DYNAMIC LIGHT - TOWARDS DYNAMIC, INTELLIGENT AND ENERGY EFFICIENT URBAN LIGHTING

DELIVERABLE D.T2.1.3

WPT2 - GIS-based database for municipalite of Čakovec

10/2017

CONTENT

LIST OF IMAGES

LIST OF TABLES

1. INTRODUCTION

Town of Čakovec is placed at north-west part of Republic of Croatia and it is cultural and political capital of Medjimurje county.

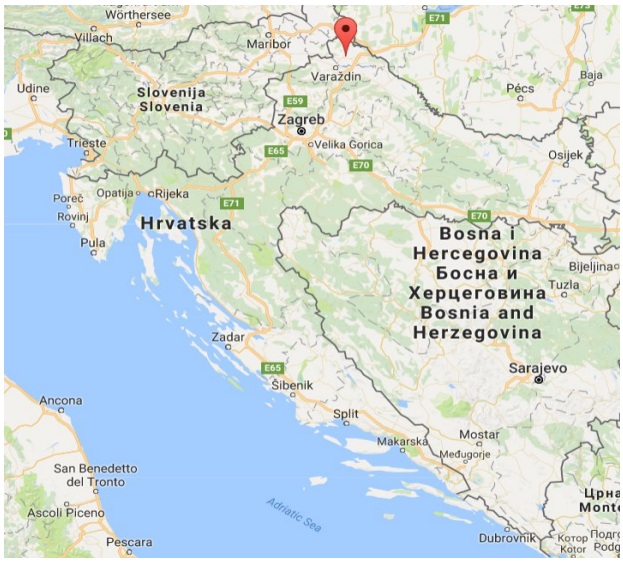


Image 1. *Republic of Croatia*

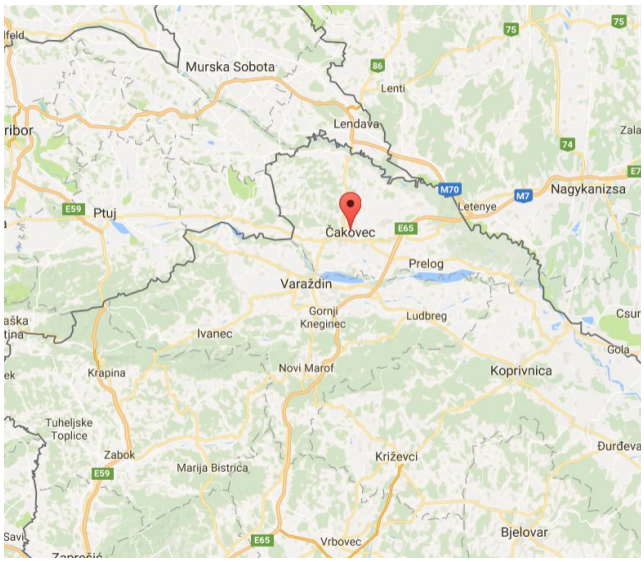


Image 2. *Nort-west part of Croatia*

Total area of administrative area of Town of Čakovec is 72,80 km^2 while total population of area is 27.104. Administrative area of Town of Čakovec consist of Town of Čakovec and 13 suburban settelments:

- Ivanovec,
- Krištanovec,
- Kuršanec,
- Mačkovec,
- Mihovljan,
- Novo Selo na Dravi,
- Novo Selo Rok,
- Savska Ves,
- Slemenice,
- Štefanec,
- Totovec,
- Žiškovec,
- Šandorovec.

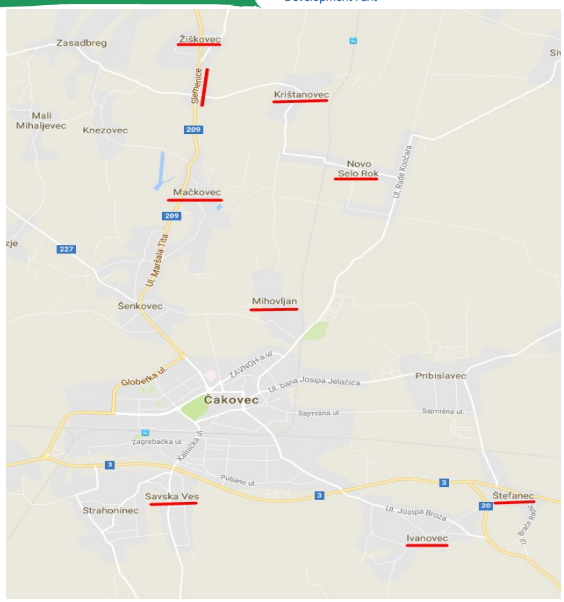


Image 3. *Settelments placed north of the Town of Čakovec*

Image 4*. Settelments placed south of the Town of Čakovec*

Table 1. *Geographic data of Town of Čakovec*

GEOGRAPHIC DATA	
Latitude	46° 23' N
Longitude	16° 25' E
Elevation	164 m

The selected area covers two part of Town districts (part of East and part of West Town district). Center of the Town is placed in the middle of both Town districts which was the main reason for selection of the area. Additonally, all important institutions are covered with selected area. Selected area is shown in ***Image 5.***

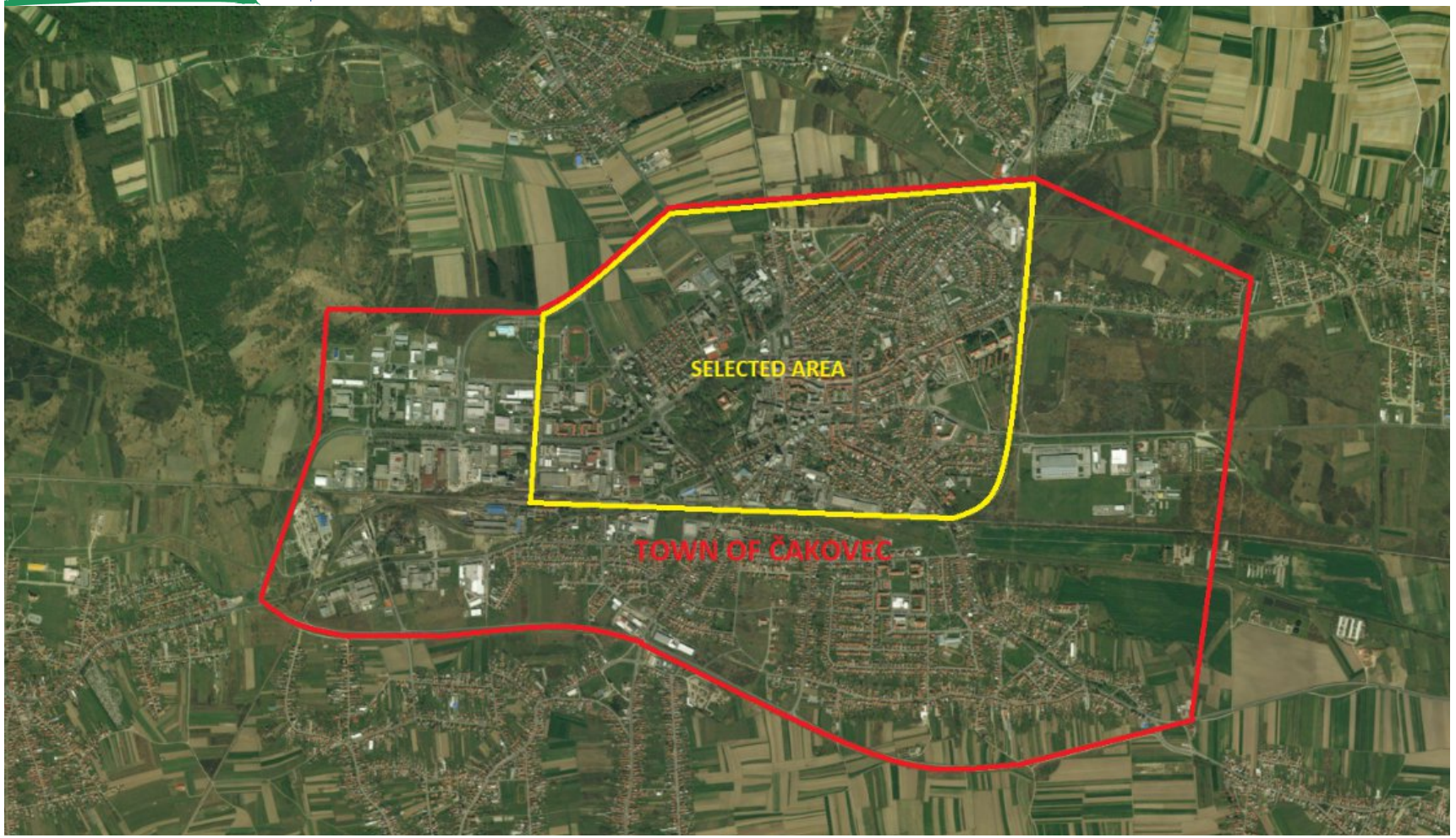


Image 5. *Red - Town of Čakovec, Yellow - selected area*

2. DATA SOURCES AND METHODOLOGY USED

Once the area has been selected, it was necessary to collect data and information on the current lighting infrastructure. The majority of technical information and data which was necessary to create quality GIS database was collected from *Energy audit of public lighting for Town of Čakovec* (here after: ***Energy audit***). The owner of public lighting (Town of Čakovec), Elektra Čakovec (National Energy Company ltd.) and Kabel Mont ltd. (privat subcontracted company which mantains public lighting) have additionally provided information and data of new luminaires which was implemented in meantime. Based on Energy audit which was made in 2015 and new information, field survey of current state of public lighting was made in order to check the accuracy of data and information. Once field survey of current state of public lighting was conducted, coordinates of each public lighting pillar where collected.

Mobile application GIS Cloud was used for data (coordinates) collection. Since the mobile device (GPS) had a slightly deviation from the actual position on the field, the collected data required additional processing. Collected coordinates of each pillar in the area where processed in order to to create accurate and quality GIS database for public lighting. Once coordinates for each pillar in the area where collected and processed they where linked to technical information about pillars and luminaires in Excel table which was provided by WPT2 leader.

Public procurement for creation of *Project assignment document*, *Main project document* and photometric measurement was carried out in order to select renowned company on the market. IPT Inženjering ltd. was selected according to public procurement rules. External associates of IPT Inženjering ltd. have performed photometric measurement in order to collect relevant data which was needed for creation of quality GIS database. Photometric measurements was performed at six streets in the area which represent six specific lighting situations for selected area. Results of photometric measurement where linked (in Excel table) to coordinates of pillars for the area where photometric measurement was performed.

Filled out Excel tables where loaded in QGIS in order to create fully operational spatial GIS database.

Filled out *Excel tables* and *Report on photometric measurement* can be find as an ***Attachment Nr. 1*** and ***Attachment Nr. 2***.

2.1. STRUCTURE AND NAMING OF THE DATA

Information and data which where included in GIS database can be divided in to:

- **geo_DB_luminaire -** Tabular are shown coordinates of each pillar linked to technical and other information such as: street name, owner of public lighting, company which is maintaining public lighting, lighting source, type of luminaire, luminous efficacy, luminous flux, total power of luminaire, material of public lighting pillar, height of public lighting pillar, distance between pillars, mounting height of luminaire etc.
- **geo_DB_photometric -** Tabular are shown positions where photometric measurements was performed. First coordinate is presenting first pillar in the row where photometric measurement was performed while second one is representing last pillar. Distance between position of measuring device and calculation field is presented as well. Photometric data (luminance, overall uniformity, longitudinal uniformity, date and time of measurement) are shown as well.
- **geo_DB_switchboard** - Tabular are shown coordinates of each substation which powered public lighting. Energy consumption are shown by substations power line, street name etc.

As mentioned above, all collected data and information where linked to coordinates of each pillar and substations in Excel table provided by WPT2 leader. Those tables where later on loaded in QGIS in order to create fully operational spatial GIS database.

2.2. SOFTWARES

In order to collect and process all relevant information for creaton of quality GIS database free mobile application ***GIS Cloud*** and free ***QGIS software*** where used.

2.2.1. GIS Cloud

Mobile application *GIS Cloud* has provided the easiest and free way of collecting coordintes for public lighting infrastructure. In order to start collecting coordinates for public lighting infrastructure it was necessary to download free mobile application which provides easy use and easy identification of infrastructure in real space. Once *GIS Cloud* was installed on mobile device it was necessary to register in order to access the collected data which was sent to a cloud.

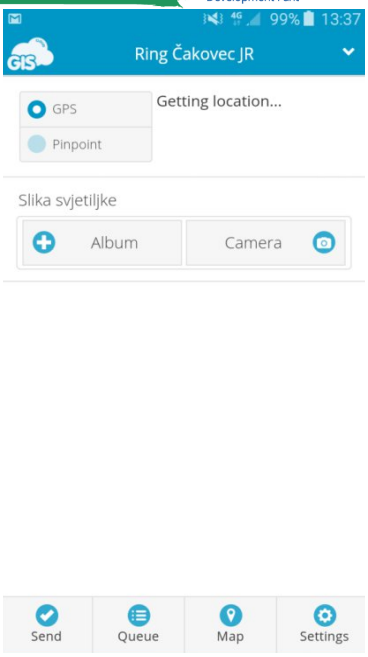


Image 6. *GIS Cloud mobile application*

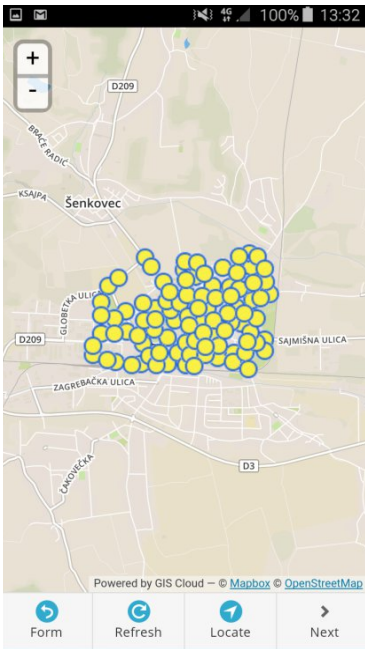


Image 7*. Map of the selected area in GIS Cloud mobile apllication*

Apart from the fact that collected data can be accessed from the mobile application, the same can be achieved with internet browser installed on computer. Once field survey was conducted, collected data where processed in order to eliminate unwanted deviations of the coordinates from the actual position in space. Collected data where downloaded and linked to relevant technical information in Excel table.

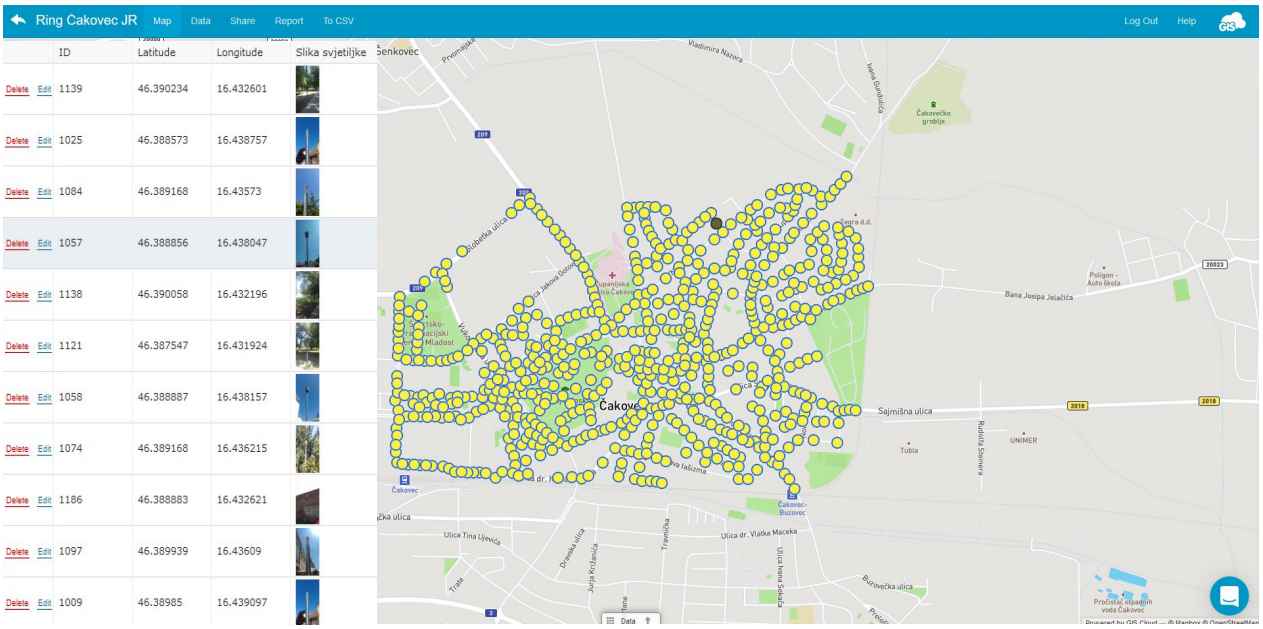


Image 8. *GIS Cloud interface with colleted data*

2.2.2. QGIS

Once Excel table with collected data was loaded in QGIS, points which represent position of each luminaire, substation and postion of photometric measurement are displayed on the map. Every point on the map can be additionally corrected if udesirable deviations occur. Undesirable deviations of points from real position in space can occur when loading data from Excel table.

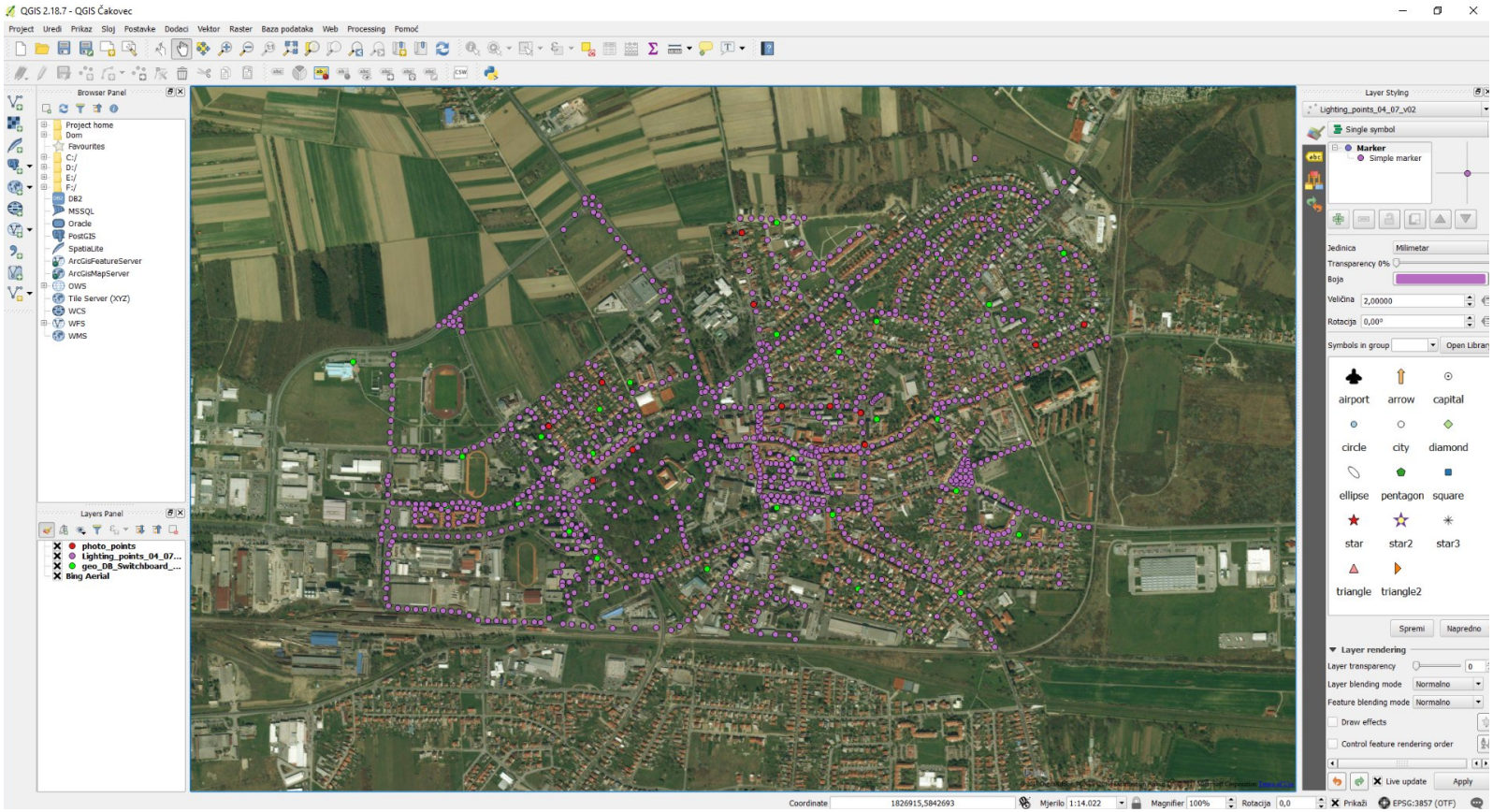


Image 9. *GIS Cloud interface with colleted data*

3. VISUALIZATION OF THE COLLECTED DATA

Three fully operational GIS databasees where created within this deliverable:

a) GIS database for luminaires at selected area

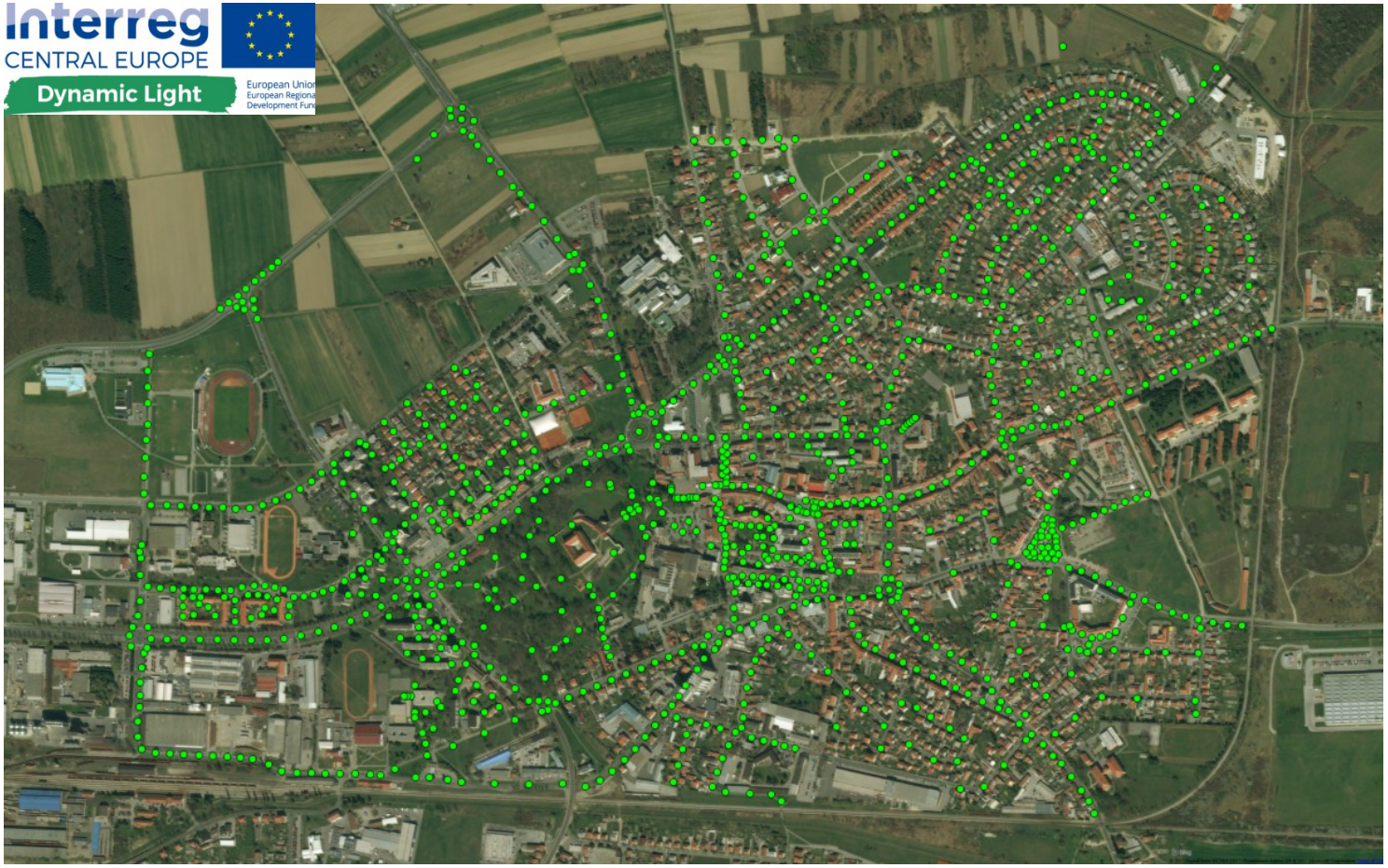
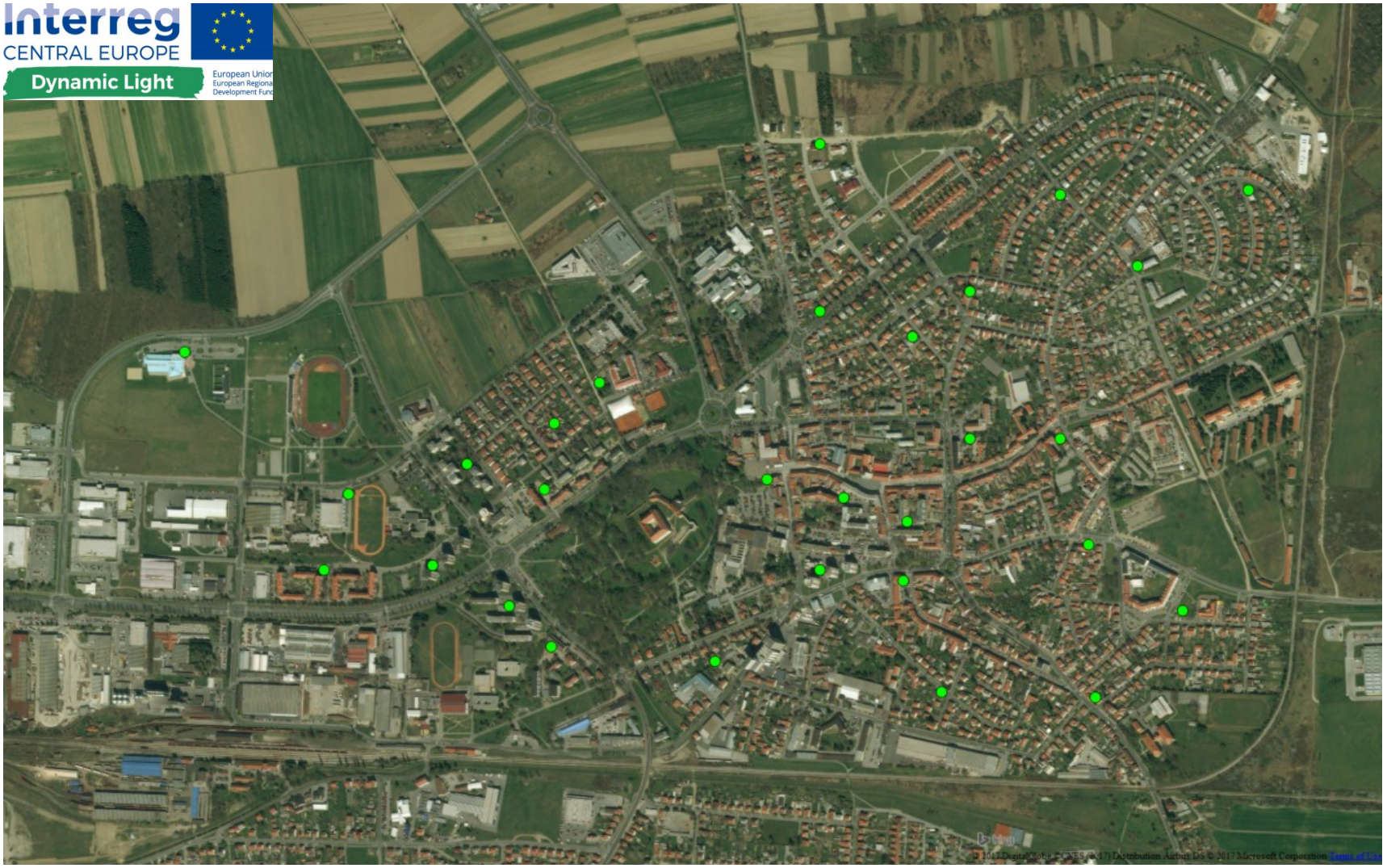


Image 10. *Spatial position of luminaires at selected area*

b) GIS database for substations at selected area



c) GIS database for photometric measurements at selected area

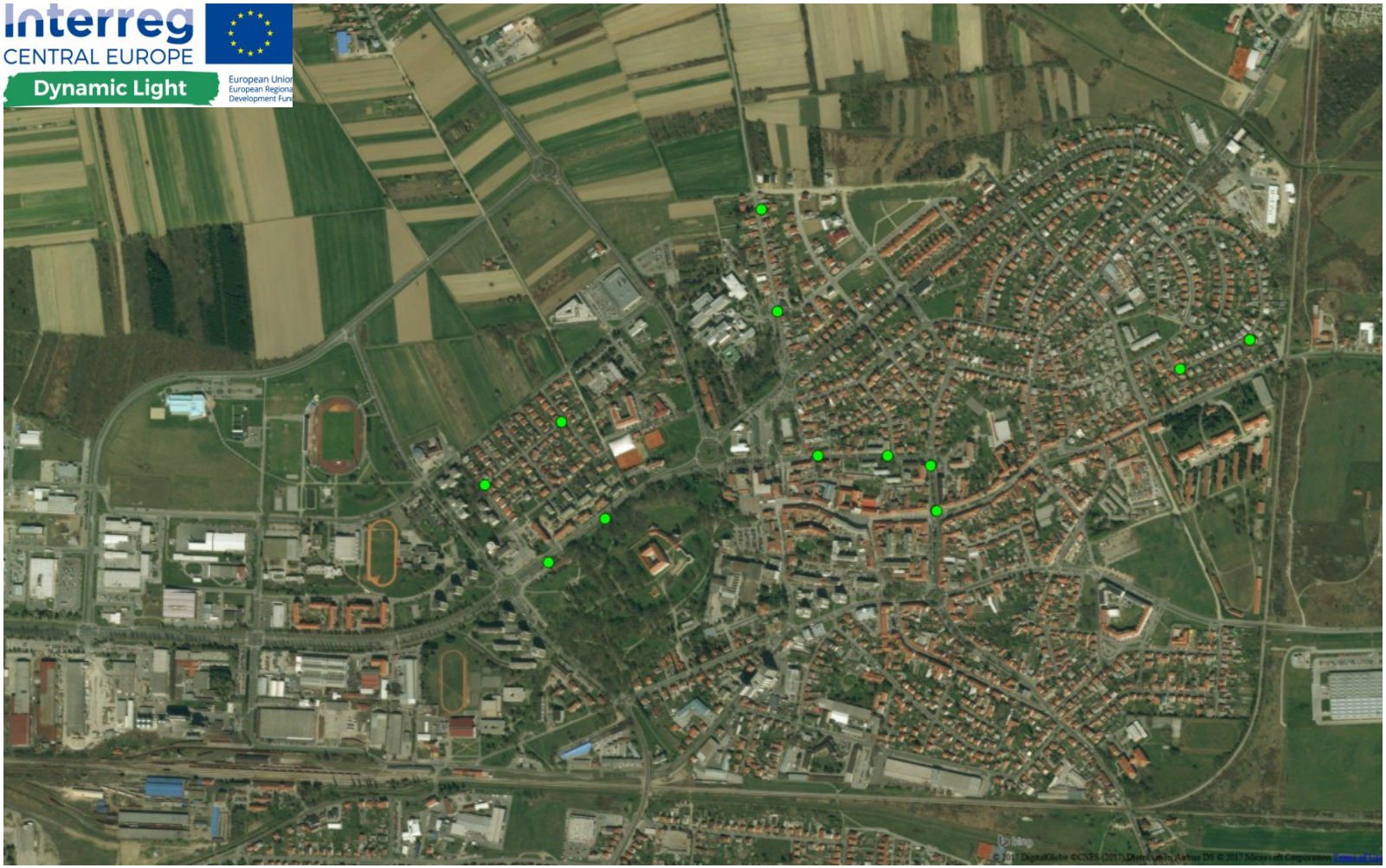


Image 12. *Spatial position of measurement fields*

GIS database for photometric measurements shows results of coordinates of measurement field in selected area and time when measurement take place.

4. OTHER

Future use of the GIS database

Since Town of Čakovec didn't have GIS database for public lighting, the same was created as part of the D.T2.1.3 deliverable.

GIS database and information which was collected in order to create quality database are the base for creation of other deliverables in WP2 (*D.T2.2.1 Analysis of lighting situations*) and WP3 (*D.T3.1.1 Analysis of the global lighting situation at pilot municipaliies, D.T3.1.2 Selection of pilot locations & form of lighting application, D.T3.1.3 Analysis of the specific lighting situation*). Results of photometric measurements and collected technical information about luminaires and substastions stands out from the data which where used in previously mentioned deliverables in WP2 and WP3.

Expected impact and benefits of the tool for the concerned territories and target groups

Created GIS database will provide spatial platform of each luminaire and substation which is currently installed and used at the selected area.

Owner of public lighting (Town of Čakovec), HEP Elektra Čakovec ltd. (National Elektricity Company) and Kabel Mont ltd. (subcontracted privat company which maintance public lighting) where contacted in order to collect all relevant data about public lighting in Town of Čakovec which was base for quality GIS database. The owner of public lighting has additionally provided information and data of new luminaires which where installed in meantime.

Sustainability of the tool and its transferability to other territories and stakeholders

Created GIS database will be handed over to the Town of Čakovec for fuhrter use. Information and data of future modernization and reconstruction of public lighting will be retrograde filled in current database. Part of the Town which is not covered with the GIS database can be in future added to the database in order to create a clear and visible state of current public lighting.

Results of additionally analysis (photometric measurements etc.) which is to be carried out in the future can be also included in GIS database.

Lessons learned from the development/implementation process of the tool and added value of transnational cooperation

Creating good and quality communication with the owner of public lighting (Town of Čakovec) and companies that maintains and manages public lighting can be marked as added value to the project. Additionally, development of the GIS database and comparison of the current state of public lighting in Town of Čakovec and other partner's City gives a clear guidelines in which direction modernization and reconstruction of public lighting should develop.

In order to create quality GIS database knowledge of certain free application and software was needed. Learned knowledge and resourcefulness in GIS Cloud mobile application and QGIS software is what stands out in the lessons learned from the development of GIS database.