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PRESENTATION
FROM THE

ICA JOINT WORKSHOP



Miktor Cap Photography

Olomouc
Czech Republic
April 27–30, 2018



Atlases & Cognition & Usability



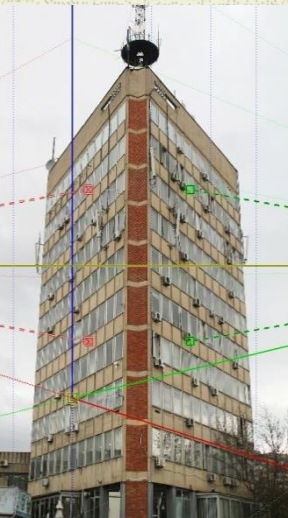
Bashkim IDRIZI & Besart HALIMI

THE 3D VIRTUAL CARTOGRAPHIC MODEL FOR THE CITY OF PRISHTINA

ICA COMMISSIONS JOINT WORKSHOP
ATLASES, COGNITION, USABILITY

April 27-30, 2018

Dept. of Geoinformatics – Palacký University
Olomouc - Czech Republic



Overview:

- Preface
- Use cases of 3d city models
- Target area
- Data collection
- Used software
- Development of geodatabase in ArcGIS Pro
- First step of preliminary modeling in ArcGIS Pro
- Second step of modeling and editing of textures in Trimble Sketchup Pro
- Third step of modeling by City Engine
- Web application
- Conclusions!

Preface:

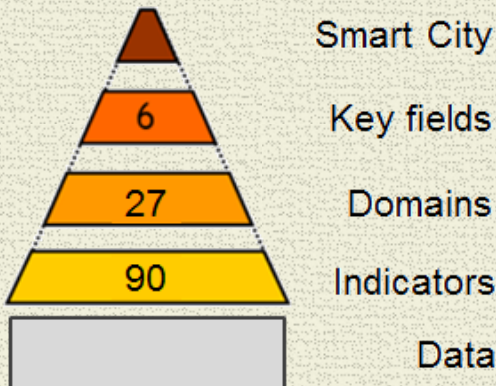
- 3d modelling and visualization of urban areas

- Spatial planning
- Disaster management
- Security reasons
- Engineering projects
- Cadastre
- Land management, etc.

- Smart cities

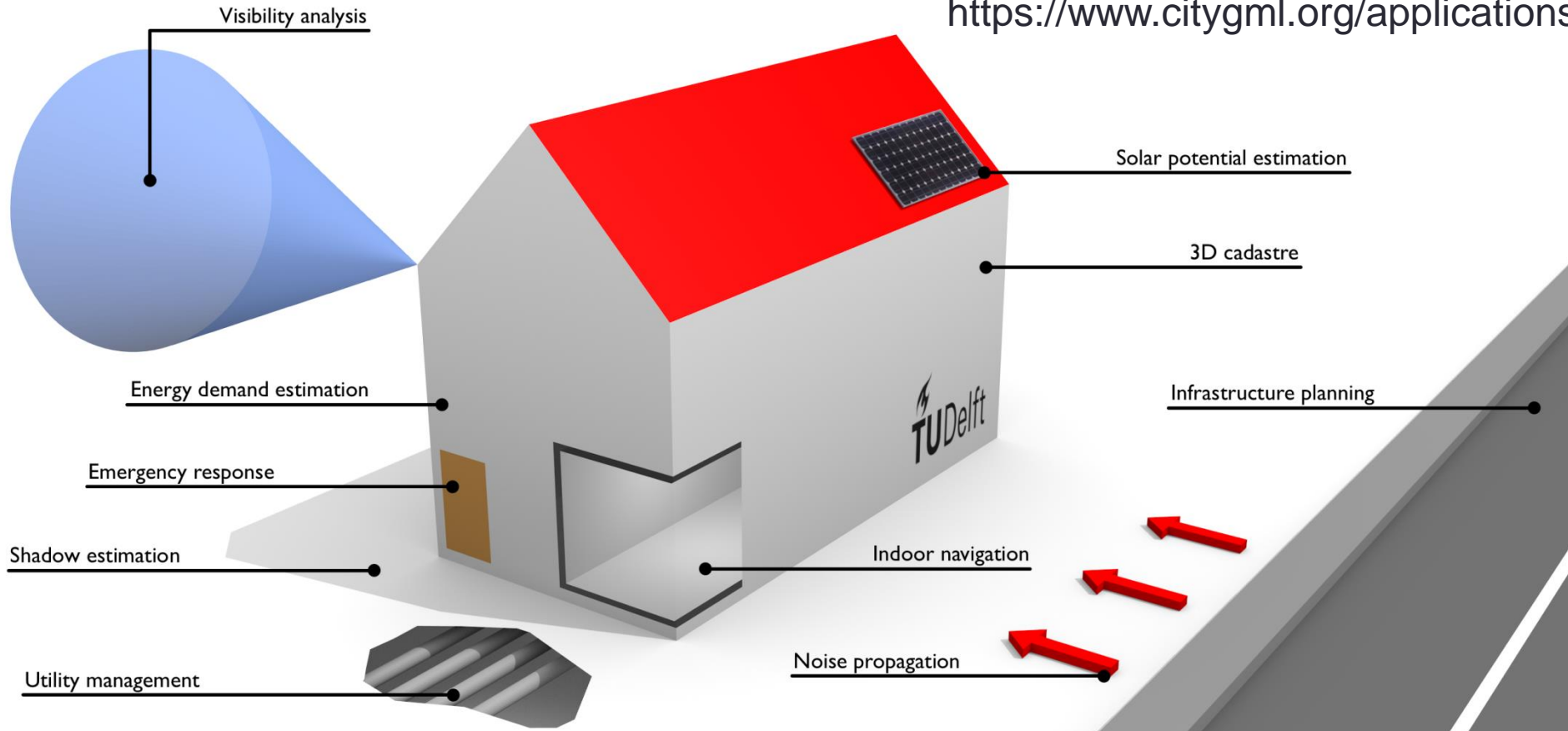
- Smart solutions

- Contribution for Prishtina city



Use cases of 3D city models:

<https://www.citygml.org/applications>



Precondition: 3d model of harmonized, standardized, and georeferenced spatial data!

Target area:

Center of the city of PRISHTINA

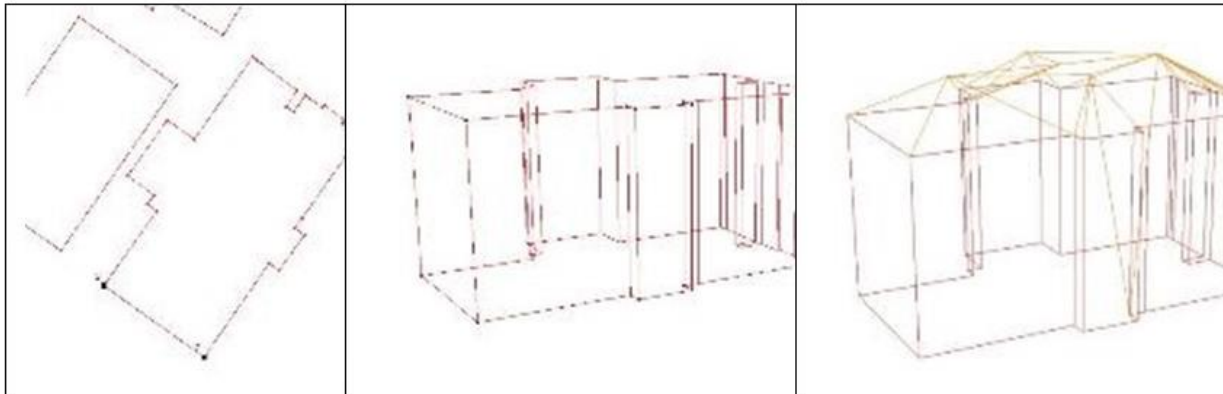
Reasons

- Concentration of governmental institutions
- Big number of cultural heritage buildings and zones
- Problems in urban planning
- Land use management
- Usurpation of public areas
- Sound - acoustic problems
- Air pollution
- Traffic etc.

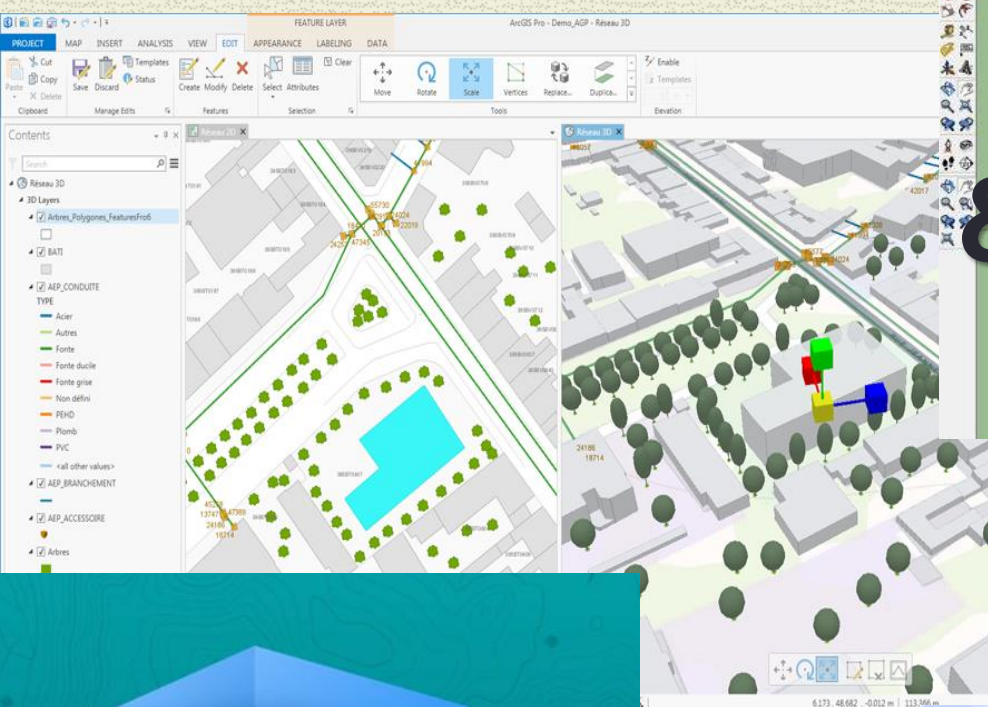


Data collection:

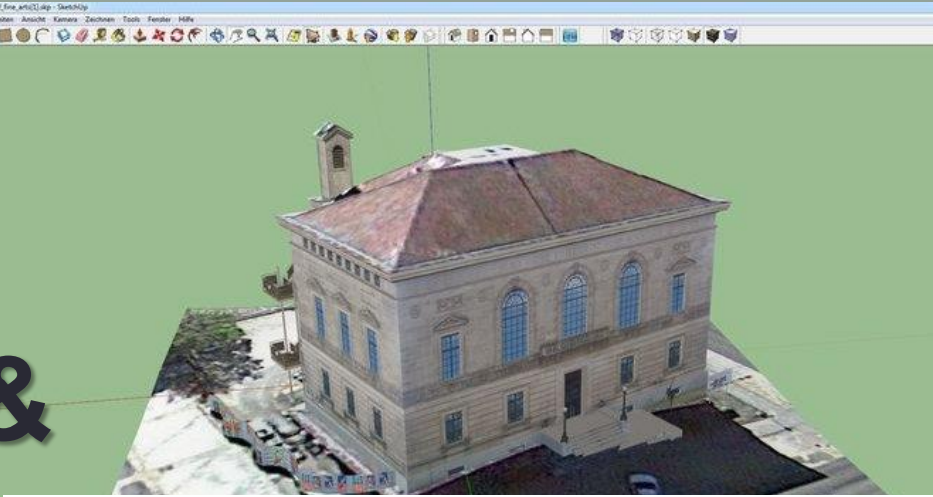
- *Surveying with drone, GPS and total station*
- *Measurement of footprint distances for at least 3 points,*
- *Measurement of areas inside the buildings*
- *Measurement of front areas with more than 1m, if those can not be measured by geodetic instrument*
- *Measurement the roofs of buildings*
- *Collection of attribute data for buildings*
- *Number of floors*
- ***Accuracy of 3d coordinates: $\pm 10\text{cm}$***



Used software:



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ArcGIS Pro

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Why ArcGIS Pro:

- 64bit application with friendly interface
- Easy editing and exchanging 2d and 3d data
- Linking with all ArcGIS applications such ArcMap, ArcCatalog, ArcGlobe etc.
- Use hyperthreading 64bit processor, which give high speed for modeling of big databases
- Advancet options for 3d modeling and editing.
- Integration of desktop applications, databases, images, web servers, cloud applications, web applications, and mobile applications.
- Interoprability with other GIS, CAD and BIM platforms, etc.

Why Trimble Sketchup Pro:

- Advanced options for modeling and editing textures

Why ESRI City Engine :

- combines geometric data and textures/facades
- simultaneously using georeferenced spatial data as base for modeling textures and facades
- Usage of the CGA Rules defined from the Python
- obtaining the geotypical model for an area/city.

Development of Geodatabase in ArcGIS Pro

Project

Project | Portal | Notifications

Search

- Maps
- Toolboxes
- Databases
 - Modeli_Virtual_Hartografik.gdb**
 - Makinat
 - Ndërtesat
 - Objektet
 - Pemët
 - Rrugët
 - Shenat_Trafikut
 - global_scene.gdb
- Geoprocessing History
- Styles
- Folders
- Locators

OBJ

Field: Add Delete Calculate Selection: Zoom To Switch Clear Delete

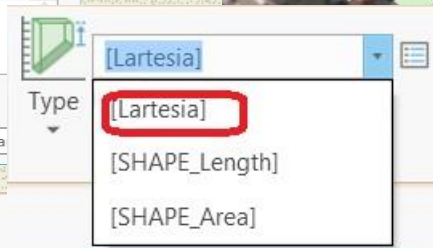
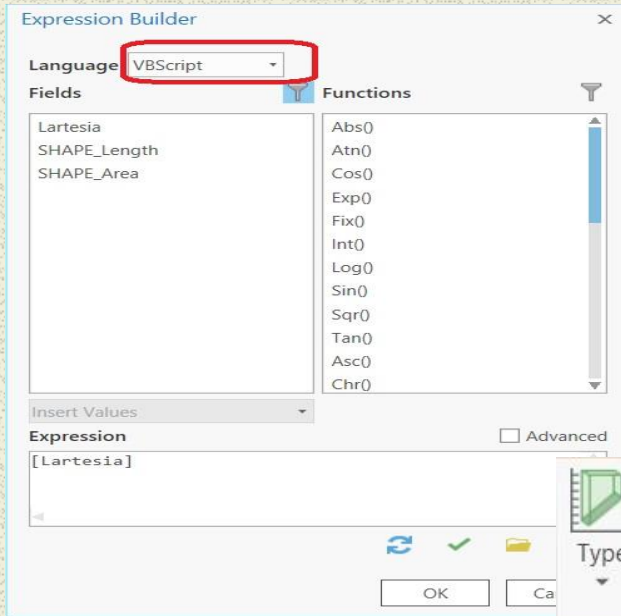
OBJECTID	SHAPE	Lartesia	SHAPE_Length	SHAPE_Area	Emri_Objektit
1	Polygon	10	347.781482	4095.054287	Objekti i Qeverisë
10	Polygon	30	105.84333	701.725451	Top Shop
11	Polygon	30	103.283703	659.334646	Route 66
12	Polygon	40	368.364307	5346.578734	Administrata Publike
13	Polygon	9	114.761706	724.76569	Kompania Sigal Aust...
14	Polygon	30	95.011885	481.776976	ProCredit Bank
15	Polygon	1	76.916258	180.1441	New BORN
16	Polygon	77.16	77.676153	287.570214	Radio Kosova
17	Polygon	3	141.856529	1165.157752	Galeria e Arteve të K...
18	Polygon	8	220.29602	2639.063537	Ministria Arsimit

0 of 26 selected

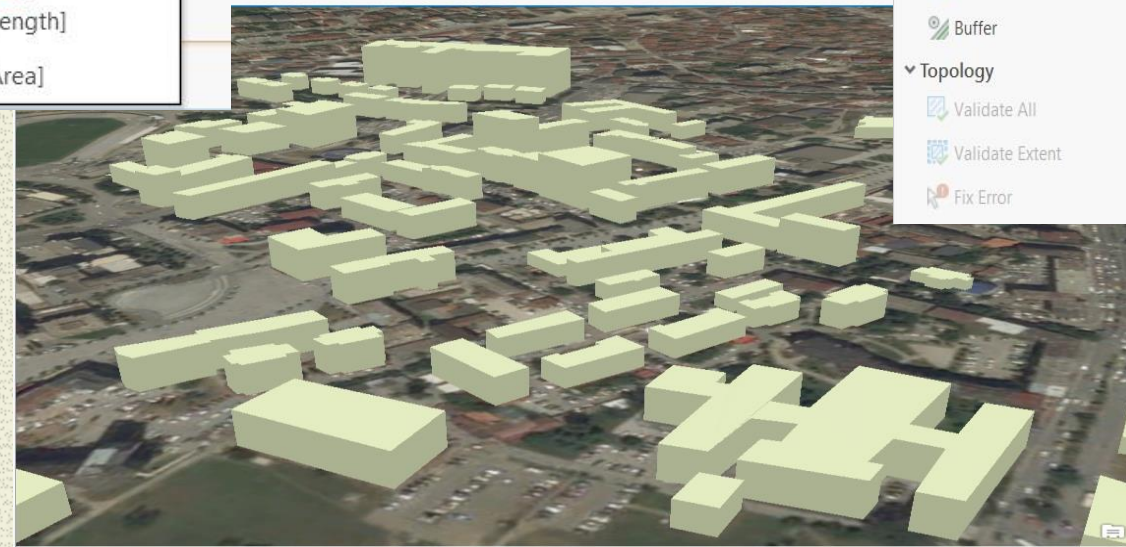
100 %

First step of preliminary modeling in ArcGIS Pro:

Footprints dimensions + heights of buildings based on number of floors



- None
Features are not extruded.
- Min Height
Extrusion is added to the features' minimum z-value.
- Max Height
Extrusion is added to the features' maximum z-value.
- Base Height
Extrusion is added to each vertex of the features' base.
- Absolute Height
The feature is extruded to the specific value as a flat top.



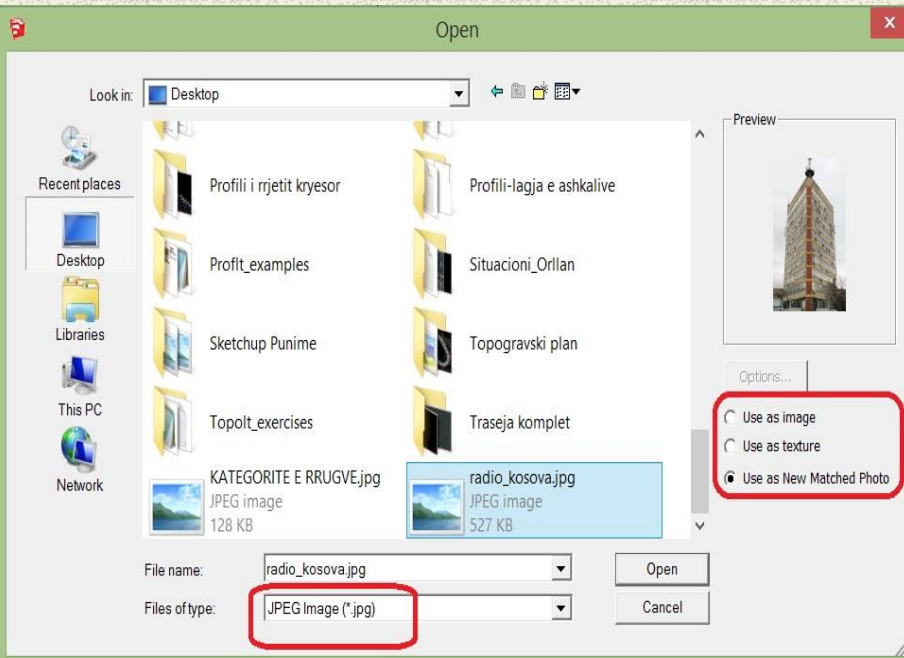
- Divide
 - Split Line
 - Split
 - Planarize
 - Clip
 - Explode
- Construct
 - Duplicate Vertical
 - Merge
 - Traverse
 - Buffer
- Topology
 - Validate All
 - Validate Extent
 - Fix Error

Second step of modeling and editing of textures in Trimble Sketchup Pro :

Used methods:

- Photo matching

- Multipatch



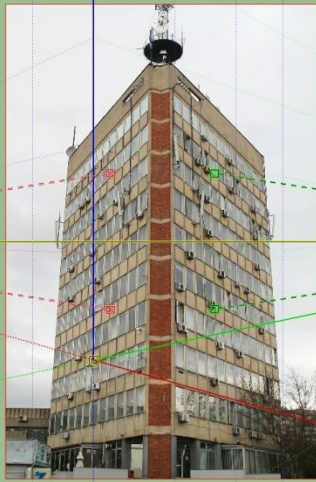
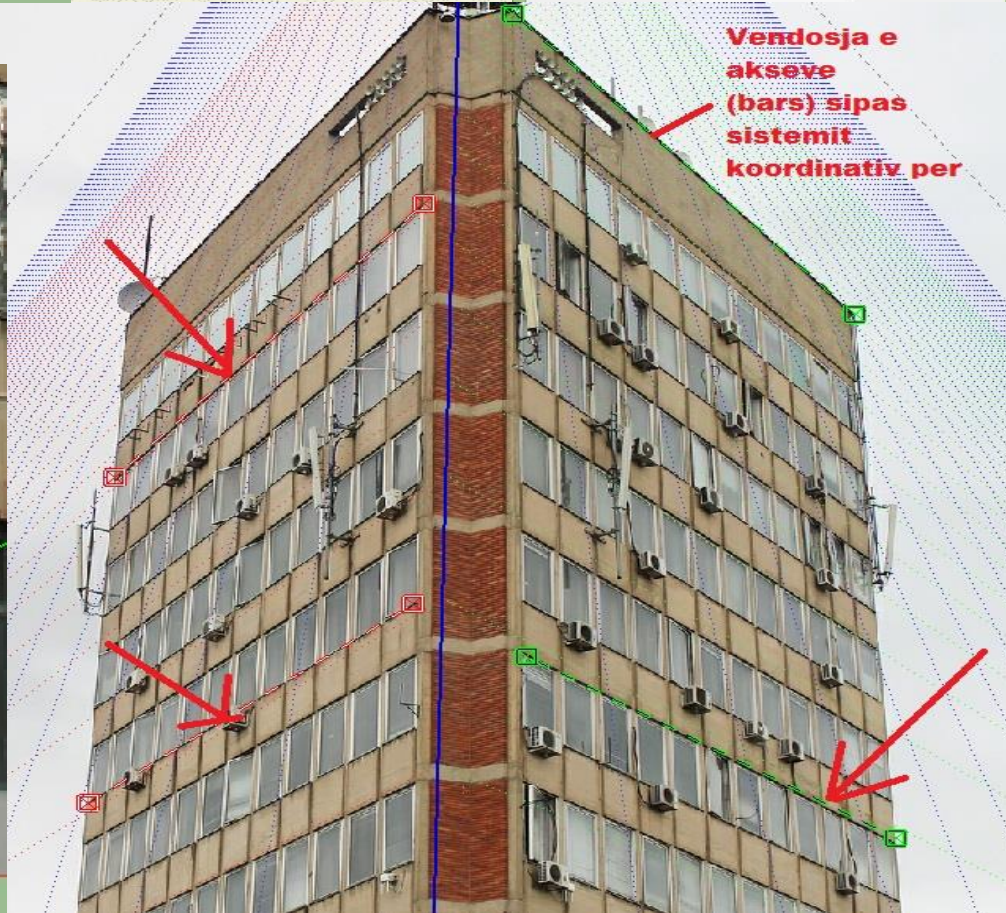
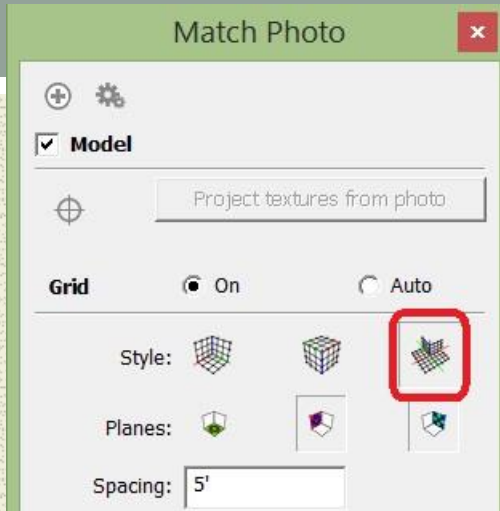
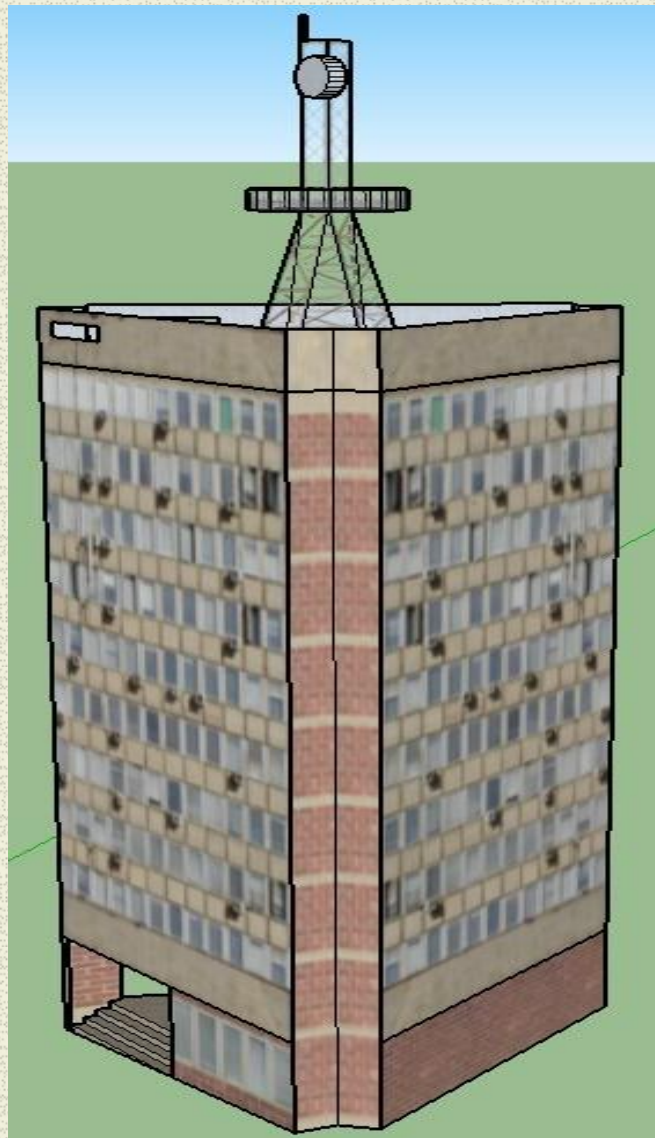


Photo Matching Method



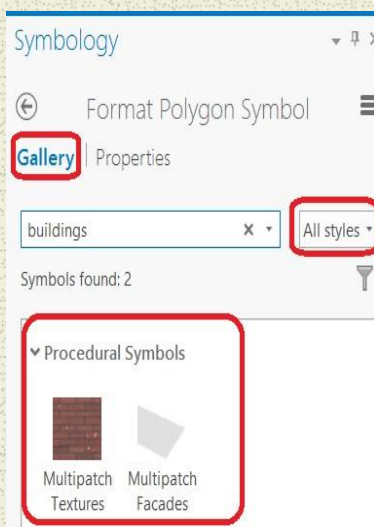
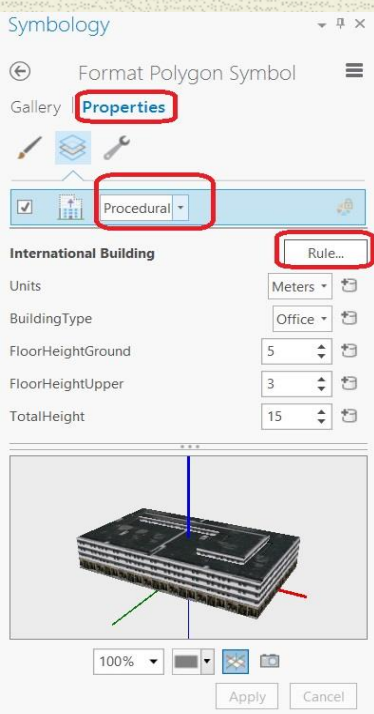
Building of National Radio-Television of Kosova



Palace of Youth and Sports

&

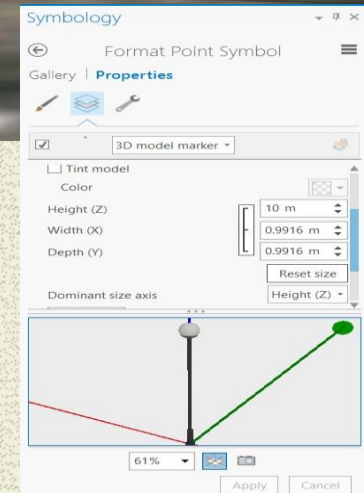
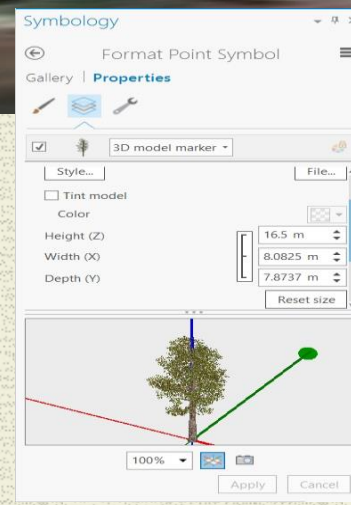
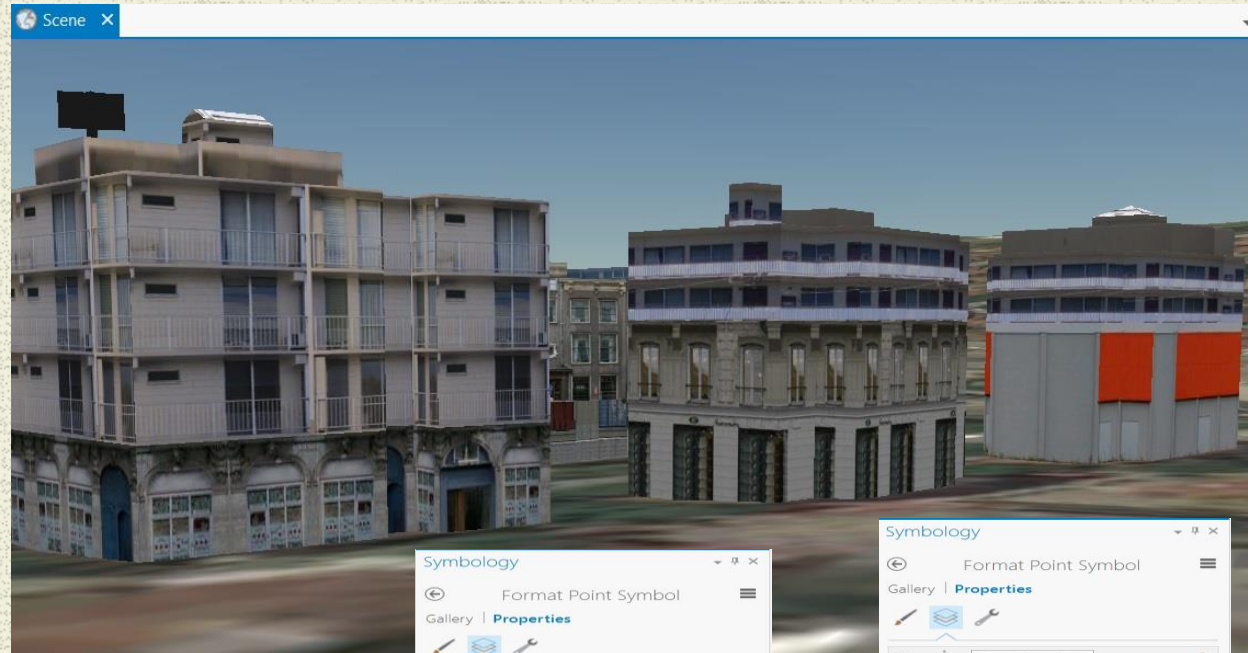
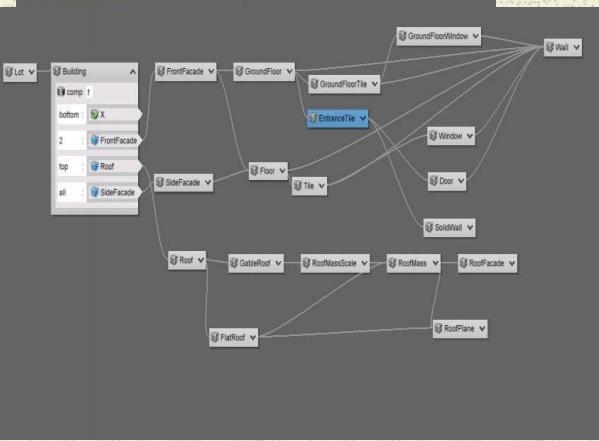
Prishtina City Stadium



Multipatch to Collada METHOD

Third step of modeling by City Engine:

The algorithm (CGA Rules) is defined with the data for floors, roofs, doors, windows, by defining the mapping procedure, while in Python programming language is given the data for the relevant geometry.



Statue of Skenderbeg in Prishtina



Building of Government



Modify Features

Scale

Change the selection.

Obj1
10

Move

Rotate

Scale

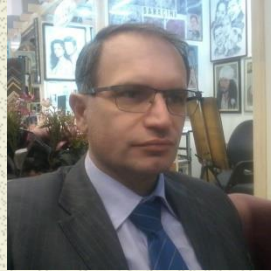
National Library of Kosova



Conclusions

- Initiative for establishing base for Prishtina smart city has been performed;
- Students have used several software for 3d modeling
- Web application was developed for representing developed 3d model
- Database is extendable aimed for wider usage by relevant institutions from central and local level
- 3d coordinates of buildings have high accuracy of 10cm, which correspond to scale of cadastral maps 1:1000
- All data are georeferenced to national coordinate system of KosovaRef01!

In behalf of both coauthors,



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THANK YOU FOR YOUR ATTENTION!!!



www.unt.edu.mk



www.uni-pr.edu



www.geo-see.org