

Third International FIG Workshop on 3D Cadastres

Developments and Practices • Shenzhen, China

25 - 26 Oct, 2012



Hrvoje TOMIĆ, Miodrag ROIĆ, Siniša MASTELIĆ IVIĆ

Use of 3D cadastral data for real estate mass valuation in the urban areas



Faculty of Geodesy, University of Zagreb
Chair of Spatial Information Management





Introduction

- Land - more or less attractive depending on difference in **position**, fertility and/or natural resources
- Valuation is process of assigning values to land locations/ properties
- Many objective and subjective valuation factors must be considered and modeled





Real estate valuation

- methods of valuation (choice of methods depends on property):
 - Sales comparison
 - Income capitalization
 - Cost approach method
- Individual - single property valuation
- Mass property valuation





Mass valuation methods

- Mass Valuation – Automated Valuation Methods (AVM):
 - GIS
 - Artificial Neural Networks (ANN)
 - Multiple Regression Analysis (MRA)
 - Combinations

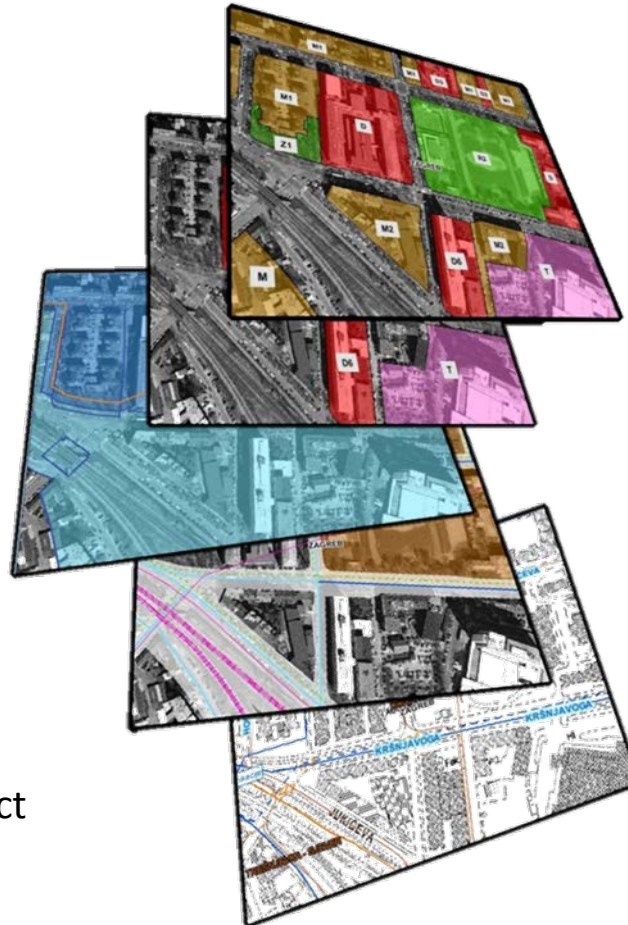




Mass real estate valuation factors

rural areas:

- Land parcels
- Topographic data
 - (dtm, forest areas, water areas, ...)
- Land quality, rain expectancy, average temperature,
- Legal constraints:
 - Intended land use, district borders ...



urban areas:

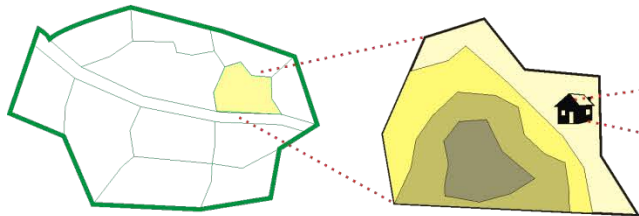
- Land parcels
- Legal constraints:
 - Intended land use, district borders ...





Internal/external valuation factors

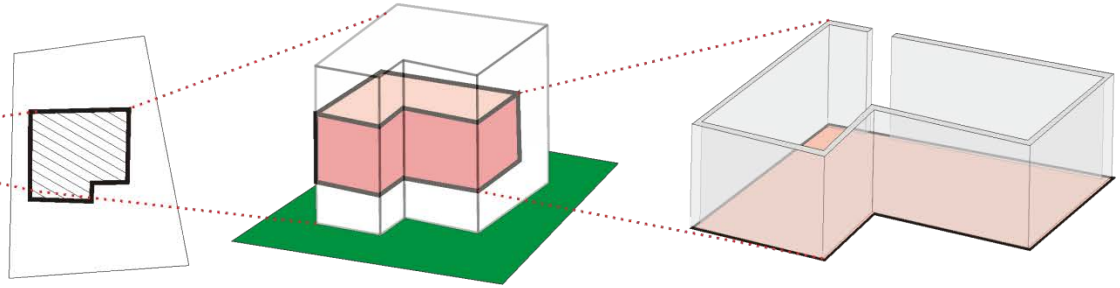
external - location factors



- city/municipality

- location within a zone

internal factors - real estate characteristics



- area of a parcel
- purpose
- total area
- number of floors
- ...

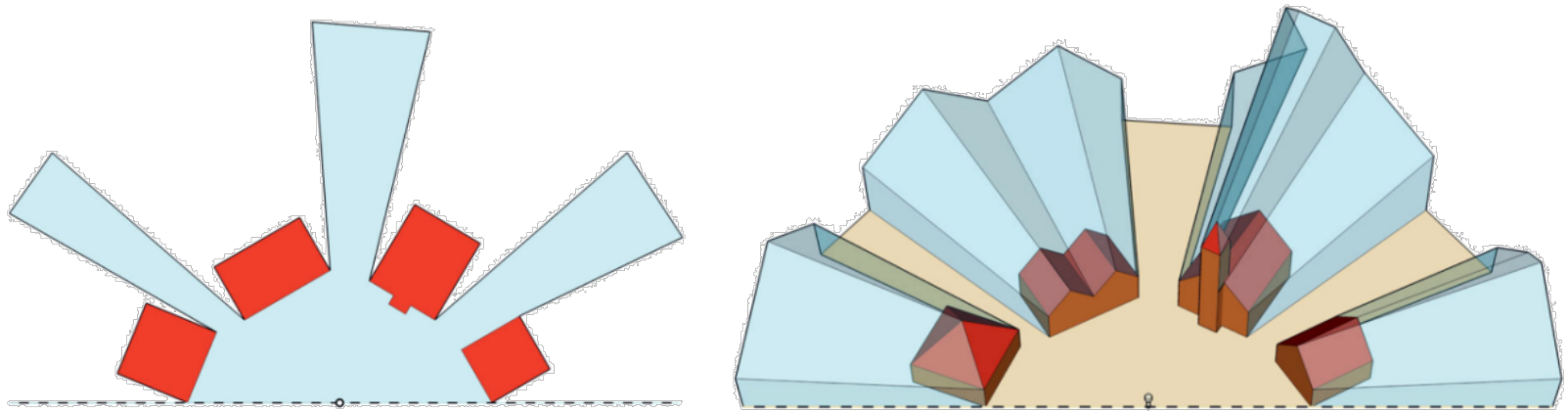
- orientation
- floor
- area
- ...

- number of rooms
- number of bathrooms
- equipment quality
- ...





Visibility polygon



picture: Bilsen 2008

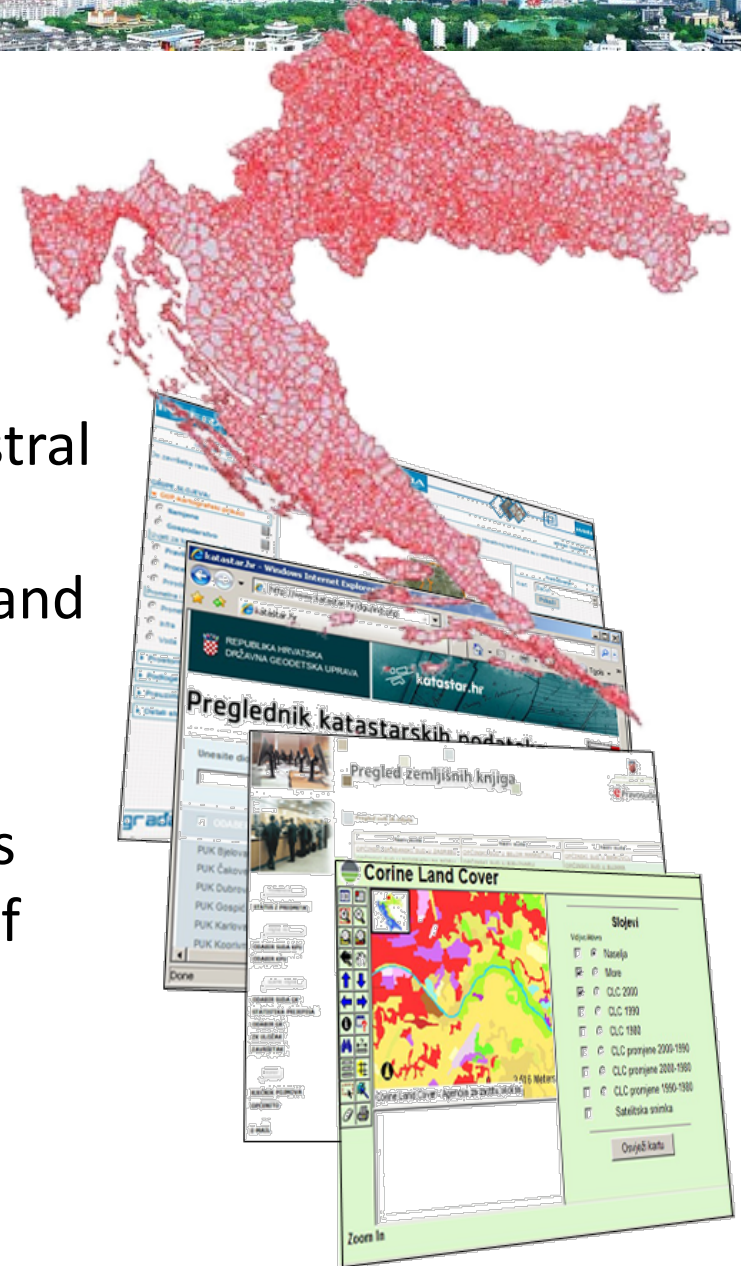
- 2D / 3D visibility polygon – architectural valuation of space
- assumption that a real estate with a bigger visibility polygon, i.e. a better view, has a bigger market value than the same real estate with a smaller visibility polygon





Current state

- Cadastral data - Classic European system of land cadastral parcels, 3327 cadastral municipalities, currently in process of transition from "Land Cadastre" to "Real Estate Cadastre"
- Topographical data - SGA has finished project of creation of topographical database.





Current state – web services



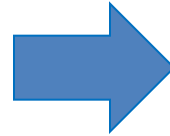
UREĐENA ZEMLJA

Nacionalni program sređivanja zemljišnih knjiga i katastra



www.katastar.hr

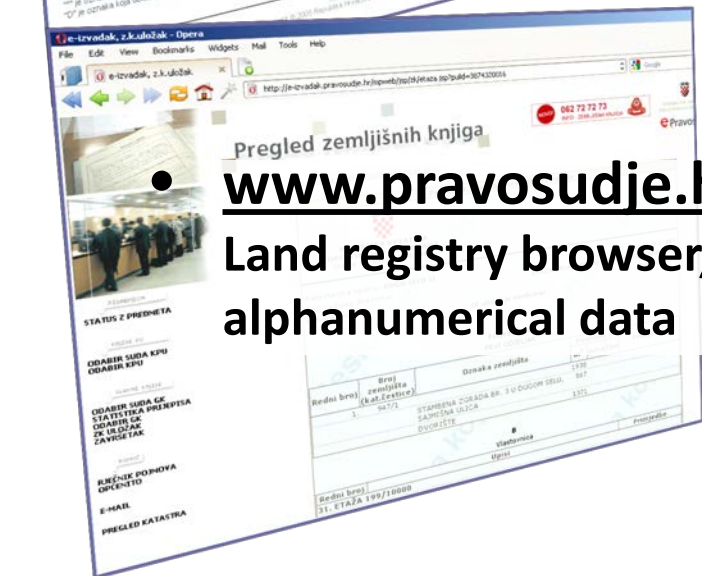
Cadastral data browser,
alphanumeric data



Joint Information System (JIS):

establish a common database of the cadastre and land registries and a single application for keeping and maintaining the data
2003. - end of 2009.

alphanumeric and graphical data



www.pravosudje.hr

Land registry browser,
alphanumeric data

geoportal.dgu.hr – WMS and WFS

(soon) – graphical cadastral and topographic data



Implementation of test system

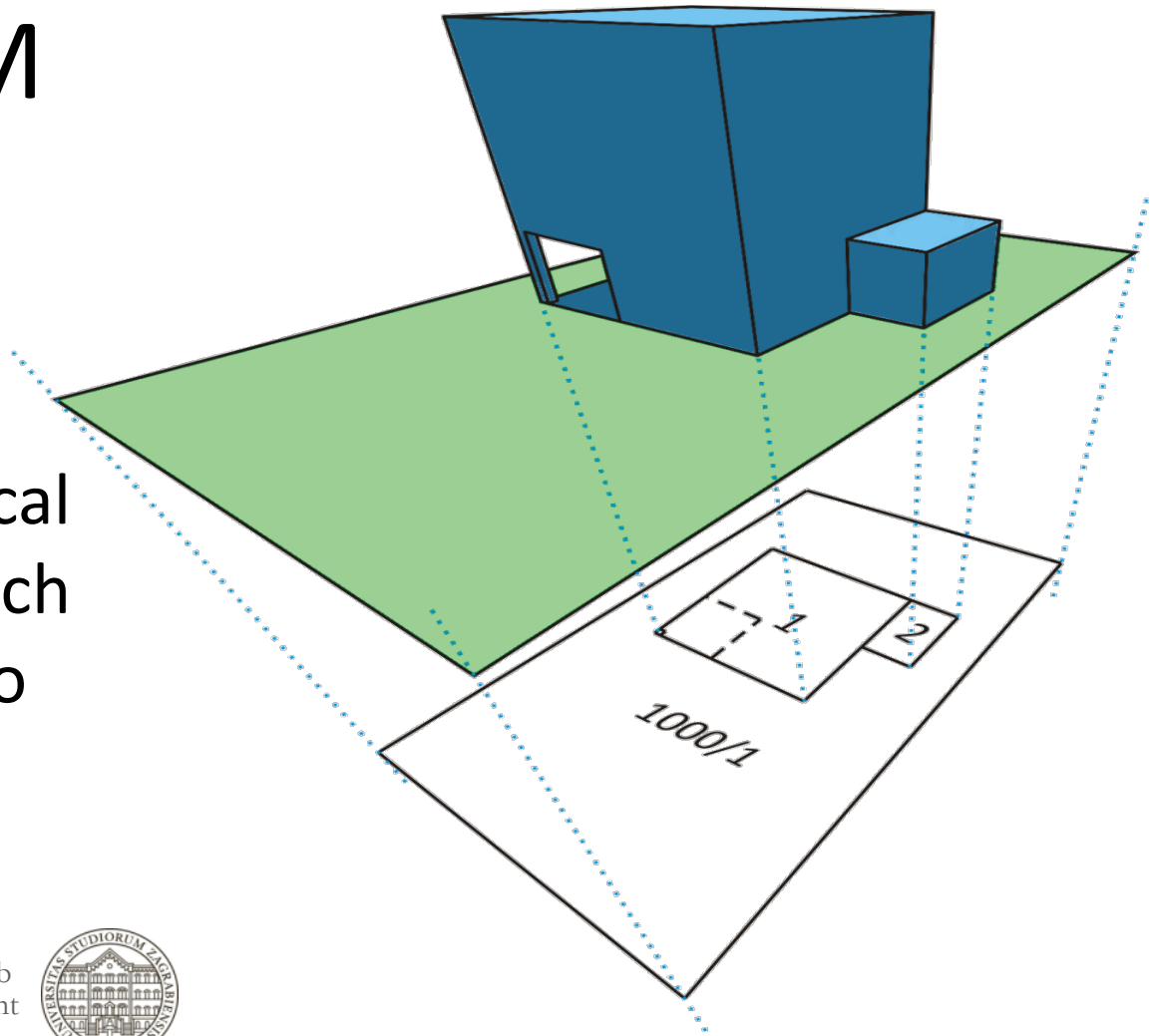
- 2D cadastral data
 - (land parcels and buildings)
 - digital cadastral map (DCM) of the cadastral municipality of Centre – Zagreb (Capital)
- topographical data – elevation
- modelling, storing and analysing using the combination of PL/SQL procedures and Oracle 11g SDBMS built-in spatial functions/FME





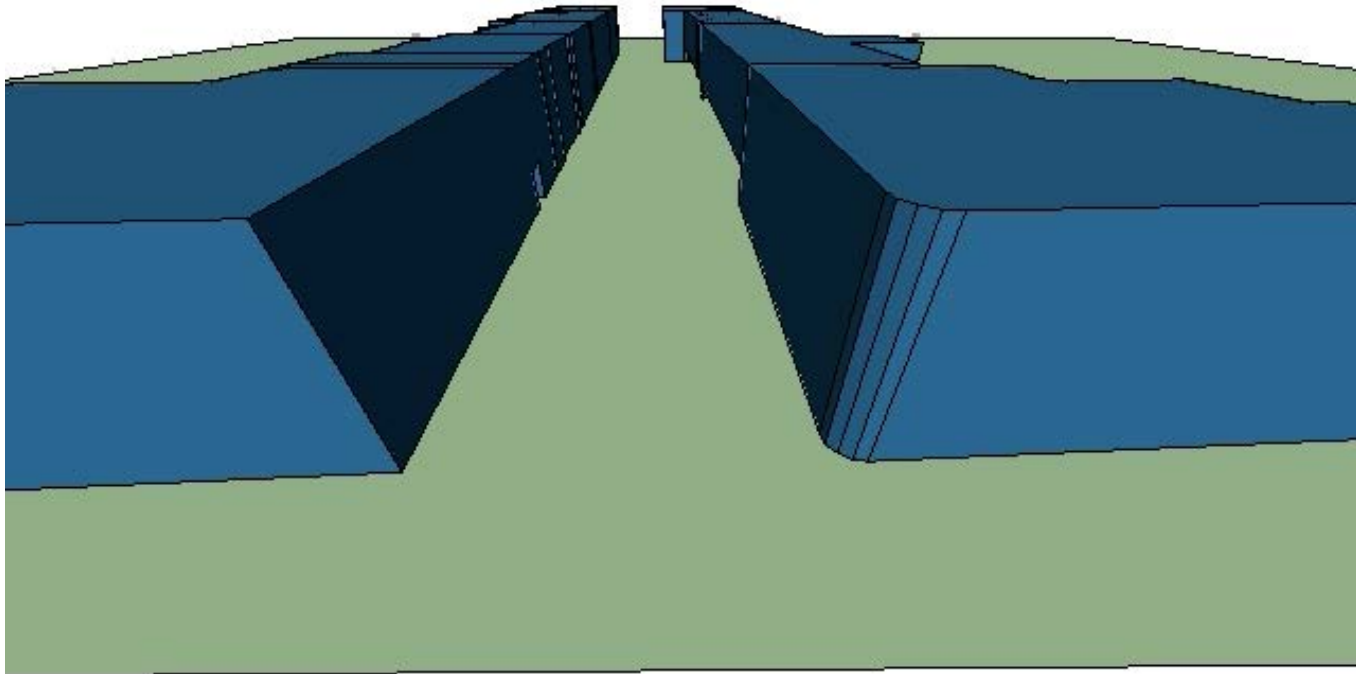
Modelling of buildings based on DCM

- Extruding 2D parcel data
 - 3D geometrical bodies on which it is possible to apply Boole operations



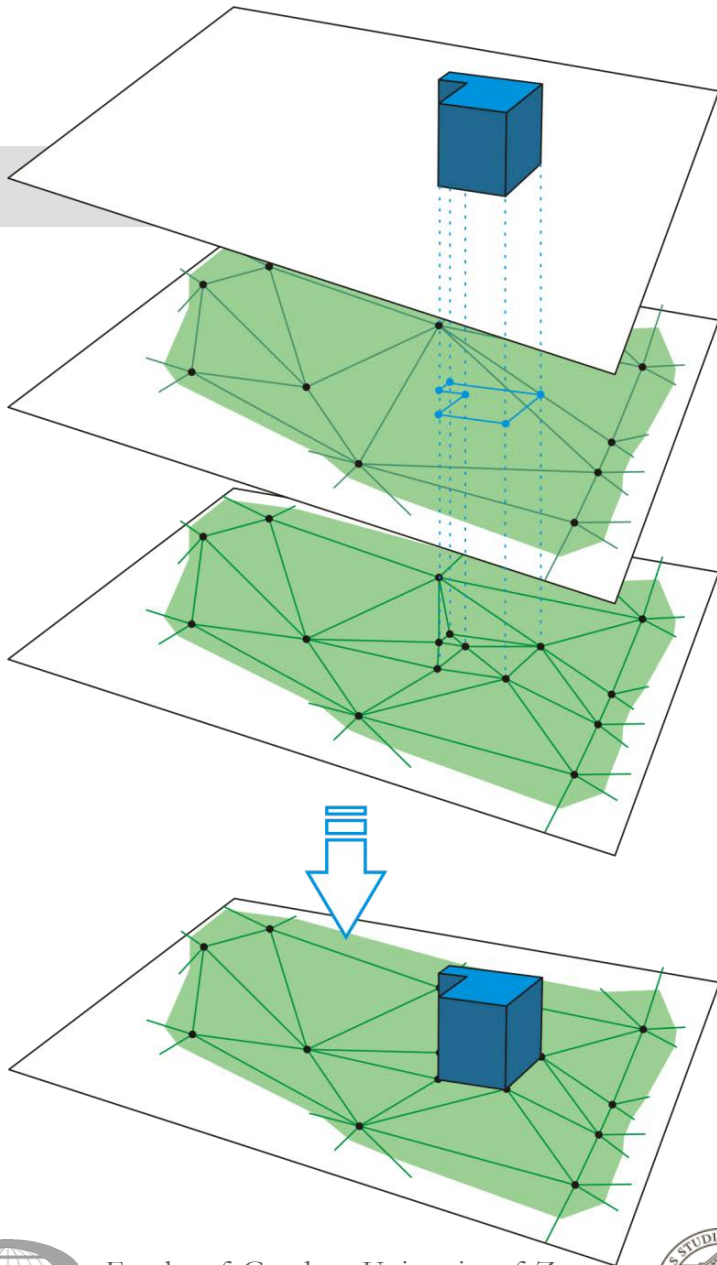


3D buildings model



Creation and modelling of DTM

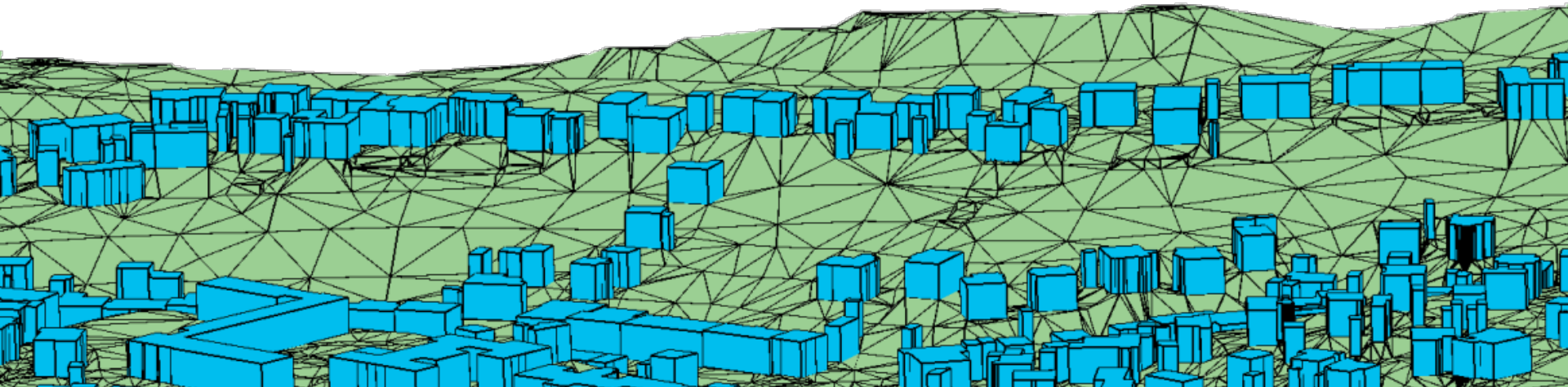
- digital relief model (DRM) for the test area is made on the basis of triangular points taken from the contour lines and altitudes of the Croatian basic map sheets, with added split points at the cross section of buildings and terrain, to keep topological accuracy





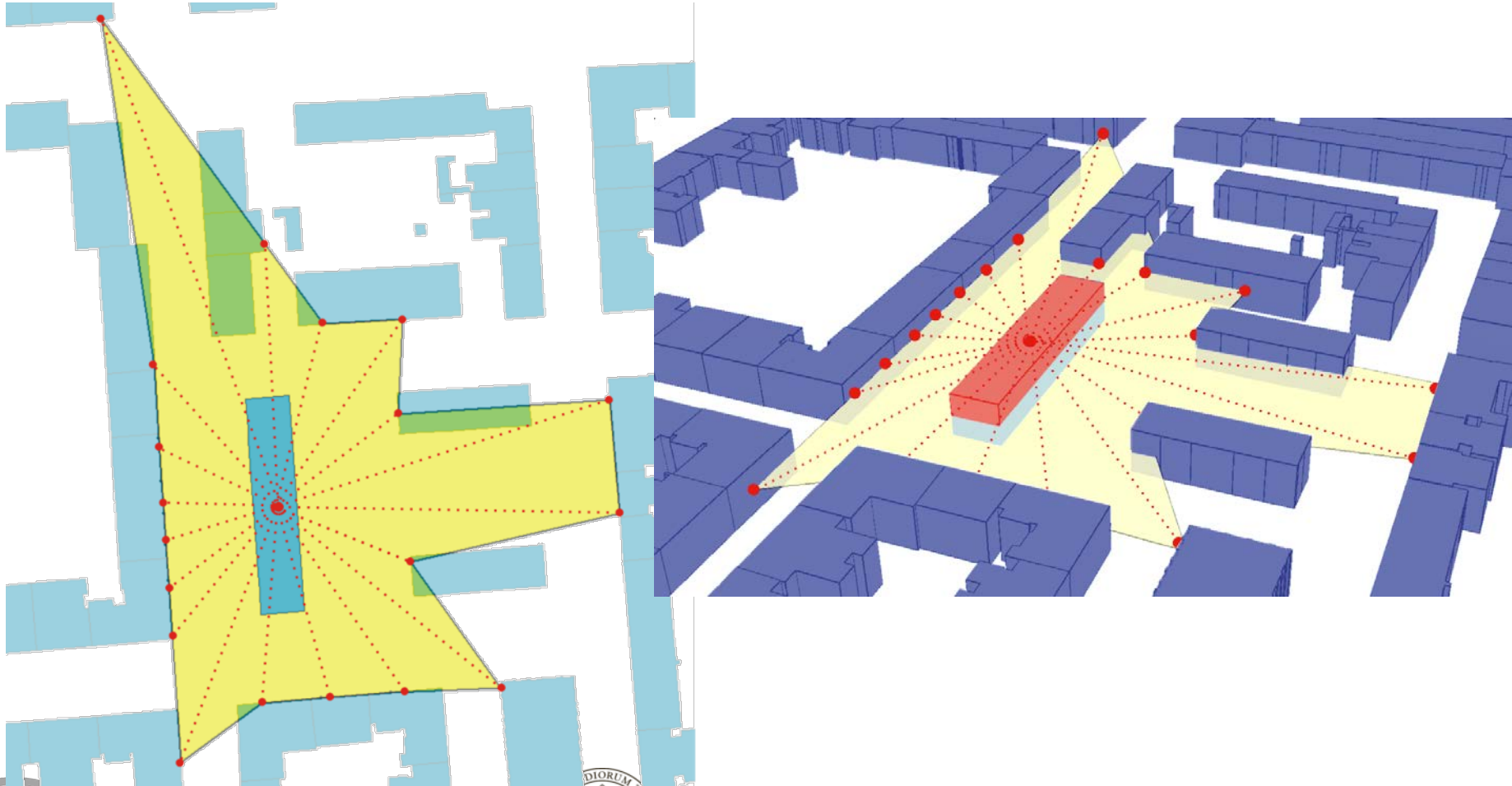
Calculation of visibility polygon

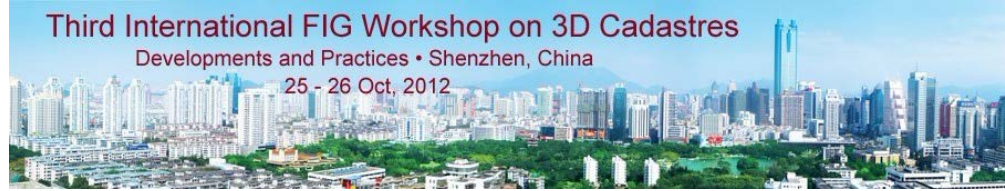
- Procedure of automatic calculation of 2D visibility polygon:
 - cross section of horizontal vision in all directions with the first obstacle in a 3D space model. The obstacle can be a building or a terrain which cuts the vision



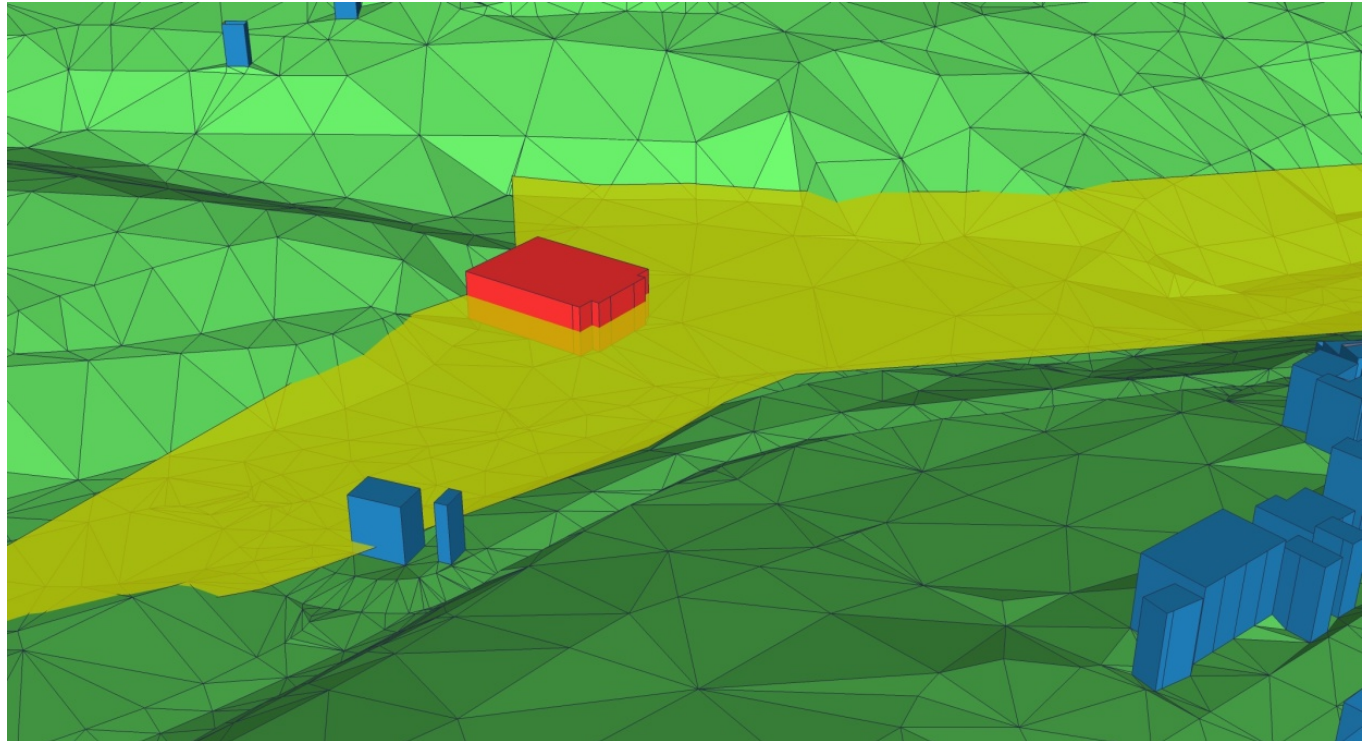


Calculation of visibility polygon





Calculation of visibility polygon

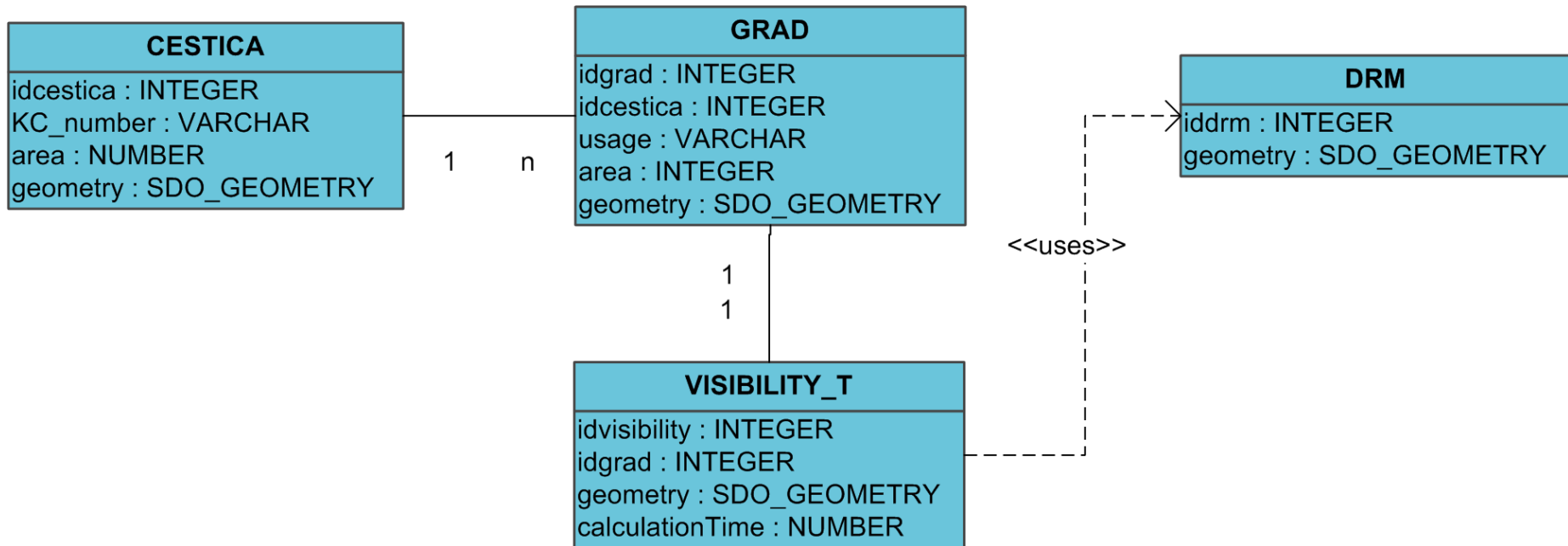


- geometry of the intersection - SDO_GEOMETRY data type, area of the polygon, time for calculating the procedure for an object building, number of objects included in the query, a unique building identification.





Implemented test model class diagram





Visibility polygon area [m²] for the whole test area

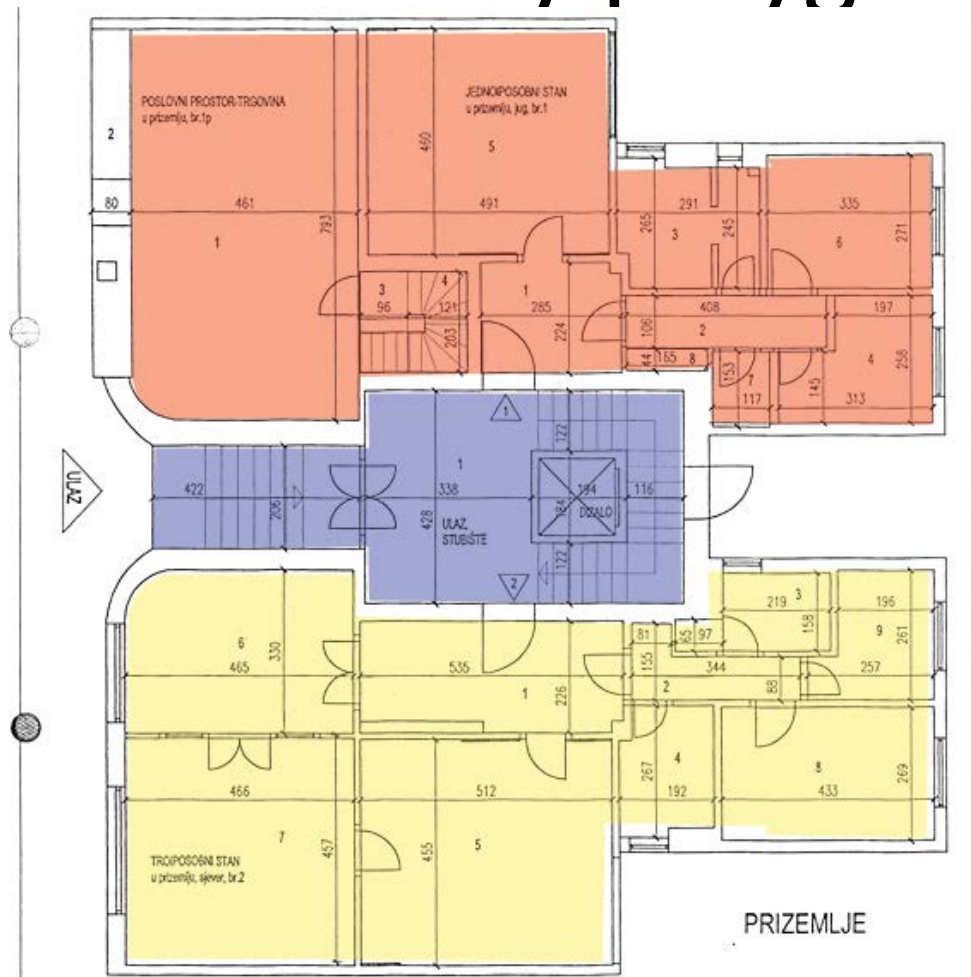


- 0 - 1000
- 1000 - 2000
- 2001 - 3000
- 3001 - 8000
- 8001 - 20000
- 20001 - 30000
- 30001 - 40000
- 40001 - 50000
- 50001 - 100000
- 100001 - 150000
- 150001 - 200000
- 200000 - 300000
- 300001 - 350000
- 350001 - 400000
- 400001 - 521872

- 13137 buildings
- over 2 days to compute



More detailed calculation of visibility polygon



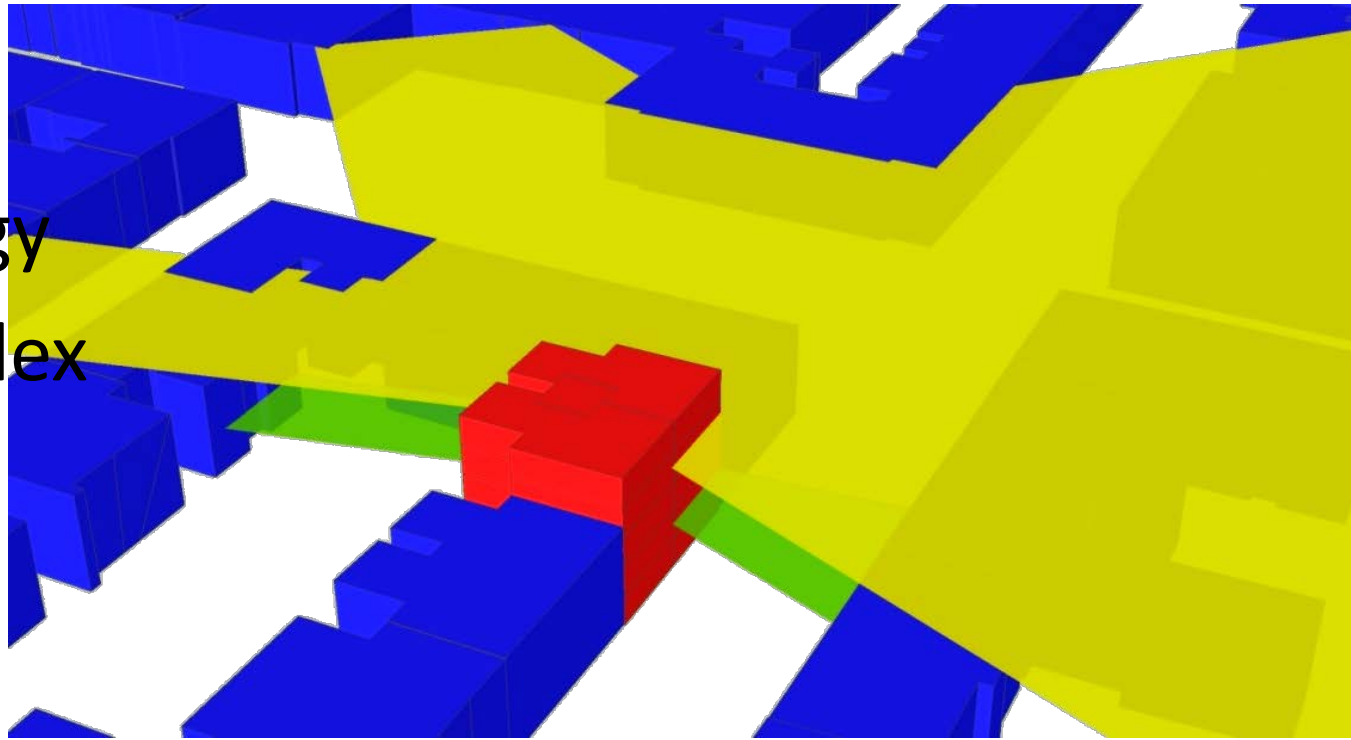
according to plan
of particular
parts of real
property –
condominiums,
flats





More detailed calculation of visibility polygon

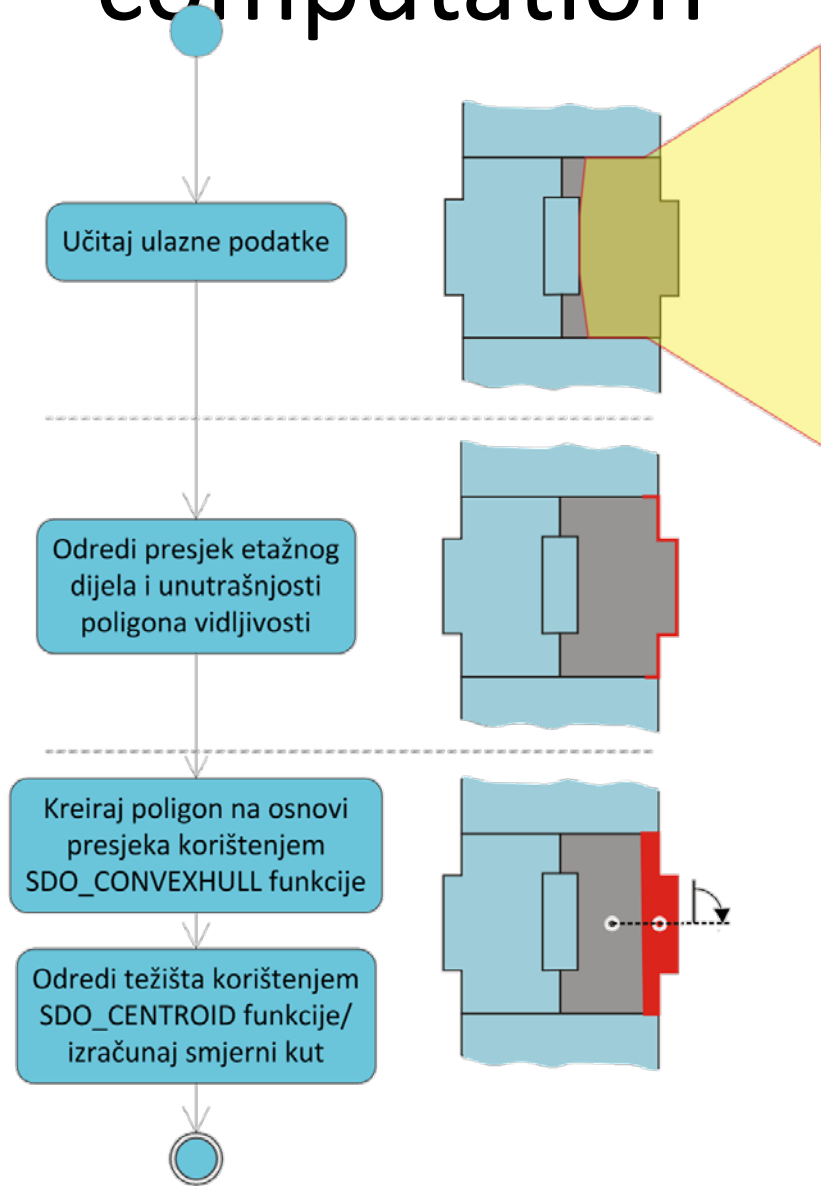
- Same methodology
- More complex modeled objects





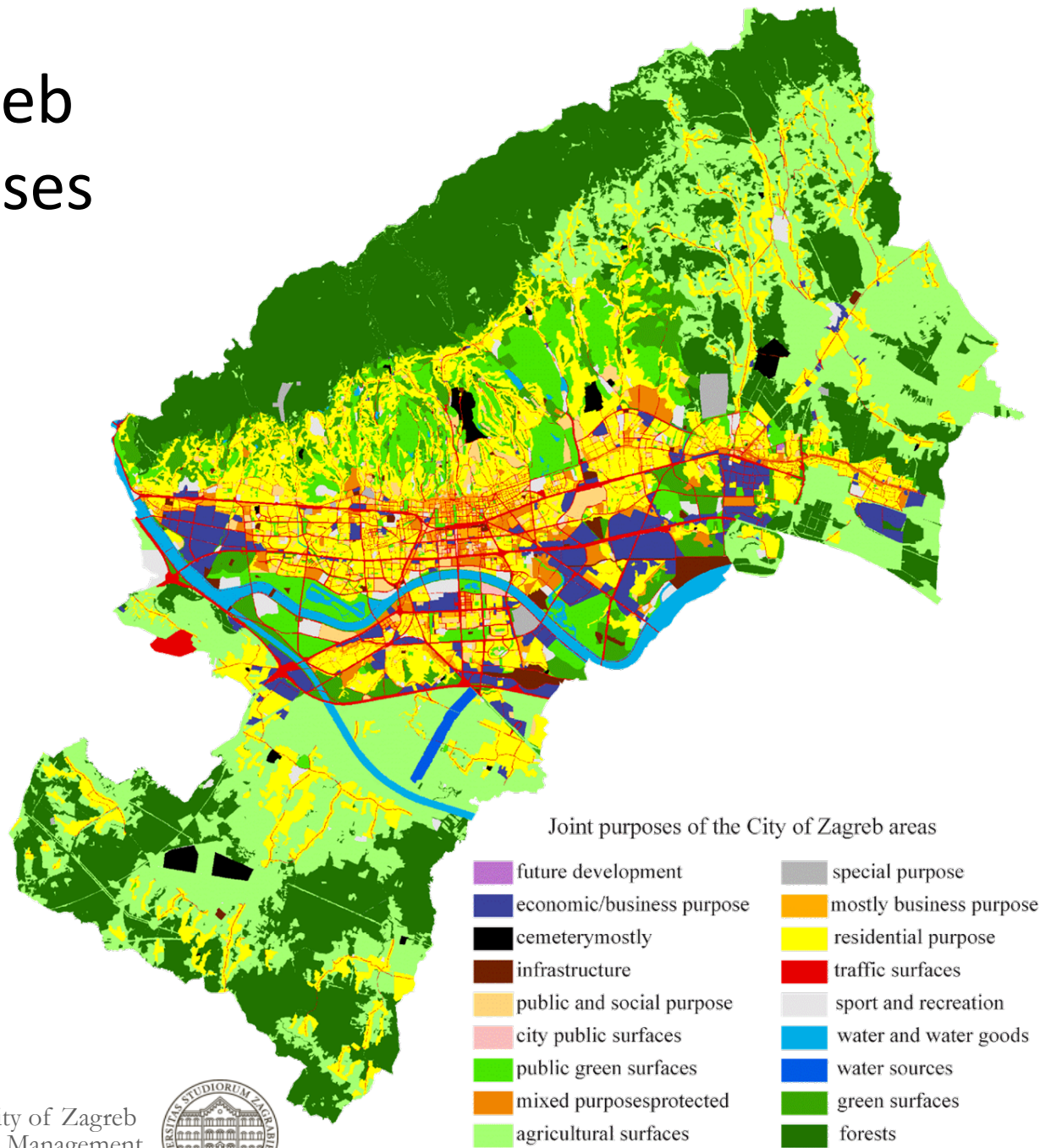
Possible usage – computation of orientation

- Procedure compute orientation towards the sides of the world



City of Zagreb

Joint purposes areas





Conclusion

- Possibilities of application of the information system presented in this work are wide:
 - strategic and spatial planning,
 - urbanism,
 - marketing, etc.
- Cost/benefit analysis



Thank you for your
attention!

Hrvoje TOMIĆ, Miodrag ROIĆ, Siniša MASTELIĆ IVIĆ

**Use of 3D cadastral data for real estate
mass valuation in the urban areas**



Faculty of Geodesy, University of Zagreb
Chair of Spatial Information Management

