

Japan International Cooperation Agency (JICA)
Ministry of Civil Affairs, Bosnia and Herzegovina

THE STUDY
ON
ESTABLISHING DIGITAL TOPOGRAPHIC MAPS
FOR
BOSNIA AND HERZEGOVINA

FINAL REPORT

Volume I

Summary

October 2005

Pasco Corporation

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Preface

In response to the request from the Government of Bosnia and Herzegovina, the Government of Japan decided to conduct the Study on Establishing Digital Topographic Maps for Bosnia and Herzegovina and entrusted the study to the Japan International Cooperation Agency (JICA).

The JICA organized and dispatched a study team headed by Mr. Eisaku Tsurumi of Pasco Corporation to Bosnia and Herzegovina seven times from February 2003 to October 2005.

The study was completed as scheduled with submission of the digital topographic maps and associated products. The study also included technology transfer to the country. I hope that the digital topographic maps will contribute to national and regional planning of the country especially on demining activities and housing planning for refugees and internally displaced persons. I also hope that this report will contribute to promote future projects and to enhance friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation of the officials concerned of the Government of Bosnia and Herzegovina for their close cooperation extended to the Team.

Kazuhisa MATSUOKA

Vice President

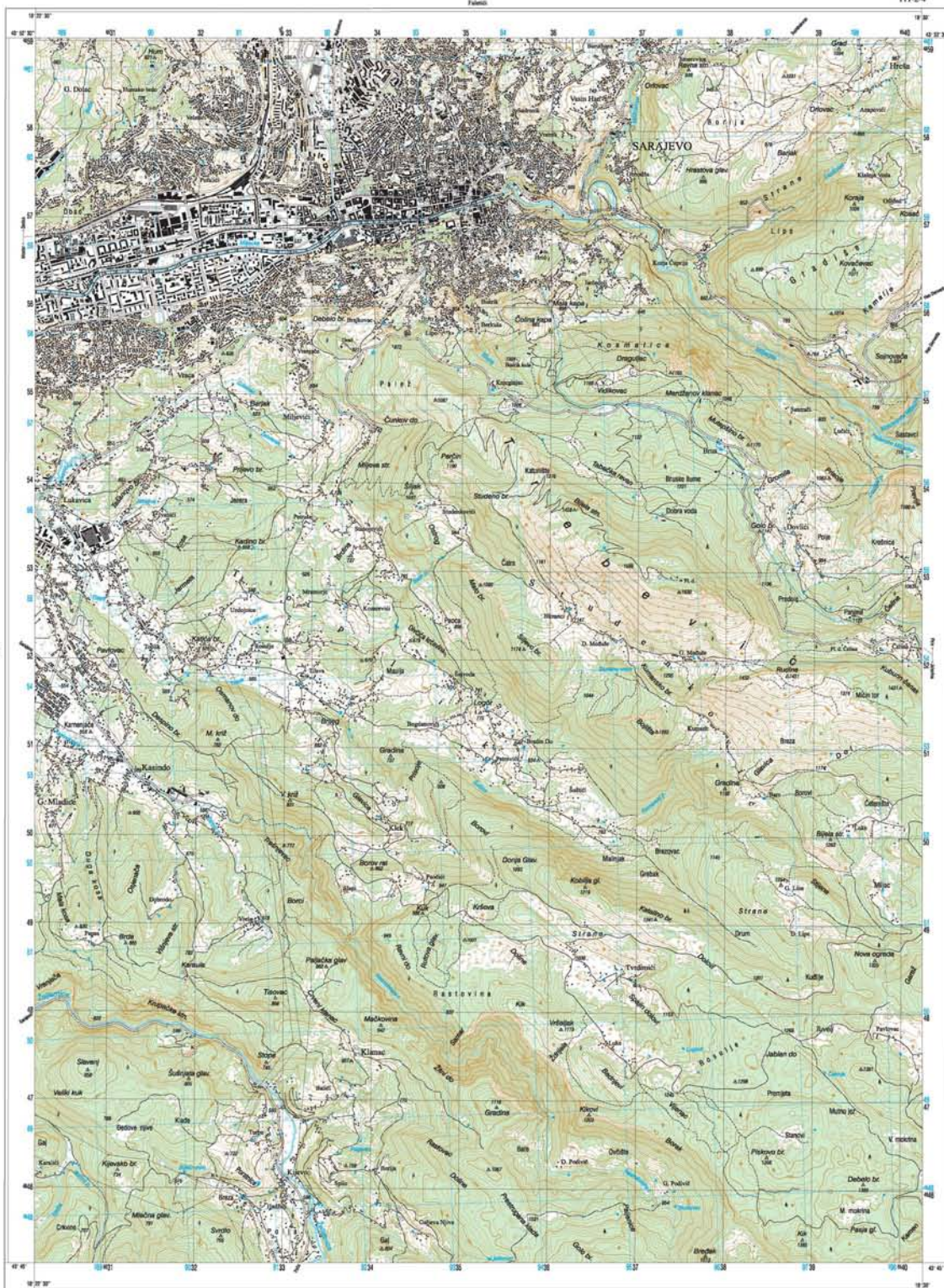
Japan International Cooperation Agency

Volume I
Summary

Topografska karta 1:25 000

Sarajevo

111-2-4



Ovu kartu je izradila Japanska Agencija za Međunarodnu Saradnju (JICA) u okviru Programa za tehničku saradnju između Vlade Japana i Vlade Bosne i Hercegovine.



Škalo
1:25 000



Ekvidistancija 10 m

— Elipsoid Besselov / Projekcija Gauss-Kruger
— Elipsoid WGS84 / Projekcija UTM

Vrsta linija TK		
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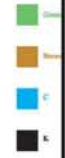


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 1 Aerial Photograph Inspection Manual

 2 Field Identification and Supplemental Survey Manual

 3 Aerial Triangulation and Digital Plotting Manual

 4 GIS Data Preparation Manual

 5 Map Symbolization Manual

1 INTRODUCTION

The Government of Bosnia and Herzegovina requested the Government of Japan to establish digital topographic maps for Bosnia and Herzegovina (BiH) in October 2001. In response to the request, the Government of Japan decided to conduct "The Study on Establishing Digital Topographic Maps for Bosnia and Herzegovina" (hereinafter referred to as "the Study").

The Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical international cooperation programs of Japan, dispatched a preparatory study team to investigate the situation of topographic mapping in BiH. After a thorough investigation by the preparatory study team, the scope of work for the Study was agreed upon between Ministry of Civil Affairs and Communication, BiH, and the JICA on October 23, 2002. (Scope of Work, and Minutes of Meetings 1)

JICA organized the JICA Study Team (hereinafter referred to as "the Team") as the execution body. The Study, as a three-year (four-phase) project, started in February 2003 and ended in October 2005.

At the beginning of the Study, the Team presented the Inception Report including the work plan to the Coordinating Committee Meeting and the report was agreed between the BiH side and the Team. According to the plan, the works were performed with the BiH side's close cooperation. The Team presented the Interim Report in February 2004, reporting the progress of the Study during the first and second phases. In January 2005, the Team presented the Progress Report reporting the progress during the third phase.

This Final Report includes the processes and results of the digital topographic mapping and, technology transfer. It also presents recommendations to the Government of BiH on its future data updating and servicing.

1-1 Objectives

The objectives of the Study are:

- (1) To take new aerial photographs of the whole country of BiH;
- (2) To prepare new digital topographic maps on a scale of 1:25,000 covering the forty-seven (47) map sheets for the cities which are; Sarajevo, Mostar, Tuzla, Zenica, Bihac, Travnik, Citluk, Livno, Jajce, Siroki Brijeg, Gorazde, Banja Luka, Bijeljina, Prijedor, Doboje, Trebinje, Zvornik, Derventa, Gradiska, Visegrad, and Brcko (herein-after referred to as "the Principal 21 Cities".);
- (3) To prepare digital topographic maps (structured, ^{1/} but not symbolized) covering the whole country of BiH except the forty-seven (47) map sheets for the Principal 21 Cities, based on the existing 1:25,000 scale topographic maps; and
- (4) To pursue technology transfer in the course of implementation of the Study.

In addition to the above objectives, ten (10) sheets of 1:25,000 scale topographic maps, sixteen (16) sheets of large scale topographic maps and so on were prepared using the new aerial photos taken in this project for providing basic topographic data for the JICA study project on Sustainable Development Through Eco-tourism (hereinafter referred to as "the Eco-tourism Study").

1/ structured: In this report, "to structure" means to define layer codes and data type of GIS data and/or to put topology information to the GIS data.

1-2 Study Area

The Study areas are shown in Figure 1-1. New aerial photographs cover the whole country. Orange-colored quadrangles show the new mapping areas for the Principal 21 Cities. Green-colored quadrangles show the additional mapping areas. The rest of the quadrangles are covered by GIS data ^{1/} created from the existing 1:25,000 scale topographic maps. The blue circles and yellow squares show additional large scale topographic mapping areas.

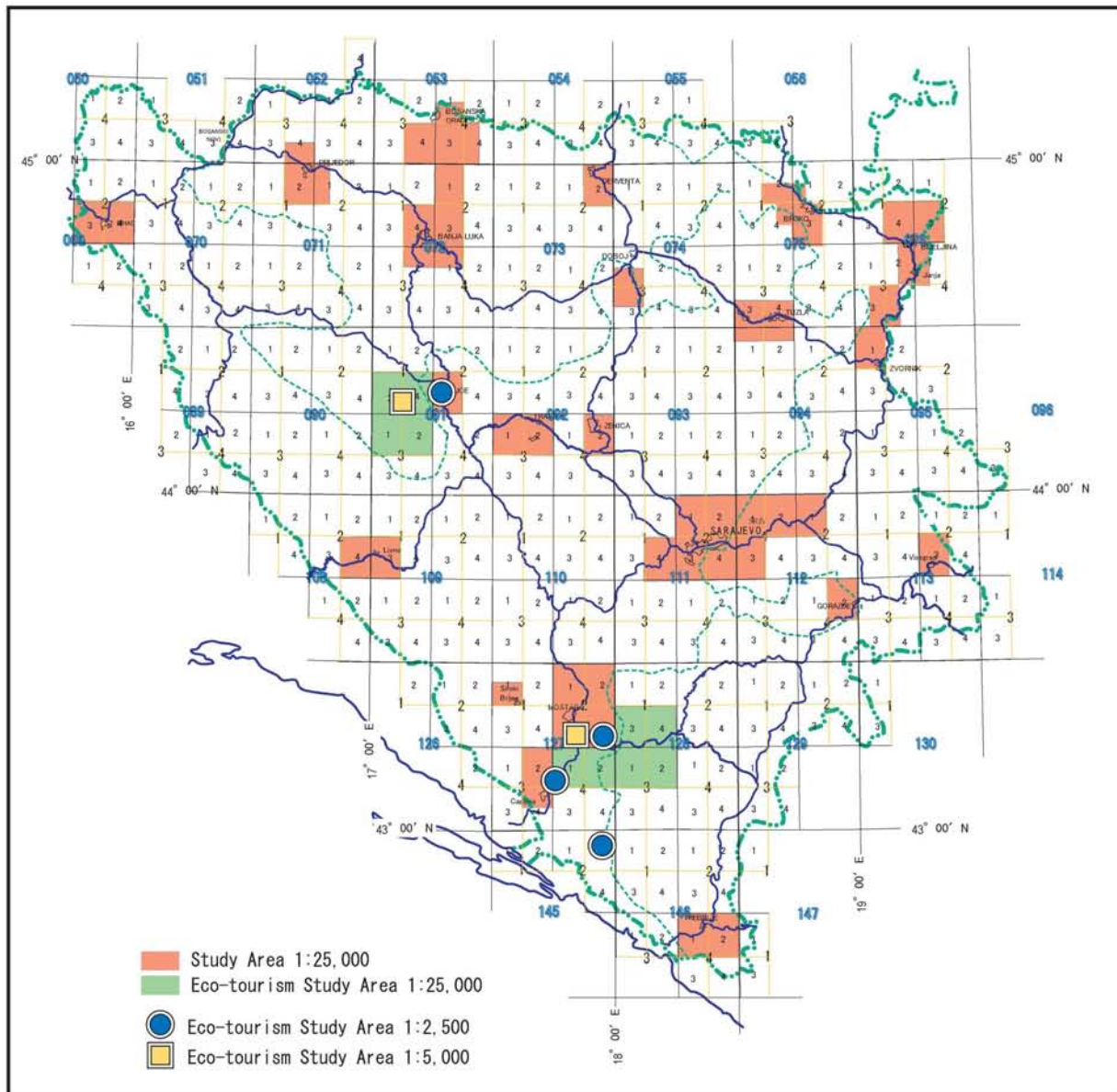


Figure 1-1 Study Area

1/ GIS data: In this report, a term of "GIS data" is especially used as vector data for GIS, DXF data and/or ArcInfo coverage to be exact.

1-3 Organization of the Study

JICA organized the JICA Study Team (hereinafter referred to as "the Team") as the execution body. The assigned members are listed in Table 1-1.

Table 1 - 1 Study Team Members

Mr. Eisaku Tsurumi	Leader
Mr. Daikichi Nakajima	Supervisor of Aerial Photography
Mr. Yutaka Nakada	Supervisor of Control Point Survey
Mr. Sadao Matsumoto	Supervisor of Photo Interpretation, Field Identification and Field Completion, and Coordinator
Mr. Takeo Muto	Supervisor of Additional Control Point Survey, Photo Interpretation, Field Identification and Field Completion
Mr. Minori Onaka	Supervisor of Digital Plotting
Mr. Nobuhiro Sata	Supervisor of Digital Plotting
Mr. Takashi Shimono	Supervisor of Digital Map Symbolization
Mr. Toshinori Otsu	Supervisor of Digital Map Symbolization, and Coordinator
Mr. Hidetoshi Kakiuchi	Supervisor of GIS Data Creation
Mr. Kazunobu Kamimura	Coordinator
Mr. Fujio Ito	Coordinator
Mr. Kei Sato	Coordinator
Mr. Kohei Yamamoto	Coordinator
Mr. Atsushi Saito	Interpreter
Mr. Koichi Karasawa	Interpreter

The Government of BiH (the BiH side) assigned the Ministry of Civil Affairs as the counterpart agency. The Coordinating Committee was organized in the BiH side for smooth implementation of the Study. The Team executed the Study in close contact with the Committee. The Committee comprises the following organizations.

- Ministry of Civil Affairs, Bosnia and Herzegovina
- Ministry of Foreign Affairs, Bosnia and Herzegovina
- Federal Administration for Geodetic and Real Property Affairs, the Federation of Bosnia and Herzegovina
- Republic Administration for Geodetic and Real Property Affairs, the Republic of Srpska
- Department of Public Records, the Government of Brcko District

A member from the Ministry of Civil Affairs takes the chair.

The members are listed in Table 1-2.

Table 1 - 2 Coordinating Committee Members (2005)

Mr. Srdjan Arnaut	Adviser and Chief of Cabinet of Minister of Civil Affairs, Bosnia and Herzegovina
Mr. Sefik Rizvanovic	Adviser to the Minister of Civil Affairs, Bosnia and Herzegovina
Mr. Haris Cengic	Assistant to the Minister of Civil Affairs, Bosnia and Herzegovina
Ms. Biljana Grujic	First Secretary, Department for Economic Multilateral Relations and Reconstruction, Ministry of Foreign Affairs, Bosnia and Herzegovina
Mr. Eldin Donlagic	Assistant director of Federal Administration for Geodetic and Real Property Affairs, Federation of Bosnia and Herzegovina
Mr. Vladimir Bojat	Director of Republic Administration for Geodetic and Real Property Affairs, Republic of Srpska
Mr. Lazo Sikimic	Assistant director of Republic Administration for Geodetic and Real Property Affairs, Republic of Srpska
Mr. Hajrudin Jusufovic	Head of Public Records Department, Brcko District of Bosnia and Herzegovina
Ms. Senada Hamidovic	Head of Division of Cadastre Books and Archive of Public Records Department, Brcko District of Bosnia and Herzegovina
Mr. Kemal Karkin	Director of Project Implementation Directorate, Ministry of Communications and Transportation, Bosnia and Herzegovina

The following persons participated in the meetings as the members in 2003 and 2004.

Table 1 - 3 Coordinating Committee Memebers (2003 - 2004)

Mr. Mirza Pinjo	Ministry of Foreign Affairs, Bosnia and Herzegovina
Mr. Todor Panic	Republic Administration for Geodetic and Real Property Affairs, Republic of Srpska
Mr. Nikola Ristic	Public Records Department, Brcko District of Bosnia and Herzegovina
Mr. Stanko Tomic	Public Records Department, Brcko District of Bosnia and Herzegovina

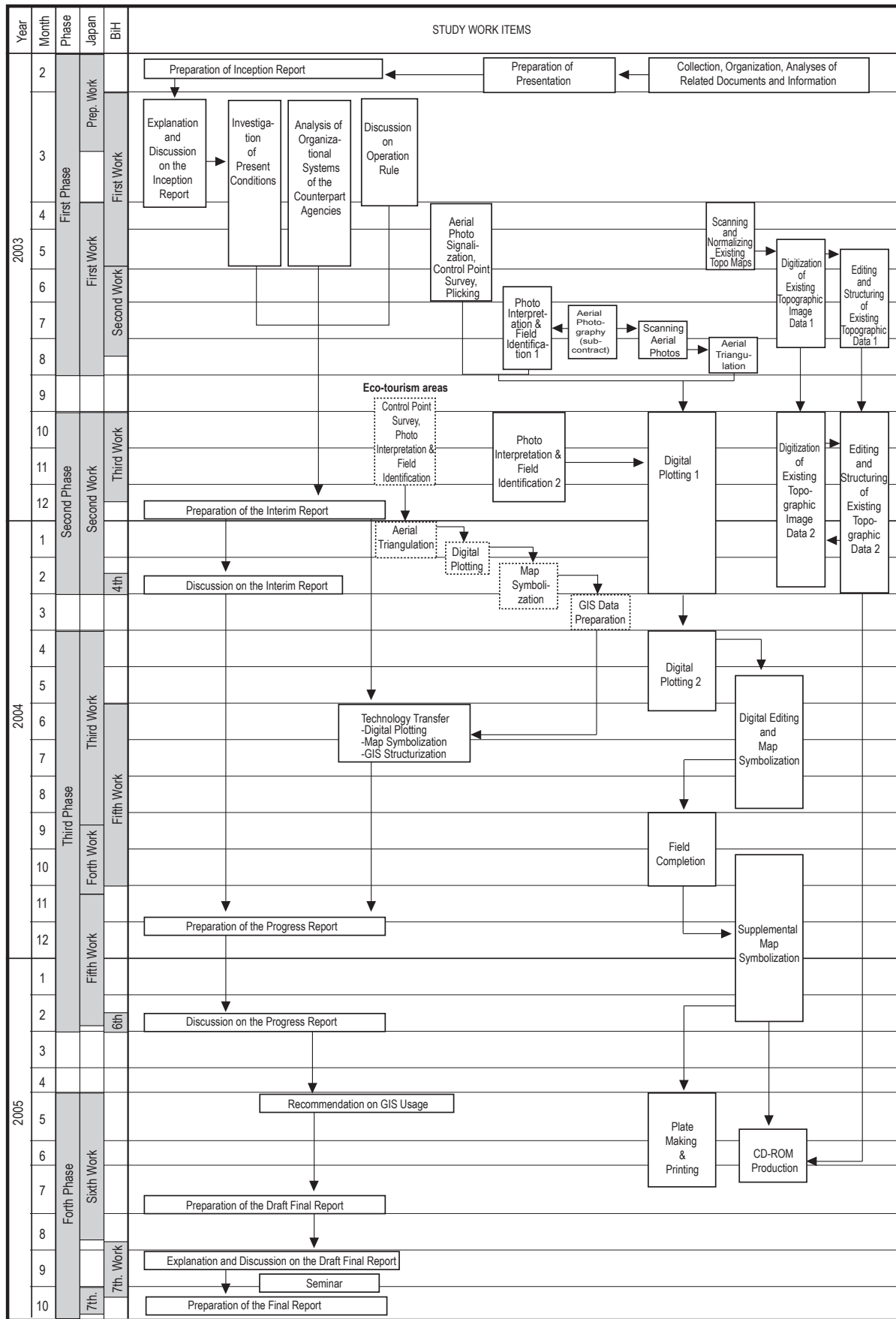


Figure 1-2 Overall Study Flow

1-4 Flow of the Study

According to the work plan agreed upon between the BiH side and the Team in March 2003, the Team conducted the Study from 2003 through 2005 in cooperation with the BiH side. The works were performed in BiH and Japan with some additions to the original plan and completed in October 2005. Chronological process of the Study is shown in Figure 1-2.

The objectives of the Study, described in Section 1-1, can be divided into topographic data production and technology transfer. And topographic data production is divided into new mapping and digitization of existing topographic maps.

The process adopted for the new topographic data production in this project is briefed below.

New Mapping for 21 Principal Cities

1. Signalization of existing control points were performed in the new mapping areas to prepare ground control points for aerial triangulation. In addition, control point survey with GPS and signalization of new points were performed.
2. Aerial photography was carried out for the whole country.
3. With the progress of aerial photography, photo interpretation and field identification for the new mapping areas were performed using enlarged photo prints.
4. On the other hand, aerial photos were scanned to make photo image data (scanned data).
5. Aerial triangulation was performed, using the result of control point survey and the scanned data of photos.
6. Digital plotting was carried out using three-dimensional photo images, based on the results of aerial triangulation, photo interpretation and field identification.
7. Based on the plotted data, draft analogue maps were compiled through digital map symbolization. National boundaries and letters of place names, etc. were included.
8. After completion of draft analogue maps, field completion was carried out using the outputted draft map sheets. National boundaries and letters were also checked.
9. Based on the results of field completion, supplementary works of digital plotting, digital map symbolization and lettering were performed. Outputted draft map sheets are finally checked to finalize the symbolized map data.

10. From the final symbolized map data, plate films of each map sheet were processed for printing.
11. The new map sheets were printed with offset printer and these symbolized data were stored into media.

Digitization of Existing Topographic Maps

The process of digitizing the existing topographic maps in this project is briefed below. .

1. All the existing topographic map sheets were scanned and then the scanned data were geo-referenced.
2. Based on the geo-referenced map image, topographic map features and contour lines were digitized to make vector data except for the newly mapped areas.
3. The vector data were topologically structured into GIS data. From the contour data, digital terrain model (DTM) was generated.
4. The vector data resulted from the supplementary digital plotting for the new mapping areas were also structured into GIS data.
5. All the GIS data were finally checked and stored into media.

2 OUTPUTS AND PROCESSES

2-1 Outputs

The final outputs are listed in Table 2-1. These products, which are itemized in the SW for the Study, were delivered to the Government of BiH. (Minutes of Meetings 1, Volume II) The additional outputs are the work in the Eco-tourism Study areas. The digital outputs are organized and stored in HDDs. When necessary, the digital data can be copied and retrieved in a form of Compact Disk.

Table 2 -1 Output of the Study

	No	Item	Quantity	Coverage/notes	Media	
Study Report	1)	Inception Report (English)	20 copies			
	2)	Interim Report (English)	20 copies			
	3)	Progress Report (English)	20 copies			
	4)	Draft Final Report				
		Main Report (English)	20 copies			
		Summary (English)	20 copies			
	5)	Final Report				
		Main Report (English)	20 copies			
		Summary (English)	20 copies			
		Appendix (English)	20 copies			

	No	Item	Quantity	Coverage/notes	Media	
Study Results	1)	1:40,000 scale aerial photograph		Report, flight record, flight center coordinates, flight index maps		
		Negative films	1 set	1: 40,000, Whole country		
		Contact print photographs	2 sets	1: 40,000, Whole country		
		Scanned data	2 sets	whole country	HDD & tape	
		Records on Aerial Photography	2 sets	Film reports, Camera calibration certificates, Flight index, etc.		
	2)	Results of control point survey	2 sets	Principal 21 cities and the Eco-tourism Study Areas		
	3)	Results of aerial triangulation	2 sets	Principal 21 cities and the Eco-tourism Study Areas		
	4)	1: 25,000 scale topographic map				
		Symbolized data	2 sets	Principal 21 cities and the Eco-tourism Study Areas	HDD	
		Plate films for Printing	1 set (4 colors x 57 sheets)	Principal 21 cities and the Eco-tourism Study Areas		
		Printed maps	100 copies (100 x 57 sheets)	Principal 21 cities and the Eco-tourism Study Areas		
	5)	GIS data				
		Topographic data	10 sets	whole county	DVD, HDD	
		DTM	2 sets	whole country	HDD	
	6)	Scanned data of the existitng topographic maps	2 sets	whole country	HDD	
	7)	1:2,500 scale topographic maps	1 sets	four locations in the Eco-tourism Study Areas	HDD	
		1:5,000 scale topographic maps	1 sets	two locations in the Eco-tourism Study Areas	HDD	
8)	1:25,000 scale ortho-photo	1 set (20 sheets)	Eco-tourism Study Areas	HDD		

2-2 Control Point Survey and Signalization of Control Points

The areas for the Principal 21 Cities were divided into 14 blocks and two blocks were added for the Eco-tourism Study. The work involved 1) selection of control points; 2) signalization of control points; and 3) GPS observation. To select the ground control points, existing control points were examined. Signalization of existing control points was done for preparing the GCPs for aerial triangulation. A total of ten and three GPS sessions were conducted in FBH and RS, respectively. The results were analyzed and calculated for examination. Several points, after aerial photography, were found to be in need of pricking work because the signals were unrecognized on the photos. Pricking works were performed during the field identification survey from September to October 2003.

2-3 Aerial Photography

A total of 2,702 aerial photographs were taken. The work was subcontracted to FM-International Oy FINNMAP. The aircraft, Rockwell Turbo Commander 690 with the aerial camera system, Leica RC-20, was mobilized on July 3 2003; The mission was completed; The aircraft was demobilized on August 12, 2003.

2-4 Photo Interpretation and Field Identification

The first work was from June 21, 2003 to August 19, 2003. And the second work was from September 17th, 2003 to November 30th, 2003. Forty-seven (47) map sheets were planned; ten (10) map sheets were added for the Eco-tourism Study. Initially, geo-referenced-photo-images were planned to be used, but because of delay in aerial photography, double-enlarged photographs were used instead. All the results were recorded onto double-enlarged photographs; the data acquired are listed in the specifications for plotting data acquisition.

2-5 Scanning of Aerial Photographs

All the photographs were scanned at a resolution of 20 micrometers. The work was conducted in Japan from mid-July to mid-August 2003. The data were stored in AIT2 tapes that had random access functions and also in HDDs.

2-6 Aerial Triangulation

The digital aerial triangulation was conducted for respective blocks using 615 models of the new aerial photographs in the Principal 21 Cities (47 map sheets in area) and the Eco-Tourism study areas (10 map sheets in area) in Japan. Triangulation modules used were HATS, MATCH-AT and Pat-B. Inspection was conducted; the results satisfied the standards.

2-7 Digital Plotting

Fifty-eight (58) mapping sheets in the Principal 21 Cities areas and ten (10) map sheets in the Eco-tourism Study areas were the plotting areas. The work was conducted from October 2003 to February 2004 and from April 2004 to May 2004 in Japan.

2-8 Digital Map Symbolization

After digital plotting, the digital map symbolization was conducted from October 2004 to February 2005 in Japan. Some of the digital map symbols were redesigned for efficient operation of the work. Among sixty-eight (68) sheets, thirteen (13) map sheets are adjacent to the neighboring countries: Croatia, Serbia and Montenegro. The counterparts provided the national border information; the Team included the border information. The layout and marginal information were discussed and agreed.

2-9 Field Completion

The field completion work was conducted from September 2004 to October 2004. Field completion in this project covers four kinds of works, namely, (1) field check, (2) reference of existing source materials, (3) national boundary check, and (4) lettering check. The Team prepared a manual for field completion in the local language. After training sessions in Sarajevo and Bijeljina, the counterparts under the instruction of the Team members conducted the work. The results were recorded onto colored draft maps which had been prepared in Japan.

2-10 Supplementary Digital Plotting

With the results of the field completion, the supplementary digital plotting was conducted in Japan. The additional acquisition layers are four: (1) Wide bridge (more than 17.5 m in width) with piers; (2) Wide bridge (more than 17.5 m in width) without piers; (3) Industrial reservoir (more than 35 m in length or diameter); and (4) Pond (less than 35 m in length or diameter). Other acquisition agreements were made on tunnels, power lines, gas pipelines, water pipelines and electrified/non-electrified railroads.

2-11 Supplementary Digital Map Symbolization

The work was conducted in Japan using the final results, dxf files, from the process of the supplementary digital plotting. Fonts and size, former village without a house, small railroad, national boundaries, and new-map-sheet names were resolved. New symbols and letters were added also.

2-12 GIS Data Creation

The main processes of GIS data creation are: 1) To define the coverage schemas and layer structure; 2) to digitize manually the contour lines and the other topographic features from the geo-referenced scanned topographic map images; 3) to automatically convert contour line data to vector data using Raster to Vector conversion software; and 4) To create the coverage data putting topology information. For newly mapped areas, the Principal 21 City areas and the Eco-tourism Study areas, the plotting data were used instead of going through the digitization processes of 2) and 3).

2-13 DTM Generation

The data of DTM (Digital Terrain Model) with a grid distance of 25 meters were generated from the contour line dataset of GIS by ArcInfo Topogrid command, that is to say, as ArcInfo Grid format. There are two types of the contour line dataset: One type is the dataset created digitizing the 1:25,000 scale existing topographic maps and the other is the dataset created from the new plotting data. The DTMs were generated using both types of the contour line dataset, respectively.

2-14 Reproduction

A total of 57 sheets of the new 1:25,000 scale topographic map were offset-printed at the end of the project. All the symbolized data of the new mapping (68 map sheets) were copied into media in order to deliver to the BiH Government.

3 TECHNOLOGY TRANSFER

One of the objectives of the project is to pursue technology transfer of digital topographic mapping so that the BiH agencies concerned with mapping can revise the 1:25,000 topographic maps in the future. It can be pointed out that the transferred technology would be useful not only for 1:25,000 but also for other scale mappings and various purposes else.

3-1 Programs

Seven processes of topographic mapping are: control point survey and signalization of control points, aerial photography, photo interpretation and field identification, and digital plotting, digital map symbolization, field completion, and GIS data creation. Therefore, the Team conducted technology transfer sessions for each of these processes.

For those processes except aerial photography, technology transfer sessions were conducted. Control survey and signalization of control point, photo-interpretation and field identification, and field completion were conducted through OJT. The aerial triangulation and digital plotting sessions were conducted in Japan from February to March 2004 and in BiH during the third phase from May to June 2004.

Training session for digital map symbolization were conducted in BiH in the third phase from May to June 2004 and in Japan from October to November 2004. The GIS data creation training session were conducted in BiH in the third phase from May to June 2004 and in Japan from October to November 2004. The systems for technology transfer were installed in two locations; Figure 3-1 shows the system installed. The specifications on the system are included in Volume II-4. All sessions are shown in Table 3-1. A total of 34 counterparts took the sessions.

Table 3-1 Technology Transfer Sessions

Subject	Place	Period	Instructor
Control Point Survey and Signalization of Control Point	BiH	April 2003 - June 2003	Mr. Yutaka Nakada
Photo-interpretation and Field Identification	BiH	July 2003 - August 2003	Mr. Sadao Matsumoto
		September 2003 - November 2003	Mr. Sadao Matsumoto
Aerial Triangulation and Digital Plotting	Sarajevo	May 2004 - June 2004	Mr. Minori Onaka
		September 2005	Mr. Nobuhiro Sata
	Bijeljina	May 2004 - June 2004	Mr. Minori Onaka
	Japan	February 2004 - March 2004	Mr. Hidetoshi Kakiuchi and Mr. Mitsuhiro Asai
Digital Map Symbolization	Sarajevo	May 2004 - June 2004	Mr. Toshinori Otsu
		September 2005	Mr. Takashi Shimono
	Bijeljina	May 2004 - June 2004	Mr. Takashi Shimono
	Japan	October 2004 - November 2004	Mr. Toshinori Otsu
Field Completion	BiH	September 2004 - October 2004	Mr. Sadao Matsumoto
GIS Data Creation	Sarajevo	June 2004	Mr. Hidetoshi Kakiuchi
	Bijeljina	May 2004 - June 2004	Mr. Hidetoshi Kakiuchi
	Japan	October 2004 - November 2004	Mr. Hidetoshi Kakiuchi

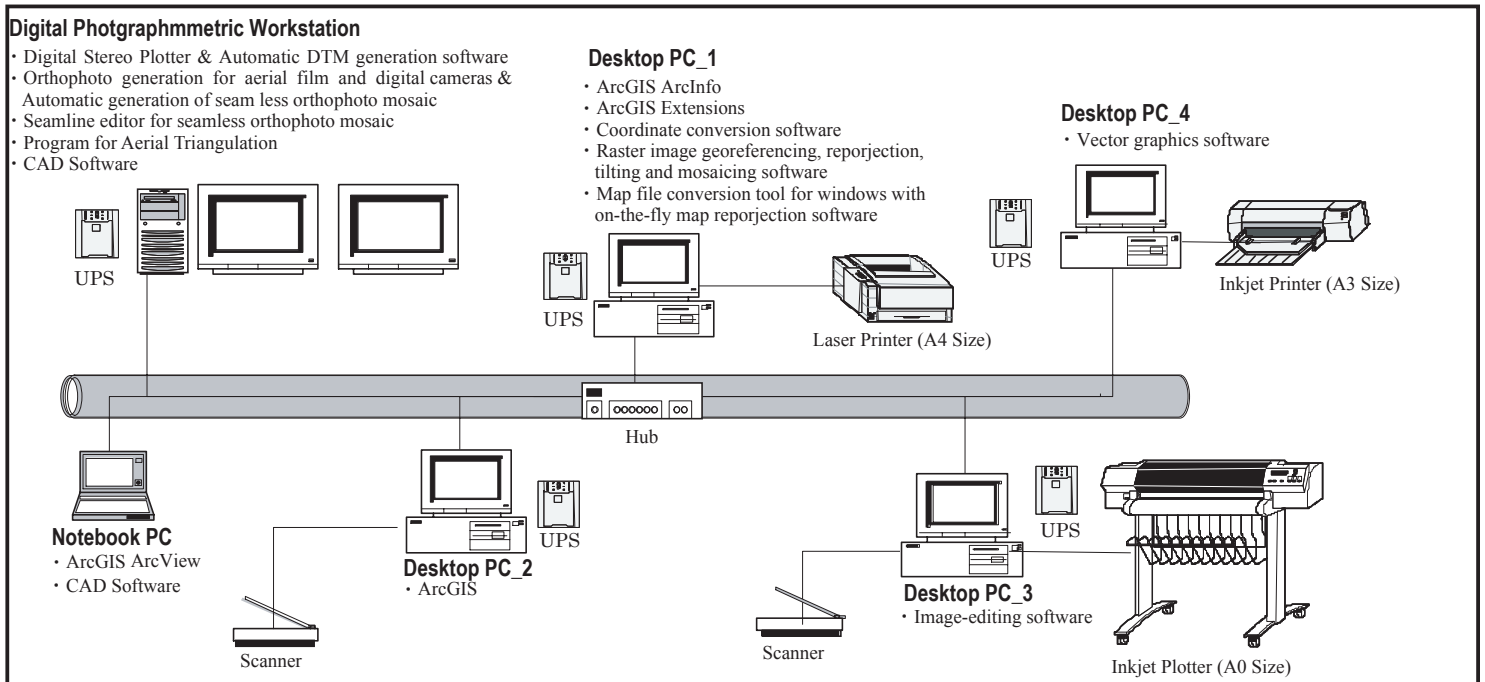


Figure 3 - 1 System Diagram

3-2 Evaluation

(1) Control Point Survey and Signalization of Control Point

Although some of the counterparts who participated in control point survey had been inexperienced in GPS observation, they acquired the techniques during the mission. As for signalization of control points, in spite of their elaborate works, many of the signals were damaged or missing because of a long time interval between the setting and aerial photographing. Some of the counterparts participated in inspection and repair of the signals. Through these works, the counterparts have learned appropriate size, shape, and color of signalization (three-white 1 m x 3 m wings placed in a radial pattern) for aerial photography at the photographic scale of 1:40,000.

After obtaining aerial photographs, about ten aerial signals were found unrecognizable on the photos and in need of pricking work. During the field identification, the Team members finished the pricking for these control points. Due to limitation of the time, the counterparts had no chance to experience this work. Pricking is, however, an indispensable process for the future topographic mapping in BiH. Therefore, the Team gave instruction during the field completion work in the third phase. The counterparts have acquired the skill.

(2) Photo Interpretation and Field Identification

As for aerial photograph interpretation and field identification, the counterparts, who had had little experience of these works, made remarkable progress with high level of understanding and speed of learning during the mission. The results acquired by them on double-enlarged photographs are regarded to be satisfactory for plotting.

(3) Aerial Triangulation and Digital Plotting

Although most of the trainees have experience of personal computer operation, it was their first time to experience digital mapping with computer systems.

As for digital plotting in particular, there were some difficulties for most trainees to make rapid progress because the plotting work includes the skill to manually handle a 3-dimensional measuring mark, which takes a lot of days to master. Moreover, although a few of the trainees have experience of large-scale mapping with conventional equipment, they were unfamiliar with small-scale mapping like 1:25,000. In general, small-scale plotting needs to skip small objects, but beginners are apt to plot too detailed topography.

After instructions by the team, the trainees attained to a level to exercise the process themselves. More experience is indispensable. It is desirable that they will try to complete one map sheet at least. Independent training is helpful to bring them a big progress in a few months, which will build

3-3 Seminar

According to the original work plan of the Study, the Team, jointly with the Ministry of Civil Affairs organized a seminar to be held in the end of the final phase. It was held on September 28, 2005, at Hotel Grand, Sarajevo. This seminar was organized to announce the newly established digital topographic maps and to exemplify usages of the maps with the aim of cultivating potential map users.

The attendants include those concerned with the data usage from state and regional governments, public corporations, foreign organizations for international cooperation, foreign embassies, and several private sectors. The number of participants is ninety.

After the Team explained the new mapping products, Charge d'Affaires of Japan handed over the catalogue of the products to the Minister of Civil Affairs.

After then, five speakers gave the following presentations mainly about application of the digital topographic map to specific fields.

Project of Digital Topographic Maps for Bosnia and Herzegovina

Eldin Donlagic, Faculty of Civil Engineering, University of Sarajevo

Demonstration of Level 25,000 Digital Spatial Data

Amira Kadic, JP Geodetski Zavod

Usage of Digital Maps scale 1:25,000 in the Process of the Humanitarian Demining in Bosnia and Herzegovina

Tarik Serak, Bosnia and Herzegovina Mine Action Centre

Preparation of Technical Study for the Project "Motorway on the Corridor Vc" using Digital Elevation Model

Selma Lukovac and Arijana Gacko, IPSA Institute

GIS Application to the Study on Sustainable Development through Eco-tourism in Bosnia and Herzegovina

Hidetoshi Kakiuchi, JICA Study Team

Finally the Team presented recommendations to the Government of BiH on the future topographic mapping and servicing. The recommendations are compiled in Chapter 5 on the Main Report, Volume II.

4 DISCUSSIONS BETWEEN THE BIH SIDE AND THE STUDY TEAM

The Coordinating Committee had a total of five meetings to direct courses of the Study. Two types of discussions were included: one is on general directions and the other is on specifications. The results of the discussions are summarized below. Details are included in the Minutes of Meetings attached in Volume II.

- (1) Ellipsoid and Projection: The digital topographic mapping should be based on WGS-84 and UTM. But Bessel and Gauss-Kruger would be applied to the printed-paper maps.
- (2) Mapping Areas: The mapping areas of the Principal 21 Cities were slightly changed from the original plan; the eco-tourism study areas were added.
- (3) Control Point Survey: Two points were agreed: 1) utilization of existing control points by setting aerial signals; and 2) GPS survey for new control points where the existing points do not satisfy conditions.
- (4) Topographic Map Features: Features to be included in the new map were determined. The total number of map symbols was reduced from 356 to 286. In the supplementary digital map symbolization process, additional five symbols were adopted and letters to be used were specified.
- (5) Specifications of OJT Equipment: Specifications on computer systems were determined. Two installation locations were specified.
- (6) National Boundaries: The national boundaries were agreed to be inclusive onto the new maps.
- (7) Mapping Area across the National Boundaries: The mapping areas across the national boundaries are agreed to be: 1) As far as the opposite shoreline when a national boundary is defined by a river; 2) two centimeters beyond the boundaries when not defined by a river.
- (8) Map Sheets to be printed: The forty-seven map sheets to be printed were specified. After that, ten map sheets for the eco-tourism study areas were specified to be printed.
- (9) Map Sheet Name: New-map-sheet names were agreed to be provided by the BiH side.
- (10) Position Data of Public Facilities: Authorized new position data of public facilities were agreed to be provided by the BiH side.
- (11) Specifications of Map Symbols and Letterings: As included in the Interim Report, both sides agreed on the digital map symbols and letterings. When improvement is necessary, both sides

discuss the matter.

- (12) Marginal Information: The Team presented a sample of layout. Both sides agreed on the layout. The note on the Mapping Project was agreed to be written in marginal space in local language.
- (13) GIS Data of Additional Mapping Areas: For eco-tourism study areas, the GIS data from the existing data were agreed to be updated with new GIS data.
- (14) Image of the New Map: General image of the new map was discussed based on the offset-printed sample copies of symbolized map sheets and it was agreed that the image should be similar to the existing topographic maps. JP Geodetski Zavod tested printing the same sheet using the films the Team brought.
- (15) Official Check: The official check on letterings and the national boundaries was agreed to be done by the BiH side.
- (16) Partly Blank Sheets: Both sides confirmed that nine out of forty-seven (47) sheets included partly blank space.
- (17) Delivery of the Results for the Eco-tourism Study Areas: Both sides confirmed that the results of 1:25,000 topographic mapping and other mappings for the eco-tourism study areas should be delivered to the Ministry of Civil Affairs.
- (18) Seminar: It was confirmed that a one-day seminar should be held in Sarajevo in September 2005. The Ministry of Civil Affairs, BiH and the Team were agreed to jointly organize the seminar.
- (19) Adjoining Map Sheet Names: The names of the adjoining map sheets were agreed to be provided by the BiH side.
- (20) Recommendations: The BiH side mentioned an intention to prepare its official report based on the recommendations given by the Team.

5 RECOMMENDATIONS

The JICA Study Team presents the BiH Government the following recommendations on the state topographic mapping.

- (1) **Map Revision:** The BiH Government should revise the existing 1:25,000 scale topographic maps published in the 1970s, using modern technologies including those transferred through the Study project before the photos are outdated. For urgent revision, following three recommendations are made: 1) Improvement in control point survey; Usage of ortho-photo for provisional mapping; and 3) Prioritization of GIS data preparation.
- (2) **Standardization of Digital Topographic Data:** Digital topographic data to be published and maintained at the state level should be kept standardized in unified data system.
- (3) **Data Updating:** Topographic information should be updated periodically with appropriate time intervals taking the size and rate of land use change into account.
- (4) **Archives:** All the old topographic data and maps should be kept in archives and they should be available upon users' requests.
- (5) **Reorganizing Mapping Agencies:** The BiH Government should reorganize a specified agency responsible for state topographic mapping.
- (6) **Higher Accessibility of Existing and New Maps to the Public:** All the topographic information including the old maps inherited from the former Yugoslavia and new maps prepared by the BiH Government should be open to the public. In order to realize the open publicity, the Government should renew the former Yugoslavian law as soon as possible.
- (7) **Publicity and Promotion on Digital Maps:** The Government should make every effort to publicize the existence of topographic maps in the analogue form and digital form to the public. The Government should show good examples of data usage to the public.
- (8) **Standardization of Map Prices:** Prices of the topographic maps published and maintained by the Government should be standardized.
- (9) **Technical Training:** The Government should build up a standard program of technical training in order to secure a necessary number of technical staffs for topographic mapping and data updating.
- (10) **Application of the Study Outputs:** The Government should use the study results for national and regional planning and development especially for demining, locating houses for refugees and internally displaced persons, and for private led economic development. The eco-tourism related application was a case of utilizing the Study result; the scheme should be used to other regions in BiH.