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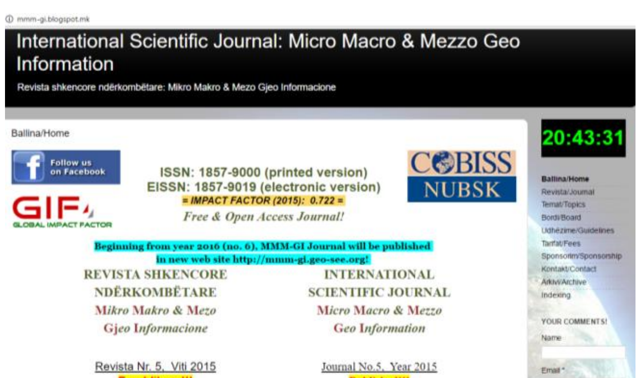

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DATA-DRIVEN ECONOMIES IN THE WESTERN BALKANS

Vlado CETL, Alexander KOTSEV and Jean DUSART[1]

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SUMMARY

Building of European data economy is an integral part of Digital Single Market strategy in the European Union. Digital data is recognised as an essential resource for economic growth, competitiveness, innovation, job creation and societal progress in general. Estimation on possible data economy benefits on European Union scale are well known. At the same time, there is no quantifiable evidence on the state and perspectives of the data driven economy in Western Balkans. In this paper, we provide an overview and elaborate on the emerging opportunities for the establishment of data-driven innovation and data economies in Western Balkans, where National Spatial Data Infrastructures implementation and Open data initiatives could be seen as main drivers. In February 2018, European Commission also adopted strategy for Western Balkans, thus, confirming the European future of the region.

Key words: Spatial Data Infrastructures, Open Data, Data Economy, INSPIRE.

INTRODUCTION

Information is a critical asset that increases the value of data resources and underpins key parts of the economy. The ranges of activities where data and technology can be applied to increase the economic return are multiple. Taking geodata as a use case, the main economic driver on a pan-European scale is INSPIRE (Infrastructure for Spatial information in Europe).

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The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

The context in which INSPIRE is evolving has a history of more than two decades. Looking back twenty years ago, the accessibility and online sharing of public sector data were minimal. Finding the right content was very difficult, if at all possible. Documentation was poor or missing and data were kept in incompatible formats. It was difficult and time consuming to combine datasets from different sources (Craglia, 2010). In order to overcome these challenges, strong coordination was needed between stakeholders at European and national levels. The most appealing solution for all was a pan-European Spatial Data Infrastructure (SDI), leveraging on existing national data infrastructures. In particular, this was addressed on a political level through the establishment of INSPIRE directive (Directive 2007/2/EC).

The implementation of the Directive is not yet finalised, however it already improved data sharing and interoperability between public authorities for environmental and other policies on European, but also on the national level[2]. In the last few years we can see an increasing number of spatial data and services available across European Union (EU) and beyond.

Moreover, the emergence of Open Data in this context helps to reinforce the importance of making data available (Dusart et al. 2016). During the last couple of years we have seen the emergence of national/regional and thematic Open Data portals. This has included efforts to make EU institutions data available as Open Data through the EU Open Data Portal, and further steps to help share content from national portals to a European platform through the Pan-EU Open Data Portal. Within the Open Data setting, geospatial data is playing a prominent role.

Finally, the recently published Communications on "Building a European Data Economy" (COM(2017)9) and "Towards a common European data space" (COM(2018)232) clearly highlight the increasing importance of data as a driver for growth, innovation and job creation. It is estimated that by year 2020, the value the EU data economy will increase to EUR 643 billion, representing over 3% of the EU GDP. To explore the situation in countries outside EU, during INSPIRE 2017 conference, the Joint Research Centre of the European Commission (JRC) co-organised the workshop with the World Bank, the UN Economic Commission for Europe (UNECE) and the Food and Agriculture Organization of the United Nations (FAO). The workshop explored the challenges and possibilities related with Data driven economy

[2] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016DC0478R%2801%29

in Central and Eastern Europe (Kotsev et al. 2018). Several Western Balkans (WB) countries actively participated to the workshop: Albania, Bosnia and Herzegovina, Serbia and Former Yugoslav Republic of Macedonia.

The objectives of this paper are to further elaborate on the emerging opportunities for the establishment of data-driven innovation and data economies in Western Balkan countries. In the next sections, based on the inputs from the abovementioned workshop and additionally collected materials for Kosovo[3] and Montenegro, we provide an overview of the EU relation to the WB, and discuss National SDIs and Open Data Initiatives as drivers for data-driven economies in WB.

THE WESTERN BALKANS AND THEIR RELATION TO THE EUROPEAN UNION

The Western Balkans (WB) are a diversified and complex region (Figure 1, Table 1), where political and economic reforms are an integral part of the EU accession process and have ranked high on the policy agenda for the past fifteen years.

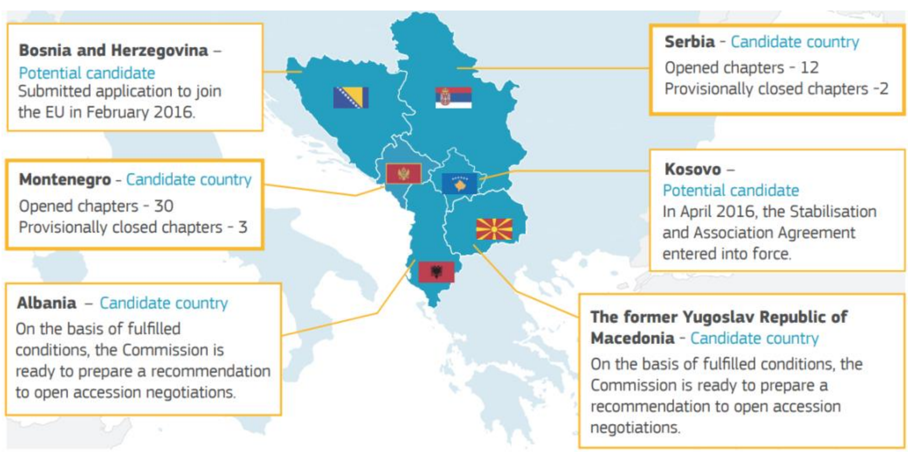

Figure 1: Overview of the EU relations with WB (Source EC Factsheet 2018).

Although individual countries of the region are at different stages of EU integration (candidate or potential candidate), all of them see EU

[3] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence. This note applies to the whole document and each time Kosovo is mentioned.

membership as their objective. The EU is the WB's largest trading partner (43 billion EUR (2016)). EU companies are the biggest investors in the WB with over €10 billion of Foreign Direct Investments in the past five years.

Table 1. General information about Western Balkan region (Source: JRC, DG Eurostat and DG NEAR data)

Country	**Population (2016)** millions	**GDP per capita (2016)** EUR	**EU financial support (2014-2020),** million EUR	
			Total	**Innovation and competitiveness**
Albania	2,876	3,718	649,4	44,0
Bosnia and Herzegovina[4]	3,517	4,494	167,1	34,0
Kosovo	1,816	3,304	645,5	135,0
FYR Macedonia	2,081	4,691	664,2	73,0
Montenegro	0,623	6,355	270,5	21,2
Serbia	7,057	4,904	1.508,0	105,0

The attention of policy-makers in the region has been focused on questions of economic growth and competitiveness, albeit less so on using research and innovation (R&I) to achieve broader societal goals. At the same time, the European Commission (EC) has made research an explicit priority for competitiveness with important links to economic governance and the annual Economic Reform Programmes. All countries in the region have proposed reforms to modernize their policies and structures in support of research, technology and development (Matusiak and Kleibrink, 2018).

Considering this context, on the 6th of February 2018, the EC adopted a strategy for 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans', confirming the European future of the region as a geostrategic investment in a stable, strong and united Europe based on common values (COM(2018)65).

The Strategy sets out an Action Plan with six concrete flagship initiatives targeting specific areas of common interest: rule of law, security and migration, socio-economic development, transport and energy connectivity,

[4] For Bosnia and Herzegovina the time span covers only the period from 2014 to 2017

digital agenda, reconciliation and good neighbourly relations. Concrete actions in these areas are foreseen between 2018 and 2020. To support this, the EC proposes to gradually increase funding under the Instrument for Pre-Accession Assistance until 2020 in so far as reallocations within the existing envelope allow. In 2018 alone, EUR 1.07 billion of pre-accession assistance for the Western Balkans is already foreseen, on top of almost EUR 9 billion from the 2007-2017 period. Increased funding in the fields of transport, energy, the social sector, the environment, and private sector development, including the digital economy is foreseen.

The development of the EU "Digital Single Market" contributes to developing businesses, creating growth, boosting productivity, promoting innovation, transforming public services and improving citizens' quality of life. It is essential that the WB are included in the EU's efforts to embrace technological change for them to be able to benefit from digital tools, ensuring a prosperous and sustainable future for their citizens. Together with the partners in the WB, the EC will launch a Digital Agenda for the WB. The digital society should be developed and so support will be provided in particular to eGovernment, eProcurement and eHealth services as well as to the development of digital skills.

NATIONAL SPATIAL DATA INFRASTRUCTURES AND OPEN DATA INITIATIVES IN THE WESTERN BALKANS

Many activities have been focused on enhancing the access and sharing of data. As already mentioned, the main driver for making spatial data available across EU is the INSPIRE Directive (Directive 2007/2/EC). The Directive requires actions from EU Member States and also has direct implications for the countries neighbouring the EU, regardless of whether or not they are candidate countries. The Directive itself is not mandatory for WB countries, however they all follow the principles of INSPIRE (Cetl et al. 2014).

In addition, to foster the re-use of Open Government data in Member States, back in 2003 EC adopted the Public Sector Information (PSI) Directive (2003/98/EC)[5]. The Directive established framework rules regarding the availability, accessibility and transparency of Open Data in Europe. Furthermore, it was recommended to have a standard electronic licence for the re-use of Open Data and a tool to find the relevant data sets via a list of

[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:en:PDF

portal websites. In 2013, the PSI Directive was revised[6] and amendments were made to further embed "open by default" principles, with additional provisions on marginal cost-oriented fees, transparency and support to machine-readable and open formats.

The proposal for a new Directive on the re-use of public sector information [recast] (COM(234) final) will further stimulate the publishing of data, limit the exceptions allowing public bodies to charge for the reuse of their data and enlarge its scope to data held by public undertakings and research data resulting from public funding. It will also ensure coherence with the General Data Protection Regulation (GDPR[7]).

According to the Global Open Data Index for 2016, which measures the openness of data globally, the situation in WB differs significantly (Table 2).

Table 2. Global Open Data Index for WB in 2016 (source: Global Open data Index[8])

Country	Rank	Score (%)
Albania	47	36
Bosnia and Herzegovina	58	26
Kosovo	58	26
FYR Macedonia	52	31
Montenegro	49	35
Serbia	41	41

All countries in the WB are working with the Open Government Data (OGD) in some form (RESPA, 2015). They have all joined the Open Government Partnership (OGP), except Kosovo which is applying for membership. Albania, Macedonia, and Montenegro were some of the earliest countries to join the OGP, whilst BIH and Serbia joined in 2014.

The NSDIs development in WB is supported by the close cooperation and collaboration between National Mapping and Cadastral Authorities (NMCA) that became even more intense after the first regional conference in Croatia in 2008. It became an annual event that is held each year in a different WB country (Cetl et al. 2013). The last, 10th regional conference for cadastre and Spatial Data Infrastructure was held on 8-9 June in Skopje, FYROM, hosted

[6] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013L0037
[7] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016R0679&from=EN
[8] https://index.okfn.org/place/

by the Agency for Real Estate Cadastre. About 100 delegates from NMCAs, universities and the private sector gathered in Skopje to share experiences, achievements, challenges and plans. Representatives of individual NMCAs were working on Cadastre and NSDI reforms during the past 10 years and discussed the future plans. Opportunities and future planned projects were in the focus of the event as well.

The „INSPIRATION – Spatial Data Infrastructure in the Western Balkans" project had a positive impact on the NSDIs development in the region. It ran from 2012 to 2013 (GFA Consulting Group 2013). As a multi-country project it aimed at promoting NSDI and coordinating its implementation in the WB countries[9] with a view to prepare beneficiary countries to meet the objectives of the INSPIRE Directive. The main beneficiaries of the project were the NMCAs that also played the role of principal coordinators and focal points.

As a sort of follow up in June 2014 the IMPULS Project started that will go on until autumn 2018 (Wasström, 2016). The IMPULS project is financed by Sida, the Swedish International Development Cooperation Agency. The project is managed by Lantmäteriet, the Swedish Mapping and Land Registration Authority together with the Croatian counterpart State Geodetic Administration as junior partner. Eight organisations are participating in IMPULS: Immovable Property Central Registration Office of the Republic of Albania, National Authority for Geospatial Information in Albania, Federal Administration for Geodetic and Real Property Affairs of Bosnia and Herzegovina, Republic Authority for Geodetic and Property Affairs of the Republic of Srpska, Bosnia and Herzegovina, Kosovo Cadastral Agency, Agency for the Real Estate Cadastre of the FYR Macedonia, Real Estate Administration of Montenegro and Republic Geodetic Authority of the Republic of Serbia. The project aims to achieve a sustainable impact on the implementation of the INSPIRE Directive that will enable the beneficiaries to meet the EU-requirements, as well as develop interoperability and e-government in each country. The project will provide the basis for how technical interoperability can be achieved, how authorities should disseminate spatial data in an electronic format via services, and how they should share spatial data with other public authorities and other countries.

In 2016 started the Western Balkans Academic Education Evolution and Professional's sustainable training for Spatial Data Infrastructures

[9] Including also Croatia

(BESTSDI[10]) project within Erasmus + Programme. The goal of the project is to give incentive to all universities in the partner countries in the region of Western Balkans to introduce Spatial Data Infrastructure (SDI) as a platform for spatial data usage in any applicative concept that upgrades SDI in their study programs in standardized and well-elaborated form.

The facts presented during the JRC Workshop at INSPIRE 2017 Conference (Kotsev et al. 2018) showed that WB countries are progressing well with their NSDI implementation in accordance with INSPIRE. In addition, some progress is also visible with regards to Open data.

Albania

The six medium term priorities of the Government of Albania settled in the National Strategy for Development and Integration (NSDI 2015-2020) include issues on ensuring innovative, citizen-centred good governance; enhancing innovation and competitiveness and sustainable and integrated management of resources such as land and water. An important element that the Government of Albania is trying to address through the e-government and citizen-centric service, is the development of standards and inter-institutional interaction frameworks in relation to accessibility and exchange and free flow of information and data.

The National Cross-cutting Strategy “Digital Agenda of Albania 2015-2020”, among others important elements of the information society, e-government and citizen-centric service, addresses issues of the Infrastructure for Geospatial information. The Geographical Information (GI) and the geo spatial data service are an important part of e-Government of Albania.

The State Authority for Geospatial Information ASIG[11] is responsible for the establishment and functioning of national geospatial data infrastructure in the Republic of Albania, offering access to geospatial data through the national Geoportal[12] and expansion of the Gov Net infrastructure, e-taxes, e-procurement, e-customs, and e-patents. Currently, this geoportal offers 67 online services of various geoinformation topics, services that enable citizens and institutions to access online information, without the need to draft multiple papers and receive a response from the relevant institution. The Immovable Property Registration Office (IPRO) is one of the main

[10] http://bestsdi.eu/
[11] http://asig.gov.al/english
[12] https://geoportal.asig.gov.al

beneficiaries of the National geoportal. From the network services offered by this geoportal, borders of over 2.2 billion cadastral parcels are improved and are currently being corrected, with use of orthophotos.

The approval and implementation of new laws in 2014 "On right to information" and "On notification and public consultation" are the important indicators in 2016 for Albania ranked 47th worldwide according to the Global Open data Index. Regarding WB, Albania together with Serbia is leading the rank in the field of right to information. The Open data portal is providing many data sources[13].

Recently, Albania took also part of the initiative of Open Government Partnership (OGP). The object of this observation is the assessment of readiness for increasing transparency, the level of implementation of regulative reforms and the impact they provided in improvement of services for individuals.

Bosnia and Herzegovina

Considering its organization, Bosnia and Herzegovina is consisting of two entities, the Federation of Bosnia and Herzegovina (BA-BIH), and the Republic Srpska (BA-SRP), and one administrative district, the Brčko District (BA-BRC). Several projects regarding NSDI and Open Data are seen as important:

- KATASTAR.ba – The unique software for all cadastral business processes deployed in 79 municipalities in Federation Bosnia and Herzegovina (BA-BIH) with a centralized data centre
- E-SERVICES – A pilot project providing the first government e-Services to the citizens of BA
- RCN – Real estate price register for BA-BIH and Republic Srpska (BA-SRP),
- Address register for BA-BIH and BA-SRP.

The private sector should be a driving force behind the SDI and Open Data initiative as it could greatly benefit from both. Unfortunately, only finding out what data is produced at which administrative level takes effort. For example, one would have to contact more than 140 municipalities to get data about addresses and house numbers for the whole territory of BA.

[13] http://open.data.al

Some institutions in both entities have identified this problem and are working hard on its solution. One example is the Federal Geodetic Administration (FGA) which managed to implement KATASTAR.ba – the first IT system to be used by all of the municipalities in the BA-BIH. Before KATASTAR.ba, each municipality had its own way of managing their data. There were approximately 25-30 different software solutions and methods used to manage the same data. The unification of data maintenance and business logic enabled the BA-BIH to publish a centralized cadastral registry which is available to everyone and which covers the entire BA-BIH[14].

In BA-SRP entity, the GARS (Republic Administration for Geodetic and Property Affairs) acts in a similar way and both institutions cooperate on implementing the same projects. It is important to note that although these institutions have almost the same functions they abide by two different legal frameworks. The main difference is in jurisdiction as the GARS has jurisdiction over local cadastral and land registry offices and in the Federation, municipalities have jurisdiction over cadastral offices and the land registry offices are under court jurisdiction.

In both entities, there are laws and regulations regarding data sharing that institutions in their respective entity must adhere to. These regulations are set up to ensure transparency as well as privacy protection which, in terms of Open Data, represent two opposite sides and try to answer the question of what data must be shared, and what data should not be shared. Between these two sides is a non-regulated grey area in which the institutions should, proactively, share their data and at least try to make it as reusable as possible by sharing the data in its original, editable form.

Kosovo

In the context of the Real Estate Cadastre and Registration Project, the Kosovo Cadastral Agency (KCA) is currently working on the development of a strategy for the NSDI (Meha et al. 2015). This NSDI aims to transform the way spatial data and services are shared within Kosovo so it may underpin national social and economic development to the benefit of all. The strategy is strongly based on the principles of the INSPIRE.

Several NSDI components have already been implemented, such as the draft version of the Law, several public geospatial datasets, and the establishment

[14] http://katastar.ba

of the national geoportal[15]. The Geoportal is developed in accordance to INSPIRE standards meaning the inclusion of network services for searching, viewing and downloading geospatial data. Being the first geoportal in Kosovo, KCA paid extra attention to create a user-friendly web portal with lots of "help tools". Currently there are more than 2000 registered users.

Open data is promoted through Open Data Kosovo[16], a non-profit organization that believes in using civic-tech and digital humanitarianism to open government. This initiative promotes the idea that governance data should be made freely available for everyone to use and republished as they wish, without restrictions from copyright, patents or other mechanisms of control.

The former Yugoslav Republic of Macedonia

As an EU candidate country, FYR Macedonia already transposed the INSPIRE Directive into the Law on National Spatial Data Infrastructure. The open data initiative is formalised through the Law on Public Sector Data Use. Both were put into force in February 2014.

The Law on NSDI covers domains and activities on metadata, interoperability of spatial datasets and services, web services, data exchange, governing of the NSDI and general clauses. The Law transposes EU INSPIRE Directive, defining the spatial data themes from the INSPIRE Annexes, describing the NSDI organisational structure and identifying the stakeholders and milestones for implementation. Complete synchronisation of the NSDI with the INSPIRE Directive requirements is set for the end of the 2019. The administrative and technical coordinator of the Law implementation is the Agency for the Real Estate Cadastre (AREC). The Law recognises 19 more stakeholders, which are all governmental institutions of various levels. Currently, there are 74 web services published and documented within the metadata catalogue on the national geoportal[17].

The Law on Public Sector Data Use legally mandates public sector data availability and openness, taking in regard limitations for sensitive data, metadata scope, open data central register – data portal structure and functionality and up-to-date data status regulation. Governmental institution in charge of implementation of the Law is the Ministry of Information

[15] http://geoportal.rks-gov.net
[16] http://opendatakosovo.org
[17] http://nipp.katastar.gov.mk

Society and Administration. Concepts covered by the Law follow the EU Digital Single Market Open Data Policy. There are currently 25 institutions contributing with the 154 active datasets on the national open data portal[18].

Montenegro

Montenegro, as EU candidate country, is committed to EU integration process. Transposition and implementation of EU environment acquis have the highest priority. The Real Estate Administration is responsible for implementation of the NSDI Law and they establish and maintain a geoportal[19] that provides access to services for a number of metadata and spatial datasets. The implementation of the INSPIRE directive depends on adoption of a new law which would enable the integration of geospatial data from different sources into a functional unit. The draft of this law has been prepared during 2016 and sent for revision to the European Commission.

The Law on Free Access to Information from 2012 has implemented the Directive 2003/98/EC only in the part of free access to public sector information, but not in the part of the reuse of public sector information and OD licences[20]. Although Montenegro joined the OGP in 2011 and has drafted the Second Action Plan which is currently in the public debate phase, not much OGD is available, and it has no OGD portal. Open Data strategy is in the preparation but it is not yet adopted.

The Parliament of Montenegro adopted in 2017 amendments to the Law on the Free Access to Information, which, among else, regulate re-use of public data. The law introduced the obligation not only to share the data with public, but also to produce new and digitize existing databases, as well as to create an open data portal by May 2018, as the central address for accessing government databases[21].

Serbia

In the beginning of 2017, the Serbian Government adopted a Strategy of Measures and Activities for Increasing of Quality of Services in the Field of Geospatial Data and Registration of Property Rights in Official State

[18] http://www.otvorenipodatoci.gov.mk
[19] http://www.geoportal.co.me
[20] http://www.homerproject.eu/images/Docs_/Publications/OD_PLANS/MONTENEGRO__Open_Data_Recommendation_Plan.pdf
[21] http://institut-alternativa.org/en/montenegro-at-the-bottom-of-open-data-ranking/

Register – Reform Path of Republic Geodetic Authority (RGA) by 2020. The overall objective of the strategy is to support the economic reform of the Government by effective provision of information in the sphere of real estate and geospatial related activities for the fast, easy and rightful decision-making at all strategic levels. The main aims include the establishment of an efficient system for real-estate registration, improvement of quality, reliability and maintenance of spatial data and services, integration into the e-Government, advancement of NSDI, which would improve the access to geospatial information and simplify and speed-up communication between government, private sector and citizens.

The NSDI technical framework that encompasses the establishment of network services and application of the INSPIRE implementing rules aiming to reach interoperability by harmonization of spatial data themes under jurisdiction of RGA is planned to be developed until 2019. The Digital Platform of National Spatial Data Infrastructure can be used to collect data, connect it, and create added-value data according to user needs[22].

The availability of quality data, governance and exchange within the Government, as well as the general understanding of the policy-making process based on data, have been recognized as a key challenge for the transformation of the Serbian public sector in line with the European administrative space. The Serbian Electronic Government Development Strategy 2015 – 2020 recognizes the concept of Open Data. In 2016 a national Open Data portal[23] was established that provides some non-spatial data. At the same time, the importance of Spatial Data and NSDI for Open Data was recognized as well.

CONCLUSIONS

WB has a clear European perspective and future. However, individual countries have to meet European criteria. A credible enlargement perspective requires sustained efforts and irreversible reforms. Countries of the region are at different stages of EU integration and as part of their EU accession, they have drawn up national programmes and strategies to bring them into alignment with EU legislation. The focus and effort of the institutions in the WB countries is directed at meeting the criteria in order to achieve this goal. This huge and complex task includes the adoption and harmonization with EU acquis. Regarding data economy, it can be assumed that the role of

[22] http://www.geosrbija.rs
[23] https://data.gov.rs

digital data will be following a similar pattern like in EU, and is therefore expected to be contribution to an increasing relative share of Gross domestic product (GDP).

Lack of awareness and availability of data are seen as barriers to the full deployment of a data economy in WB. However, progress in NSDI implementation and Open data initiatives could be seen as a main drivers of data economy. WB is already showing multiple good practices regarding NSDIs with clear European dimension. Efforts that are more considerable is needed for open data to have noticeable effects on their societies. This will take strong commitment and hard work to foster a culture of openness, transparency and participation.

Continued support and joint actions by EU and international organisations (UNECE, FAO, World Bank, etc.) will help in WB alignment with European and Global Agenda. The focus should be on convincing the decision/policy makers in WB on one hand and on the other to serve stakeholders and citizen's needs.

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SPATIAL PLANNING OF THE AGRICULTURAL TERRITORIES IN BULGARIA – HOW TO FILL THE GAP?

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SUMMARY

Spatial planning in the agricultural territory is crucial for the regional and rural development in Bulgaria. However, agricultural spatial development is poorly covered by the national legislation. Currently, there is a vital need in developing a modern and adequate related concept that is different from the existing from the time of the centrally planned economy one. The objective of the paper is to present the author's concept on agricultural spatial planning in conditions of marked-planned economy and in line with the acting in Bulgaria Spatial Development Act (SDA, 2001). A further development of the concept of the General Development Plan (GD Plan) as regulated in Chapter Six of the SDA (2001) is suggested. The author considers inappropriate for on-farm level the Specialized Detailed Development Plan as regulated in Art. 111 of SDA (2001) and promotes the idea of developing Land Use Plan (LU Plan) with appropriate characteristics. Spatial planning of the agricultural territories should be recommendatory in the small-scaled planning (GD Plan) and advisory for the big-scale planning (LU Plan), stimulated by financial and other instruments. To serve the public and private interests it should be based on zoning of the agricultural production, economy potential of the land and nature recourses and existing infrastructure. Spatial zones and territorial elements with their regimes are discussed.

Key words: Spatial planning, Agricultural territory, Development zones, Territorial elements

INTRODUCTION

The agricultural territory in Bulgaria shares the greatest part of the national space and has great income potential. Though being important to the national economy, its problems are being somehow circumvented by the state. The

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agricultural territory is the only one, compared to the other territory types, that has no contemporary spatial development rules regulated by the legislation. Its spatial development is supposed to be controlled generally by the market regulation mechanisms. A negative consequence from this state abdication is the chaotic and non-holistic land use, which causes inefficient agricultural production and environmental problems. Bad land governance allows for: fragmentation of land ownership (that causes negative effects on maintaining land quality, mechanization of field production and economic growth of the small and middle farms); bad transport connectivity in the field; bad structure of crop production (abandonment of intensive crop production, growing ineffective crops on the most valuable and technically equipped land); destruction of the biggest part of 250 irrigation systems; degradation processes and the pollution of the agricultural land (lack of strict control); loss of agricultural land under urbanization and construction), etc. and finally to non-use of the land production potential and underestimation of Bulgarian lands.

Two acts are nowadays responsible of the national territory planning: the Regional Development Act (RDA, 2008) and the Spatial Development Act (SDA, 2001). The first of them regulates the strategic planning of the spatial and regional development. The second one regulates the territory development in terms of investment design and construction (Art. 1, para. 2 SDA, 2001). Spatial planning transfers the strategic regional foreseeing to the territory and, vice versa, regional strategic planning can be developed only on proper territorial basis, achieved by spatial planning.

General foreseeing for the agricultural territory on a national level is presented in the National Regional Development Strategy (NRDS) 2012-2022 as regulated by Art.19, para. 1 RDA (2008). This planning document addresses the rural areas, including the peripheral (NCSD 2013-2025), the underdeveloped (RDP 2014-2020) and the areas for targeted support (Art 5 RDA, 2008). It pays main attention to the development of the specific potential of the agricultural territory, to its economic convergence and environmental protection.

The agricultural territory, as a part of the national space, is subjected to analysis and development forecasts by the other strategic document regulated by RDA (2008): NCSD 2013-2025 (Art. 7b RDA, 2008), which focuses on the territorial development. Its analysis outlines the main problems of the agricultural territory and provides guidelines for: introducing innovations, sustainable management of the natural resources, utilization of the natural and demographic potential of the rural areas, restoration and modernization of the irrigation infrastructure, restoration and reconstruction of the facilities for the water harmful effects control, promoting intensive production and organic farming, assisting the production in the sensitive areas, land consolidation, reduction of the number of deserted land properties, etc. It promotes strict protection of the highest category land from construction and urbanization. The document defines the main objectives of sustainable rural development on the base of conservation, restoration and proper management of the land resources and through a sole integrated plan for all sectors, giving a priority to the agricultural.

The strategic instrument for spatial planning, supposed by the legislation, is the General Development Plan (GD Plan) (Chapter 6, Section 2 SDA, 2001). It sets the territorial and time framework of actions and investment intentions within an administrative and/or territorial unit. However, the GD Plan contains details about the urbanized territories, while the other territories are presented only by their borders and some territorial elements. The agricultural territory in the GD Plan is presented by the following general territorial elements (Annex 2 to Art. 68, para. 2 of Ordinance 8 to SDA, 2001):

- area, for which it is permissible to change the permanent agricultural purpose of use for construction
- area in a regime of a ban on change of its permanent purpose of use
- farm land: cropped fields
- farm land: permanent crops
- non-farm land: pastures, slopes, gullies, pests
- area in a regime, which is influenced by environmental requirements

Ordinance 8 SDA (2001), art. 5, para. 5, 6 and 7, regulates territories and development zones in the cities of national importance (cities-centers of hierarchical level 1 and 2 as to the NCSD 2013-2025) that have specific purpose of use: for agricultural activities. Related texts are found in two other documents. Sofia Municipality's Spatial Planning and Construction Act envisages groups of agricultural development zones in the Sofia suburban area (Art. 6, para. 1, item 7 SMSPCA, 1995). The Administrative and Territorial Structure of the Republic of Bulgaria Act provides for urban and suburban zones Art. 3, para. 1 ATSRBA (1995) in the land belt between Sofia urban and Sofia municipality border for agricultural production activities. However, these agricultural development zones are not recorded in Sofia green system (Art. 10, para. 1 SMSPCA, 1995). No such zones are foreseen for the other cities by the SDA (2001).

Agricultural territory planning is addressed in Art. 111 SDA (2001) through a Specialized Detailed Development Plan (SDD Plan) (Chapter 6, Section 3 SDA, 2001) for the agricultural and other territories with the purpose “to solve particular structural problems and cover structural parts of the municipality's territory". Spatial development of all the other territories (forestry, protected, disturbed for restoration Art. 7 SDA(2001), etc.) has its regulations in particular normative documents – the Forestry Act (FA, 2011), the Protected Areas Act (PAA, 1998), Agricultural Land Protection Act (ALPA, 1996), etc. Some regulatory mechanisms for the agricultural territory planning can be found in the Agricultural Land Ownership and Use Act: one-year land-use agreement (Art. 37c ALOUA, 1991) and some procedure rules for voluntary land consolidation (Art. 37e ALOUA (1991); Chapter 9 RIALOUA (1991). ALOUA (1991) generally concerns establishment of ownership and acquisition of land. There are some texts associated with agricultural land-use planning in the Inheritance Act, which limit the landed property size according to the different methods of permanent purpose of use: 0.3 ha for cropping fields, 0.2 ha for pastures and meadows and 0.1 ha for perennial plantations (Art. 72 IA (1949). Art. 2, para. 3 ALPA (1996) foresees measures for the conservation and restoration of soil fertility, sets limitation to the change of the permanent purpose of use of the agricultural land to urbanized one.

The regulations of these acts are too general in nature and are not sufficient for conducting spatial development activities. None of the acts reflects a comprehensive management concept for integrated planning of the agricultural territory, consisting of objectives, measures and actions, and based on technological indicators. The economic development of the farms, sustainable land use and balance between the functions of the other territories is still not considered in a comprehensive document for developing united territorial basis. As a consequence of this gap, the land use planning for the agricultural territories is currently unofficial, chaotic and non-holistic. There is lack of spatial development decisions in the GD Plans for the agricultural territories, according to the natural characteristics and the anthropogenic impacts. There are no rules and technical standards for development of SDD Plans (land use plans) for the agricultural territories. There are no developed and implemented agricultural land use plans.

The objective of this study is to develop a concept for spatial planning of the agricultural territory with zones and territorial elements at two different scales, according to the scales of the regulated spatial planning documents in Bulgaria: the General Development Plan and the Specialized Detailed Development Plan (SDA, 1991). By this concept, the author makes some suggestions for amendments of SDA (1991).

MATERIALS AND METHODS

While developing the ideas of the study, the following scientific methods and approaches were used:

- *Documentary analysis* - collection, processing and analysis of normative, strategic, historical and other documents from the country and abroad in respect of land-use plans and maps, including national documents for rural development, the National Strategy for Regional Development of the Republic of Bulgaria 2012-2022, the National Concept for Spatial Development 2013-2025, Ordinances of the Council of Ministers, acts of the Municipal Services of Agriculture, Analytical Reports on Sustainable agriculture management at municipal level, land use plans and maps.
- *Quantitative and qualitative methods for collecting and processing information*: economic, geographic and statistical data. When collecting statistical information, the following sources of statistical information were used: policies, strategies, plans, programs and projects developed, analyzes, forecasts and anticipated planned development for the agricultural territories; farm and economy data, general characteristics of the territory (including natural conditions, transport and technical infrastructure, environment) from the National Statistical Institute; agrarian reports, statistical reports from statistical agencies; official registers, publications and documents of state bodies and departments (ministries and agencies, district and municipal administrations, etc.); official registers, planning and strategic documents at municipal level.
- *Expert assessment* for formulation of an up-to-date concept of agricultural spatial and land-use planning, its content and scope.

The use of up-to-date strategic and normative documents, information databases of national registers and historical evidence is a real basis for achieving credible results. The realism of the proposed methodology contributes to clarity, regarding the scope and the content of the land development plans.

RESULTS

Art. 111 SDA (2001) doesn’t specify any scale or characteristics of the SDD Plan. This is supposed to be regulated for each type of territory in a separate document. Since there is no regulation for the agricultural territory, the author presents own theory for amendments in the existing planning documents with an effect on the appropriate structuring and efficient use of the agricultural territory. The author’s views are summarized in a concept for agricultural spatial and land-use planning at the scales of the regulated official documents: 1) the small scale of the GD Plan; 2) the large scale of on-farm level.

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A CONCEPT-SCHEME FOR AGRICULTURAL TERRITORY ZONING AND ITS REPRESENTATION IN THE GENERAL DEVELOPMENT PLAN

Theoretical considerations

The development and spatial plans in Bulgarian legislation are specific category legal acts, which specificity is that they contain mandatory predictions and perspectives performing bindings. Their legal features are specific and mandatory for enforcement. If their prescriptions should not be fulfilled, sanctions or coercive administrative measures follow. Can this be valid for the agricultural territory?

Zoning of the territory meets the provisions of Art. 106 of SDA (2001) and Art. 2 of Ordinance 8 to SDA (2001) that contain provisions for the mandatory regimes of the GD Plan. On the contrary, Art. 17, para. 3 CRB (1991) and Art. 4, para. 1 ALOUA (1991) provide that "the private property is inviolable" and "proprietors shall be free to determine the method of use of the agricultural land according to its permanent purpose of use". This means that if the GD Plan promotes detailed structural zoning for the agricultural territory, a legal contradiction will occur with CRB (1991) and ALOUA (1991). Further, the “agricultural activity” as a kind of activity in a territory (Art. 4, para. 7 of Regulation 7 to SDA, 2001) depends on natural, social and financial factors, which are dynamic in nature. A mandatory regime on farming zones will bring to deficits and bad results in crop production, land relationships and other spheres of interaction. For example, the amortization period of the permanent plantations is in many cases shorter than the operational period of the GD Plan, the EU subsidizing of the agricultural production requires a five-period of land management, etc. This means that protecting the agricultural land and its production functions by means of strategic spatial planning can be realized through a flexible approach that will concern the regulation of the basic territory development instrument: the GD Plan. The idea of this study is that in the scope of GD Plan should be developed *a concept-scheme for the agricultural territory development of a recommendatory nature*. The implementation of its projections can be different financial mechanisms like subsidizing policies, land tax policies, etc. There are similar examples from the developed EU economies, where Master Plans are recommendatory but incentive systems lead to their strict adherence (as for example in UK). Further, *Art. 2 of Ordinance 8 is to be amended with recommendation for structural foreseeing for the agricultural territory*. This will make possible designation of development zones and territories with recommendatory regimes as an extensive approach to maximization of the land use effect. It should correspond with the local soil and climatic conditions and should consider cultivation of appropriate crops, applying appropriate systems of agriculture, ameliorations, etc.

Features of the concept-scheme for the agricultural territory zoning and its representation in the General Development Plan

Since the GD Plan has mandatory regime, the author accepts the boundaries of the agricultural territory as mandatory**.** They outline **a zone for market-oriented agricultural production.** Its characteristics should include: long-term regime as foreseen by the GD Plan and no permission of changing the permanent purpose of use for construction. This zone should be subjected to the entrepreneurship for primarily commodity production for the market. Different systems of agriculture and mechanized soil tillage should be applied. It should include the following main methods of permanent use: cropping fields, perennial plantations, pastures and meadows. As to the author's concept, the agricultural territory **consists of development zones with recommendatory regimes**. The idea for development zones stems from the diversity of land quality and climatic conditions over the country. It presupposes regional specialization of the agricultural production. The purpose is to use the each location productive potential of the agricultural land. The information background for zones designation should be: 1) the traditional zoning of the agricultural production; 2) the land quality assessments; 3) the existing soil varieties; 4) the availability of technical infrastructure (mainly ameliorative) that serves the agricultural production process, etc. The following development zones in compliance with the Cadaster and Property Register Act (2000) methods of permanent purpose of use (Ordinance RD-02-20-5/2016 to CPRA,1991) with recommendatory regimes should take place:

1. Recommendatory development zone: cropping fields for establishing crop rotations
2. Recommendatory development zone: permanent plantations
3. Recommendatory development zone: pastures
4. Recommendatory development zone: meadows
5. Recommendatory mixed development zone: for combining agricultural production with other kind of production and/or tourist function (e.g. a tourist farm with a profile of viticulture and wine/beekeeping/fruit growing, etc.)

Additionally, the GD Plan should point out: the degraded soil hot area, the non-farm territory and the territory intended for irrigation and drainage. In this sense, the following territorial elements should be outlined:

6. Non-farm territory - unused land with developed shrubs and forest vegetation, ravages, gullies, slopes and other non-agricultural land
7. Territory for restoration from soil degradation
8. Territory of irrigation/drainage system: built-up, or under construction, or under an open procedure for construction
9. Territory intended for future irrigation and/or drainage
10. Terrain under reclamation

The adherence of the recommendatory regimes should be stimulated through different financial incentives. By following the recommendatory regimes of these zones, the following desired effects will be achieved: the chaotic transformation of the cropping fields into lands for permanent crop growing, meadows, etc. will be limited and vice versa; the structure of agricultural production will be improved, i.e. of intensive crops: fruit and vegetables will be grown where the natural conditions are allowing; the traditional production of national importance will be preserved, such as the production of roses and other essential oil crops; the integrity of pastures and meadows with a focus on preserving the biodiversity and providing grazing areas for livestock farming in the future will be maintained, etc.

According to the specific regional and settlement conditions, **suburban agricultural territory** should be outlined. It should be meant for the cities–centers of 1st and 2nd hierarchical levels (according to NCSD 2013-2025) and for settlements with forecasts for economic and social activity increasing. This territory is a question of spatial development policy, not of applying development norms. They should not be treated in the concept as a mandatory instrument of spatial planning. They should be designated where there are appropriate physical-geographic conditions and availability of land resource. The suburban agricultural area is a transitional area between the urbanized and agricultural territory. It is of ecological importance for creation of natural environment and providing for quick contact of the citizens to the natural life factors. As an ecologically "natural break", it contributes to spatial limitation of the extensive urbanization.

The suburban agricultural area should be intended for direct self-supply with fresh food. It should be suitable for personal and family entrepreneurship. A **particular terrain with a specific regime** (areas suitable for linking the agricultural activities with recreational activities – villa zones) should be part of this territory. It can also overlap a *territory with permissible regime* for change for urbanization permanent purpose of use.

The need for contact with nature environment and also for fresh immediate food has brought to development the idea of **urban farming area within the urbanized territory,** mainly in the cities-centers of 1st and 2nd hierarchical level (according to NCSD 2013-2025). It is a contemporary tendency to plan suitable urban landed properties for small agricultural production, being at the same time part of the city's green system. In the economic sense, such area should be foreseen for private and family entrepreneurship for subsistent agriculture and rarely for the market. The anthropogenic impact should not be in conflict with the urban functions (Yarlovska, 2017).

A CONCEPT FOR THE AGRICULTURAL LAND-USE PLANNING ON FARM LEVEL

Theoretical considerations

The DD Plan, as regulated by Art. 108 SDA (2001) has the following peculiarities: 1) the DD Plan is mandatory for realizing investment intentions for construction and/or for changes in street regulations (Art. 12, para. 2 SDA, 2001); 2) the DD Plan for territories out of settlements can be applied only if it complies with the provisions of an operating GD Plan (Art. 45 of Ordinance 7 to SDA, 2001): if the development regime of the territory has to be changed and a DD Plan to be applied, this is possible only if the GD Plan is changed (amended) by firstly modifying the GD Plan through an analogous to its creation procedure (Art. 134 para. 3 SDA, 2001); 3) the DD Plan fulfills the technical standards provided by Ordinances 7 and 8 to SDA (2001), which are mainly connected with construction. The SDD Plan as regulated by Art. 111 SDA (2001) is supposed to be a kind of a DD Plan and should meet its set-up rules. However, some circumstances hinder the implementation of these rules to a spatial plan for the agricultural territories and they are the following: 1) spatial planning for the agricultural territories generally is not connected with construction and street regulation but is intended for land-use optimization, i.e. first, for creating optimal territorial conditions for the agricultural production process and, second, for balancing the interaction between human activities and the environment; 2) the SDD Plan for the agricultural territories is supposed to have shorter operational period than that of the GD Plan because land use in the agricultural territories has more temporary character than land use under construction elements: planning and the implementation of the plans are affected by dynamic factors like natural factors, land relationships, agricultural subsidy policies; 3) the territorial elements may have different lasting regime: for example, engineering infrastructure (provided by the operational GD Plan and implemented by the DD Plan), the permanent field roads that connect important territorial elements with naturally developed tree and shrub vegetation along and the unused non-categorized lands such as pests, gullies, rays vs. the functional field roads of a crop rotation or perennial plantation, fields, quarters and grazing parcels, etc., with more temporary nature.

The land function as means of production but being natural resource predetermines the specificity of spatial planning for the agricultural territories and its instruments. The dynamism of the natural and social (land relationships) factors put difficulties to regulate the agricultural land use planning in the legislation. There are still big gaps concerning land relations and land governance like the total lack of suitable regulations for the small scale spatial planning for the agricultural territory in the SDA (2001) and in other acts concerning land ownership, land use, land relations, protection of farmland. Still, there is no regulated terminology associated with spatial planning of the agricultural territory. However, some sub-normative and legal-administrative acts use such terminology. The term "land use plan" is used in the RIALOUA. It is referred in Art. 13a, para. 4, item 2 and Art. 18b, para. 1 RIALOUA (1991) to as a "structural land-use plan before the formation of the cooperative farms and state-owned farms": obviously a graphic documentary form the past. The terms "land use draft project" and "land use plan" can be found in some Municipal Development Plans. Some legal and administrative acts that solve private property problems also mention them. It is paradoxical that the only contemporary legal reference for a document with the issued content is in the Art. 111 SDA (2001): the SDD Plan for agricultural territories. Consequently, there exists a great need in revising and reconstructing the legislation on the agricultural land use planning on farm level on the base of a scientifically grounded concept. It is obvious that the regulated in Ar. 111 SDD Plan doesn't fit to the purposes and role of a land-use plan (LU Plan) for the agricultural territories. There are no developed normative instruments for the SDD Plans for agricultural territories neither in the SDA (2001) nor in any other normative document in force. The SDD Plan for the agricultural territory is totally different in purpose, technological criteria and procedure of creation and implementation from the DD Plan as stated in SDA (2001). Actually it is not a plan for construction but for land use. The time duration of its implementation is dynamic and depends on natural and frequent finance, social and production factors. So instead of the term SDD Plan that is empty of content in regards of the agricultural territory, most appropriate is the term Land Use (LU Plan). The LU Plan for the agricultural territory cannot be mandatory but only consultative due to the dynamism of the affecting factors. This is in contradiction with the status of the DD Plan which is mandatory for construction. If the agricultural development zones of the GD Plans are recommendatory, the LU Plan for agricultural territories shouldn't be subordinated to the GD Plan as the DD Plans are. Spatial development planning for owned or leased land on farm level is a matter of private initiative. It cannot be imposed by legal force.

What the land proprietors and users are today legally concerned with is: the right to freely choose the method of the permanent purpose of use (Art. ALOUA, 1991); requirements for land protection but without strict accountability for their implementation (ALPA, 1996); the clauses included in the Agreements for consolidated plots for the use of farmland (Art. 37c, ALOUA, 1991).

According to a previous investigation (Moteva, Spalevich, 2016), the farmers need consultative land use plans for structuring their land by method of permanent purpose of use and for the arrangement of the land plots within crop rotations, rotational grazing, rotational mowing, perennial plantations with activities for preservation and improvement of the quality of their land. It is important for them the design of the field road network, of antierosion forest belts, terraces, etc.

The only vital incentive for implementation of holistic agriculture with environmental protection at present is the European subsidies under the RDP 2014-2020 but not the official legislation.

Features of the concept for agricultural land-use planning on farm level

The role of the LU Plans, as treated in the concept, is for choosing appropriate land use pattern, according to certain indicators, mostly related to economic criteria and environmental norms. The general provisions for the LU Plans should be:

- LU Plan should be elaborated for the territory of: a farm or part of a farm land or of a group of agricultural holdings or part of their total territory
- The scope of a LU Plan should be related to the scope of activity of the agricultural holding for which the contracts for rent or cooperatives are being developed.
- Land-use planning will be carried out at the request of the landowners and the land-users.

The LU Plan should treat the agricultural land use as dependent on the natural factors: relief, soils; the anthropogenic interference; need of land reclamation and environment preservation; the technical, social and labor resources. They should generally provide for the following territorial elements:

1. Agricultural land for cultivation of arable crops and introduction of crop rotations, including annual cereals, industrial crops and annual and perennial fodder crops, vegetables, fallow land.
2. Agricultural land for perennial cultivation of vineyards, orchards, nurseries, etc.
3. Agricultural land for grazing livestock, i.e. pastures
4. Agricultural land for meadows.

5. Land with foreseeing for irrigation and/or drainage
6. Land included in irrigation and drainage systems and/or included in approved projects or projects in process of validation for construction of irrigation/drainage systems
7. Land, requiring special activities for soil fertility restoration: meliorations, prevention of floods and foreseeable disasters, forest-ameliorative and hydro-technical measures for protection of the soil cover from water and wind erosion, agro-ameliorative activities
8. Uncultivated agricultural land, i.e. unused land with developed shrub and forest vegetation (including those protected under the Art. 2, para.1 FA, 2011) ravages, gullies, slopes, stabilized field roads, etc.
9. Territory, suitable for land consolidation
10. Territory for mixed agricultural use and recreation (under §4 of the AR of the ALOUA, 1991)
11. Territory for permaculture farming (including alternative and organic farming)
12. Main and secondary field road network
13. Animal pathways network
14. A crop rotation field
15. A grazing section in rotational grazing
16. Terrain for animal summer camp and water supply in a pasture
17. A field for sequential mowing in a meadow.

Depending on the objectives of the LU Plan, it should be developed on the basis of: cadastral map, soil map, soil valuation map, scheme of the land exposures, scheme of the slopes, ownership map, scheme of the irrigation systems, scheme of the amelioration activities envisaged for restoration of soil fertility and others kinds of thematic graphical materials. The LU Plan should be subordinated to the foreseeing of the strategic planning documents: NSRD, Regional Development Plan, District Development Strategy and Municipal Development Plan (Art. 9 RDA, 2008).

The LU Plan regulation could be supplemented to Ordinance 8 to the SDA (2001) in a separate chapter on “Land-Use Plans for the Agricultural territories”. Since this change affects the legal framework related to the agricultural territory and its legal provisions, another suitable option is to regulate the scope, the content and the technical implementation of the LU Plan by a separate Ordinance to SDA (2001).

CONCLUSIONS

On the base of through analysis of Bulgarian spatial planning legal framework, was established that there are no comprehensive regulations for spatial development of the agricultural territory. This is considered risky in terms of: deterioration of land quality under anthropogenic pressure, loss of agricultural land under urban sprawl, irrational use of the agricultural machinery, deterioration of the environment, arising conflicts between the different types of territories, potential loss of income. A contemporary concept for spatial development of the agricultural territory and for its conversion through the spatial planning instruments regulated by the Spatial Development Act (2001): the General and the Specialized Detailed Development Plans is proposed. It designates two scales of development plans for the agricultural territory:

1) A specialized scheme/concept for the agricultural territory within the scope of the relevant small scale GD Plan is proposed. Planning should have general provisions and should account for the peculiarity of the territorial and natural resources. Unlike the basic plan, the scheme should be recommendatory. Development zones in compliance with the Cadaster and Property Register Act (2000) methods of permanent purpose of use will be designated. Also, territories in need of reclamation will be defined. In certain conditions, suburban agricultural area and area with agricultural activities within the urbanized territory of the cities-centers of 1st and 2nd hierarchical level can be recommended.

2) A consultation Land-Use Plan on farm level (instead of the regulated in Art. 111 SDA, 2001, Specialized Detailed Development Plan for the agricultural territory) in a large scale is proposed too. It will be oriented to economically and environmentally development planning. It will be subordinated to the specialized scheme/concept in the GD Plan. Some common territorial elements are designated.

Allying these two newly suggested documents will require amendment in the existing legal framework: Chapter Six of SDA (2001), dealing with the development plans and Ordinance 8 to SDA (2001), dealing with the scope and content of the development plans.

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DEVELOPMENT OF URBAN (CITY) TOURISM IN KOSOVO

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ABSTRACT

In order to fully understand these concepts we will first define tourism and then urban tourism. Therefore tourism can be defined as an activity by which a person can realize and improve his characteristics, i.e. the characteristics of their humanity in any respect, and in addition it is also viewed as a set of relationships and occurrences arising from the stay of visitors in various tourist destinations which do not concern their stay and that they stay there for recreation and pleasure, rather than earning a profit.

Urban tourism includes all forms of tourism and services that take place in urban areas that influence the conduct of various cultural events, manifestations, sports - recreational elements etc. Urban tourism is an increasingly important area of economic activity and, as such, should have a more proportionate level of development. In order for tourists to be satisfied with a tourist destination, we have to satisfy their needs and provide them with the best conditions in order to feel like at home. In addition to this, it is also important to mention the cultural tourism as very important in presentation cultural events in Kosovo which has a favorable climate and multiple natural, cultural and historical resources that represents the basis of its tourist resources.

Key words: Tourism, urban tourism, cultural tourism, manifestations, Kosovo, cultural and historical heritage.

INTRODUCTION

When we talk about tourism, we can say that it represents a branch of an industry that is constantly on rise because its trends are constantly changing.

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Cities have always attracted tourists with their cultural content that they offer in order to contribute to the creation of new forms of tourism, both cultural and educational. In addition to these species, there are also eco-tourism, rural tourism, spa and many other types. City tourism has become a contemporary trend in the world when it comes to tourism, because an increasing number of visitors or so-called tourists are interested in spending their vacation in them. As we know, there are many definitions of urban tourism, but the one that is most applicable is that it refers to vacations related to visits to larger or smaller cities, where these visits can relate to different needs such as sightseeing, shopping etc. We can say that Kosovo is characterized mainly by mountainous terrain, with favorable climate and multiple natural, cultural and historical wealth. Urban tourism has a good character of the tourist offer thanks to numerous sports and cultural facilities. During the two seasons, various events are held which are of great importance for all visitors to Peja city. Urban tourism has a multifunctional context in which it is possible to achieve many different types of tourism in order to meet the needs of each individual.

1. DEVELOPMENT OF URBAN TOURISM IN KOSOVO

Urban tourism also includes trips related to visits to large or smaller cities, which may for various reasons include sightseeing, shopping, visits to relatives or friends, business reasons, culture, entertainment and similar. They include a high level of concentrated services and various facilities, a large number of events, sports events, education, etc. Tourism has been and remains an important area for Kosovo society and the economic development of the private sector and the economy in general. Kosovo offers good opportunities for winter tourism and hiking, recreational sports, and also cultural tourism based on our historical and cultural heritage. Kosovo has excellent potential of mountain tourism, national parks, culture as well as the potential of sports hunting. Among the listed resources, we have noticed that the hotels were concentrated in areas that have nothing to offer in terms of tourism, urban centers and the most important roads. Kosovo has significant potential for the development of mountain tourism on the mountain of Prokletija and Shar Mountain. There were various dilemmas about what culture is and what is its connection to tourism.

Williams defines three broad categories of modern use of term "culture":

1. As a general process of intellectual, spiritual and aesthetic development;
2. As an indicator of a certain "way of life"; and
3. As work and practice within the intellectual and artistic activities.

Although under the burden of war, and the existence of war-based image abroad, the city of Peja has great natural, historical and cultural potential to become a tourist destination that promises especially in the regional context of the Balkans.
A special touristic motive with visible aesthetic features is the cave in the village of Radavac, and the waterfall of the spring of Beli Drim, which is located in the village of Radavac, about 11 km from the center of Peja, in the direction towards Rozaje, in the northeastern mountain of Prokletija.
It is undoubtedly one of the largest cave in the region, and despite not being sufficiently explored, it was declared a natural monoment along with the source of Beli Drim.
Every city is significant and stands out for something, thus in the following text we will describe the tourism of the city of Peja, as well as some manifestations that take place there as well as the cultural and historical heritage which is of huge significance to this city.

2. URBAN TOURISM OF PEJA CITY

City of Peja is located in the Dukagjini Plain in the west of Kosovo Province between 40 ° and 42 ° north longitude, at an altitude of 498 m.
Peja is spreading near the place where the rivers Beli Drim and Bistrica connects, with length of 63km and a surface of 514km^2, while the quantity of water is above 300m^3.
Peja is a city located in the western side of Kosovo. Its Territory is covered with forests that are rich in coniferous green trees that hide unprecedented fortunes for hunters and collectors of medicinal herbs.
Also, it is rich with places that enable the development of tourism and hunting. Rugova Mountain (Boge) is one of the most popular tourist destinations. The Municipality of Peja is oriented to tourist and recreational center in Peja; to explore the caves; to promote tourism; to explore the caves of Rugova canyon near the village of Radavac.
Peja has always been distinguished by its rich diversity of architectures. Many items were produced, starting with food and clothing items to items of high artistic value. In that time the best masters, blacksmiths, tailors and many others worked there. The city was famous for the production of safran which was used both as spice and as colour for textile. The climate on the mountains in winter is long and cold, but in summer it is very warm where tourists can enjoy clean air and colorfulness of beautiful landscape.
In addition to all this, it is important to note that urban tourism affects cities and their attractions, and that many tour operators in their catalogs include urban toursim as a program of the entire arrangement or as a secondary motive within the summer arrangement.

Therefore, as it can be seen on a given figure 1, many attractions and investments are included in order to influence the entertainment and recreation in order to meet the needs and tourists wishes.

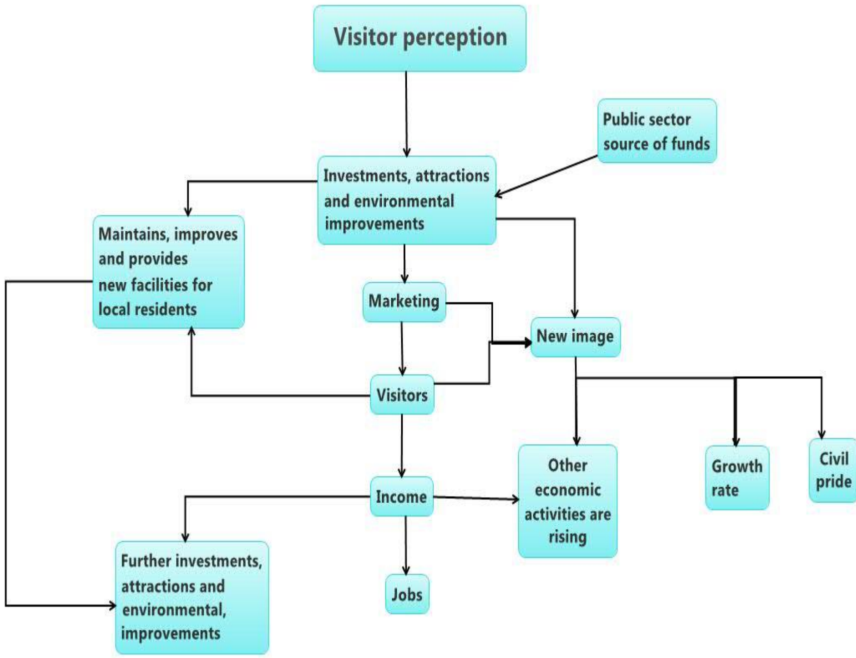

Figure 1. *Urban tourism strategy* **-** *Law, C.M; Urban Tourism, the Visitor Economy and the Growth of the Large Cities Continuum, London, New York, 2002, str.50.*

2.1. MANIFESTATIONS OF PEJA CITY

Figure. 2. *Manifestations in Peja*

Manifestations are very significant for any city, also for Peja, because by doing so, their maintenance contributes to better promotion of the city. One of those that is significant is Anibar.

Anibar manifestation is held every year. This organization was founded in 2010 by young people who through their skills want to express their creativity in order to attract as many young people as possible to join their organization in order to work together and achieve better success and thus contribute to something that will be of great use for further advancement.

This event is currently the only animation festival in Kosovo.

Rugova traditional games are among the most visited cultural manifestations in Peja**.** These games represent a hereditary value year after year. Their main activity in this program is wrestling accompanied by other sports, traditional food and drinks.

International Literary Encounter - Azem Shkreli is still the most famous representative of Kosovo Albanians who were born in the literary period of the 1960s. At the International Literary Meeting "Azem Shkreli", which is organized every year in honor of this writer, many writers and linguists participate. The goal of organizing this cultural event coincides with raising awareness of cultural and literary values. Based on the events held, the following table shows us how many visitors were in the period 2008-2017. years.

Table 1. *Number of visitors (domestic and foreign) and nights, 2008- 2017 in the regions of Kosovo (statistikat-e-hotelerisë-tm4-2017.pdf)*

Period	Number of visitors		Number of nights	
	Domestic	Foreign	Domestic	Foreign
2008	19.678	24.616	22.602	46.910
2009	52.631	36.318	54.876	76.042
2010	44.662	34.382	45.123	76.394
2011	42.044	30.349	44.757	65.584
2012	49.973	48.790	52.008	90.968
2013	45.380	50.074	54.867	83.883
2014	46.477	61.313	55.274	102.066
2015	60.200	79.238	81.372	120.669
2016	45.579	83.710	62.211	131.785
2017	34.569	86.032	48.111	144.736

This table shows us the number of visitors - domestic and foreign, as well as the overnight stays of domestic and foreign visitors during the period 2008-2017 in the regions of Kosovo, which includes (Gjakova, Gjilan, Mitrovica, Peja, Prizren, Prishtina, Ferizaj). In 2017, the number of domestic visitors decreased by 24.16% compared to 2016, while the number of overnight of the domestic visitors were also reduced by 22.66%. However, when it comes to foreign visitors, the situation is different. Statistical data show that both visits of foreign visitors and overnight stays were increased by 2.77% and 9.83% compared to 2016.

3. CULTURAL AND HISTORICAL HERITAGE

Figure 3. *Bajrakli Mosque*

Bayrakli Mosque is located in the town of Peja, Kosovo. Because of its importance, it is on the list of cultural monuments of exceptional importance. The main location of this mosque is in the old town so called Charshia. It is believed that the mosque was built in the second half of the 15th century and belongs to the type of one-storey cubic building with a dome and minaret. The interior decoration of the mosque is modest. The walls are unaltered with shallow profilings, rarely stylized floral and geometric motifs, and caligraphic inscriptions from verses from the Muslim Holy Book of Qur'an.

Figure 4. *Hamam Mosque*

Hamam Mosque was built in 1587. It is located in the old part of the town (settlement) "Haxhi Zeka" near the hamas of Haxhi Beg and the building of the first Albanian school in Peja. The mosque is one of the oldest historical monuments of cultural heritage, not just in Peja, but in whole Kosovo.

Figure 5. *Patriarchy of Peja*

The Monastery Complex of the Peja Patriarchate consists of four churches built between the 13th and 14th centuries. For centuries, this monastery was the center of the Serbian Orthodox Church. By the 17th century, the monastery was an advanced monastic seat with hundreds of learned monks. It is located in the beautiful Rugova Canyon by the river Bistrica. It seems that in the place where the Patriarchate is now, in the cast of St. Sava was founded a meta of the monastery of Zice, in that time seat of the Serbian Archbishopric. Archbishop Arsenia I raised the church of the Holy Apostles in the town of Peja, seeking to keep the center of the Serbian church in a less endangered place and closer to the center of the country. Today the Peja Patriarchate Monastery is an important spiritual center with 25 nurses. Sisterhood deals with humanitarian work and maintains monastic economy. It is also worth mentioning that the Patriarchate of Peja is protected all the time.

Figure 6. *Monastery Visoki Decani*

The Visoki Decani Monastery is one perfection surrounded by forest silence. It was built in the 14th century with its seat on the western part of the river Bistrica. This monastery is one of the most beautiful that can ever be seen. What this monastery adorns are the frescoes and icons contained therein. In the main monastery church of the Visoki Decani monastery you can see over a thousand different compositions featuring various characters.

***Figure 7.** Peja Spa (Peja Banja)*

Peja Spa (Pecka Banja) is located in the municipality of Istok. The rivers Bijeli Drim and Bistrica are in the vicinity.
During the construction of this hotel, two tombs were found:

- A male tomb – in it were found weapons, silver and bronze soaps (decorative metal buckles for women's belt) and a ring.
- Female tomb - rich in inventory such as fibula, omega-shaped needle, ring and bracelet with geometric motifs, all forged silver and bronze.

4. TOURISM SUPPLY

Tourism supply is defined as the amount of goods and services offered on a particular market at a certain price. As we know Kosovo has a lot to offer, we just need to know how to represent our products to the interested party. A consumer meets his needs only if at given moment he buys a product he likes. At the same time, as a region, we need to provide visitors with various attractions that when they come to us they feel comfortable and enjoy those days of vacations. All participants should contribute to the offer, which will contribute to the expansion and diversification of the tourist offer, thus enabling the increase in tourist spending, which will increase the temporary residence of domestic and foreign tourists. The factors are different but the three most commonly used are:

- Attractive factors affect the satisfaction of human needs that affect recreation, entertainment and leisure.,
- Communication factors include an infrastructure that is more or less developed encompassing the roads, and traffic branches that affect the area that encompass tourism movements,
- Reception factors include all those organizational forms that provide accommodation, food, entertainment as well as recreation of tourists.

5. TOURIST DEMAND

Tourist demand is the quantity of goods or services that is placed on a market at a certain time and at a certain price. The most common tourist demand for tourist statistics is defined according to Cooper as the total number of persons participating in tourism movements or who want to get involved in these developments in order to be able to use different tourist services outside their place of residence or the environment in which they live and work. Demand can be ideal, potential, realistic and effective. Tourist demand in recent years has become increasingly demanding, and the offer has been continuously working on the creation of new programs and new forms of tourism. It happens that many sellers do not sell their products for a number of reasons. Some of these reasons are for instance that they have not offered an adequate product, or they have a high price, and therefore the buyer can change their decision and do not want to buy such products. Therefore, the offer must be directed and adjusted to the demand, that is, it must have sufficient financial resources, educated people around, a favorable environment and therefore it will function in a better and more efficient way.

CONCLUSIONS

Based on the above information about urban tourism, we realize that everything is based on the travel of tourists and their visiting of various cultural attractions that one city possesses. Tourism which is based on beautiful landscape and culture also exists and has development potential, but is limited by not attaching to the quality and state of environment. Cities with rivers, lakes and mountains draw the attention of tourists oriented to entertainment and enjoyment, this includes recreational and entertaining contents. So all of this shows that urban tourism has a distinctly cultural character regardless of the motives that an individual has made on the journey. The development of tourism must go step by step with the development of local resources, and in this way, in first case, it should concentrate on not so extensive but highly profitable initiatives, especially when it comes to the number of foreign visitors and overnight stays instead of recreational one-day trips. We also mentioned the cultural heritage of the Peja city, which is very important and which visitors like to visit.

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ISSUES OF CADASTRAL MAPS UPDATING AND ACCURACY FOR ESTABLISHING GIS DATABASES OF DETAILED URBAN PLANS

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SUMMARY

Cadastral map, when the Real Estate Cadastre is being produced, initially contains the boundaries of cadastral parcels, buildings, and cultures. After the formation of the Real Estate Cadastre, under the procedure cadastral maintenance, all changes on real estate which are taking place on the ground are being registered; however, the registration is not done ex officio by the administrative authorities. Practice has shown that property rights holders fail to report a vast number of changes that occurred in relation to the registered status in the cadastre to the administrative authority in a timely manner. A particular problem are the differences between areas in graphical and textual GIS database, and all of the issues above represent a major issue in the case of adoption of cadastral maps as conditionally accurate for the creation and implementation of detailed urban plans. The issue persists in operative cadastre over the entire territory of Montenegro, with its emergence and solution being analyzed in detail on the example of the Municipality of Bar.

Key words: Cadastral Map, Detailed Urban Plan, Immovable Property, GIS, database, DCM Bar.

1 INTRODUCTION

The functioning cadastre is a complete record of public and private rights and limitations pertaining to land users and owners, based on the state survey (Kaufmann and Steudler, 1998). It is being implemented through the

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geodetic-cadastral information system with the database holding coordinated land registration and cadastral mapping.

There is a multi-annual trend in Europe to produce studies on spatial data status. Ever since 2001, status is being evaluated and research results are being subsequently published, in the format of European Commission annual reports, which serve as the foundation for decision making on future plans and projects (Aleksić et al., 2014).

The territory of Montenegro, with the area of 1,382,623 ha, is divided into 23 and 796 cadastral municipalities; with approximately 1,300,000 cadastral parcels, according to the cadastral records. The main issue notable in practice is the quality of existing records as a foundation for the new survey. The majority of cadastral municipalities to be surveyed had been covered by the census cadastre, predominantly used for fiscal purposes – cadastral revenue calculation only. Usability and quality of a property register established in such a manner is limited in several manners.

The Directorate for Real Estate (formerly the Direction for Real Estate) had performed several measurement campaigns of WGS coordinates on more than 1300 trigonometric points and polygonal points in towns, from 1997 to 2011 (Real Estate Directorate , 2010). The measurements were performed using static and RTK method. It was estimated that horizontal position accuracy for points measured by the means of static method is approximately 1 cm, and for the network RTK, the accuracy of positioning is better than 2 cm. Data obtained and subsequently processed and implemented in the MontePos system had provided for completing one of the greatest projects in Montenegro in the field of geodesy – the Unique Horizontal Transformation Model. By developing a unique horizontal transformation model, the Real Estate Cadastre data maintenance had became unified, at least regarding the GNSS technology application. The Directorate for Real Estate had published the project results for the official use in 2012, indicating it as mandatory for all GPS measurements over the territory of Montenegro. This provides for a uniform measurement results quality firstly, i.e. independence from contractor, thus reducing and making the scope of works easier for the local units of the Directorate for Real Estate – both in issuing geodetic base data (being significantly destroyed on the ground) and control of geodetic survey documents.

However, this did not solve the poor heritage of cadastral data. Coordinates of trigonometric points used are not independent from each other. The degree of correlation between neighboring points' horizontal position varies depending on the distance between them, as the result of identical measurement procedures and processing methods used for estimating points' coordinates at the time. In general, stochastic links between the points are stronger for the points in close vicinity, decreasing with the greater distance

between the points. Under the further procedure of quality control, the estimate was done for the Helmert similarity transformation parameters, based on the coordinates of all common points. Having that the least squares method was used, resulting corrections were also obtained. Corrections are the measures of congruence between the new and the existing reference system, serving as the test for existence of blunders, i.e. non-congruent coordinates of common points. Corrections per coordinate axis of the existing reference system were used for this purpose.
By excluding these points from the set of common points, conclusions could have been made regarding the territories where they had occurred. Usually, such points were grouped, indicating that they were locally congruent in general, however poorly fitting the trigonometric network of Montenegro. Measurements on the polygonal points in the towns of Montenegro were also performed for the purpose of parameters determination.
It was characteristic that a significant non-congruence of individual polygonal points was determined in the town of Bar. Understanding etiology and exploratory character of this issue requires laying out theoretical and practical foundation of town trigonometric networks.
The major challenges we are facing today have a critical geographic dimension – especially regarding the natural disasters, climate changes, or urbanization process. Catastrophic earthquake on April 15, 1979 and its consequences on the Montenegrin seaside area, the Municipality of Bar in particular, had imposed the need to use data with greater and more homogenous accuracy in the survey. A local trigonometric network, used for the town survey purpose, commonly named the town trigonometric network, is serving that. It is a part of state trigonometric network, with the link being established by calculating points coordinates in the coordinate system of the state where the city, or most of it, is being situated. The town trigonometric network fundamentally relies on the state trigonometric network and 1st and 2nd order state network, having the shape of triangles with sides length of 1 – 4 km. Part of polygonal lines in Bar is based on the state trigonometric network, and the remaining ones are based on the local network. Data acquisition shows that no official and detailed study on differences in datum of these networks was ever performed. Consequence of their non-congruence are mostly visible in the cadastral maintenance issues. The annual plans of the Directorate for Real Estate of Montenegro recognize the importance of designing resurvey and determination of new polygonal network coordinates in Bar. However, that is yet to be achieved, and the cadastral maintenance will remain difficult and encumbered by many problems directly emerging from the poor data. The problems multiply when using the cadastral maps for developing detail urban plans. The text below provides practical examples depicting possible consequences of taking

parcel data from the local units of the Directorate for Real Estate as conditionally accurate and relevant bases for spatial planning. Although this problem exists all over the territory of Montenegro, the above issues of geodetic networks uniformity in Bar had indicated choice of the examples from the territory of that Municipality. Practical and original solutions are offered, with a prominent explorative character, founded upon the previous results and/or experiences achieved over the territory of ex-YU.

2 PROCEDURE OF CADASTRAL MAPS PRODUCTION AND USE OF THE EXISTING GIS DATABASES

Geographic (geospatial) information is the foundation for local, regional, and global decision-making. The Real Estate Cadastre establishing procedure by the means of the aerial photogrammetric method consists of several phases. The administration organ or contractor delimiters cadastral municipalities, mostly using data from the census cadastre block sketches, produced in 1:10000 scale to identify positions of boundary points defined under the census cadastre production.

Cadastral municipality is a territorial unit that covers a territory of one settlement as a rule, with the law establishing its name, being the fundamental unit for survey performance and production of the Real Estate Cadastre. The administration organ, setting geodetic benchmarks and entering the boundary description in the minutes of boundary demarcation, demarcates cadastral municipality boundary (Law on the state survey and cadastre, 2007).

Before the commencement of acquisition, all owners or property rights holders are obligated to demarcate boundaries of the parcels they use at their own cost, using the visible marks with dimensions prescribed.

Aerial photogrammetric images are the perspective presentation of terrain, meaning that only the point at the center of the image is shown without any deformations. As the distance from the image center grows, deformations increase. Deformations are also a consequence of the acquisition axis slope and the fact that the terrain points are not situated at the same plane, thus the points with the same positions and different heights are projected on the image at different position. Due to that, images are being rendered and ortho-rectified, to remove deformations being a consequence of central projection and acquisition axis slope.

All phases of cadastral maps production are prone to influence of various sources of errors, thus when measuring a value, its “true” value can never be obtained. Measurement errors occur due to the imperfections of measurement equipment, procedures and methods, meteorological conditions, knowledge of operators, globally categorized as blunders, systematic errors and accidental errors. Blunders mostly occur due to the operator's carelessness or the selection of wrong measuring equipment and may be remedied by the appropriate and correct equipment use in the optimal method, with some of them being removed by statistical tests. Systematic errors are usually the result of imperfections of measuring instruments, methods and external influences, and can be removed or reduced to the acceptable degree by the equipment calibration and selection of the appropriate methods, with the remaining ones being removed by the means of statistical models, being constant or varying in line with a certain rule. Accidental errors result from a great number of factor, differing in value and sign and cannot be mathematically related to the measurement results, thus cannot be eliminated as such. Due to the different errors occurring in all phases of cadastral maps production, presentation of immovable properties on the cadastral maps is not completely true to the immovable properties on the ground.

After completing the aerial photogrammetric acquisition, topographic details recognition on the ground is being performed by zooming in on the aerial photogrammetric image and splitting it into photo-sketches serving as the base for details recognition. Common dimensions of photo-sketches are 40 cm x 40 cm, and the officer identifying details on the ground as acquired and visible at the photo-sketch, so the topographic details may be identified unambiguously providing for acquisition of additional data on immovable properties (e.g. measuring fronts of constructions, designation of fence type). Recognition determines spatial features and inputs them on the photo-sketch to be subsequently shown in the cadastral map. Stereo-plotting procedure provides coordinates of spatial points and production of cadastral maps.

Cadastral parcels areas had been determined in the various manners: from the original measurements, from the measurements graphically taken from the cadastral maps, from cadastral parcel detail points read from the cadastral map or using the planimeter – a device for mechanical calculating of areas. In practice, we are facing numerous examples where difference between parcel area, recorded in property folio, and parcel area, as obtained using the detailed points' coordinates from the cadastral map exceeds the permitted value obtained from the formula (Rulebook on content and method for state survey of immovable properties, draft version, 2015):

$$\Delta = 0.0007 * \sqrt{P} * M \qquad (1)$$

where M is map scale denominator and P is parcel area.

Example 1: *Difference between parcel area in property folio and in cadastral map*

Cadastral parcel No. 746/13 CM Dobre Vode, Municipality of Bar, has the area registered in the property folio of 500 m2, while the area obtained by calculating from detail points' coordinates from the cadastral map is 567 m2, exceeding the permitted difference of 38 m2 for cadastral map scale 1:2500.

Operative capacity and importance of the new IT technologies in geodetic-cadastral records of urban areas is the fact changing the method and dynamics of utilization. GIS with database is the "fuel" accelerating these changes, particularly in the dynamics of registering changes and method of the modern cadastre maintenance (Longley et al., 2005).

On the other hand, data manipulating flows in the cadastral records impose the need to distribute spatial information to the great number of users. User requirements refer to data viewing and searching in the map form, searching through the feature attribute list per certain criteria, layer presentation control and finally generating the appropriate reports and/or base maps.

Regarding the advanced users of these technologies, they mostly cover creating physical and logical data model for spatial information with the integration of available data, and creating the appropriate topology and data analysis. State and local level commonly use the advanced software systems for spatial data management under the ESRI technology (ArcExplorer, ArcMap, ArcCatalog, ArcPad), providing for data manipulation on the local computer or as the fully functional client requesting the GIS data use from the remote server over the internet. For fully functional client, most of the operations related to spatial data manipulation are being performed at the client's side, with server having the role to make the sharable information available. The ESRI ArcIMS serves distribution of maps, data, and metadata by the means of internet. The system is designed for simple creating of maps, development of web pages with interactive maps and WEB-GIS sites administration. The ArcIMS architecture covers presentation, business logic and data level.

Practical use of GIS in the cadastre, Open Source GIS solutions in particular, may increase the error threshold and disturb its standard defined balance. These systems contain numerous modules that the users often use wrongly or apply the models, for the purpose these are not developed, or combine them with data that are not completely consistent. Solution of the problem is for the users of cadastre and its spatial database to become increasingly aware of the spatial data quality issue; especially today when definition of errors and analysis of their propagation or interoperability becomes a routine for modules and tools at disposal of the GIS community.

Furthermore, there is the need to note that an immovable property, i.e. cadastral parcel is not being determined by its area numerically expressed in the property folio; since that area cannot be identified on the ground without the cadastral map, having that the position, shape and area of a parcel are determined by the boundaries at the cadastral map, shown in a certain scale. In the event when GIS databases contain different area in the property folio and in the cadastral map for a given parcel, the area from the cadastral parcel is the only identifiable and possible to be demarcated on the ground. The logical question follows – why not simply calculate accurate areas of all parcels and enter corrections in property folios, with validation through the GIS database. A legal issue arrises, since the areas registered in property folios were used in legal foundations used for registration of property rights. In the majority of such registration, pursuant the provision of the Real Estate Cadastre data reliability, their accuracy was not questioned. For instance, in the event of immovable property sale, the sale contract always contains the area from the property folio, since only such a contract is a credible document for property rights registration in the cadastral records. If areas calculated from the cadastral maps are to be registered in property folios, the owners would be registered with greater or smaller areas than the ones they had bought, inherited, or being granted by the decision of a governmental organ, etc.

3 ANALYSIS OF THEORETICALLY DEFINED VALUES OF PARCEL BOUNDARY POINTS POSITION DISCREPANCY AGAINST THE EMPIRICALLY OBTAINED RESULTS

Scale for the cadastral maps production (i.e. projected accuracy of parcel boundary points position accuracy) depends of the terrain grade. There are four terrain grades: grade A, grade B, grade V, and grade G; with the land being classified pursuant to the development degree, distance from towns, infrastructure, etc. Depending from the terrain grade, maps were produced in the appropriate scale, as shown in the table below (Rulebook on content and method for state survey of immovable properties, draft version, 2015).

Table 1: Map scales per terrain grades

Terrain grade	A	B	V	G
Map scale	1:500	1:1000	1:2000	1:2500
	1:1000	1:2000	1:2500	1:5000

For each map scale, the Rulebook on Content and Method for State Survey of Immovable Properties determines standards for positions of parcel boundary points and other detail points, as shown in the table below:

Table 2: Standards for boundary points positions depending on the map scale

Map scale	1:500	1:1000	1:2000	1:2500	1:5000
Standard for parcel boundary points position (m)	0.05	0.10	0.15	0.20	0.25
Standard for other detail points position (m)	0.08	0.15	0.20	0.25	0.30

Therefore, if there was a fence, wall or other topographic detail surveyed on the ground at the moment of aerial photogrammetric acquisition, recognized in photo-sketch and shown in the cadastral map by a line, and subsequently surveyed in the field using another method, the difference in position of parcel boundary point surveyed against boundary line position in the cadastral map should not exceed the values shown in the table above.

Apart from the errors in the procedure of the Real Estate Cadastre establishing and the cadastral maps production, erroneous positions of cadastral parcels boundaries are a consequence of not adhering to the regulations under the Real Estate Cadastre maintenance procedure, primarily when performing cadastral parcels subdivision based on measurement of fronts (Đurović, 2011).

Example 1: *Boundary position discrepancy in the field against its position in the map as the result of the errors in the procedure of the Real Estate Cadastre establishment and cadastral maps production*

Practical example refers to the boundary line between cadastral parcels No. 2142 and 2143/1, CM Polje. Boundary line between the two parcels was established from the aerial photogrammetric acquisition in 1987, used for production of cadastral maps, scale 1:1000. Parcel boundary points position standard for map scale 1:1,000 is 0.10 m, i.e. 10 cm. Based on the detail points acquisition over the existing concrete wall on the ground using polar method, coordinates of points in state coordinate system were calculated, unambiguously determining its position. After mapping the points on the cadastral map, it was determined that the existing wall on the ground has positional deviation of 0.43 m against the position of cadastral boundary between the percels No. 2142 and 2143/1, CM Polje.

In theory, this discrepancy may be due to land usurpation or error in the cadastral map production procedure. For the reason above, the photo-sketch (zoomed part of aerial photogrammetric map) was viewed, containing a clear designation that at the time of acquisition, the boundary line between the parcels No. 2142 and 2143/1 coincided with metal fence on concrete wall, with the auxiliary building being present in the southeast of the parcel No. 2143/1, still existing on the ground. This indicates that the wall was not moved since the time or aerial photogrammetric acquisition, thus the boundary line discrepancy between the ground and cadastral boundary is the consequence of the cadastral map production procedure, meaning that the boundary point position discrepancy is 0.43 m instead of 0.10 m permitted.

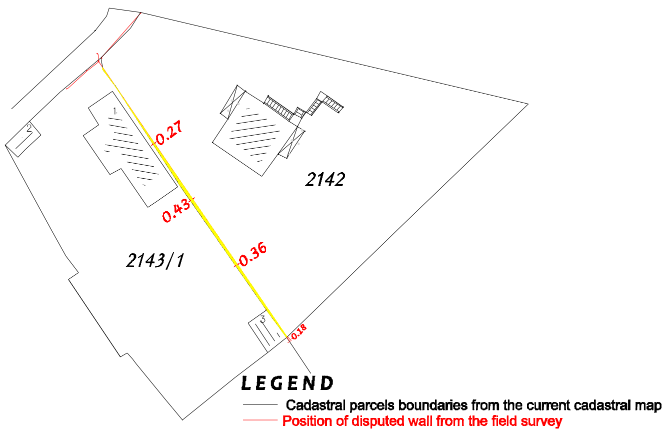

Figure 1: Presentation of cadastral parcels No. 2143/1 and 2142 CM Polje, Municipality of Bar

Example 2: *Discrepancy of boundary position on the ground against its position on the map resulting from errors (lack of officer's skills) in parcel subdivision under the Real Estate Cadastre maintenance procedure*

The Real Estate Cadastre maintenance involves registration of changes that had occurred after the Real Estate Cadastre establishing, by performing detailed survey by the means of polar, orthogonal or lately GPS method on the spot, producing survey sketch, and use it to map changes in the cadastral map working original and register accordingly in the cadastral records – property folio, after passing a resolution on enforceability.

A certain number of survey sketches serving as the base for cadastral parcel subdivision do not contain detail points coordinates for newly formed cadastral parcel – lengths of parcel fronts are shown only, depicting parcel geometry, without determining its position in the state coordinate system. This does not provide for precise and unambiguous immovable property position determination, having that the survey was done using the tape (which provides for measuring slanted area only, not horizontal area (reduced to a plane)). Commonly, due to the lack of knowledge or effort, altitude differences were also not measured, thus the slanted areas only remained.

At the location named “Zeleni pojas”, settlement of Susanj, Bar, cadastral parcels No. 832 and 825, CM Susanj, subdivided to establish several hundreds of parcels inside their boundaries, parcel subdivision was performed exclusively by measuring front lines of the parcels on the ground, although ground has significant slope. Predominantly for that reason, there were major (up to several meters) discrepancies between the boundary position on the ground and in the cadastral map.

Example 3: *Practical example of cadastral parcel boundaries deviation against their actual position on the ground (1)*

Detail points of cadastral parcel No. 832/125, CM Susanj were surveyed, and after being mapped on the cadastral map, the analysis of boundary position on the ground was analyzed against their position in the cadastral map. Figure 2 shows boundaries of the cadastral parcel No. 832/125, with red showing the position of boundaries from the current state acquisition on the ground, and black showing position of boundaries from the current cadastral map. Discrepancies at the characteristic were also shown, reaching 5.96 m, and the parcel was “shifted” towards northeast.

This provides for adjusting boundaries on the ground and cadastral map under the DUP parcels subdivision and resolving property rights relations. Had the processing officer established the urban parcel to match the owners – cadastral parcel, there would be no possibility to adjust boundaries, thus the owner of the cadastral parcel No. 832/125 would hold a part of neighboring parcel in his property at the southwest, while the part of property between the red and the black line at the northwest would be outside his property, although he is registered as the owner.

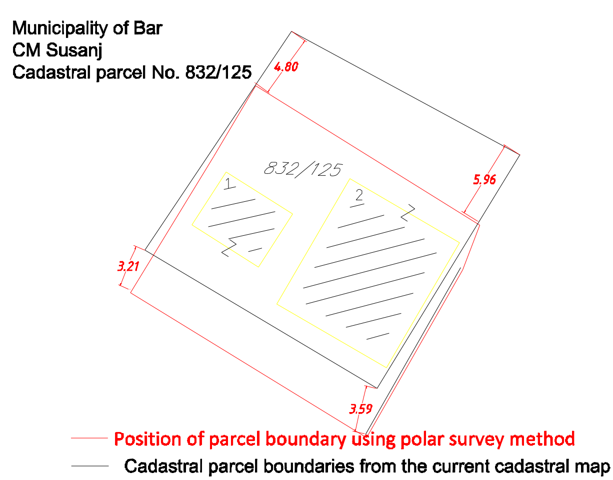

Figure 2: Boundaries of cadastral parcel No. 832/125 CM Susanj

Example 4: *Practical example of cadastral parcel boundaries deviation against their actual position on the ground (2)*
The same location provides an example where the position of road is fully wrongly shown in the cadastral map, so when its position is demarcated on the ground from the coordinates, its position “crosses” the existing buildings, with the road factually existing on the ground, however behind the building’s northeast side.
Figure 3 shows position of the cadastral parcel No. 825/171, CM Susanj, with blue line showing the factual position from polar method survey on the ground and black line showing position in the cadastral map. In the northeast of the parcel, there is a road, which, according to the data from the cadastral map, “crosses” the existing, surveyed buildings.
Pursuant to the positions of the existing immovable property boundary on the ground and the boundary positions of the cadastral parcel No. 825/171 in the cadastral map, conclusion emerges that the property owner holds in the field the yellow marked area under his property without being registered as the property rights holder; it is registered as the part of non-categorized road pursuant to the cadastral data instead (although the road is actually situated above), while the area in green is outside the fenced property of the immovable property owner, although he is registered as property rights holder for that part of parcel.

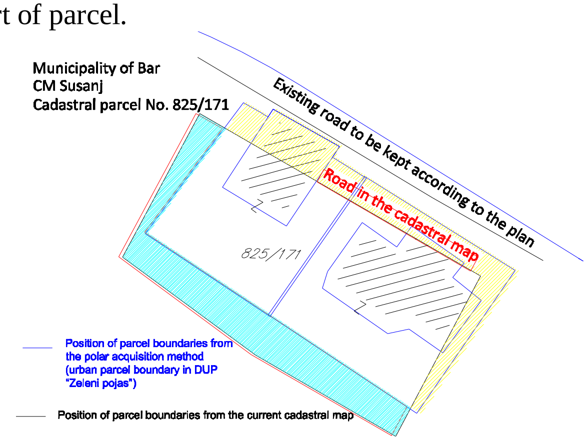

Figure 3: Boundaries of cadastral parcel No. 825/171 CM Susanj

Accepting cadastral boundaries as conditionally accurate and planning the road at the position of the road shown in the cadastral map would invoke the situation to trace the road over the existing buildings, and such buildings could not be registered in the cadastre. Having that these non-congruencies of immovable property boundaries are not a consequence of boundaries moving and usurpation on the ground, and are caused by erroneous mapping

in the cadastral map, great damages would be imposed to the property owners, caused by the fault of governmental organs, and not their own fault. For that reason, the need for accurate and precise determination of current situation is obvious prior to drafting the planning documents, to avoid the problems when implementing the plan.
The examples above indicate that the position of cadastral parcels boundaries shown in the cadastral map cannot be accepted as a priori accurate; instead, for the purposes of detailed urban plans production, there is a need to provide quality and updated geodetic base maps. However, due to the lack of financial means, practice usually opts for alternative solutions, meaning the use of existing cadastral and topographic maps, along with the data collected by authorized geodetic organizations in the Real Estate Cadastre maintenance procedure.

4 CONCLUSIONS

Practice daily imposes the problems caused by the low quality of data in the cadastral records. The lack of financial resources often imposes the necessity to use the existing cadastral and topographic maps as the only available data on immovable properties, topographic features and relief, used as the foundation for urban planners to plan space and draft proposals for establishing urban parcels, roads and other various purpose areas.
The major challenges we are facing today have a critical geographic dimension – especially regarding natural disasters, climate change, or uncontrolled urbanization process. Shortcomings of cadastral records and non-precision in the existing GIS databases, described in the paper as the causes of problems when drafting and implementing urban plans, may be divided into three categories: outdated cadastral data reflected by a vast number of changes that had occurred on the immovable properties on the ground and not being registered in the cadastral map and the cadastral records, inaccurate positions of cadastral parcel boundaries, topographic details and difference between the areas registered in the property folios against the areas obtained by calculating from the cadastral map. More precisely, there is the need to resolve the issue of data quality in the spatial cadastral database – not only in the data domain (thematic, spatial, and temporal), but more importantly – for the data quality components (origin, accuracy, resolution, completeness, consistency).
Operative capacity and importance of the new IT technologies in geodetic-cadastral records of urban areas is the fact changing the method and dynamics of utilization. GIS with database is the “fuel” accelerating these changes, particularly in the dynamics of registering changes and method of

the modern cadastre maintenance. The majority of parcels, out of some 1,300,000 in Montenegro, suffer the issue of non-congruence of data in graphical and textual database. This is the fact that complicates and imposes operative complexity of the relation: services – cadastral database – user. Due to the noted problem of non-uniform geodetic networks in Bar, the paper analyzes several examples and offers solutions for the territory of this Municipality.

Procedure of cadastral parcels subdivision pursuant to the planning project provides for resolution for the issue of cadastral parcel boundaries position discrepancies against the position of the fences existing on the ground, providing that the planning officer receives updated and quality cadastral – topographic maps prior to commencing parcel subdivision planning. Otherwise, if cadastral positions of immovable properties boundaries and topographic features are to be accepted, the possibility to coordinate the existing situation in the field and the status in the cadastral records is being eliminated.

The issue of non-congruence between the parcel areas registered in the property folio and the areas obtained by calculating from parcel detail points coordinates from the cadastral map must be solved initially in the cadastre, since it cannot be resolved in the planning documents drafting phase. One of the methods is to perform adjustment of parcel areas in property folios to the parcel areas in the cadastral map by correcting the areas in the property folios, in line with the areas calculated from the map. Justification of such an approach is in the fact that the numerical area shown in the property folio is an abstract data, having no significance on its own unless it is congruent with the area on the cadastral map, being identifiable as such on the ground.

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MAPPING THE WORLD AND MAP CREATOR FUNCTIONS FOR COLLECTION, INTEGRATION AND DATA VISUALIZATION

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ABSTRACT

Information technologies are changing the world we live. Nowadays modern people have access to web-based maps for the entire World. By one click we can visit the farthest location or whichever place we are interested in. There are several web sites, visited every day by millions of people for searching, routing or even adding data. But how it is made a global map? There are two main components – initial data and a tool for integration and visualization. When we are talking about detailed (navigable) Global Map, it is easy to imagine the resources needed to be build, and what about to be maintained and to be kept up to date! With regard of the tools, there are advanced GIS software available, even free ones. With that respect one of the components for mapping the World is available and we just need data - data for every continent, country, city, village, neighborhood, street, address, object. Does not sound that easy. Certainly not to the ability to many, but just few companies who map the World.

Key words: Information technologies, Global map, mapping tools, data visualization.

INTRODUCTION

Information Technology (IT) is a group of technologies designed to collect, process, store and distribute sound, graphic, textual and spatial information. They are based on a microelectronic combination of computer

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and telecommunication equipment.Information technology encompasses the practical application of informatics and in this respect share some common features with engineering disciplines.

The term "information technology" in its modern sense was first used in 1958 by Leavitt H. and T. Whisler in an article in the Harvard Business Review, where they noted that "the new technology still has no definite name. We will call it Information Technology (IT). " The processed information is most often in a discreet form. Information technologies are sometimes also called digital (digital). Due to the important role of communications in modern information processing tools, the wider concept of information and communication technologies is often used. At the heart of information technology is the information (data) - their main task is to automate and systematize their work with computing equipment (computers). Information is a concept related to the objective property of the objects and phenomena (processes) to generate a variety of states that can be transmitted to other objects through interactions and sealing in their structure. Although there is no commonly accepted specific definition, information is usually understood as available, usable knowledge. In the narrower technical sense, the information is arranged in a row of symbols (data).

The theoretical basis for information technologies is information science - a science that deals with the collection, transformation, transfer and storage of information by random, including automated means. It studies the information in terms of its structure, its quantitative characteristics, the forms and ways of its presentation, as well as the information processes as a composition of the main information activities and the methods and means for their automation. Informatics is closely related to mathematics, linguistics, computer and communications engineering, geography and other sciences.

MAP CREATOR BY HERE

Map Creator is a free, web-based and available on mobile mapping program for volunteer edits. Mobile version is in the stores for Android and iOS. It`s creation has been inspired with the aim for having accurate, detailed and fresh Global Map. within the context of the crowdsourcing, as a social network phenomenon. Crowdsourcing is closely related to the social networks like Facebook, Twitter, LinkedIn, where individuals share some personal or interesting to them information in the network. By using the fact people likes to “share”, crowdsourcing aims to obtain concrete knowledge in specific area. In the Geo science area, it is information from the ground for the surrounding physical reality or to be used the so called local knowledge in order of map maintenance.

Despite of the fact Map Creator is a free web-based program, data content is owned by HERE Technologies. HERE is a pioneer in the digital mapping of the world with more than 30 years experience and global reach. HERE Maps are used by millions worldwide through mobile apps, social networks and in 3 out of 4 cars equipped with a navigation system. Map Creator is only one of the tools and methods used in the overall mapping process by HERE. By using the power of crowdsourcing, idea is to be gained access to the real time changes across the globe and those changes looked like initial data to be implemented into the map. Can be added or updated roads, routes, places and house numbers, to bring accuracy and context to the digital world. By editing data in the program, there are combined two stages from the digital mapping process:

- Initial data collection (variety of options and tools available – PND and GPS devices, mobile phones, cameras etc.), which could be replaced by local knowledge, if it exists;
- Geocoding – each edit in the program is a digital mapping and ideally reflects physical reality.

To ensure the highest quality all community content is verified before integration. Process flow contain:

- Moderation – automated and human verification;
- Validation - automated and human validation;
- Integration;
- Baseline map delivery cycle;
- Usage in the derivative products, e.g. here.com, HERE WeGo mobile app.

MAP CREATOR STRUCTURE, MAIN FUNCTIONS AND SPECIFICS

HERE’s road network contains different kinds of road geometry that’s displayed by using various colors and icons. To render the correct display and routing information, it is important to accurately define their geometric representation, their traffic significance, and their attributes according to reality and/or local knowledge. The following chapter gives an overview about the structural elements of a road in Map Creator.

1 Road structure

1.1 Road segments

Road segments are the smallest sub-unit of a stretch of road. The geometric representation of a road segment is defined by its start and end points (nodes) and the shape and sub-shape points along the road segment (Fig1).

1.2 Nodes

Nodes are the start and end points of a road segment. If the road segment is connected to other segments, the node will be displayed as a diamond. If a road segment's node isn't connected to anything (e.g. a dead-end road), it will be displayed as a circle.

1.3 Shape points

Shape points are round and are used to define the shape of a road. They can also indicate the endpoint of a dead-end road.

1.4 Sub-shape points

Sub-shape points are small, dark circles along a road segment. Sub-shape points are important when creating a curved section of a road segment. If you move a sub-shape point to a new position, it turns into a shape point, and two new sub-shape points will be created on either side of the shape point. If needed, you can use the newly created sub-shape points to further define the shape of the road segment.

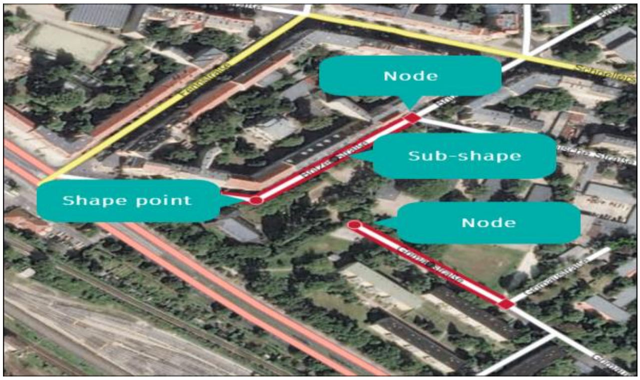

Fig.1: "Road structure"

2. Road attributes

Almost 50 road attributes can be used to describe various types of roads in Map Creator (e.g. speed limit, lanes, etc.). To simplify editing attributes on roads, there are several "Road types" (e.g. highway) which have a default set of attributes to prevent invalid combinations (e.g. pedestrians allowed on a highway). After drawing a new road or selecting an existing road, the "Road attributes" menu (Fig2) opens on the left and displays all editable road attributes. Click on each title to expand the section and see the attribute choices. Attribute information is critical for correct display and routing purposes and should be edited according to reality.

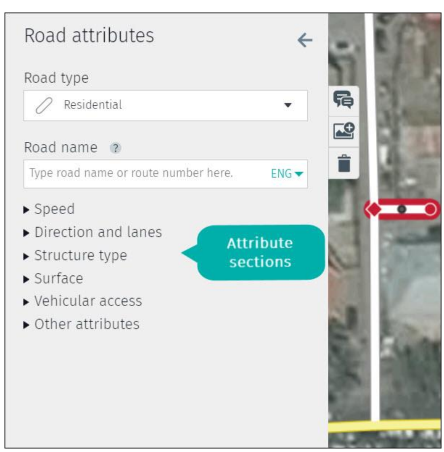

Fig.2: "Road attributes" menu with expandable attribute sections

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2 Road types

It is important to designate a road type (Fig.3) because it defines relevance and importance of a road segment when optimizing route calculations. In Map Creator, all road types have a default set of attributes adhering to HERE specifications. Highway, main, local access, residential, parking lot and 4WD roads are mainly vehicular roads, while pedestrian zone, pedestrian road and trails are primarily for pedestrians and restrict vehicles.

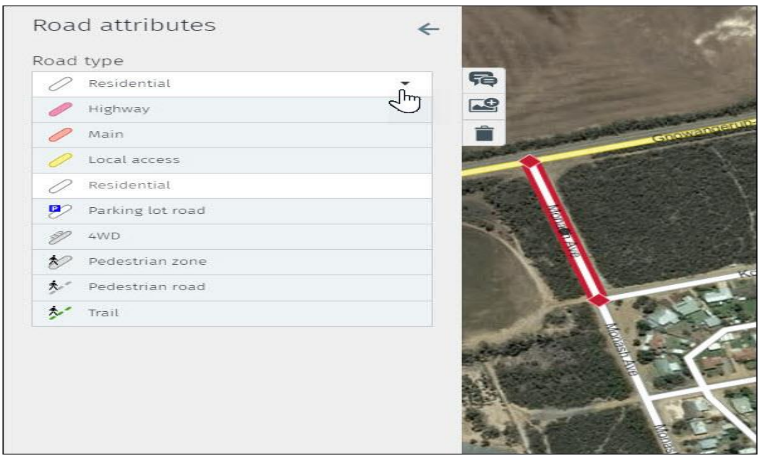

Fig.: 3"Road types" in Map Creator

2.1 Highway

"Highways" are the main connectors between different countries, cities, and metropolitan areas. The main characteristics are: limited access, motorized vehicles only, relatively high posted speed, and a median separating traffic traveling in opposite directions.

2.2 Main

"Main" roads are primary or arterial roads with a high traffic thoroughfare between cities, villages, and within urban areas. They typically provide a fast connection to adjacent highways.

2.3 Local access

"Local access" roads are secondary roads with a moderate traffic flow which provide a relatively fast connection to cities and villages. Within urban areas they connect residential areas with main roads.

2.4 Residential

“Residential” roads are roads within neighborhoods. These roads are low-traffic and normally used by locals rather than as a thoroughfare, but can also connect to local access and main roads.

2.5 Parking lot road

“Parking lot roads” lead to parking spaces in front of shopping malls, convention centers, amusement parks, etc.

2.6 4WD

“4WD” is used when the road quality is only suitable for vehicles with 4 wheel drive. The “4WD” road type is only available in a subset of countries where this type has a frequent appearance (e.g. North America, Africa and Oceania).

2.7 Pedestrian zone

“Pedestrian zone” is a pedestrian-friendly shopping street where vehicle access is limited to delivery vehicles and emergency/service vehicles.

2.8 Pedestrian road

“Pedestrian roads” are walkways which are wide enough to allow emergency/service vehicles to pass.

Fig.: “Pedestrian road” (e.g. Germany)

2.9 Trail

“Trails” are walkways, paths, tracks, or earth roads which are only accessible by pedestrian.

3 Road name and language code

Road names and route numbers should be entered according to the street sign in reality (Fig.4)

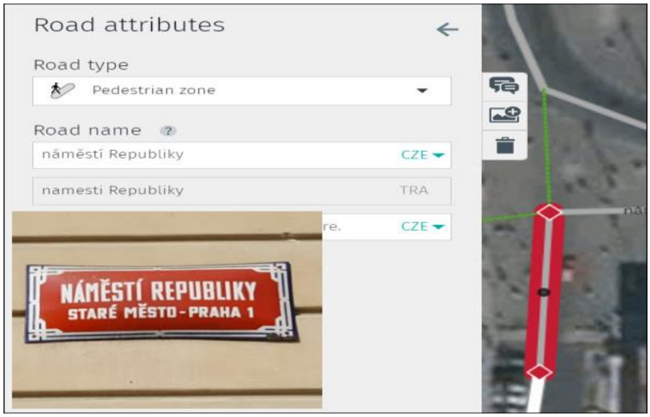

Fig.:4 Road name in reality and implemented in Map Creator (e.g. Czech Republic)

4 Speed

Speed information is essential for routing calculations and pre-warnings for speed monitoring. Speed information can be expressed in two ways:

- As a speed limit.
- As an average speed.

Both attributes should be added according to reality.

4.1 Speed limit

Speed limits are based on posted speed limit signs in reality. Currently in Map Creator, only general speed limits can be implemented, for example:

- Sign posted speed limits.
- Derived from reference signs according to country-specific driving regulations.

4.2 Average speed

The average speed classifies the overall speed trend along a road and is entered as a range (Fig.5). This differs from speed limits, which are entered based on posted speed limit signs. Therefore it is possible for the speed limit to fall outside of the average speed range.

Average speed ranges are predefined for each road type. You can change the average speed range by clicking on the arrow and choosing a new average speed range which best describes the speed trend of the road.

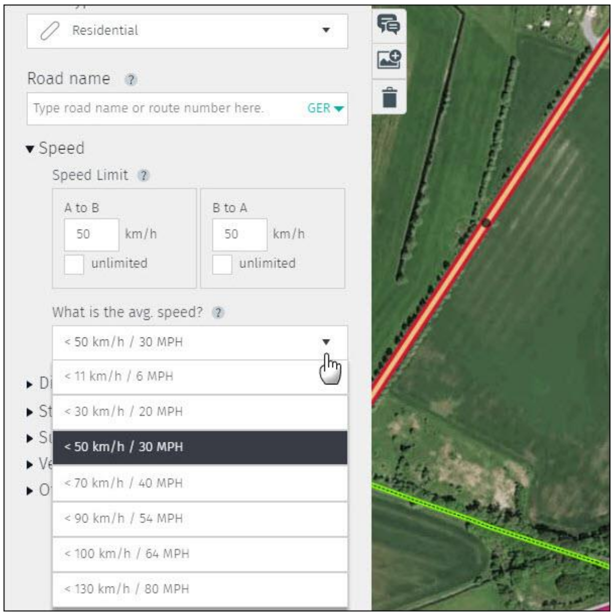

Fig.5: Changing the average speed

5 Direction and lanes

The direction and lane gives an overview of direction of travel (1-way/2-way) and number of lanes.

5.1 Direction of travel (1- or 2-way road)

The direction of travel attribute is one of the most important attributes for routing. Take great care when adding or changing direction of travel. Implement 1- or 2-way roads according to sign posted information (Fig.6)

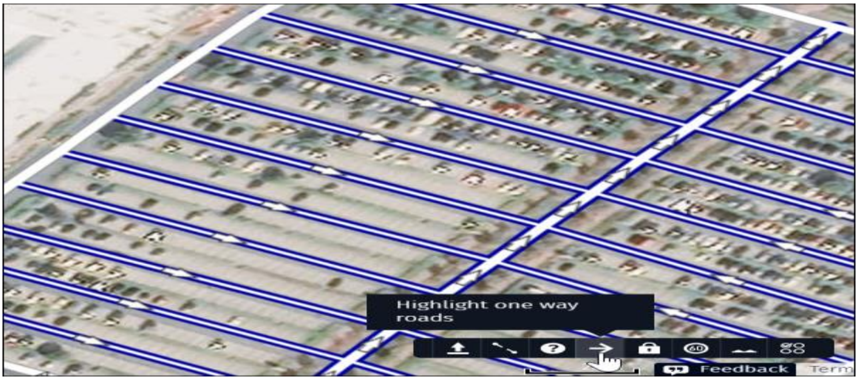

Fig.:6 One way display

5.2 Number of lanes

Number of lanes indicates the total number of traffic lanes in a single direction. The attribute provides the general lane trend.

6 Structure type

The structure type gives information about the physical works applied to a road segment. Map Creator differentiates three types:

- Open road
- Tunnel
- Bridge
-

7 Surface

7.1 Road is paved

A paved road consists of materials which create a solid surface (concrete, asphalt, brick, cobblestone, etc.). If the road is considered unpaved (gravel, dirt, grass, sand, etc.), uncheck the “Road is paved” box.

7.2 Poor surface quality

Check this box if most of the road has uneven or broken pavement.

Fig.: “Poor surface quality” (e.g. broken pavement)

7.3 Dirt

Check this box if the road is sandy and muddy most of the time.

7.4 Gravel

Check this box if the road is primarily gravel.

8 Vehicular access

Vehicular access defines vehicle types allowed on a road. This information is very important for routing purposes and should reflect reality. For all road types (except “Residential”), you can only see a subset of access types because Map Creator shows only logical combinations (e.g. a Highway cannot be “Local vehicular traffic only” so that access type is not visible on a Highway). The full set of access types can be seen in “Residential”. The following access types are visible in Map Creator:

8.1 No vehicular traffic allowed

The checkbox for “No vehicular traffic allowed” is unchecked by default. If you check the box, the road type will change to “Pedestrian road,” which defaults to allow “Emergency vehicles.” If this does not reflect reality (i.e. emergency vehicles are not allowed), change the road type to “Trail.”

8.2 Local vehicular traffic only

“Local vehicular traffic only” is unchecked by default. Check the box if through traffic is prohibited

PLACES AND PLACE STRUCTURE

Map Creator offers the ability to edit Points of Interest (POIs), also called Places. There are more than 350 Places categories and 90+ editable attributes. Places are point data associated to a road segment. The following chapter provides an overview about the structural elements of a place in Map Creator.

1 Place structure

The Place structure is composed of three elements that define the Place object. Those are the Place icon, the display point and the routing point.

1.1 Place icons

Places icons are displayed as round icons (Fig. 7) containing a symbol that corresponds to Place category. The icon should be positioned at the entrance of the building or the entrance of an open location (e.g. Park-Recreation) where the Place is visible in reality. For some Place

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categories, more than one icon can mark a single Place, due to multiple entrances (e.g. Underground Train-Subway).

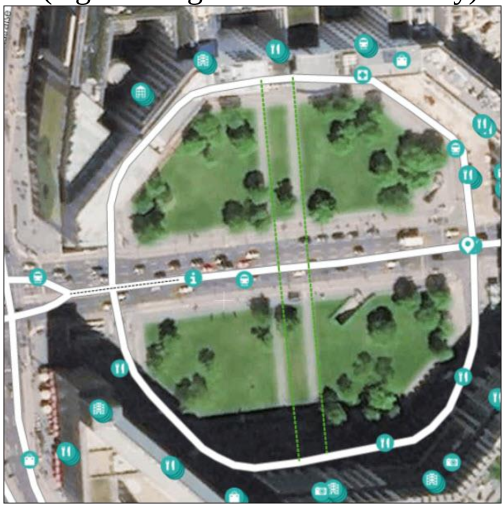

Fig.:7 Round icons with various category symbols representing Place locations

1.2 Display point

The display point, a red circle around the Place icon (Fig. 8), appears when clicking on the Place. It can be moved in all directions to identify the location of the entrance of a building or the entrance of an open area.

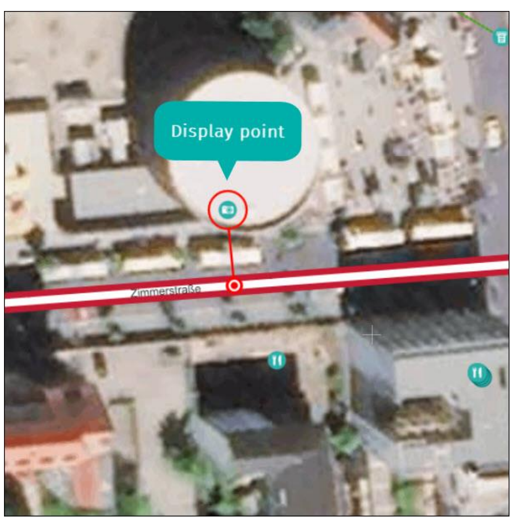

Fig.: 8 Display point

1.3 Routing point

The routing point (Fig. 9) appears as a red dot on the road segment. It can be moved along the road to represent the arrival location or entrance of the Place.

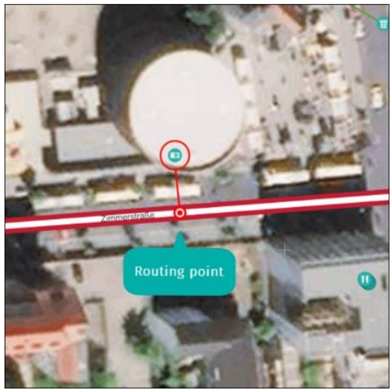

Fig.: 9 Routing point

1.4 Stacked places

It is possible that the display point of several Places is located at the same coordinates (Fig. 10). In these cases, you will see the stacked Places icon. Hover over the stacked Places icon to see a list of all Places at the same position.

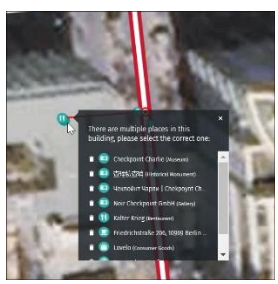

Fig.10: Stacked places icon

HOUSE NUMBERS AND HOUSE STRUCTURE

House numbers are the individual address data displayed as a point object. A house number object needs to have a house number or a

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building name included and might have both. The following chapter gives an overview about the structural elements of a house number in Map Creator.

1 House number structure

The house number structure describes the single elements that define the house number object. Those are the house number icon, the display point and routing point of the house number (Fig. 11).

1.1 House number icons

The house number icons are displayed as square icons and include the house number information. They should be located at the entrance of the building where the individual house number can be seen in reality.

Fig.11: Square icons representing the house number information

1.2 Display point

The display point is represented through the house number icon (Fig. 12) as a red circle and can be moved in all directions to identify the correct location of the entrance of a building.

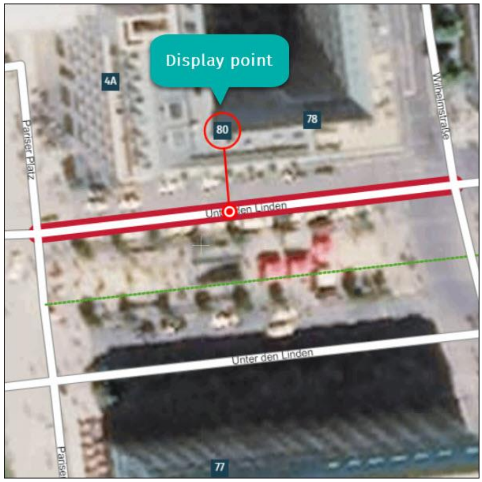

Fig.12: Display point

1.3 Routing point

The routing point is displayed by a red dot (Fig. 13) on the road segment and can be moved along the road to represent the correct arrival location at the house number.

Fig.13: Routing point

Map Creator usage and some analytics – 2017 total

Number of MAU: 5000+ globally

Number of edits (year-to-date or last year): 24.7M edits, 1.3M added kilometers

- South Asia: 1.4M
- Oceania: 556.000
- North Asia: 394.000
- MEA: 5M
- WEU: 3.1M
- EEU: 5.9M
- NA: 813.000
- SEA: 3.6M
- LATAM: 3.9M

Academy use.

Based on the abovementioned structure and program functionalities Map Creator has plenty of options for usage. HERE has been working with academic communities for years, where there have been setup a real training program around digital mapping (combining theory and practical sessions) together with the teachers. The students mostly work around updating their local area, but can also focus on specific tasks like remote islands (Fiji), speed limits, …
HERE is also expanding its academic approach with a focus on future developers: students gain practical development experience by working on location related applications using the HERE APIs and SDKs.

3 audiences:

- High schools
- Universities
- Young entrepreneurs (LATAM)

Since 2017, HERE benefit from back-up from the European Union through the Erasmus+ program. HERE also partner with inter(national) organizations like iGEO where digital mapping challenges via Map Creator become part of the official program.

Associations
A variety of associations use Map Creator to update the map in remote or rural areas or to focus on specific attributes. For instance sports associations add bike pathways, NGO’s focus on local wheelchair access.

We have more long term agreements with Auto-Moto clubs for continuous imagery collection (using our partner tool Mapillary) and then integration of the detected changes into Map Creator, often also working as ambassadors

For tourism

Making everywhere simple to navigate for tourists and locals alike. For example, in 2017 there were added more than thousand kilometers of trials in the Carpathian mountain.

For traffic

Keeping the 4 out of 5 cars using HERE maps up to date and going in the right direction. Map data for navigation purposes contains more than 350 attributes implemented and split in different products.

Partner programs

HERE has been partnering with 3rd parties to ensure a feedback loop for map users (Ford, BMW and many other), to update the map on specific attributes or to provide edits in restricted areas that are inaccessible for non-authorized persons. Other parties, like insurance companies, use the map data to verify road attributes and correct them if needed through Map Creator, creating a real win-win situation.

Local government

Cooperation with local government to enhance the map for citizens and tourists. Locals update the map with shops, emergency access roads etc. In some cases, they can also use our APIs to create their own application and provide it to the citizens.

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LEVEL OF ADAPTABILITY OF FIVE CONIC MAP PROJECTION VARIANTS ON MACEDONIAN NATIONAL AREA AS STATE MAP PROJECTION

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UDC: 528.93:528.232(497.7)

SUMMARY

Nowadays a large number of cartographic projections are used for many purposes; some of them are utilized as cartographic state projections. In the Republic of Macedonia the Gauss-Krüger projection is in use as official state cartographic projection. Regarding the position of the territory and the criteria that the state projection has to fulfill, the Gauss-Krüger projection is not the most favorable projection for projecting the state territory. The goal of this paper is the comparison of the state projection with all variants of conformal cone projections while analyzing the results. From the obtained results, it is defined that the average linear deformation in the first variant is **1.98 cm/km**, in the second variant **is 1.96 cm/km**, in the third variant **2.61 cm/km**, in the fourth variant **1.78 cm/km** and in the fifth variant is **2.95 cm/km**. These values are smaller when compared to the average linear deformation of Gauss-Krüger projection that is **8.49 cm/km**. The conformal cone projections enable symmetrical dispersion of the isograms, and the maximal linear deformation is **8.49 cm/km**. While with the Gauss-Krüger projection the maximal value of the linear deformation is **25.4 cm/km**.

Key words: state cartographic projection, cone projection, deformations, linear scale, isograms.

INTRODUCTION

The Republic of Macedonia is located in the central part of the western Balkans (Figure.1.), and it spreads between parallels with latitudes from 40^{o} to 42^{o}, while the distance from the Greenwich meridian is around 22^{o}. The geographical coordinates of the most extreme points including the central point are given in Figure.2. The Republic of Macedonia has an area of 25

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713 km^2 , while the length of the bordering line is 899 km; these parameters show that this is a small state that has the shape of ellipse.

Figure. 1. Location of the R.M.

Point	Geographic coordinates					
	φ			λ		
North	42°	22'	21"	22°	18'	4"
South	40°	51'	16"	21°	7'	33"
East	41°	42'	33"	23°	2'	12"
West	41°	31'	4"	20°	27'	32"
Center	41°	35'	0"	21°	45'	0"

Figure.2. Extreme points of the R.M.

The Gauss-Krüger projection is used as the state cartographical projection in the R.M. and it was established in the 1924 year, when the R.M was part of the SFRY regime. The central meridian in use is the meridian with the geographical longitude of 21 ° that passes through the western part of the territory. This causes a part of the territory to be projected with a higher linear deformation from the permitted (10cm/km), and the dispersion of the isocholes to be asymmetrical regarding the territory (Figure.4.). Linear deformation will not pass the value of 10 cm/km and the dispersion of the isocholes will be symmetrical if we use two coordinate systems (Figure.3.). Considering the size of R.M and the need for transformation of the coordinates in the areas that are located in the border of the two coordinate systems the use of two coordinate systems is unacceptable.

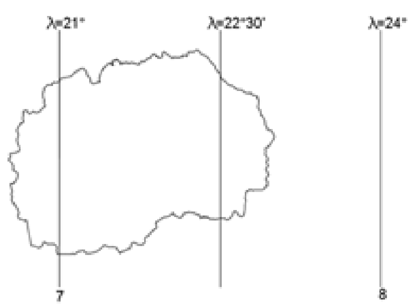

Figure.3.R.M in two zones of Gauss-Kruger projection

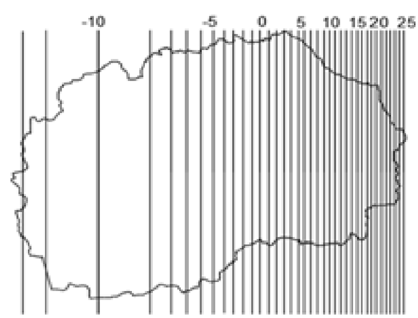

Figure.4.Isocholes in Gauss-Kruger projection

EFFORTS FOR NEW STATE CARTOGRAPHIC PROJECTION OF THE REPUBLIC OF MACEDONIA

Gauss-Krüger projection does not fulfill the criteria for projecting all of the teritory with deformations smaller than 10 cm/km and symmetrical dispersion of the isograms regarding the territory. As a result a lot of reseaeches have been made trying to define varinats of projections that can be applied as state cartographical projection. The main factors taken into account when choosing the state cartographical projection are (Shehu. A., 1971):

- The value of the maximal linear deformation
- The dispersion of the linear deformation
- The adjustment of the mathematical model for geodetic calculations.

Taking into consideration the fact that the R.M lies along parallels and it is located in middle geographical latitude, the Lambert conformal conic projections would be a good variant to use as state cartographic projection. The aim of this research is the comparison between all variants of the conformal cone projections with the Gauss-Krüger projection and the possibility of implementing conformal cone projections as state cartographic projection. The objectives of this research are:

- Suitability of conformal cone projection for the territory of R.M.
- Analyzing the value of deformations
- Dispersions of deformations
- Implementation of cone projections as official state projection.

For this specific purpose a test-model was selected, that consists of 38 points located across the territory (Figure.5.). From the total number 33 points are represented by cities in the R.M while four points are the most extreme ones, including the central point. In conformal cone projections the deformations depend on the geographical latitude so the distribution of the points in this test model is suitable for this criteria, also a lot of geodetic duties with high precision are made in cities for which the value of the deformations is necessary.

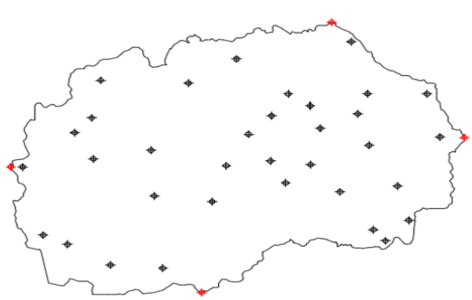

Figure. 5. Dispersion of the points from the test model

For all points of the test model, the linear deformations are calculated in all possible variants of the conformal cone projections and from them the average linear deformations in a proper variety are conducted. The results are compared with the average linear deformation of the Gauss-Krüger projection that is calculated with the implementsation of the same test model.

$$\theta = \frac{\sum_{1}^{n} |\Delta d|}{n} \qquad (1)$$

where: θ - average value of linear deformation
Δd - linear deformation
n - number of points from test model.

CONFORMAL CONE PROJECTION

Conformal cone projections have been primarily developed by Lambert (Snyder. J.P., 1987). These projections enable the projection of the earth's ellipsoid in the cone shape through particular mathematical models, most applicable for state cartographic projection are the conformal cone projections in which the tangent cone (Figure.6.) or the secant cone can be used (Figure.7.).

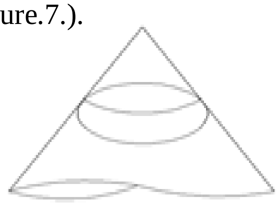

Figure. 6. Tangent cone

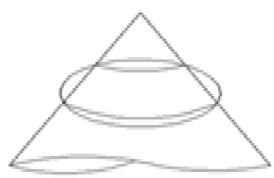

Figure. 7. Secant cone

The determination of the position of the points in the two dimensional coordinate system is enabled through the use of the polar and the rectangular coordinate system (Figure.8.).

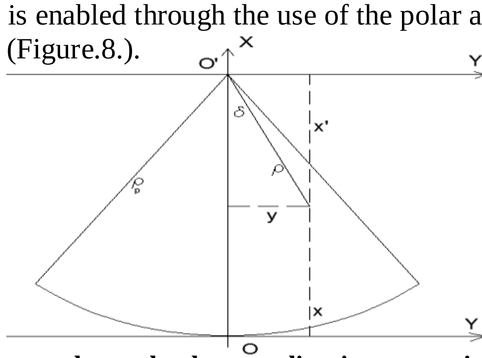

Figure.8. The rectangular and polar coordinative system in conformal cone projections

The relationship between the rectangular coordinates and the polar coordinates in the projection is enabled through the following formulas (Frančula, N., 2004):

$$y = \rho \sin \delta \tag{2}$$

$$x = \rho_p - \rho \cos \delta. \tag{3}$$

One of the most significant features of the conformal cone projections is that there are no deformation of the angles (*w=0*) that causes the linear scale in the direction of the meridian and the parallels to have equal value *(m=n)*.
When processing the variants of cone projections for the Republic of Macedonia the ellipsoid of Bessel (Bessel 1841) is used. This ellipsoid is also used in the processing of the Gauss-Krüger projection. The Bessel ellipsoid is still in use nowadays in the R.M. as the official ellipsoid.

I – VARIANT

This variant of the conformal cone projections requires the use of the tangent cone where the linear deformations are positive, meaning that the length in the map is longer regarding the same length in the ellipsoid. In this variety when projecting, the following condition is required:

- The parallel with the given longitude (φ_o) needs to be projected without deformations $(n_0=1)$.

Regarding this condition the determination of the constant of the projection *"k"* and the constant of the integration *"K"* are conducted through the following formulas (Srbinoski. Z., 2012):

$$k = \sin \varphi_o \tag{4}$$

$$K = \frac{r_o U_o^k}{k}. \tag{5}$$

As a parallel that will be projected without deformations is the parallel that passes through the central point of the R.M, apart from it in the north and the south the deformations rise. As the Y - axis of the rectangular coordinative system it is considered the tangent of the parallel that passes through the point with the minimal geographic latitude (Figure.2.), while the X - axis is a projection of the meridian that has the geographic longitude of 21 ^{o} .In order to avoid the use of the negative coordinates through the Y- axis, the Y coordinate starts with a value of 50 000 m. From the conducted calculations it is estimated that the average linear deformation for all points from the test model is **1.98 cm/km**, the maximal linear deformation at the northern point is **9.49 cm/km**, while the central point is projected without deformations.

The city of *Radovis* has the minimal linear deformation of **0.01 cm/km** while the city of *Kriva Palanka* has the maximal linear deformation of **5.85 cm/km**. The dispersion of the isograms is symmetrical in relation to the central point and the territory, its graphical presentation is shown in Figure.9.

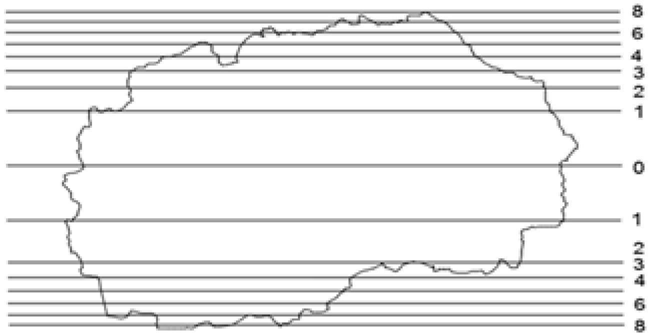

Figure.9. Isograms in the first variant

II-VARIANT

In this variant the tangent cone is also used, and the cone touches the ellipsoid in the parallel that passes through the middle of the Republic of Macedonia, meaning that the geographical latitude of this parallel is determined as the average value from the geographical latitude of northern and southern point, so the geographical latitude of this parallel is $f_o=41^o36'48.5''$.

In this variant during the projection of the ellipsoid the next requirements should be met:

- The parallel that pass in the middle of the territory (f_o) should be projected without deformations $(n_o=1)$
- The linear scale in the bordering parallels should be equivalent$(n_S=n_N)$.

Regarding these two conditions the constants *"k"* and *"K"* are determined with the following formulas (Srbinoski. Z., 2009):

$$k = \frac{\log r_S - \log r_N}{\log U_N - \log U_S} \tag{6}$$

$$K = \frac{r_o U_o^k}{k}. \tag{7}$$

The coordinate system in all variants is defined as in the first variety. From the conducted calculations it is estimated that the average linear deformation has a value of ***1.96 cm/km***. The maximal linear deformation appears in the bordering parallels and has a value of ***8.74 cm/km***, while the minimal linear deformation appears in the standard parallel (f_o) of ***0.00 cm/km***. From the cities, *Radovis* has the minimal linear deformation of ***0.00 cm/km,*** while the city of *Kriva Palanka* has the maximal linear deformation of ***5.27 cm/km***. The dispersion of the isograms is symmetrical in relation to the standard parallel. Its graphical presentation is shown in Figure.10.

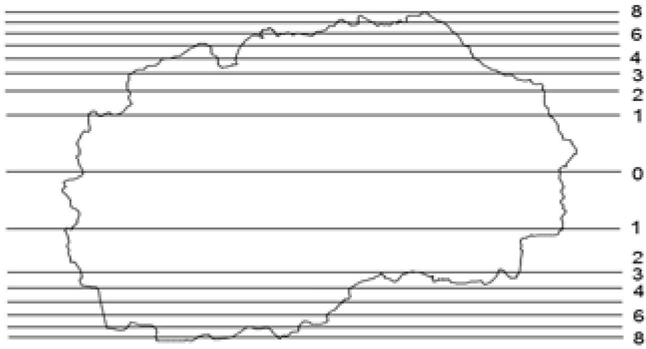

Figure.10. Isograms in second variant

III-VARIANT

This variant foresees the projecting of the ellipsoid in the secant cone in which the following condition should be met:

- Two parallels with the given geographical latitude (standard parallels) should be projected without deformations *(n_1=n_2=1)*.

According to the majority of scientists best results are obtained if these two standard parallels are postured in 1/6 and 5/6 from the length of the arch of the meridian through the bordering parallels. For the territory of the Republic of Macedonia these parallels reach the geographical latitudes f_1=41°06’25” and f_2=42°07’09”.Taking into consideration this condition the determination of the constant of the projection *“k”* and the constant of the integration *“K”* are conducted through the next formulas (Srbinoski. Z., 2009):

$$k = \frac{\log r_1 - \log r_2}{\log U_2 - \log U_1} \tag{8}$$

$$K = \frac{r_1 U_1^k}{k} = \frac{r_2 U_2^k}{k}. \tag{9}$$

From the conducted calculations it is defined that the absolute value of the average linear deformation measures ***2.61 cm/km***. The maximal linear deformation occurs in the northern point and has a value of ***4.88 cm/km***. The parallels with the given geographical latitude are projected without deformations. From the cities, the city of *Ohrid* has the minimal linear deformation of ***-0.01 cm/km,*** while the city of *Radovis* has the maximal linear deformation of ***-3.89 cmk/km***. The dispersion of the isograms is symmetrical in relation to the standard parallels. Its graphical presentation is shown in Figure.11.

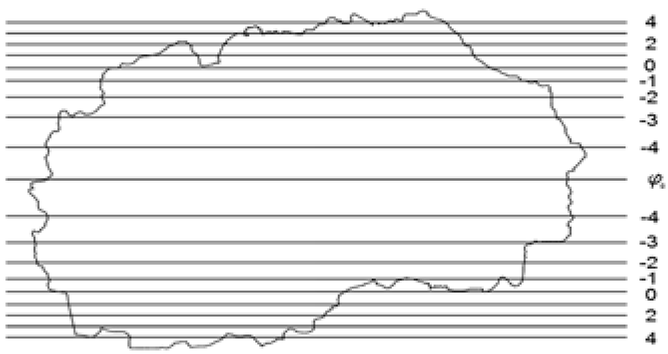

Figure. 11. Isograms in the third variant

IV-VARIANT

In the fourth variant the projection of the ellipsoid is done in the secant cone, in which the following conditions should be met:

- The standards parallels should be projected without deformations (n_1=1).
- The bordering parallels should have the same deformation (n_S=n_N).

Taking into consideration these conditions the determination of the constant of the projection *"k"* and the constant of the integration *"K"* are calculated through the following formulas (Srbinoski. Z., 2009):

$$k = \frac{\log r_S - \log r_N}{\log U_N - \log U_S} \tag{10}$$

$$K = \frac{r_1 U_1^k}{k}. \tag{11}$$

The parallel with the geographical latitude of $f_1 = 42^0 00'00''$ is adopted as a standard parallel, while the geographical latitude of the second parallel is estimated with iterative procedure, and its geographical latitude is $f_1 = 41^0 13'45.1''$.

From the conducted calculations it is defined that the absolute value of the average linear deformation is ***1.78 cm/km***. The maximal linear deformation occurs in the southern point and has a value of ***-6.49 cm/km***, while the standard parallels are projected without deformations. From the cities, the city of *Dojran* has the minimal linear deformation of ***-0.08 cm/km,*** while the city of *Kriva Palanka* has maximal linear deformation of ***3.02 cm/km***. The dispersion of the isograms is symmetrical regarding to the standard parallels and its graphical presentation is shown in Figure.12.

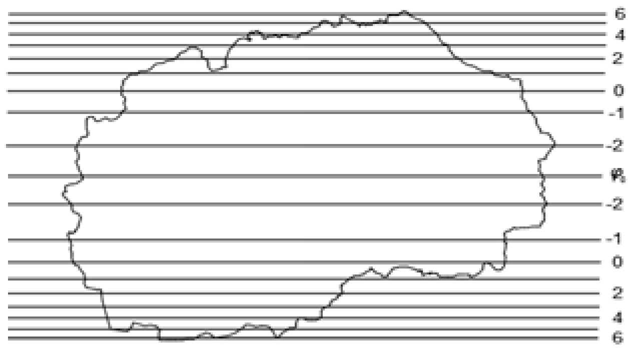

Figure.12. Isograms in the fourth variant

V-VARIANT

This variant requires the projection of the ellipsoid to be done in the secant cone, in which the following conditions should be met:

- The bordering parallels of the territory that is projected should have the same deformations.
- The largest scale should be larger from 1, for as much as the smallest scale is smaller from 1.

Taking into consideration these conditions the constant of the projection *"k"* and the constant of the integration *"K"* are determined through the following formulas (Srbinoski. Z., 2012):

$$k = \frac{\log r_S - \log r_N}{\log U_N - \log U_S} \tag{12}$$

$$K = \frac{2 r_N U_N^k r_o U_o^k}{k(r_n U_N^k + r_o U_o^k)} \tag{13}$$

$$\varphi_o = \arcsin(k) \tag{14}$$

where:

r_s- the radius of the point that lies on the southern parallel
r_n- the radius of the point that lies on the northern parallel
r_o- the radius of the parallel with the minimal linear scale
f_o- the geographical latitude of the parallel with the minimal linear scale.

From the conducted calculations it is established that the absolute value of the average linear deformation is ***2.95 cm/km***. The maximal linear deformation occurs in the most extreme points in the north and south, and has a value of ***4.37 cm/km***. The same value of the deformation occurs in the city of *Radovis* with ***-4.37 cm/km***, while the smallest deformation occurs in the city of *Resen* with ***-0.06 cm/km***. The dispersion of the isograms is graphically presented in Figure.13, from which it can be seen that dispersion of isochloes is symmetrical in relation to the standard parallels.

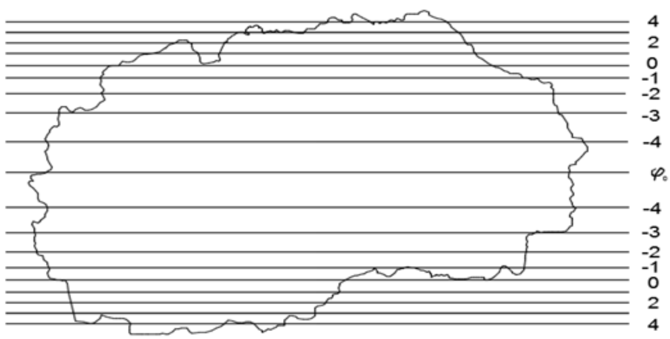

Figure.13.Isograms in the fifth variant

CONCLUSIONS

The conformal cone projections have a major application in cartography; approximately 90 % of the projections that are used around the world apply the Lambert conformal cone projection or the Transversal Mercator projection (Iliffe.J and Lott.R., 2008). Conformal cone projections offer a good solution for projecting the territory that lies in the medium latitudes and along parallels. From the results that are shown in Table.1 it is confirmed that the use of any variant of conformal cone projections would be much favourable than the Gauss-Krüger projection that is in use as official state cartographical projection.

Table 1. Results from conformal cone projections and Gauss-Krüger projections conducted from test model

Significant factors	*Lambert conform conical projection*					*Gauss-Krüge projection*
	I	*II*	*III*	*IV*	*V*	
Θ	***1.98***	***1.96***	***2.61***	***1.78***	***2.95***	***8.49***
m_{max}*(cm/km)*	***9.49***	***8.74***	***4.88***	***6.49***	***4.37***	***25.4***
Dispertion of deformations (cm/km)	***0 to 9.49***	***0 to 8.74***	***-3.89 to 4.88***	***-2.25 to 6.49***	***-4.37 to 4.37***	***-10 to25.4***

It is confirmed that equal values are obtained using either *I* or *II* variant, in which the tangent cone is applied. Precisely in the second variant a smaller linear deformation appears because the standard parallel passes through the middle of the territory of Republic of Macedonia. From the other three variants in which the secant cone is applied, the *IV* variant gives a better chance of projecting because in this variant smaller value of average linear deformation are obtained. The value of average linear deformation in *IV* variant is smaller in comparison with the all other variants.
In Gauss-Krüger projection the criteria for projecting the territory with deformations up to 10 cm/km is not reached in the eastern part of the R.M. Roughly around 12% of our territory is projected with deformations higher than 10 cm/km, also this projection has asymmetry in the dispersion of the isograms. From the conducted research it is concluded that the conformal cone projections are suitable for the territory of R.M., all variants offer smaller deformation and symmetrical dispersion of deformations. From the five processed variants, the *IV* variant would be the most favorable variant, but its implementation as state cartographic projection would induce a series of additional issues. The actual state cartographic projection is being used for a long period of time and a lot of geodetic activities; for example geodetic maps and topographic maps are developed in the Gauss-Krüger projection, so the change of the projection would also result in solving the issues that would occur.

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ASSESSMENT OF UNDERGROUND MINING COPPER DEPOSIT “BREGU I GESHTENJËS”

UDC: 553.43(496.5)

Skender LIPO[1] and Nevina POLO[2]

SUMMARY

In the last 20 years, the mineral extraction industry in Albania has experienced a significant decline. The main reasons for this decline have been the lack of market for these minerals. Nowadays, several new copper deposits have been evaluated but it is worth underlining that the amount of mineral reserves in these deposits has been limited. Although the constant interest in these copper deposits, from foreign and domestic companies, still today, there is a lack in investments for opening new mines in these deposits. The main reason is the limited amount of copper ore in these deposits. This paper analyses the mining assessment of one of these copper deposits with about a million tons of extracted mineral reserves. Based on the geological medium of this deposit and the continuity of the ore bodies, the mining method and the dimensions of the mining units have been selected which, due to the concrete conditions, realize a high annual production of mineral with low mining loss indicators. The impacts of indicators of mineral losses and dilution in the breakeven cutoff grade in mineral processing and operative cost in extraction of one ton concentrate are estimated.

Keywords: Copper deposit, restricted mineral reserves, mineral losses and dilution.

INTRODUCTION

Copper deposits in our country are mainly located in the north part of Albania, with the exception of copper deposit in Rehova district, located in the south-east. Today in Albania there are more than 20 mineralized copper deposits, with total geological reserves of 22 million tons and with an average grade of 1.4 % Cu (Shushku B. etc, 2015). Some of these deposits are under mining activities and most of them are in the phase of feasibility study. Since the amount of geological reserves for each of

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these copper deposits is limited in quantity, there is little chance that these copper deposits will be taken for exploitation. One of these copper deposits is the deposit called “Bregu i Geshtenjes” that belongs to the known copper mine Rehova.

Before some data on the technical and economical assessment of this copper deposit is shown, a briefly discussion on the main factors that determine whether an ore deposit is to be taken for exploitation is presented. Generally speaking, the main factors for a feasibility assessment are (1) grade of metal in ore bodies (2) the size of the deposit (3) mining technology (4) accessibility and (5) social development and environmental requirements where the new mine will be located.

Starting from the last point, social development and environmental requirements where this copper deposit is located do not cause any obstacles to starting a new mining activity. Considering the low-income and the lack of employment opportunities, the community of Rehova welcomes the realization of a new mining activity. Meanwhile, residents of these villages have worked for more than 15 years in mining and geological activities performed in this district and do possess good professional skills in this area. Currently the environment in this area has undergone noticeable negative changes from mining activity. The negative physical changes, especially from surface mining activity developed in those copper deposits, have been a major environmental problem for this area. Negative impacts on the environment are present even today after more than 20 years since the closure of the mining activity in this area. It is so worth noting that starting a new mining activity can also help to regenerate the present damaged environment.

The new deposit "Bregu i Geshtenjes" is located in a mountainous terrain, at a height of about 1000 meters above sea level, with a climate that favors considerable snowfall. The area is rich in surface and underground water. The site is connected with the auto road to the city of Korça. The electrical network is present. The mining works, previously carried out in this area, provide internal roads and ample space for collecting sterile waste that can be extracted from the new mine. The copper mining complex in our country is located in the north of Albania, far from this deposit. This does not favor the cooperation of the new mine with the opportunities that these mining complexes offer in the field of mining technology and large capacity for copper ore processing.

The copper mining technology with underground mining is well known in this mining area. The work experience gained in mining activities, developed in this mining region will be a positive factor that will support the start of work in the new mining activity.

The main obstacle in the opening of this activity is the size of mining deposit. According to geological studies carried out at this mineralization zone (Kalina P. etc, 1986), an amount of around 1 350 000 tons of copper ore with an average content of about 1.92% Cu is estimated. Although this estimation of the mineral reserves capacity of this deposit is satisfying, several other factors must be taken into account. Considering the spatial position of the mineralized material, the distribution of these reserves in some ore bodies with different quantity of ore, the poor continuity of the geometry of the ore bodies and the mining method that can be adapted to this deposit, the amount of mineral reserves that can be extracted from this deposit is even smaller.

The average metal content (1.92% Cu) in the mineralized material is acceptable, compared to other mineral deposits that are today in used. Some economic indicators relevant for a mining activity are presented hereafter.

1. MINERAL RECOURSES OF A DEPOSIT THE ONLY ASSET OF A MINING ACTIVITY

The management of the mineral reserves of a deposit is firstly associated with a detailed study of geological medium, the creation of a data base of geological works, analytical processing and their graphic representation. Then the management of the mineral reserves continues with design of mining project. Booth these phases begin after an approximate assessment of the value of a mineral deposit. Let’s write the simplified equation for the calculation of the value of a tone of mineral (v) and the value of the entire mineral resources (V):

$$v = \bar{g}_m \times R_t \times s_m \qquad (1)$$

$$V = v \times Q_m \qquad (2)$$

Where:

$\bar{g}_m$ - Average grade of metal in extracted mineral

R_t - Total recovery in enrichment and smelting.

s_m - Price of metal ($/ton)

Q_m - Quantity of extracted mineral

As can be seen from the equation (1), the value of one tone extracted mineral depends directly on the average grade of metal in the extracted mineral ($\bar{g}_m$), and the recovery index (R_t) in enrichment and smelting of mineral. The higher the grade of metal in the extracted mineral and the higher the recovery indicators, the higher the value of one tone of extracted mineral will be. While the value of the entire mineral resource (equation 2) depends on the value of one tone of extracted mineral and the quantity of extracted mineral. The average grade of metal in extracted ore ($\bar{g}_m$) depends on the average grade of metal in mineralization material ($\bar{g}$), but also from the recovery indicators determined by the processes of mining. The amount of minerals extracted (Q_m) depends on the amount of mineralized material (Q) in the deposit given for exploitation. We underline that the two parameters, the amount of mineralized material (Q) and the average grade of metal ($\bar{g}$) determine the only assets for a mineral deposit.

While metal prices (s_m) cannot be dictated by mining companies. Metal price fluctuations are very difficult to predict, especially from mining companies with a small influence on the production of minerals, such as companies operating in our country. In the periods when the price of metals is increasing, mining companies can profit by increasing production capacities, but note that this growth is limited by the selected mining technologies that determine the maximum production and processing capacities. In the periods when metal prices decrease, mining companies are forced to reduce the sales of the mineral produced, or to reduce production capacities or, in extreme cases, to interrupt mineral extraction. Interruption of mineral extraction was observed during 2016 – 2018 period in some copper mines in our country, and this extreme measure was assessed as a wrong solution.

Based on some preliminary data on the quantity and quality of the ore of this copper deposit, the recovery coefficients in the mining, milling and metallurgy (Goskolli E. etc, 1998), and the selling price of a tone of metal, we can estimate approximately the value of this mineral deposit.

$$\bar{g}_m \approx 18 \text{ kg copper per ton; } R_t \approx 0.76; s_m \approx 6500 \text{ \$/ton; } Q_m \approx 900.\,000 \text{ ton}$$

$$v = \bar{g}_m \times R_t \times s_m \approx 89 \text{ \$/ton of extracted mineral; } V = v \times Q_m \approx 80\,000\,000 \text{ \$}$$

We note that the final product of this mining activity will be copper concentrate. The question that arises now is weather the value received from the sale of that concentrate will cover all costs for conducting mining operations?

2. SOME ASSESSMENTS ON GEOLOGY AND MINING TECHNOLOGY FOR COPPER DEPOSIT “BREGU I GESHTENJES”

The copper deposit in Rehova is located in the south east of the country, 25 kilometers from the city of Korca and far away from the copper mining complex located in the north of Albania. This deposit is formed by four different sources named, “Kanisqel”, “Dushku i Trashe”, “Çifligu” and the new deposit “Bregu I

Geshtenjes". All these deposits located within an area of no more than 4 km^2. The first three deposits have been exploited and know they are closed. The Kanisqel deposit is exploited with open pit mines, the "Dushku i trashe" have been exploited by combining the open pit and underground mine, while the "Chifligu" deposit was exploited only with underground mines. From the work experience in these mines (Mançka A. Kiço. L, 1987) are noted some conclusions such as:

- The contacts of orebodies with the hosted rocks are not sharp. Mineralized zone with an average grade 0.3% to 0.6% Cu envelop the ore bodies.
- In some cases during the exploitation works are encountered small mineralized lenses, non-assessed by geological works, with small size and with a grade more than 2% Cu. This phenomenon appeared more often during the mining works on the two open pits developed in this copper deposit.
- Generally the mineralized material and the hosted rock were unstable.
- To maintain the size of the mining units, they often expanded to the mineralized material around the boundaries of the ore bodies
- Quantity of extracted mineral from each mining units is high compared to the calculated reserves.
- The dilution indicator in some mining units reached up to 15%.

2.1 SOME DATA ON THE GEOLOGY OF THIS COPPER DEPOSIT.

The pyritic copper mineralization of "Bregu i Geshtenjes" ore deposit located at the uppermost parts of the lower volcanogenic package, some 30 to 180 meters from the contact agglomerate – diabase. The thickness of mineralized zone varies 20 to 40 meters, while the thickness of the body is from 1 to 12 meters. The mineralized zone consists of breccious diabase and volcanic diabase highly affected by the hydrothermal alterations.

The industrial mineralization goes to the direction of strike from 900 to 1000 meters, and widely to the direction of dip from 100 to 400 meters. The ore bodies have the shape of lenses and they are located mainly at the northeastern part of the centriklinale closure. The typical cross section of this deposit consists of 3 to 5 ore bodies, while there are some 22 known ore bodies in the entire ore deposit and among them the ore body number 2 is the most consistent one.

Generally the contacts of ore bodies and mineralization zone are determined by chemical analysis. The transition of ore bodies to mineralized zone is gradual. The same is also the contact between the ore bodies and hosted rocks on hanging and foot walls. Changes in the metal content in the ore bodies and mineralized zone is irregular without any trends.

The ore body number 2 located some 3 to 25 meters below the ore body number 1, and it represents the most consistent ore body of the entire deposit. It extends for 900 meters along N-NW to S-SE and develops for 50 to 320 meters along its dip westwards with angel 20^0 to 35^0. The thickness of the ore body varies from 1meter to 12 meter. The average grade of copper is 2.22% and 15.44% S.

There are some others mineralized occurrences in this copper deposit, but not of the grade to be contoured like industrial ore bodies. Considering the geological condition of these ore bodies, it can be mentioned that only ore body number 2 has a consistent continuity of the curve tonnage – ore grade, this estimated according to the mining technology adopted for this ore deposit. In following, only for this ore body it is continued with designed levels and mining units, based on the parameters of selected mining methods and extractable of ore reserves from this ore body are calculated.

2.2. A SHORT DESCRIPTION ON MINING TECHNOLOGY

The opening of the new mine will be done with two main works, a mining works with a moderate slope, no more than 10 degree, will start in the quota +968 and a ramp that will start at +1020 and will drop down to the lower level of the mine + 780. Opening works will be 4 meters wide and with a section 12 m^2. From the ramp will initially open the main levels every 50 meters and then the intermediate levels every 25 meters. Sublevel height should be maximized, reducing drift meters per tonne. Mining works, with a total length about 14 500 meters, will be realized in three years, where in the first two years there will be a higher intensity. With these mining works have to be prepared for mining all mineral reserves of ore body number 2, from lower level + 780 to upper level + 1000 meters. Reserves above level + 1000, where there are some ore bodies with limited reserves, will not be taken into account in this study. Also the mining reserves that are located below the level + 780, where there is a small body with no more than 50,000 tons mineralized material with a grade 1.08% Cu, was not taken into account in this study because mining of this reserves is assessed as non-economic.

In order to increase the quantity of extracted mineral it is intended for the preparation and mining of this ore body will be performed in two levels simultaneously. The Increasing of the amount of extracted mineral each year, will contribute to shortening the life of the mine, so the costs for mining activity will be decrease.

Based on the geological medium, stability of hoisted rocks and ore body, size and continuity of the ore bodies and the experience of mining in this deposit, two mining methods have been selected. The upper part of ore body, exactly from level + 968 to level + 855 will be mining with **sublevel caving method**. The rock mass is stable enough to allow sublevel drifts to remain stable. The hanging wall is unstable and will collapse to follow the cave created from mineral extraction. For this mining method dilution and ore losses are a big problem. In this case host rock contains copper mineral that fluctuated from 0.3% to 0.7 % Cu. In this condition dilution have a moderate influence on the copper grade in extracted mineral.

Because the small depth of upper mining level from the surface, and based on the work experience in this mine, it is expected that during the extraction of the ore, there are many opportunity to have sinkholes.

Mineral reserves from level + 780 to level + 855 will be prepared by sublevels and mining with **cut and fill method**, starting from the lower sublevel and advancing upward. When 2 ore 3 vertical slice has been mined, voids are backfilled with a mixed material create with hydraulic sand tailings and waste rock. This method gives possibility to avoid extraction of minerals with low grade ore and to recover pockets of mineralization material in the host rock. This method provides low indicators of mineral loss and dilution, but has a higher cost per one ton of ore extraction compared to sublevel caving method (Lipo S. Bakiu A. 2013).

In order to maintain a high level of safety in the mine, sublevel must be dimensioned in accordance with the actual conditions, keeping in mind that sublevel design has a high influence on mining efficiency, recovery and costs. The sublevel height for both mining methods will be 12.5 meters.

By evaluating the size of the mining body at each level, the dimensions and rate of exploitation of mining units, the mineral losses and dilution indicators for each block and levels, are estimated quantities of mineral to be extracted from each level. In the table are given the quantities of minerals that expected to mining from different levels by years.

From the data given in this table we note that the amount of extracted mineral will be 897 755 tons, with an average content of 1.81% copper. The amount of metal found in this mineral is only 162 482 tons. The graph given in figure 1 shows the expected amount of metal production planned by levels, quarters and years.

2.3 SOME DATA FOR ORE ENRICHMENT PROCESS

The final product will be the concentrate produced by the enrichment factory. In this mine has been working for more than 10 years an enrichment plant with processing capacity of 60,000 tons of mineral per year, with an average recovery index of 82% and a grade of copper in concentrate about 16.5%. Today, this plant has been out of function. A new enrichment plant has to be build, with a full cycle of enrichment, where there will be some successive enrichment. After the first flotation process, milling of materials obtained will again be used to provide a better distribution of copper during the last flotation phase.

Tabela nr. 1 Planning of mineral production organized by levels and years

Level	Cutoff grade 0.5 %		Years							Sum
			1	2	3	4	5	6	7	
968	Ton	9206	9206	0	0	0	0	0	0	9206
	% Cu	1.71	157.4	0	0	0	0	0	0	157.4
930	Ton	86431	86431	0	0	0	0	0	0	86431
	% Cu	1.55	1340	0	0	0	0	0	0	1340
905	Ton	59309	0	59309	0	0	0	0	0	59309
	% Cu	1.05	0	622.7	0			0	0	622.7
880	Ton	169909	0	0	98800	71109		0	0	169909
	% Cu	1.55	0	0	1531.4	1102.2		0	0	2633.6
855	Ton	182634	0	0	0	0	40000	85000	57634	182634
	% Cu	2.25	0	0	0	0	900	1912.5	1296.8	4109.3
830	Ton	67719	0	0	0	0	0	67719		67719
	% Cu	1.79	0	0	0	0	0	1212.2		1212.2
805	Ton	196343	0	0	0	80000	116343		0	196343
	% Cu	2	0	0	0	1600	2326.9		0	3926.9
780	Ton	126204	0	75000	51204	0	0	0	0	126204
	% Cu	1.78	0	1335	911.4	0	0	0	0	2246.4
Sum +780	**Ton**	**897755**	95637	134309	150004	151109	156343	152719	57634	897755
	% Cu	**1.81**	1497.4	1957.7	2442.8	2702.2	3226.9	3124.7	1296.8	16248.2

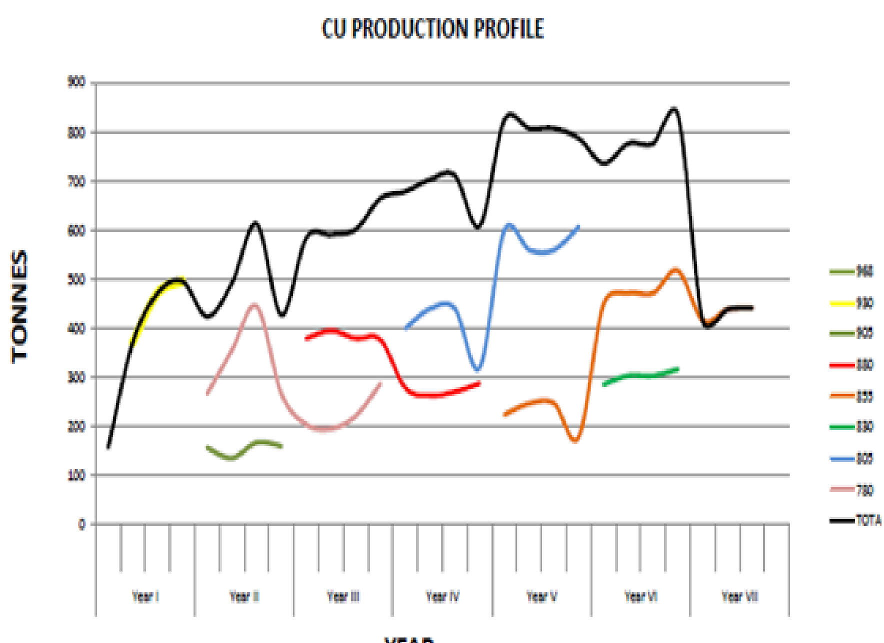

Fig. 1 Expected amount of metal production planned by levels, quarters and years

Then, the cleaning phase will give a better quality concentrate (25% Cu). Gold and silver can be obtained at 74% with new techniques in similar processes. Based on the work experience and well-known minerals qualities, it is thought to achieve a recovery of about 85% during the enrichment. The enrichment cost will not be high (North Stars Studi, 2010).

Capital expenditures for the construction of the new enrichment plant and the complex of mine office are expected to be about $ 2.8 million. The operational cost for extracting and processing one ton of mineral extracted is estimated at about $ 25 per tone.

Ultimately, this new mine is expected to produce around 55,250 tones of concentrate with a grade of copper 25%. From this concentrate is expected to be taken about 250 kg gold and 6000 kg silver.

3. MINING ACTIVITY IN THIS COPPER DEPOSIT AND SOME EXPECTED ECONOMICAL INDICATORS.

Mining activity in this mine is restricted by the amount of mineralized material and the metal content in this material. Under these conditions, during selection of mining technology, it is intended that the amount of mineral reserves, expected to be extracted from underground, to be as high and the indicator of mineral losses to be as small.

After determining the shape and boundaries of ore body and mining methods to be used, it was no easy to determine the dimensions of the production units. Clear lack of continuity of the shape and size of ore body at different levels, created problems in the design of the size of production units. Dimensions of the production units were selected in each case, with the idea that for every mining unit have to realize lower indicators of mineral losses. The boundaries of the mining units, in some cases, have been extended to the hosted rock. The hosted rock in most cases contains copper ore in the range of 0.3% to 0.6%. Extracting this poor material together with the ore bodies will bring an increased indicator of dilution, but at the some time will minimize the losses of mineral.

Evaluation of impact of losses mineral and dilution in rate of profits for each mining unit (see Figure 2), it seems that the increase of mineral losses has a greater impact on reducing profit, compared with this impact caused by the increase of dilution. This is explained by the fact that the increase in dilution is accompanied by the reduction of the mineral losses, and the dilution material contains copper ore at the limits of 0.5%. From the evaluations performed, see the graphs in Figure 2, we conclude that the mineral dilution to 15% would significantly reduce the losses of mineral. With this working regime, economic indicators for each production unit, will be the best for this new mine. The increase in dilution index to 15%, when the waste material contains no less than 0.5% copper, bring a small negative impact on the profit. Figure 2a show change of profit curve from change of indicators of mineral losses and dilution. Impact of increase of dilution at the profit curve is made when the dilution material contains copper ore at 0.4% and when the dilution material does not contain copper ore.

From the analysis of this mining technology, we conclude that the indicator of recovery mineral (1- mineral losses), for every mining unit is reduced faster by the increase of mineral losses, compared with the increase of dilution. This does not mean that a high dilution should be accepted, as this would significantly increase the production cost of concentrate. The graph shows that when the metal content in the mineral delivered to enrichment is less than 0.7% Cu, the enrichment process will be without profit. So the grades of the metal in the extraction mineral have to be high than break even cut-of grading (0.7%Cu) for processing in enrichment plant. Minerals extracted from different production units must be averaged in order that the grade of copper in averaged mineral to be as high as possible.

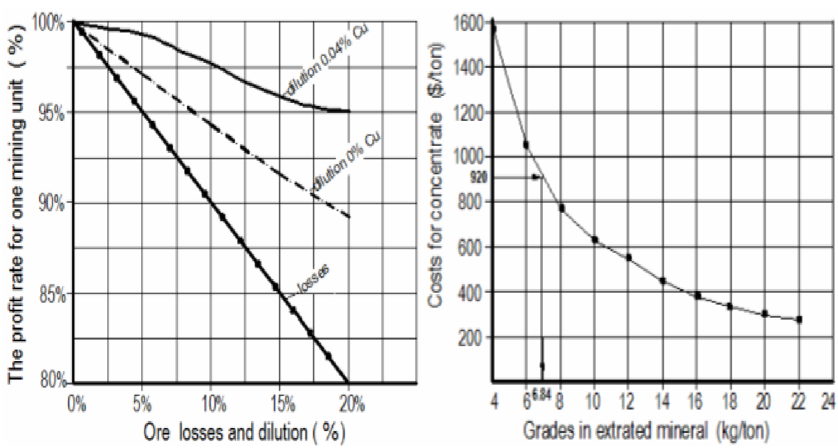

Fig. 2 The relation between indicators of profits, losses and dilution (a), and increase of cost of concentrate with decrease of grade of copper in extracted mineral (b).

Based on the mining and enrichment technology accepted for this new mine, we calculate the amount of concentrate to be produced:

$$Q_c = \frac{Q_m \cdot \bar{g}_m \cdot R_c}{g_{con}} = 55248 \text{ ton concentrate}$$

Where:

Q_m - The amount of ore expected to be extracted from this mine (Q_m = 897755 ton)

$\overline{g}_m$ - Average grade of metal in extracted mineral after process of averaging ($\overline{g}_m$ = 1.81 % Cu.)

R_c - Recovery indices in mineral processing (R_c = 0.85 %)

$\overline{g}_{con}$ - Average grade of metal in concentrate ($\overline{g}_{con}$ = 25 % Cu)

To estimate the economical profit, expected to be obtained from a mining activity, it is necessary to pre-evaluate firstly a number of technological parameters (geological, mining, enrichment and metallurgical), and then to evaluate a range of economic parameters, such as capital costs, operating costs, bank interests, various taxes, environmental obligations and product sales prices. Both sets of parameters require increased care in their assessment for every concrete mining activity. Every mining deposit and any mining activity are unique in the geological conditions approaching and pre-assessment of these parameters is very difficult. Under these conditions, the pre-assessment of the above parameters is always approximate and the true values of these parameters will be determined only when the mining activity is completed.

Considering once again the production capacity of this new mine, about 55 200 ton of concentrate with a grade 25% Cu, remains to be estimated all the capital expenditures and operating costs that will accompany this mining activity. For this copper deposit some capital and operational expenditure studies are carried out for different mining technology. In these studies, where other mineral indicators have been chosen, it has resulted that total costs are very close to the income that can be obtained from the exploitation of this deposit.

CONCLUSIONS

The “Bregu Geshtenjes” copper ore deposit has a limited amount of reserves. A successful mining activity under such conditions can be assured only if the necessary guarantees are taken:

- The mining method that is selected to be used in such ore deposits, with limited mineral reserves, should first to provide a mineral extraction with minimal mineral losses. Selected mining methods in this deposit are sublevel caving (with approximate indicators of losses and dilution, respectively 8% and 15%) and sublevel with cut and fill (with approximate indicators of losses and dilution, respectively 5% and 8%).
- Based on the mining technology proposed to be used in this mining activity, the maximum size of mining units were determined, to increase production rates and reduce the costs for mining works for each mining unit.
- From the assessment of the impacts of the mineral losses and dilution on the economic effectiveness for each mining unit, were determinet the

optimal indicators of mineral losses (not greater than 8%) and diluotion (not greater than 15%).

- The grade of copper in extracted mineral will be fluctuated from 0.5 % Cu to 2% Cu. The extracted mineral will be averaged before sending for enrichment, so the grade of copper in the extracted mineral that will be sent for enrichment should not be less than 0.7%.
- Përmbajtja e bakrit qe do te nxirret nga miniera do te luhatet ne kufijtë 0.5 deri 2 % cu. Minerali i nzjerre do te mesatarizohet para se te cohet për pasurim.
- To optimize operating costs, annual mining production should be as high as possible. For this purpose, it is planned to work in several mining units simultaneously.
- The processing capacities in the enrichment plant should support the annual production of mines.

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DETERMINING POINTS STABILITY IN GEODETIC CONTROL NETWORKS USING HANNOVER METHOD

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SUMMARY

The structures and the land which they are built on, are under constant and / or occasional action of external and / or internal forces, which leads to geometric deformation and their displacement. For the purpose of timely detection of the mentioned deformations and displacements, it is necessary to perform continuous control measurements. Such control measurements can be implemented through certain geodetic methods. By using geodetic methods, information on structure or ground displacement and deformation can be obtained. This paper presents the general procedure of determining the stability of points using a Hannover method and its mathematical procedure. The practical part of this paper, carried out by Hanover method is based on measurements in two epochs (1.Epoch 96 and 2.Epoch 97) carried out in purpose of testing and calibration of certain methods and instruments at the polygon „Novoselka“ (Vuchkov, 2000). Application of the method in this paper aims to present the procedure for its performance and determine its strength by comparison of achieved results with the results of other method applied on the same measurements. In order to preserve continuity in the paper, there is a brief explanation of the need and way of setting the geodetic control network, elevation of the measurements and part of the world mostly applied methods of examination of points stability. The Conclusion also refers to the deficiency of all statistical methods in general, due to the duration of time needed to perform the geodetic measurements.

Key words: geodetic control network, discrete point, displacements, deformations.

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1. GEODETIC CONTROL NETWORK

Geodetic networks that are established for the needs of engineering geodesy are called special purpose networks, whereas networks that are used to determine displacements and deformations of structures are called geodetic control networks. As in all geodetic problems, as well as in the tasks for determining the displacements and / or deformations of certain objects, the procedure is performed through a certain number of points called discrete points of the object. The discrete points are used to analyze eventual displacement or deformations, whereas basic points are certain number of points located outside the unstable area, but still close to the object, through which the discrete points of the object are observed.
In order to be able to control the object's stability at all through the discrete points embedded in it, it is necessary to connect them to the points of the basic network in a single coordinate system both in position and height. This set of points defined in a single coordinate system is called a geodetic control network (hereinafter referred to as GCN)
The shape and size of the network depends of the shape and dimensions of the object, the configuration of the terrain and the expected deformations and / or displacements of the object. The number of points in the basic network should be as low as possible but not less than 4 points, while the number of discrete points depends on the size of the object and the expected deformations and / or displacements. GCN are most often presented in the Cartesian rectangular coordinate system in:

- one dimensional (1D) for height position;
- two dimensional (2D) for plane position and / or a combination of
- three dimensional (3D) coordinate system for the position of the grid points in the space.

The relative position of the points from the GCN is determined with geodetic measurements. In order to achieve the basic goal for which the network is established, i.e. even a small value of the displacement vector to be detected, the network should be precise and reliable.
Measurements are performed in time differences so-called epochs, which usually depend on the speed of expected displacements and / or deformations of the object.
The first epoch, also known as the zero epoch, is established after the stabilization of the GCN itself, while the remaining ones are carried out successively in the period of time determined by the basic project for the object.

2. EQUALIZATION OF GCN

As mentioned before, geodetic measurements that primarily serve to determine the relative position of points in the GCN are specified with an a priori analysis project. The method of data processing and the determination of the unknown parameters that define the position of the points in the GCN, depends on the type of measurements that were performed.
The most commonly used method of equalization of measured data is the method of indirect equalization. GCN are adjusted as free networks with minimal trace in all points of the basic network for the first epoch, while in the following epochs of the measurements the equalization is completed with minimal trace in the points of the basic network, which will be determined to be stable or not.
After analyzing, removing gross errors using Data snooping, and completed equalization, evaluation vectors $(\hat{\mathbf{x}}_1, \hat{\mathbf{x}}_2)$ and correspondent singular cofactor matrices $\left(\mathbf{Q}_{\hat{\mathbf{x}}_1}, \mathbf{Q}_{\hat{\mathbf{x}}_1}\right)$ about the points from GCN are obtained (in the previous and in the current measurement epoch). The vector $\hat{\mathbf{d}}$ and the matrix $\mathbf{Q}_{\hat{\mathbf{d}}}$, are basic for performing deformation analysis and are calculated using the following equations:

$$\hat{\mathbf{d}} = \hat{\mathbf{x}}_2 - \hat{\mathbf{x}}_1 \quad \text{...(1)}$$

$$\mathbf{Q}_{\hat{\mathbf{d}}} = \mathbf{Q}_{\hat{\mathbf{x}}_2} + \mathbf{Q}_{\hat{\mathbf{x}}_1} \quad \text{...(2)}$$

3. METHODS FOR POINTS STABILITY ANALYSIS

In order to examine the stability of points in the GCN, a number of methods have been developed that most had received their names after the research centers and / or the authors (Nasevski, 2001).
The most famous world methods can be listed:

- **Hannover** (Pelzer, 1971),
- **Delft** (Baarda, 1968, Kok, 1977),
- **Munich (**Chrzanowski, 1981),
- **Fredericton** (Chrzanowski et al., 1982) etc.

These methods are basically static methods. With the application of static methods, it is assumed that due to the short period of time in which the measurements were performed, there were no deformation and / or displacement of the object and / or the ground on which the points of the GCN were stabilized.

4. HANNOVER METHOD

This paper presents the application of the *Hannover method* or the Hannover procedure for examining the stability of points in the GCN. This method was developed by Pelzer (1971) and (1974), and its practical application was adapted by Nimeier (1976) and (1982) year.
Like most other methods, this method is based on examination of the displacements through the difference of the coordinates of the points by conducting a global stability test calculated as the mean discrepancy between two consecutive measurements (epochs) in the GCN.

4.1. MATHEMATIC MODEL

4.1.1 ANALYZING THE HOMOGENEITY OF TWO MEASUREMENT EPOCHS

In order to be able to determine the stability of the points through the difference in the coordinates in the GCN obtained in the procedure of equalization, it is necessary to analyze the homogeneity of the measurements in both epochs (Nasevski, 2001; Pelzer, 1971; Mihailović and Aleksić 1994, 2008; Ašanin, 2003; Vrce, 2011).
Therefore two hypotheses are set:

$$\mathrm{H}_0\colon \mathbf{M}(s_1^2) = \mathbf{M}(s_2^2) \text{ – } \textit{нулта хипотеза наспроти} \qquad \text{...(3)}$$

$$\mathrm{H}_a\colon \mathbf{M}(s_1^2) \neq \mathbf{M}(s_2^2) \text{ – } \textit{алтернативна хипотеза} \qquad \text{...(4)}$$

Statistic test:

$$\mathrm{T}\left|\mathrm{H}_0 = \frac{s_1^2}{s_2^2}\right|\mathrm{H}_0 \sim \mathrm{F}_{(\mathrm{f}_1,\mathrm{f}_2)}, \text{ каде } s_1^2 > s_2^2 \qquad \text{...(5)}$$

$$\mathrm{T}\left|\mathrm{H}_0 = \frac{s_2^2}{s_1^2}\right|\mathrm{H}_0 \sim \mathrm{F}_{(\mathrm{f}_1,\mathrm{f}_2)}, \text{ каде } s_2^2 > s_1^2 \qquad \text{...(6)}$$

- If $\mathrm{T} < \mathrm{F}_{1-\alpha,\mathrm{f}_1,\mathrm{f}_2} \Rightarrow \mathrm{H}_0$ the measurements in both epochs are with homogeneous accuracy. The unified dispersion factor is calculated the following equation:

$$s^2 = \frac{f_1 s_1^2 + f_2 s_2^2}{f_1 + f_2}, \qquad ...(7)$$

where, f_1 *and* f_2 are degrees of freedom

- If $T > F_{1-\alpha, f_1, f_2} \Rightarrow H_a$, the measurements in both epochs are not with homogeneous accuracy. In this case the unified dispersion factor (s^2) is not calculated, and homogenization of the measurements needs to be done.

4.1.2 GLOBAL TEST FOR POINTS STABILITY OF GCN

The stability of the points implies there were no displacement in the time period between the two eras, i.e. a stable point is point that kept its position between two sets of measurements. To perform the test two hypotheses were set:

$$H_0: \mathbf{M}(\hat{\mathbf{x}}_1) = \mathbf{M}(\hat{\mathbf{x}}_2) - \textit{zero hypothesis} \qquad ...(8)$$

$$H_a: \mathbf{M}(\hat{\mathbf{x}}_1) \neq \mathbf{M}(\hat{\mathbf{x}}_2) - \textit{alternative hypothesis} \qquad ...(9)$$

where the parameter $\hat{\mathbf{d}}$ is calculated using the equation (1), after which the **gap** or the secondary discrepancy is calculated according to the formula:

$$\theta^2 = \frac{\hat{\mathbf{d}}^{\mathbf{T}} \mathbf{Q}_{\hat{\mathbf{d}}}^{+} \hat{\mathbf{d}}}{h} \qquad ...(10)$$

Where:

$h = \text{rang}(\mathbf{Q}_{\hat{\mathbf{d}}})$
$Q_{\hat{d}}^{+} = P_d$

Statistic test:

$$T \left| H_0 = \frac{\theta^2}{s^2} \right| H_0 \sim F_{h,f},$$
$$T \left| H_0 = \frac{\theta^2}{s^2} \right| H_0 \sim F_{h,f,\lambda} \qquad ...(11)$$

$$\lambda = \frac{1}{\sigma^2} (\mathbf{Hx}_{\boldsymbol{a}} - \mathbf{w})^{\mathrm{T}} - (\mathbf{HQ}_{\hat{\mathbf{x}}} \mathbf{H}^{\mathbf{T}})(\mathbf{Hx}_{\boldsymbol{a}} - \mathbf{w}), \qquad ...(12)$$

$\lambda -$ non-centrality parameter.

- If $T < F_{1-\alpha, h, \lambda} \Rightarrow H_0$ Points are not displaced with probability of $(1-\alpha)$,
- If $T > F_{1-\alpha, h, \lambda} \Rightarrow H_a$ There is at least one displaced point

With this test, global information about network stability in two different epochs is obtained.

4.1.3 GLOBAL TEST FOR POINTS STABILITY FROM BASIC GEODETIC NETWORK

As previously stated, GCN consists of a set of points from the basic geodetic network and a set of points of the object (discrete points).
For this purpose, the following hypotheses come together:

$$\mathrm{H}_0 : \mathbf{M}(\hat{\mathbf{x}}_{\mathbf{s_1}}) = \mathbf{M}(\hat{\mathbf{x}}_{\mathbf{s_2}}) \text{ – } \textit{zero hypothesis} \qquad ...(13)$$

$$\mathrm{H}_a : \mathbf{M}(\hat{\mathbf{x}}_{\mathbf{s_1}}) \neq \mathbf{M}(\hat{\mathbf{x}}_{\mathbf{s_1}}) \text{ – } \textit{alternative hypothesis} \qquad ...(14)$$

where:
$\hat{\mathbf{x}}_{\mathbf{s_1}}$- evaluation vector for the coordinates from the previous epoch
$\hat{\mathbf{x}}_{\mathbf{s_2}}$- evaluation vector for the coordinates from the current epoch.
In order to examine the stability of the points of the basic network, the vector of the coordinate differences is divided into two sub-factors:
- $\hat{\mathbf{d}}_{\mathbf{s}}$ – for basic points
- $\hat{\mathbf{d}}_{\mathrm{o}}$ – for discrete points

$$\hat{\mathbf{d}} = \begin{bmatrix} \hat{\mathbf{d}}_{\mathbf{s}} \\ \hat{\mathbf{d}}_{\mathbf{o}} \end{bmatrix}, \qquad ...(15)$$

This procedure also means dividing the matrix of weights into a submatrix of weights in the following way:

$$\mathbf{P}_{\hat{\mathbf{d}}} = \begin{vmatrix} \mathbf{P}_{\mathbf{ss}} & \mathbf{P}_{\mathbf{so}} \\ \mathbf{P}_{\mathbf{os}} & \mathbf{P}_{\mathbf{oo}} \end{vmatrix} \qquad ...\ (16)$$

The square form is presented with two independent square sub forms. The first refers to the mismatch of the basic points, and the second to the mismatch of the points of the object:

$$\hat{\mathbf{d}}^{\mathbf{T}} \mathbf{P}_{\mathbf{d}} \hat{\mathbf{d}} = \hat{\mathbf{d}}_{\mathbf{s}}^{\mathbf{T}} \overline{\mathbf{P}}_{\mathbf{ss}} \hat{\mathbf{d}}_{\mathbf{s}} + \bar{\mathbf{d}}_{\mathbf{o}}^{\mathbf{T}} \mathbf{P}_{\mathbf{oo}} \bar{\mathbf{d}}_{\mathbf{o}} \qquad ...(17)$$

Where:

$$\bar{\mathbf{d}}_{\mathbf{o}} = \hat{\mathbf{d}}_{\mathbf{o}} + \mathbf{P}_{\mathbf{oo}}^{-1} \mathbf{P}_{\mathbf{os}} \hat{\mathbf{d}}_{\mathbf{s}}\ , \qquad ...(18)$$

$$\overline{\mathbf{P}}_{\mathbf{ss}} = \mathbf{P}_{\mathbf{ss}} - \mathbf{P}_{\mathbf{so}} \mathbf{P}_{\mathbf{oo}}^{-1} \mathbf{P}_{\mathbf{os}} \qquad ...(19)$$

Using the equation (10) the average discrepancy or gap is calculated:

$$\theta_s^2 = \frac{\hat{\mathbf{d}}_\mathbf{s}^\mathbf{T}\overline{\mathbf{P}}_\mathbf{ss}\hat{\mathbf{d}}_\mathbf{s}}{\mathrm{h_s}}, \qquad ...(20)$$

Where: $\mathrm{h_s} = rang\ \overline{\mathbf{P}}_\mathbf{ss}$.

Statistic test:

$$\mathrm{T}\left|\mathrm{H}_0 = \frac{\theta_s^2}{S^2}\right|\mathrm{H}_0 \sim \mathrm{F}_{h,f}, \qquad ...(21)$$

According the equation (21): If $T < F_{1-\alpha,h,f}$, than H_0 is accepted. If $T > F_{1-\alpha,h,f}$, than $\mathrm{H_a}$ is accepted.

4.1.4 LOCATING DISPLACED POINTS IN THE BASIC GEODETIC NETWORK

When the global test shows the existence of displaced points in the basic network, the displaced points must be located. Therefore the coordinate vector of the points in the basic network is divided into two sub-factors:

- $\hat{\mathbf{d}}_F$ - which contains the difference of the points coordinates which are conditionally stable, and
- $\hat{\mathbf{d}}_B$ - which contains the difference of the points coordinates that are considered as unstable.

$$\hat{\mathbf{d}}_\mathbf{s} = \begin{bmatrix} \hat{\mathbf{d}}_F \\ \hat{\mathbf{d}}_B \end{bmatrix}, \qquad ...(22)$$

The next step is division the cofactor matrix into the next submatrix:

$$\mathbf{P}_{\mathrm{ss}} = \begin{vmatrix} \mathbf{P}_{\mathrm{FF}} & \mathbf{P}_{\mathrm{FB}} \\ \mathbf{P}_{\mathrm{BF}} & \mathbf{P}_{\mathrm{BB}} \end{vmatrix}, \qquad ...(23)$$

The square form is presented with two independent square sub forms:

$$\hat{\mathbf{d}}_\mathbf{S}^\mathbf{T}\overline{\mathbf{P}}_\mathbf{SS}\hat{\mathbf{d}}_\mathbf{S} = \hat{\mathbf{d}}_\mathbf{F}^\mathbf{T}\overline{\mathbf{P}}_\mathbf{FF}\hat{\mathbf{d}}_\mathbf{F} + \bar{\mathbf{d}}_\mathbf{B}^\mathbf{T}\mathbf{P}_\mathbf{BB}\bar{\mathbf{d}}_\mathbf{B} \qquad ...(24)$$

Where:

$$\bar{\mathbf{d}}_{\mathrm{B}} = \hat{\mathbf{d}}_{\mathrm{B}} + \mathbf{P}_{\mathrm{BB}}^{-1}\mathbf{P}_{\mathrm{BF}}\hat{\mathbf{d}}_{\mathrm{F}}, \qquad ...(25)$$

$$\overline{\mathbf{P}}_{\mathrm{FF}} = \mathbf{P}_{\mathrm{FF}} - \mathbf{P}_{\mathrm{FB}}\mathbf{P}_{\mathrm{BB}}^{-1}\mathbf{P}_{\mathrm{BF}} \qquad ...(26)$$

For every point from the basic geodetic network an average discrepancy is calculated:

$$\theta_j^2 = \frac{\bar{\mathbf{d}}_\mathrm{B}^\mathrm{T}\mathbf{P}_\mathrm{BB}\bar{\mathbf{d}}_\mathrm{B}}{\mathrm{h_B}}, \text{ за } j = 1,2,\dots,k. \qquad \dots(27)$$

$\mathrm{h_B} = rang\ \mathbf{P}_{BB}$ ($\mathrm{h_B}$ =2, for two-dimensional network).
In the set of k – points, the point with maximum value θ_j^2 is recognized and the point that responds to θ_{max}^2 it is said to be displaced and it is removed from the basic geodetic network.
For the remaining k-1 points an average discrepancy is calculated:

$$\theta_{REST}^2 = \frac{\bar{\mathbf{d}}_\mathrm{F}^\mathrm{T}\mathbf{P}_\mathrm{FF}\bar{\mathbf{d}}_\mathrm{F}}{\mathrm{h_s}-2}, \qquad \dots(28)$$

Followed by the statistic test:

$$\mathrm{T}\,\Big|\mathrm{H}_0 = \frac{\theta_{REST}^2}{S^2}\Big|\,\mathrm{H}_0 \sim \mathrm{F}_{h,2,f}. \qquad \dots(29)$$

If $T < F_{1-\alpha,h,f}$, then $\mathrm{H_0}$ is accepted and we conclude there are no displaced points If $T > F_{1-\alpha,h,f}$, then $\mathrm{H_a}$ is accepted. If this is the case, the procedure is repeated until the test (29) shows that there are no displaced points in the network.
After the procedure, the points in the basic network are divided into displaced and unmodified. In further analysis of the GCN, displaced points from the basic network are treated just like the points of the object.

5. ANALYSIS OF THE POINTS STABILITY OF THE GEOPOLYGON "NOVOSELKA" WITH THE APPLICATION OF THE HANNOVER METHOD

For this practical procedure, a test of stability of GCN of the geopolygon "Novoselka" was carried out on the territory of municipality of Novo Selo (Vučkov, 2000).
The geopolygon as GCN consists of 21 points of which: 11 points of the basic network and 10 points of the object - the dam. In this procedure, the points from the basic network in the GCM are analyzed, and they serve as a geopolygon for the examination of other methods and calibration of geodetic instruments. The points of the basic network are stabilized in a geologically stable field, they are numbered with Arabic numerals from 1 to 11 and represent reinforced concrete pillars on which a forced centering system is

installed, with the exception of point No. 11 on the platform and it is stabilized with a metal wedge with dimensions of 10 mm x 100 mm. The test is only for the points of the basic network (Fig. 1) with an adopted plan of measurements of routes and lengths.

The general data for the core network are the following:

$m=$	11	-	Number of points
$D_{min}=$	87	-	Minimal length
$D_{max}=$	2082	-	Maximal length
$\overline{D}=$	611	-	Average length

The measurements were performed in 1996 and 1997 with duration of (Vučkov, 2000):

- Epoch 96 – seventeen consecutive days
- Epoch 97 – fourteen consecutive days

Table: 1: Specifications about the basic network in two different epochs (Vučkov 2000).

	Epoch 96	Epoch 97	
$n_{directions}$	85	87	Number of measured directions
$n_{lengths}$	35	44	Number of measured lengths
n	120	131	Total number of measurements
$\hat{\sigma}_0^2$	0.289’’	0.424’’	Dispersion coefficient of equalization
f	90	101	Degrees of freedom
σ_0^2	0.64’’	0.64’’	Dispersion coefficient a-priori

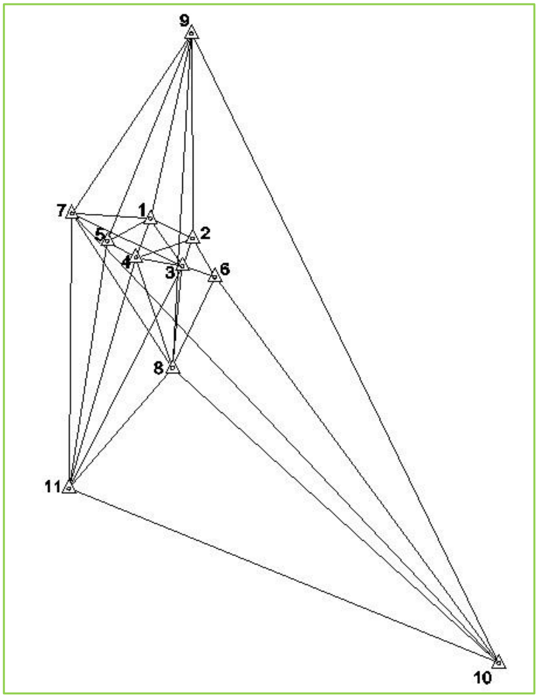

Fig.1: Geodetic network in the Geopolygon "Novoselka"

Table 2: Definitive coordinates (Nasevski, 2001)

Point	1. Epoch 96		2. Epoch 97		Difference [mm]	
	Y(m)	X(m)	Y(m)	X(m)	d_y	d_y
1	877.2302	1059.6939	877.2294	1059.6945	-0.8	0.6
2	999.9983	1000.0037	999.9982	1000.0032	-0.1	-0.5
3	969.9750	918.2695	969.9748	918.2689	-0.2	-0.6
4	835.7537	943.1784	835.7538	943.1796	0.1	1.2
5	752.2227	992.2113	752.2224	992.2120	-0.3	0.7
6	1064.0471	885.0298	1064.0478	885.0315	0.7	1.7
7	650.5019	1074.5252	650.5014	1074.5256	-0.5	0.4
8	941.3904	613.2868	941.3961	613.2851	-4.3	-1.7
9	996.1649	1612.4060	996.1667	1612.4084	1.8	2.4
10	1885.4414	-269.6264	1885.4447	-269.6286	3.3	2.2
11	642.0835	252.8102	642.0837	252.8080	0.2	-2.2

First of all, an analysis of the homogeneity of measurements in both epochs was made whose characteristics are given in Table 1 for Epoch 96 and

Epoch 97 based on hypotheshys (3 and 4) and statistics test (5 and 6), the following results were obtained:

$$\mathrm{T} = \frac{s_2^2}{s_1^2} = 1.467 < 1.617 = F_{0.99}(90{,}101),$$

therefrom, the hypothesis H_0 Is accepted, meaning that measurements in both epochs are with homogeneous accuracy and the dispersion coefficient $\sigma_0^2 = 0.64$ is accepted. The definite values of positional coordinates of the points obtained on the basis of previously carried out mediate equalization with minimal trace in all points of the basic network are given in Table 2. The global test (21) upon the previously calculated gap based on (20):

$$\theta_S^2 = \frac{\mathbf{d_s^T \bar{P}_{ss} d_s}}{\mathrm{h_{ss}}} = \frac{60.744}{19} = 3.199,$$

$$\mathrm{T} = \frac{\theta_S^2}{\sigma_1^2} = 4{,}999 > 1.641 = F_{0.95}(19{,}191),$$

it was concluded that in this set of points, there are one or more displaced points.
After this conclusion, the localization of the displaced points was reached, where five iterative procedures were carried out. It has been confirmed that points **8, 6, 4, 9** and **10** are displaced. By removing these points, the statistic test showed lower value of the quantile and the zero hypotheses was accepted, meaning there are no displacements for the other points of the basic network. The results are given in the Table 4.

Table 3: Short preview of the results of shifted points determined by the Hannover method in five interactive procedures.

Number	k	α_k	h_s	**Shifted point**	$T(H)$	$F_{1-\alpha,h_s,f}$
(0)	11	0.05	19		4.999	1.641
1	11	0.05	17	**8**	3.192	1.677
2	10	0.04556	15	**6**	2.826	1.744
3	9	0.04110	13	**4**	2.302	1.829
4	8	0.03661	11	**9**	1.961	1.940
5	7	0.03211	9	**10**	1.717	2.091

The results from the the carried our procedure for the same points by using the Munich method, undertaken from Nasevski, 2001, for the purpose of analysis of the both methods, are given in the Table 5.

Table 4: Short preview of the results of shifted points determined by the Munich method in four interactive procedures (Nasevski, 2001).

Number	m'	$\alpha_{m'}$	h_s	**Shifted point**	$T(H)$	$F_{1-\alpha_{m''},h_s,f}$
(0)	11	0.05	19		4.999	1.641
1	10	0.04556	17	**10**	5.075	1.644
2	9	0.04110	15	**9**	5.238	1.715
3	8	0.03662	13	**6**	4.960	1.804
5	7	0.03211	11	**8**	1.009	1.921

6. CONCLUSIONS

The deformation analysis procedure using the geodetic methods is an extensive and serious work that requires special attention. The Hannover method is a commonly accepted method for implementing such processes, due to its simplicity and high transparency of processes in the procedure up to the end result. Comparatively corresponding results obtained by the practical part of the paper and ones obtained by the method of Munich of the test polygon “Novoselka” (Nasevski, 2001) using the same measurements, define this method as acceptable and adequate for such procedures. Based on the results give in Table 3 and Table 4, it is clear that the both aplied methods have identified identical points as unstable, as the points 10, 9, 6 and 8, and the difference is located in point 4, where it is shifted according to the Hannover method, whilst it is stable according to the Munich method.

The main disadvantage of this, and of all static methods is the time period of performing the measurements, in which we assume that deformations have not occurred. In the analyzed GCN for the this paper, the time period of measurement in both epochs is in average 15 days, during which there may not and should not ignore the fact that some deformation occurred as a consequence of some internal or external forces which affect the ground on which the points are stabilized. Such deficiency of static methods, and thus of this method, puts them in a subordinate role compared to dynamic methods. Therefore, when applying static methods, greater attention should be paid to the duration of measurements in order to avoid possible deformations occurring during measurement.

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PRECISE GEODETIC MEASUREMENTS ON STRUCTURS OF BLACK METALLURGY

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SUMMARY

The need for precise geodetic measurements for the determination of deformations of structures placed in facilities of black metallurgy is a great challenge for every geodetic expert. The very specific way of carrying out this type of measurements is related to the special conditions for their performance, as well as the need to ensure high accuracy in the determination of deformations on the structures.
In the concrete case, deformations are obtained by processing highly precise optical measurements on the basis of which all further alignment and on-site machining activities were planned for supporting the process of hot rolling mill stand housing windows refurbishing and its evaluation for misalignment improvements.
With this paper, the members of the Chair of Advanced Geodesy at the Faculty of Civil Engineering in Skopje want to demonstrate the universality of the geodetic deformation measurements and the concrete application in determining deformations of the mill stand which is an industrial plant with special significance for the production capacities of „Makstil" SC – Skopje.

Key words: Mill stand, precise geodetic measurements, deformations.

PRECISE GEODETIC MEASURMENTS ON MILL STAND IN SC "MAKSTIL" - SKOPJE

The mill stand is the most important plant in the industrial complex - the hot rolling mill of „Makstil" SC - Skopje, which is used for making thick tin sheets. The dimensions of the building are 10 x 5 x 6 meters.

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Due to lack of position tolerance of housing windows many product quality and equipment damage problems are possible. The mill survey summarized results and recommendations are considered in three distinct areas as follows (Jankuloski, B. et al., 2011):

1) Housing windows
2) Bottom plate
3) Top separator

Of particular importance for the production process is the bringing of the industrial construction into a position of its projected position, which implies the verticality of the carriers of the mill stand and the horizontality of the bedplates that are located on its bottom.

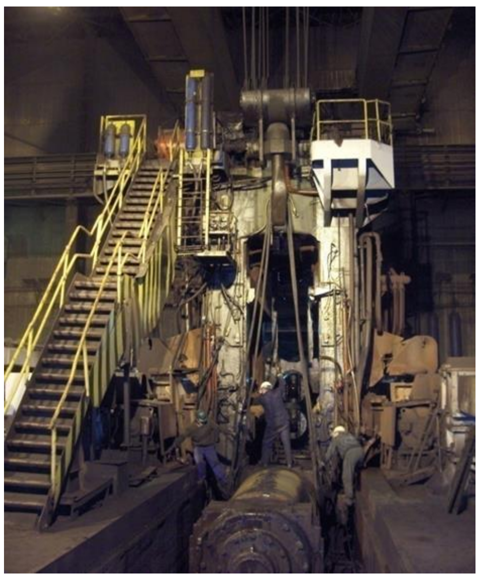

Figure 1: Mill stand construction in hot rolling mill - “Makstil” SC - Skopje

The conducted geodetic measurements in the period 4 - 8 January 2010 at an average temperature of 1˚C, covered the following activities:

- Defining the verticality of the structure through the verticality of carriers and worktops of mill stand in the direction of transport of the material;
- Defining the verticality of the construction in the direction of Roll Change Side - Drive Side;
- Defining the parallelness of the carriers of the mill stand;
- Defining the horizontality of the bedplates and rails in the mill stand;

- Defining the horizontality of the reducer located at the top of the mill stand. (Srbinoski Z., Bogdanovski Z., 2010).

Before the start of the measurements for each previously mentioned position, appropriate sampling of the construction with a certain number and layout of measuring points was carried out.
In addition is shown the layout from part of the points used for checking the verticality of the construction from the front side of the mill stand.

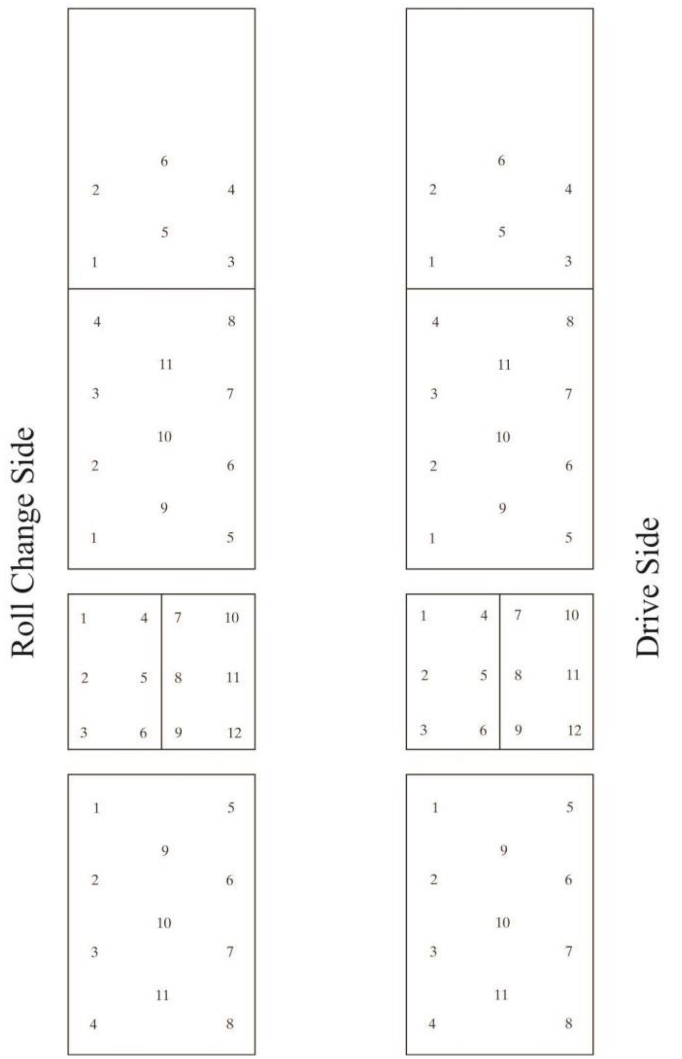

Figure 2: Location of measuring points on the entrance part from the mill stand

GEODETIC MICRONETWORK AND INSTRUMENTS FOR PERFORMING OF THE PRECISE GEODETIC MEASUREMENTS

For quality and precise determination of the deformation sizes when using the geodetic deformation measurements, the quality and accuracy of the geodetic basis, which determines these sizes, is of great importance.
Considering the specificity for carrying out geodetic measurements in industrial plants, when designing the geodetic network there are additional conditions that need to be met with regard to the design of such type of networks that serve for deformation measurements of objects and constructions in normal external conditions. First of all, this refers to the illumination of the construction and the space which contains a number of physical obstacles that disable the optical visibility within a network that is actually more than necessary (Figure 3).

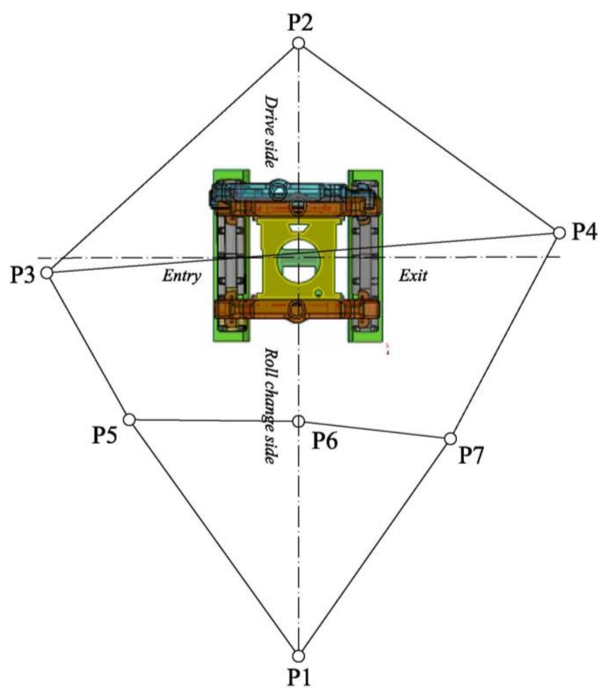

Figure 3: Layout of the geodetic network for deformation measurements in the mill stand

Based on the previously stated characteristics and possibilities that are present in closed industrial facilities, as is the case with the mill stand, the design of the network was correlated with the set tasks for examining the verticality of the construction. In the part for determining the horizontality of certain surfaces of the construction, the benchmark was used in the immediate vicinity of the mill stand which is part of the leveling network in the plant.

When it comes to precise measurements such as geodetic deformation measurements, it is more than important to use the appropriate measurement technology to carry out the measurements. The term proper refers to the relationship between the declared accuracy of the instruments and their ability to be used in the special conditions present in the industrial capacities. The accuracy of the used geodetic measurement technology in determining the deformations of the mill stand corresponds with the aforementioned characteristics. A high precision total station Trimble S6 - 1” with declared angular accuracy of ± 1” was used to determine the verticality of the carriers and a measurement accuracy of ± 1mm + 1PPM. In order to determine the horizontality of certain surfaces of the construction, the Trimble DiNi digital precise leveling instrument with a precision of ± 0.1mm was used. (Srbinoski Z., Bogdanovski Z., 2010).

Figure 4: Total station - Trimble S6

Figure 5: Leveling instrument - Trimble DiNi

RESULTS OF THE PRECISE GEODETIC DEFORMATION MEASURMENTS ON MILL STAND

In the direction of the previously set goals, the performed activities, as well as the conducted calculations and analyzes, the results of the geodetic deformation measurements of the mill stand were in accordance with the expectations for the deformation of the construction relative to the projected state.

The results of the conducted geodetic deformation measurements indicated to a more comprehensive analysis due to the nature of the construction and determination of sizes that need to correct the deformed to theoretical projected state. Exactly from this point of view for this type of measurement requires control and verification of the results by independent type measurements. An example of this is the mutual confirmation of the results of the non-verticality of the carriers and the non-horizontality of the reducer at the top of the construction.

When it comes to the specific results of the frontal verticality (Roll Change Side - Drive Side), it should be emphasized that this condition is determined based on measurements of 40 measuring points placed on the worktops on the entrance (Ingoing) and exit (Outgoing) side of the mill stand. From the measurements of these points, the mean vertical planes were determined for each of the plates, and then the deviations of those planes from the axis of the construction were analyzed. With positive sign are the deformations of the points on the outer sides of the vertical plains, and with negative sign are the deformations of the points that lie between the vertical planes and the axis of the construction.

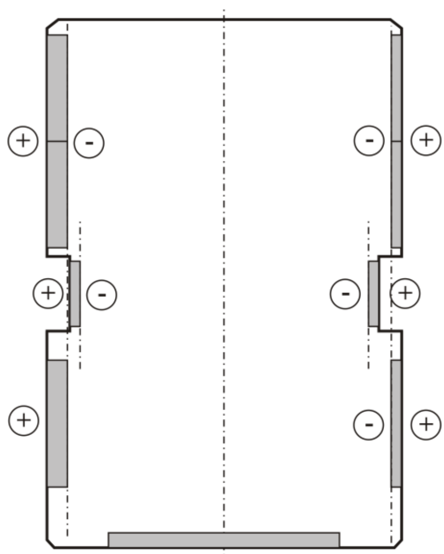

Figure 6: Sign of the deformations on the frontal verticality

The results showed that deviations from the vertical at the points located on the front (Ingoing) side of the construction moved in the range from **-1.1 mm** to **+1.0 mm**, while deviations from the vertical in items that are on the output (Outgoing) side are moving in the range of **-1.9 mm** to **+2.6 mm**.
Interesting are the results obtained from the examination of the mutual lateral side parallelness of the carriers on the construction that indicated a relatively good parallelness with a maximum deviation defined on the basis of the mean verticals of 0.5 mm.

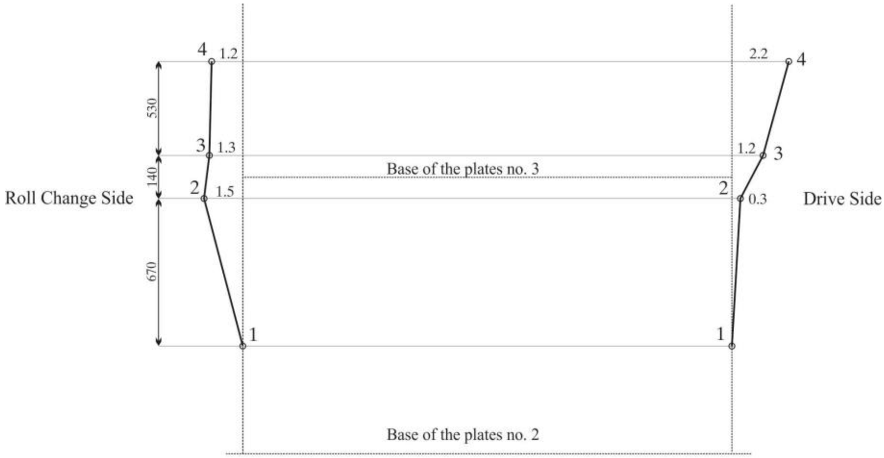

Figure 7: Lateral verticality of carriers measuring points – position Entry

The concrete results of the geodetic deformation measurements for determining the lateral verticality of the construction (Input - Output of the material) was determined on the basis of measurements at 8 points placed on the sides of the worktops Roll Change Side and Drive Side.

Figure 8: Local unevenness on the worktops

It should be emphasized that the selection of the points was based on the suggestion of the experts from Makstil, and the possible irregularities in the production of the plates (different widths and local unevenness - Fig.8), as well as the possible non-parallelism of the worktops with the construction carriers - directly influence the determination of the deviation from the vertical.

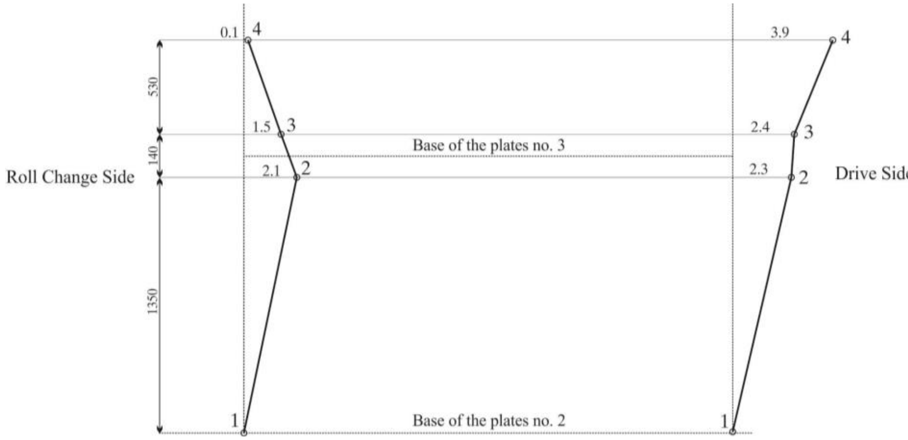

Figure 9: Lateral verticality of carriers measuring points – position Output

It is interesting to point out that the deviations from the vertical of the Drive Side points were tended towards the engine, with the mean angular deviation from the vertical of the entry and output carrier at 0º 06 '01 "corresponding to a linear deviation of **1.8 mm/m**. As regards the deviations of the Roll Change Side points, it should be noted that they were smaller and within the accuracy of manufacturing of the plates.

Further analysis of the results was related to the conducted leveling measurements to determine the horizontality of certain surfaces within the structure. At the beginning, the determination of the so-called Pass Line - the baseline in relation to which the other horizontal planes are defined. The materialization of this line was carried out on the recommendation of the investor as a tangential line of traction cylinders.

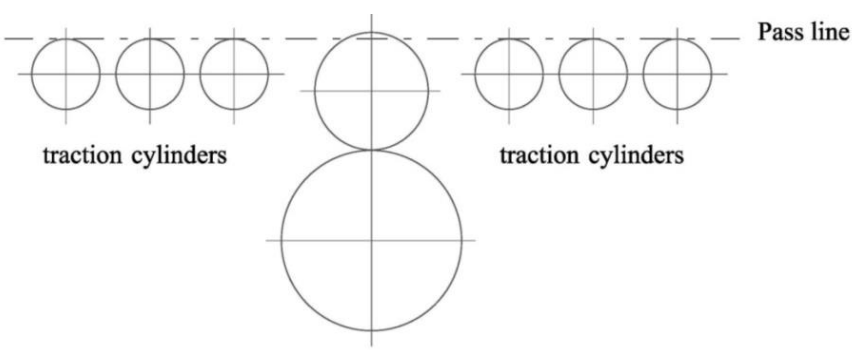

Figure 10: Defining the basic horizontal line - Pass Line

Given the fact that to a greater extent these cylinders were in un-level state, the Pass Line - the baseline was defined by the average height of the first internal traction cylinders.

Based on the defined main horizontal line are determined deviations from individual tangents of traction cylinders in relation to her.

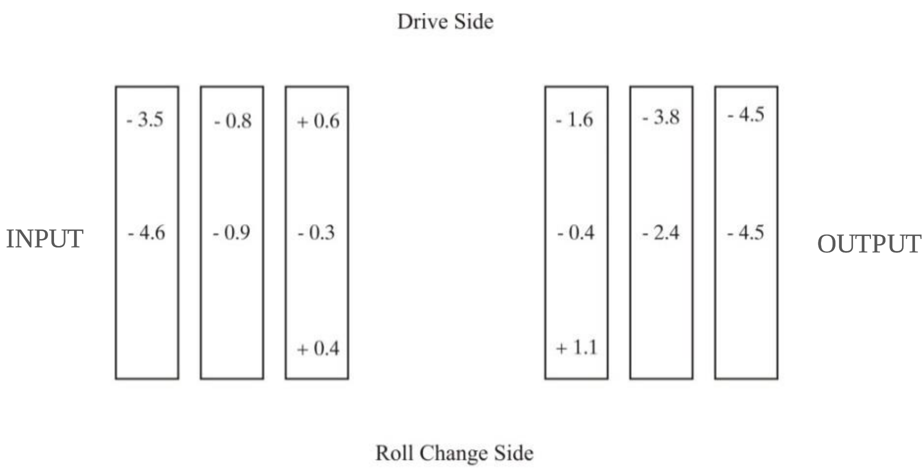

Figure 11: Deviations in relation to Pass Line registered at the measuring points of the traction cylinders

The largest deviations of the traction cylinders appeared on the most distant cylinders (relative to the axis of the object) and they were **-4.5 mm**.

The deviations of the horizontality of the bedplates were also determined. The median height difference between the Roll Change Side and Drive Side plates was 1.7 mm, which showed the un-leveled surface of Drive Side in relation to the Roll Change Side.

Last of the planned tasks was determining the horizontality of the reducer mounted on the upper mill stand in the area of Drive Side. From the obtained results of the leveling measurements, it is concluded that the maximum inclination is in the direction of Roll Change Side - Drive Side.

For a better display, the deviations are displayed relative to the endpoint seen toward the Roll Change Side page, marked with number 1.

This inclination was 3.1 mm, that if we take into account the distance between the measurement points corresponding to the relative inclination of 1.9 mm / m. This result fully corresponds with the results of the examination of the lateral verticality of the carriers of the construction of the mill stand.

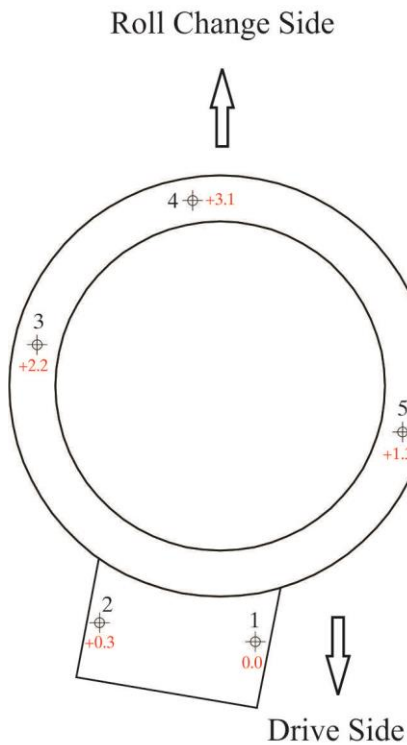

Figure 12: Deviations registered at the measuring points of the reducer relative to point 1

CONCLUSION

The significance of geodetic techniques and technologies in determining deformations on structures of black metallurgy is of great importance. It can be freely stated that geodetic deformation measurements of industrial structures have a leading role in monitoring the working life of such type of constructions, as well as in obtaining information on the state and condition of these constructions. The very importance of industrial structures leads to the need for constant control of the theoretically set constructive characteristics and determination of their eventual changes. Apart from their particularity from the aspect of the specific conditions in which the production activities are carried out and the need for continuous activity of the production process, these objects are included in the group of constructions "dependent" on geodetic deformation measurements. Therefore, the use of geodetic deformation measurements is inevitable in determining the changes in the structural elements in relation to the theoretically set conditions for the optimal functionality of the industrial plants and, consequently, the industrial capacities as a whole.

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