

# **The Challenges of Border Demarcation Kosovo-Macedonia**

**Murat MEHA, Behar SELIMI, Republic of Kosovo**

**Key words:** Border demarcation, geodetic measurements, GIS, Kosova

## **SUMMARY**

The article is based on border demarcation between the two new countries in the Balkans. The author of this article is a direct participant of demarcation researches, in confrontation with many different challenges but at the same time trying to solve acceptable solutions for the both side.

Determination of territories at any level has always shown special challenges. After the World War II and colonization many unclosed cases had remained related to states' territorial determination. Even in undeveloped continents such in Africa, Asia and in Latin America in the second part of XX century new territorial determinations were done. There are more than hundreds of unclosed border cases between different states around the world. The main factor that affects changes in territorial determination is the different natural resources as a very important source in economical development. New born countries need new demarcation with unique specifications. These specifications are directly related with states' creating factors, with diplomatic inter-state relations and with the local factor. Border determination process has four specific phases. The border between Kosovo and Macedonia has an interesting specific, where the delineation of Kosovo's border in 2001 was done by other teams without the presence of Kosovo's team.

Border demarcation challenges of the commission that worked during April 2008-December 2009 are: collection and harmonization of archival documentation for the defined border line, finding the geodesic (points) in the region and the locating of border point-pyramids, GPS system review, combination of GPS measurements with permanent stations with temporary references, the next challenge was total station. Communication with local residents about the defined border line was important because their homes were left on the other side of the border, and trying to manage their properties was very complex. The inter-state border is defined only when the commission, the surveyor, and the respective team set the point-pyramids in the border line, determine their coordinates precisely, fulfilled with the respective documentation. During this process, the surveyor confronts with the challenge of selecting the basic geodesic points, with the challenge of reaching standard deviation in measuring, region challenges and with local inhabitants.

In this article is shown the general and the specific system of border demarcation between the Republic of Kosovo and the Republic of Macedonia during 2008-2009.

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## 1. INTRODUCTION

New born countries around the world started mostly to create at the beginning of the last century. It was the beginning of empires' dissolution, colonies' decomposition and the increase of people's awareness for independence. The creation of new orders with new economical-political systems had an important impact on people for self-determination. This also happened in South-East Europe territory where new national states create, but also other states create too with different territorial national combination. In this case, Kosovo declares its independence in February 17<sup>th</sup> 2008, as the 193<sup>d</sup> state in the world. In Ahtisaari's document was included the border line between Kosovo and Macedonia which was approved in 2001 between Serbia and Macedonia. Knowing that since 1991, until now in the world have been created 35 new states, so this could relate to the quote: "You live in the age of interdependence. Borders don't count for much or stop much, good or bad anymore." - President of the USA, Bill Clinton 2001. New state's border demarcation is based in state's Constitution (Constitution 2008).

Demarcation is based in few dominant factors, as in: historic factors, legal facts and the demarcation that the pairs have available. In most of the cases of state border demarcation, the importance of the surveyor and of the geodesic measurements is incontestable, which will be used in work's following.

From a general point of view, border demarcation has developing periods where the main aim is the solution of acceptable and sustainable choices. Exploring the set out problems, the reached progress in different time phases, gained implemented results from the commission and the maintenance of the border is the integral of state border. Some of these phases of state's border are current even in other states that now have the sovereignty and integrity, but that join the European Union. This implicates the union of sovereign states in union's frame.

Different authors have highly contributed on the determination of state-international borders as (Archer, N. 2006). The ground border could be combined with three forms of its placement in the ground:

- Geometric determination of the border
- Determination based on physiogeographic factor
- Determination based on anthropogeographic factor

**Geometric determination of the border:** this form of state border demarcation is based on the exertion of straight lines, arched, parallel, meridians, circle, sector, etc. Also other factors as physiographic factor, but the anthropogeographic factors are not reviewed. This is the easiest form of border's determination, considering the parcels of the border defined previously in the Cadastral Information System. This form of border determination between the Republic of Kosovo and the Republic of Macedonia we have exploited when the parcel border is matched

with the state border, as seen in fig 1. Also this form of determination of the border line is exploited in flat terrains, and when there were no special natural objects.

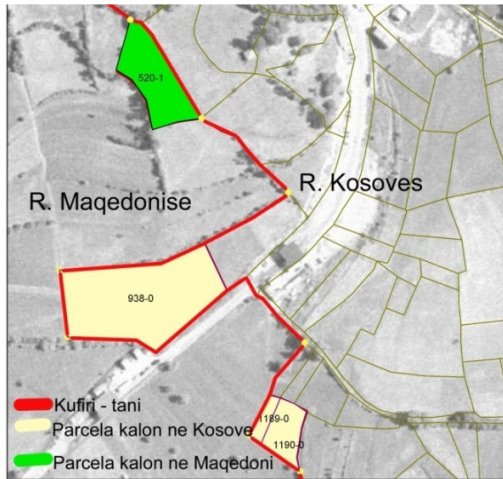


Fig.1. The border line near Gllloboqica

Fig.2. Border line that crosses highest points

**Physiographic factor:** physic geographic features of the terrain are very appropriate for state border determination in high points, watershed lines, water reservoir lines and in other characteristic geographic lines. Analyzing point's positions that are appropriate for the stability and their sustainability, it is concluded that the demarcation in these lines, physically is very difficult. These difficulties were also proved in Sharri's high mountains, where the border line crosses the sea levels over 2000m, see fig.2. The main challenges on determining the border line in previous mentioned terrains, are especially expressed on finding the ways for material's conveyance to stabilize the border pyramid and for geodesic measurements in determining their coordinates. See picture 3.



Fig. 3. a) Helicopter on border demarcation

b) Geodetic field works .

**Anthropogeographic factor:** anthropogeographic factor in state's border line determination is based on line analysis of ethnics, cultures, language, religion, and in cadastral lines of the territories. This demarcation form is complex, especially in mixed dwellings. For this it is required more time and analysis together with local inhabitants. In border demarcation of Kosovo-Macedonia this edition was not analyzed but only the factor of cadastral data. At the both sides of Kosovo-Macedonia border, we have only Albanian dwellings and Albanian population. Dwelling borders from land registration in cadastre was a convincing factor for local inhabitants in accepting the border line demarcation. Border line determination between the Republic of Kosova and the Republic of Macedonia has unified three types of borders in the region:

- Border of parcel
- Border of Cadastral zone
- State border

Of course, after consulting and from documentation's analysis, communication with the local inhabitants for the border line has enabled necessary modifications and the approval from the mixed commission of both states. The conveyance of data for Immovable property's Registration in the Registers of the Cadastral Information System is done according to laws and legal acts of each state. Land administration transferred into the other state, obey to land administration rules of the state were they register.

## **2. GEOGRAPHIC EXTENSION AND COMPOSITION OF KOSOVO-MACEDONIA BORDER ZONE**

The border between Kosovo and Macedonia is a separating line with 173km length, and it is classified as a ground border. Border line's geographic extension is east-west in the south part of Kosovo and in the north part of Macedonia. Now the determined border line in the terrain is clear from low and high vegetation of 3m width at both sides of the border. The border that crosses Lepenci River is a particular example. Geographic extension of the border line is mostly at mountains' peak and at different lowlands. Border line points in Sharri Mountains have an altitude of 2500m above the Adriatic Sea level. In lower areas, points of the border line are in a quota of 300m. Different challenges even the interest in border demarcation and the geological composition of the terrain has preceded to it.

Geological composition of the terrain at the border line between the R. of Kosovo and the R. of Macedonia is very complicated with the presence of geological formations, Geologic map of Kosova 2003. These formations are of the oldest geological age up to the newest ones.

The border starts from the pyramid where the border of Albania-Macedonia-Kosovo meets, and from there upper Paleozoic formations appear crossing the zone with a segment of 38km. These formations mostly are built of crystallized schist with different composition. From the new quaternary formations in this area appear lake sediments and river terasa.

Lower Paleozoic formations have appeared in a length of 35km, mostly composed of philytes, epidote etc. Middle Triassic formations appear with 6km length after the previous mentioned middle Triassic formations, mostly built of limestone and dolomites. After 22km from the

border, appears the lower Paleozoic formation composed of epirot and chlorites. In this segment's frame appear the magmatic rocks with length of 5km.

Lower Paleozoic formations mostly composed of phylite, biot, epidot appear in the following 4km length. In 13km segment appear middle Jurassic formations, composed of gabbro-magmatic rocky formations, periodites and dunites. In 22km segment appear Cretaceous formations mostly built of conglomerate limestone. The other length of 15km has lower Paleozoic formations, composed of muskovitbiot schist. In a segment with 9km length again appear cretaceous formations built of limestone, conglomerates. At the end of the border line near the border between Kosovo-Macedonia-Albania, appear middle Jurassic formations mostly built of basalts. This formation appears with 4km length at the end of the border line meanwhile it continues further.

Combined composition with different geological appearance offers future research opportunities not only of the age of formations but also of other geological compositions that would relate different studies of correlation of Kosovo's territory with other neighbor countries. These formations offer the possibility of common geological researches of both states for country's economical development. This geological composition of formations, guarantees the stability of the land where are placed the pyramids-border points.

### **3. CONSULTATIONS AND DECISIONS OF POLITICAL LEVEL**

Determination and organization of border demarcation commission between the R. of Kosovo and R. of Macedonia, is based in the document of ex Finnish President, Ahtisaari (<http://www.Kosovo-status-process>), who has worked in finding the proposal for the solution of Kosovo's status. After Kosovo's declared independence on February 17<sup>th</sup> 2008, the obligations that were from Ahtisaari's document should be fulfilled at the set forth time period. Political, diplomatic and economic developments in the independent Kosovo influenced on determining Kosovo's commission for border demarcation with the R. of Macedonia. Macedonia's demarcation commission was determined earlier because of the previous determined border lines with other neighbor countries. Demarcation border was an important factor for knowing and creating new reciprocal diplomatic relations between the two states. The first common meeting of mixed commission was held in the International Civil Office (ICO) in Prishtina. The mixed commission of two states has continued the working according to the signed protocol on April 18<sup>th</sup> 2008 in Skopje. In this meeting participated the representatives of both of the commissions, also ICO and American Administration representatives. Consultations of political level still continue between the three states on locating the pyramid at the meeting point of the three borders: Kosovo-Macedonia-Albania. The pyramid at the border between these three states is placed in an altitude of 2092m, on the presence of three states' and ICO representatives in Prishtina.

#### 4. PUBLIC COMMUNICATION, TRANSPARENCY AND SECURITY

Public communication for border demarcation is a submitted task at the beginning of the work when the proposal for commission's work was prepared.

Public communication in demarcation's case is separated in three levels:

- Communication with local inhabitants in the border zone.
- General public communication and
- Communication of political level.

The welfare process is related with the sincere communication with the inhabitants, the properties of whom will be touched from the demarcation line. It was explained to them fairly and detailed about all the possibilities to their own bests or to their damages.

Communication with the local inhabitants is very important, because the main challenges are expected to come from those positions. This information is done in different manners but also through direct conversations in the terrain. Presented documentation, security, surveyor and detailed clarification have the main word.

Public communication, especially the communication with wide opinion is done through electronic and written media, so this information form is directly related with the requirements of local inhabitants. This is also depended from the opinions of local inhabitants. A concrete case of demarcation, local inhabitants from the both sides of the border are Albanian nationality, so border determination has influenced on their family relationships.

Communication of political level is very necessary to create the conditions and convenience on taken decisions from the decision takers. Time after time direct meetings in four levels are: meetings with government representatives, meetings with local government mainly with the mayor and municipal advisors, meetings with local inhabitants from Kosovo and also from Macedonia. This communication's aim is to clarify demarcation's flow, challenges, perspectives and the whole process.

Previous analysis clarify that communication and transparency are two components that make the process easier and accelerate the realization of whole demarcation. So within a year the physical demarcation is realized between the border of Kosovo and Macedonia. All disagreements are relativities at the foreseen time giving the demarcation process a normal flow.

Security continues to be important to the welfare of demarcation process. At Kosovo-Macedonia border zone were no conflicts between the two states, but there was an armed conflict among Albanian citizens of R. Macedonia and government's armed forces, because of their dissatisfaction about their discriminated position in the R. of Macedonia. This conflict has happened in 2001, and it occurred at the border zone, in Macedonia's territory, in Tanushe, Mjak, Sllup, Matej, Stanqiq villages, etc. These villages are inhabited only by Albanians, who are kindred with the inhabitants of R. of Kosovo villages. In February 2001 was signed an illegal agreement for border demarcation between ex-Yugoslavia and R. of Macedonia. This move was a step, that even the local inhabitants understood that it was a direct attack for their properties separation. Since then up to 2008, at border zone villages appeared armed groups and time after time they used to control the zone. So, the demarcation commission has taken certain

steps in communication and security practice at the border zone. Some of the important actions related with communication and security of border demarcation are:

- Naming of observer – village’s representatives of most problematic part along the border line. This has created a direct communication between the commission and local inhabitants.
- Increasing of Kosovo’s police patrols and their communication with the inhabitants about border signs not to be removed as it was done in practice at the beginning of the process.
- Technical team for placing the signs and pyramids at the border line was always associated with patrol groups in terrain.
- Common border police patrols from both states, move along the border line, and have an importance because they imply that the border line no longer will be a separating line, but a union line.

## **5. METHODOLOGY AND RESEARCH ABOUT BORDER DEMARCATION**

### **5.1. Researches of documentation for border line**

Relevant factor for determining separation line between the two states is demarcation. Documentation can be diversified as: graphic documentation, textual or in different images. The actual documentation and archive-historic documentation should be consulted so then to achieve to reality on state’s border line determination. Author Frances L. Pollitt 2008, analysis and evaluates the created documentation, maps and letters from David Thomson (1770-1857) about USA-Canada border. As for us we don’t have such an old documentation but the comparisons are always possible.

The R. of Kosovo as a formed state two years ago, has large gaps of graphic and textual documentation. These documentation gaps have made many difficulties even in defining properties and in general in land administration, as it is explained in articles of Meha M. 2008 a. b. Exploited documentation for border demarcation Kosovo-Macedonia is presented as follows:

- Topographic map in scale 1:25000;
- Cadastral map in scale 1:500 – 2500;
- Various sketches from early periods of surveying;
- Coordinative tables of basic geodesic points and their description;
- Reference network in one or another state’s territory;
- Transformation rates from the coordinate system of one state to another, because both of the states have different projection and ellipsoid projection.

### **5.2. Geodetic measurements on determining coordinate points of border line**

Geodesic measurements have started one month later after stabilizing points-pyramids in terrain. Determination of pyramid coordinates in border line between the two states is necessarily to be done from geodesic basic networks of both states.

Border line between R. of Kosovo and R. of Macedonia has a length of 173km where the main and auxiliary pyramids are placed. General number of located pyramids in terrain is:

- 1 pyramid in three borders (triple pyramid )
- 67 main pyramid
- 365 auxiliary pyramid
- 4300 mathematically determined points

Main and auxiliary pyramids are made of reinforced concrete, but some auxiliary points are made of natural rock or of any other object.

Shape and size of the points is shown in the following figures see fig. 4.

For each pyramid located in the border line, geodesic measurements were done according to previous certain criteria, shown in the following table (see **Instructions**). Measurements were done with GPS system, Leica type 530.

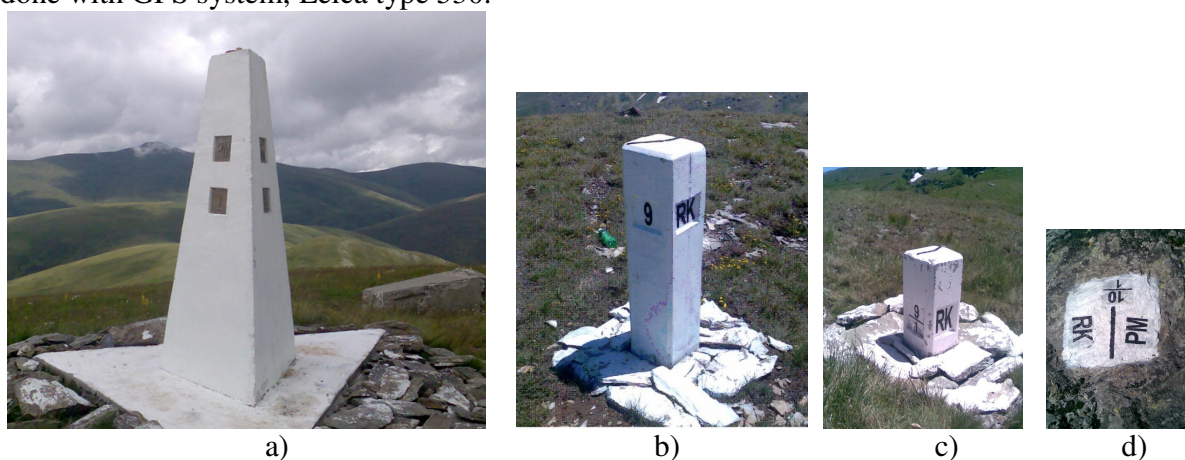


Fig. 4. a) Pyramid triple point, b) main pyramid, c) auxiliary pyramid, d) natural rock

Procedure of measurements and other characteristics are shown on table 1.

Table 1.



Procedure-measurement technique	Minimum number of satellites	Minimum duration of measuring	Typical horizontal accuracy	Other characteristics
Statics	4	1 hour	Two frequency: 5 mm+ 1ppm	For the application of the two-frequency receivers there must be no limitations of the base line
Statics	4	1 hour	Two frequencies: 5mm+1ppm	For the application of the two frequency receivers there must be no limitations of the base line
Rapid Statics	4	8-30 min.	Varies between the accuracy of the statics and kinematic method of 5mm+1ppm up to 1 cm+2 ppm	The procedure is the same as with the statics method, but the duration of the measuring time is shorter
Kinematic method with additional processing PP Kinematic	4	2 stages	1 cm+ 2 ppm	The base line is limited to approximately 10 km. The receiver requires 5 satellites to conduct the OTF initialization. The mobile receiver must be initialized with centimeter accuracy.

Realized accuracy on determining pyramid's centre coordinates is  $\sigma = + 3\text{cm}$ . This result is achieved by respecting previous determined criteria. We fulfilled all necessary standards during the GPS measurements, because this was our intention, Martin 2008.

According to geodesic measurements as necessary information, full aerophotogrametric survey of border line is done in band of 6 km.

### 5.3. Transfer of properties from one state to another

Properties in the process of border demarcation have specific treatment in previous analysis of border pyramids placements. In all territory of Kosova we are faced with different type and quality of cadastral data, (Meha, 2007). This is directly in relation with the Developed Policy, and Governance of land administration of the country, (Burns, T. Dalrymple K. 2008; Grindle, M. S., 2007.). Based on delineation of border line happen to predict properties' separation or certain properties to remain on the other side of the border with the owner. Until now, all of the property owners are interested to stay in that side which they've been living until now.

Surveys made in terrain, 91 property owners that eventually the property could remain on the other side of the border are as following on the table 2.:

Table 2

Do you want your property to be on the other side of the border?	YES (7)	No comment (5)	NO (79)
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Demarcation commission ensures that the property of each owner to be registered in the cadastral information system of state, in the municipality that they live. A short description of passing owner's parcels in Kosovo-Macedonia relation is done based on the final agreement of the mixed commission for displacing the state border, in a way that some of the parcels to be found on the side that the owner lives see fig 1..

This transfer's realization is done according to the following process:

- Analysis of owners' demand on passing their property on the other state,
- Reaching of the agreement in the international mixed commission for the required transfer.
- Preparation of property documentation from the state that they've been in until the moment of transfer.
- Geodesic measurements in terrain and preparation of technical data for properties that are in transfer.
- Triple signing (by the owner and from two commission representatives) of documentation for each property that it's in transfer.
- Signing and sealing of documentation for registration in properties register in cadastral informative system. In Kosovo this is done in the Register of Immovable Property Rights.
- Further treatment of the registered property according to these state criteria in which the transfers were done with all of the rights and obligations to the state and property.

According to this procedure some successful cases developed.

#### 5.4. Creation of GIS for the border

Geographic information system GIS, for the border and for the border zone is necessary:

- To create data base
- To manage border line data
- For administration and for land reform of border zone (Meha 2009)
- For maintenance of the border in technical, legal and security aspect.

Demarcation's working period is characterized with data base's creation as for border management, land administration in border zone, and for its maintenance in the future. During 2008/09 GIS system has functioned through Geomedia Professional 5.2 software, and also from some modules for transformation of coordinates from one system to another. This kind of process will continue also in 2010, with required advancements. In general, only the border of

Kosovo-Macedonia has over 5000 points. To control them will be very difficult without the GIS system. In fig 5 is shown the collecting and elaboration of data for border in GIS system through Geomedia software.

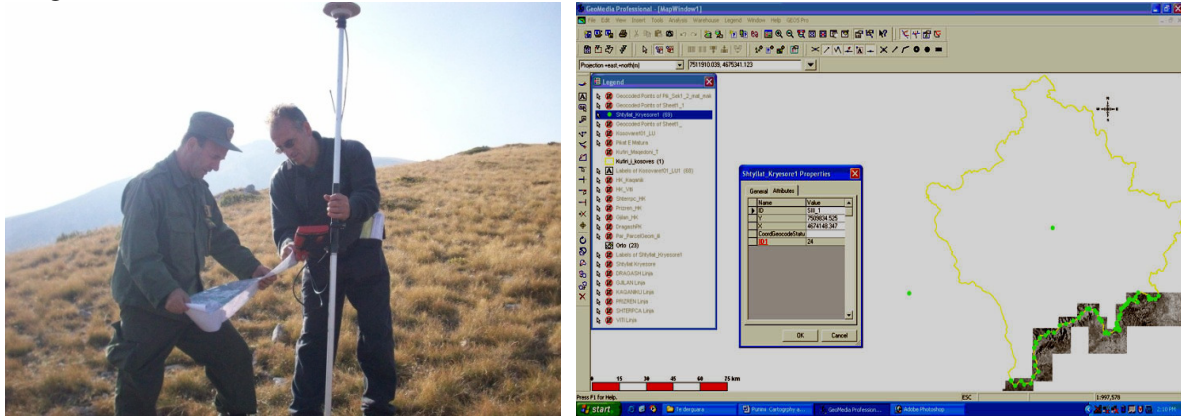


Fig.5. Data collecting for border demarcation and GIS,

The Geographic Information can be defined as information about the nature and locations of certain border area. That information's with all attributes and features are going to present clear current situation. The process of creating GIS as a tool for land administration for border region is complex and expensive but will have positive impact on poverty alleviate.

## 6. PUBLICATIONS

Various publication relating to border demarcation Kosovo-Macedonia are done in different time periods as in local publications as well in international ones.

Publicity of border demarcation in Kosovo with the R. of Macedonia could be evaluated even from its treatments over 250 articles on local daily press, over 35 shows and information in the electronic media and dozens of online articles.

Participation of demarcation commission in different international meetings was a unique achievement and preparation for the future. Following counted meetings, will have clarified even more the position and obligation of demarcation commission. This was the first case that the R. of Kosovo forms a commission for the demarcation so the international experiences were very important.

The most important meetings that the author of this article participates are:

- International Border Research Unit (IBRU) Durham University UK,
- FIG,
- Institute of Peace Washington DC USA,
- State Department in Washington DC,
- Local publications in daily and periodic press,
- Online publications.

## 7. ACHIEVED RESULTS

Final peaceful determination of border line between the two states has, a many dimensional importance for both states. This applies when the states are new and the border demarcation process is finished quickly, as Kosovo's and Macedonia's demarcation case. In November 2009, based on article 18 of R. of Kosovo constitution, the border line is confirmed from Kosovo's parliament. The same thing happened in the R. of Macedonia.

Another important result for border demarcation was because of the geodesic works: finding basic geodesic points, stabilizing border pyramids, geodesic measurement from both states were very successful. The success is reflected in geodesic measurements' harmonization, measurement's equalization and in the determined accuracy realization.

Creating the conditions for new technology exploitation and for other developments based on the border demarcation. Aerophotogrametric surveys of all border line with 6km width, which means 3km in each side of the border line.

Another result is the thanking of local inhabitants for realizing this important project even though at the beginning there was a resistance from their side on determining where to put the border line.

Mixed commission for border demarcation has received gratitude from the International Civil Office in Prishtina, for developing of activities, cooperation and realization of project as a whole within the set time.

## 8. CONCLUSION

The realization of state project border demarcation with the R. of Macedonia was an achieved challenge for mixed commission but especially for the Kosovar commission. Authors of this article express their gratitude to Kosovo's Government which gave us the chance to contribute for our country. Our contribution is modest but also based on the quote of American President, John F. Kennedy: "And so, my fellow Americans, ask not what your country can do for you. Ask what you can do for your country", January 20, 1961 is available. The contribution for peace is required from each of us, so the quote of Federal Germany President, Roman Herzog (1994-1999) relates exactly to our contribution: "Rather protect yourself by friends than by a fence." This is exactly what we gave as a commission for the demarcation.

Documentation from border demarcation fulfills the actual requirements of demarcation and the requirements for border developments in the future, from the aspect of:

- Creating data base for the whole border line,
- Using advanced technology in GIS system,
- Border's maintenance in technical aspect, legal and security.
- Harmonizing and replacing old data with new data in coordinate system, in GPS measurement, etc.

This form of data system for the border, offers digital geo information (according to requirements, it could be analog too) of maps, sketches and tables to join integrated GIS of Kosovo. In this way, Kosovo's border is defined according to laws, enabling its visual appearance, with adaption of international requirements.

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## BIOGRAPHICAL NOTES

Murat Meha is a University Professor and Deputy Head of the state Demarcation Commission. He has been teaching at the University of Prishtina - Kosovo since 1988. He has also taught for ten years at Tetova University (FYR of Macedonia). He worked for five years as Manager of SEO Ferronikeli, for three years as a CEO of Kosova Cadastre Agency, in different funded EAR projects, USAID project, KTA etc.

His teaching and research concern survey, cadastre, Land Administration and Land management. and related educational and capacity building activities. He is currently the member of Kosova Surveyor Association..

Main publications of Mr Meha are on survey, cadastre, Land Administration and Land management. He published two University books, two books for Kosovo Cadastre Agency, one book translated, and several school geographic atlases and maps. More than 80 professional and science papers in different professional magazines, symposiums, conferences etc. Most of those articles are available on Internet at: FIG, ICC, Euro Geographic, WPLA, CELKCenter, FAO GIM International etc.

### CONTACTS

Assoc. Prof. Dr. sc. Murat Meha  
Faculty of Mine and Metallurgy  
University of Pristine, Pristine  
Republic of Kosova  
Tel. + 377 44 120 958  
e-mail: [mmeha@yahoo.com](mailto:mmeha@yahoo.com)

### CONTACTS

Mr. sc. Behar Selimi  
Deputy of Kosovo Police, Pristine  
Republic of Kosova  
Tel. + 377 44 519 919  
e-mail: [bselimi@hotmail.com](mailto:bselimi@hotmail.com)