

The Role of Geodesy in Modernization of Croatian Railways

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Key words: railways, modernization, infrastructure, and geodesy.

SUMMARY

At the beginning of the 90-s in the last century the changes in the economic surrounding took place in Croatia as well as in the neighbouring countries. Therefore Croatian Railways had to adopt itself to these changes. Unfortunately, the war that hit Croatia had a bad effect on the development of railways. A great deal of railway tracks were damaged by war destruction while at the same time there was an appalling fall in passenger and goods traffic. On its way to approach European integrations Croatian transitional economy is in urgent need of effective and modern railways which would link it with the world, and above all with Europe, because very important pan-European traffic corridors pass through Croatia.

The modernization of Croatian railways infrastructure, passenger and goods traffic as well as informatics support in all segments of Croatian Railways business running is of the exceptional importance, as the railways are ecologically acceptable, energy-saving and very safe traffic system.

Geodesy has found its part in this multi-disciplinary process since it always has played an important part in building and running the railway business. Spatial data that is used in the process of modernization of the railway infrastructure is collected by geodetic methods. Apart from the construction of geo-informatics system in running the railway business and other real estates, geodesy is an irreplaceable factor-through engineering task of preparing spatial basis, staking out of different projects and surveying during building works.

This work shows the role of geodetic profession in the organization structure of Croatian railways as well as taking part in modernizing Croatian railways infrastructure. Special attention is paid to making the geoinformatics system of real estates that are in possession or ownership of Croatian Railways. This system will be used to monitor and record the real estates, so it will give a new quality level for managing the documents of real estate cadastre within Croatian Railways.

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1. INTRODUCTION

Expansion and improvement of railway network for high speeds is the main priority in Europe, because people and goods transport is very safe by using railways. Permanent development of railways since 19th century has established connection between Stockton and Darlington in England. This connection has posted railways as a skeleton for developing national economies. Because of poor relationships between national railways systems, European railways are not materializing incomes what we would prefer, but today when we would like to safe our nature railways have unique chance to become the leader in people and goods transport. For people transport railways needs 9,5 less ground then road transport. In one-hour two gauges railway can transport the same number of people and goods, as by using highway road that has 16 tracks and is 122 meters wide. Railway exonerate roads, protects nature and unrenowned nature recourses from destruction, decrease road accidents and ecological disasters – respects peoples and nature. Because of all that, comparative ecological advantages of railways are becoming market advantages.

Modernization of Croatian Railways - CR is very important so that we can work much more efficiently. Geodesy has found its part in this multi-disciplinary process since it always has played an important part in building and running the railway business. Spatial data that is used in the process of modernization of the railway infrastructure is collected by geodetic methods. Apart from the construction of geoinformatics system in running the railway business and other real estates, geodesy is an irreplaceable factor-through engineering task of preparing spatial basis, staking out different projects and surveying during building works.

Currently CR is in process of restructuring and modernization. This year passenger motor pool has been modernized by introducing leaning inclination trains on the relation between Zagreb and Split. Also in the goods motor pool some new trains for truck transport have been introduced. Because new trains can achieve higher speeds the whole railway track was reconstructed from Zagreb to Split. On some parts of the railway track we had to build completely new track. On the other hand, the construction process of geographic information system of real estates that are owned by CR has begun. That system will enable monitoring and keeping records of real estates, so CR will be much more efficient and economic with higher quality level.

2. GEODESY INSIDE ORGANIZATION STRUCTURE OF CR

CR are limited liability Company in 100% ownership of the Republic of Croatia (National Gazette 2003). CR is company whose job is public transport of passengers and goods in domestic and international railway traffic, and construction and maintenance of railway infrastructure.

Organization foundations of CR (Official Gazette of CR 2003); are made of activities inside business area of Commercial sector, Train traction and rolling stock and CR Infrastructure, and activities of Board areas, Corporate administration, Board office and Regional offices (Fig.1).

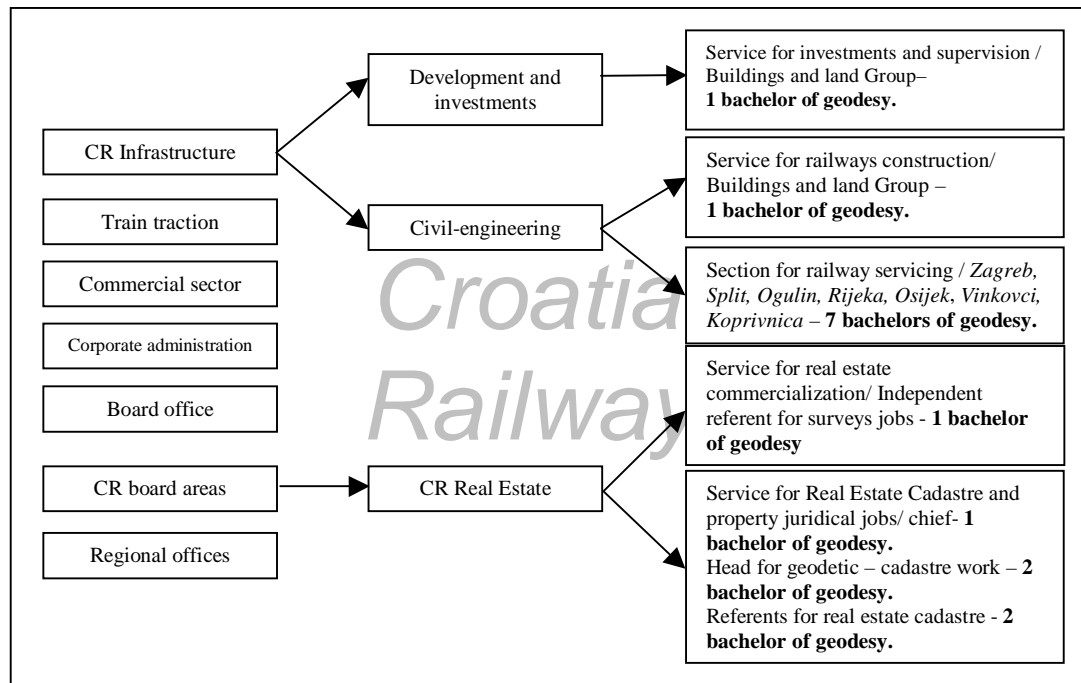


Fig. 1: Geodesists inside organization structure of CR.

From the organization structure of CR, it is visible that it includes a large number of different branches of business, employees with a different qualifications and geodesy experts. Croatia Railways have 15000 employees; from that number only 15 people are from geodesy branch.

Their jobs are mostly related to the jobs inside business areas of CR Infrastructure and Board office. Inside business areas of CR infrastructure, they work in department of Development and Investments and Civil engineering, and inside Board office they work in Croatia Railways Real Estate department.

Inside Development and Investments, Service for investments and supervision, geodesists are taking part in supervising construction of technical documentation, making agreements for construction and building permissions, taking part in making documents for public competitions and choosing the most acceptable offers for specific surveys works and investments. Also they are involved in supervision during execution of surveys jobs.

Geodesy experts inside Civil-engineering department are working in railway constructions service and railway servicing section. Inside railway constructions service they work on examination of CR track network constructions according to actual regulations, determining technical terms and they are taking part in negotiations for project documentation. They also works on railway constructions by coordinating activities related to other investors works in

CR network's protected belt. Examination and judgment of technical documentation from railway construction area for needs of regular and investments servicing, is they work also. Keeping technical documentation and records from CR network railway construction area, taking part in arranging technical basis for public tender and making agreements for works with other contractors outside CR for their area of work is geodesist work.

The largest number of geodesists inside organization structure of CR is situated in CR Real Estate. CR Real Estate department are working on commercialisation of real estates and they are making real estate cadastre. Inside CR Real estate department geodesists work in Real estate cadastre and property juridical relationship service, and also inside service for real estate commercialisation. The basic task of geodesists inside Real estate cadastre and property juridical relationship service is making of real estate cadastre and solving property juridical status of real estates in possession and ownership of CR. Inside service for real estate commercialisation geodesists are working on jobs where CR are buying or selling real estates.

Fig. 1 shows a complete organization structure of CR with number of geodesists in each business department / unit / service. As it is mentioned before and you can see from fig. 1 there is very small number of geodesists. In regard to forthcoming modernization and reconstruction process in CR the need for increasing a number of geodesists is intruding.

3. THE ROLE OF GEODESY IN MODERNIZATION OF CROATIAN RAILWAYS

Because railway modernization has high priority in European transport politics, CR has directed their long way business politics to construction of modern infrastructure on Croatian sections, providing highly standardization means for transport and establishing modern business organization, which will provide conditions for offering fast and high-grade services.

Railway network across Croatia are 2750km long (Fig. 2), and they are divided into main railway track, main secondary railway tracks, I order railway tracks, II order railway tracks. One-gauge railways are 2500km long, while two gauges railways are 250km long. About 1700km are electrified, while the rest of the tracks are not and that is a big problem.

Through Croatia few pan European railway corridors are passing (Fig. 3) and they are B and C branch of V. pan European corridor, and X. pan European corridor which links Germany with southeast Europe.



Fig. 2: Railway network tracks in Croatia



Fig. 3: Pan European corridors across Croatia

In regard to traffic position of Croatia and entering in European integrations, CR has aspiration to modernize infrastructure. Some parts of railway tracks - C branch and B1 branch of V. pan European corridor - "Lika railway track" which links two biggest cities in Croatia, Zagreb and Split, has been reconstruction. During these constructions Geodesy has been included also, through engineering tasks of preparing spatial basis, staking out of different projects and surveying during building works. On some parts reconstruction meant completely new railway track, so CR buy new land, and property – juridical relationships has to be arranged. Because of a small number of geodesy experts in CR, bigger engineering geodesy works, are assigned to private geodetic companies through public tender. On these projects geodesy expert's, employees of CR are consultants.

Besides that, the main task of geodesy in modernization process of CR is to head real estate Cadastre possessed by CR, and making it in geoinformation system. Problems that will be occurred, and which already assist in every day work, are that according to the new Law of Croatian Railways (National Gazette 2003), which is accepted and will be relevant from 1. January 2006, railway infrastructure is public land for common use in ownership of the Republic of Croatia (National Gazette 1996). That means that there will be duality in ownership regime, there will be some real estates which will be in ownership of Republic of Croatia and real estates that will not become a part of railway infrastructure composition, they will be in ownership of infrastructure leadership – CR.

It is a known fact that foreign railway boards, large part of their profits are making using their real estates, because in many cases railway tracks are passing through city centres. CR are not using all potential that they have in their real estates. The main reason for that is that CR Real estate department until now, didn't have knowledge about real estate in their possession and ownership, which of them are free for commercialisation. Because of that they have functioned as a service for people that have been interested for buying or selling individual real estates (Butković 2002). Realization of geoinformatics subsystem for Real estate

cadastre, strong foundations for modern approach of real estate commercialisation will be made.

Geoinformatics system for CR real estate Cadastre besides standard attributes which every Real Estate Cadastre have (cadastral and land-registry data), will have some specific data related to organization structure of CR.

Manage all the data is very expensive, but very useful. The main task of all economical subjects (including Croatian Railways) is tendency to reduce the costs, increase the productivity and better exploit of all resources. To make easier and to improve management, CR wants to introduce geoinformatics system – CRGIS which will store all the data, and shown them on maps. To make GIS function inside CR organization it is necessary to insure some specific resources that are integral part of every GIS system (hardware, software), we must collect the data and educate the CR employees, and with all this we must be able to manage on high quality level – CR management (Fig. 4).

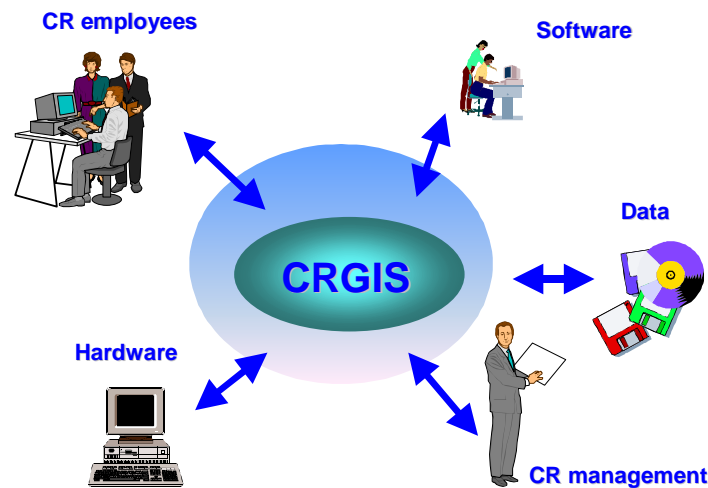


Fig. 4: Basic parameters of CRGIS

People are one of the primary elements in construction of GIS systems, because only very well educated persons can manage the GIS project. According to world experiences, people must organize in teams with:

- GIS manager – manages and organizes team for GIS system (**bachelor of geodesy**)
- GIS planner – draws up plans for GIS (programmer)
- GIS analyst – analyses spatial data (**bachelor of geodesy**)
- GIS operator – records and updates the data (2 operators)

Access to CRGIS should have users in all administration departments of CR, as they could analyse spatial data in the process of making decisions. Organization should accompany demands of CRGIS team that must be positioned in administration part of CR structure.

CRGIS system is organized in three parts:

- CARTHOGRAPHIC – map drawing in digital and analog shape

- DATA BASIS – developing and using of data bases, which are integral part of GIS system
- SPATIAL ANALYSIS – analysing and modelling the data – *making decisions*

In railway traffic analysing geo-spatial data is the key for making good decisions. If we want to monitor the trains, road traffic, find the best route for deliver goods or transport the people, understanding these subjects from geo-spatial viewpoint is very important, because than, we can make good use of all railway resources. In Fig. 5 all kinds of data that are very important for CR are shown.

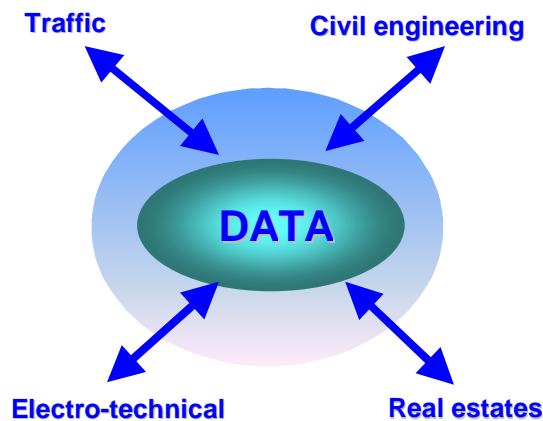


Fig. 5: Data groups in CRGIS

Traffic data include data that are connected to: number, name, direction, distance, and purpose of railway tracks. Civil engineering data include all buildings and objects related to railway with all relevant data about them. In electro-technical group of data all facilities with their name, number, distance, map, sketch, stationary and technical data are included. A real estate as the main data group includes all cadastral and land-register data related to all real estates that are in possession or property of CR.

It is necessary to establish relationship between all kinds of data (Fig. 6). By vectorising raster data we are making vectors that are related with tables from database by common attributes. This will enable us to see all relevant data for specific part of railway track by push the vector, which represents part of railway track. This is just one small example of large possibilities that can be achieved by CRGIS system. Realization of that system will allow us in every moment in time to be acquainted with momentarily condition of all trains and railway stations around Croatia. By using GPS systems we could monitor all trains while they are travelling, so we will be able to react much quicker in intervention situations.

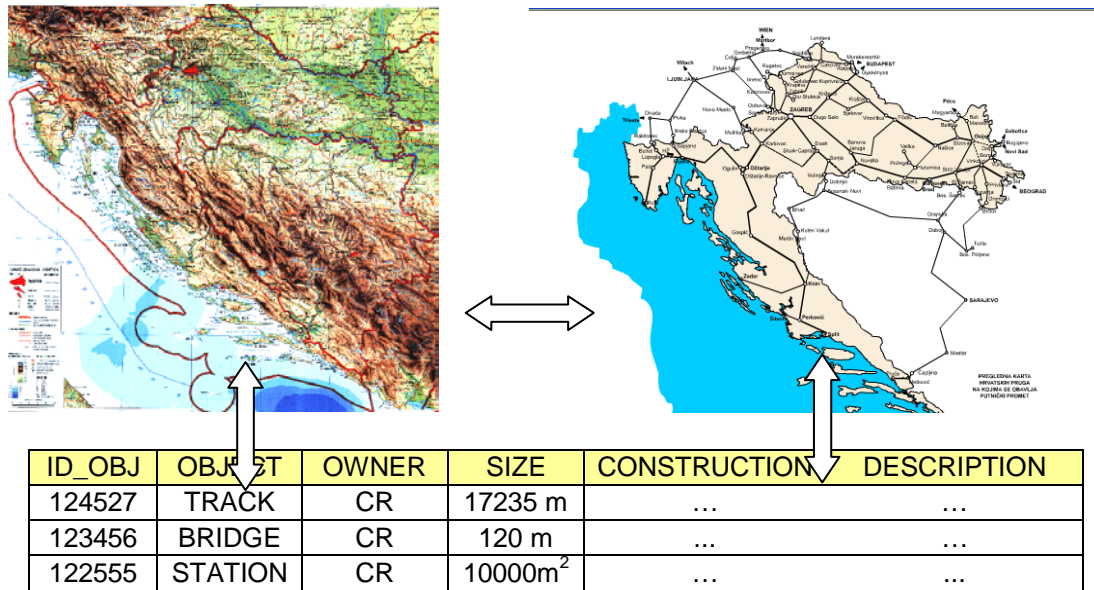


Fig. 6: Relations between data in CRGIS system

Geoinformation system that is shown in this work at this moment is in pilot-project phase. Some proposals were given for its design and what should be included in it. Some parts of descriptive data are already recorded in access database, graphic data (Fig. 6) are being prepared for digitalisation. That includes collecting and preparing maps for digitalisation from all regional departments. Regional department of Zagreb has been the most successful in this process up to now. Project team has been founded with members from business department of informatics, real estates and infrastructure. One of the first steps was establishing Web pages of CR (URL1), which give users traffic information's and cartographic maps (Fig. 7).



Fig. 7: Web surrounding of CR

CR web pages have been functioning for several years, and this year they were completely redesigned. They are accessible in Croatian, English and German, which allows foreign users access to useful information's. Some information from CRGIS system will also be accessible on web pages.

4. CONCLUSION

Modernization of Croatian Railways will be very long and systematic process in which geodesy must insure its status, knowing that its role is very important in this process. Intention of this work was to show all the problems that are related to geospatial data within Croatian Railways. Geodesists are the experts who are the most qualified for this field of work. Realization of geoinformation system in Croatian Railways will resolve a lot of problems. The new level in managing the data, which are now hard to get and are poorly organized, will be insured. In every moment in time we will be able to make decisions according to detailed analysis of actual data. The quantity of data that is being organized in CRGIS is very big, but benefits from them are so useful, so the system that is presented in this work must be finished very quickly.

This is the first time that Croatian Railways are confronted with this kind of task, so they must maximally use the experiences of their neighbouring countries, which have already made systems for managing the railways like this one. Web pages of Croatian Railways that are made and their functionality prove that Croatian Railways have a very good informatics team, which will with geodetic experts help establish CRGIS.

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BIOGRAPHICAL NOTES

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