

RECORDING PROPERTY RELATIONS ON PIPELINE ROUTE IN GIS

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Abstract

Jadranski naftovod manages 622km long pipeline that runs through area where people lives or have properties on which preform activities. On those parts of land, a pipeline company and a landowner both have a legal interest. Laws and agreements regulate relationship between them. Due to the quantities of cadastral parcels which the pipeline crosses, it is necessary to have database in which are entered all information about rights recorded in land register, but also contracts and agreements concluded between landowners and pipeline company. Data provided by legal experts and surveyors integrates in GIS, enabling every authorised user insight in registered property rights for every cadastral parcels on route and access to collection of all contracts and agreements between landowners and the pipeline company. Owing to such information, it is possible to know what rights need to record in land register and what obligation towards landowners the company has.

Key words: GIS, pipeline, easement, legal rights, right of way

Introduction

JADRANSKI NAFTOVOD, dioničko društvo (JANAF Plc.), headquartered in Zagreb, Croatia, is managing an oil pipeline system designed and built in the period from 1974 to 1979, as a modern, efficacious, and cost-efficient crude oil transportation system for both local and foreign users. Along with crude oil transportation, other major activities of JANAF Plc. are also reloading and storage of crude oil and petroleum products.

The JANAF system was built as an international crude oil transportation system from the Port and Terminal of Omišalj, Island of Krk, Croatia to both local and foreign refineries in Eastern and Central Europe. The designed capacity of the pipeline amounts to 34 million tons of oil annually (MTA), while its installed capacity is 20 MTA.

The JANAF system consists of the following, as shown in Fig. 1:

- Crude oil handling Omišalj Terminal on the Island of Krk, with storage tank farm of 1.000.000 m³ and 60000 m³ for petroleum products; the accompanying pumping and metering stations and the Port of Omišalj.
- Pipeline around 622 km long comprising the following sections:
 - Omišalj – Sisak
 - Sisak – Virje – Gola
 - Virje – Lendava
 - Sisak – Slavonski Brod
 - Slavonski Brod – Sotin
- Crude oil handling terminals in Sisak, Virje and Slavonski Brod, with storage tank farms (100,000m³ in Sisak and 40,000m³ in Virje), the accompanying pumping and metering stations.
- Submarine oil pipeline Omišalj-Urinj, linking the Omišalj Terminal with INA -Oil Refinery in Rijeka.
- Petroleum products terminal Žitnjak-Zagreb (capacity: 142,000 m³).

JANAF has a total storage capacity of 1.54 million m³ for crude and 202,000 m³ for petroleum products (JANAF.HR).



Fig. 1. JANAF System.
Source: Own study.

JANAF GIS

Historically, the JANAF data or maps have been the repositories of the facility data and spatially referred data. Later on, the computer-aided-design (CAD) alignment maps replaced the hand-drafted alignment maps. Although the alignment sheets today still represent a major part of the Company operation, GIS has replaced the alignment sheets as the repository for pipeline facility information.

GIS eliminates the maintenance of multiple data sets in separate departments of an operating company. Software applications and data reports for individual departments are used together with the data from the central GIS data repository in order to meet specific data requirements. As the central GIS database is updated and maintained, the updated facility data are utilized in their applications. GIS also provides the user with many analysis functions, including the ability to perform spatial queries (ENVIRONMENTAL-EXPERT.COM).

Enterprise GIS is gaining momentum, by facilitating the integration of all operations into a simple centralized database, utilities can minimize data redundancy and update changes in the system more efficiently. The GIS system allows for centralized monitoring, display and analysis with all information on location and condition of an oil pipeline.

JANAF-GIS data are obtained by digitizing archival documentation and collecting data by surveys. The data are centralized in the GIS database of JANAF.

Data organization in JANAF GIS

Since all collected spatial data must be organized in a meaningful way, layers presenting certain related data are used. Objects in GIS generally can be divided into two abstractions: discrete objects or vector data type and continuous fields or raster data type.

Furthermore, in a GIS vector data type, geographical features are expressed by considering those features as geometrical shapes. Different geographical features are expressed by different types of geometry: as points, lines or polylines and polygons. Points, lines, and polygons are the elements of mapped location attribute references.

Spatial data in JANAF-GIS are maintained for the pipeline route, as well as for all related installations and facilities necessary for the operation, management and control system.

In JANAF GIS similar objects are organized in groups of layers as shown below in Fig. 2.

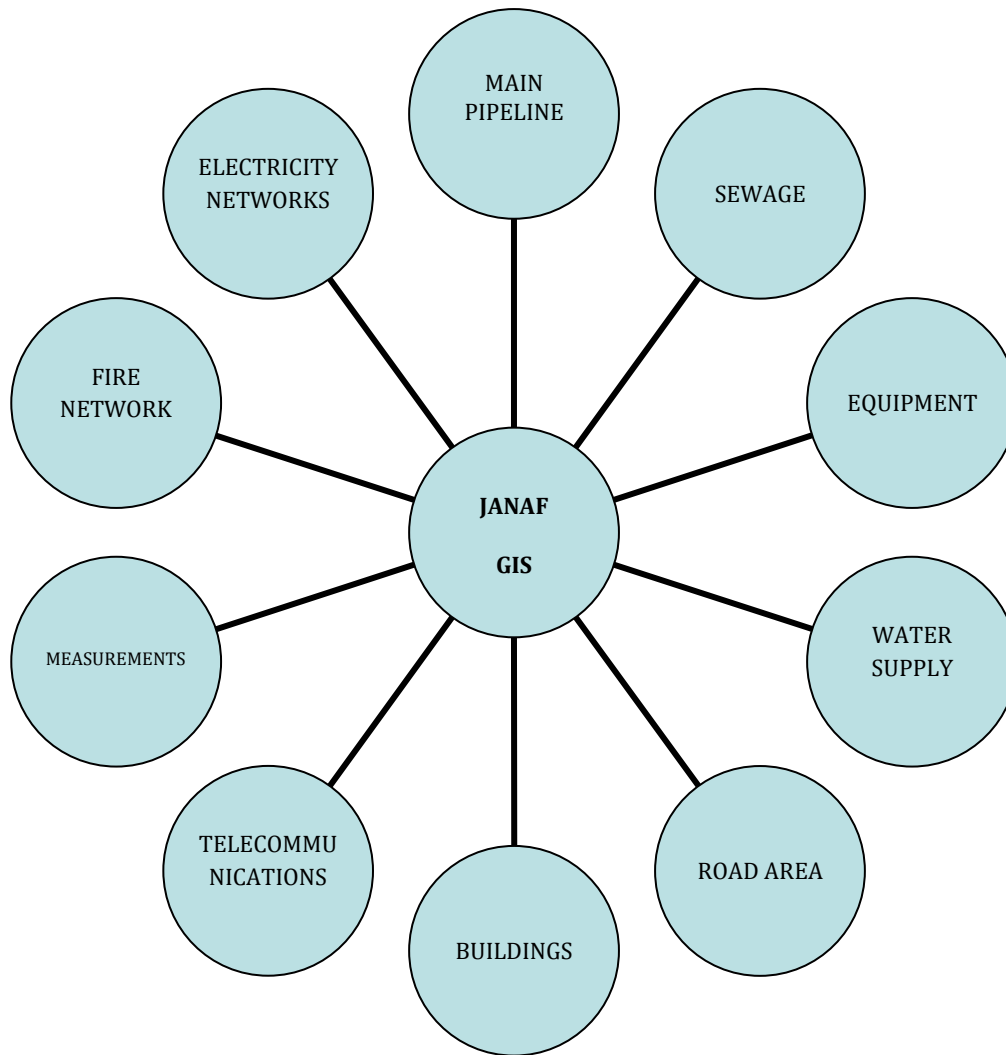


Fig. 2. Organization of layers in JANAF-GIS.
Source: Own work.

All these layer groups actually contain coherent layers. Furthermore, all layers represent several objects having the same geometry and similar features.

For example, Figure 3 shows the layers contained within the "main pipeline" layer group and the objects represented within that particular layer.

Cadastral maps

The Croatian system of registering the real property and associated rights is based on two registers: the cadastre and the land register. In State Geodetic Administration cadastral offices (20 regional cadastral offices with their 92 branches and the Municipal Office for Cadastre and Geodetic Works of the City of Zagreb), the real properties are registered according to their technical characteristics. The cadastral data on the real property (cadastral parcels) is the basis for the establishment, renewal, keeping and maintenance of land registers that are kept at 109 land registry offices of 65 municipal courts. In land registers, the data on cadastral parcel title holders is associated to the data on cadastral parcels defined by the cadastre. The Croatian system of registering the real property and associated rights has several objectives. The most important ones include the introduction of security in the real property legal transactions and the protection of titles registered in the registers. As such, the cadastre and land registers represent the most important registers that serve as the basis for the rule of law. Traditionally, as in many countries of Central Europe (Austria, Germany, etc.), the Croatian model of registering the real property and associated rights has not been institutionally unified. The Republic of Croatia is linking the cadastral and land registry data through the Real Property Registration and Cadastre Joint Information System (JIS).

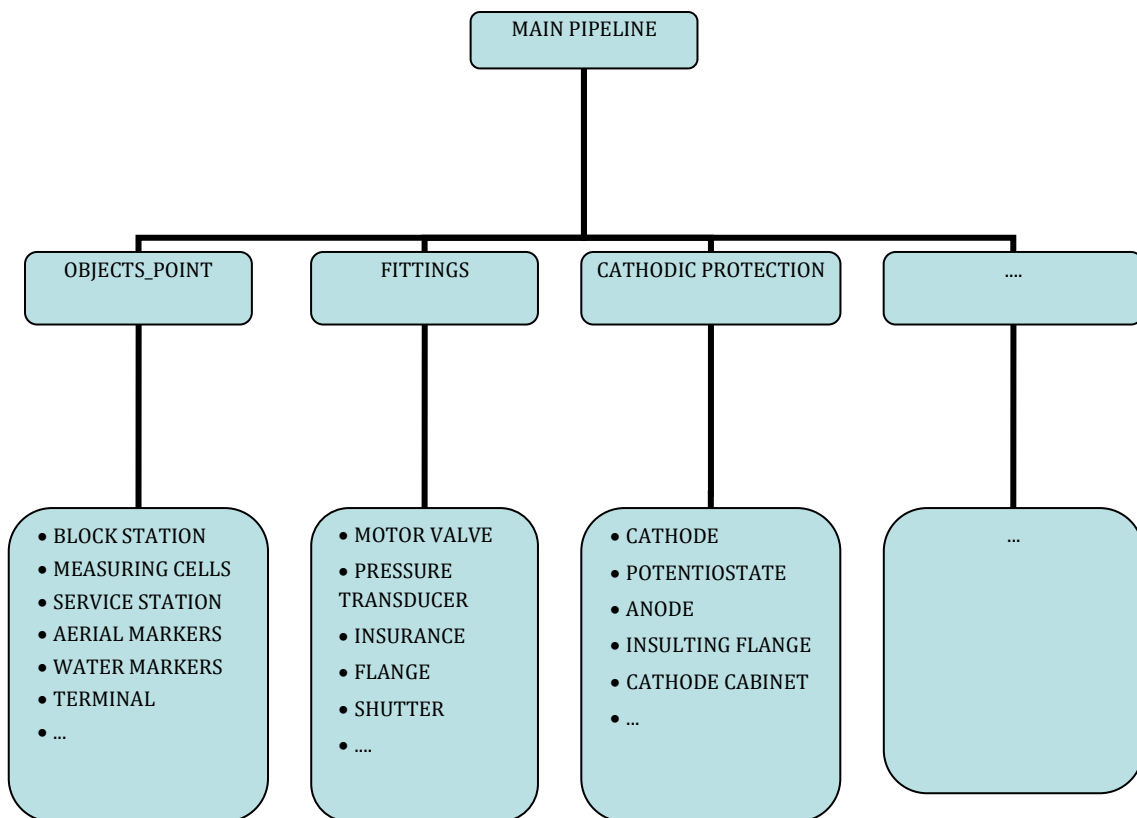


Fig. 3. Layers in "main pipeline" layer group.
Source: Own work.



Fig. 4. Scanned cadastral map.
Source: Own work.

As in many other countries of Central and Eastern Europe and due to the historic legacy of over half a century, the land registry and cadastre system in Croatia was poorly kept until 1996 when the new Law on Ownership was adopted. Due to its role in taxation, the cadastral system reflected the situation on the ground in a more up-to-date way but, throughout Croatia, the majority of cadastral maps that were being used dated back to the 19th century so they were understandably often inaccurate, obsolete, fragile and maintained exclusively in analogue format (AJHNER-BOLFAN, 2010.).

As pipeline runs through different parts of country, there is various quality of cadastral data depends on area. So cadastral offices deals with scanned analogue plans, digitized maps in CAD-formats and for some municipals in GIS-supported formats.

Cadastral data in JANAF-GIS

Depends on type data we get from local cadastral offices, we need adjust it form which can be entered in GIS. Most unfavourable case is when we get scanned cadastral plan, such as show on Fig. 4. To adjust it in GIS-supported format we need do next steps:

1. Digitizing – Digitizing is the process of converting paper-based graphical information into a digital format. When you digitize a map, you use drawing commands to trace data from the paper map into a DWG file. Digitizing lets you take information from raster images or paper maps, and enter it into a digital map. Before you begin to digitize, consider the following: Suitability of source maps, Global coordinate system, Tiling maps, Layer organization, Data storage: internal or external, Representation of node, network, and polygon topologies.
2. Creating topology – Polygon topology is an extension of network topology and focuses on area-based relationships. Every area forms a polygon; and each polygon in a topology consists of a set of links. A polygon in a topology has a centroid, which is a point or block element within the polygon, and contains information about the area it encloses. When digitizing data that will be used to create a topology, these principles to achieve the most accurate results should be followed:
 - a. Boundaries (or other polylines) should be completed with the Near, Intersection, or Endpoint object snaps to ensure that closed areas such as parcels, buildings, and water bodies are in fact complete polygons.
 - b. Line segments should be snapped to existing end points where they intersect.
 - c. When data for network topology are digitized, shouldn't be duplicate objects.Each polygon in a polygon topology has a centroid, which is a point or block element within the polygon, and contains information about the area it encloses. Centroid information is stored as object data and saved with the map. Each centroid must have attributes about cadastral parcel such as unique ID number and necessary information for identification parcel –number of parcel and ID or name of cadastral municipal.
3. Export to SHP-file- A shapefile is a simple, nontopological format for storing the geometric location and attribute information of geographic features. Points, lines, or polygons (areas) can represent geographic features in a shapefile. Structure of cadastral parcel is polygonal, so shp-file contains position, geometry and attribute information of all parcel from certain municipal we made topology.
4. Importing shapefile into a geodatabase feature class – feature class GE_KC_P contains all cadastral plots within 200m zone around JANAF route. Shapefile with adequate geometry and necessary attributes could be load in geodatabase.

Depend on data we get from cadastral offices – we need to pass these steps – from first if we get scanned plan, second/third if we get CAD drawing without/with topology or last step if we get GIS supported format such as shp-file.

Easements and Right-of-way

A pipeline right-of-way (ROW) is property in which a pipeline company and a landowner both have a legal interest. Each has a right to be there, although each has a different type of use for the land. (NATIONAL RESEARCH COUNCIL (US). COMMITTEE FOR PIPELINES, 2004.) Pipeline companies are granted permission from private landowners to transport petroleum products across their private lands. That permission is documented in a written agreement called an easement, and it is obtained through purchase, license, or by agreement with the landowner.

A pipeline requires regular observation, integrity assessment and maintenance to maintain the safety of its operations. Part of that task is to ensure that the pipeline ROW is kept clear of trees, structures and other encroachments that might interfere with the safe operation of the pipeline and the pipeline company's access to the line.

One of the key facilitators of ROW inspection is ROW clearing. Good communications between the pipeline operator and the public are important in minimizing any issues between the public and the pipeline operator, especially during initial clearing activities.

ROW clearing is performed for a variety of reasons with the paramount reason being safety. ROW clearing enables:

- Aerial surveillance – Patrols are completed to detect potentially harmful excavation activities along the pipeline ROW and visually assure no releases have occurred.
- Damage prevention – A clear ROW provides a visual corridor so the pipeline can be protected from unauthorized excavation and development.
- Routine maintenance access – Clear access to the pipeline is critical to completing required maintenance in a safe, efficient and effective manner.
- Emergency response access – Clear access to the pipeline allows for a prompt response in the event of an emergency.
- Corrosion protection – Tree roots can wrap around a pipeline, damaging the protective coating of the pipeline, compromising efforts to avoid pipeline corrosion (CHEVRONPIPELINE.COM).

An easement is an agreement that confers on an individual, company or municipality the right to use a landowner's property in some way. While these agreements grant rights, they also have the effect of partially restricting an owner's use of the affected portions of land. For example, if you own property and a pipeline company has a pipeline passing under your land, it is likely that they will have a registered easement that will guarantee them access to the line and restrict uses or activities that would hamper such access or cause safety concerns. Easements and rights-of-way are usually registered on the certificate of title to the property. They remain with the land and are automatically transferred from one owner to another as the land is sold. Easements remain on the title until the holder of the easement discharges their rights from the certificate of title. An easement or right-of-way usually describes a particular portion of property, and although not visible on the ground, provides an area of access to the holder of the easement or right-of-way (ALSA.AB.CA).

Recording easements in GIS

Due to historical reason, during construction of pipeline, easements were not recorded in land register, although, to some owners compensation was paid.

Recently, JANAF start process of recording easements in land register. For that purpose, geodetic department need to generate list of all cadastral plots by municipals trough where pipeline route passes. That is gain by intersect right of way zone (10m buffer around pipeline route) with cadastral parcels (as we mentioned before feature class GE_KC_P contains cadastral data), what is shown on fig. 5.

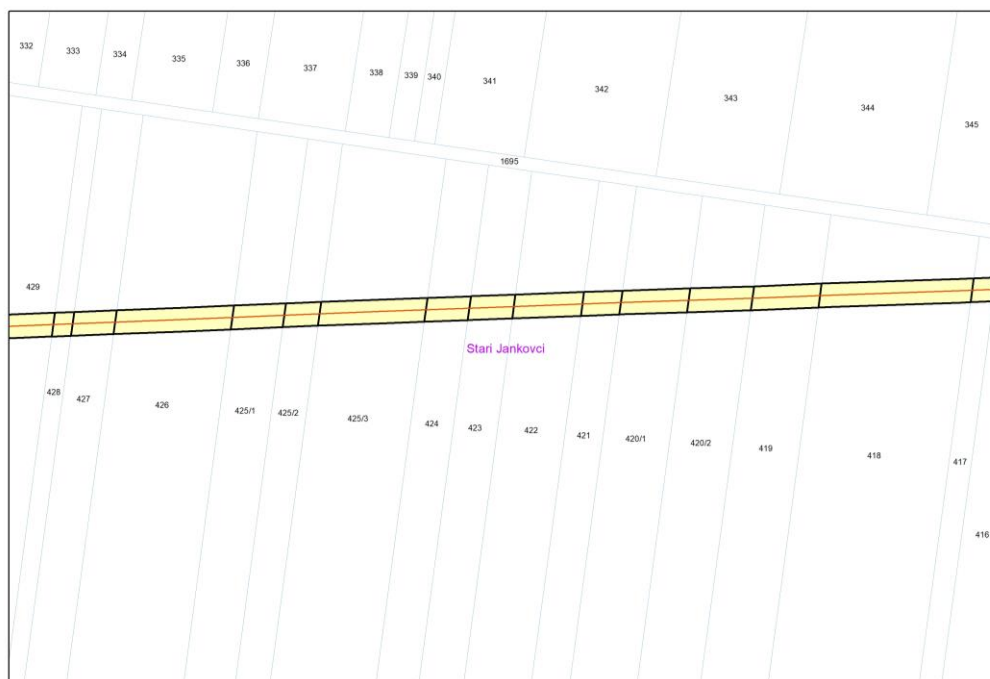


Fig. 5. Intersection of cadastral parcels and JANAF ROW.
Source: Own study.

After that GIS analyse, it is possible to export list of all cadastral plots on pipeline route. By that list of cadastral plots, legal expert need to check out which JANAF have some recorded rights. For all relevant cadastral plots it had to be taken deed which shows encumbrances. On fig. 6 it is shown one deed where on list of encumbrance is visible that Jadranski naftovod is registered right of way. It is stated that rightholder have access on corridor of 5 meters right and left from pipeline route in purpose of regular maintenance, cutting trees and other vegetation which could damage pipeline, reparation of pipeline or related installation and remedy harmful consequences as result of damages.

NESLUŽBENA KOPIJA

REPUBLIKA HRVATSKA
Općinski sud u Valovaru
ZEMLJSKOKNJIŽNI ODJEL VINKOVCI
Stanje na dan: 24.07.2018. 23:18
Katastarska općina: 332365, STARI JANKOVCI
Broj ZK uložak: 1005
Broj zadnjeg dnevnika: Z-5855/2018
Aktivne plombe:

IZVADAK IZ ZEMLJIŠNE KNJIGE

A
Posjedovnika
PRVI ODJELJAK

Rbr.	Broj zemljišta (kat. čestice)	Oznaka zemljišta	Površina			Primjedba
			jutro	člv	m2	
1.	422	ORANICA POPOVCI			11151	
2.	1652/1	ORANICA U SELU			848	
3.	1652/2	ORANICA U SELU			232	
UKUPNO:					12231	

B
Vlastovnika
Sadržaj upisa

Rbr.	Primjedba
2.	Vlastnički dio: 1/1 BURIĆ ZDRAVKO (SPASENJE), OIB: 82148032077, SRBLJA, NOVI SAD, MAKSIMA GORKOG 6

C
Teretovnika
Sadržaj upisa

Rbr.	Ime	Primjedba
2.	2.1. Zaprimljeno 18.01.2018.g. pod brojem Z-829/2018 UKNJIŽBA, STVARNA SLUŽNOST na k.č. 422. Na temelju rješenja Z-829/18 (RZ-145/17) od 24.01.2018. radi redovnog i izvanrednog održavanja naftovoda u koridoru od 5 (pet) metara lijevo i desno od osi cjevovoda koji uključuje pregled trase, redovno održavanje, sječu drveća i drugog raslinja koje može ugroziti cjevovod, popravak naftovoda sa pripadajućim podzemnim instalacijama, otklanjanje štetnih posljedica nastalih uslijed havarije, a prema kopiji katastarskog plana sa ucrtanom trasom naftovoda, u korist: JADRANSKI NAFTAVOD D.D., OIB: 89018712265, MIRAMARSKA CESTA 24, ZAGREB	

Potvrđuje se da ovaj izvatak odgovara stanju zemljišne knjige na datum 24.07.2018.

Zemljišnoknjižni sud u Valovaru (vrijeme tiskanja) 25.07.2018. 11:06:32 Stranica 1

2.1 Zaprimljeno 18.01.2018.g. pod brojem Z-829/2018

UKNJIŽBA, STVARNA SLUŽNOST na k.č. 422. Na temelju rješenja Z-829/18 (RZ-145/17) od 24.01.2018. radi redovnog i izvanrednog održavanja naftovoda u koridoru od 5 (pet) metara lijevo i desno od osi cjevovoda koji uključuje pregled trase, redovno održavanje, sječu drveća i drugog raslinja koje može ugroziti cjevovod, popravak naftovoda sa pripadajućim podzemnim instalacijama, otklanjanje štetnih posljedica nastalih uslijed havarije, a prema kopiji katastarskog plana sa ucrtanom trasom naftovoda, u korist:

JADRANSKI NAFTAVOD D.D., OIB: 89018712265, MIRAMARSKA CESTA 24, ZAGREB

Fig. 6. JANAF registered right on list of encumbrance.
Source: Own study.

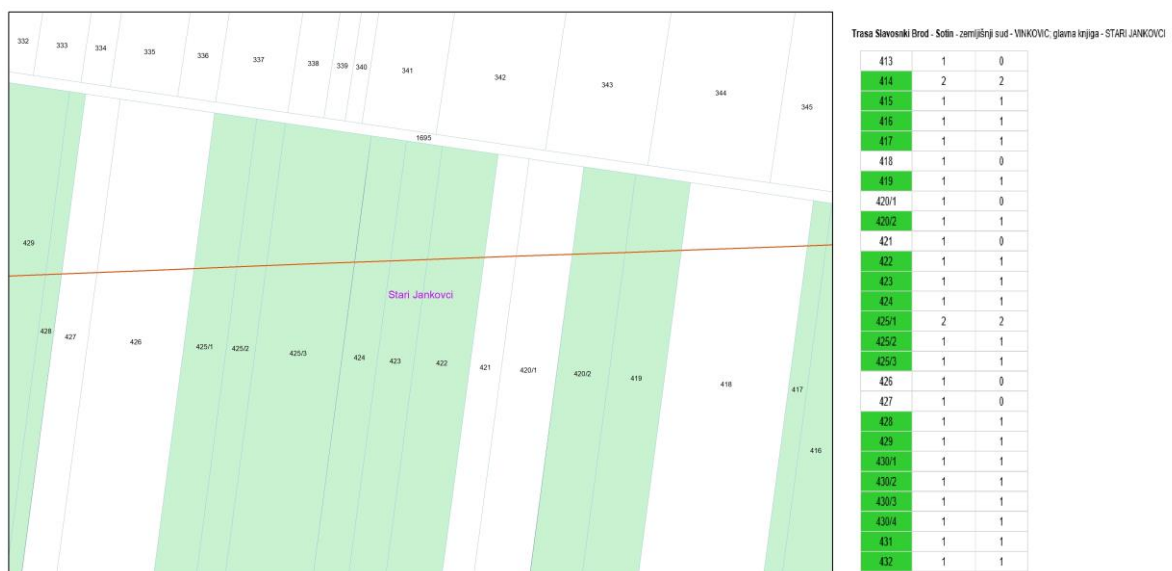


Fig. 7. Visualisation and list of cadastral plots where JANAF have registered easement.
Source: Own study.

Data about cadastral plots on which is founded registered rights of JANAF, legal expert through web browser interface enter in GIS. Also data about owner such as name, address, personal ID number,

ownership ratio on cadastral plot ect. and about agreement (date, signers, document number ect) are entered in database.

After legal expert enter all date in database it is easy to visualise what are cadastral plots where JANAF have registered legal rights. On viewer, it is easy to visualise then what cadastral plots have registered rights for JANAF, such as shown on fig 7. Green coloured plots have registered rights and it is obvious that for uncoloured plots through pipeline route runs, need to take some action. To have list of those plots, we export it in table where marked plots with registered rights are.

When on certain cadastral plot JANAF establish some rights, legal expert start process of entering necessary attributes in GIS through web browser interface. Fig. 8 shows how looks interface where legal experts enter data about owners and easement agreements. Here is important to note that legal experts do not work with any spatial data, but only entering necessary attribute data. By linking with cadastral plot, which has own geometry and position, we can visualise where are plots where JANAF did or did not register easement.

After entering required information about owners, agreement and link them with cadastral plots, automatically records in database, and could be seen in GIS maps immediately, and in reports, allowing generating various statistic, such as shown on fig. 9. This statistic shows total number of cadastral plots on each pipeline route section, and on how many plots are recorded easement. It is represented numerical and graphical on column chart.

The screenshot displays the JANAF web browser interface. The main window is titled 'Dokument' and contains a form for entering document details. The fields are as follows:

Oznaka	IPD-06752
Vrsta/podvrsta dokumenta	Rješenje / ZK ispravni postupak
Svrha dokumenta	Cijev
Datum	18.4.2018.
Potpisnik (OIB/MBS)	Ilija Ivić (00000000000/-)
Referent (JANAF)	Jadranka Dražić
Trasa	Slavonski Brod - Sotin
Broj ZK uloška	132 k.o. Stari Jankovci
Provedeno u ZK	<input checked="" type="checkbox"/>
Napomena	Z-5225/2017
Klasa	59/17
Površina služnosti	0,00
Plaćeno	<input type="checkbox"/>
Datum plaćanja	
Način isplate	
Banka	
Broj računa za isplatu	
Iznos	0,00

At the bottom of the form are buttons for 'Spremi' (Save) and 'Odustani' (Cancel). Below the form is a button for 'Povratak na listu dokumenata' (Return to document list).

The modal window 'Nova osoba' (New person) is open, showing the following fields:

Ime	Ilija
Prezime	Ivić
Ulica	M.Gupca
KBR	52
KBR dodatak	
Naselje	Stari Jankovci 32241
OIB	00000000000
Tip osobe	Vlasnik
Omjer suvlasništva	
Pravna osoba	<input type="checkbox"/>
Naziv tvrtke	
MBS	
Napomena	

Fig. 8. Web browser interface for entering data about rights on plots.
Source: Own study.

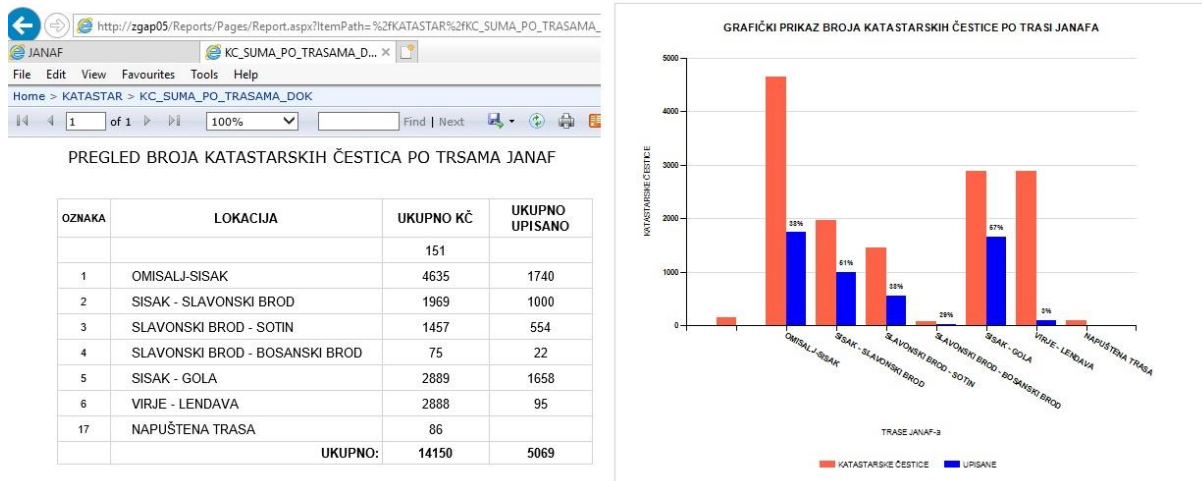


Fig. 9. Number of plots with recorded easement by pipeline route section.
Source: Own study.

Conclusion

The aim of introducing GIS in JANAF is to have all data collected in one place. Very important data refer, among others, to the property rights for every cadastral parcels on route. That is why application for reviewing right properties.

Since many problems have been observed in terms of communication and information transfer between geodetic expert who provides spatial data for cadastral plots, and legal experts, which have information about legal rights on certain parcels, it was necessary to consider different solutions that might be helpful and practical.

Before introducing GIS, It was hard to find on which cadastral plot are registered some rights without archives search. This data wasn't transparent, and other employers need to send an inquiry to legal experts. Such process was definitely time wasting, sometime results with many data were misplaced and it took a lot of time to find them.

Owing to the use this GIS application, the entire process is made easier and faster. Now, at the same moment, all participants in the process can see list or map of cadastral plots on which are registered legal rights. Moreover, all data are centralized in one place and every authorized user has access to them. Integration with GIS allows positioning of any data without need to search on other maps.

Finally, one of the crucial things in the work process itself is to notice how legal expert, not educated in GIS technology, fill database by user-friendly interface. Clearly separated tasks of GIS expert who provide spatial data about cadastral plots, and legal expert who enter legal rights attributes are complement and together provides valuable combination of alphanumeric and spatial data. The entire process is made transparent, allowing seeing for each cadastral plots its legal status. Also can be generated various statistic and present it to superiors showing progress in some period. That gives the employees a sense of team participation, indirectly motivating them to perform quicker and better their tasks in the process.

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