

Title of Paper:

## **Information system of Slovenian railway infrastructure - RAGIS**

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Abstract:

Slovenia is small central European country of around 1250 km of railway connections without stations tracks and railway yards. Lines connect seashore over Alps to the Central Europe.

Seven years ago directions of information system of Slovenian railway infrastructure were designed. Now we renovate them with new knowledge. The first chapter describes alphanumeric part of IS where we already modernized data model and prepared new input/report application. Database software was changed. New numbering and the way how outside organizations access the application was implemented. Next chapter describe how we connect input/report application with exists GIS tools and with database from different sources and what kind of problems we need to solve. Last part shows what kind of steps we prepare for the future and why is it wisely.

### 1.0 Introduction

RAGIS (RA-ilvay GIS) with full name: Information System of Slovenian Railway Infrastructure was started in eighties in the 20th century.

Last year we made a new step to the renewal of the application and to the fresh and user friendly tool. That way we renewed alphanumeric input application which is described in the following article.



Picture 1: Europe and Slovenia

## 1.1 Slovenian Public Railway Network

Until a few years back the whole slovenian railroad network was a part of the Slovenian railroads in the sense of real-estate. As this area is now regulated with the European commission, this part is now divided to the Public railway infrastructure and to the Slovenian railroads as the authorized railroad manager. The government of the Republic of Slovenia also established an Agency for Railroad Traffic, which regulates proper usage of state subventions and time division of trains. More detailed information is available the following web addresses: [www.gov.si/dzp](http://www.gov.si/dzp) and [www.slo-zeleznice.si](http://www.slo-zeleznice.si).



Picture 2: Slovenian Public Rail Network

## 1.2 RAGIS history

RAGIS history began in the late eighties of the 20th century when the first pilot studies implementing ESRI ArcInfo and dBase database software were introduced.

Next milestone happened in the years of 1992-1993, when we created the first digital map of the new country and the maps and locations of tracks and stations (with the same software). This was also the first digital thematic map, which was completely set up in digital technique, up to the color separation and color base setup for printing.

Next milestone was the year of 1997, when we executed an import of alphanumeric part from dBase to MS Access 97 database. An input application was created with masks and client-server architecture. Six servers on six local area networks were installed. Geographic part was also implemented in server-client architecture with the use of ESRI ArcView programs and pre-set route layer from Esri ArcInfo. Client side needed to have applications such as MS Access and Esri ArcView installed.

In the year of 2003 we renewed the alphanumeric part again, as described in the following article.

## 2.0 Renewal of the input application

In the year of 2003 we finished the first phase of renewal of input application

(alphanumeric part of RAGIS). Renewal was running on three segments: renewal of alphanumeric data model, data transfer and new input application programming.

## 2.1 Renewal of alphanumeric data model

Before we started programming input masks we thoroughly checked all attributes that are implemented on individual layers. There are more than 100 of these layers with xxx attributes each. We also went through content attributes as well as system attributes that enable us data positioning later. There are three major object positioning types:

- dynamic segmentation by kilometer position on track
- with aid of centroid, which can be found on the floor plan of the object
- with the connection to the lot number, where data is held

We also added a few new layers, which document track work, essential to the condition of the upper track layer and are refreshing monthly. We then implemented a renewed model with MS SQL Server. As we needed more reliable software from MS Access, the MS SQL Server was the logical choice for us. It is more reliable and not that much more expensive. And since some other applicatinos, running in our company, already use MS SQL, our decision was even easier.

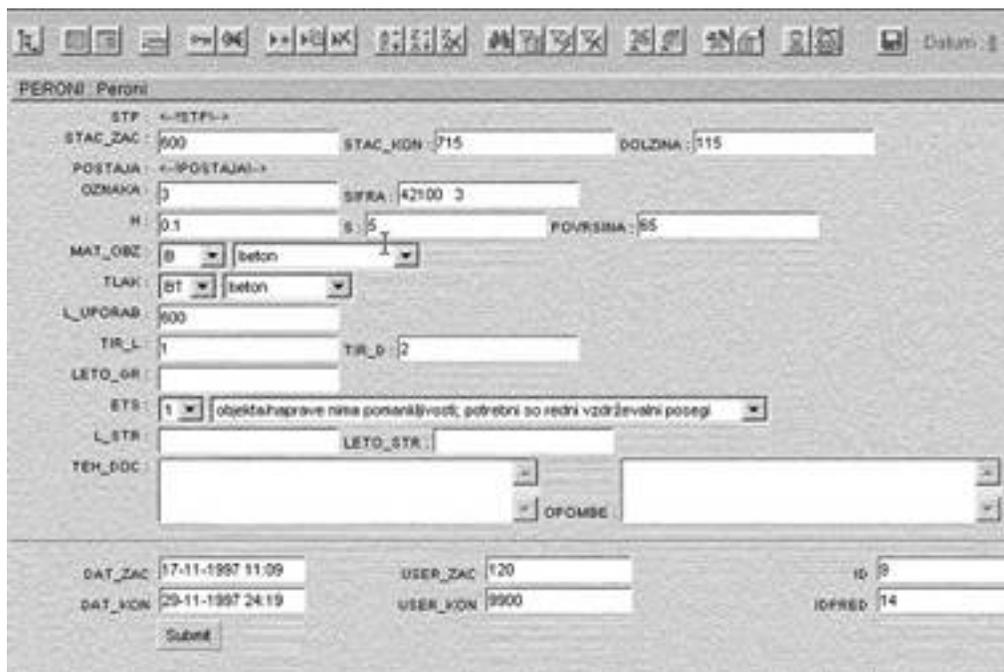
## 2.2 Data transfer from existing database

Project itself also required the existing data and history must be preserved and transcribed again. Therefore we transferred all data into renewed model with MS SQL supported database. Where attributes were added, a blank field remains until first new entry. Empty part of database will be filled in shortly.

## 2.3 Programming of input application

Input application was programmed in PHP environment (web technology). Since

PHP technology is basically different from client-server architecture, we had to reprogram some self-evident issues and include them into the application. Now only MS IE or Netscape Navigator and connection to the network are required from any client to work with the application. All other procedures such as user access, application updates and database services are executed on the server side. This makes the maintenance cheaper and maintenance response faster.



The screenshot shows a web application interface for data entry, titled "PERONI Peroni". The form contains various input fields and dropdown menus for technical specifications. At the bottom, there are date and user information fields and a "Submit" button.

STP	←STP→				
STAC_ZAC	600	STAC_KON	715	DOLZNA	115
POSTAJA	←POSTAJA→				
OZNAKA	3	SIFRA	42100 3		
H	0.1	S	5	POVRŠINA	85
MAT_ORZ	B	beton			
TLAK	B1	beton			
L_UPORAB	600				
TIR_L	1	TIR_D	2		
LETO_OR					
ETS	1	objekta naprave nima posebnih vrst, potrebni so redni vzdrževalni posegi			
L_STR		LETO_STR			
TEH_DOC				OFOMBE	
DAT_ZAC	17-11-1997 11:09	USER_ZAC	120	ID	9
DAT_KON	29-11-1997 24:19	USER_KON	9900	IDFRED	14

Submit

Picture 2: Input Data Application

## 2.4 Route system

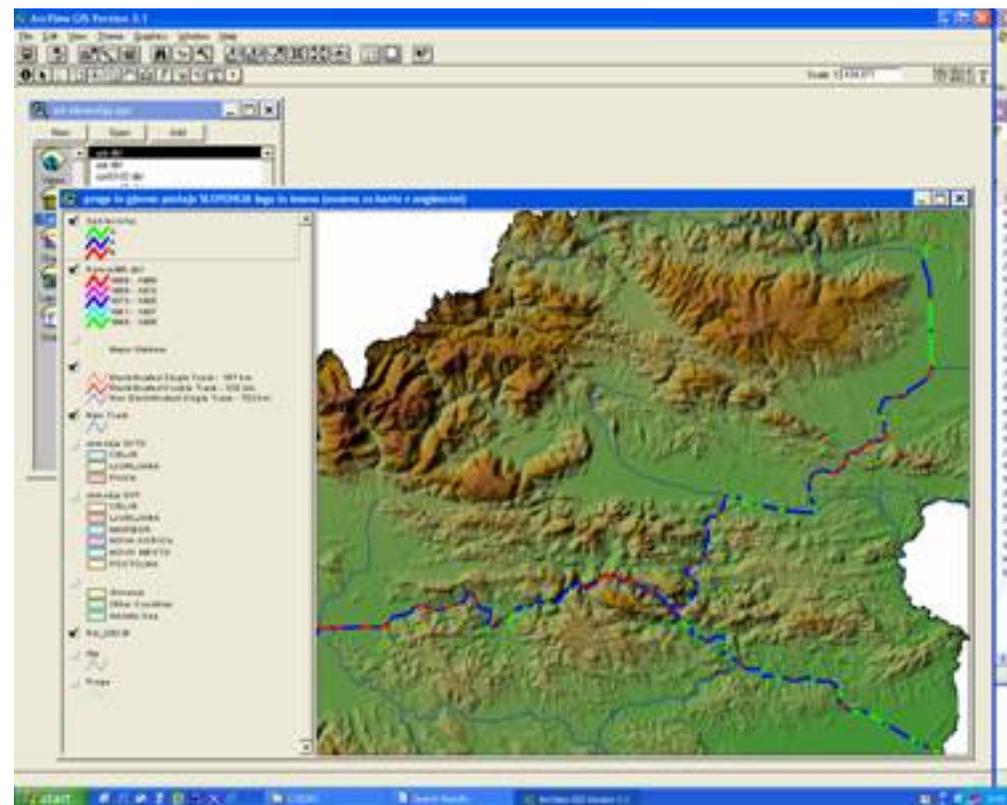
A new base for dynamic segmentation was implemented in this complex. A new track Murska Sobota – Hodoš, which connects existing public railroad network of north-east Slovenia with Hungary, was added. Procedure was taken directly from the project, which was already designed in national local Gauss-Kruger coordinate system. The other tracks are partially scanned from maps 1:50,000 and partially from maps 1:5,000. The rest of the network will also be supplemented. With such supplementation we will achieve greater precision of geographic positioning of objects themselves.

Nevertheless the new route system is equipped with new track numbers which changed after the independence of Republic of Slovenia.

## 2.5 Geographic part

Geographic part remained unchanged due the lack of resources. It is limited to the usage of a some ESRI ArcView, PC Arc/info, ARC/INFO and ArcExplorer installations. Alphanumeric data is dynamically segmented through SQL connection with use of route system as well as ArcView. Then the layer in the shape file is prepared and saved to the designated space on server. In that shape it is available to less demanding users.

In Republic of Slovenia there is also the national institution called Geodetic Administration of Republic of Slovenia, which provides various data of so called public geodesy (land survey). In our case we mainly use scannograms of thematic or general maps, terrain relief, ortophotographies and various vector-based data. Every house in Slovenia, which has an address number, also has a centroid, located in the ground map of it. That way it is usually not difficult to define location of any address in Republic of Slovenia. Centroids of all static units (from settlements up as well as polygons of all areas from small communities through municipalities to the national level) are also provided. A lot of these sources are available and you can just imagine possible combinations.



## Picture 4: Last large maintenance

### 2.6 Plan for further steps

We assume that in the end phase of project there will be from 150 to 180 users in the Holding Slovenske železnice d.o.o. As we applied at the beginning, the users outside Slovenian Railroads, more precisely, from the Agency of Railroad Traffic are also expected. Here there is an estimate of 30 to 50 users.

That way we created a concept of alphanumeric input application, operational within intranet inside Slovenian Railways. Only in here various attributes can be changed. Agency and government users will access data through internet and be able to get geographic overviews. Geographic overview will also be available to the internal users. A second phase is planned shortly where we intend to implement ESRI IMS software and functions and options, linked to it. Current option of internal accessibility within LAN directly to database through SQL will remain after IMS implementation since some users will still have specific demands which will differ from the mainstream demands.

### 3.0 Conclusion

We are at the end of the article and I hope that current situation on the field of railroad geographic system of RS was satisfactory presented. In the following years there is a lot of work to be done in the field of implementing existing software and modifying it to the local needs and knowledge of users. I would like to emphasize again that application with as few faults and bugs as possible as well as regular maintenance, precise GIS planning and adaptation to the needs of users is essential at such vital project and with that number of users. Only with the support of the knowledge growth within the system development there is a possibility of deep implementation of the system itself into the company.

### 4.0 Acknowledgments:

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## 5.0 Abbreviation

RAGIS - (RA-ilway GIS) Information System of Slovenian Railway Infrastructure  
RS – Republic of Slovenia

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