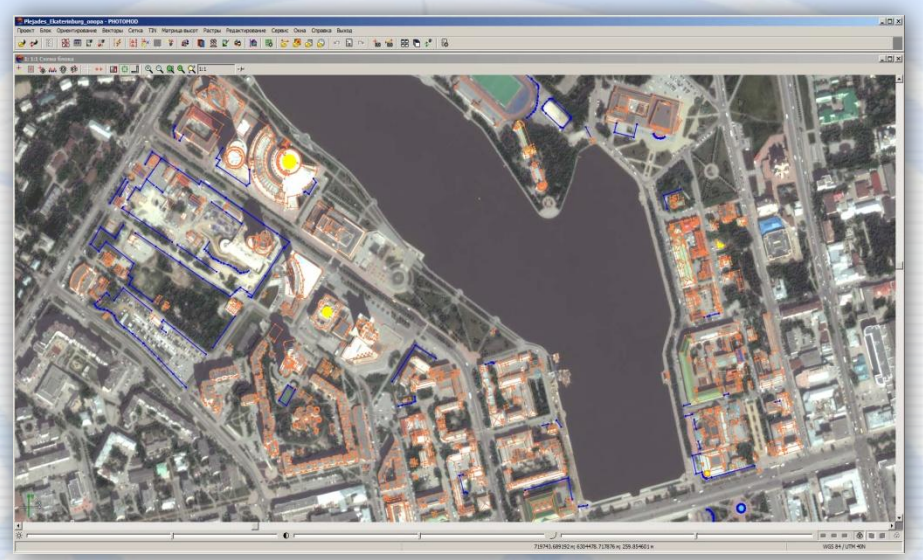
Aerial camera A3 (VisionMap) .
Ground sample distance (GSD) – 6 cm, DSM (LAS) cell size – 12 cm, MESH
Jerusalem, Israel

New “old” products. TrueOrtho



Vector 3D-model creation

- Automatic blocks of images orientation
- Automatic DTM creation
- Automatic orthophoto creation
- Semi-automatic stereovectorization
- Automatic buildings 3D-models generation by closed polygons set
- Manual and semi-automatic object texturing

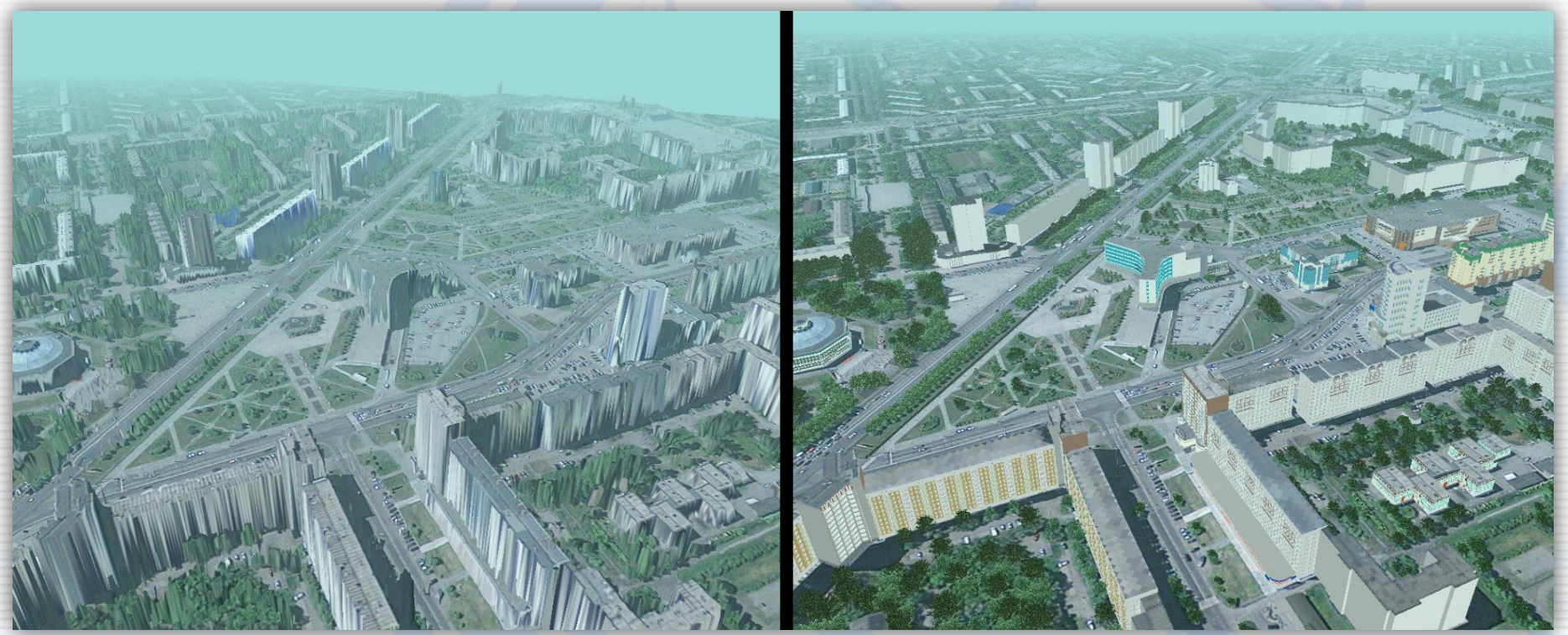


Vector 3D model

Satellite sensor Pleiades, Ground sample distance (GSD) – 0.5 m at nadir, Ekaterinburg, Russia

Proc and cons of two types of 3D models

Satellite sensor GeoEye, Ground sample distance (GSD) – 0.5 m at nadir, Novokuznetsk, Russia



Proc and cons of two types of 3D models

Dense DSM

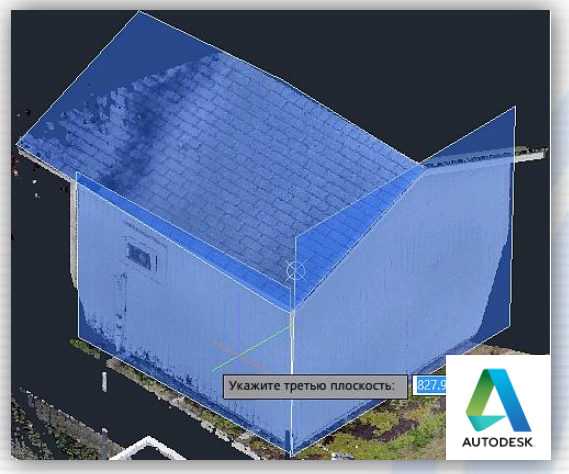
Pros	• Full automation
Cons	• No way to attach database (no vector objects) • More powerful hardware requirements

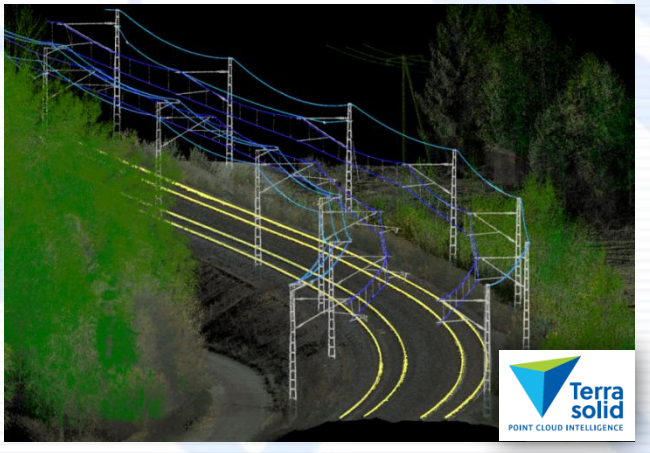
Vector model

Pros	• High accuracy • Ready for GIS (ability to attach database to vector objects)
Cons	• A lot of manual job (vectorization) • No automatic facade texturing

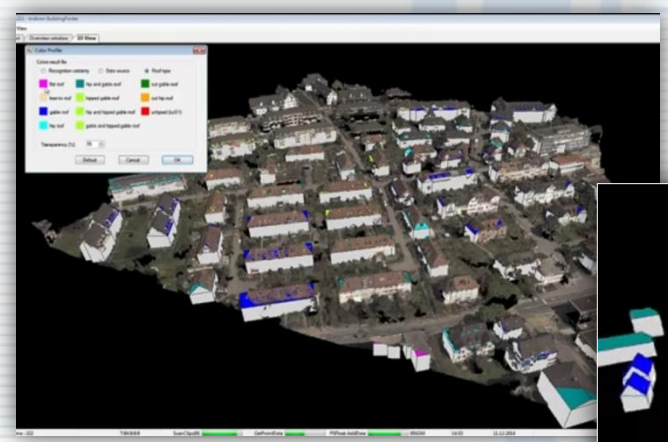
Automation in 3D vector models generation (point cloud)

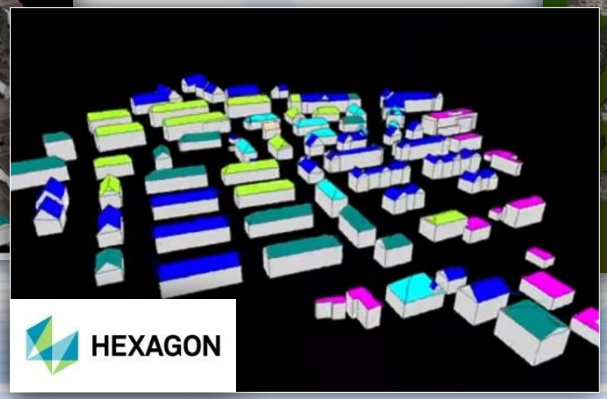
Automation of point clouds vectorization

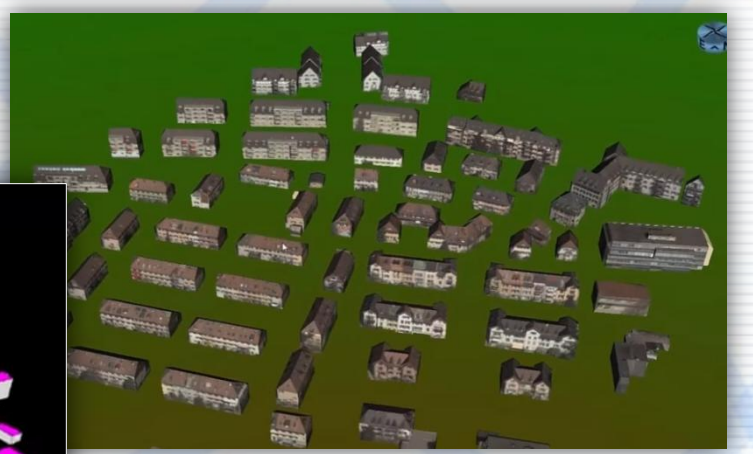




Automation of point clouds segmentation, building and line objects detecting. Auto texturing

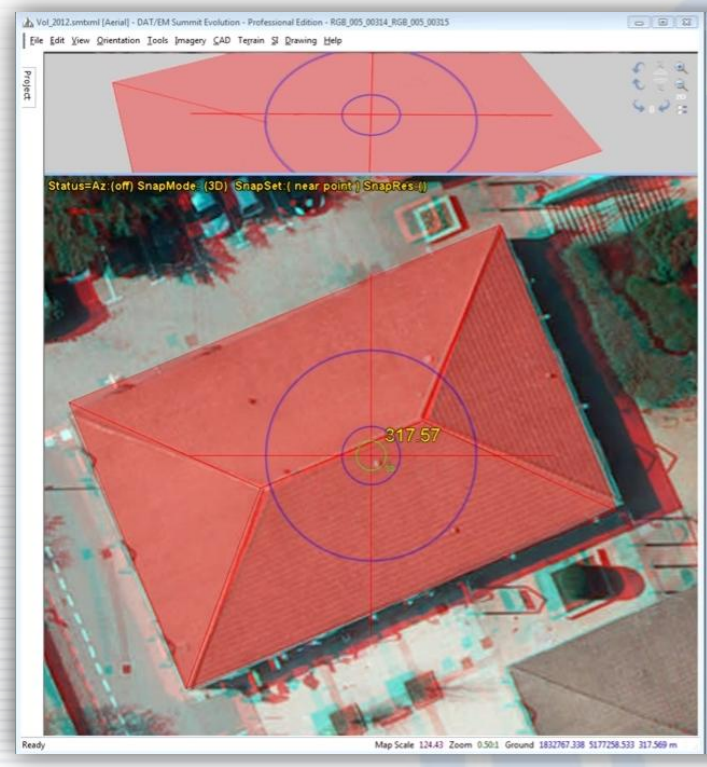


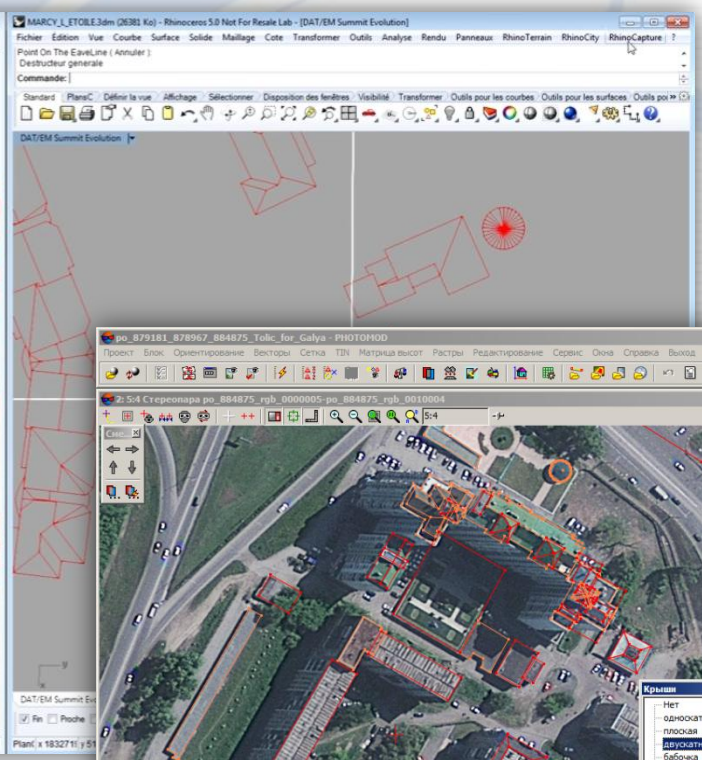




Automation in 3D vector models generation (stereo)

Automatization in stereovectorization

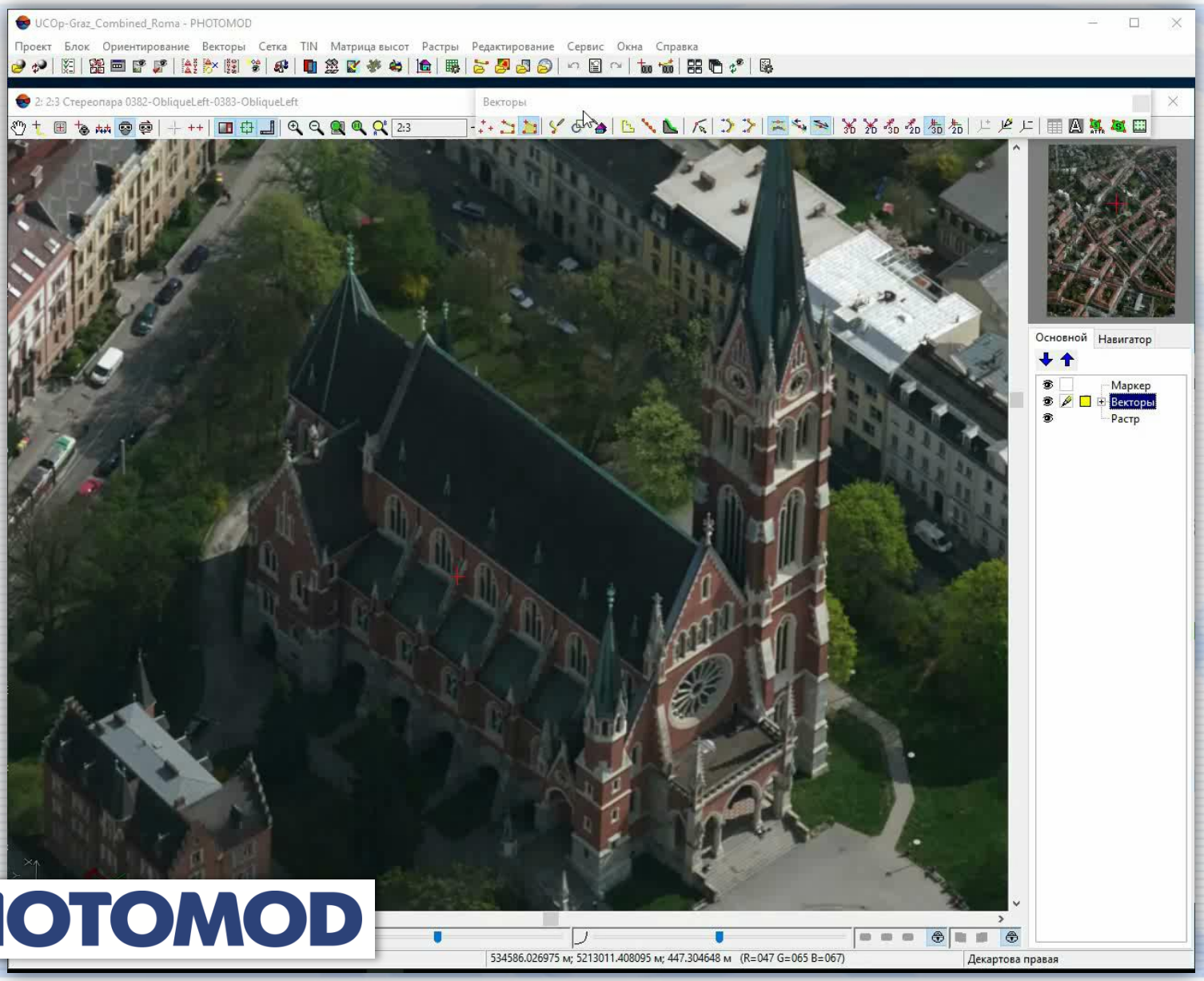




RhinoCity

PHOTOMOD

Automation in 3D vector models generation (stereo)



PHOTOMOD

Automation in 3D vector models generation (stereo)

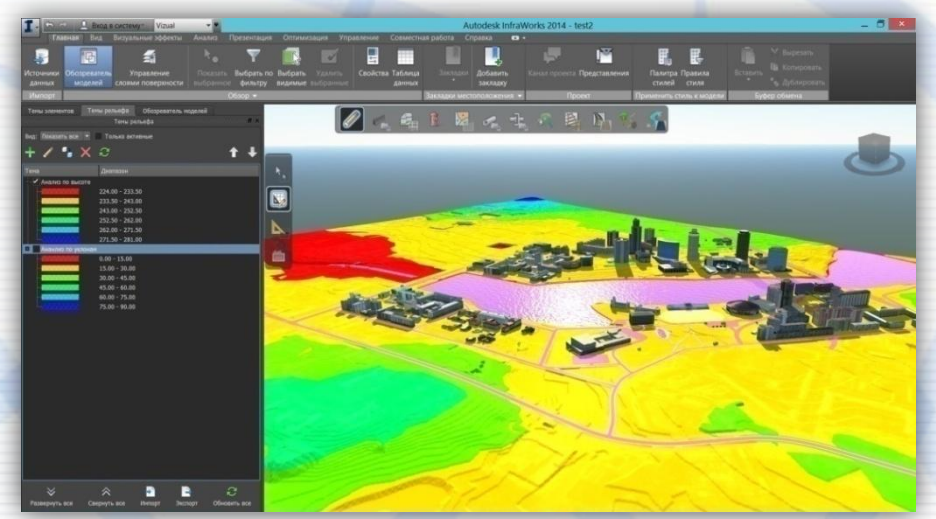
PHOTOMOD

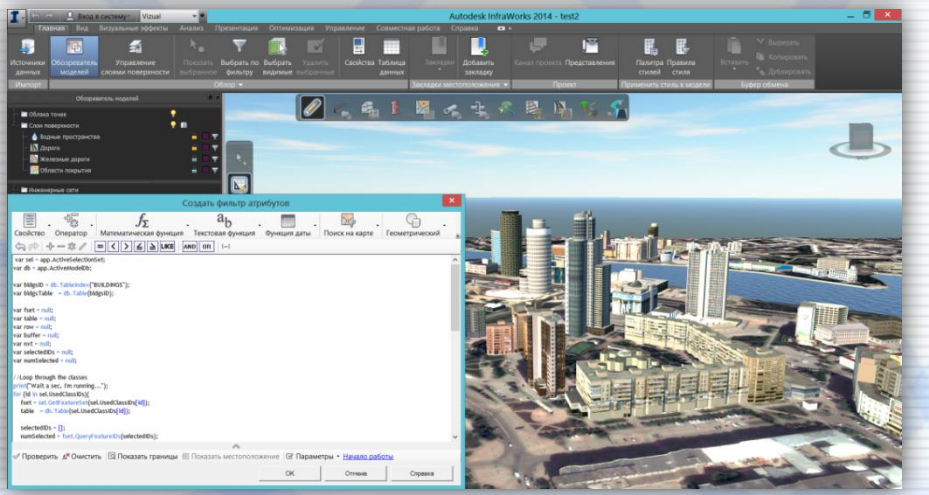
3D-GIS creation

PHOTOMOD + AUTODESK INFRAWORKS

Opportunities of using 3D-GIS functions:

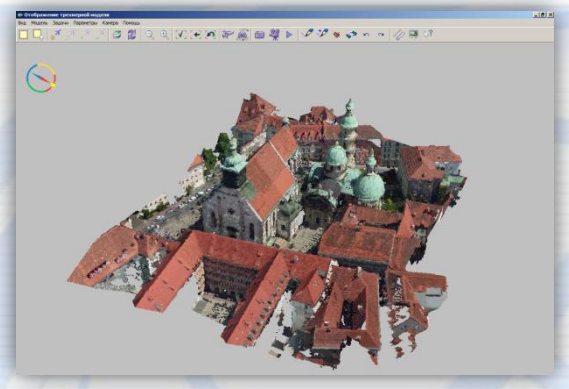
- Linking to a database
- Attributes associated with 3D objects
- Selecting objects with queries
- Spatial analysis
- Etc.

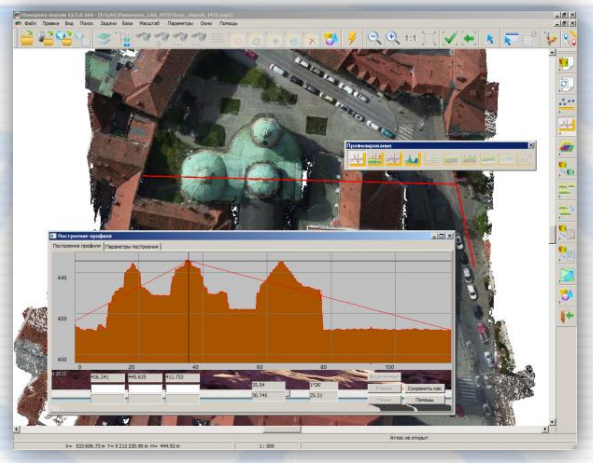


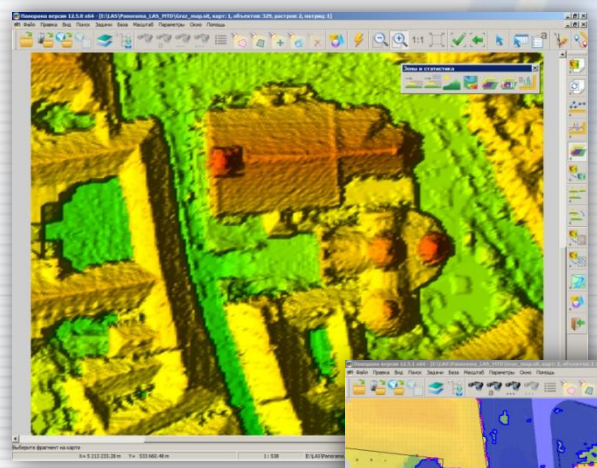


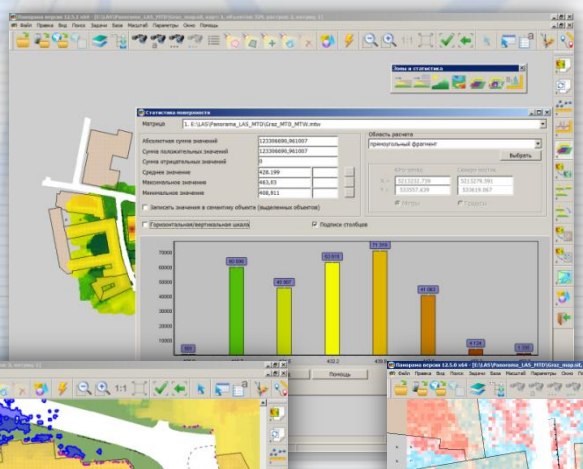
PHOTOMOD – GIS «Panorama». 3D analysis

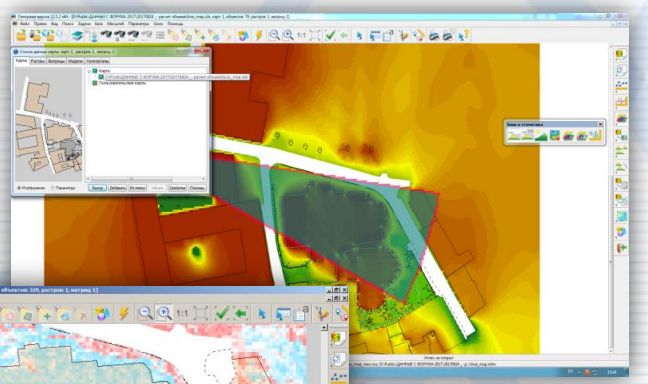
- Metrics and Statistics
- Profiling
- Territorial zoning
- Secondary surfaces
- Data multiplication

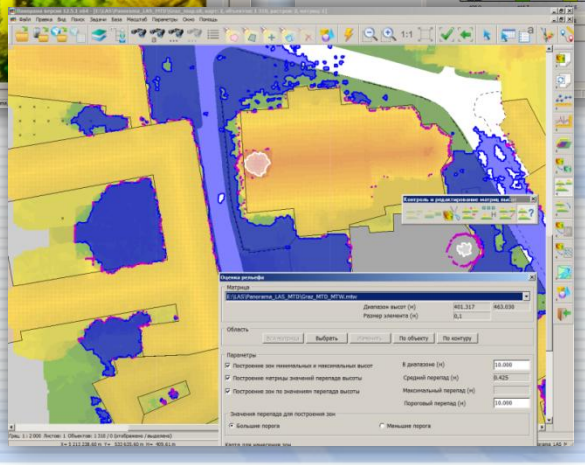


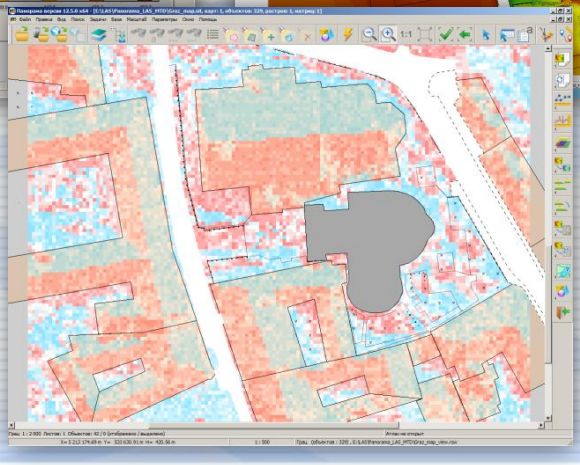








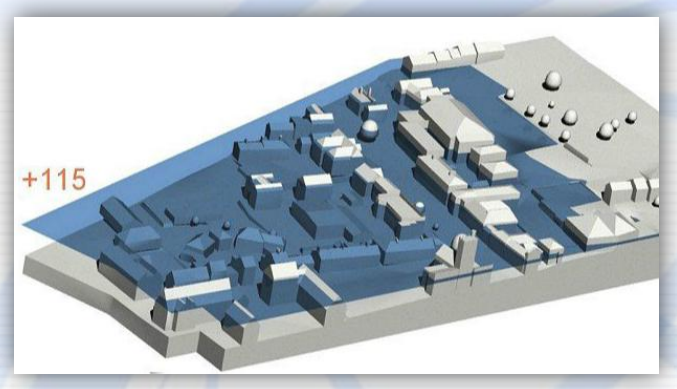


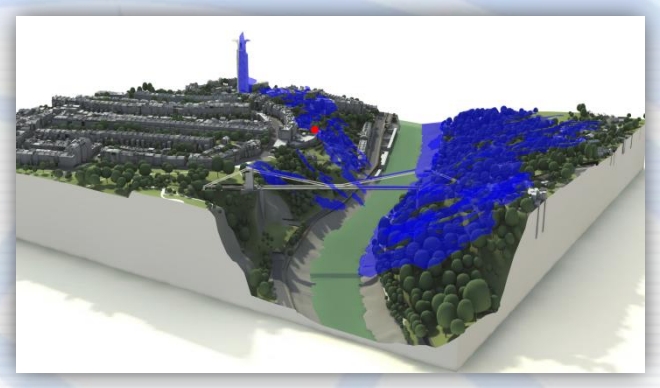


Application of 3D-models

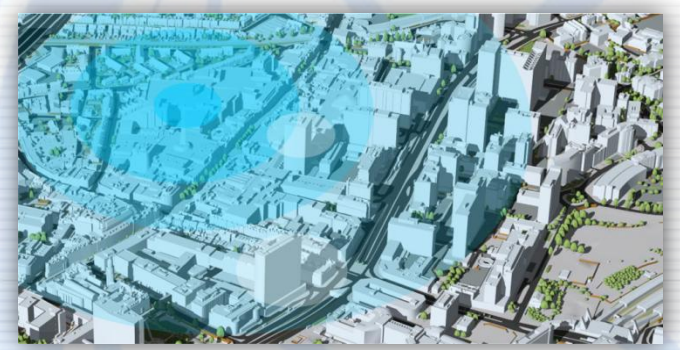
Height analysis

- Flood monitoring and forecasting
- Earthwork volume calculations
- Design of drainage systems

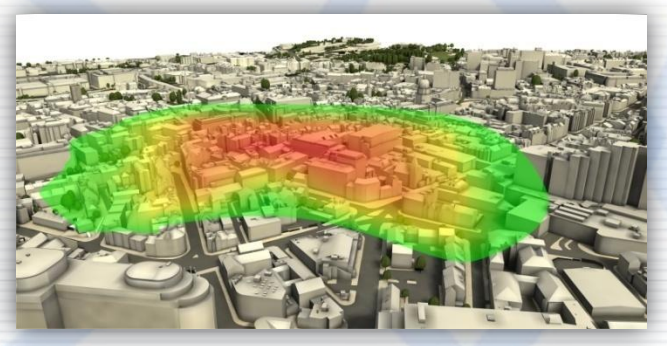




Telecommunication



Disaster managements



Urban planning

3D cadastre

Sun and shadow studies

Rapid prototype models

3D geospatial base for Smart Cities

City government

Specialists ⟷ **Citizens**

3D geospatial base for Smart Cities

PHOTOMOD

One of the few high-end system in the world market capable of creation of ANY type of 3D-models from ANY source of RS data

Thank you
for the attention!