

ATHENS WORKSHOP



Workshop Joint FIG Commissions 3 and 8
Athens – 13th and 14th December 2022



Integration of SDI and interoperability of LIS

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GEOMETRIC INTEROPERABILITY OF LIS

case study:

**INTEGRATION of GEOMETRIC data of Slovenian
real estate CADASTRE and SPATIAL PLANS**



University of Ljubljana
Faculty of Civil and Geodetic Engineering



arrs

SLOVENIAN RESEARCH AGENCY

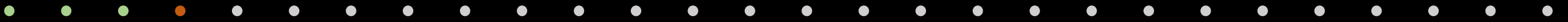
„Where to draw the line?“

THE TOWN PLANNER - THE LAND SURVEYOR -

SDI expert

SPATIAL PARTITION OF LAND – LAYING OUT PRIVATE PROPERTY BOUNDARIES -

INTEROPERABLE (geometry) INTEGRATION



INSPIRE ?

LEGAL REGIMES and CADASTRE in Slovenia

SPATIAL ACTS

SDI service

The screenshot displays the Slovenian Spatial Information System (SDI) interface. At the top, it identifies the user as 'REPUBLIKA SLOVENIJA' and the 'MINISTRSTVO ZA OKOLJE IN PROSTOR'. The system title is 'PROSTORSKI INFORMACIJSKI SISTEM EVIDENCA STAVBNIH ZEMLJIŠČ'. A search bar on the left is labeled 'Iskanje po naslovu'. The main map area shows a cadastral map with various colored polygons representing land parcels. On the right, a layer control panel is visible, divided into 'Osnovni sloji' and 'Prekrivni sloji'. The 'Prekrivni sloji' section is expanded, showing a list of layers with checkboxes:

- Evidenca stavbnih zemljišč
 - > Pozidana zemljišča
 - > Nepozidana stavbna zemljišča
- Občinski prostorski akti
- Državni prostorski akti
- Upravni akti
- Nepremičninske evidence



GEOMETRICALLY INTEROPERABLE ?

Property **RIGHTS (CADASTRAL BOUNDARIES)**

European **BASIC REFERENCE DATASETS (2017)**

Legal **RESTRICTIONS** of Property rights (**REGIMES BOUNDARIES**)

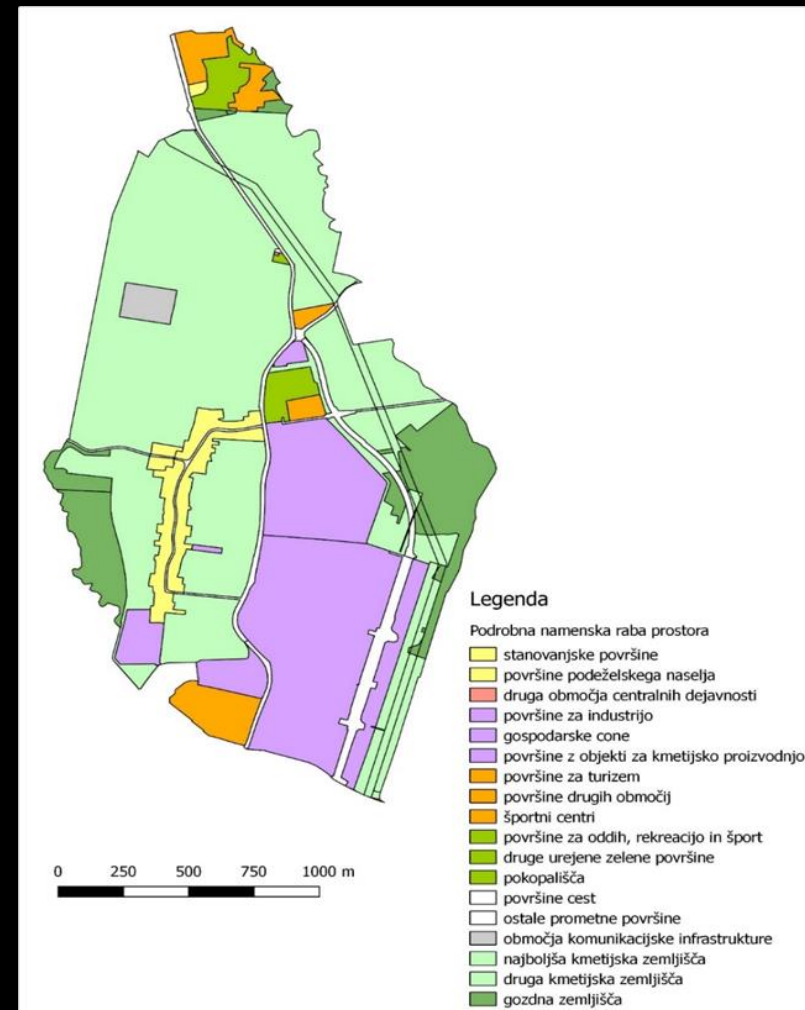
HIGH QUALITY

CADASTRAL GEOMETRY

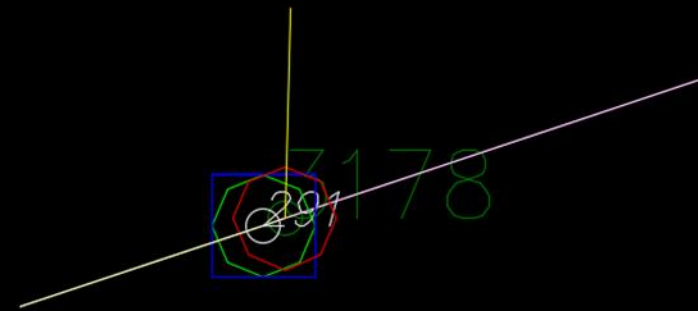
HIGH POSITIONAL ACCURACY



DETAIL SPATIAL PLAN



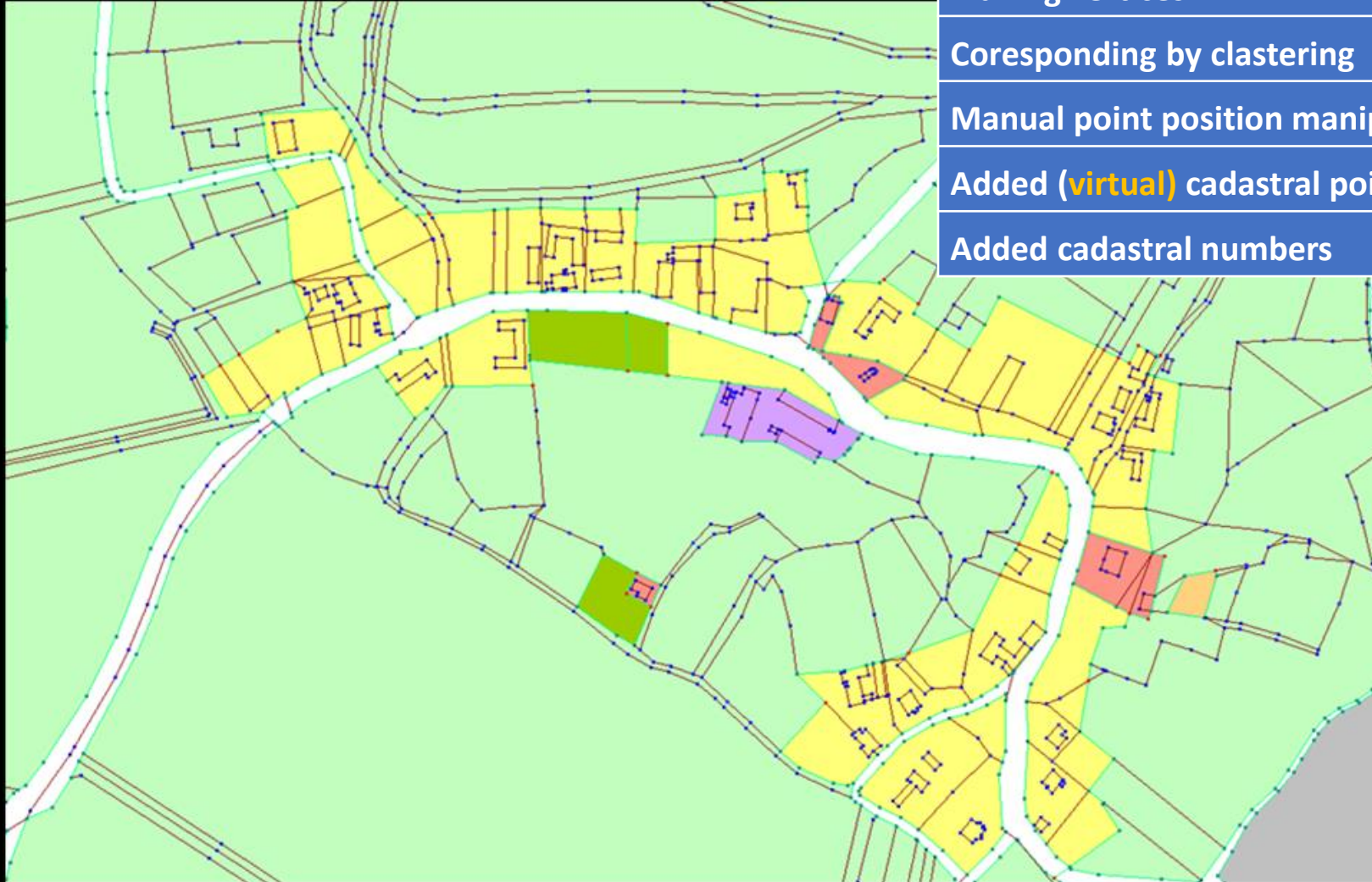
SMALL POSITIONAL DIFFERENCES ~ 0,5 m



TOPOLOGICAL TOLERANCE ASSESMENT

CLUSTER INTEGRATION

SUPERIMPOSITION: COMBINED INFO

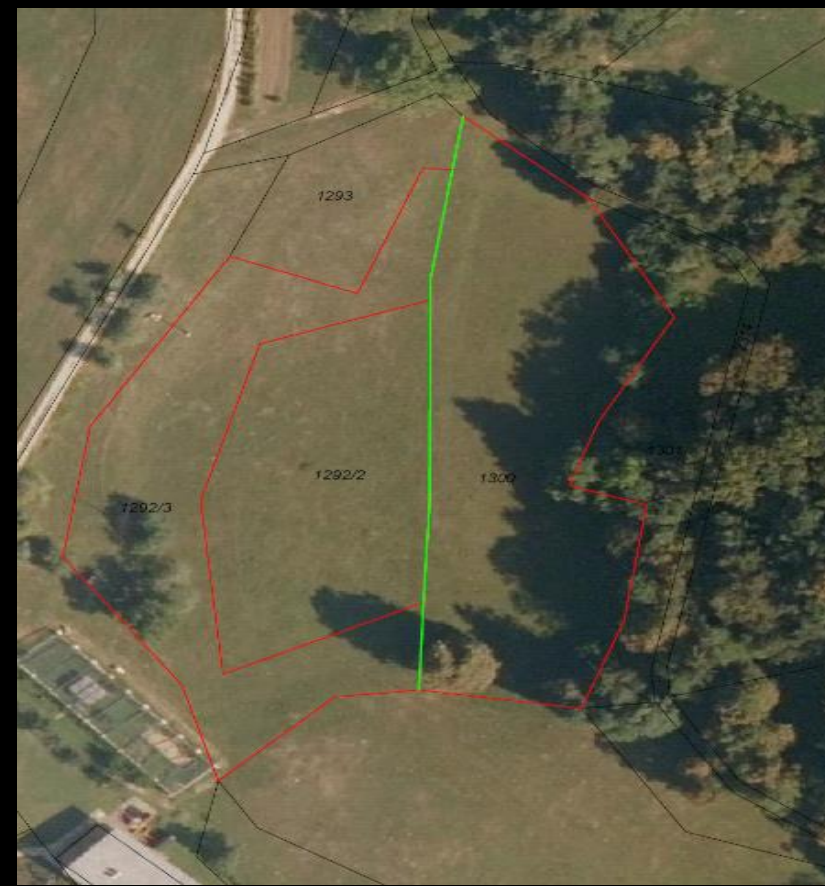
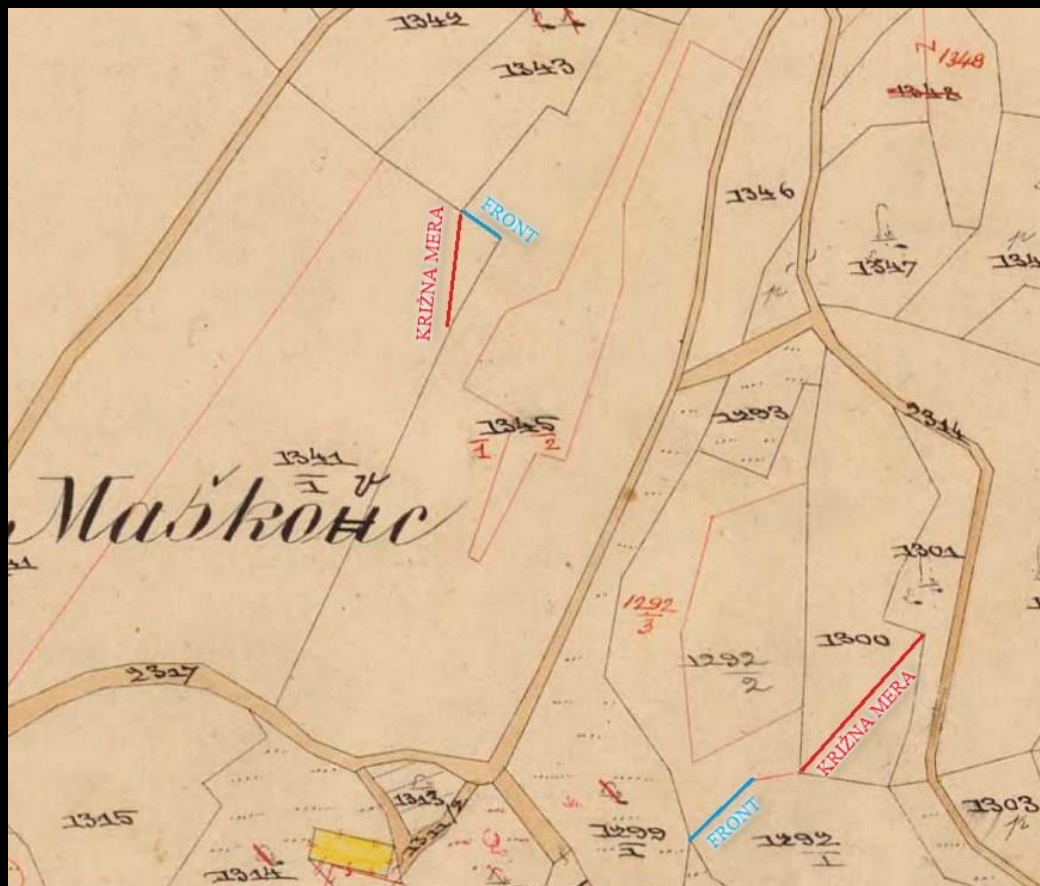


	Number of points
Cadastral points	3398
Planing vertices	1500
Corresponding by clustering	1340 (89%)
Manual point position manipulation	160 (11 %)
Added (virtual) cadastral points	39
Added cadastral numbers	51

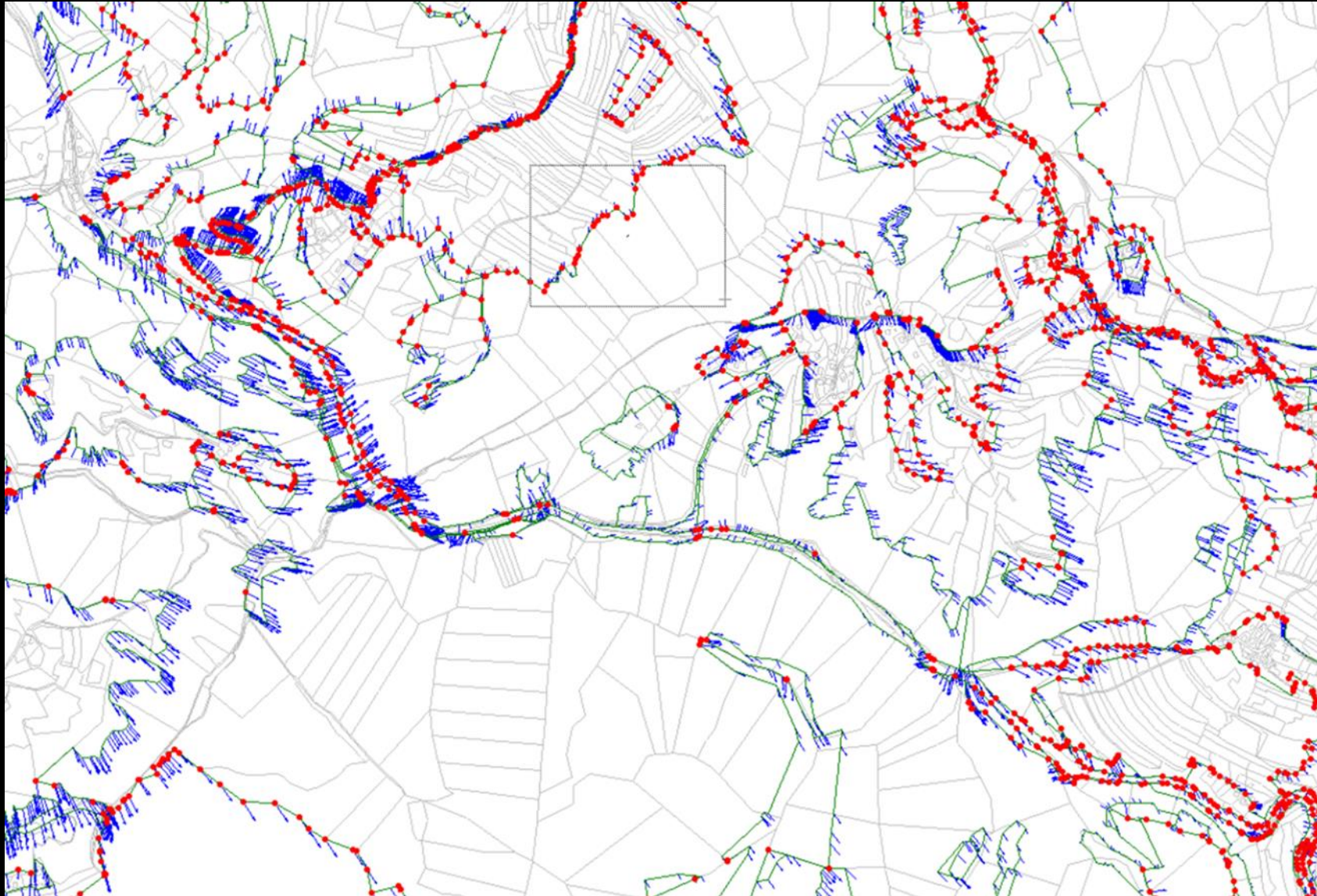
CADASTRAL index MAP – LOW QUALITY !

traditional

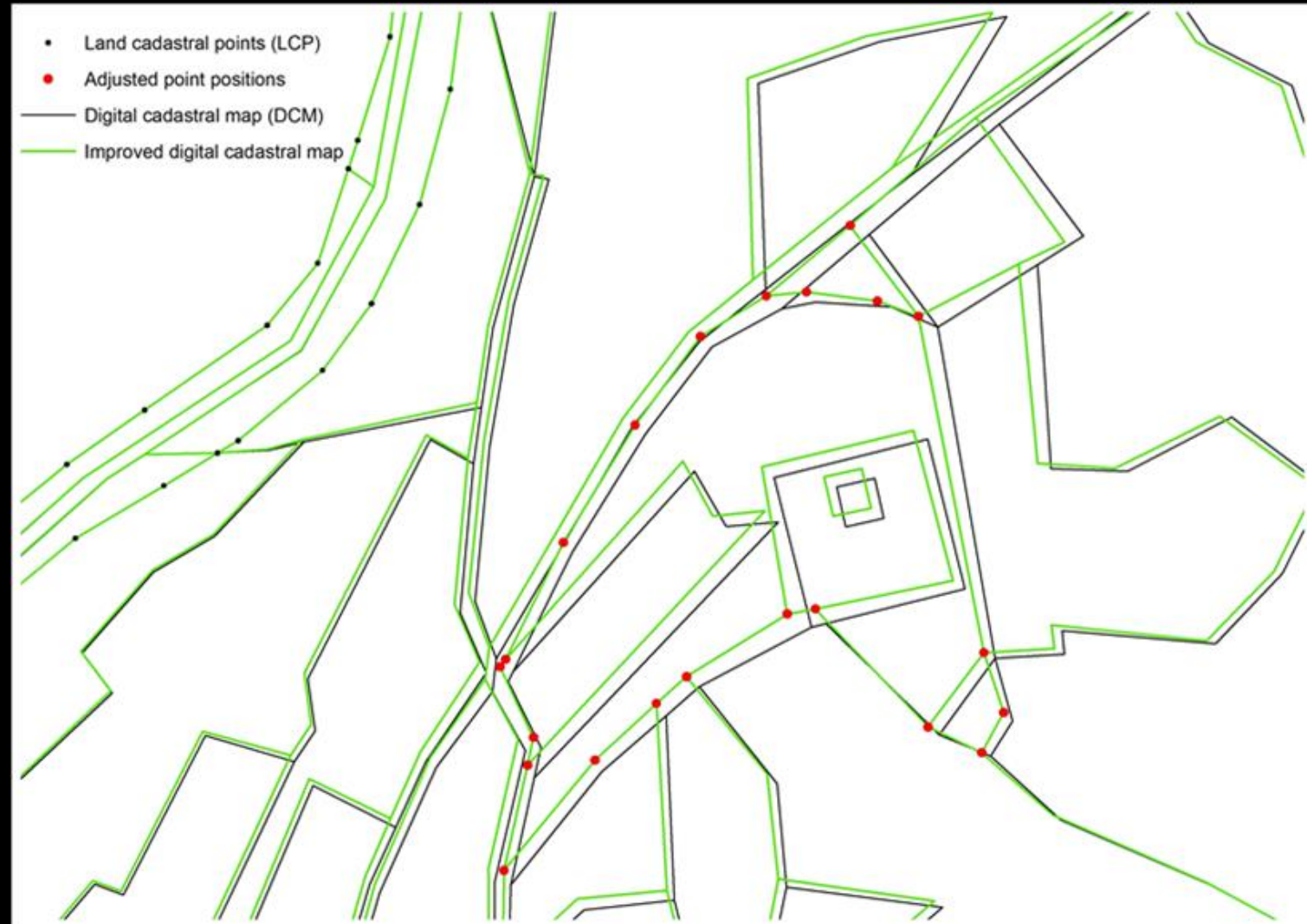
vectorised



UNHOMOGENEITY of reference cadastre



POSITIONAL ACCURACY IMPROVEMENT (PAI) of reference cadastre (membrane proximity adjustment)



INTEGRATED CADASTRAL GEOMETRY, but...





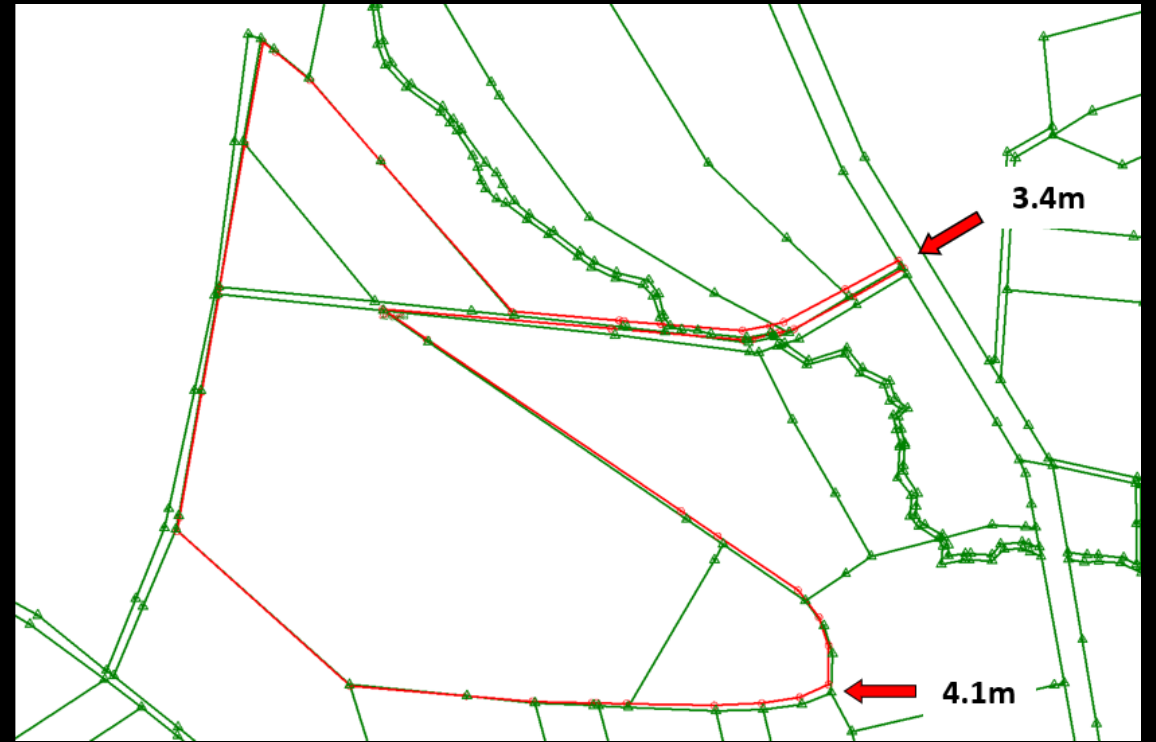
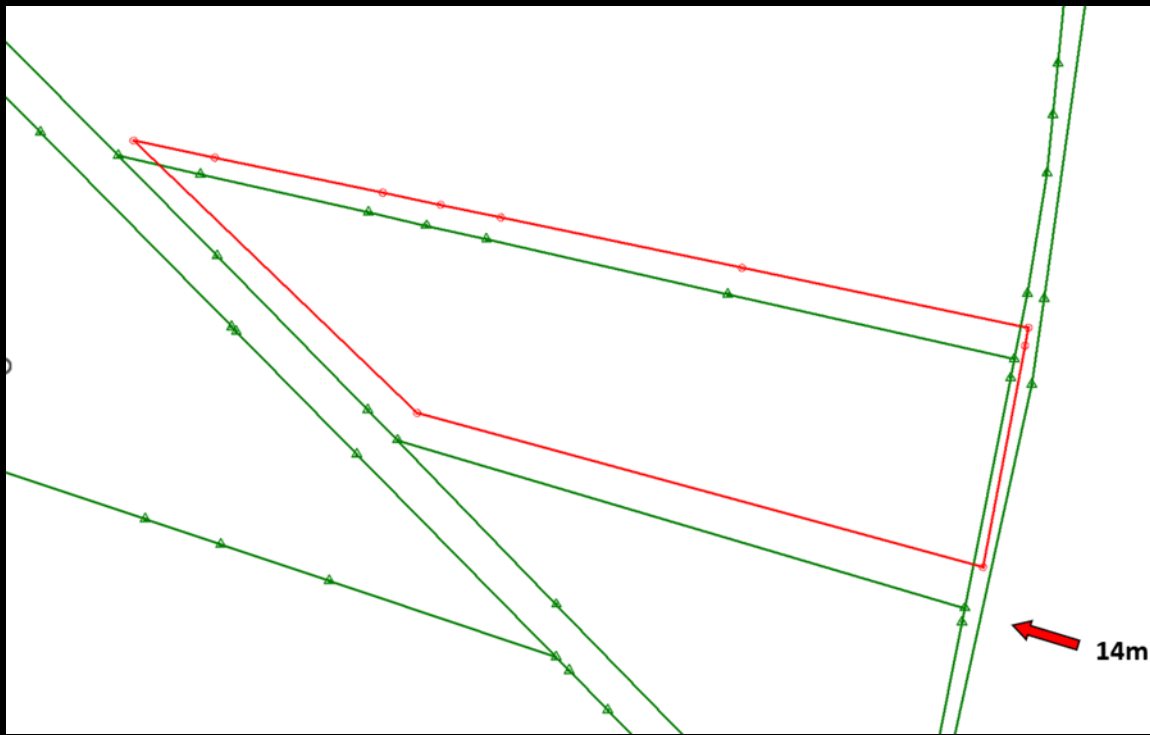
CADASTRE for SPATIAL PLANNING

OLD reference : **IMPROVED** reference

INTERPRETATION AMBIGUITIES

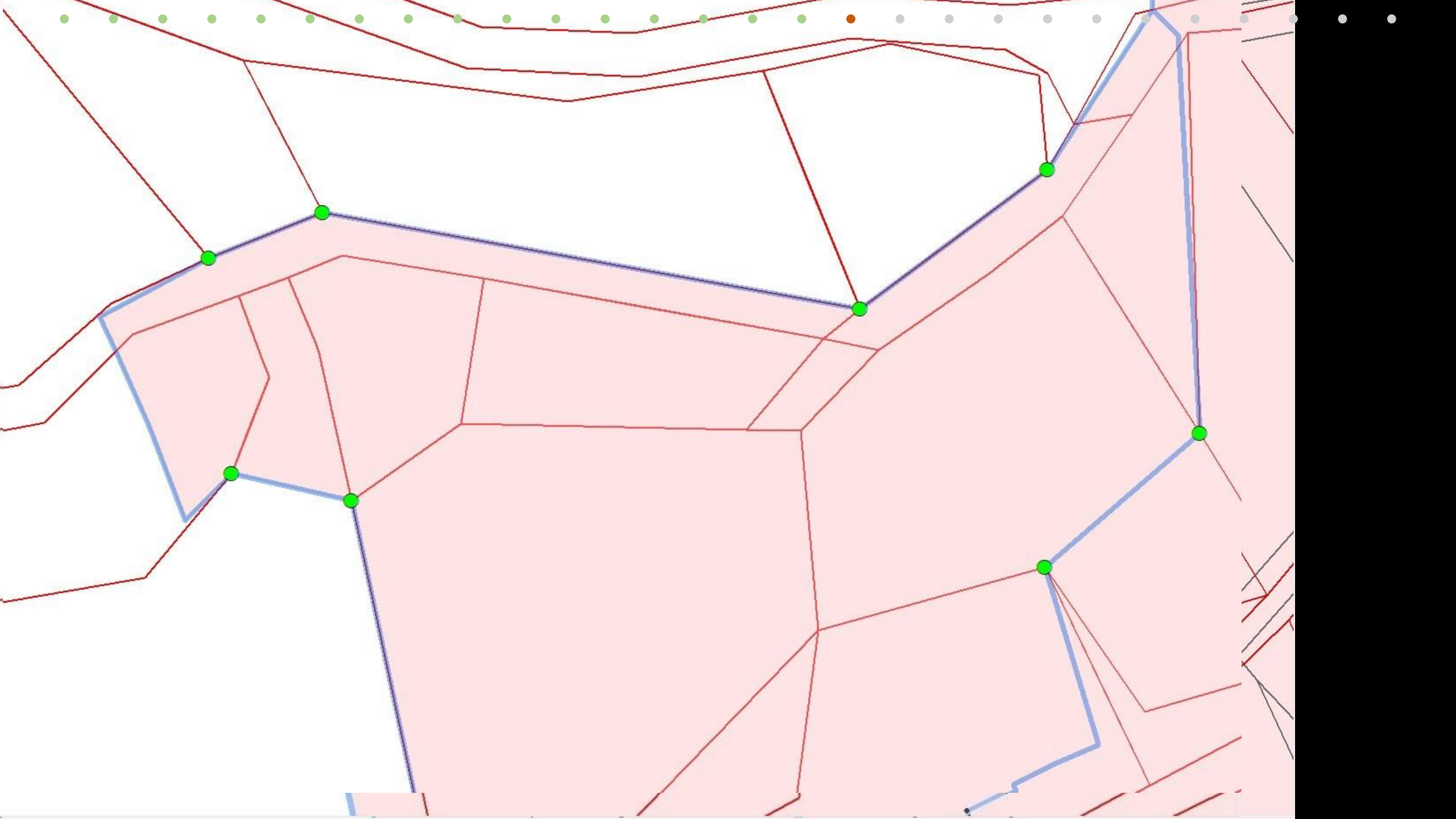
SUPERIMPOSITION ???

CADASTRAL MAP (green) and SPATIAL PLAN (red)





MATCHING





FINDING IDENTICAL information OBJECTS

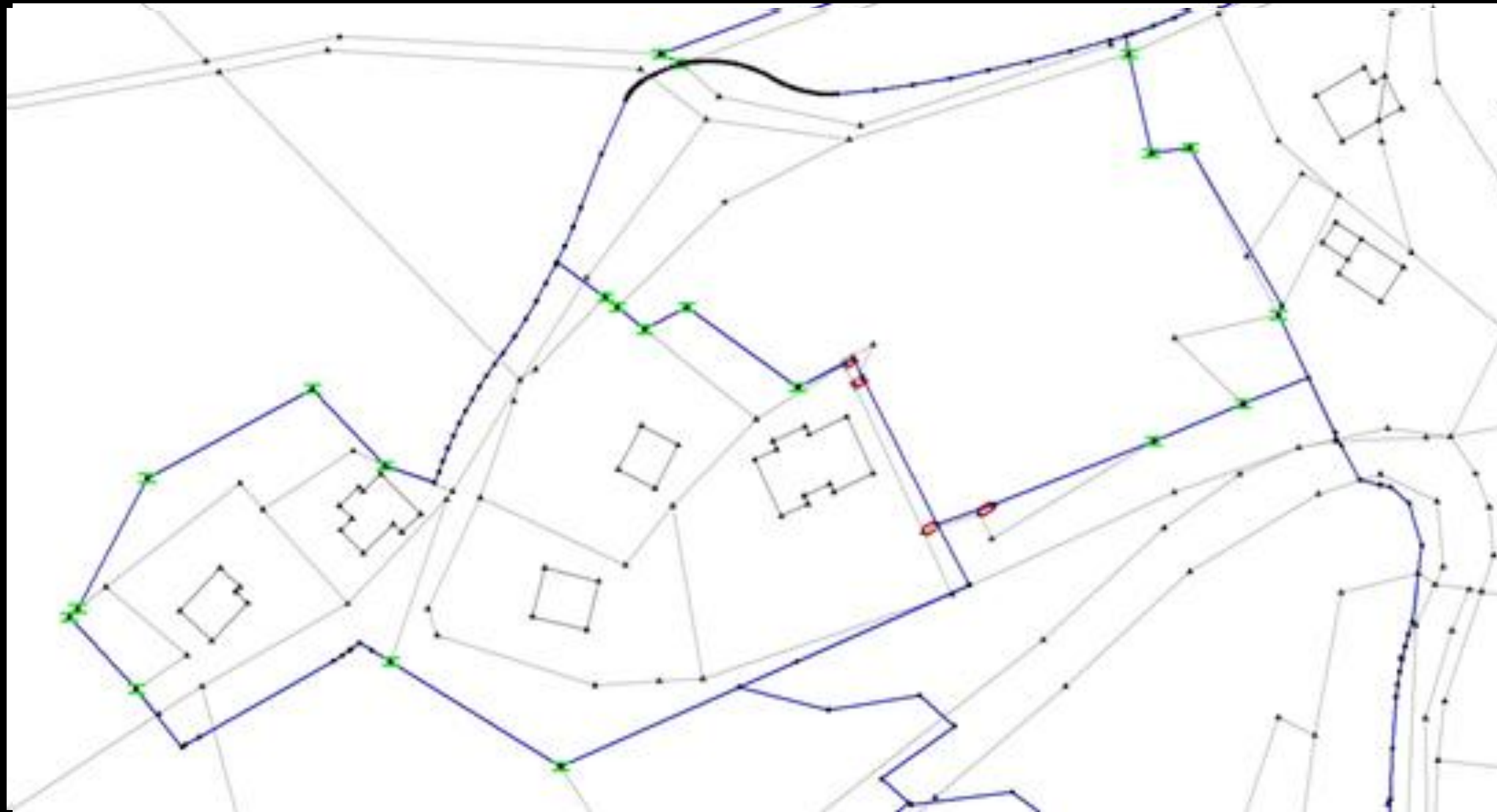
in different data sets

MATCHING and HOMOGENIZATION (iterations):

SEARCH – CONNECT – ADJUST/HOMOGENIZE

SEARCH – CONNECT – ADJUST/HOMOGENIZE

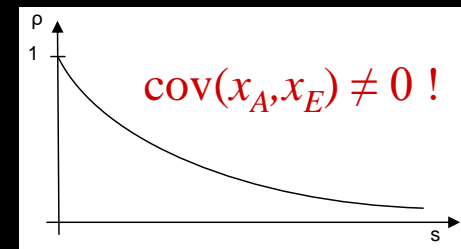
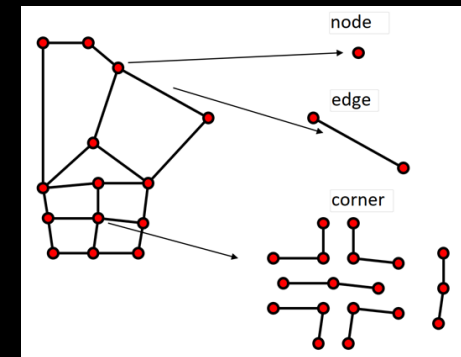
SEARCH – CONNECT – ADJUST/HOMOGENIZE



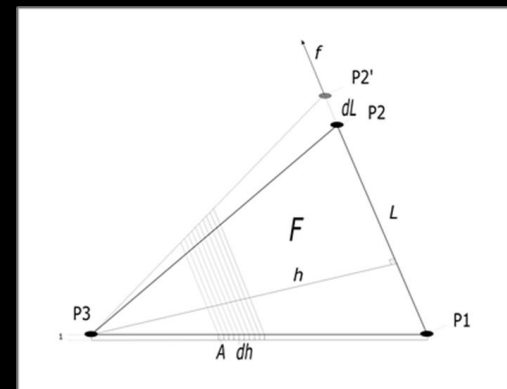
GEODETIC CALCULATIONS

TOPOLOGICAL FACTS from GEOMETRIC ATTRIBUTES:

- **DECOMPOSITION:** **GEOMETRIC PARAMETERIZATION**
- search for **POINT RELATIONS** (automated identity observation)
 - **TOPOLOGICAL**
 - and **PROXIMITY** relations
 - **DISTANCE DEPENDENT CORRELATIONS**
- **LEAST SQUARES ADJUSTMENT** (Gauss-Markov model)
 - **TEST FOR IDENTITY** (corresponding covariance matrices)
- **HOMOGENIZATION:** Proximity Fitting with a Mechanical Membrane Model Based on Hooke's Law



$$v^T P v \stackrel{!}{=} \min \quad x = (A^T P A)^{-1} A^T P l$$



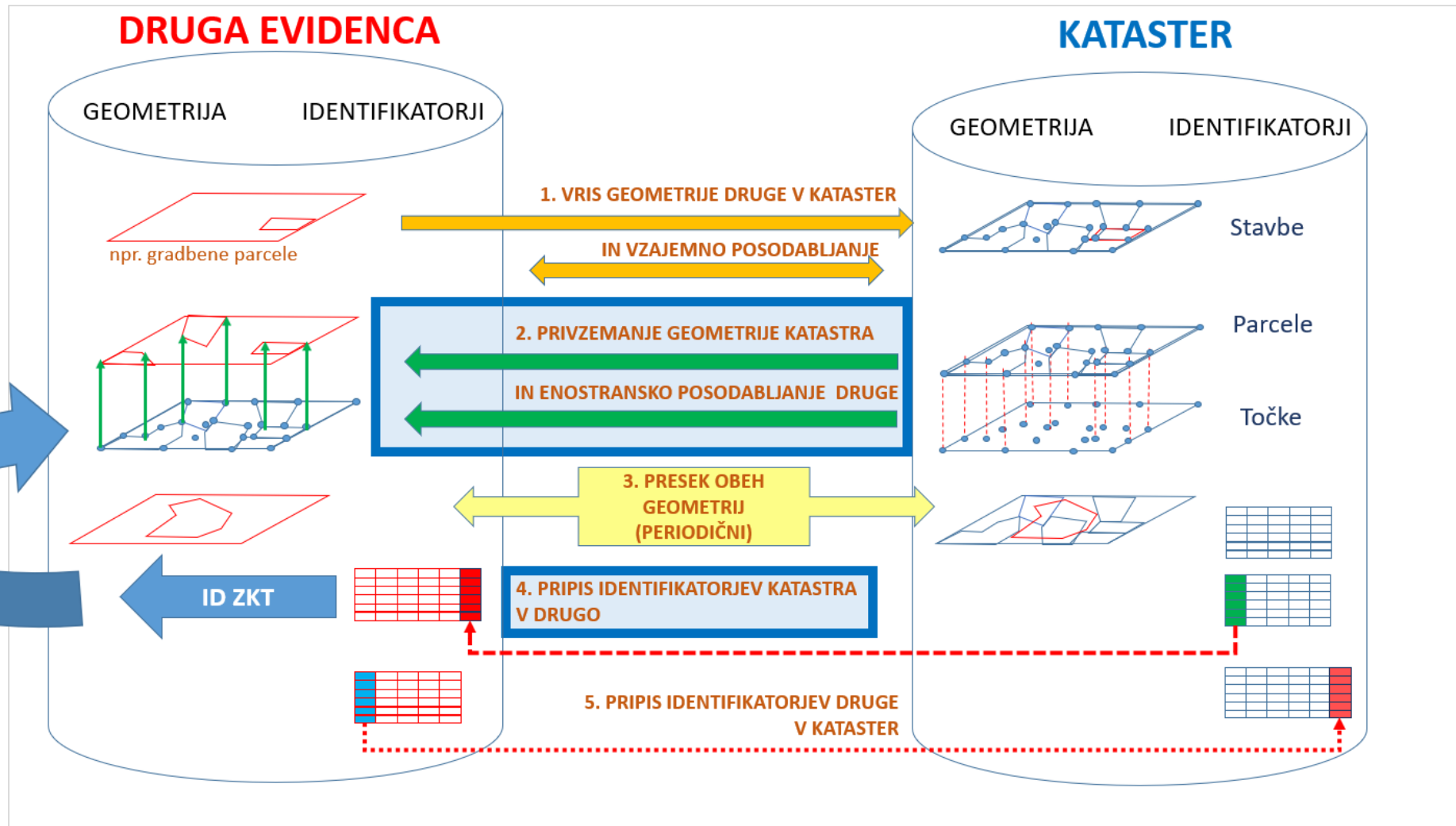


CHALLENGE:

DYNAMIC UPDATES of reference GEOMETRY

PERMANENT CONNECTIONS – IDENTITY OBSERVATIONS

PERMANENT, COMBINED, INTER-OPERABLE CONNECTIONS

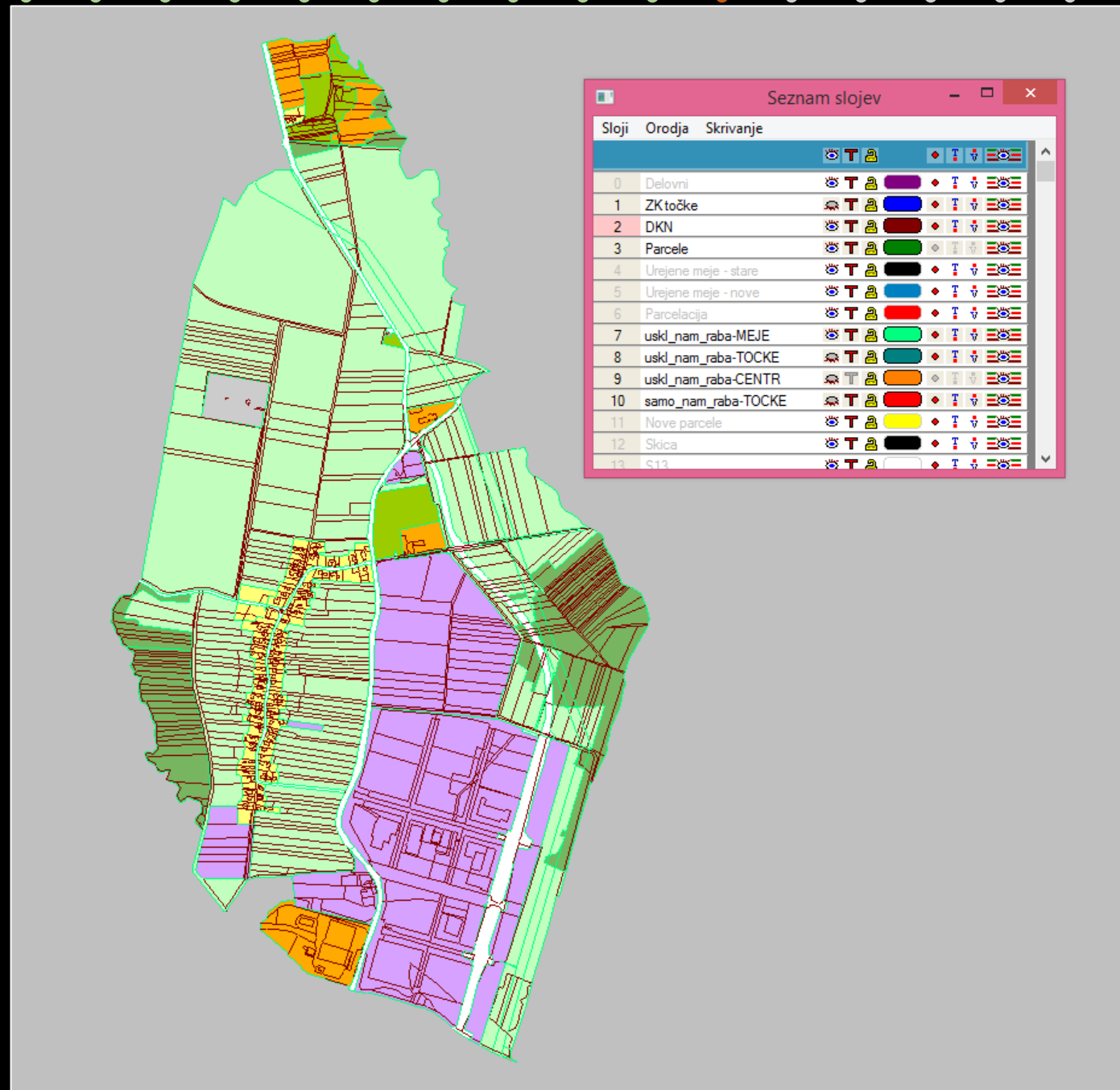


RESULT:

Geometrically
INTEROPERABLE LIS

INTEGRATED
geospatial data

MULTIPURPOUSE
CADASTRE

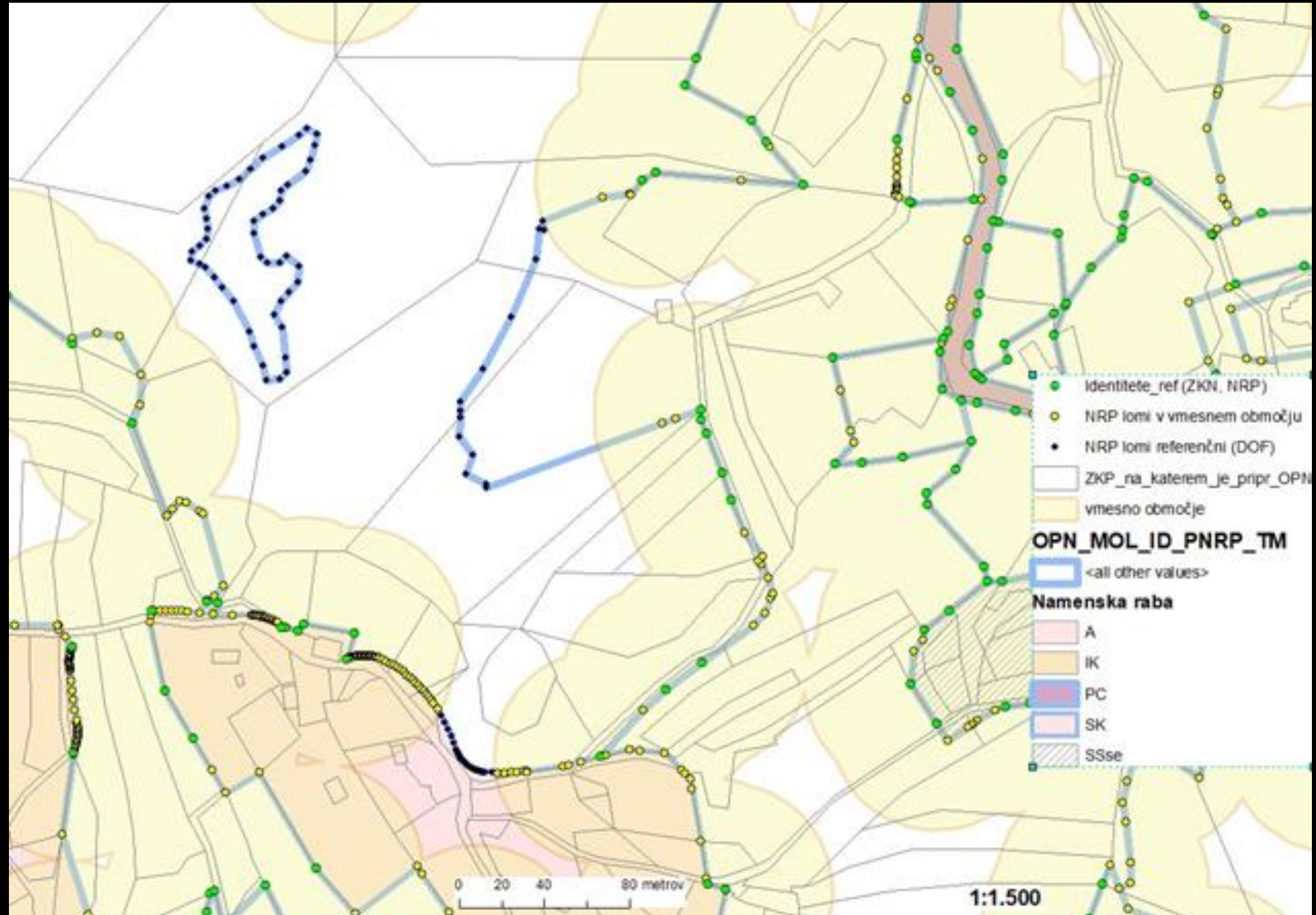


INDIVIDUAL TREATMENT OF THE SUB- Selection

Green – discovered
coincident points

Yellow - intermediate
areas (do not coincide
with the cadastre)

Blue: according to
topography (they are not
adjusted; reference,
anchor)



Take-away

- distinguish QUALITY between OBSERVATION BASED and VECTORISED (GIS) layers
- GEODETIC MATCHING: CALCULATE geometric CONNECTIVITY instead of GIS/CAD drafting/REDRAWING geometry
- PERMANENT CONNECTIONS for CONTINUOUS UPDATING



FURTHER RESEARCH

SEMANTICS INTEROPERABILITY OF LIS



Surveying and
Mapping Authority
of the Republic of
Slovenia



CONNECTIVITY of SPATIAL DATA
of (other) official records

with real estate CASTRAL DATA

Slovenian research project V2-2156 (2021-2023)

Chair of Geoinformatics and RE Cadastres

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