Republic of Albania

The State Authority for Geospatial Information

Project on Geospatial Information for Sustainable Land Development in Tirana - Durres Area in the Republic of Albania

Final Report

January 2022

Japan International Cooperation Agency (JICA)

PASCO CORPORATION

KOKUSAI KOGYO CO., LTD.

IM
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Location of the Project

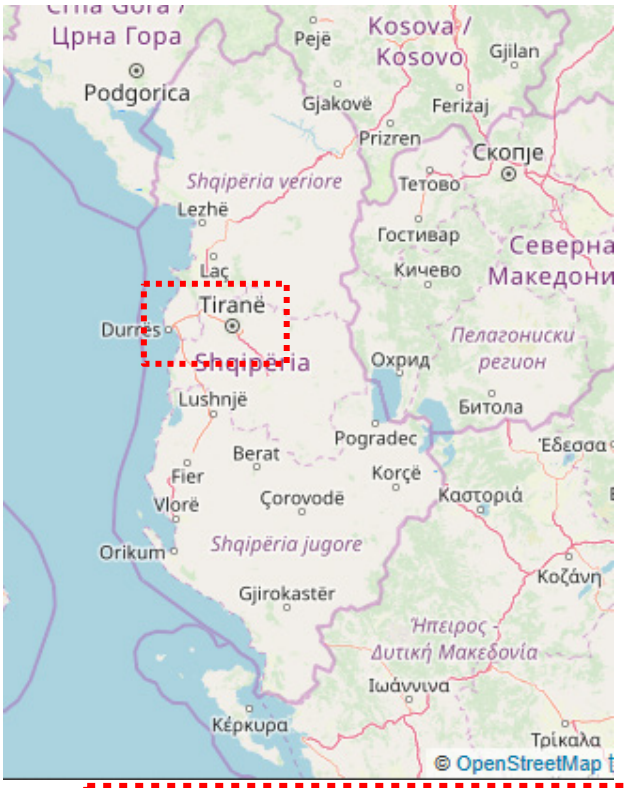


Table of Contents

Exchange rate: EUR1=JPY129.821000(January 2022, JICA Rate)

List of Tables

List of Figures

List of Photos

Photos

Tirana City

ASIG

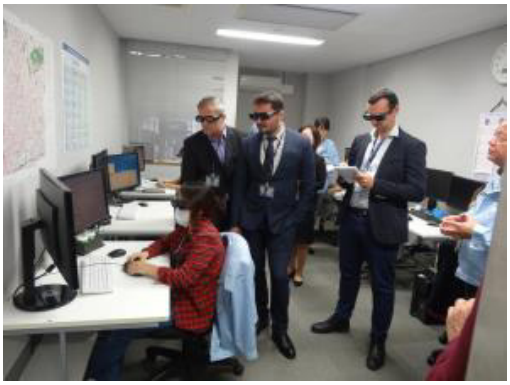
JICA Project Commencement Conference

Discussion on specifications

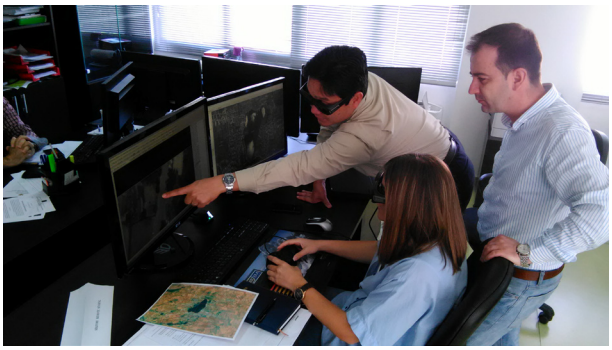
Visit Vora

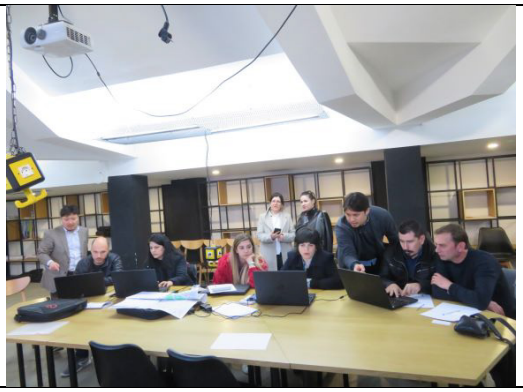
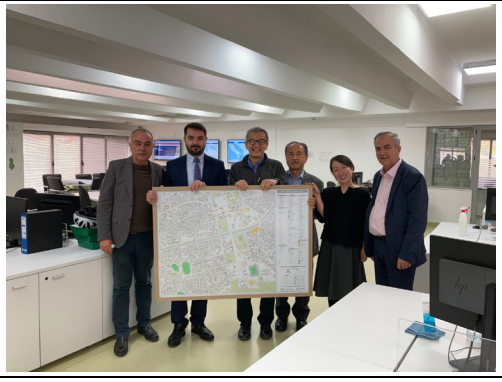
Visit Durres

GSI (Training for executives)



PASCO Okinawa (Training for executives)

	
JICA HQ (Training for engineers)	Mobara City (Training for engineers)
	
Technology transfer	Technology transfer
	
Technology transfer	Inspection
	
Training for students	Training for students

	
GIS training for municipalities	GIS training for municipalities
	
JICA Project Final Conference	Regional Conference
	
The 1st JCC	The 2nd JCC
	
The 3rd JCC	Handover of the digital topographic map

Abbreviation List

Abbreviation	Description
ALBPOS	Albania Positioning System
AREC	Agency for Real Estate Cadastral
ASIG	State Authority for Geospatial Information
BIG	Board of Geospatial Information
CIR	Color infrared
CORS	Continuously Operating Reference Station
DEM	Digital Elevation Model
DPS	Data Product Specifications
EU	European Union
FTP	File Transfer Protocol
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
GSI	Geospatial Information Authority of Japan
INS	Inertial Navigation System
INSPIRE	Infrastructure for Spatial Information in Europe
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
KCA	Kosovo Cadastral Agency
MMS	Mobile Mapping System
OJT	On the Job Training
PC	Personal Computer
PDF	Portable Document Format
RGB	Red, Green, and Blue
UAV	Unmanned aerial vehicle
UML	Unified Modelling Language
UPS	Uninterruptible Power Supply
VAT	Value Added Tax

1. Summary of the Project

1.1. Outline of the Project

1.1.1. Purposes, Expected Effects, and Target Area of the Project

The Project had the following purposes, expected effects, and target area:

(1) Background to the Project

The city of Tirana, which became the capital of Albania in 1920, is located in a plain, about 20 km inland from the Adriatic Sea. In addition, the city of Durres, which is located to the west of Tirana and faces the Adriatic Sea, is one of the leading port cities in Albania and supports the economy of Albania as a base for imports and exports. Since the surrounding areas of these cities are on relatively gentle terrain which makes land development easier, and there is a highway between the two cities for convenient transportation, the population in the Tirana-Durres Region, an area connecting the capital city Tirana to Durres in its suburbs, has been growing sharply in recent years. Especially in the city of Tirana, the population increased from approx. 550,000 in 2011 to approx. 610,000 in 2015 (approx. 22% of the total population of 2.8 million in Albania in the same year)[1], an increase of more than 10% in four years. The National General Plan for Territory was created in 2016 in order to deal with rapid urbanization and disorderly development due to the sharp population growth. In the future, sector-by-sector plans and land management registers must be created to promote infrastructure development based on the Plan. However, the large-scale (1/2,000) digital topographic maps on which they will be based had not been updated since the 1980s.

Meanwhile, the State Authority for Geospatial Information (ASIG) was established to conduct operations related to geospatial information in an integrated manner as part of the national strategies to meet the increasing needs for geospatial information development and prepare for accession to the EU in the future. ASIG had some challenges creating digital topographic maps by itself and conducting the quality control of handling orders for creation of orthophotos, etc. ASIG needed to improve its technical and managerial abilities to create digital topographic maps to ensure efficient development of such maps with adequate quality.

With the background described above, the Project is implemented based on the request made by the Albanian government to the Japanese government in order to develop digital topographic maps of the Tirana -Durres Region and improve their maintainability.

(2) Purposes of the Project

The Project aims at creating 1/2,000 digital topographic maps (about 300 km^2) in the Tirana-Durres Region to enhance ASIG's abilities for photogrammetry and accuracy and quality management to encourage the

[1] Reference: the total population of Albania in 2021 was of 2.84 million and that of the city of Tirana was approx. 910,000 (approx. 32% of the total population.)

utilization of digital topographic maps and thus promote social service and infrastructure development.

(3) Expected outcome

i. Creation of 1/2,000 digital topographic maps in the Tirana-Durres Region (about 300 km^2; 20 km^2 of which are created by ASIG)

ii. Creation of work regulations on technologies for digital topographic mapping

(4) Target area of the Project

Based on the consultation with ASIG, the target area of the Project was determined as shown in Figure 1-1.

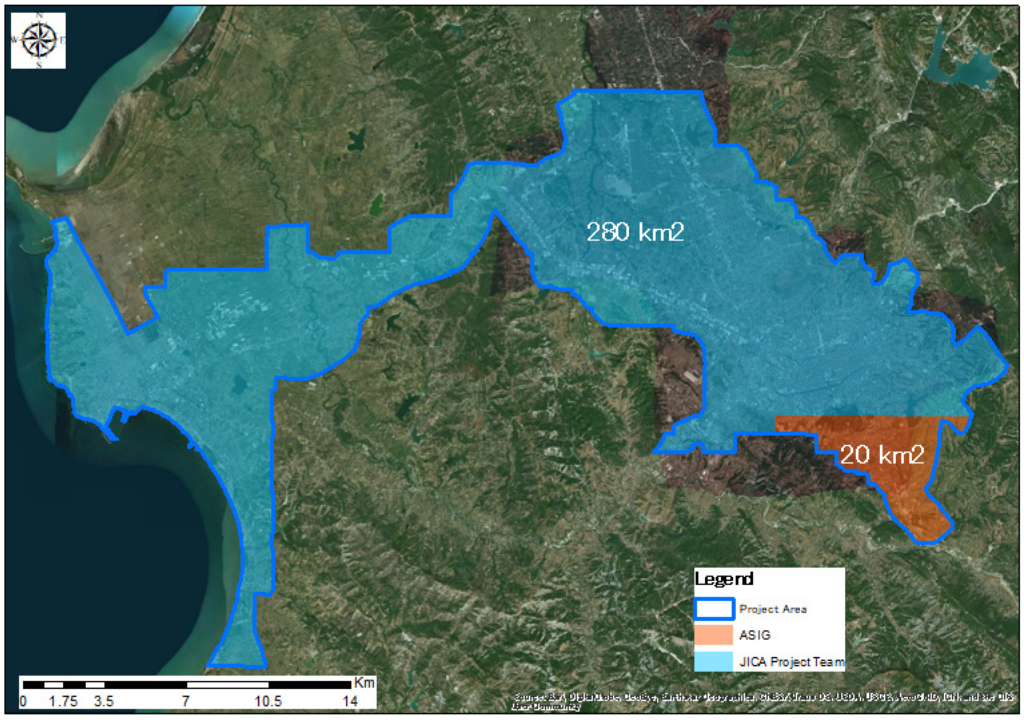


Figure 1-1 Target area of the Project

1.1.2. Outputs

The following table lists the outputs from the Project.

Table 1-1 List of the Outputs of the Project

Items		Quantity	Remarks
(1) Study reports	Inception Report (IC/R)	10 copies in English	Including 7 copies to ASIG

Items		Quantity	Remarks
		1 PDF copy	1 copy to ASIG
	Interim Report (IT/R)	3 copies in English	To JICA
		3 copies of Japanese summary	Ditto
		1 PDF copy	1 copy to ASIG
	Draft Final Report (DF/R)	3 copies in English	To JICA
		3 copies of English summary	Ditto
		5 copies of Japanese summary	Ditto
		1 PDF copy	1 copy to ASIG
	Final Report (F/R)	10 copies in English	Including 7 copies to ASIG
		10 copies of English summary	Including 7 copies to ASIG
		5 copies of Japanese summary	To JICA
		2 PDF copies	1 copy to ASIG
(2) Outputs of technical cooperation	1) Work regulations for digital topographic mapping and supervision (including manuals for topographic mapping) Guidelines - Geospatial Data Product Specification Creation - Field Verification and Field Compilation - Quality Evaluation of Map Data <u>Manuals</u> - Leveling - Ground Control Point Survey - Photogrammetry - Fieldwork - Data Capturing And Data Editing - Cartography and Generalization - Data Structurization	2 sets in English and Albanian	Including 1 set to ASIG

Items		Quantity	Remarks
	- UN Vector Tile - Survey Operation Manual for Topomap		
	2) Records of holding Regional conference	2 sets	Presentation materials and Videos
(3) Aerial photos and orthophotos	1) Result of GCP survey	1 set	
	2) Digital aerial photos	1 set	1,802 photos, Approx. 388 km^2
	3) Result of aerial triangulation	1 set	
	4) Orthophotos	1 set	1,178 photos
(4) Digital topographic maps	1) Field survey results - Field verification - Field completion	1 set	1 set to ASIG
	2) Digital data files (1) Digital topographic maps (2) GIS database (3) Digital topographic maps in PDF format (4) Data Product Specifications (including map symbols)	 2 sets 2 sets 2 sets 2 sets	 Including 1 set to ASIG Approx. 300 km^2 Including 1 copy to ASIG Approx. 300 km^2 Including 1 set to ASIG 162 Sheets/Files Including 1 set to ASIG
	3) Report on quality control including accuracy control tables	2 sets	Including 1 set to ASIG
(5) Vector tiles of the digital topographic maps produced by using UN Vector Tile Toolkit	UN vector tiles Program of web map site	2 sets	Including 1 set to ASIG Approx. 300 km^2 (10 zoom levels)

1.2. The Changes Made after the Project Started

Since the start of the Project, on the basis of consultation with ASIG and JICA, changes have been made to the following matters in the initial plan.

（1） New aerial photography

ASIG agreed to use the aerial photograph taken in 2015 at the time of concluding R/D of the Project as the base of the digital topographic map to be created by the Project. However, it was confirmed that a considerable

amount of changes had occurred over the years since 2015 in the target area of the Project. Therefore, JICA and JICA Project Team (hereinafter called "JPT") judged that the Project needs to cope with the changes. As a result of examining the method (comparison between new aerial photography and on-site survey, etc.) and the costs associated with them, it was decided to implement new aerial photography that is most appropriate in all aspects such as work period, cost, and quality. Because of this, the project duration was extended from 28 months to 37 months and, it was decided to withdraw the orthophoto creation work of 1 km^2 using UAV that had been initially planned. The new aerial photography was conducted as described in 3.2.5 and the aerial photos were used for creation of the digital topographic maps as described in 0.

The 1st amendment of R/D was signed on 25th October 2017 for the above change.

(2) Accuracy of digital topographic map

At the time of the second dispatch of JPT (12 September - 31 October 2017), the accuracy of the planar position that the digital topographic map of scale 1/2,000 specified by ASIG should have was confirmed to be higher than the accuracy standard of equivalent scale applied in Japan. The former is 40 cm and the latter is 140 cm. Therefore, in addition to the usual digital map creation process, it was decided that JPT, together with AGIS, would make sure of the following to ensure the targeted accuracy.

1) The newly taken aerial photography shall have specifications equivalent to those carried out in 2015.
2) While carrying out stereo plotting, in principle, operators enlarge the display scale of the aerial photograph used for the work equivalent to 10 times of 1/2,000.
3) ASIG and JPT mutually check the intermediate data by using the newly created orthophotos and make modifications as necessary. The scope and locations of the inspection target shall be decided upon consultation between them.
4) JPT shall submit the provisional final product to ASIG and have it inspected. Based on the inspection results, JPT shall make necessary modifications and submit the result to ASIG as the final product, and then obtain the certificate from ASIG by the time of draft final report creation.
5) Likewise, JPT shall receive provisional final products that ASIG produces with OJT and carry out inspections. Based on the results, ASIG shall make necessary modifications and submit the result to JPT as the final product. Based on the submitted results, JPT shall summarize suggestions and others in the draft final report.

JICA and ASIG signed on the minutes of meeting dated on 25th October 2017 regarding the above matter.

(3) Change of procurement of equipment and materials

In response to the results of ASIG's actual circumstances survey after the Project began and upon request, an A3 digital multi-function printer (including expendable items) which was planned to be procured was cancelled, the number of licenses of some software, etc., was reviewed, and the configurations of installation for the software were changed (refer to 3.2.14 for details).

(4) Change of compliant geographic information standards

In the first mission in July 2017, JPT obtained the specification plan of the digital topographic map from ASIG and verified this specification plan on the completion of the first mission. As a result, JPT found that the data acquisition target features were similar to what they assumed at the start of the project, and there was no particular objection in the explanation to the ASIG Director General and the ASIG members. However, when JPT gave a progress report of the work on 10 October 2017, the ASIG Director General stated that "the specifications of the digital topographic map to be created in the Project should be compliant with the INSPIRE directive (geospatial information standard in Europe)". As a result of repeated discussions between JPT and ASIG, JPT and ASIG agreed that it was appropriate to create the digital topographic map compliant with the INSPIRE directive by considering that the INSPIRE directive sets out common rules for geospatial information in each EU country, and the background is that compliance with them is one of the requirements for EU accession. JICA also agreed.

For this reason, comparisons and additions / subtractions were conducted between the geodetic reference system and topographic map features that had been independently applied in Albania and those defined in the INSPIRE Directive.

(5) UN vector tile production

For further promotion of utilization of the topographic maps, vector tile production by using UN Vector Tile Toolkit and the related technology transfer have been added to this Project.

The 2nd amendment of R/D was signed on 24th June 2020 for the above change.

(6) Extension of the project duration due to COVID-19

The project duration was extended again, from 48 months to 57 months due to COVID-19 pandemic.

The 3rd amendment of R/D was signed on 30th April 2021 for the above change.

2. Project Outcome, Effectiveness, and Recommendations

2.1. Attainment of the Project Purposes

The given project purposes were attained as follows.

Table 2-1 Attainment of the Project Purposes

<table>
<tr><th>Purpose</th><th>Attainment</th></tr>
<tr><td>Digital topographic map (approximately 300 km^2) at 1/2000 covering the Tirana-Durres area is developed.</td><td>In the course of the Project, a 1/2,000 digital topographic map (approximately 300 km^2) was developed.</td></tr>
<tr><td>ASIG's capabilities in photogrammetry and accuracy/quality control are strengthened, thus promoting social service and infrastructure development.</td><td>ASIG's capacity has been enhanced through technology transfer in topographic mapping including photogrammetry. The overall capacity of ASIG in topographic mapping has been enhanced through technology transfer in accuracy and quality control.
ASIG has begun to update the topographic maps by themselves using the equipment provided in the Project. From this, it can also be confirmed that the purpose of capacity building has been achieved.
The orthophotos created in the Project have already been utilized in the work of local governments and contribute to the development of social services and infrastructure. ASIG Geoportal has 238 different layers and is accessed by about 1600 users every day. The orthophoto created by the project was uploaded to the ASIG Geoportal on 27 August 2018. According to ASIG Geoportal data from 27 August 2018 to 3 November 2021, the orthophoto is the most clicked by users when compared in terms of clicks per km^2 among 238 layers.
<table>
<tr><th></th><th>Data</th><th>Clicks/km^2</th><th>Area: km^2</th></tr>
<tr><td>1</td><td>Orthophoto in 2018</td><td>912,795</td><td>370</td></tr>
<tr><td>2</td><td>Orthophoto in 2015</td><td>10,464</td><td>12,000</td></tr>
<tr><td>3</td><td>Orthophoto in 2007</td><td>51,497</td><td>10,340</td></tr>
</table>
Source: Department of GIS and Geoportal of ASIG
The orthophoto has a narrower coverage than other orthophotos. However, it is the latest and highest resolution orthophoto in</td></tr>
</table>

Purpose	Attainment
	ASIG Geoportal. For this reason, it is possible that the number of clicks is quite high, as many users will zoom in and out of the objects many times. In the future, when the topographic map data are included in ASIG Geoportal as one of the existing layers, it can be assumed that they will be used by many users, just as the orthophoto of the Project is used by them. In the future, it is expected that the digital topographic maps prepared at a scale of 1/2,000 will be utilized for social services and infrastructure development as they become more widely available in Albania.

As mentioned in the table above, ASIG has already been expanding and updating the topographic maps by themselves. The map of Figure 2-1 is one of the examples created by ASIG. This is the area in a part of Kruja municipality (surrounding area of the Project area). ASIG carried out all the necessary work by using the aerial photos taken in the Project and equipment provided. ASIG is responding the needs from the governmental organizations. JPT believes that this is evidence that ASIG successfully built sufficient capabilities in creation of topographic maps.

Figure 2-1 Example of map created by ASIG after the technology transfer

2.2. Expected Effect in Future

(1) Now that the 1/2,000 digital topographic map (about 300 km^2) of Tirana-Durres area has been prepared, it is

expected to be used by various users. Especially, municipalities in the Project area where 1/2,000 digital topographic maps were developed will use them for the following purposes; 1) To manage land and houses by overlaying the topographic maps with land registry maps, 2) To record houses on the topographic maps for the purpose of fixed asset taxation, 3) To make a housing development plan on the topographic maps, 4) To record damaged houses affected by the 2019 earthquake.

(2) The quality of topographic maps to be produced by ASIG in the future will be further improved by following the survey regulations and specifications developed by the Project.

2.3. Recommendations

Recommendations 1: Provision of digital topographic maps to a wide range of users

The digital topographic maps developed in the Project maintain a high level of accuracy and also contain a variety of information. For this reason, the data are very useful not only for the governmental agencies, but also to a wide range of users, including municipalities, private companies, and the general public. Therefore, it is desirable to provide the topographic maps to these users as soon as possible, and to encourage the development of their effects in various situations.

In order for users to use digital topographic maps in their daily work and business, they need to be provided in the form of vector data that can be analyzed and edited, not just viewed. If the users have ArcGIS (commercial GIS software), they can use the symbolized digital topographic maps on their own PCs. If the users are using GIS software other than ArcGIS (including QGIS, which is open source software), the users can utilize the un-symbolized digital topographic maps.

In order to further expand the number of users, one of the possible methods is to extend the functions of the geoportal to enable analysis and editing on the web browser in the future.

The earthquake that struck northwest of Tirana in November 2019 killed 51 people, injured more than 3,000, and caused extensive building damage. The Albanian government was required to consolidate information on the ever-changing damage situation, the status of emergency response measures, and the damage to public facilities and equipment, as well as their recovery, and to make the information fully visible in the form of geospatial information. Soon after the disaster, municipality officials carried tablets containing the latest satellite images provided by the donor countries to the disaster site to conduct field surveys that would contribute to damage assessment.

As in the case of the earthquake, the Albanian public administration sector has also learned the lesson that consolidating information on the areas where COVID 19 has spread and sharing information on the infected areas with the relevant agencies are essential to rebuild a timely and appropriate health care delivery system.

Providing digital topographic maps in the hands of relevant agencies through the methods described above is an important preparation for future disasters and pandemics.

Recommendation 2: Update of topographic maps and expansion of topographic map area

ASIG has named the JICA topographic map data as ALBTOPO 2000 and positioned it as the national base map data. Since the land use in the area where the topographic maps were prepared is changing rapidly, it is necessary to update the topographic map in a timely manner. It is also desirable to expand the coverage of topographic maps to contribute to the development of local cities and infrastructure.

In order to achieve proper updating of the existing topographic maps and expansion of the mapping areas, in the long term, JPT recommends that ASIG formulate a national plan for the development of geospatial information in Albania and to set national development goals.

In the short term, it is necessary for ASIG to promote the new map creation and regular update of large-scale topographic maps, in densely inhabited districts and planned development areas. In particular in areas where 1/2,000 digital topographic maps were produced by the Project, regular updating is essential, since they constitute the most developed area in the country.

Each house and narrow road is shown on a large scale map, such as 1/2000 scale. This information on the location of houses and roads can be used by users to maintain and manage social infrastructure directly linked to buildings, such as water pipes, power lines, and telecommunications networks. In some cases, personal information such as the head of the household, the family structure, the amount of tax paid, etc., may be added to the topographic map data as attributes.

If the large scale topographic maps are not updated for a long period of time in the urban areas, they will no longer be able to meet the needs of its users. This means that the users of geospatial information will lose confidence in ASIG, responsible for maintaining topographic maps.

The most common method for updating topographic maps is to use aerial photographs and satellite images; however, the resolution of satellite images is insufficient to update the high-precision ALBTOPO 2000. For this reason, aerial photography with high resolution by aircraft should be conducted periodically (e.g., every three years) over the entire area where the topographic map was created, and in large-scale development areas, it is desirable to take aerial photographs by drone each time after the completion of construction and to use them for updating.

These works and the expansion of the topographic map area will require a large budget. Therefore, it is essential for ASIG, as the national geospatial information agency, to develop a medium- to long-term plan for updating and expanding the topographic maps, as well as a budget plan for these purposes, and to secure financial resources.

In addition, it is expected that the value of topographic maps in the Albanian government will be further enhanced by sharing information with the following geospatial information users.

ASIG should propose the use of ALBTOPO2000 to various government agencies and try to expand the number of these users. If the use of ALBTOPO2000 as a common social infrastructure becomes a standard within the government agencies, the government will inevitably allocate more budget for the expansion of the ALBTOPO2000 area.

Table 2-2 Responsible organizations in charge of geospatial information

Geospatial information	Responsible organization
Basic Map	ASIG
Determination of Reference Frame and Geodesic Controlling	
Geographical Network Systems	
Geographical Nomination	
Digital Model of Terrain	
Ortho-imagery	
Borders of Administrative Units	Agency for Implementation of Territorial Reform (AZRT)
Address System	General Directorate of Civil Status (DPGJC)
Cadastral Plots	Central Office of Real Estate Registration (ZRPP)
Transport Network	Institute of Transport (IST)
Hydrography	Ministry of Agriculture & Rural Development
Protected Areas	National Agency of Protected Areas (AKZM) Institute of Culture Monuments (IMK)
Soil Coverage	Ministry of Agriculture Ministry of Tourism & Environment
Geology	Institute of Geo-Sciences, Hydrology & Environment (IGJEUM)
Statistical Units	Institute of Statistics (INSTAT)
Demography	
Buildings	Central Office of Real Estate Registration (ZRPP)
Pedology	Agriculture Technology Transfer Center of Fushe-Kruje (QTTB)
Land Utilization	National Agency of Territorial Planning (AKPT) Agriculture Technology Transfer Center of Fushe-Kruje (QTTB) Ministry of Tourism & Environment
Human Health and its Security	Institute of Public Health (ISHP)
Urban Infrastructure & Governmental Services	Agency for Territorial Development (AZHT)
Infrastructure for Environment Monitoring	National Agency of Environment (AKM)
Industrial Infrastructure	Ministry of Infrastructure & Energy Ministry of Tourism & Environment
Agricultural Infrastructure & Aquaculture	Ministry of Agriculture & Rural Development
Areas with limited usage	Agency of Territorial Development Ministry of Tourism & Environment, National Agency of Natural Resources (AKBN)

Geospatial information	Responsible organization
Areas with Nature Risk	National Agency of Civil Emergencies (AKEC)
Atmospheric Conditions	Institute of Geo-Sciences, Hydrology & Environment (IGJEUM)
Meteorology	
Hydrology	
Seas	Albanian Hydrography Survey (SHHSH), Command of Coast Guard
Ecological Zoning	National Agency of Protected Areas (AKZM)
Habitats	
Distribution of Species	Ministry of Tourism & Environment
Energy Resources	Ministry of Infrastructure & Energy
Mineral Resources	National Agency of Natural Resources (AKBN) , Albanian Geological Survey (SHGJSH)

(Source: Department of GIS and Geoportal in ASIG)

On the other hand, it is also effective to carry out partial updating of topographic maps with the cooperation of municipalities. ASIG has a future goal of rebuilding a geoportal equipped with editing functions (building a WEBGIS) and allowing municipalities to update the topographic maps on the geoportal.

In order to realize these, it is necessary not only to take technical measures such as system development, but also to design the institutional arrangement that includes clarification of shares of responsibilities among the municipalities and ASIG regarding the topographic map update.

As a preliminary step to achieving this goal, JPT proposes as follows: (1) ASIG establishes a workflow to update topographic maps based on the information obtained from municipalities. (2) Based on the workflow, ASIG receives accurate information from the municipalities on the areas to be updated. (3) ASIG repeats the topographic map update with the information from the municipalities. (4) After the stabilization of map update process, ASIG trains the staff of each municipality for topographic map revision. (5) Each municipality updates the topographic map based on the information collected by themselves. (6) Each municipality forwards the updated topographic maps to ASIG. (7) After inspecting the updated topographic maps by the municipalities, ASIG keeps them in their server, (8) ASIG starts the design of WEBGIS which each municipality could update the topographic maps more easily.

As a reference, municipalities in Japan maintain 1/2,500 topographic maps of their urban planning areas in accordance with the City Planning Law. After the creation of these topographic maps, each local government takes the initiative in maintaining and managing them. Geospatial Information Authority of Japan (GSI) collects these 1/2500 topographic maps and uses them to develop and update the national base map information. This information is available through the GSI website. It is hoped that the establishment of a mechanism that requires the use of ALBTOPO 2000 under the legal system will facilitate the expansion of topographic map development in Albania.

Recommendation 3: Promotion of activities to increase the number of GIS users within Albanian governmental organizations

The use of GIS is expected to be effective in facilitating policy making and the implementation in the Government of Albania, the municipalities, and the public corporations in Albania. However, the use of GIS by each institution is not always sufficient at present. The challenges are that the geospatial information (digital topographic maps, etc.) that can be used is not sufficiently prepared as described above, and that the technology using GIS has not fully penetrated the users.

In order for digital topographic maps to be used not only for viewing but also for business purposes, GIS training is needed for municipalities that lag behind in information technology among government agencies and lack the technical personnel. GIS training and procedures for typical use cases should be widely provided. In order to realize this, ASIG, which is the organization that produces geospatial information in Albania and has a good understanding of GIS use, shall take the lead in this activity. For this purpose, it is important to further improve the skills of ASIG staff and secure the necessary personnel and budget.

As the number of GIS users increases, the need for new and updated topographic maps will increase. The Albanian government will prioritize the allocation of geospatial information budgets. Then ASIG will be able to create and update topographic maps instantly. JPT recommends that ASIG take steps to actively increase the number of GIS users in order to form this virtuous cycle.

3. Results of Project Implementation

3.1. Workflow

The workflow of the Project was as shown below.

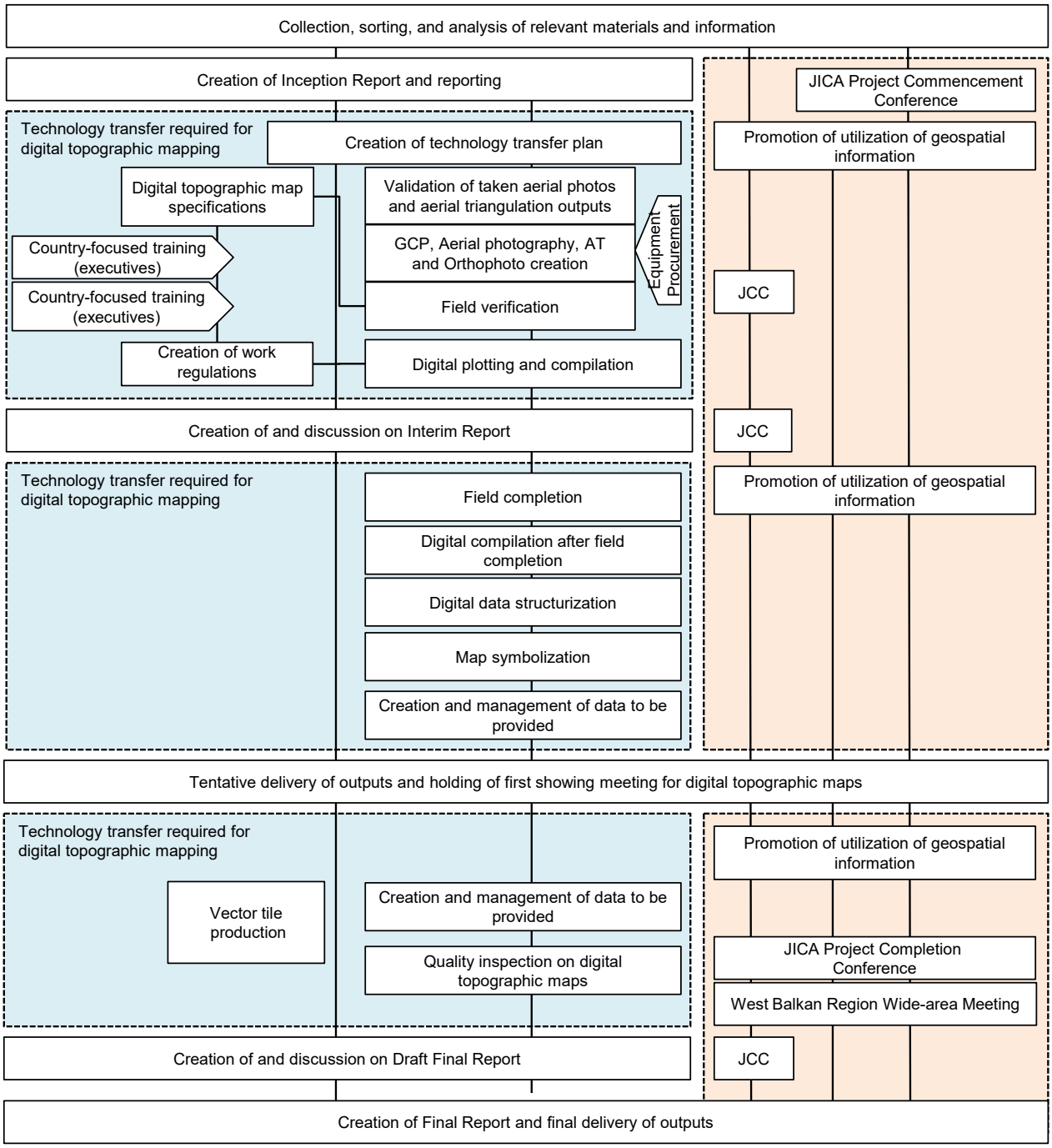


Figure 3-1 Project Workflow

3.2. Completed Work

3.2.1. Collection, Sorting, and Analysis of Relevant Materials and Information

JPT analyzed the materials collected by the detailed planning survey conducted in January 2017. Furthermore, the information and materials available in Japan were collected, sorted, and analyzed in preparation for the

Inception Report of this Project.

3.2.2. Creation of Inception Report and Reporting

Based on the TOR of the Project and related materials, JPT prepared the Inception Report describing the activities, the work process schedule, and the personnel plan of the Project, together with the draft of the technology transfer plan. After that, the several changes described in "1.2" were made based on mutual understanding and agreement among JICA, ASIG, and JPT.

3.2.3. Creation of Technology Transfer Plan and Implementation of Technology Transfer

Technology transfer from JPT to ASIG was carried out throughout the Project based on the technology transfer plan created under the agreement of JPT and ASIG. The details of the technology transfer are described in Chapter 4.

3.2.4. Validation of the Aerial Photos taken in 2015 and their Aerial Triangulation Results

Since digital topographic maps were originally planned to be created using the aerial photographs taken in 2015, JPT validated them together with the aerial triangulation results and found no defect.

A stereo model was established based on the obtained aerial photographs and the results of the aerial triangulation, the reference points were measured in three dimensions, and they were verified by comparing the reference point value with the measured value. As a result, as shown in Table 3-1, it was confirmed that there were no issues with accuracy.

Table 3-1 Accuracy of the aerial photographs of 2015 and aerial triangulation results

Item	Horizontal (m)	Height (m)
Standard deviation of Difference of Control Points	0.077	0.078
Acceptable Range of Standard Deviation	0.080	0.080

3.2.5. Ground Control Points Survey, Aerial Photography, Aerial Triangulation, and Orthophoto Creation

（1） Overview of the work

Ground control point survey, aerial photography, aerial triangulation, and orthophoto creation were out-sourced and conducted by Hansa Luftbild AG of Germany (hereinafter referred to as Hansa) which was selected through nominated competitive bidding. JPT managed the progress and supervised the work.

(2) Activities carried out

(a) Planning and preparation

The following activities were conducted.

- Determination of the photography specifications

  Resolution on the ground: 8 cm

  Degree of duplication: Overlap=60%、Sidelap=30% (When planned)

  Course of photography: L1- L52, in total of 52 courses

  Number of shots: 1802 photos

  Photography ground altitude: 1540 m

  Camera focal length: 100.00 mm

- Creation of the photography plan
- Obtainment of photographing permission from the Ministry of Defense and flight permission from the Aviation Station

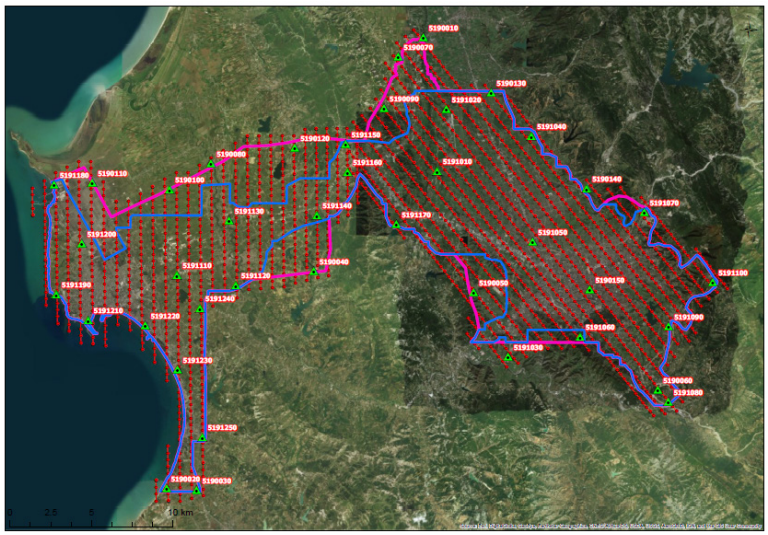


Figure 3-2 Photography plan

(b) Implementation

750 photographs on 29 courses were taken in the Durres area on 26 May 2018, and 1,052 photographs on 22 courses were taken in Tirana area on 27 May 2018.

Photographic Equipment

Aircraft: Cessna 404 (D-IDOS)

Camera: UltraCam Eagle 100 (Vexcel)

GNSS/INS system: AeroControl II d (IGI)

Photographing management system: CCNS4 (IGI)

Cessna404

UltraCam Eagle 100

AeroControl II d

CCNS4

Photo 3-1 Photographic equipment

(c) Ground control point Survey

The ground control point marking and measurement were conducted from the end of March until the beginning of May 2018. The points were selected on the basis of the preselection under consideration of the individual situation at the points. A total of 40 GCPs were established.

As a base network for processing of ground control point coordinates, the Albanian Satellite Positioning System, ALBPOS, which comprised 16 permanent stations, was used. The heights were calculated on the basis of the global model of the geoid EGM2008. The final coordinates in height were derived by processing with ALBAGEO3 software, which is customized software that allows transformation of ellipsoidal heights into geoid elevations, especially for the area of the Albanian territory (for half of 125 shared points distributed homogenously).

GCP N.	5190020	Index Map K-34-100-A

Nation	ALBANIA	
Local Government	TIRANË	Local Government Unit 6
Municipality	KAVAJË	

ETRS89 Geographical Coordinates (ref. ALBPOS)		KRGJSH 2010 (ETRS89-TMzn)	
φ:	N41°13'2.136"	N (m)	4564818.594
λ:	E19°30'24.616"	E (m)	458644.172
Height Ellipsoidal (m):	36.162	Height Orthometric (m):	1.655

The orthometric heigths were calculated with the software ALBAGEO 3

Permanent GPS Stations Connected	Errors	σ E (m)	σ N (m)	σ h (m)
ALBPOS Network		0.005	0.008	0.015

Marked GCP	4/11/2018
Measured GCP	4/11/2018

Figure 3-3 An example of GCP point description

（d）Quality inspection

Inspection of photographed images, GNSS / INS data, aerial triangulation results (shown in Table 3-2), and orthophoto (shown in Table 3-3) was conducted.

Table 3-2 Accuracy verification result of aerial triangulation result measured by the plotting machine

Item	Horizontal (m)	Vertical (m)
Standard Deviation of Residual Control Point	0.008	0.017
Acceptable range	0.080	0.080

Table 3-3 Result of accuracy verification of orthophoto

Type	No. of Points	Mean dX (m)	RMS dX (m)	Mean dY (m)	RMS dY (m)
Control Points	34	0.014	0.055	-0.014	0.053
Other Points	93	0.021	0.037	-0.023	0.039

(3) Result of the work

The aerial photographs together with the result of aerial triangulation were used for creation of digital topographic maps. The orthophotos were provided to ASIG in August 2018, which then had been published on the Geoportal of ASIG.

Table 3-4 Deliverables of the Photography

Data	1. Camera calibration report/interior orientation (IO) data 2. Raw data for aerial images, GNSS, and INS data 3. Oriented Digital Aerial Images RGB and CIR 4. Processed GNSS- and INS-data for the images 5. Flight log 6. Date of acquisition for each aerial image 7. Rinex file of the measurement 8. Observation data of GCPs Survey 9. List of Control Points and Check Points 10. Point description sheet of Control Points and Check Points 11. Aerial Triangulation observations 12. Aerial Triangulation Block Adjustments project (digital file) 13. Exterior Orientation Elements 14. RGB and CIR Orthophoto 15. DEM and breakline used for orthorectification
Documents	1. Aerial Sensor Operation Plan 2. Aerial Photography Report 3. Oriented Aerial Images Production and Block Adjustment Report 4. Orthophoto Production Report 5. Product Quality Management Plan/ Report

Source: https://geoportal.asig.gov.al/map/?auto=true

Figure 3-4 ASIG Geoportal

3.2.6. Discussion on Map Symbols, Work Criteria, and Specifications

(1) Overview of the work

Map symbols were defined with reference to the symbols defined in EU INSPIRE. Work standards and specifications were defined based on the existing guidelines of Albania and the defined map symbols as described above. The data specifications were defined by only adding features, without deleting or modifying features that were originally defined in EU INSPIRE in principle. The directive includes not only general rules concerning the development of geospatial information, but also specific data product specifications, and defines the feature items to be acquired and their data structures. Therefore, in order to comply with the data product specifications, it is not possible to formulate the feature items and data structures to be acquired independently in this project, and the features defined in the data product specifications are within the EU region. It was judged that there would be excess or deficiency in application

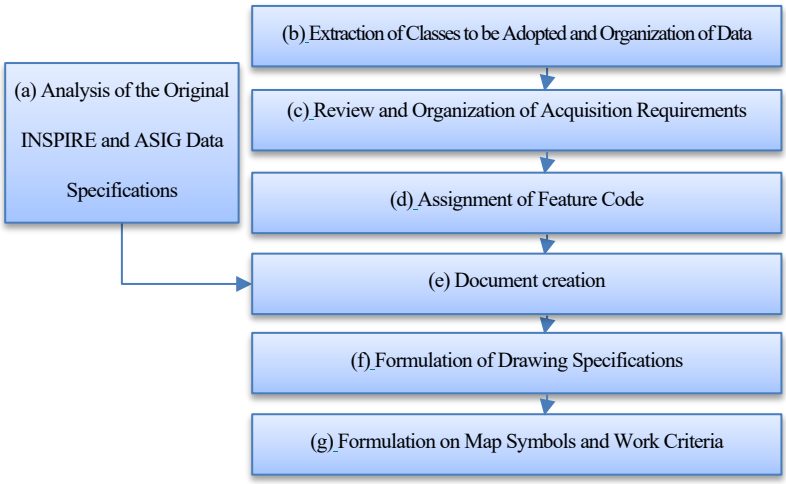


Figure 3-5 Procedure for discussion on map symbols, work criteria, and specifications

in Albania due to the setting of general feature items. These are summarized in the Data Product Specifications (DPS).

In July 2021, DPS 1.0 version was prepared after minor correction of its contents and without major update in its contents as the first complete version and provided to ASIG.

(2) Decisions made

(a) Compliance standards

As described in 1.2 (5) above, it was decided to make specifications in compliance with EU INSPIRE directive. For this reason, the work was carried out according to the procedure shown in Figure 3-5.

Then, the policy for adopting the data specification based on the INSPIRE directive was determined as follows. This is a policy agreed between JPT and ASIG through three times of opinion exchanges between January and March 2017, following the creation of data specification draft as well as the organization and review of relevant materials which were conducted by JPT on the basis of the agreement made in October 2016 to formulate specifications in accordance with INSPIRE.

- Out of the 34 themes (subjects) disclosed as INSPIRE data specifications and the ASIG's 34 data specifications of INSPIRE, 10 themes formally adopted as specifications for Albania have been covered. Table 2-6 shows the list of themes, the adoption situation in Albania, and the situation of specification formulation. The data specifications of 10 themes adopted by ASIG were the data specifications of INSPIRE which were translated into Albanian with a small number of additional features according to local needs.
- In principle, from the INSPIRE and ASIG data specifications, all features that can be instantiated have been included.
- In principle, the data specifications of INSPIRE and ASIG have not been changed, but when necessary, addition have been made without any change of feature names or the structure of the data.
- The data specifications of INSPIRE and ASIG have been adopted in the map and additions have been made with reference to the existing topographical maps of Albania and the maps of the neighbouring countries, etc. for insufficient parts.
- Note that the drawing specifications are defined in the INSPIRE data specifications, but they presuppose simple expressions on the display which are simple line types such as solid or broken lines and limited expressions such as single-color paint-out. Therefore, it was decided that addition or a revision is to be made to those specifications as necessary.
- In data specifications, it was important to be capable of flexibly storing data in the relational database and GIS data format, keeping in mind the publication of the digital topographic maps by ASIG after completion of the Project.

Table 3-5 Data Specification, the status of adoption at ASIG, and consideration for adoption

Status of Data Specification Consideration by the INSPIRE Data Product Specifications **As of June 2018**

Theme	EU Nr.	AL Nr.	Abbr.	Name	Approval Status (by ASIG) ○: Approved ×: Not Approved △: In Progress	Analysis of Scoping Features ○: Yes (within the scope) ×: No (Obviously outside the scope) △: Questionable	Remarks
I	1	1	RS	Coordinate reference systems	×	×	There is no "spatial" feature type defined.
	2	2	GG	Geographical grid systems	△	×	There is no "spatial" feature type defined. Shall be used for consideration of the data unit, especially ortho photo imagery.
	3	3	GN	Geographical names	○	○	Very well clarified. GM_Point, Line, or Surface. As of strategy, use it as an independent point feature instead of embedded attribute, thereby simplifying the specification.
	4	4	AU	Administrative units	○	○	Very well clarified. GM_Line for Boundary, Multi-surface for Unit Boundary may mainly be used instead of units to be used.
	5	5	AD	Addresses	○	×	NOT for JICA 1/2,000 Topomap. Practically no possibility of collecting this info. ASIG may have it if desired later on.
	6	6	CP	Cadastral parcels	○	×	NOT for JICA 1/2,000 Topomap. Practically no possibility of collecting this info. ASIG may have it if desired later on.
	7	7	TN	Transport networks	○	○	Mostly network structure related feature types, and insufficient portrayal definition.
	8	8	HY	Hydrography	○	○	"Network" and "Physical Water" Packages will be Limitedly used according to the AL spec. Insufficient portrayal definition.
	9	9	PS	Protected sites	△	△	Questionable, Most sites shall be represented already by other boundary features. More consideration needed.
II	1	10	EL	Elevation	○	○	ElevationVectorElements should be fine. Propose to choose either Coverage or TIN.
	2	11	LC	Land cover	×	○	RASTER shall NOT be adopted. Code list shall be identified from major external definitions.
	3	12	OI	Orthoimagery	○	△	Shall be conceptually compliant with it.
	4	13	GE	Geology	○	△	Basically NOT for JICA 1/2,000 Topomap. Only a small part of the specification could be adopted.
III	1	14	SU	Statistical units	×	×	Basically NOT for JICA 1/2,000 Topomap.
	2	15	BU	Buildings	○	○	Preferably LoD0 (2D) or 1 (Flat roof) with limited types of Elevation. Practically, LoD2, 3 and 4 are NOT implementable, except other constructions such as chimney, monument, etc.
	3	16	SO	Soil	×	×	Basically NOT for JICA 1/2,000 Topomap.
	4	17	LU	Land use	×	×	Tightly associated with ps, am, nz, lc. More serious consideration of overlapped feature association needed. At second analysis work, LU classes have been removed. LU is for planning and planned use of land, LC is for actual land coverage. For Topomap LC shall be used.
	5	18	HH	Human health and safety	×	×	Basically NOT for JICA 1/2,000 Topomap. Mostly Human health and safety statistics.
	6	19	US	Utility and governmental services	×	○	Portrayal definition shall be considered in more detail.
	7	20	EF	Environmental monitoring Facilities	×	×	Shall partly be adopted for major facility features. Changed to not to adopt after detailed analysis

Status of Data Specification Consideration by the INSPIRE Data Product Specifications **As of June 2018**

Theme	EU Nr.	AL Nr.	Abbr.	Name	Approval Status (by ASIG) ○: Approved ×: Not Approved △: In Progress	Analysis of Scoping Features ○: Yes (within the scope) ×: No (Obviously outside the scope) △: Questionable	Remarks
	8	21	PF	Production and industrial facilities	×	○	Requires some more careful analysis on overlapping features with other packages.
	9	22	AF	Agricultural and aquaculture facilities	×	○	Code list shall be clarified.
	10	23	PD	Population distribution and demography	×	×	Basically NOT for JICA 1/2,000 Topomap.
	11	24	AM	Area management / restriction / regulation zones & reporting units	×	×	Associated with lu and the same as lu. At 2nd analysis, it has been removed. The features are more like nationwide scale controlled areas and thus they are out of scope for topomap.
	12	25	NZ	Natural risk zones	×	×	Associated with lu and the same as lu.
	13	26	AC	Atmospheric conditions	×	×	Physical observation features only. Changed, no feature extracted from the theme.
	14	27	MF	Meteorological geographical features	×	×	Physical observation features only. Changed, no feature extracted from the theme.
	15	28	OF	Oceanographic geographical features	×	×	Physical observation features only. Changed, no feature extracted from the theme.
	16	29	SR	Sea regions	×	×	Requires external reference such as sea bottom depth for contour line features. Changed, No applicable class in the theme.
	17	30	BR	Bio-geographical regions	×	×	Requires more consideration with other overlapped land classification features. Changed. No applicable class in the theme.
	18	31	HB	Habitats and biotopes	×	×	Shall be partially adopted. More consideration needed with other overlapped land classification features. Changed. There is no applicable class in the theme.
	19	32	SD	Species distribution	×	×	Basically NOT for JICA 1/2,000 Topomap.
	20	33	ER	Energy Resources	×	×	Basically NOT for JICA 1/2,000 Topomap.
	21	34	MR	Mineral Resources	×	×	Physical geographic features only.

[Note]
* ASIG's specification will be preferentially in use as long as they have been officially approved; otherwise original INSPIRE's specification will be in use.

(b) Geodetic reference system

It was confirmed to ASIG that the geodetic reference system is KRGJSH 2010.

Geodetic Reference System is GRS80. “GRS80” is the geodetic reference system determined in 1980 and internationally accepted. Albania does not have its own geodetic origin in the country and uses the European coordinate system. Albanian geodetic coordinate system is one part of ETRS89 (European Terrestrial Coordinate System). "ETRS89 " is the European Terrestrial Coordinate System accepted by the subcommittee of the International Association of Geodesy (IAG) for the Europe "EUREF" and fixed in the stable part of the

European Continental Plate. “EUREF (European Reference Frame)” is the name of the coordinate system officially accepted as the geodetic reference frame for the EU. The coordinates of the domestic reference points are calculated from the reference points of ETRS89 existing in neighboring countries.

Benchmarks are also incorporated into the European frame of reference. It does not have its own elevation origin. Also, no geoid model has been created. Generally, a geoid model called EGM2008 created by National Geospatial- Intelligence Agency (NGA) is used.

Table 3-6 shows the spatial reference system of the digital topographic map.

Table 3-6 Spatial reference system

Spatial Reference System	KRGJSH2010
Ellipsoid	GRS80
Semi-major axis	6378137.000 m
Inverse Flattening	1/298.257222101
Reference System in Height	Mean Sea Level of Adriatic sea
Projection System	Transverse Mercator Zonal
Scale Factor at Origin	1.0000
The origin of coordinate system	20°00'00" East of Greenwich, the equator
False Easting	500,000.00m
False Northing	0.00m
Unit of Measurement	Meter (Three Places of decimals)
Datum	ETRS89 (European Terrestrial Reference System 1989)

(c) Map index system

Since there had been no official provision for map sheet size of 1/2,000 in Albania, the map index system was newly defined by ASIG. 1 map sheet size is 1,600 meters north- south and 1,800 meters east –west. The index system covers the entirety of Albania for further map production.

In addition, ASIG and JPT agreed that seamless data would be created in the entire area, although the map sheet size is specified in DPS.

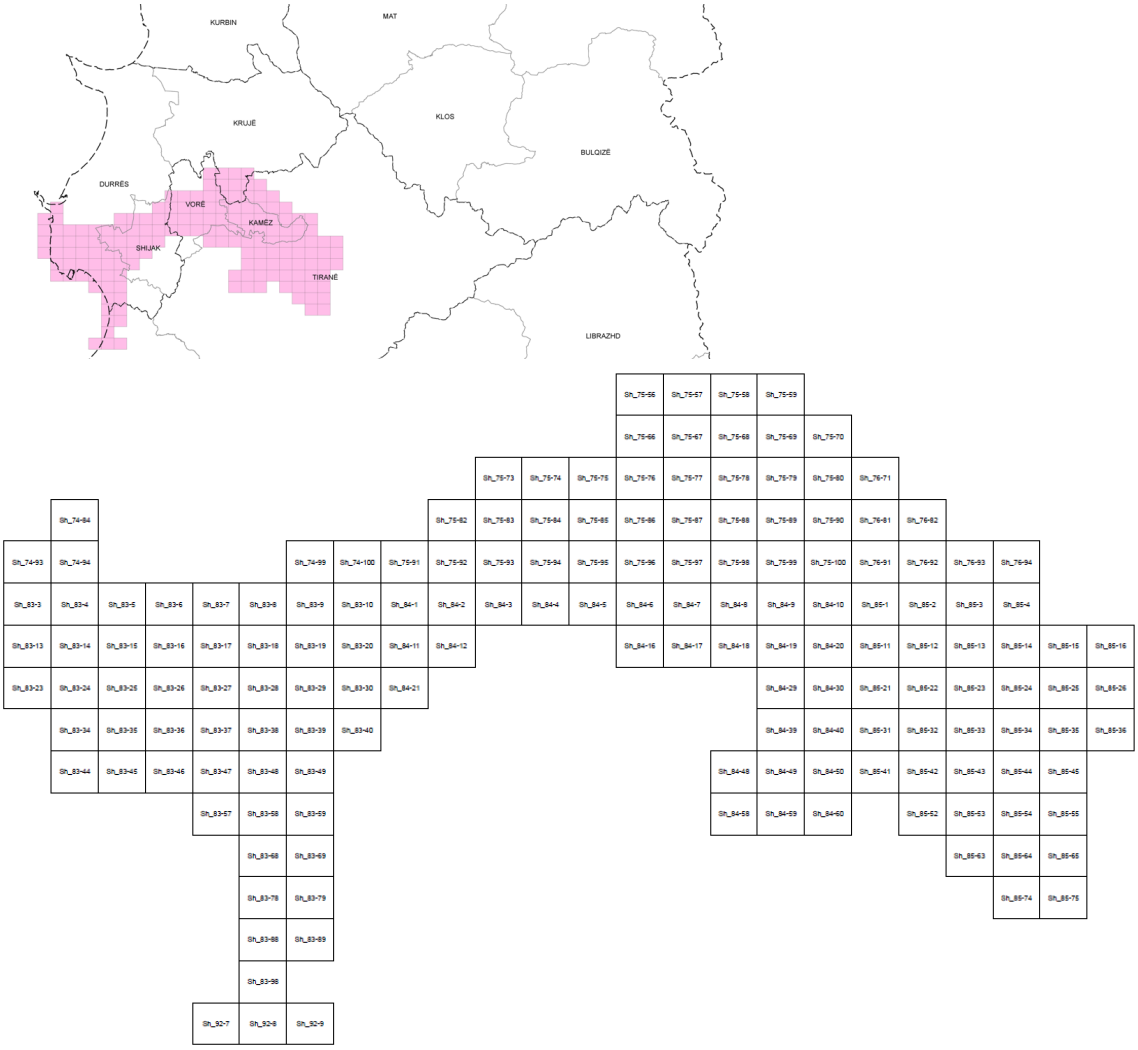


Figure 3-6 Map index

(d) Database foundation

It was decided to use the format of relational database (SQL Server format) that is optimal for mapping/editing processing and data disclosure in ArcGIS, which was software used for digital topographic map creation, for web service establishment. The structure of the data is relatively simple as GIS data and in the geometric form, attributes have been limited to only points, lines, polygons, and instances. Since there was no topology or relevance between features, it was supposed that no serious problem occurred in conversion to other data formats.

(3) Result of the work

The work was carried out as follows.

(a) Analysis of the Original INSPIRE and ASIG Data Specifications

All the data specifications of 34 INSPIRE themes, including the 10 themes adopted by ASIG, were comprehensively analyzed. First, the static class diagram showing feature specifications was analyzed and all concrete classes[2] that could be instantiated were extracted. It was decided that the attributes of abstract classes[3] that could not be instantiated were to be described directly in the lower concrete class.

Examples of abstract class and concrete class are given below. The abstract class "HydroObject" which is contained in the package “Hydrography" is the parent class of the same package and describes the common property that all child classes are supposed to have, such as attribute id. "HydroObject" does not appear in the actual data set, but it is an abstract class on the data structure described in the data specification. The concrete class "HydroNode" which is contained in the package Hydrography is a class that represents the center line of a waterway, a class that inherits the properties such as attributes described in "HydroObject" and appears as data as figures. The extracted result is shown in Figure 3-7 as a UML static class diagram. Out of the 34 themes, those that were outside the scope of this project, such as "cadastre", were excluded for each theme. In addition, by consultation with ASIG, features that were insufficient as topographic map representations were independently defined as the theme "ASIG". This was because INSPIRE was designed mainly to protect the environment and it does not contain all items of expression by symbols like conventional topographic maps.

Hydro Network (HydroNode, WatercourseLink, WatercourseSeparatedCrossing)

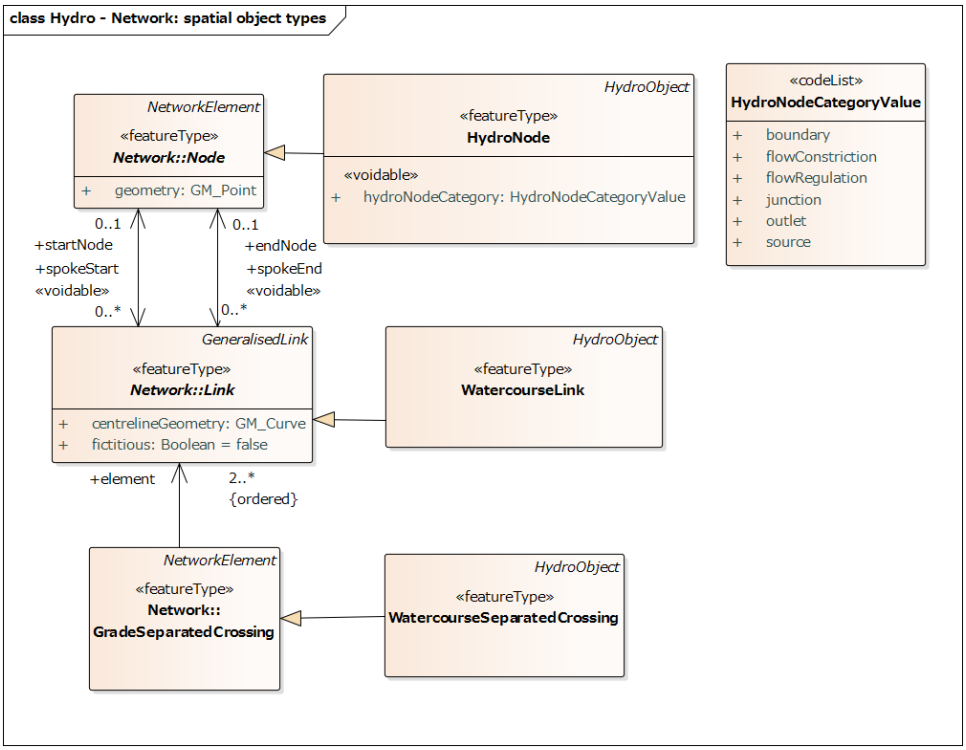


Figure 3-7 Example of Data specifications expressed by using UML diagram (Package HY: Hydrography)

[2] Feature classes that can generate instances of feature
[3] Feature classes that cannot generate instances of feature

The original INSPIRE was analysed. As a result, 86 features from INSPIRE plus 9 cases independently developed by ASIG were adopted as the data specifications of the digital topographic map. Additionally, several objects were included in one feature, depending on the attribute. For example, a feature "GovernmentalService" represents a public organization, but represents six types of institutions, including public offices, fire departments, hospitals, elementary schools, and universities, depending on the attribute. Given the classification of features based on these attributes, more than 800 target features were covered as candidates for adoption alone. All extracted features were compiled in a table format by theme. Figure 3-8 is one of the examples.

Table 3-7 Example where the extracted features are compiled

3.1.4.2	Named Placed	Emërtimil Vendit	Geographical Names	«feature Type»	Instanceable	+ geometry :GM_Object + inspireId :Identifier + name :Geographical Name [1..*]	+ beginLifespanVersion :DateTime + endLifespanVersion :DateTime [0..1] + leastDetailedViewingResolution :MD_Resolution [0..1] + localType :LocalisedCharacterString [1..*] + mostDetailedViewingResolution :MD_Resolution [0..1] + relatedSpatialObject :Identifier [0..*] + type :NamedPlaceTypeValue [1..*]	Point	by default	GeographicalName + spelling :SpellingOfName [1..*] NamedPlaceTypeValue + administrativeUnit + building + hydrography + landcover + landform + populatedPlace + protectedSite + transportNetwork + other

(b) Extraction of Classes to be Adopted and Organization of Data Structures and Attributes

For features that were candidates for adoption, geometric data types, feature names, and attribute code lists were created, and multiplicity was defined. The proposed plan was confirmed with JPT and ASIG repeatedly three times in January, February, and April 2018, and the list of features was confirmed.

(c) Review and Organization of Acquisition Requirements

In the data specifications of INSPIRE, acquisition requirements of each feature, such as the size of features to be converted into data, were not clearly stated, and were left to the agencies of individual countries that maintain the data. For this reason, appropriate acquisition requirements were described for each feature while referring to public surveying schemes, etc. in Japan. Also, for example, rules for data acquisition were prescribed, such as acquiring a closed figure clockwise and a shoreline with the water surface located on the right-hand side in the traveling direction.

(d) Assignment of Feature Code

The data specifications of INSPIRE are specified by feature names. However, because a long feature name (for example, "AdministrativeBoundary" is required for accuracy in spelling and type of uppercase and lowercase letters) can be a factor of description error and so on in the work of data maintenance, etc., a rule for data code assignment was formulated so that all the combinations of features and attributes can be described with 13-digit numbers and alphabetical characters.

Table 3-8 Example of feature codes(NamedPlace 03-01-P-01-XX-XX-XX-XX)

Theme		Feature name		Geometry		Attr.1st			Attr.2nd			Attr.3rd			Attr.4th			Example of encoding							
Name	Code	Name	Code	Type	Code	Name	Value	Code	Name	Value	Code	Name	Value	Code	Name	Value	Code	Theme	Feat.	Geom.	Attr.1	Attr.2	Attr.3	Attr.4	Code combined
GN	03	NamedPlace	01	Point	P	Name	+ administrativeUnit	01	n/a	n/a	xx	n/a	n/a	xx	n/a	n/a	xx	03	01	P	01	xx	xx	xx	03-01-P-01-xx-xx-x
							+ building	02																	
							+ hydrography	03																	
							+ landcover	04																	
							+ landform	05																	
							+ populatedPlace	06																	
							+ protectedSite	07																	
							+ transportNetwork	08																	
							+ other	09																	

(e) Document Creation

Upon completion of drawing up the diagram, the document was compiled as Data Product Specification (DPS). DPS were prepared in accordance with ISO 19131: 2007 Geographic information - Data product specifications. Comprehensively describes the information formulated so far.

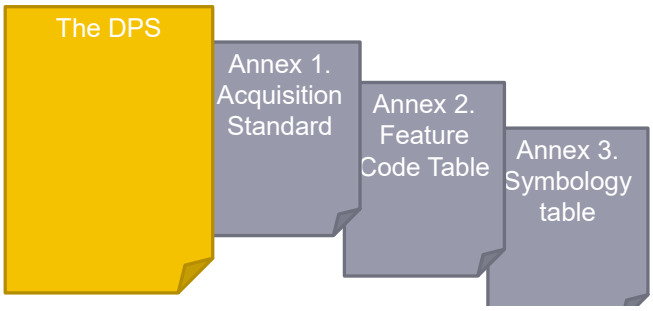


Figure 3-8 Composition of Data Product Specification

The composition of the document is as shown in Figure 3-8.

As of June 2018, DPS 0.1 version was prepared as an appendix to the locally re-entrusted tender documents on field verification and supplementary measurements. The document was used as the specification of tender documents after ASIG's approval.

In November 2018, data quality which was undeveloped was formulated as DPS version 0.2. Data quality was described in compliance with ISO 19157: 2013 - Geographic information - Data quality.

As described in 1.2 (3), the accuracy of the feature position was determined to be 40 cm in the Project, but it was unclear what parts of what features are to be measured, and how they should be measured, and what values (maximum value, standard deviation, least squares error, etc.) should be achieved. For this reason, the data quality plan was formulated to include the definition of data quality of individual feature (what kind of quality a certain feature should have), a conformity quality level (value of accuracy, etc.), and a quality evaluation method (a method of measurement, a rate of measurement, etc.).

In July 2021, DPS 1.0 version was prepared after minor correction of its contents and without major update

in its contents as the first complete version, and provided to ASIG.

(f) Formulation of Drawing Specifications

In order to comply with the data specifications of INSPIRE as described above, it was decided that the map symbols procedure was to be reviewed after data specifications were reviewed and roughly determined.

Map symbols were reviewed for the formulation of DPS version 0.1. In accordance with the premise of the review, the drawing specifications indicated in the INSPIRE data specifications were first adopted. INSPIRE stipulates expressions of features whose main purpose is display on a PC. Many of them are simple types of line and filling. Symbolic map symbols as applied in conventional topographic maps are not included. For this reason, a symbolization plan was formulated for point features as targets by referring to the topographic map symbols adopted by neighbouring countries, and the arrangement of equally spaced symbols was specified for vegetation in addition to the filling indicated by INSPIRE. A part of the formulated map symbols is shown in Figure 3-9. For example, the LandCoverUnit of the LandCover package was a class representing vegetation and land use situation. Single colour filling was prescribed in INSPIRE. On the other hand, the drawing specifications of this Data Product Specification specify that vegetation point symbols are to be placed at equal intervals in the feature range in addition to single color filling which was specified in INSPIRE.

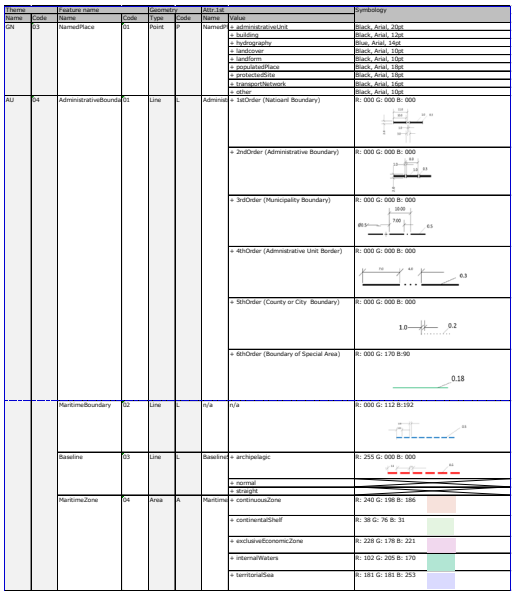


Figure 3-9 Excerpt from map symbol proposal

(g) Formulation on Map Symbols and Work Criteria

Map symbols and work criteria have been complied based on the discussions on map symbols, work criteria, and specifications, and the final version (version 1.0) was provided together with the main DPS to ASIG.

3.2.7. Creation of Work Regulations

(1) Overview of the work

JPT created a draft of the work regulation including the accuracy and quality control of each step of the process of the creation and maintenance for 1/2000 digital topographic maps;

- Geospatial Data Product Specification Creation
- Field Verification and Field Compilation

- Quality Evaluation of Map Data

The quality of survey results has been guaranteed by the public survey work regulations in Japan. In recent years, however, with the progress of the development of the domestic standard JIS X 7100 (geographical information) that complies with the international standard ISO 19100 series (Geographic Information), the development of surveying regulations that are consistent with the ISO 19100 series was comprehensively implemented. On the other hand, ASIG needed to prepare geospatial information based on the INSPIRE Directive that complies with the ISO 19100 series. Therefore, from the viewpoint of reflecting the knowledge of quality control of surveying in Japan and being able to comply with the ISO19100 series, JPT made a comparison / examination of them and determined the fields in which regulations should be established.

(2) Decisions made

Based on the above 3.2.6, more specific review policies were set as follows when initiating the work by JPT.

- Retain all the laws, official rules, and guidelines already existing in Albania, and just add guideline documents for parts needed and not yet prepared.
- Utilize Japanese GSI's documents (Not to prepare new but to use proven ones).

(3) Result of the work

(a) Examination of existing guidelines

Based on the policy mentioned, the existing guidelines of Albania were examined and the related guidelines of Japan were confirmed. Major relevant guidelines of Albania in 2019 are shown in Table 3-9. The guidelines of the basic plan and basic survey, and the specifications of major products were found to be in place.

Table 3-9 Albania's survey-related guidelines

Technical Guides (http://www.asig.gov.al/index.php/2014-11-06-22-34-05/udhezues-teknik)
Technical Guidelines for Data Control and Geographic Information Systems.
Detailed Technical Guide on the Metadata Profile
Network Services Policies
Technical Standards for Planning, Realization, and Control of Air photography and Lidar Scanning
Technical Standards (http://www.asig.gov.al/index.php/2014-11-06-22-34-05/ligji)
Uniform Rules for Creating and Administering Geospatial Information
Draft Decision on "Rules for Exchange of Geospatial Data Groups and Services between Public Authorities"
State Standards for the Technical Specifications of the Geospatial Information in Albania. Topic: Transport Networks

State Standards for the Technical Specifications of the Geospatial Information in Albania. Topic: Geology
State Standards for the Technical Specifications of the Geospatial Information in Albania. Theme: Ortoimazheria
State Standards for the Technical Specifications of the Geospatial Information in Albania. Topic: Digital Terrain Model
State Standards for the Technical Specifications of the Geospatial Information in Albania. Theme: Geographic Networking Systems
State Standards for the Technical Specifications of the Geospatial Information in Albania. Theme: Protected Areas
State Standards for the Technical Specifications of the Geospatial Information in Albania. Topic: Land Use
State Standards for the Technical Specifications of the Geospatial Information in Albania. Topic: Defining the geodetic reference framework and geodetic control
State Standards for the Technical Specifications of the Geospatial Information in Albania. Subject: Land cover
State Standards for the Technical Specifications of the Geospatial Information in Albania. Topic: Areas with natural hazards
State Standards for the Technical Specifications of the Geospatial Information in Albania. Theme: Demography
State Standards for the Technical Specifications of the Geospatial Information in Albania. Theme: Seas
State Standards for the Technical Specifications of the Geospatial Information in Albania. Subject: Statistical Units
State Standards for the Technical Specifications of the Geospatial Information in Albania. Subject: Mineral Resources
Documents of NSDI (http://www.asig.gov.al/index.php/2014-11-06-22-34-05/nsdi-dokuments)
Business Strategic Document Plan
Laws and Bylaws (http://www.asig.gov.al/index.php/2014-11-06-22-34-05/ligjet-dhe-aktet-nenligjore)
Law no. 72/2012 "On the organization and functioning of the National Infrastructure of Geospatial Information in the Republic of Albania".
VKM Nr. 144, dated 22.2.2012 On the Approval of the Policy Document "On the Establishment of the National Geospatial Data Infrastructure".
DCM No.147, dated 20.2.2013 "On the approval of the Regulation on the Organization and Functioning of the State Authority for Geospatial Information".
DCM No.669, dated 7.8.2013 "On the Approval of the Rules for the Designation, Creation and Implementation of the Albanian Geodetic Reference Framework (CCHR) as a Metadata" (Amended by DCM No. 322, dated 27.04.2016)
VKM Nr. 829, dated 7.10.2015 On the Approval of the "State Standards for Technical Specifications of the Geospatial Information Infrastructure in Albania - Hydrographic Theme".
DCM No.942, dated 19.11.2015 "Planning and Realization of Airspace of the Territory of the Republic of Albania".
VKM Nr. 1077, dated 23.12.2015 On the adoption of the Regulation "On the Creation, Conservation and Updating of Metadata, Cataloguing Structure and Deadlines for Creating Specific Maturities for Each Template" .
VKM Nr. 1078, dated 23.12.2015 On the Approval of the Document "State Standards for the Technical Specifications of the Geospatial Information in Albania, Theme - Administrative Unit Boundaries" .
VKM Nr. 321, dated 27.4.2016 On the Approval of the Document "State Standards for the Technical Specifications of the Geospatial Information in Albania - Theme: Cadastral Plots".
VKM Nr. 322, dated 27.4.2016 On Amendments and Addendum to Decision no. 669, dated 7.8.2013, of the Council of Ministers, "On the Approval of the Rules for the Designation, Creation and Implementation of the Albanian Geodetic Reference Framework (KRGZ) as Metadata.
VKM Nr. 359, dated 11.5.2016 On the Approval of the Document "State Standards for the Technical Specifications of the Geospatial Information in Albania - Theme: Buildings".

VKM Nr. 859 dated 7.12.2016 "For the approval of the document" State Standards for Technical Specifications of Geohaphne Sector Information in Albanian-Subject: Address System ".
VKM nr. 38 dated 18.01.2017 "On the Adoption of Data Interpretation, Databases, and Geospatial Services"
VKM nr. 142 of 22.02.2017 "On the Approval of the Document" State Standards for the Technical Specifications of the Geospatial Information in Albania - Theme: Geographical Names "
Order No. 87, dated 25.7.2013 Updated (Amended by Order No. 235 dated 3.12.2013) "On the Composition, Organization and Functioning of the Board for Geospatial Information".
Guide no. 3, dated 06.09.2013 On the Establishment of Geodetic Points with the Assistance of Global Navigation Systems (GNSS).
Guideline No. 4381 / 1, dated 22.09.2015 "On the Transformation of Coordinates from the Global Geodetic Reference Framework" Itrf2005 (Epoka 2007.2) "and the Albanian Geodesic System" Alb86 "in the European Geodetic Reference Framework" Etrf2000 (Epoka 2014.177) "and" Etrf2000 (Epoka 2008) ".
Code of Ethics for the State Authority for Geospatial Information, issued by Decision No. 28 dated 16.06.2015.
Regulation on the Prevention of Conflict of Interest in Exercising Public Functions at the State Authority for Geospatial Information
Internal Regulation for the Functioning of ASIG
Key Labor Processes in ASIG

Meanwhile, survey-related guidelines in Japan in 2019 are shown in Table 3-10.

Table 3-10 Survey-related provisions in guidelines

Name
JICA's Survey Regulation (Covering entire mapping works from Trigonometric survey to map revision)
Manual for Public Mapping Using Terrestrial Laser Scanner
Manual for Public Mapping Using UAV
Manual for Public Mapping Using UAV with Laser Scanner
Manual for Public Mapping Using Multi-GNSS
Manual for Public Leveling Survey Using GNSS
Manual for Public Mapping Using Mobile mapping System
Manual for Data Product Specification
Regulation for Public Mapping Using Digital Photogrammetry
Regulation for DEM Generation Using Airborne LiDAR
Regulation for Public Mapping Using RTK-GPS
Manual for Digital Ortho Photo
National Survey Regulation (Geodetic Survey, Leveling Survey)
National Survey Regulation (Field Topographic Survey, MMS Survey, Photogrammetry, Existing Map Digitalization, Ortho photo, Airborne LiDAR, Fundamental Map Production)
National Survey Regulation (Applied Survey, Traverse Survey, River Survey, Cadastral Survey)

As a result of comparing and examining the regulations maintained in Japan and in Albania, it was judged that the three fields to be newly developed were as shown in Table 3-11.

(b) Creation of work regulations

JPT prepared for three types of regulation, namely Geospatial Data Product Specification Creation, Field Verification and Field Compilation, and Quality Evaluation of Map Data based upon the following regulations of Japan.

- Geospatial Data Product Specification Creation Guideline
- JICA's Survey Regulation (Covering entire mapping works from Trigonometric survey to map revision)
- Guideline on the quality of map data and its evaluation (Rev. 1) (Draft)

JPT explained to ASIG about a series of the work regulations in February 2019 during the technology transfer training period and provided to ASIG in November 2019.

Table 3-11 Result of comparative review of provisions

Nr.	Workflow	Japanese regulation	Albanian regulation	Necessity
1	Data product designing	Official practical manual	No	Yes
2	Geodetic survey	Public survey regulation	Yes	No
3	Leveling survey	Public survey regulation	Yes	No
4	Photo control point survey	Public survey regulation, Official practical manual (RTK-GNSS survey)	Yes	No
5	Photography	Public survey regulation	Yes	No
6	MMS	Official practical manual (MMS mapping)	No	No (Out of scope)
7	UAV	Official practical manual (UAV photogrammetry, UAV LiDAR mapping)	No	No (Out of scope)
8	Field identification	Public survey regulation	No	Yes
9	Plotting and editing	Public survey regulation, Official practical manual (Photogrammetry)	Yes	No
10	Field completion	Public survey regulation	No	Yes, and combined with #8
11	Orthophoto	Public survey regulation, Official practical manual (Orthophoto)	No	Yes
12	Quality evaluation	Public survey regulation	No	Yes
13	LiDAR	Public survey regulation, Official practical manual (LiDAR)	Yes	Out of scope
14	Metadata	Official practical manual	Yes	No

3.2.8. Creation of Digital Topographic Maps

3.2.8.1. Field Verification

(1) Overview of the work

"Field verification" work is to verify and collect information of features necessary for the creation of maps defined in the specifications that can only be checked on site, such as information of places that cannot be clearly viewed in aerial photos and names and classifications of facilities. The work was carried out in accordance with the DPS 0.1 version.

Lorenco & Co SHPK (an Albanian company, hereinafter referred to as Lorenco & Co), selected through open tendering, completed the work for 280 km^2 under the supervision of JPT. For the remaining 20 km^2, ASIG personnel completed the work during the OJT for technology transfer (See 4.3 for technology transfer.).

(2) Activities carried out

(a) Planning and preparation

A detailed work plan was prepared. Prior to the preparation of the plan, JPT provided Lorenco & Co. with concrete explanation of the work and demonstration both in urban areas and suburban areas using the required methods using tablet PCs. The plan described work structure, implementation methods in both the field and office, personnel plan, work process schedule, quality and safety management methods, etc.

At the beginning of the work, a total of 10 teams, each consisting of two members were formed (five teams in Tirana and five teams in Durres) formed, which was later increased to 17 (seven in Tirana and 10 in Durres), in consideration of the work progress.

Lorenco & Co and JPT independently conducted trial work according to the work specifications to make sure that there were no gaps in understanding between them. The results of each work were compared and uncertainties and inconveniences found in the trial were eliminated. Lorenco & Co conducted the second trial work and showed adequate improvements to start the actual work.

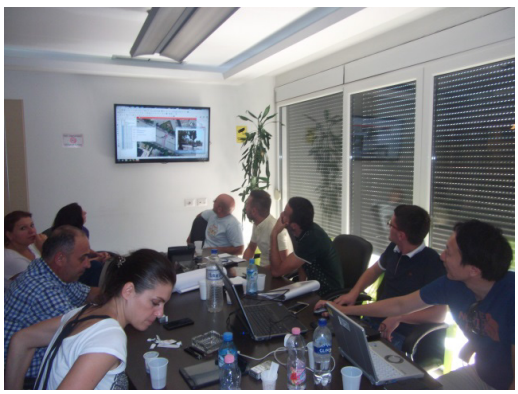


Photo 3-2 Explanation of work procedures

(b) Implementation

Lorenco & Co carried out the work while JPT accompanied each work team and directly gave guidance on the focus points concerning area differences and different investigation methods for different areas. The team leaders of Lorenco & Co also went together for guidance visits so that the contents of the guidance would be shared not only with the team but with all the teams.

Photo 3-3 Field verification work

(c) Quality check

To check the quality of the work done by Lorenco & Co, JPT conducted sampling of the same field verification work and inspected the quality through comparison between the work results of Lorenco & Co and those of JPT.

The work area had various environments and conditions such as dense areas, local cities, rural areas, mountainous areas, and coastal areas, and the work teams also differed in levels of skills and understanding. Therefore, comprehensive quality inspection without disparity in work environment, conditions, and team was required.

For the quality inspection, a total of 14 locations (total 6.7 km^2) were selected from the project area in consideration of locality, density, total balance, etc., and field verification was conducted again in each of the locations for comparison. The comparison was conducted in consideration of differences of levels of importance as shown in Table 3-12.

Table 3-12 Examples of levels of Importance

Level of Importance	Items
Must be checked in field verification"	Positions and names of public facilities
Desirable to check in field verification but can also be checked at the time of field completion work	Shapes of roads, water bodies, perimeter structures, bridges, buildings, etc.

（d）Collection of the existing information

ASIG and JPT searched and examined the existing information available in Albania and then decided to use the information listed in Table 3-13 for the topographic map. The information was collected by ASIG from the National Geoportal or related organizations and shared with JPT.

The collected information was examined to determine whether could be applied to new topographic maps, for factors such as scale, location accuracy, and time of information. The facility information (existence and name) that can be confirmed on site (such as Educational_Institutions, etc.) was confirmed and updated by Field Completion work.

Table 3-13 List of existing information to be used for the topographic map

Source information	Source from	Decision
Geographical_names.shp	ASIG Geoportal information	Use for NamedPlace
Rivers_monitoring_stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/RiverMonitoringStation
Noise_Monitoring_Stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/NoiseMonitoringStation
Pollution_Monitoring_Stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/PollutionMonitoringStation
Beach_monitoring_stations.shp	ASIG Geoportal information	Add "AsigPointCartographicFeature"/BeachMonitoringStation
Educational_Institutions.shp	ASIG Geoportal information	Use for GovernmentalService/NamedPlace
Governmental_institutions_(ADISA).shp	ASIG Geoportal information	Use for GovernmentalService/NamedPlace
Governmental_institutions_(RTSH).shp	ASIG Geoportal information	Use for GovernmentalService/NamedPlace
Order1_(State).shp	ASIG Geoportal information	Use for AdministrativeBoundary/NamedPlace
Order2_(AdministrativeBoundary).shp	ASIG Geoportal information	Use for AdministrativeBoundary/NamedPlace of QARKU
Order3_(Municipal).shp	ASIG Geoportal information	Use for AdministrativeBoundary/NamedPlace of Municipality

Source information	Source from	Decision
Land_Covering(CORINE).shp	ASIG Geoportal information	Reference information to create the latest LandCoverUnit area based on the new Ortho image
Monuments_of_Culture_Point.shp	ASIG Geoportal information	Use for NamedPlace
Monuments_of_Culture_Polygon.shp	ASIG Geoportal information	Use for NamedPlace
UKT_WaterandSanitation_20181101	Water and Sanitation Directory of Tirana (UKT) (collected by ASIG)	Use only for reference layer due to poor accuracy (Only overlay with new map data. Do not merge with new map)
roadCategory.shp urbanArea.shp	ASIG Geoportal information/Created and categorized by JPT with APT's instruction	Categorize "highway" and "interurban" road according to the "roadCategory.shp". For the category except for "highway" and "interurban" and the others ("path"/"underconstruction"/"gardenRoad"/"bicycleLane"), The road inside of "urbanarea (urbanArea.shp)" shall be categorized as "urbanRoad". The road outside of "urbanarea (urbanArea.shp)" shall be categorized as "villageLocalRoad".

Water information (UKT)

As a result of the examination of the collected water network information, problems were found, such as topology error in water pipe network, and misalignment of manhole positioning. ASIG and JPT found that it would be difficult to correct these errors to integrate the water network information into the new topographic map. ASIG and JPT discussed and agreed to use the water network information provided by UKT as a reference layer rather than integrating it into the new topographic map.

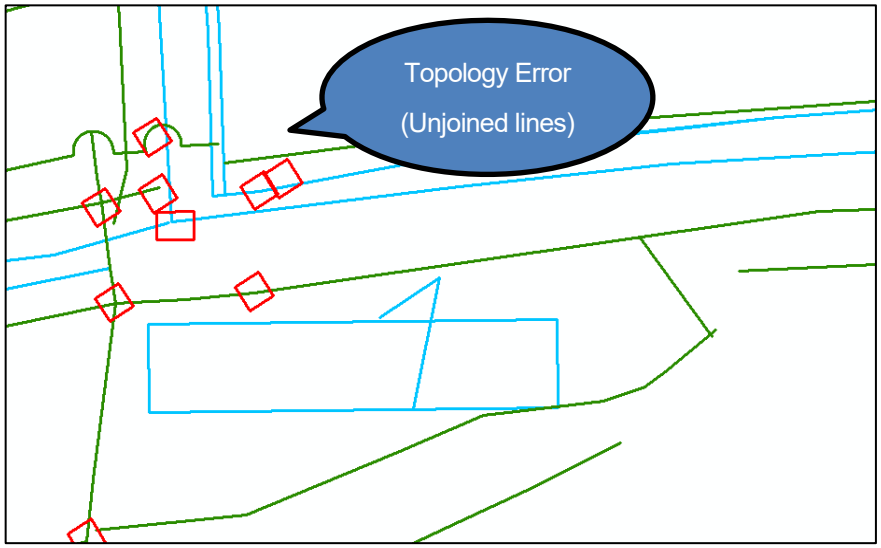


Figure 3-10 Water network data

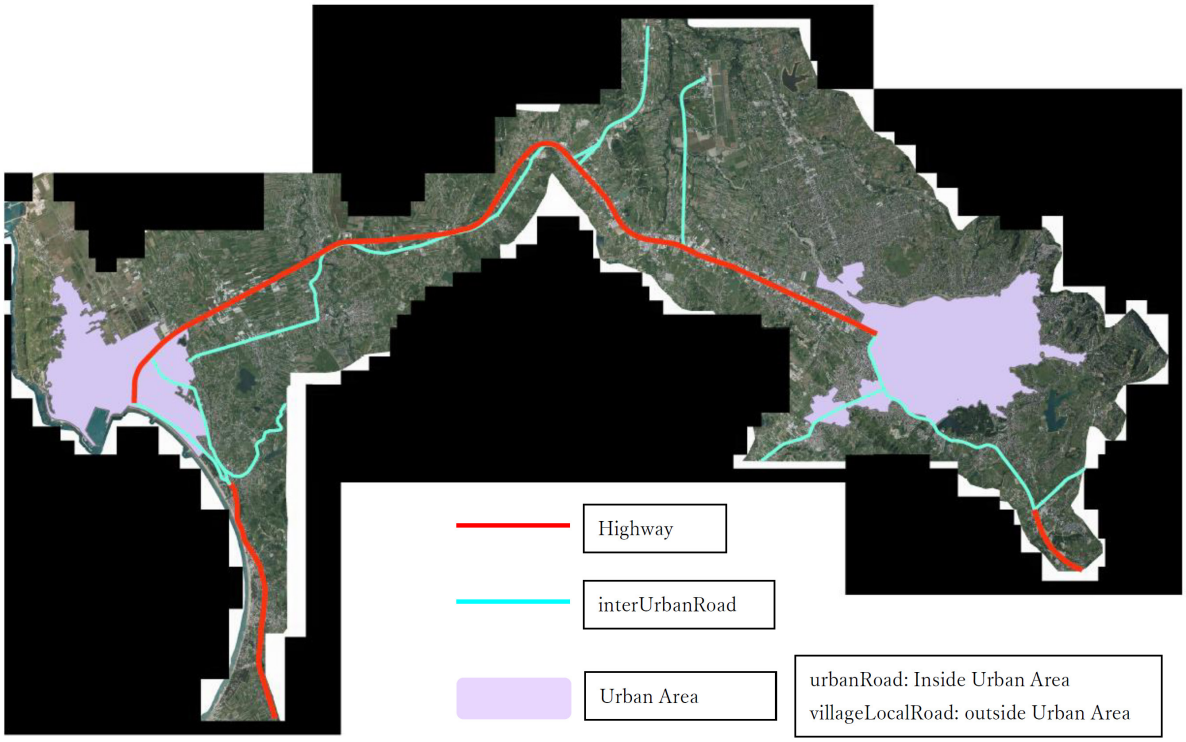


Figure 3-11 Road categories

(3) Result of the work

Classification code numbers were added to the features checked on site through the field verification work.

The deliverables of the work were accepted and transferred to the stereo plotting work.

3.2.8.2. Stereo Plotting and Compilation

(1) Overview of the work

Based on the DPS described in 3.2.6, topographic and features were plotted using the aerial photos and the field verification result along with the workflow shown in Figure 3-12.

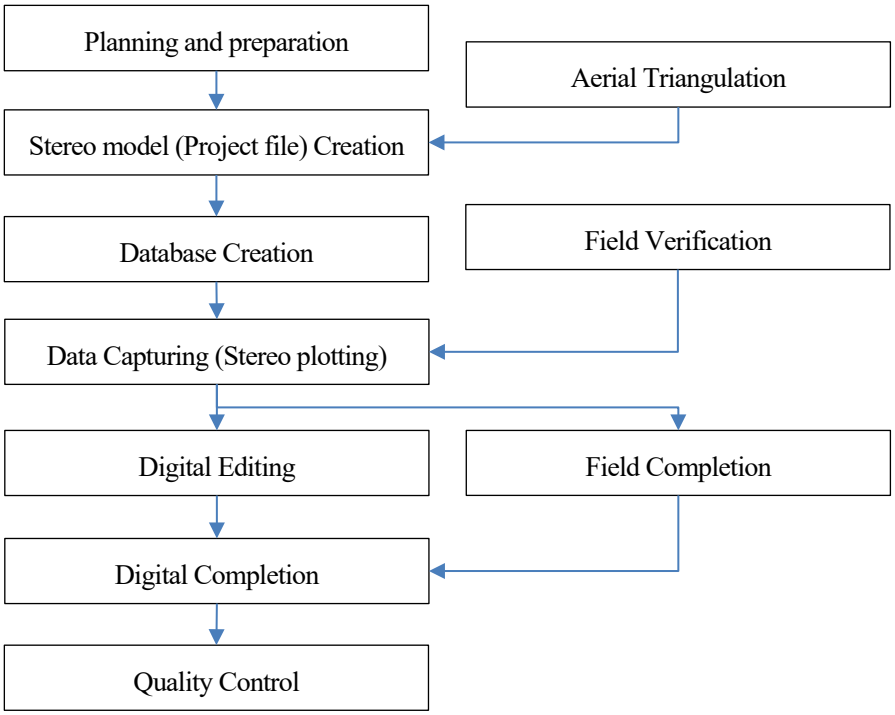


Figure 3-12 Work flow of Stereo Plotting and Compilation

(2) Activities carried out

Stereo plotting is to interpret features on the aerial photos and acquire/capture the features that meet the acquisition requirements described in DPS according to their geometry. For the point features, a point is plotted inside a target feature; for the line features, a line is drawn on the center or edge/ shape of a target feature; and for the polygon features, a polygon is drawn on the edge/ shape of a target feature.

As for contour lines, a line is drawn by keeping a cursor of a topomouse touching on the terrain at a certain height.

The procured software for photogrammetry was used for the plotting work and its technology transfer described in 4.4 and 4.6.

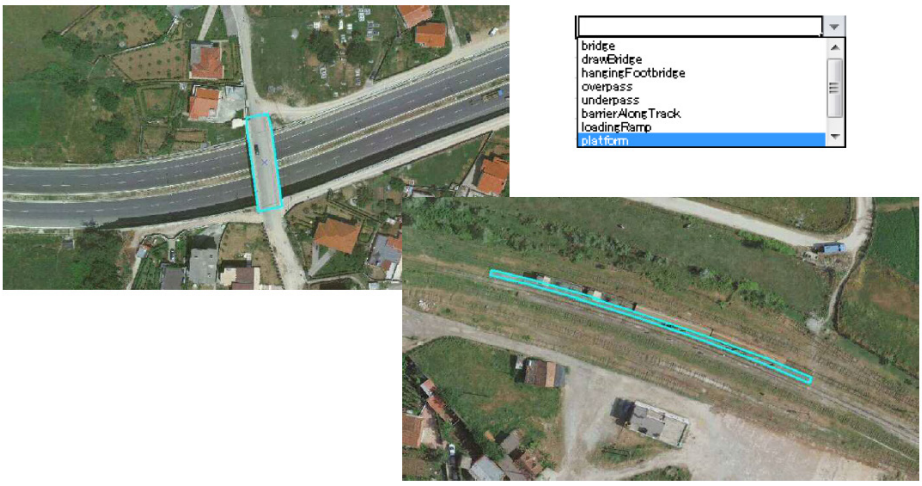


Figure 3-13 Sample of data acquisition

The plotting work was done by data capturing as described above while using the results of the field verification and field completion as well as other reference information as listed in Table 3-14.

Table 3-14 List of reference information used for stereo plotting

Theme	Reference
GN: Geographical names	Field Verification, Field Completion
AU: Administrative units	Provided data from ASIG
TN: Transport networks	Field Verification, Field Completion Provided data from ASIG
HY: Hydrography	Field Verification, Field Completion
PS: Protected sites	Field Verification, Field Completion
EL: Elevation	Provided data (Lidar 2015) from ASIG
LC: Land cover	Field Verification, Field Completion CLC2012
GE: Geology	Existing topographic map
BU: Buildings	Field Verification, Field Completion
US: Utility and governmental services	Field Verification, Field Completion Provided data from ASIG
PF: Production and industrial facilities	Field Verification, Field Completion
AF: Agricultural and aquaculture facilities	Field Verification, Field Completion
AS: ASIG	Field Verification, Field Completion Provided data from ASIG

(3) Result of the work

1/2,000 digital plotting data of the target area was created by the work described above. The Roadarea, center lines of roads and rivers, basin, etc., were made by applying secondary processes to the plotting data.

The digital plotting data was finalized after carrying out data check.

Figure 3-14 Examples of stereo plotting ((Left) Roadarea, (Middle) VehicleTrafficArea, (Right) Roadarea and VehicleTrafficArea)

3.2.8.3. Field Completion

(1) Overview of the work

"Field completion" work is to verify the things that are found to be unclear during the stereo plotting and compilation work in the field. It is important to well understand the questions and instructions given by the operators of the stereo plotting and compilation work, correctly identify the items to be confirmed, and properly answer questions.

The questions and instructions given by the operators of the stereo plotting and compilation work include 1) unclear or unidentified things, 2) items that were not verified or were wrongly verified during the field verification and 3) items for which the operators have different opinions from the results of the field verification. Therefore, reconfirmation is a part of the field completion work. In other words, the field completion work is done to conduct final confirmation to input correct information to the topographic map.

This work was carried out by ASIG, JPT, and Lorenco & Co.

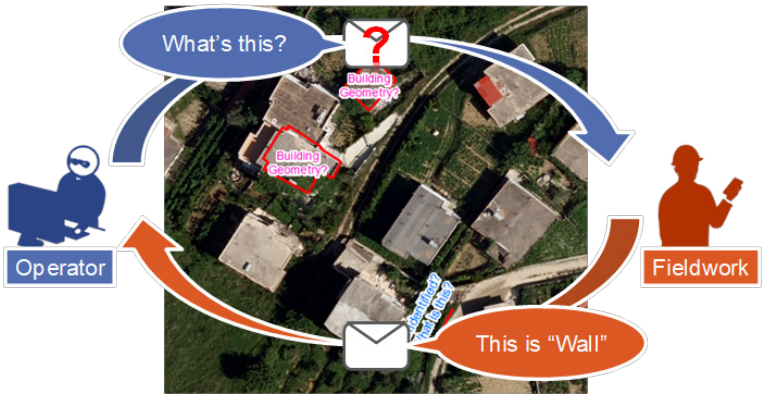


Figure 3-15 Concept of Field Completion Work

(2) Activities carried out

(a) Planning and preparation

JPT provided detailed explanation about the purposes and work items of the field completion and demonstrated the work for Lorenco & Co. Technical instructions focusing on how to respond to the questions given by the operators were included. JPT also shared the results of the analysis on the outputs of the field verification work with Lorenco & Co in order to avoid similar mistakes.

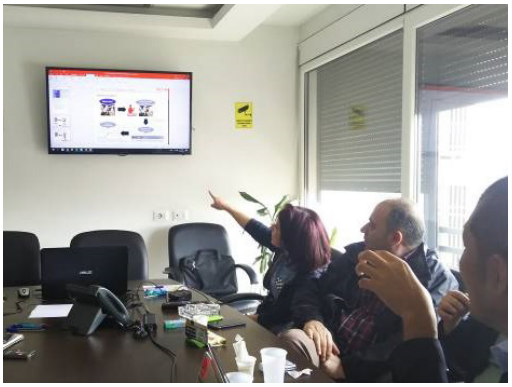



Photo 3-4 Explanation of work procedures

(b) Implementation

Approx. 4,400 items were given by the operators. Lorenco & Co identified all of the items in the field and confirmed and recorded the results into tablet PCs, as they had done for the field verification, under the supervision of JPT.

Table 3-15 List of items given by the operators

Category	Description	Quantity
Area	Unclear extent/boundary	155
Code	Wrong code	2,795
Connection of lines	Unclear connection of rivers, waterways, etc.	15
Existence	Unclear if the feature exists	107
Geometry	Unclear shape (e.g. Building shape)	205
Name	Wrong name	23
Location/ position	Unclear location/position	461
Unidentified	Unidentified on the aerial photos	236
Others	Combination of the cases described above	388
Total		4,385

(c) Quality check

JPT conducted a comparative inspection by applying a sampling method and checked the quality of the work done by Lorenco & Co. The number of samplings extracted was set to 2% or more in accordance with Japanese inspection and surveying regulations, which was 88 or more corresponding to the total of 4,385 items. JPT selected 236 (about 5.38%) from a total of 15 locations as inspection targets, taking into consideration regional characteristics and the areas assigned to the work teams within Lorenco & Co. Then, JPT performed the filed completion work at the selected 15 locations, and used the results as the standard for comparative inspection.

As a result of the comparative inspection, 15 errors were confirmed. Responses to the instructions of "confirm the position of the streetlight" and "confirm the range (boundary) of the graveyard, etc.", were not clear. These errors were explained to Lorenco & Co and corrected.

(3) Result of the work

After correcting the errors found by the quality check, all the work results finally passed the inspection including consistency and accuracy, and the work was completed. The output of the work was transferred to the digital compilation work.

3.2.8.4. Digital Compilation

Using the results of the field completion and existing materials such as the administrative boundary, 1/2,000 plot data of the project area were created. Thematic inspections such as classification and attributes, and topology inspections were carried out, and the final data were completed. Refer to “3.2.8.2. Stereo Plotting and Compilation” for details of the work.

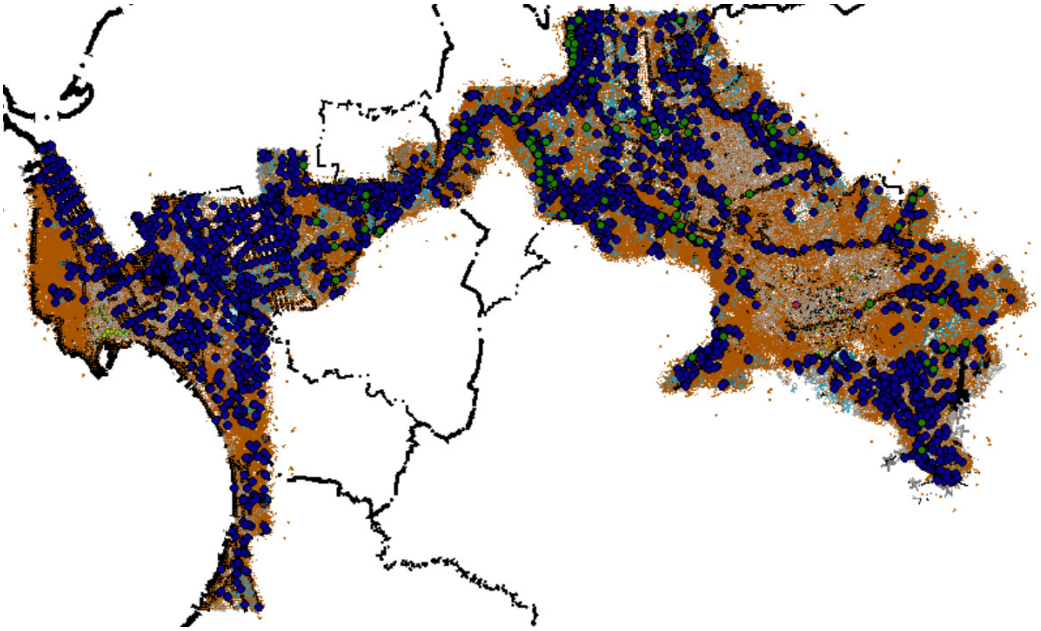


Figure 3-16 Result of Stereo Plotting and Compilation

3.2.8.5. Digital Data Structurization

(1) Overview of the work

The topographic map data created in the form of Geodatabase have been processed to be topologically structured data that are suitable for applicative GIS purposes. The structured data have been installed on the ASIG's data server in a form of enterprise geodatabase. The same data specification as DPS described in 3.2.6 was applied. Among the data specifications, some modifications based on technical restrictions of software such as ArcGIS Enterprise and PostgresSQL (limitation on the number of characters in variable names and requirements for prefixes and suffixes) were implemented. The modification was done by replacing characters, codes, etc. that are uniquely bidirectionally exchangeable with the original data specifications.

(2) Decisions made

ArcGIS Enterprise 10.6.1 was installed in the procured data storage server, and a database (Enterprise Geodatabase) was established for geospatial data. PostgresSQL10 was used as a database management system. The database has been designed and implemented according to the specifications agreed upon through discussion with ASIG and was ready to store the final digital topographic maps. The final data are expected to be installed in October 2021. The specifications are the same as the data specification described in 3.2.6. Among the data specifications, modifications based on technical restrictions of software such as ArcGIS Enterprise and PostgresSQL (limitation on the number of characters in variable names and requirements for

prefixes and suffixes) were implemented. The modification was done by replacing characters, codes, etc. that were uniquely bidirectionally exchangeable with the original data specifications.

(3) Result of the work

The digital topographic maps were created in seamless form Table 3-16 shows the work items done for data structurization.

Table 3-16 Work content of digital data structurization

Work item	Content
a) Layer structurization	Conducted layer structurization to enable efficient use of digital topographic maps on GIS.
b) Digital topographic map database construction	Constructed a digital topographic map database with a topological structure to enable editing (correction, addition, and deletion) of GIS data and various analyses.
c) GIS data creation	Created GIS data that consist of spatial data (digital topographic map) with a layer structure and attribute data.
d) Attribute data creation	Based on the data product specifications, designed the database structure and entered attributes necessary for each of the layers (such as code numbers, names of administrative bodies, and elevations) to create attribute data.
e) Finalization	Provided mutual links between spatial and attribute data that have been created to finalize the digital topographic map database.

3.2.8.6. Map Symbolization

(1) Overview of the work

Based on the DPS, map symbols were applied along with the workflow shown in Figure 3-17.

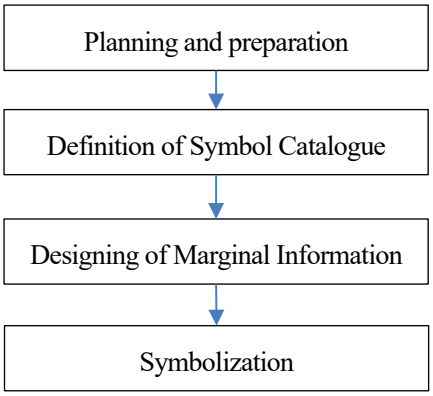


Figure 3-17 Work flow of Symbolization

(2) Activities carried out

Map symbolization was performed by using ArcGIS. Some functions of ArcGIS were used to set the symbols defined for each feature.

Annotations are interpolated in GN (Geographical names) where geometry is point. The names of features whose geometry is line, such as roads and rivers, are interpolated in the centerline data and displayed in parallel with the shape of features. For contour lines and control points, the elevation values are displayed as annotations.

When symbols and annotations were crowded at scale of 1/2,000, "Thinning" and "Transition" were used to arrange them appropriately.

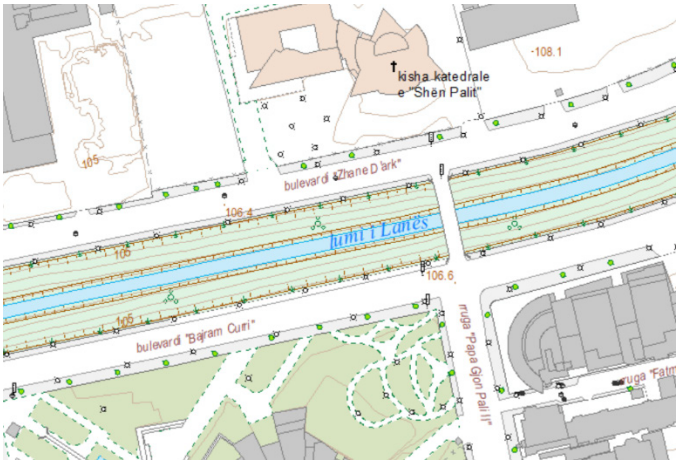


Figure 3-18 Annotation for Road, River, Contour, Spot Height

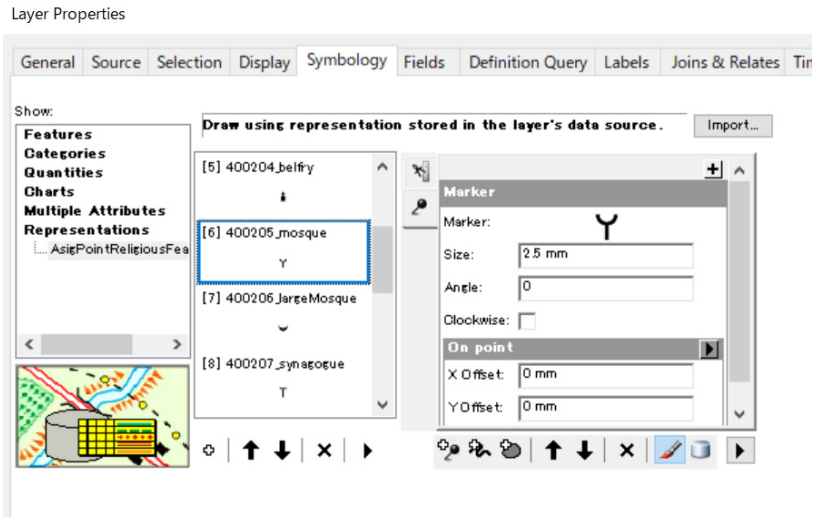


Figure 3-19 Symbol setting in ArcGIS

(3) Result of the work

Cartographic adjustment and symbolization work was carried out according to the DPS.

The design of map layout was determined as shown in Figure 3-21 based on the request from ASIG for map unit sized symbolized maps.

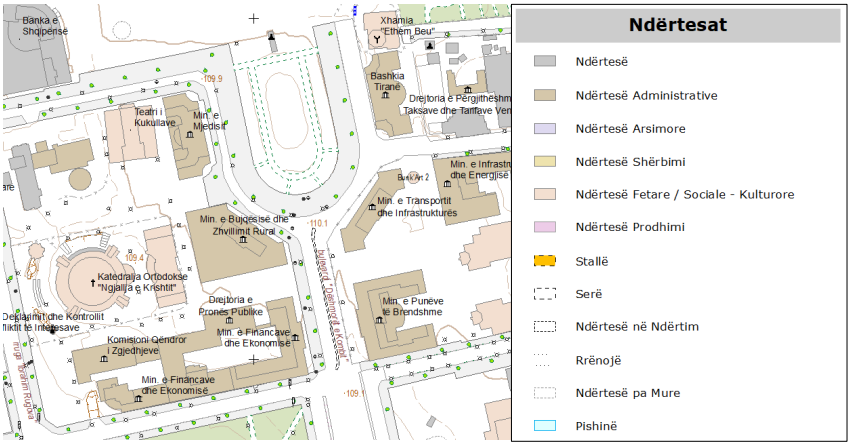


Figure 3-20 (Left) An Example of symbolized map, (Right) Legend of “Building

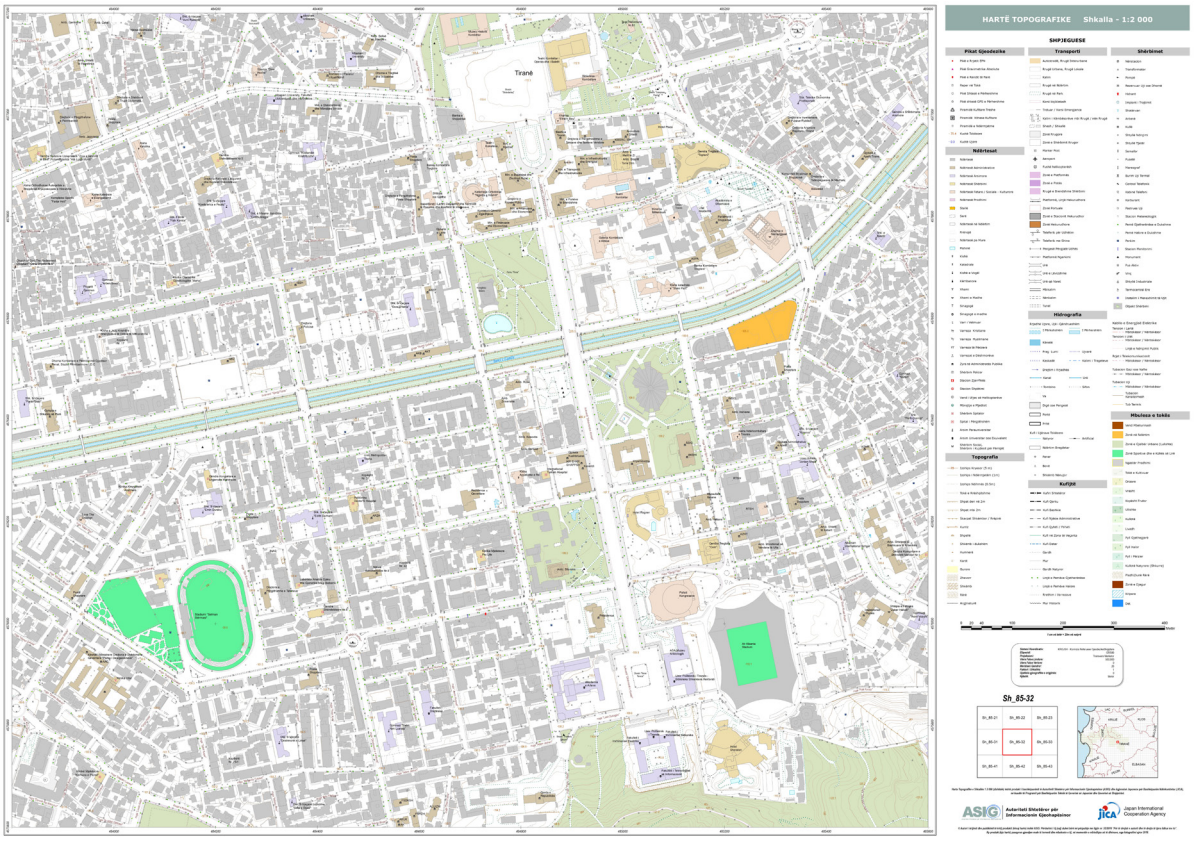


Figure 3-21 Map layout

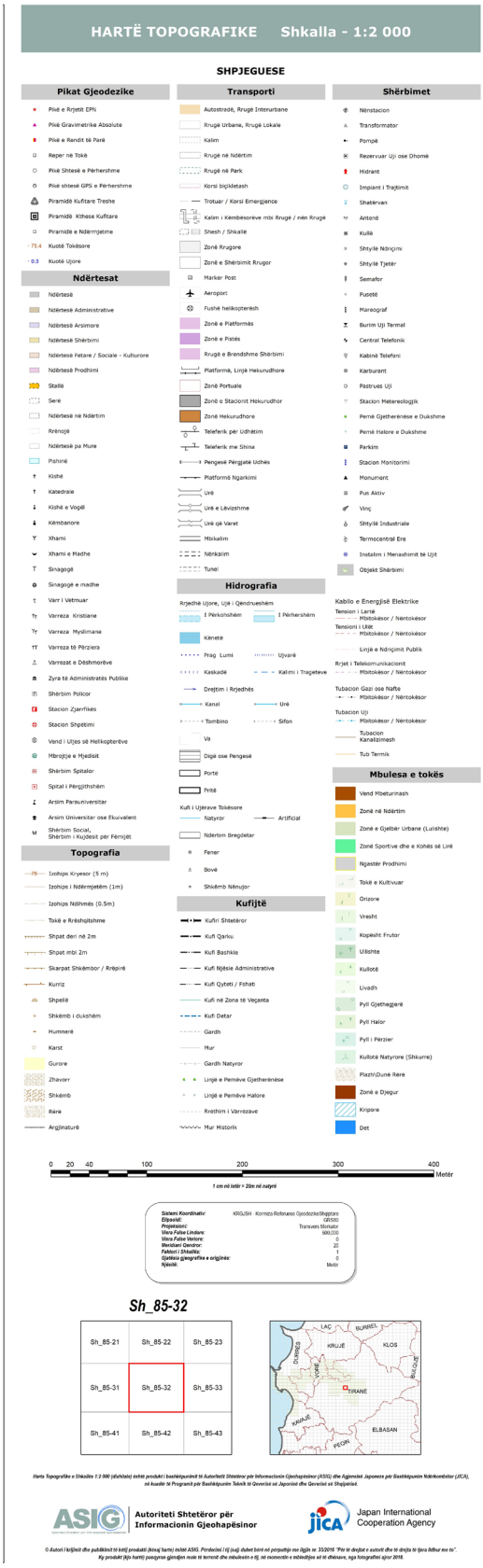


Figure 3-22 Legend of the map

3.2.8.7. Creation and Management of Data to be Provided

(1) Overview of the work

The final digital topographic map created by the Project was stored in the data storage server procured by the Project. The maps will be coordinated with ASIG's existing Geoportal after web-based GIS services are established (this will be done by ASIG after completion of the Project).

(2) Decisions made

Because the initial scope of the Project did not include the establishment of web-based GIS services by JPT, it was difficult to satisfy all the needs within the scope. Therefore, in view of the hardware and software procured, fine adjustment has been made to the project scope; the scope of work items that ASIG will address after the Project have been set so that it will satisfy ASIG's needs as much as possible (Figure 3-23). JPT proposed the conceptual drawing to ASIG and obtained agreement in December 2017. The final topographic map dataset was installed into the server in October 2021.

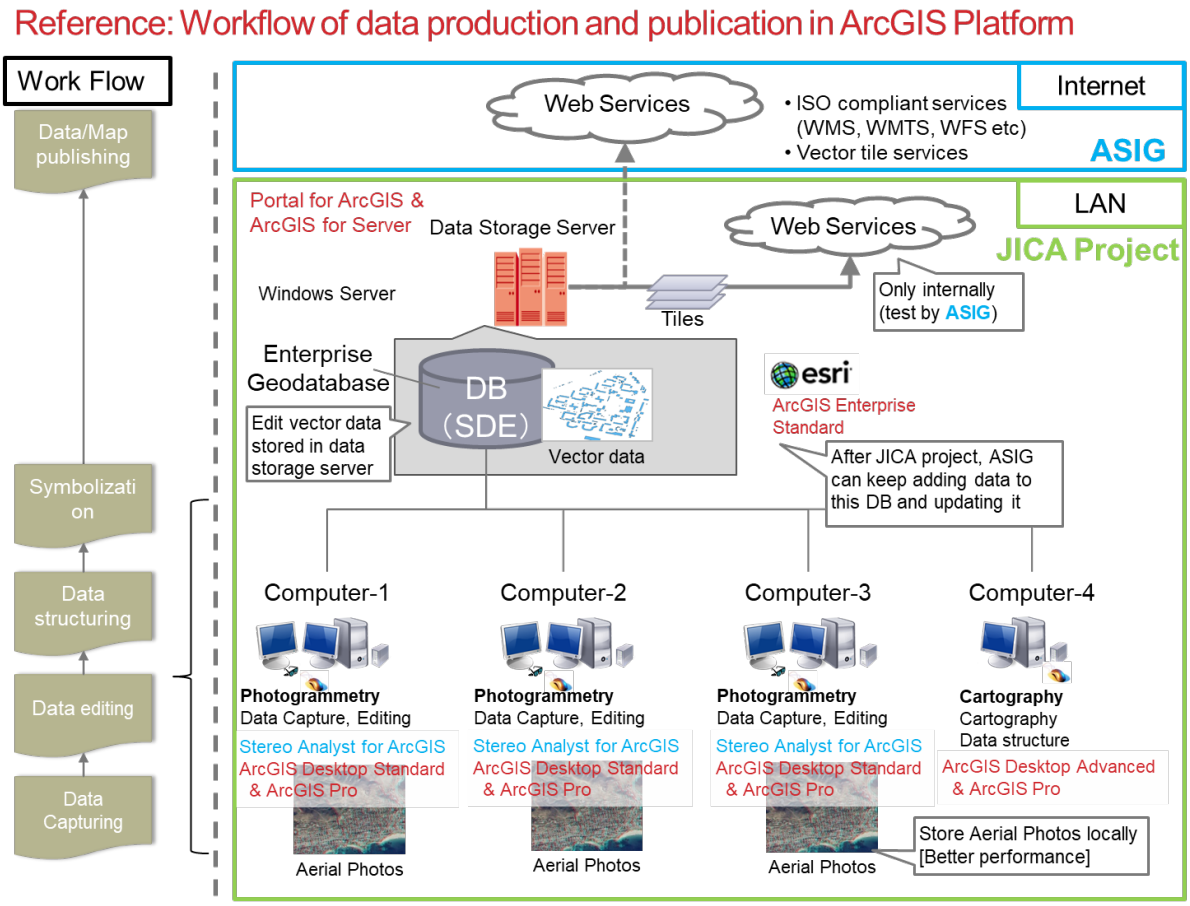


Figure 3-23 Workflow of data production and publication

(3) Result of the work

As a result, the following work items were completed.

- The Project has established a web service establishment environment that can only be used in LAN, using a data storage server and ArcGIS products. With this environment, ASIG can develop the web GIS service forms (including ESRI vector tiles) they desire and conduct performance tests in LAN.
- The Project has stored the digital topographic map as a deliverable in the database within the data storage server procured.
- The following technical matters for the deliverables were confirmed.

1. Database environment: SDE (Enterprise geodatabase)
   ✓ PostgreSQL 10
2. Project data environment: ArcGIS Pro 2.2 project file and related datasets
   ✓ Symbolization for 1/2,000 topo-maps
3. Representation environment: Sample ESRI Vector tile package (*.vtpk)
   ✓ Simple symbolization (provisional)
4. Documents: User's manual, etc.

3.2.8.8. Quality Inspection

(1) Overview of the work

The digital topographic map was completed based on DPS (acquired data items, data structure, quality, drawing specifications, etc.) described in 3.2.6 and by adding the map layout described in 3.2.8.6. DPS defines quality requirements and quality evaluation methods of the features in accordance with ISO 19100. DPS describes how to evaluate quality, the elements to be evaluated as quality, and the quality level required for each feature.

The methods for quality evaluation were classified as shown in Table 3-17, and used as an effective combination for the quality elements and quality sub-elements to be evaluated as shown in Table 3-18.

Table 3-17 Types of evaluation methods (Excerpt from DPS)

Caregory	Category	Type	Description
1	Comparison	Interior	Use only dataset itself
		Exterior	Use other data source or
2	Intervention	Automatic	Computerized processing
		Manual	Requires manual examination
3	Measurement	Quantitative	Calculate percentage of error
		Countable	Count total number of error
4	Proportion	Full	Evaluate all contents
		Sampling	Evaluate randomly extracted intances

Table 3-18 Evaluation method set by combination of evaluation methods (Excerpt from DPS)

Data Quality Element	Data Quality Sub Element	Name of Method	Types of Method				Description of Evaluation
			Interior / Exterior	Automatic / Manual	Quantitative / Countable	Full / Sampling	
Completeness	Excess (Commision)	Rate of excess items (Excess)	E	M	Q	S	Manually compare all visible features in the area by referencing result of field verification, existing maps,and orthophotos.
	Omission	Rate of missing items (Missing)	E	M	Q	S	Manually compare all visible features in the area by referencing result of field verification, existing maps,and orthophotos.
Logical Consistency	Conceptual Consistency	Number of items not compliant with the rules of the conceptual schema (Data model validity)	I	A	C	F	Compare entire dataset with UML static diagram defines the data model structure and count any type of case violation of the UML
		Number of invalid overlaps of surfaces (Invalid overlaps)	I	A	C	F	When reporting this data quality measure, the types of feature classes corresponding to the illegal overlapping surfaces shall be reported as well.
	Domain Consistency	Number of items not in conformance with their value domain (Domain validity)	I	A	C	F	Count of all items in the dataset that are not in conformance with their value domain.
	Format Consistency	Number of data invalid format (Format validity)	I	A	C	F	Data can be opened by dataformat native environment with no opening error.
	Topological	Number of faulty point-	I	A	C	F	A point-curve connection exists where different curves

Features to which the same evaluation method can be applied based on the data structure and the required quality level are grouped, and for each evaluation method, the method for evaluating the quality, the elements to be measured as the quality, and the required quality level were set. The local objects are required.

Table 3-19 An example of logical consistency test (Excerpt from DPS)

Name	**Number of items not compliant with the rules of the conceptual schema (Data model validity)**
Data quality element	Logical consistency
Sub element	Conceptual consistency
Data quality scope	Yes: GN (Geographical names) Yes: AU (Administrative units) Yes: TN (Transport networks) Yes: HY (Hydrography) Yes: PS (Protected sites) Yes: EL (Elevation) Yes: LC (Land cover) Yes: GE (Geology) Yes: BU (Buildings) Yes: US (Utility and governmental services) Yes: PF (Production and industrial facilities) Yes: AF (Agricultural and aquaculture facilities) Yes: AS (ASIG)
Data quality Basic measure	Error count (Number)
Data quality evaluation criteria	Compare entire dataset with UML static diagram defines the data model structure and count any type of case violation of the UML. - Any type of violation of the UML should be error. - Error count = Number errors
Conformance quality level	Error count 0
Quality evaluation methodology	Run automatic diagnosis of Class name, Attribute name, attribute type, attribute valid range, association. - Conformance quality level ≧Error count: Pass - Conformance quality level < Error count: Fail

■ Quality evaluation of positional accuracy

[1] Quality requirements of positional accuracy

RMSE (Root Mean Square Error) is used for quality evaluation of positional accuracy of the digital topographic map.

RMSE is defined by the following formulas where:

Employment values of X-coordinate, Y-coordinate and height of i-th are X_{oi}, Y_{oi} and H_{oi},

Most provable values of X-coordinate, Y-coordinate and height of i-th are X_{pi}, Y_{pi} and H_{pi}

A) Horizontal accuracy

$$\mathrm{RMSE} = \sqrt{\frac{\sum_{i=1}^{n}\left\{\left(X_{oi}-X_{pi}\right)^2+\left(Y_{oi}-Y_{pi}\right)^2\right\}}{n}} \quad \ldots\ldots (1)$$

B) Elevation accuracy

$$\mathrm{RMSE} = \sqrt{\frac{\sum_{i=1}^{n}\left\{\left(H_{oi}-H_{pi}\right)^2\right\}}{n}} \quad \ldots\ldots (2)$$

Quality requirements of the digital topographic map are as follows.

- Horizontal accuracy: 0.40m (95.4% reliability)
- Elevation accuracy: 0.60m (95.4% reliability)

RMSE is 68.2% reliability, thus quality criteria for evaluation are as follows.

- Horizontal accuracy: RMSE=0.20m (68.2% reliability)
- Elevation accuracy: RMSE=0.30m (68.2% reliability)

[2] Quality evaluation methodology

Coordinates acquired GNSS-RTK survey are used as most provable values for quality evaluation.

Targeted planimetric features were extracted from the digital topographic map by using a random sampling technique. It is desirable that the data is three-dimensional, such as the corner of a road edge.

[3] Results of accuracy

JPT conducted GNSS-RTK survey at 38 locations. Results of the comparison between the coordinates acquired by the survey and those of the digital topographic map are as follows.

- Horizontal accuracy (95.4% reliability): 0.292m
- Elevation accuracy (95.4% reliability): 0.258m

Thus, it was judged that the digital topographic map satisfied the quality requirements of both horizontal and elevation accuracy.

ASIG also conducted GNSS-RTK survey at 71 locations to evaluate the accuracy. The results are as follows.

- Horizontal accuracy (95.4% reliability): 0.379m
- Elevation accuracy (95.4% reliability): 0.715m

As shown above, the quality requirement of horizontal accuracy is satisfied, however that of elevation accuracy is not satisfied. The cause is described in the next section.

[4] Discussion

Figure 3-24 and Figure 3-25 show differences of elevation values between the coordinates acquired by the survey and those of the digital topographic map.

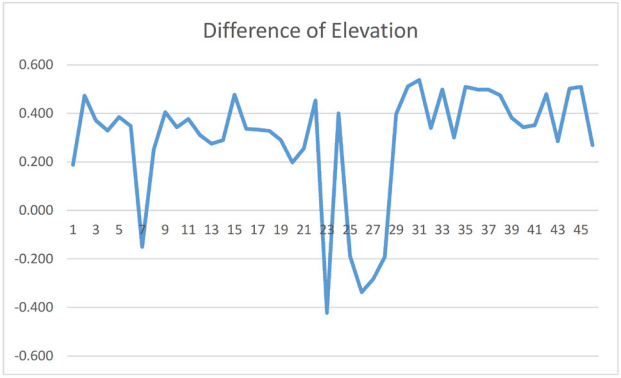


Figure 3-24 Differences between the coordinates acquired by the survey and those of the digital topographic map in Tirana area

The average of the differences between the coordinates acquired by the survey and those of the digital topographic map is 0.294m. Most of the differences are positive (+) values, and it can be seen that there is the about 0.3m to 0.4m offset as a whole.

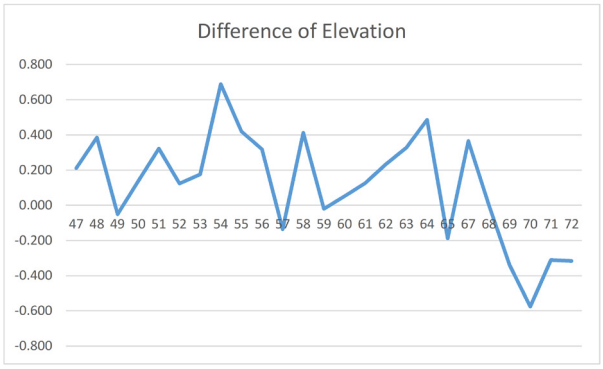


Figure 3-25 Differences between the coordinates acquired by the survey and those of the digital topographic map in Durres area

The average of the differences between the coordinates acquired by the survey and those of the digital

topographic map is 0.286m. Most of the differences are positive (+) values, and it can be seen that there is about 0.2m to 0.3m offset as a whole.

Figure 3-26 shows distribution of the differences. The yellow points mean that the differences are within +0.4m to +0.6m, the blue points mean that the differences are within -0.6m to -0.4m, and the read points mean that the differences are over +0.6m. In most of the locations, the offset is about +0.4m. The points showing minus-end-directed offset and those having over 0.6m difference are located in the port area.

Figure 3-26 Distribution of the differences of height values

It is considered that when the difference does not occur randomly but is offset by a certain amount in a certain direction, the cause may be due to the accuracy of the geoid model.

Albania is located in the Alps-Himalayan orogeny whose terrain was formed by the Alpine orogenic movements. Crushing due to plate collision and uplifting plates have formed folded mountains. Therefore, it is presumed that the Albanian geoid model is not flat and the slope is large in some areas.

The geoid model defined in the Albanian datum is EGM2008. It has been reported that the accuracy of EGM2008 is low in coastal areas and mountainous areas.

In general, GCPs used for aerial triangulation are not densely distributed. However, in areas where the slope of the geoid is large, measures such as predicting the elevation accuracy of the topographic map with a highly accurate geoid model in advance and adding GCPs in areas where the low accuracy can be considered.

In Japan, a high-accurate geoid model (GSIGEO 2011) was developed by conducting leveling survey, GNSS survey, and gravity survey. Works on improving the accuracy by adding aerogravity survey have been conducted.

If a high-accurate geoid model is developed in Albania in future after conducting gravity survey and leveling

survey in accordance with the ASIG's plan, the accuracy of elevation of GNSS survey and topographic maps is expected to be improved.

(2) Activities carried out

ASIG and JPT started the mutual inspection after JPT provided the draft topographic data to ASIG in September 2019 using the defined quality assessment method in DPS and the Quality Evaluation of Map Data Guideline. Then the quality of the digital topographic map, as of March 2020, was evaluated in accordance with those documents to make sure that the product is ready to be finalized and delivered.

The quality evaluation was carried out as follows.

(1) Select the area/map sheets to inspect, covering 2% or more each from Tirana area (approx. 196 km^2), Durres area (approx. 84 km^2), and ASIG implementation area (approx. 20 km^2).
(2) Check the digital topographic map data for each quality element for each feature according to the Quality Evaluation of Map Data Guideline and describe the result in the individual table (Form 2-2).
(3) Create a summary table (Form 2-1) for each area by summarizing the individual tables and evaluate in terms of pass/fail.

(3) Result of the work

For the evaluation of logical consistency and formal consistency, data format (ArcGIS File GDB format) error of all data of the product was evaluated by 100% inspection of readability in ArcGIS.

For position accuracy and absolute positional accuracy, a sampling inspection was applied and GNSS-RTK survey was carried out for the road data created.

For completeness, excess and omission, a sampling inspection was also applied and visual comparison with the orthophotos was carried out.

As a result of quality check, the quality of the topographic map data satisfied the quality specified in the DPS. The errors found during the quality check were corrected.

After the series of mutual inspections between ASIG and JPT, JPT carried out the final topological check and made corrections of topological errors before delivering our final data to ASIG.

3.2.9. Production of UN Vector Tile

(1) Overview of the work

Production of UN vector tiles from the developed digital topographic map was carried out as OJT. Raspberry Pi[4] (refer to Figure 3-27) and United Nations Vector Tile Toolkit (UNVT) were used for UN vector

[4] Developed and provided by the Raspberry Pi Foundation (UK) for the purpose of education.

tile production work with the cooperation of GSI.

Raspberry Pi is a small single-board personal computer (all the necessary electronic devises are integrated on a single board). UNVT is a project as well as a toolkit created by the United Nations Senior Geospatial Specialist aiming to ensure that map providers such as public institutions and any other map suppliers can share their maps on the web using the latest web map technology.

Figure 3-27 Raspberry Pi package

(2) Activities carried out

All of the work was carried out by following the workflow shown in Figure 3-28.

a) Set up the server hardware and operating system to learn the operating environment of UNVT web map service
b) Install and set up the UNVT tools
c) Set up the web map portal with open dataset (data conversion and web server setup)
d) Set up the web map portal with project dataset (data conversion and web server setup)
e) Optimize the data distribution (define the symbol and draw scale. This step will repeat several times to find the suitable setting for map provision.)

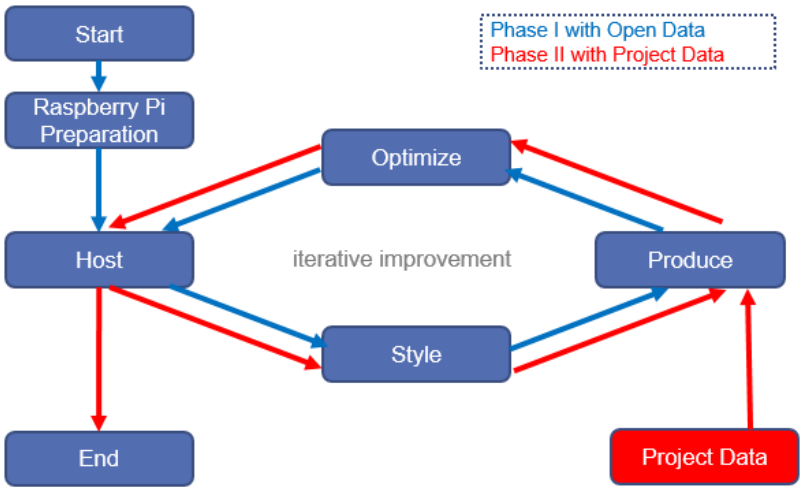


Figure 3-28 Workflow of UN vector tile production (OJT)

(3) Result of the work

As a result of OJT, project datasets were converted into the UN vector tile format. In addition, a web map site was established on Raspberry Pi where users can access the UN vector tile map layer with a web browser.

Table 3-20 shows the amount of tile data created during the UN vector tile conversion. The dataset of UN vector tiles secures the original conditions, and some items (drawing scale, symbols and projection) are optimized for web mapping.

The UN vector tiles were produced by converting the final digital topographic map dataset, and therefore the following items are the same as the original dataset.

- Map layers (can be specified with definition file for conversion)

  Layers can be specified with definition file (See appendix XXX) for conversion. This file defines the target file of conversion and zoom level of display as below.

```
'NamedPlace' => -> (f) { #pt
    f['tippecanoe']['minzoom'] = case f['properties']['NamedPlaceTypeValue']
    when 'administrativeUnit', 'populatedPlace'
      12
    when 'hydrography', 'landform', 'transportNetwork'
      MAXZOOM - 2
    when 'landcover', 'protectedSite'
      MAXZOOM - 1
    when 'building', 'other'
      MAXZOOM
    end
```

},

- Map Symbol

  Symbols also defined by a definition file. For the web map publication, complex symbols cause low performance, and therefore apply the simple templates for the map symbols. The below text shows the setting of symbols for each layer.

```
id: RoadArea
type: fill
source: v
source-layer: RoadArea
paint: {
  fill-color: [
    rgb
    242
    242
    242
  ]
  fill-outline-color: [
    rgb
    104
    104
    104
  ]
}
```

- Map extension

  Same as original dataset

- Accuracy of the map

  Same as original dataset

- Projection

  The map projection is converted into the web Mercator projection, per the specification of UNVT.

To prioritize the display speed, simple symbols and an appropriate display scale are optimized for web map service. In addition, map projection was changed into the web Mercator projection, per the specification of UNVT.

Table 3-20 Zoom level and the number of UN vector tiles and layers

Zoom Level	Equivalent Scale	Number of Tiles	Number of Layers (Total number of layer file)
7	1:4,000,000	2	2(4)
8	1:2,000,000	2	4(7)
9	1:1,000,000	3	7(19)
10	1:400,000	6	12(53)
11	1:200,000	11	23(169)
12	1:100,000	21	46(503)
13	1:40,000	42	92(1257)
14	1:20,000	83	183(2881)
15	1:10,000	164	365(6375)
16	1:5,000	47	483(9461)

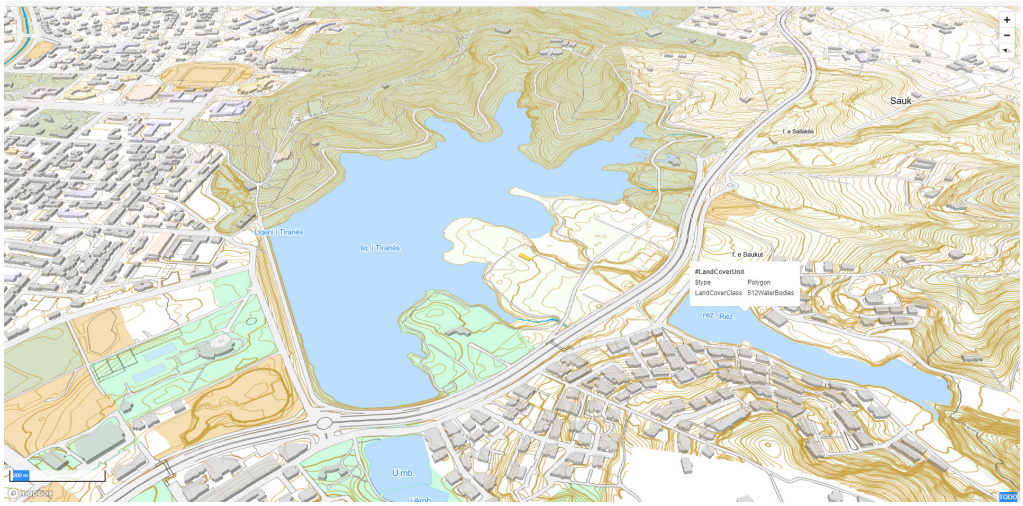


Figure 3-29 Sample image of UN vector tile

The inspection of UN vector tiles conversion has been done as follows, and confirmed that project data were converted without any errors;

- No errors while running the conversion program
- The converted data are stored in the specified folder
- Tile specification file (tiles.mbtiles) and Style file (style.json) are created correctly
- Web map service can be started with the converted data
- The converted data are shown in correct scale and symbols which are specified in the definition file with web browser

The generated UN vector tiles can be seen on in 2D as well as 3D through the test site. Also, ASIG will be

able to establish a UN vector tile based web map portal to provide the topographic map to public where any users can access to the topographic map as vector data with their web browser.

3.2.10. Country-Focused Training

The following two courses of country-focused training were conducted.

3.2.10.1. Training for Executives

(1) Overview and participants in the training

Training for ASIG executives was conducted in December 2017. The participants learned Japan's case examples and acquired knowledge in a wide range of areas from the development and provision to the utilization of geospatial information.

Table 3-21 Overview of the country-focused training for executives

Dates	3-16 December 2017
Aims of training	Provide ASIG executives with information and knowhow that will contribute to the business development and operation of ASIG
Training items	1. Intellectual property rights to geospatial information 2. Examples of utilization of geospatial information 3. Supervision method for creation of geospatial information 4. Techniques for creation of geospatial information using leading-edge technologies 5. Business development through cooperation among industry, government, and academia
Venues	Geospatial Information Authority of Japan (GSI), National Space Policy Secretariat of Cabinet Office, Secom Co. Ltd., Topcon Corporation, Zenrin Co., Ltd., Mitsubishi Electric Corporation, Kameoka City of Kyoto Prefecture, PASCO Corporation, and Kokusai Kogyo Co., Ltd.

Table 3-22 Participants in country-focused training for executives

Name	Position
Mr. Lorenc Çala	General Director
Mr. Kristaq Qirko	General Manager, Directory of Geodesy and Cartography
Mr. Klaudio Collaku	General Manager, Directory of National GIS and Geoportal
Mr. Myrtezan Kollcaku	General Manager, Directory of Finance and Support Services
Mr. Klajd Jankulla	Manager, Directory of Finance and Support Services

(2) Training results

The participants achieved the following results through the training.

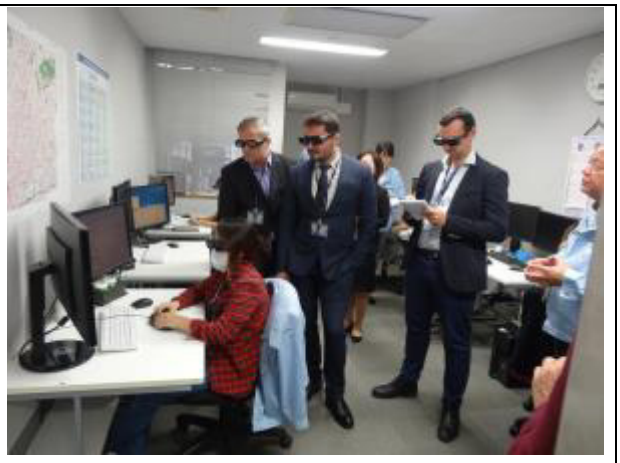
Table 3-23 Results of training for executives

Item	Result
Understanding of concrete work processes of development and maintenance of digital topographic maps	Through the training at GSI, Zenrin, Kokusai Kogyo, PASCO, etc., the participants deepened their understanding of the development and maintenance of digital topographic maps and other geospatial information. They created a workflow based on what they learned in the training, and it was considered as an item of the action plan presented by the participants on the last day of the training.
Understanding of the quality management methods	Through the training at GSI, Zenrin, etc., the participants reaffirmed the importance of quality management. They also learned quality management flows and concrete methods at PASCO Okinawa Office through demonstration with actual data.
Understanding of accuracy of topographic maps	Through the lecture at GSI, the participants learned the history and purpose of the establishment of accuracy regulations in Japan, and through the subsequent training, understood "it is important to set accuracy requirements according to the purpose". They also acquired a very important awareness that "provision of the latest information brings more benefits to the users than unnecessary pursuit of accuracy". At PASCO Okinawa Office, they also watched how to ensure accuracy of the topographic maps to be created in the Project and their concerns were relieved.
Learning about utilization of topographic maps and other geospatial information	Through the training at Secom, Topcon, Zenrin, Kameoka City, Kokusai Kogyo, PASCO, etc., the participants learned that geospatial information is utilized for various purposes not only in government organizations but also in local public bodies and private companies. They especially realized that 3D data has greater possibilities than just showing "objects three-dimensionally" through spatial analysis.
Collection of information of latest technologies concerning geospatial information	Through the training at GSI, Cabinet Office, Topcon, Mitsubishi Electric Corporation, Kokusai Kogyo, PASCO, etc., the participants collected information of the latest technologies for the development, maintenance, dissemination, and utilization of geospatial information. Development of a microsatellite in the country, analysis of LiDAR data, and establishment of regulations concerning the use of drones were especially incorporated into the action plan presented by the participants on the last day of the training.
Collection of information about intellectual property rights to geospatial information	Through the training at GSI, Zenrin, etc., the participants collected information about handling intellectual property rights to geospatial information. The participants made a comment that careful consideration should also be given to the creation and distribution of geospatial information in Albania.

Item	Result
Collection of information about business development through cooperation among industry, government, and academia	Through the training at the Cabinet Office and the private companies, the participants collected information about the importance of cooperation and human resources development with universities, the roles played by private companies in the creation, maintenance, promotion, and utilization of geospatial information, and collaboration with private companies. The participants, in particular, realized that collaboration with private companies was one of the success factors in the creation and utilization of geospatial information in Japan. Asking the government to consider local companies as important stakeholders was stated in their action plan.

As mentioned in the table above, the participants acquired awareness through the training that "roles played by private companies and cooperation with private companies are very important in the development, maintenance, dissemination, and utilization of geospatial information and is one of the success factors in Japan". JPT could not agree more. It is hoped that ASIG will find good partners in Albania and that development and utilization of geospatial information will be further promoted.

GSI



PASCO Okinawa

Report to JICA HQ

Report to JICA HQ

Photo 3-5 Country-focused training for executives

3.2.10.2. Training for Engineers

（1） Overview and participants of the training

Country-focused training for ASIG engineers was conducted in October 2018. Through the training, including practical training in the offices of PASCO Corpoation and Kokusai Kogyo Co., Ltd., the participants learned about plotting work and acquired knowledge and skills for the work.

Table 3-24 Overview of country-focused training for engineers

Dates	14-27 October 2018
Aim of training	Provide basic knowledge to create efficient digital topographic maps of appropriate quality and promote their use
Training items	1. Operation of national surveying and geospatial information 2. Examples of utilization of geospatial information 3. Rules and quality management of geospatial information work 4. Photogrammetry plotting (including practical training)
Major venues	GSI, Increment P Corporation, Kyoritsu Air Survey Co., Ltd., Mobara City of Chiba Prefecture, Kokusai Kogyo Co., Ltd., and PASCO Corporation

Table 3-25 Participants in country-focused training for engineers

Name	Department
Ms. Safete Mihali	Directory of Geodesy and Cartography / Cartography Sector
Ms. Esma Hoxha	Ditto
Mr. Martin Rusi	Directory of Geodesy and Cartography / Remote Sensing Sector
Ms. Boronica Margjeka	Ditto
Ms. Denisa Kukaj	Directory of National GIS and Geoportal / Standards of Geoinformation Sector

（2） Training results

The participants achieved the following results through the training.

Table 3-26 Results of training for engineers

Item	Result
Understanding of operation of national surveying and geospatial information	Through the training at GSI and the Association of Precise Survey and Applied Technology, the participants deepened their understanding about the development, operation, maintenance, and dissemination of spatial information by a national organization and the purposes of the surveyor system, which is a national qualification system, and the surveying work rules. They understood that GSI's methods to update maps would be especially useful for the maintenance of spatial information at ASIG. Albania does not have a surveyor qualification system, but the participants understood that such a registration system would be useful in the country to ensure the reliability of the work.
Understanding of examples of utilization of geospatial information	Through the training at Mobara City office, Increment P, Georepublic, Dynamic Map Platform, Kokusai Kogyo, and PASCO, the participants learned that geospatial information is utilized for various purposes not only in government organizations but also in local public bodies and private companies. In the lecture about the development of the high-accuracy 3D maps that is currently under development to achieve an autonomous driving and safety support system, they learned that maps are not used by people but by automobiles for autonomous driving, combining information of dynamic positions such as information of congestion and traffic restrictions. Such concepts of spatial information do not exist in Albania and the participants deepened their understanding about new activities and possibilities concerning spatial information.
Understanding of rules and quality management of geospatial information work	Through the training at GSI, Increment P, etc., the participants reaffirmed the importance of quality management. At PASCO Okinawa Office and Kokusai Kogyo Okinawa Office, they also learned flows and concrete methods of quality management through demonstration with the actual data of the Project. They also became acutely aware that, if geographical information is not updated, the quality will decline, giving less credibility and eventually destroying the credibility of the responsible organization.

Item	Result
Understanding and acquisition of photogrammetry plotting techniques	At Kyoritsu Air Survey, the participants acquired knowledge about all the processes of aerial photographing, which will be necessary for photogrammetry. The lecture about the preparation for takeoff (flight permission, confirmation of flight courses, confirmation of weather conditions, and aircraft inspection) was realistic, using video of the company's daily operations, and the participants learned hidden efforts and the reality that could not be learned in regular lectures. They also saw photographing aircraft and aerial cameras that do not exist in Albania and deepened their understanding about the acquisition of photo data, which is the most important tool for plotting. At PASCO Okinawa Office, the participants learned how to create digital topographic maps using the plotting devices and software to be used in the Project. They had different views about 3D plotting method, partly because it has not been established in Albania. However, through the training, they reached consensus on how to acquire data. At Kokusai Kogyo Okinawa Office, they received lectures and technical guidance about filtering of aerial laser measurement data, creation of digital topographic maps based on the data acquired with MMS (Mobile Mapping System, high-accuracy 3D mobile measurement system), and techniques to create true Orthophotos using aerial photos.
Collection of information of latest technologies concerning geospatial information	Through the training at GSI, Dynamic Map Platform, Increment P, PASCO, etc., the participants collected information concerning the latest technologies for the development, maintenance, dissemination, and utilization of geospatial information. They especially learned the spatial information technologies that will contribute to the improvement of social environment in Albania, such as information about high-accuracy 3D maps using MMS, preparation of large-volume POI (Point of Interest, certain point in map) information, how to publish updated map information as soon as infrastructure improvement is completed, and utilization of maps that can be easily used by the general public who are not used to using maps.

In addition to the above, the participants also renewed awareness that "the government and local public bodies bear a reasonable amount of cost to develop infrastructure and update spatial information, and this routine work contributes to the preservation of national land, improvement of people's lives and business development of private companies". In Albania, development of topographic maps, etc. is rarely conducted through public-private partnership or by local public bodies. It is expected that the lessons learned from the training will be shared with many people and contribute to the development of spatial information in Albania.

	
Kyoritsu Air Survey	Mobara City Office
	
JICA Headquarters	PASCO Okinawa

Photo 3-6 Country-focused training for engineers

3.2.11. Promotion of Utilization

JPT and ASIG took various opportunities in order to encourage more organizations to make the most of the newly created topographic maps through the Project. In addition, one of the purposes of the promotion activities was to have people understand the contribution to the Balkan region through JICA's technical cooperation.

The first publicity campaign in the Project was the kick-off conference inviting governmental and private sectors, and two neighboring countries, namely Kosovo and North Macedonia, in 2017 (The conference is described in another section of this Report).

The main organizations targeted for promotion of geospatial information utilization were the municipalities involved in the Project, the Albanian governmental organizations, and a geospatial information community in the Balkan region. The activities carried out through the Project are described below.

3.2.11.1.Promotion Activities to the Organizations under the Government of Albania

[Explanation of Project Outline]

JPT invited Albanian governmental organizations in need of geospatial information to the kick-off meeting for the Project. In October 2017, JPT visited the following organizations individually to discuss the details of the Project.

Table 3-27 The organizations visited in October 2017

Name of Organization	Utilization of Geospatial Information
Governmental Organizations	
Immovable Property Registration Office, Ministry of Justice (IPRO)	IPRO is responsible for management of cadastral maps as one of their duties. IPRO has a registration section (4 staff members), a cartography section (4 staff members), a GIS section (3 staff members), and a CORS section (5 staff members) related to geospatial information. IPRO is developing cadastral index maps using AUTOCAD and ArcGIS.
National Territorial Planning Agency Ministry of Energy and Infrastructure	The Agency uses the orthophotos in ASIG Geoportal for an integrated development plan in Durres and Tirana. A few staff members of the Agency utilize the licensed ArcGIS paying service and maintenance fees, mainly for land use plan. The challenge that the Agency faces is that they collect the data from the related municipalities for land use but the data from them are too obsolete to adjust to the current situation.
Agency for Legalization, Urbanization, and Integration of Informal Areas and Buildings, Ministry of Construction and Transportation (ALUIZNI)	ALUIZNI has a GIS section with a head and 2 staff members and a Cartography section with a head and 3 staff members for management of geospatial information, focusing on buildings, roads, water, and land parcels in urban areas. They use the orthophotos produced in 2015 through ASIG Geoportal.
Agency for Territorial Development, Ministry of Urban Development	The Agency has a GIS Division consisting of 5 engineers. The Division is responsible for geospatial information regarding land use plans and urban development plans prepared by contractors. The Division has 5 sets of ArcGIS (Version 10.5) and pays annual fees for service and maintenance. The GIS Division visualizes the changes in the urban area by overlaying the orthophotos from two periods, 2007 and 2015, provided by ASIG Geoportal. The results are useful for urban planning work. The Planning Section uses AUTOCAD and Illustrator Software for cartography.
University	
Faculty of Civil Engineering,	The Department of Geodesy is one of five departments in the Faculty of Civil

Name of Organization	Utilization of Geospatial Information
Governmental Organizations	
Polytechnic University of Tirana	Engineering. They lecture the students on GIS and photogrammetry. In 2014 the Department received 20 sets of PCs, 4 total stations, 4 Theodolites, 2 GNSS receivers, and a server donated by the Chinese Government. In addition, EU provided 3 GNSS receivers and 12 PCs to the Department in the same period. Since they could not afford to purchase ArcGIS, which is the de facto standard GIS software in Albania, they use open source GIS software.

Table 3-28 shows the agreed-upon views of the questions and comments from the visited organizations.

Table 3-28 Questions and comments from the visited organizations

Question or comment	Answer from JPT
We hope that orthophotos and digital topographic maps will be published as soon as they are ready.	JPT will pass this request on to ASIG, because it will provide the deliverables to them.
We hope that the data can be downloaded from ASIG's Geoportal.	We have heard that data can be downloaded from the ASIG geoportal, which is now being updated.
New digital orthophotos and topographic maps are the tools necessary for urban planning and cadastral work.	Topographic maps are useful for these purposes because the map scale will be 1/2,000 with high accuracy.

[Meeting for showcase of JICA Digital Topographic maps]

Similar to visiting the local governments, JPT and ASIG visited the following governmental organizations to introduce the deliverables in January 2020.

Table 3-29 The organizations visited in January 2020

Organization	Participants	Main Questions and Requests
Agency for Territorial Planning	10	- How does ASIG provide topographic map data? - In addition to viewing map images through the ASIG geoportal, ASIG should provide the vector data to the government users. - Since the cadastral information of agricultural land is prepared based on 1/2000 maps, the topographic maps created by the Project will be useful. - ASIG should provide the digital orthophotos without degrading the resolution. - Governmental organizations expect ASIG to share highly accurate GIS data
National Cadastral Agency	2	
Agency of Territorial Development	1	

The questions and requests above were similar to the comments which JPT received when visiting relevant

agencies in 2017. In short, users of geospatial information were eager for ASIG to provide high quality topographic map data promptly.

3.2.11.2.Promotion Activities to Municipalities in the Project area, University and Private Companies

（1） Municipalities in the Project area

[Explanation of the Project]

In October 2017, JPT and ASIG visited the municipalities in the Project area prior to the implementation of the aerial photo shooting. JPT explained to them about the overview of the Project, requested cooperation (for the municipalities where JPT would conduct field verification), and had a Q&A session. In order to determine the area for the aerial photography, JPT interviewed the municipalities about the areas where they need to take the aerial photos. JPT tried to meet their expectations as much as possible.

Kamza City Office

Durres City Office

Shijak City Office

Vora City Office

Photo 3-7 Visits for promotion of utilization

As a result of visiting each municipality, JPT received the following questions and comments.

Table 3-30 Questions and comments concerning promotion of utilization

Question or comment	Answer from JPT
We want to know the reasons for the selection of the target scope of the verification.	The JICA Preparatory Study Team and ASIG determined the scope through discussion. The mapping area was selected because it is the largest commercial district in Albania and well developed.
GIS engineers should be trained. We hope JPT will provide GIS training.	Technology transfer to ASIG is planned, but JPT also wants to consider whether technology transfer can be conducted for other relevant organizations.

JPT had discussions with ASIG about the provision of GIS training at the ASIG office to the municipalities concerned with the Project, which was one of the requests made during the visits. ASIG expressed the opinion that GIS training for users was important in broadening the base of spatial information users. However, they also expressed the opinion that techniques would not spread in the organizations or applied to actual practices, while the users' knowledge would increase. Another opinion was that such training would not produce immediate results because ASIG knew from experience that not all participants would deal with GIS in their organizations. Therefore, JPT considered visiting the municipalities which strongly request such GIS training to individually give advice on GIS instead of providing training to all the municipalities involved.

[First-Showing Meeting of JICA Digital Topographic maps]

Initially, JPT planned to hold a meeting in the conference room in ASIG's office to invite geospatial information users to showcase the newly created topographic map data. However, in order to respond to the above-mentioned requests from the municipalities, JPT made a decision to visit each office of the municipalities to carry out the GIS training. For this reason, the topographic maps were unveiled in the meeting rooms of each municipality before the implementation of the GIS training. As a result, more local government officials were able to attend the meetings than if the meeting were held at the ASIG office in Tirana.

JPT carried out the following introductions to each municipality. The number of participants is shown in the table "Meeting for showcase of topographic maps and GIS training".

- Outline of the project (background, purpose, area of new topographic maps, scope of works, training in Japan, etc.)
- Introduction of outputs (Printed PDF map covering each municipality, topographic map data on PC, ESRI vector tile data)
- Future schedule (Invitation of the JICA Project final conference in September 2020, Request for presentation)

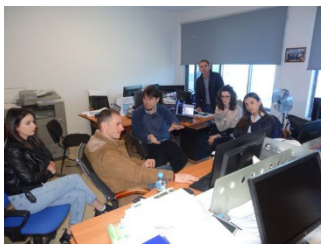
[GIS Training]

When visiting each municipality in 2017, it was found that the municipalities involved in the Project, except for Tirana Municipality, had rarely used GIS in their daily works. At the same time, JPT received requests for GIS training from them. Accordingly, JPT decided to conduct short term GIS training for the following municipalities in 2020.

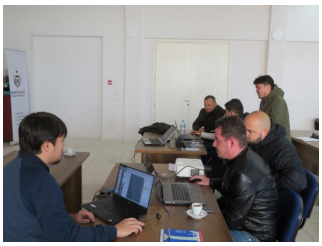
Durres Municipality, one of the municipalities in the project area, was severely damaged by an earthquake at the end of November 2019. Since most of the officers in the municipality, including engineers involved in geospatial information, were focusing on activities in the disaster area, the training was not attended.

Table 3-31 Meeting for showcase of topographic maps and GIS training

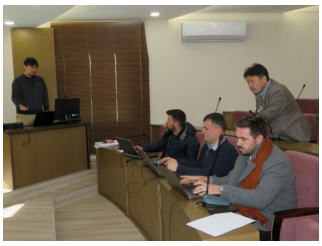
Municipality	Participants for First-Showing Meeting of JICA maps	Number of Participants	Period of Training	Level	Contents of Training
Kamza	6	5	2	Beginner	- Introduction of GIS - Types of GIS data - GIS data creation - Analysis methods using GIS data - Geo-reference method - Import of photo image to GIS
Kruja	12	5	1		
Shijak	12	3	1		
Vora	8	6	1		
Tirana	11	9	2	Intermediate	- DEM creation based on contour data - Creation of bird's-eye view data - CAD file import - Detection of buildings that are required to be evacuated when assuming new road construction
Durres	1	0	0	-	-
Total	50	25	7		



Kamza

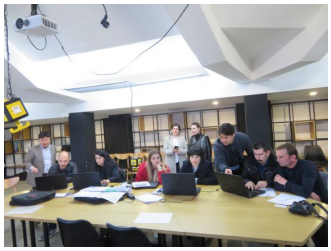


Kruja

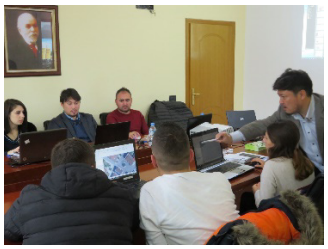


Shijak

Tirana Municipality



Tirana Municipality



Bora Municipality

Photo 3-8 GIS Training in municipalities

[Result of GIS Training]

It turned out that GIS is rarely used in the municipalities other than Tirana. In addition, the following challenges arose during the training: insufficient hard disk capacity of PCs prepared by the municipalities, holding the training in rooms with vulnerable WIFI environment, and use of PCs with Operating Systems (e.g. WINDOWS VISTA) that are no longer in use. The participants in the training learned the basic operation of QGIS, which is an open source GIS, and were able to deepen their understanding of the basic utilization methods of newly developed topographic maps.

Even in a very short training period, it is possible to understand the basics of GIS. However, in order to use GIS in practice, the officers need to continuously learn GIS using topographic map data by themselves. Having intermediate or advanced GIS technicians in the office will improve the ability of the beginners significantly. Unfortunately, not each municipality has such an ideal environment.

ASIG held a meeting for municipalities on the use of ASIG's Geoportal in 2019; in case regular GIS training for them organized by ASIG, the usage of geospatial information data will be much more activated than now. In addition, sharing of the data created by the municipalities will be greatly accelerated.

（2） University

[Collaboration with a University in Pursuit of Fostering of Geospatial Information Engineers]

Practical training to the future engineers in the field of geospatial information was organized where students of the Faculty of Geodesy of Polytechnic University of Tirana were invited in May 2019.

The objectives of the training are:

A) Understanding of topographic map production by using the latest software and hardware
B) Understanding of field verification for topographic map production
C) Understanding of technical cooperation by Japan
D) Establishment of good relationship between Japan and Albania
E) Public Relations on the Project

JPT and ASIG jointly provided both indoor and outdoor training on digital topographic map creation. His Excellency, the Ambassador Mr. Ito, visited ASIG and had a constructive dialogue with the participants.

Photo 3-9 The training for the students

（3） Private companies

Through the commencement conference, JPT and ASIG introduced the development of digital topographic maps to local private survey companies. JPT and ASIG also invited the private companies to the project final conference and introduced the developed digital topographic maps.

Since many of the private companies related to geospatial information use GIS software for their daily business and/or contracted projects, it is expected that the digital topographic maps will be utilized in their future business activities.

3.2.11.3. Promotion Activities to Geospatial Information Community in the Western Balkan Region

JICA has been providing technical cooperation on various geospatial information projects in each country in the Western Balkan region. Through the Project, JPT participated in various international conferences with the following main purposes.

- Deliver information about JICA’s technical cooperation for the development of spatial information
- Understand the activity status of the donors supporting the Balkan region and the development of geospatial information and use it for future verification work
- Dispatch information to encourage the wide use of deliverables of the Project
- Develop a network for the regional meeting to be held by JPT in 2020

The conferences in which JPT participated are as follows;

A) XI Regional Conference on Cadastral and Spatial Data Infrastructure (Montenegro, May 2018)
B) XII Regional Conference on Cadastral and Spatial Data Infrastructure (Bosnia and Herzegovina, September 2019)
C) EuroGeographics General Assembly (Czechia, October 2019)

In A) B), both JPT and ASIG members and one of the JICA Balkan office staff members jointly made presentations on the project. In C), the contents of the Project were explained in the presentation given by the Director General of ASIG.

The following is an overview of the conferences JPT attended and the contents of the JPT and ASIG presentations.

Table 3-32 XI and XII Regional Conferences on Cadastral and Spatial Data Infrastructure

	XI Regional Conference	XII Regional Conference
Dates	29 - 31 May 2018	4 - 6 September 2019
Venue	Budva, Montenegro	Neum, Bosnia Herzegovina
Participants	88	73
Participants from JICA	- Ms. UNAKI Tomoko, JICA Balkan Office - Mr. TSUDA Kaoru, JPT - Ms. Esma Hoxha, JPT ASIG	- Ms. UNAKI Tomoko, JICA Balkan Office - Mr. TSUDA Kaoru, JPT - Mr. Martin Rusi JPT ASIG
Participants from ASIG	- Mr. Lorenc Çala, General Director - Mr. Dritan Prifti, Manager of Remote Sensing and Imaging Section	- Mr. Lorenc Cala, General Director - Mr. Dritan Prifti, Manager of Remote Sensing Section - Mr. Arben Xhialli, Geodetic Reference Section
Contents of the Presentation by JPT	- Introduction of the Regional Conference to be held in Tirana by JPT in 2020 - Introduction of the Project, technology transfer of a series of geospatial information, training in Japan, topographic map creation by ASIG - JICA's technical cooperation on geospatial information in developing countries, geospatial information projects in the West Balkan region, introduction of the projects triggered by JICA geospatial information projects, and how to request JICA projects	
Participants	National organizations for spatial information A) Montenegro (Real Estate Administration) B) Albania (State Authority for Geospatial Information) C) Kosovo (Kosovo Cadastral Agency) D) Macedonia (Agency for Real Estate Cadastral)	National Geospatial Information Agencies A) Montenegro (Real Estate Administration) B) Albania (State Authority for Geospatial Information) C) Albania (State Cadastre Agency) D) Kosovo (Kosovo Cadastral Agency) E) North Macedonia (Agency for Real Estate

	XI Regional Conference	XII Regional Conference
	E) Serbia (Republic Geodetic Authority) F) Bosnia and Herzegovina (Federal Administration for Geodetic and Real Property Affairs) G) Slovenia (Surveying and Mapping Authority) H) Croatia (State Geodetic Administration) I) Bulgaria (Agency for Geodesy, Cartography and Cadastral) J) Republika Srpska (Republic Administration for Geodetic and Real Property Affairs) Donors: Japan, Norway, Sweden, the Netherlands International Org.: EuroGeographics Montenegrin government organizations (Statistical Office, etc.) and Serbian private companies	Cadastral) F) Serbia (Republic Geodetic Authority) G) Bosnia and Herzegovina (Federal Geodetic Administration) H) Slovenia (Surveying and Mapping Authority) I) Croatia (State Geodetic Administration) J) Republika Srpska (Republic Administration for Geodetic and Real Property Affairs) Donors: Japan, Norway, Sweden, Netherland International Org.: EuroGeographics

Photo 3-10 Presentation on the Project by Ms. Esma Hoxha at XI Conference

Photo 3-11 Presentations on the Project by Mr. Marin Rusi and Mr. TSUDA Kaoru at XII Conference

[EuroGeographics General Assembly]

EuroGeographics, representing more than 60 organizations in 46 countries, is an independent international not-for-profit organization representing Europe's National Mapping, Cadastral, and Land Registration Authorities. Around 90% of the official bodies responsible for geodetic surveying, topographic mapping, cadastral surveys, and land registration in geographical Europe have joined EuroGeographics. Every year, the General Assembly is held in a member state. A member of JPT was invited by the EuroGeographics as an exceptional guest this time.

Table 3-33 EuroGeographics General Assembly

Dates	7-9 October, 2018
Venue	Prague, Czechia
Participants	150 participants from 62 Organizations in 40 countries
Participants from JICA	- Mr. TSUDA Kaoru, JPT
Participants from ASIG	- Mr. Lorenc Çala, General Director - Mr. Klaudio Collaku, Director of National GIS and Geoportal - Mr. Kristaq Qirko, Director of Geodesy and Cartography - Mr. Myrtezan Kollcaku, Director of Finance and Support Services
Contents of Presentation by ASIG	- Introduction of ASIG - Geospatial Information Management by ASIG - Projects by donors, including JICA Project

Photo 3-12 Presentation by ASIG General Director at Eurogeographics General Assembly

Photo 3-13 Part of the presentation by ASIG (presentation of JICA project) at Eurogeographics General Assembly

3.2.11.4. Provision of Information and Recommendations for ASIG Regarding Promotion of Utilization

（1） Provision of sustainable methods to maintain geospatial information

In order for users to use geospatial information with confidence, it is essential that geospatial information is updated appropriately and continuously. Therefore, during the training in Japan for ASIG managers in December 2017, GSI provided lectures on how to maintain and manage the basic national base maps. GSI explained to them that the new orthophotos and 1/2500 topographic maps owned by local governments can be used to update the wider areas of the national base maps.

In addition, the GSI explained to the ASIG managers that the topographic map update in small parts, such as new construction of major roads, major developments, and changes of administrative boundaries, is carried out by GSI as soon as the public survey results are received from the relevant authorities.

GSI also explained that it is one of the basic policies of GSI to update the national base maps with the latest geospatial information provided by municipalities and public road management agencies.

（2） Proposal to strengthen user supports in ASIG Geoportal

JPT confirmed that ASIG Geoportal already has a user contact point and a function for providing information to users. To improve the service to users, ASIG Geoportal is expected to add a Chatbot function where users can give short text or voice instructions to a computer and receive the results, and to expand the Geoportal guidance in English.

- Users can make inquiries via Geoportal. User registration download services and other functions were implemented when the Geoportal was updated in 2017, and the site has become more user friendly.

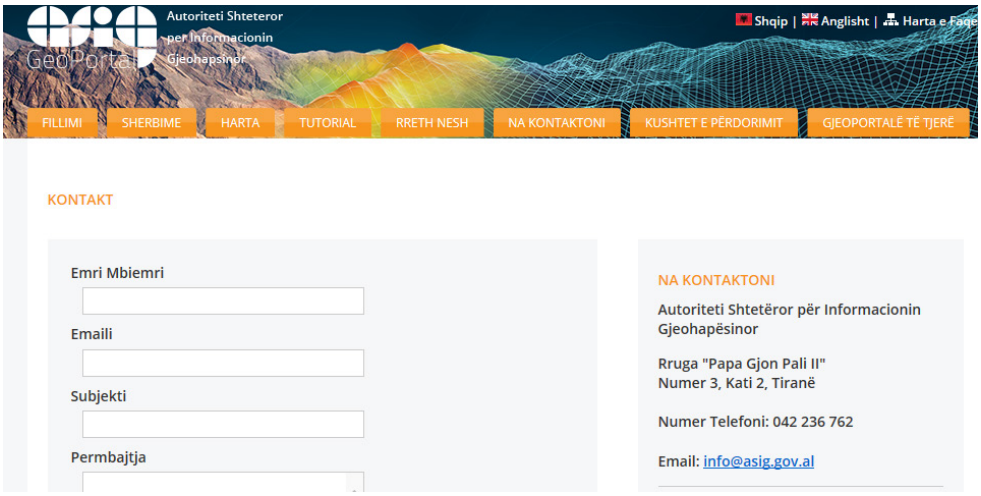


Figure 3-30 User inquiry screen on Geoportal

- Users can see how to use the Geoportal, including the downloading method, through the tutorial. ASIG does not have facilities for sale of geographical information, special exhibition, etc. in the office or provide printing services for drawings or direct data sales. ASIG thinks that, to operate with a small number of highly capable staff members, it is important to improve the Geoportal, which can always be accessed from remote places, and provide geographical information more quickly and easily, rather than establishing a sales counter in the office.

(3) Proposal for the use of topographic maps in the field of disaster prevention

Two agenda items of the presentation above at the Final Conference in November 2021 were to "Contribute to Building a disaster resilient city" based on topographic map and to "Use Topographic map as a Communication Tool".

Hazard maps for earthquake produced in Japan are based on a number of information items, such as a building's age, materials, and number of floors, the history of disasters, borehole column maps, and so on. However, the municipalities in Albania may not have such detailed data in place. Therefore, it was proposed that only the topographic maps produced in the Project and GIS software are utilized for disaster management.

The topographic map data of the Project include the elevation data of each building and the width of each road. Based on these two data items and the topographical map, JPT made the following three risk assessments in a small part of Tirana Municipality using the estimated values of building collapse, and the level of risk for each road width used in Japan.

- Risk Assessment of Building Collapse
- Risk Assessment of Road Blockage
- Risk Assessment of Difficulty in Evacuation

The result of the assessments is not accurate in a sense, as no field surveys were carried out and the

assessment was based on the limited data. However, it is possible to identify trends in the low and high risk of earthquakes in each district, and the results can be used to narrow down the high-risk districts for efficient detailed surveys.

Municipalities in Japan also invite the local residents to walk around their areas to identify hazards and record these on topographical maps.

The local authorities then draw up detailed hazard maps for each area, taking into account the views and experience of local residents. As residents are directly involved in the creation of the hazard maps, it has the advantage that they are more familiar with the risks.

A variety of risk maps were shown at the Final Conference. It is hoped that each municipality will use this information as a reference for their own disaster management efforts.

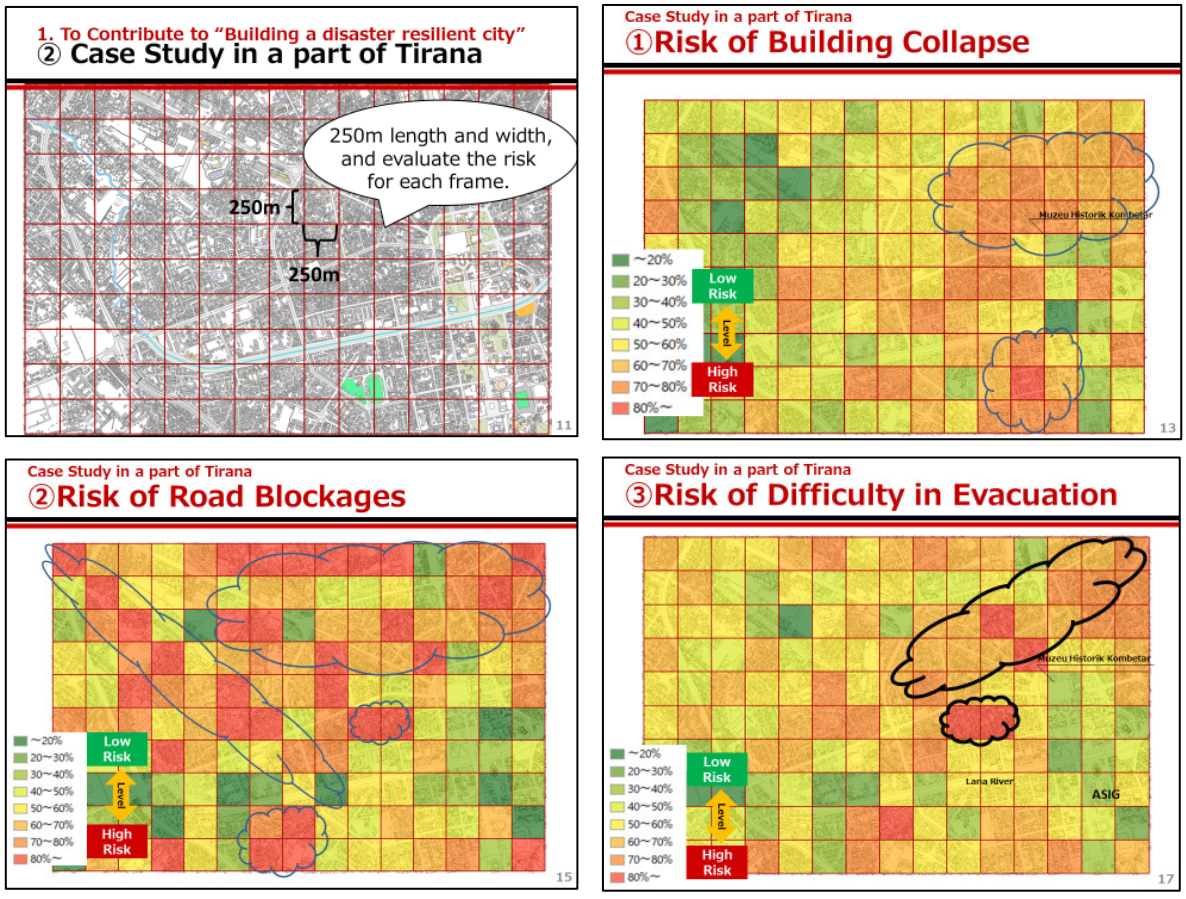


Figure 3-31 (Top-Left) Case Study Area in the center of Tirana, (Top-Right) Risk Map of Building Collapse, (Lower-Left) Risk Map of Road Blockages, (Lower-Right) Risk Map of Difficulty in Evacuation

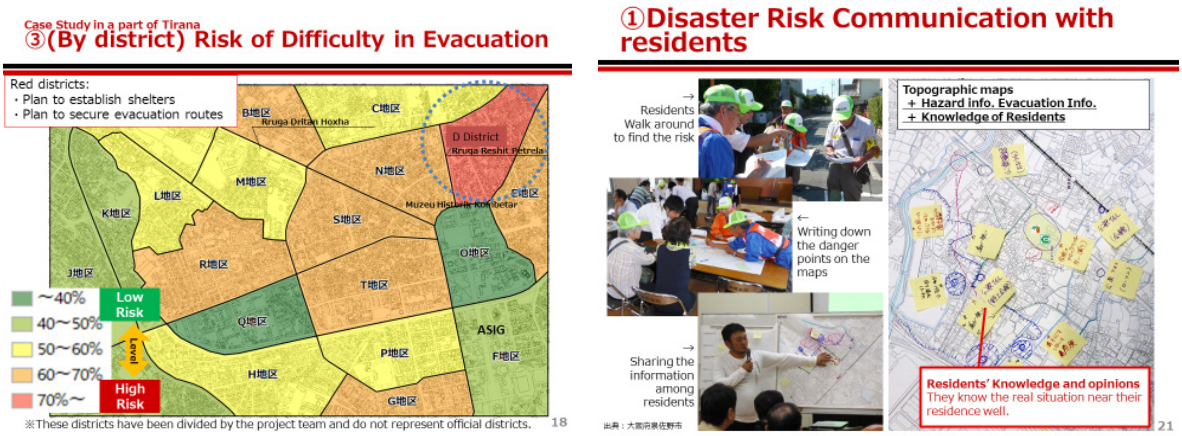


Figure 3-32 (Left) Risk Difficulty in Evacuation in a part of Tirana, (Right) Disaster Risk Communication with residents

（4） Activities aimed at increasing the number of geospatial information users

In February 2020, the project team visited municipalities in the area of topographic mapping and conducted basic GIS training for them using open source software (Q-GIS).

Through a series of training sessions, it was found that there are many municipal officials who want to utilize geospatial information but have no opportunity to learn how to use GIS.

So far, ASIG has developed briefing sessions on the utilization of the ASIG Geoportal for local governments nationwide.

In addition, ASIG has been actively establishing dissemination activities that contribute to increasing the number of geospatial information users through online conferences and SNS. In the future, in addition to these activities, if it is possible to distribute videos on how to use topographic maps using QGIS for GIS beginners, it will lead to further expansion of users.

An increase in the number of geospatial information users will lead to an increase in the social value of ASIG's existence. Therefore, ASIG is required to improve the quality of the topographic maps created by the Project regarding the topographical features, land use, and buildings and to expand the areas of topographic maps, especially in major cities and towns, to meet the needs of prospective users.

As a result, it is expected that the government will determine that it is necessary to strengthen human resources for ASIG and secure a budget for the expansion of geospatial information, which in turn will create a virtuous cycle of geospatial information development.

3.2.12. Holding of Meetings and Conferences

3.2.12.1. Joint Coordinating Committee (JCC)

JCC meetings were held as listed in Table 3-34.

Table 3-34 List of JCC meetings

NO.	Date	Contents
First JCC	19th June 2018	Confirmation of the progress of the project and its activities Opinion exchange and discussion on issues challenges
Second JCC	11th April 2019	Confirmation of the progress of the project and its activities Opinion exchange on exchanged opinions on importance of easy accessibility of geospatial information, distribution and maintenance and usage of new technologies
Third/ Final JCC	10th November 2021	Confirmation of the results and outputs of the project Acceptance of the draft final report

（1） First JCC

On 19th June 2018, the first JCC was held to share the progress of the project, and confirmed the contents of subsequent activities.

Photo 3-14 First JCC meeting

The main agenda items discussed were as follows.

1. Both JPT and ASIG confirmed that ASIG would distribute the new orthophotos through ASIG's Geoportal shortly after the product is delivered to ASIG. JPT explained that JPT would receive the new orthophotos from Hansa in the middle of July and then they would check the quality before delivering the product to ASIG. ASIG mentioned that five working days would be necessary to distribute them through the Geoportal.

2. JPT mentioned that both JPT and ASIG are concerned about distribution of the new digital topographic maps. ASIG said that ASIG is responsible for distribution of the new topographic maps and would make every effort in order to realize it. ASIG also mentioned that further assistance is needed on this matter in the near future.
3. JPT requested ASIG to inform JPT when ASIG has any information about Board of Geospatial Information (BIG).

The participants were as follows.

Albania Side

Ms. Erjola Muka	Director, Directory of Policies and Priorities for Development, Prime Minister's Office
Mr. Lorenc Çala	Director General, ASIG (Chairman)
Mr. Kristaq Qirko	Director, Directory of Geodesy and Cartography, ASIG
Mr. Klaudio Collaku	Director, Directory of National GIS and Geoportal, ASIG
Mr. Myrtezan Kollcaku	Director, Director of Directory of Finance and Supporting Services, ASIG
Ms. Safete Mihali	Sector of Cartography, ASIG
Ms. Esma Hoxha	Sector of Cartography, ASIG
Ms. Denisa Kukaj	Sector of Standards for Geoinformation, ASIG
Ms. Boronica Margjeka	Sector of Remote Sensing and Imagery, ASIG
Mr. Martin Rusi	Sector of Remote Sensing and Imagery, ASIG

Japan Side

Ms. UNAKI Tomoko	Project Formulation Adviser, JICA Balkan Office
Mr. Sokol Konomi	Technical Coordinator in Albania, JICA Balkan Office
Mr. SUGITA Akihiro	Team Leader, JICA Project Team
Mr. TSUDA Kaoru	Expert for Promotion of Utilization of Geospatial Information, JICA Project Team
Mr. YAMADA Keiji	Expert for Data Specification, JICA Project Team
Ms. SEIMIYA Nami	Project Coordinator, JICA Project Team

（2） Second JCC

On 11th April 2019, the second JCC was held to share the progress of the project, and confirmed the contents of subsequent activities.

In the meeting, participants exchanged opinions on the importance of easy accessibility of geospatial information, the importance of data distribution and maintenance, and usage of new technologies (e.g. drone, open source). Then ASIG explained how they will coordinate with municipalities and how they want the municipalities to utilize the digital topographic map via Geoportal. ASIG also shared its idea to expand the

area of the digital topographic map and the possibility of usage of drones.

At the end of the meeting, ASIG summarized that the progress was reviewed and the plan was approved and by JCC together with all the participants. As a result of the meeting, the interim report was accepted by all participants.




Photo 3-15 Second JCC meeting

Albania Side

Ms. Erjola Muka	Director, Directory of Policies and Priorities for Development, Prime Minister's Office
Mr. Lorenc Çala	Director General, ASIG (Chairman)
Mr. Kristaq Qirko	Director, Directory of Geodesy and Cartography, ASIG
Mr. Klaudio Collaku	Director, Directory of National GIS and Geoportal, ASIG
Mr. Myrtezan Kollcaku	Director, Director of Directory of Finance and Supporting Services, ASIG
Mr. Dritan Prifti	Sector of Remote Sensing and Imagery, ASIG
Mr. Saimir Burba	Sector of Cartography, ASIG
Ms. Safete Mihali	Sector of Cartography, ASIG
Mr. Martin Rusi	Sector of Remote Sensing and Imagery, ASIG
Mr. Albin Koci	Sector of System of CORS Infrastructure, ASIG

Japan Side

Mr. HIBINO Takashi	Deputy Resident Representative, JICA Balkan Office
Mr. Sokol Konomi	Technical Coordinator in Albania, JICA Balkan Office
Ms. MORIKAWA Hiroko	Second Secretary, Embassy of Japan
Mr. SUGITA Akihiro	Team Leader, JICA Project Team
Mr. SUZUKI Akira	Deputy Team Leader, JICA Project Team
Mr. TSUDA Kaoru	Expert for Promotion of Utilization of Geospatial Information, JICA Project Team
Mr. YAMADA Keiji	Expert for Data Specification, JICA Project Team
Ms. SEIMIYA Nami	Project Coordinator, JICA Project Team

（3） Third/ Final JCC

On 10th November 2021, the third/final JCC with 12 participants from ASIG, Embassy of Japan, JICA Balkan Office, JICA in Tokyo, and JPT was held to review and confirm the result of the Project.

In the meeting, JPT introduced the results in terms of the final products, including quality control, the current activities of ASIG, and three recommendations from JPT to ASIG. All of the participants confirmed the results without any objections.

During the discussion, ASIG, who is providing their Geoportal to which more than 1,600 unique IDs connect and use the contents every working day, emphasized that having topographic maps in digital format is important for ASIG as well as the users for maintenance and for usage, and that map update is especially important for the users to make decisions based on the fact. ASIG also informed the participants that they officially requested the project on development of web GIS and ASIG would be happy to provide further information when needed. JICA explained that it is in the process of evaluating the proposal.

ASIG made a request that they would like to have the final product delivered in tapes rather than external HDD for better and long term storage, where JPT asked ASIG to provide the detailed specifications of the desired tape.

As a result of the meeting, the draft final report was accepted by all participants.

Photo 3-16 Third JCC meeting

Albania Side

Mr. Lorenc Çala	Director General, ASIG (Chairman)
Mr. Kristaq Qirko	Director, Directory of Geodesy and Cartography, ASIG
Mr. Albin Koci	Sector of System of CORS Infrastructure, ASIG

Japan Side

Mr. TAKEICHI Jiro	Chief Representative, JICA Balkan Office
Mr. HIRASHIMA Jun	Project Formulation Advisor, JICA Balkan Office
Ms. MORIKAWA Hiroko	First Secretary of Embassy of Japan
Mr. Sokol Konomi	Technical Coordinator in Albania, JICA Balkan Office
Mr. KUMAGAI Hidenori	JICA Headquarters in Japan
Mr. SAKABE Shinichi	JICA Headquarters in Japan
Mr. SUZUKI Akira	Team Leader, JICA Project Team
Mr. TSUDA Kaoru	Expert for Promotion of Utilization of Geospatial Information, JICA Project Team
Ms. SEIMIYA Nami	Deputy Team Leader, Project Coordinator, JICA Project Team

3.2.12.2. Holding of Conferences

JPT together with ASIG held the following conferences to introduce the development of digital topographic maps and promote it.

Instead of holding “First-Showing Meeting of JICA Digital Topographic maps” which was planned at the beginning of the project, JPT visited each of the municipalities and government agencies and showed the digital topographic maps as described in 3.2.11.2.

（1） Holding of JICA Project commencement conference

The JICA Project commencement conference was held on 24th October 2017, where the contents of the Project and JICA's support status related to geospatial information in the Balkans area were widely explained to the people concerned in Albania. Speakers from the Kosovo Cadastral Agency (KCA) and Agency for Real Estate Cadastral (AREC) were invited to share the outcome of the topographic map project supported by JICA.

Table 3-35 Agenda of the commencement conference

Time	Title	Speaker	Affiliation
9:30-10:00	Opening Speeches	Mr. Lorenc Çala	Director General of ASIG
		Mr. Makoto Ito	Ambassador of Embassy of Japan in Albania
		Mr. Naomichi Murooka	JICA Headquarters

Time	Title	Speaker	Affiliation
Coffee Break (10:00 - 10:20)			
10:20-10:35	NSDI in Albania Past, Current, and Future	Mr. Lorenc Çala	Director General of ASIG
10:35-10:50	JICA Mapping Projects in Balkan Region	Mr. Takahiro Izumi	JICA Headquarters
10:50-11:05	Knowledge Sharing(1) Survey Training in Japan	Mr. Arian Lasku	ASIG
11:05-11:20	Knowledge Sharing (2) JICA Project in Kosovo	Mr. Avni Rrustemi	Kosovo Cadastral Agency (KCA)
		Dr. Murat Meha	
11:20-11:35	Knowledge Sharing (3) JICA Projects in Macedonia	Mr. Sasho Dimeski	Agency for Real Estate Cadastral (AREC)
11:35-11:50	JICA Mapping Project in Albania	Mr. Akihiro Sugita	JICA Project Team
11:50-12:10	Discussion (Questions and Answers)		
12:10-12:20	Closing Remarks	Mr. Hideya Kobayashi	Chief Representative of JICA Balkan Office

(2) Holding of JICA Project Final conference

The JICA Project final conference was held on 4th November 2021 to inform the parties concerned in Albania of the achievements of the Project. The main objectives of the conference were for closing ceremony of the Project, reporting what ASIG and JPT have done throughout the Project, and introduction of UN vector tile and usage of topographic maps as a tool of disaster prevention.

As a part of the COVID 19 measures, the conference was held in a hybrid format, with a small group meeting in a large meeting room and online meeting. The details are given below.

Table 3-36 JICA Project final conference

Hybrid Meeting		
	Face to face Meeting	Online Meeting
Venue	Meeting room in ASIG office	ZOOM Online Meeting
Speakers	Please refer to the Program below (9 people in total)	One from GSI in Japan
Participants	Embassy of Japan, JICA Albania Office, ASIG, JPT (10 people in total)	GSI, JICA Balkan Office, JICA in Tokyo, Tirana Municipality, Durres Municipality. Polytechnic University of Tirana, JPT and others (66 Accesses to URL in total)
Operators	Operators for online meeting, camera and audio equipment, simultaneous interpreter (3 people in total)	
Others	Video was recorded during the conference	

The below is the program of the final conference.

Table 3-37 Program of JICA Project final conference

Time	Title	Speaker	Affiliation
09:50-	OPEN		
10:00-10:05	Opening Remarks	Ambassador Mr. TAKADA Mitsuyuki	Japan Embassy in Albania
10:05-10:10	Opening Remarks	Mr. Lorenc Cala	Director General of ASIG
10:10-10:25	Project Outline Project Result/Data Distribution	Mr. SUZUKI Akira	JICA Project Team
		Mr. Albin Koci	ASIG
10:25-10:35	Technical Transfer in Albania	Mr. Dritan Prifti	ASIG
10:35-10:45	Technical Transfer in Japan	Mr. Martin Rusi	ASIG
10:45-11:00	GSI Vector Map/UN Vector Tile	Mr. FUJIMURA Hidenori	Director, Planning Division, Geospatial Information Department, GSI
11:10-11:20	Data Dissemination through ASIG Geoportal	Mr. Klaudio Collaku	Director of National GIS and Geoportal, ASIG
11:00-11:10	Use of Topographic Maps by Municipalities	Mr. TSUDA Kaoru	JICA Project Team
11:20-11:25	Q&A		
11:25-11:30	Closing Speech	Mr. FUKUDA Hajime	Deputy Chief Representative of JICA Balkan Office

The conference was reported on Albanian television, newspapers, and web news. The following are the URLs of the web news and TV reports.

https://drita.tv/mbeshtetje-nga-jica-shqiperia-krijon-hartat-digjitale-topografike/

http://24-ore.com/?p=188925

http://ata.gov.al/2021/11/05/mbeshtetje-nga-jica-shqiperia-krijon-hartat-digjitale-topografike/

https://youtu.be/PMBy9lbhZJs

which would sizeably curtail foreign-exchange risk," they

at the bottom of this year's ranking, which compares the

stimulus," Kamelyan
Shen told SeeNews.

in crisis.

Japan Supports Digital Mapping of Tirana, Durres

TIRANA - Japan International Cooperation Agency (JICA) has successfully completed a project on geospatial information and sustainable land development in Tirana-Durres area, which was developed for about four years in close cooperation with State Authority for Geo-Spatial Information (ASIG), the Embassy of Japan said in a press release. The main objective of the project is to enhance social and economic development activities in this area, by utilizing large scale digital topographic maps, the Embassy said, adding that the project has also successfully developed the capacity of topographic map production and accuracy of ASIG.

The 1: 2,000 digital topographic maps covering 300 km2 were created by a successful collaboration between the ASIG and the JICA Project Team involving local companies. The maps are in line with the EU INSPIRE directive and have rich content with high position accuracy.

The closing conference of the project as well as a Regional Balkan Conference were held last to share the results achieved with stakeholders, government agencies, municipalities, embassies of Japan in the Balkan region, local companies, etc., who are potential users of the digital topographic maps created.

The ceremony took place at ASIG offices in Tirana and was attended by the Ambassador of Japan to Albania Takada Mitsuyuki, Chief Representative of JICA Balkan Office, Takeichi Jiro (online), Director General of ASIG Lorenc Çala as well as other interested stakeholders.

From the left, Director General of ASIG Lorenc Çala and Japan Ambassador Takada Mitsuyuki

Both conferences started with the opening remarks of the Ambassador of Japan and General Director of ASIG Çala. An expert from the Japan Geospatial Information Authority introduced a new technology called "GSI Vector Map" followed by other Japanese experts who introduced the cases of the use of digital topographic maps by municipalities in Japan. ASIG presented the National Geo-portal and the way of providing data created by this project through the geo-portal.

During the Regional Conference on Geospatial Information the results of the project were presented to the representatives of the national geospatial information agencies of the Western Balkans Region who at the same time presented their future plans and expectations for technical assistance from JICA.

BANK OF ALBANIA AK-INVEST ILIRIA'98

JICA

Mbështetje nga JICA, Shqipëria krijon hartat digjitale topografike

Photo 3-17 English (left) and Albanian Newspaper

Photo 3-18 (Top left) General Director of ASIG, Mr. Lorenc Cala, Ambassador, Mr. TAKADA Mitsuyuki, Deputy Chief Representative of JICA Balkan Office, Mr. Fukuda, (Top right) Ms. Eugerta, a moderator, (Lower left) Mr. Dritan, Mr. Klaudio of ASIG, (Lower right) Mr. Suzuki of JPT, Mr. Martin of ASIG. Ms. SEIMIYA of JPT

(3) Holding of a Regional Conference

JICA has conducted technical cooperation for development of geospatial information in the West Balkan countries (Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia, and Kosovo) in the past. Excellent results have been achieved by these countries, which are making the most of the outputs of technical cooperation and developing geospatial information on their own. It is considered enormously worthwhile to share experiences with them. The main objectives of the Regional Conference were as follows;

- Introduction of JICA Project in Albania
- Introduction of JICA's Geospatial Information Projects in Balkan Region
- Introduction of UN vector tile
- Exchange activities of national geospatial information agency in each country
- Expectation to JICA's technical cooperation

JPT invited the geospatial information agencies of North Macedonia, Kosovo, Montenegro, Serbia, and Bosnia and Herzegovina (Republika Srpska and Federation of Bosnia and Herzegovina) to participate in the Conference by the online. As a result, all agencies except Serbia and Republika Srpska responded to participate in the Conference.

Gathering these national organizations in charge of geospatial information, a regional conference was held on 5th November 2021.

As a part of the COVID 19 measures, the Conference was held in a hybrid format, with a small group meeting in a large meeting room and online meeting. The details are given below.

Table 3-38 Regional Conference

Hybrid Meeting		
	Face to face Meeting	Online Meeting
Venue	Meeting room in ASIG office	ZOOM Online Meeting
Speakers	Please refer to the Program below (4 people in ASIG and JPT)	Embassy of Japan in Albania JICA Balkan Office in Serbia GSI in Japan TOPCON in Japan Federal Administration for Geodetic and Real Property Affairs in Bosnia Herzegovina Kosovo Cadastral Agency in Kosovo Real Cadastre and State Property Administration in Montenegro Agency for Real Estate Cadastre in North Macedonia (10 people in total)
Participants	ASIG, JPT	Embassy of Japan in Balkan countries, GSI, JICA

	(10 people in total)	Balkan Office, JICA in Tokyo, participant countries, JPT and others (59 Accesses to URL in total)
Operators	Operators for online meeting, camera and audio equipment, simultaneous interpreter (3 people in total)	
Others	Video was recorded during the conference	

Below is the program of the regional conference.

Table 3-39 Program of the Regional Conference

Time	Title	Speaker	Affiliation
9:50	OPEN		
10:00-10:05	Opening Remarks	Ambassador Mr. TAKADA Mitsuyuki	Japan Embassy in Albania
10:05-10:10	Opening Remarks	Mr. Lorenc Cala	Director General of ASIG
10:10-10:20	JICA Project Results/Lessons Learned from the Project	Ms. SEIMIYA Nami	JICA Project Team
		Mr. Kristaq Qirko	Director of Geodesy and Cartography, ASIG
10:20-10:30	JICA's Cooperation on Geospatial Information in the Western Balkans	Mr. HIRASHIMA Jun	JICA Balkan Office
10:30-10:40	Future Plan of National Geospatial Information Agency and Expectation to JICA Technical Assistance	Mr. Klaudio Collaku	Director of National GIS and Geoportal, ASIG (Albania)
10:40-10:50		Mr. Denis Tabučić	Assistant Director, Federal Administration for Geodetic and Real Property Affairs (Bosnia Herzegovina)
10:50-11:00		Mr. Avni Rrustemi Mr. Korab Ahmetaj	Expert for GIS and Cartography, Director of Cadastral Kosovo Cadastral Agency (Kosovo)
11:00-11:10		Mr. Bozidar Pavicevic	Head of Department for IS, Cadastre, and State Property Administration (Montenegro)
11:10-11:20		Mr. Sasho Dimeski	State Advisor for Geodetic Works, Agency for Real Estate Cadastre (North Macedonia)
11:20-11:30	GSI Activities and GSI Vector	Mr. FUJIMURA Hidenori	Director, Planning Division,

Time	Title	Speaker	Affiliation
	Map		Geospatial Information Department, GSI
11:30-11:40	Utilization of Mobile Mapping System in Japan	Mr. TAMAKI Noriyuki	Expert, TOPCON Corporation
11:40-11:50	Q&A		
11:50-11:55	Closing Speech	Mr. Lorenc Cala	Director General of ASIG
11:55-12:00	Closing Speech	Mr. FUKUDA Hajime	Deputy Chief Representative, JICA Balkan Office

Four guest speakers from Kosovo, North Macedonia, Montenegro, and Bosnia and Herzegovina made presentations on their activities in the Conference. The details of the presentation are given in the presentation materials at the end of this report. The following are excerpts from the presentations prepared by the countries on the status of their topographic maps and their expectations to JICA's technical cooperation.

Table 3-40 Presentations from the 4 countries

Country/Agency	Topographic map series	Expectation to JICA's Technical Cooperation
Kosovo Kosovo Cadastral Agency (KCA)	1/25,000 covering the whole country (9% by JICA. 10% by KCA) 1/250,000 (Technology transferred by JICA)	Creation of 1/5,000 topographic maps covering Pristina
North Macedonia Agency for Real Estate Cadastral (AREC)	1/25,000 covering the whole country (55% by JICA, 45% by AREC) 1/50,000, 1/100,000, 1/200,000, 1/500,000, 1/1,000,000 (Technology transferred by JICA) 1/25,000 maps are updating now.	Need of change of production technology and further capacity building (e.g. Technologies for update of topographic maps, Generalization of topographic maps, Remote sensing, Emergency mapping in case of disasters, Hazard mapping) AREC requested "Project on Capacity Development of Satellite Image Interpretation for Proper Land Management" to JICA in 2019
Montenegro Cadastral and State Property	1/25,000 covering the whole country (70% by JICA, 30% by CSPA) Other maps are in raster format. All of them were	Product specifications and pilot project for new state base map. Topographic maps – improvement of

<table>
<tr><th>Country/Agency</th><th>Topographic map series</th><th>Expectation to JICA's Technical Cooperation</th></tr>
<tr><td>Administration (CSPA)</td><td>produced between the 1970s and 80s.
1/5,000 (15% of the country) has not been updated since 1985.
1/10,000 (45% of the country) has not been updated since 1970.</td><td>existing data model and database, specifications of data update procedures.
Production of a thematic maps.</td></tr>
<tr><td>Kosovo
Kosovo Cadastral Agency (KCA)</td><td>1/25,000 covering the whole country
(9% by JICA. 10% by KCA)
1/250,000 (Technology transferred by JICA)</td><td>Creation of 1/5,000 topographic maps covering Pristina</td></tr>
<tr><td>Bosnia and Herzegovina Federal Administration for Geodetic and Real Property Affairs (FGA)</td><td>
<table>
<tr><th>Product</th><th>Coverage (% of area)</th><th>Database available (YES/NO)</th><th>Raster (YES/NO)</th><th>Raster origin (DB visualisation/Scan)</th><th>Producion year</th></tr>
<tr><td>TK5 FGU</td><td>0.26%</td><td>YES</td><td>YES</td><td>DB visualisation</td><td>2019</td></tr>
<tr><td>TK10 FGU</td><td>60.28%</td><td>YES</td><td>YES</td><td>DB visualisation</td><td>2016-2021</td></tr>
<tr><td>TK10 VGI</td><td>3.42%</td><td>NO</td><td>YES</td><td>Scan</td><td>1983-1989</td></tr>
<tr><td>TK25 VGI</td><td>78.74%</td><td>NO</td><td>YES</td><td>Scan</td><td>1974-1978</td></tr>
<tr><td>TK25 JICA</td><td>12.24%</td><td>YES</td><td>YES</td><td>DB visualisation</td><td>2005</td></tr>
<tr><td>TK25 FGU</td><td>4.79%</td><td>NO</td><td>YES</td><td>Scan</td><td>2009-2010</td></tr>
<tr><td>TK100 VGI</td><td>100.00%</td><td>NO</td><td>YES</td><td>Scan</td><td>1971-1985</td></tr>
<tr><td>TK200 VGI</td><td>100.00%</td><td>NO</td><td>YES</td><td>Scan</td><td>1981</td></tr>
<tr><td>TK250 FGU</td><td>100.00%</td><td>YES</td><td>YES</td><td>DB visualisation</td><td>2016-2019</td></tr>
</table>
</td><td>Project of Support for Spatial data infrastructure:
Component A: Development of technological architecture
Component B: Increasing availability of SDI data through e-services
Component C: Capacity Building and Project Management</td></tr>
</table>

3.2.13. Creation of Reports and Reporting

Table 3-41 shows the list of reports which are created throughout the project implementation.

Table 3-41 List of reports of the project

Name	Time created
Inception report	July 2017
Interim report	April 2019
Draft final report	October 2021
Final report	January 2022

3.2.14. Procurement and Provision of Equipment

Prior to the procurement of the equipment, JPT and ASIG collaborated to examine items, quantities, and specifications of the equipment to be procured. As a result, it was confirmed that an A3 multifunction printer was not greatly needed. It was necessary to adjust the number of PCs and software licenses which were required for

creation and maintenance of digital topographic maps, considering the ASIG organization. Consequently, it was decided not to procure an A3 multifunction printer, and the GIS software licenses were reviewed as shown in Table 3-43.

JPT locally procured the equipment listed in Table 3-42 and the provision and installation of equipment was completed and all of the goods were handed over on 19th October 2018 together with the equipment listed in Table 3-43 which was procured by JICA. This equipment was used to implement the technology transfer.

In the procurement of equipment by JPT, general competitive bidding was done in Albania and a local contractor was selected.

A bid invitation was posted on ASIG's website on 1 May 2018, screening was conducted between 29 May and 1 June 2018 on Technical Proposal and financial statements, and experience on similar projects, the bid was opened for the amount, and a contractor was selected on 18 June. As a result, a contract was concluded with C.C.S. Sh.p.k., a domestic contractor in Albania.

Regarding the VAT added to the set of equipment and materials procured by JICA and JPT, the refund was successfully completed for JICA and JPT after completion of the handover to ASIG in mid-November 2018.

Table 3-42 List of equipment procured by JPT (Initially planned quantity in parentheses)

Item	Quantity
Workstation for photogrammetry with 3D monitor, 3D glasses, 3D mouse, 2D monitor, and UPS	3
Workstation for GIS and cartography with 2D monitor and UPS	1
Data storage server	1
Adobe Acrobat	4
Anti-virus software	5
Notebook PC	1
Android tablet	3
Digital level and accessories	1
A3 digital multi-function printer	0 (1)
A0 printer (with scanner function)	1

Table 3-43 List of equipment procured by JICA (Initially planned quantity in parentheses)

Item	Quantity
Software for aerial triangulation, stereo plotting, editing, and orthophoto creation IMAGINE Photogrammetry, IMAGINE AutoDTM, IMAGINE Terrain Editor	1
Software for photogrammetry Stereo Analyst for ArcGIS	3
Software for GIS and cartographic	
ArcGIS Enterprise Standard	1
ArcGIS Desktop Advanced and ArcGIS Pro Advanced	1
ArcGIS Desktop Standard and ArcGIS Pro Standard	3 (2)
ArcGIS 3D Analyst	4 (3)
ArcGIS Spatial Analyst	4 (3)
ArcGIS Network Analyst	1 (3)

Table 3-44 HW and SW of plotting-related equipment

Name		PC1	PC2	PC3	PC4	Server (PC4)
						
Purpose		Aerial triangulation, aerial photography plan, orthophoto creation, plotting, editing, GIS, symbolization	Plotting, editing, GIS	Plotting, editing, GIS	GIS, symbolization	Data storage
H/W		· Desktop PC · Built-in HDD 2TB x 1, 6TB x 1 · 3D LCD monitor · 2D LCD monitor · 3D mouse · 3D glasses · UPS	· Desktop PC · Built-in HDD 2TB x 1, 6TB x 1 · 3D LCD monitor · 2D LCD monitor · 3D mouse · 3D glasses · UPS	· Desktop PC · Built-in HDD 2TB x 1, 6TB x 1 · 3D LCD monitor · 2D LCD monitor · 3D mouse · 3D glasses · UPS	· Desktop PC · Built-in HDD 2TB x 1, 6TB x 1 · 3D LCD monitor · 2D LCD monitor · 3D mouse · 3D glasses · UPS	· Data storage server
S/W	Photogrammetry	· Photogrammetry software 1 (IMAGINE Photogrammetry) · Photogrammetry software 2 (IMAGINE AutoDTM) · Photogrammetry software 3 (IMAGINE Terrain Editor) · Photogrammetry software 4 (Stereo Analyst for ArcGIS)	· Photogrammetry software 4 (Stereo Analyst for ArcGIS)	· Photogrammetry software 4 (Stereo Analyst for ArcGIS)	None	None
	GIS	· ArcGIS Desktop Standard · ArcGIS 3D Analyst · ArcGIS Spatial Analyst · ArcGIS Pro	· ArcGIS Desktop Standard · ArcGIS 3D Analyst · ArcGIS Spatial Analyst · ArcGIS Pro	· ArcGIS Desktop Standard · ArcGIS 3D Analyst · ArcGIS Spatial Analyst · ArcGIS Pro	· ArcGIS Desktop Advanced · ArcGIS 3D Analyst · ArcGIS Spatial Analyst · ArcGIS Network Analyst · ArcGIS Pro	· ArcGIS Enterprise Standard
	Other	· Anti-virus software · Adobe Acrobat	· Anti-virus software · Adobe Acrobat	· Anti-virus software · Adobe Acrobat	· Anti-virus software · Adobe Acrobat	· Anti-virus software

4. Technology Transfer

The following technology transfer was implemented according to the technology transfer plan. The contents were modified where appropriate based on the results of questionnaires and/or interviews on the participants' experiences and technical level.

4.1. GCPs Survey, Installation of Photo Signals, Utilization of CORS, and Leveling

(1) Contents, schedule, and participants

Table 4-1 and Table 4-2 show the contents and participants of this technology transfer.

Table 4-1 Schedule and contents of GCP survey, etc. technology transfer

NO.	Period	Contents
1	September 2017	Interview and discussion with participants
2	March to April 2018	GCP survey field confirmation Survey on the current situation of CORS (ALBPOS)
3	April 2019	Digital leveling

Table 4-2 Participants of GCP survey, etc. technology transfer

NO.	Name	Position	Department
1	Arben Xhialli	Head of sector	Reference Geodetic Frame Sector
2	Arian Lasku	Specialist	Ditto
3	Eduart Blloshmi	Specialist	Ditto
4	Albin Koci	Specialist	Infrastructure and CORS System Sector
5	Rudens Konomi	Specialist	Ditto
6	Oltjon Balliu	Specialist	Reference Geodetic Frame Sector

(2) Results of preliminary confirmation and challenges

As the results of questionnaire and interviews, it was confirmed that although all participants had sufficient experience and knowledge of GCP survey or GNSS survey, they did not have sufficient experience of leveling survey. It was also found that ASIG did not have a manual for GCP survey and leveling survey.

(3) Activities carried out

[1] GCP survey, installation of photo signals, and utilization of CORS

JPT together with the participants observed the GCP survey work conducted by Hansa and reconfirmed some skills required to conduct GCP survey and GNSS survey. CORS data was used for the GCP survey.

Photo 4-1 (Left) Interview with the participants, (Right) GCP Survey

[2] Leveling survey

Lectures were provided on basic theory of leveling, error elimination method, instrument verification method, etc. In particular, the error elimination method was focused on.

After the lectures, the observation training focusing on the inspection and adjustment method of the digital level, and the adjustment method of the level staff was conducted while carrying out the work on actual level routes. At the same time, technology transfer regarding the method of height connection from benchmark to the fixed points of the tidal stations by first-order leveling was carried out.

Photo 4-2 (Left) Inspection and adjustment methods of level, (Right) First order leveling Observation

（4） Evaluation of technology transfer

[1] GCP survey, installation of photo signals, and utilization of CORS

The participants reached the level where they can successfully plan, implement, and calculate GCP surveys.

They can also perform calculation using CORS data without any problems. It is expected that the participants will further enhance the contents of the manual to make it useful for the work.

[2] Leveling survey

The participants can carry out observations without problems on routes with relatively few undulations. For routes with many undulations, it may take some time to set up a digital level; however their skills will be improved as they gain experience in the future. They are capable of creating the observation result table by using the calculation arrangement method.

4.2. Aerial Photography Plan, Aerial Triangulation, and Orthophoto Creation

（1） Contents, schedule, and participants

The initially planned technology transfer of aerial photography planning, aerial triangulation, and orthophoto creation were provided from April 2019 when topographic map data creation by ASIG started. On the other hand, additional training on the method of inspecting photography results using the DAT / EM Systems' stereo plotting instrument (Summit Evolution) was carried out in response to a request from ASIG in April and May 2018.

Table 4-3, and Table 4-4 show the contents, schedule, and the participants of the technology transfer. The participants had little experience in performing aerial photography planning, aerial triangulation, and orthophoto creation by themselves; however they had knowledge and experience of managing the work because ASIG had outsourced such a project in 2015.

Table 4-3 Schedule of aerial photography plan, etc. technology transfer

Period	Contents
April - May 2018	- Inspection method of photography results using Summit Evolution - Method for evaluating the aerial triangulation results from the results report
	- Summit Evolution operating method
	- Simple stereo plotting method using Summit Evolution
July-September 2018	- Aerial photography plan - Aerial Triangulation and import/export of the result of aerial triangulation to create stereo project with IMAGINE software
July - August 2019	- DEM creation and DEM editing with IMAGINE software - Ortho rectification and ortho mosaic with IMAGINE software

Table 4-4 Participants of aerial photography plan, etc. technology transfer

No.	Name	Position	Department
1	Dritan Prifti	Head of sector	Directory of Geodesy and Cartography / Remote Sensing Sector
2	Martin Rusi	Specialist	Ditto
3	Boronica Margjeka	Specialist	Ditto
4	Ledia Aliu	Specialist	Ditto
5	Brikena Sinjari	Specialist	Ditto

(2) Activities carried out

[1] Aerial photography plan and inspection of photography results

The participants learned the theory and method of aerial photography planning. Then, training covering the following items was conducted on the inspection method of photography results using the existing data and Summit Evolution which ASIG had.

- Method of incorporating a ground reference point into Summit Evolution
- Method of measuring a ground reference point position using Summit Evolution
- Inspection of the residual between the measured observation point and the ground reference point
- Inspection of error between photography courses

Among the existing data, the parameter file of the photographing camera, the aerial photographs, and the aerial triangulation result were used for the training. For the ground reference point, a coordinate output table and a point detail table were used. Training was conducted in a lecture format, and then practical training was carried out using the existing data. Two Summit Evolution was used in the practical training, and the exercises were repeated until the participants learned how to operate it. Finally, the position coordinates of the ground reference point measured by the participants were compared with the coordinates of the original ground reference point, and whether they were correctly measured was evaluated.

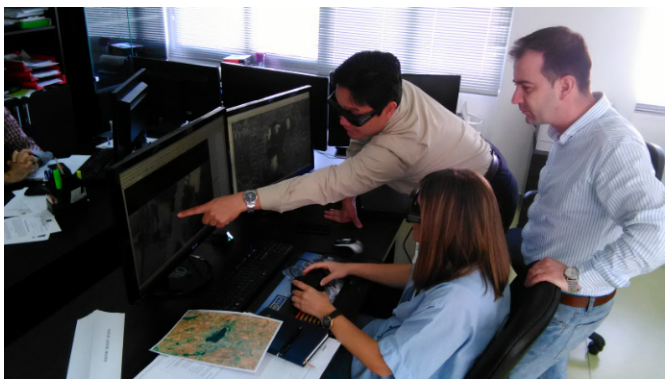


Photo 4-3 Scene from practical training

[2] Aerial triangulation

The participants learned the theory and method of aerial triangulation and evaluation of aerial triangulation results. Regarding the aerial triangulation results, it is usually necessary to examine the contents of the calculation report of aerial triangulation results. Therefore, JPT provided training and explained the following items using the actual calculation report which ASIG had.

- Is there any shortage in the quantity of tie points?
- Is there any shortage in the quantity of reference points?
- Is the standard deviation of the reference point within the limit value?
- Are the photo coordinates of the observed reference point and tie point within the limit value?
- Are the position and rotation of the exterior orientation element within the limit value?

Training was conducted in a lecture format as well as practical inspection. Through the practical training, the participants were able to understand which part of the calculation report should be examined.

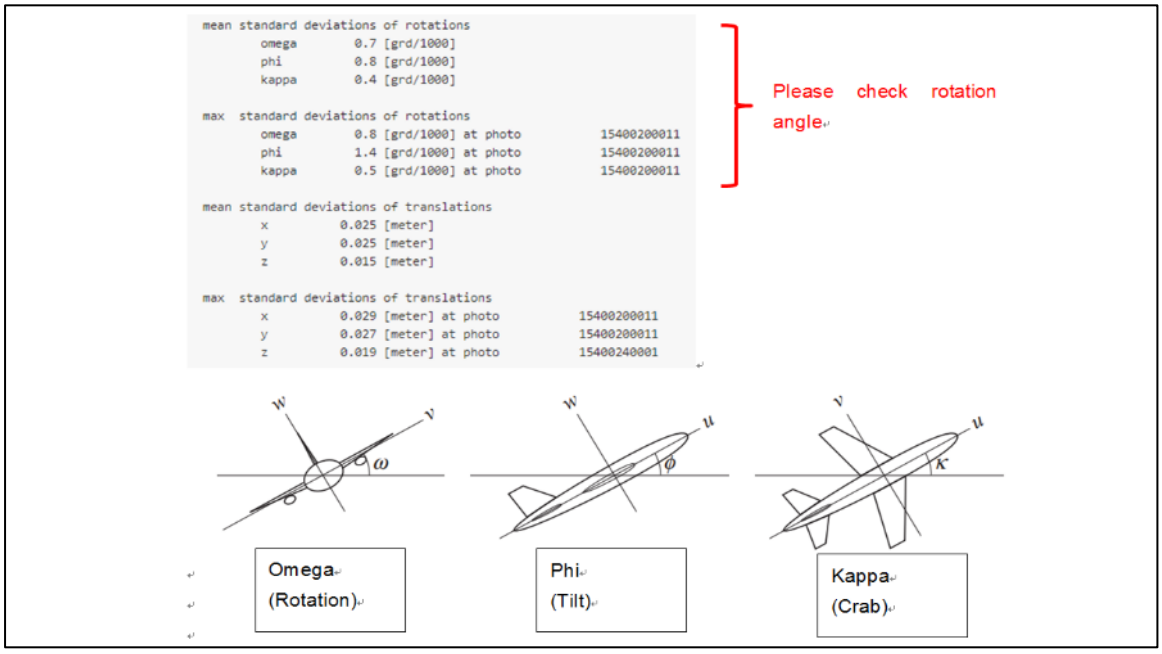


Figure 4-1 Example of inspection target in the report

[3] DEM creation and orthophoto creation

The participants learned the theory of DEM creation and orthophoto creation, in terms of the process, required parameters, quality and relation of quality of DEM, and that of orthophoto. Then, training covering the following items was conducted.

- Contour line creation from edited DTM
- Ortho rectification, seam line creation and editing, and mosaicking tool using ERDAS software
- Adjustment of created image (Sampling, Image enhancement, color balancing)

- Check and evaluation of output

The participants practiced and learned DEM creation and orthophoto creation using the aerial photos taken and the software procured in the Project.

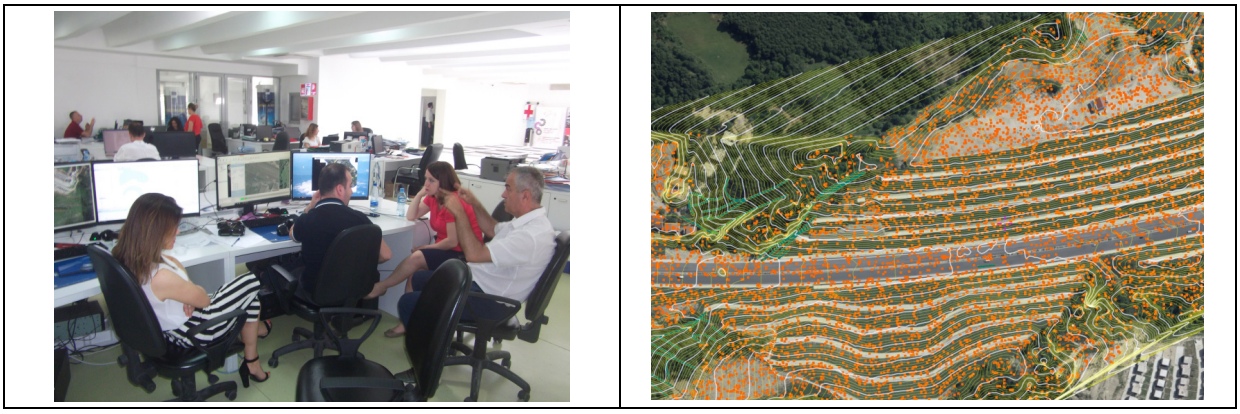


Figure 4-2 Training of DEM editing

(3) Evaluation of technology transfer

Through the technology transfer, most of knowledge and skills of the participants reached the level of "Able to teach other technicians". The quality of output of the training such as Orthophoto and contour lines created by the participants was very good. The edited DEM and the positional accuracy of the orothophotos generated from the DEM met the required specifications.

The skill of "DEM editing" is very useful skill to create contour lines on the topographic map compared to the skill of "Stereo data capturing"; however, the participants need further continuous training to achieve a level of trainer.

Table 4-5 Evaluation of photogrammetric works OJT

Item	Details	Evaluation	Criteria
Aerial Photography plan	Aerial photography planning	3	5: Able to teach other technicians 4: Able to implement / operate independently 3: Able to understand the contents and practice them independently 2: Able to implement them if supported 1: Necessity of JPT's instructions
Aerial Triangulation	1) Capability of Project file setting 2) Capability of point measurement 3) Capability of Evaluation of AT result and correction of process 4) Capability of Import / Export between different software	5	
DEM	1) Capability of DEM creation on required area and specifications	5	
	2) Capability of DEM editing 3) Capability of Contour creation from DEM 4) Capability of Evaluation of DEM result and correction of process to create Orthophoto	4	

Item	Details	Evaluation	Criteria
Orthophoto	1) Capability of Ortho creation on required area and specifications 2) Capability of Seam line creation and editing 3) Capability of Mosaicking 4) Capability of Evaluation of Orthophoto	5	

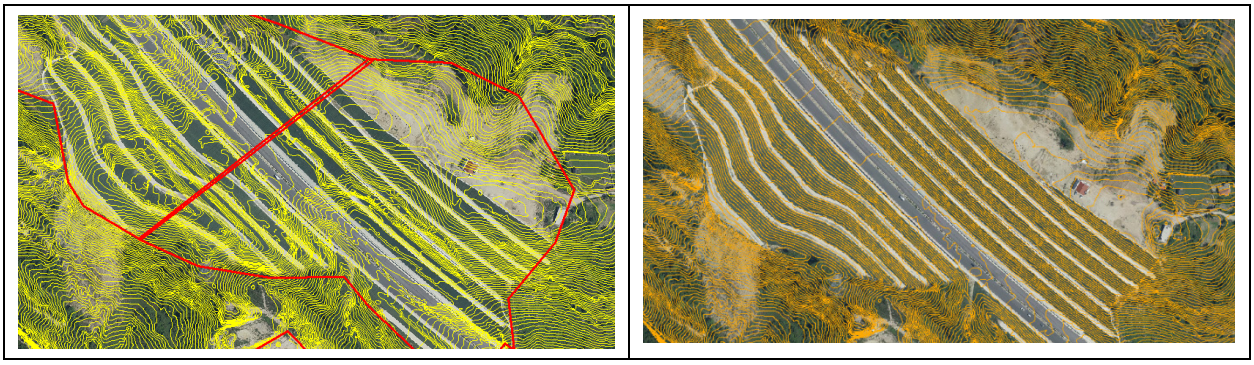


Figure 4-3 Output of the training (left: DEM before editing, right: Contour lines from modified DEM)

4.3. Field Verification

Technology transfer of field verification was conducted in the forms of lecture and on-site OJT. Regarding the topographical and features to be expressed on the digital topographic map which was determined in DPS version 0.1, ASIG staff in charge checked and collected information on site in the area of 20 km^2 where ASIG was responsible for developing the topographic map data, out of 300 km^2 which constituted the entire target area of the Project.

（1） Contents, schedule, and participants

Table 4-6 is the syllabus and Table 4-7 lists the participants of the technology transfer of the field verification.

Table 4-6 Syllabus of field verification technology transfer

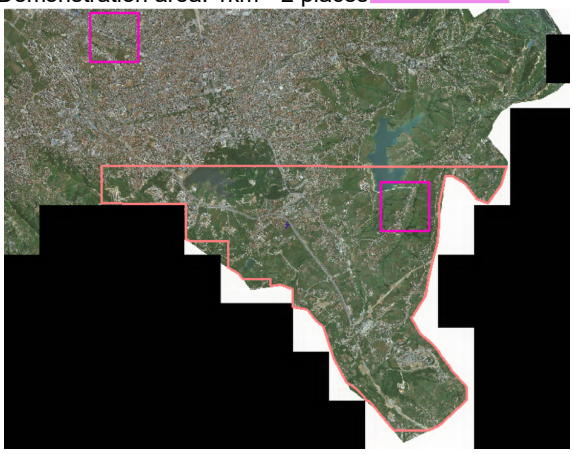
Title	Field Verification	
Overview	The technology transfer on field verification shall be conducted through actual work on an OJT basis in the area of 20km^2. This transfer shall be conducted in reference to a data product specification made in this project. “Manual for Field Verification and Field Completion” will be prepared by the instructor and provided to the participants. The notebook PC and three sets of Android tablets will be used. Therefore, three parties (1 to 2 participants in each party) shall be assembled.	
Area	OJT area: Approx. 20km^2 Demonstration area: 1km^2×2 places 	
Goals	The technology transfer is aimed at improving the ASIG staff's capabilities to create and maintain nationwide digital topographic maps on their own towards completion of such maps.	
Contents & Schedule	17 September 2018, 10:00-12:00	Method of Investigation for the Digital Field Verification(DFV) Quality Control & Schedule Management
	28 August 2018, 10:00-16:00	QGIS, Tablet & Qfield (1)
	17 September 2018, 10:00-12:00	QGIS, Tablet & Qfield (2)
	28 August 2018, 10:00-16:00	Explanation of the Data Product Specification for DFV
	29 August 2018, 10:00-15:00	Demonstration in a urban area
	30 August 2018, 10:00-15:00	Demonstration in a rural area
Others	The JICA project team provides English and Albanian version manuals. We would like the ASIG side to correct and append it so that it will be effectively used in the future.	

Table 4-7 Participants in field verification technology transfer

No.	Name	Position	Department
1	Saimir Burba	Head of Sector	Cartography Sector
2	Bledar Sina	Specialist	Ditto

No.	Name	Position	Department
3	Brikena Sinjari	Specialist	Ditto
4	Esma Hoxha	Specialist	Ditto
5	Safete Mihali	Specialist	Ditto

(2) Results of preliminary confirmation and challenges

The participants had little knowledge and experience on field work (field verification as well as field completion) for collecting information required for creation of 1/2,000 topographic map. Prior to the implementation of technology transfer, opinions and technical level of the participants were confirmed by a questionnaire survey so that technology transfer would be carried out efficiently. JPT received the following requests from the participants and adjusted the contents of the technology transfer accordingly.

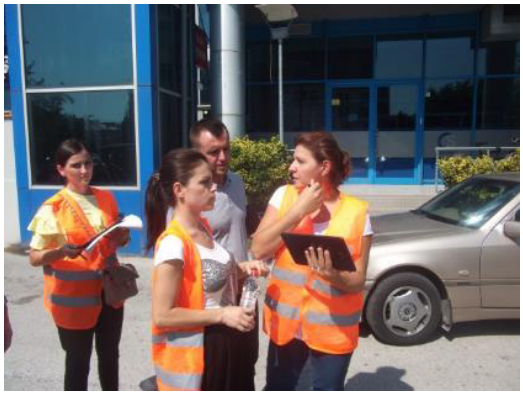
- Consideration should be given to the different levels and range of experience and knowledge of participants.
- Methods of work management (supervision), accuracy control, and data update should be included.

(3) Activities carried out

The technology transfer including demonstration and orientation was carried out according to the syllabus. Apart from the demonstrations and orientation, classroom learning was carried out based on prepared manuals.

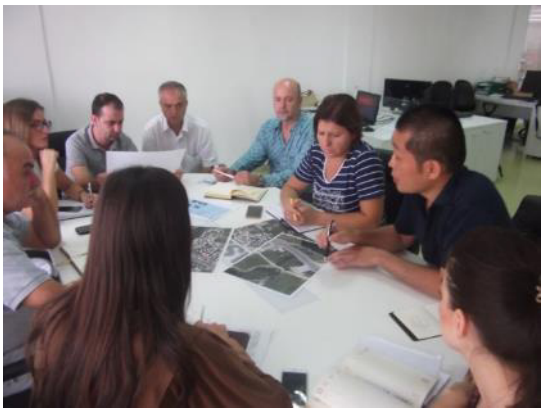
Also, as a supplementary explanation prior to the OJT implementation, technical guidance was given on how to proceed with work concretely.

The main participants of the field verification were five engineers of the cartography sector; however, the engineers of the remote sensing sector who were the participants of the technology transfer of stereo plotting also participated in the field verification OJT. Both aimed at deepening the understanding of each other's work and improving work efficiency by getting to know the relevance of field verification and plotting work. Table 4-8 shows the contents of the OJT.

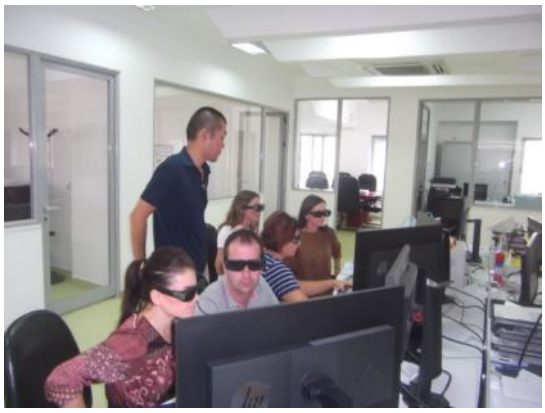


Field verification work

Classroom learning



Technology instruction to 2 sectors combined



Prediction by the stereo plotter machine

Photo 4-4 Field verification technology transfer

Table 4-8 Contents of field verification OJT

Item	Contents
Preliminary work	1) Matters to be confirmed in the preliminary work 2) Difference and understanding of prediction by 2D / 3D - 2D prediction on output paper and screen with GIS software - 3D prediction using a stereo plotting machine
Work preparation	1) Preparation of survey data - Prediction result layer (point) - Field acquisition layer (point, line, polygon) - Orthophoto image data - Working area (map index) layer 2) QGIS setting (preparation by GIS software on PC) - Attribute field setting for field acquisition layer - Setting of survey data (color, symbol) - Data migration to the work tablets 3) QField setting (preparation by GIS software on tablet PCs) - Display of survey data and confirmation of editing 4) Vehicle arrangement and preparation of safety vests
Field work (Digital localization)	1) Survey of places for preliminary work 2) Survey of specification target features 3) Measurement of roads and sidewalk edges and drawing sketches
Work in the office	1) Backup of day-to-day survey data 2) Maintenance of survey result data and addition of codes
Confirm existing materials	1) Confirmation of existing materials (provided by ASIG)

Item	Contents
	2) Confirmation of contents and attribute information of thematic map data - Apply attribute information to project specification classification

（4） Evaluation of technology transfer

As a result of observation of the participants' attitude towards fieldwork and the result of field verification, it can be evaluated that ASIG staff reached a level at which they can independently perform a series of work from preliminary work, preparation, fieldwork, through office work.

Future challenges are to improve the skills of schedule adjustment with persons in charge of subsequent work requiring the results of field verification, and the skills of personnel assignment and work plan which make it possible to perform the work while proceeding with other routine work in parallel.

Table 4-9 Evaluation of field verification OJT

Item	Details	Evaluation	Criteria
Preliminary work	1) Understanding matters to be confirmed in the preliminary work	5	5: Able to teach other technicians 4: Able to implement / operate independently 3: Able to understand the contents and practice them independently 2: Able to implement them if supported 1: Necessity of JPT's instructions
Work preparation	1) Preparation of survey data 2) QGIS setting (preparation by GIS software on PC) 3) QField setting (preparation by GIS software on a portable tablet) 4) Vehicle arrangement and preparation of safety vests	5	
Field work by using tablet PCs	1) Survey of places for preliminary work 2) Survey of specification target features 3) Measurement of roads and sidewalk edges and drawing sketches	4	
Work in the office	1) Backup of day-to-day survey data 2) Maintenance of survey result data and addition of codes	4	
Confirm existing materials	1) Confirmation of existing materials (provided by ASIG) 2) Confirmation of contents and attribute information of thematic map data	5	

4.4. Stereo Plotting and Compilation

The technology transfer of stereo plotting and compilation was conducted in the OJT area of 20 km^2.

（1） Contents, schedule, and participants

Table 4-10 and Table 4-11 show the contents, schedule, and participants of the technology transfer.

Table 4-10 Schedule and contents of technology transfer

No.	Period	Contents	
1	August-September 2018	Week 1 (30 Jul -5 Aug)	Preparation for technology transfer and discussion and confirmation of the contents of technology transfer
		Week 2 (6-12 Aug)	Preparation for technology transfer and discussion and confirmation of the contents of technology transfer
		Week 3 (13-19 Aug)	Discussion and confirmation of specifications of field verification work and stereo plotting work
		Week 4 (20-26 Aug)	Establishment of technology transfer equipment
		Week 5 (27 Aug-2 Sept)	Establishment of technology transfer equipment and improvement of the environment of ASIG existing stereo equipment
		Week 6 (3-9 Sept)	GDB (geodatabase) prototype creation
		Week 7 (10-16 Sept)	Discussion and confirmation of GDB prototype, storing in server, simultaneous editing work test, sharing of the stereo plotting specifications
		Week 8 (17-23 Sept)	Stereo plotting technology transfer
		Week 9 (24-30 Sept)	Stereo plotting technology transfer Field verification technology transfer to the stereo plotting team
		Week 10 (1-3 Oct)	Stereo plotting technology transfer (buildings)
2	November-December 2018	Week 1 (13-18 Nov)	Stereo plotting technology transfer (Transportation facilities, water space, public facilities)
		Week 2 (19-25 Nov)	Stereo plotting trial for capability check
		Week 3 (26 Nov -2 Dec)	Evaluation of result of stereo plotting trial Quality evaluation
		Week 4 (3-10 Dec)	Technology transfer relating to incorporating field verification result Stereo plotting technology transfer (Other Feature)
3	June-July 2019	Week 1 (29 May-2 June)	Technology transfer relating to incorporating result of “Field Completion”
		Week 2 (3 -9 June)	Stereo plotting technology transfer (Elevation)
		Week 3 (10 -16 June)	
		Week 4 (17 -23 June)	
		Week 5 (24 -30 June)	Data Tying between work areas
		Week 6 (1 July-7 July)	Post processing Training

No.	Period	Contents	
			Quality Control and Topology Tool
		Week 6 (8 July-14 July)	Manual Creation Evaluation

Table 4-11 Participants of stereo plotting and compilation technology transfer

No.	Name	Position	Department
1	Dritan Prifti	Head of sector	Directory of Geodesy and Cartography / Remote Sensing Sector
2	Martin Rusi	Specialist	Ditto
3	Boronica Margjeka	Ditto	Ditto
4	Ledia Aliu	Ditto	Ditto
5	Brikena Sinjari	Ditto	Ditto

(2) Results of preliminary confirmation and challenges

The following is the result of the experiences and abilities of the participants regarding stereo plotting which were confirmed prior to the start of the technology transfer. For this reason, JPT decided to provide the training starting with the common understanding of EU INSPIRE in this technology transfer where the photogrammetry software and ArcGIS were initially set up so that participants could share the knowledge of large-scale maps and the knowledge and skills of ArcGIS among themselves.

Table 4-12 Capability and experience originally held by those participating in the transfer of plotting technology

No.	Name	Large-scale topographic maps	EU INSPIRE	Digital stereo plotting	Photogrammetry software	ArcGIS
1	Dritan Prifti	Have knowledge	No	Have knowledge and skills	Have knowledge	No
2	Martin Rusi	No	No	No	No	Yes
3	Boronica Margjeka	No	No	No	No	Yes
4	Ledia Aliu	No	No	No	No	Yes
5	Brikena Sinjari	No	No	No	No	Yes

(3) Activities carried out

The OJT area was further divided into 3 blocks, and 3 participants were assigned for each of the blocks.

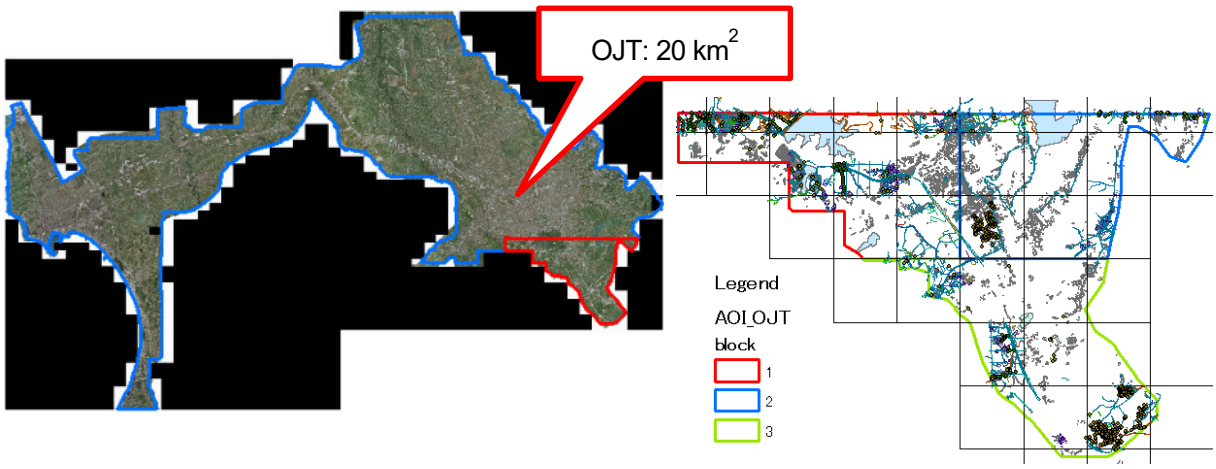


Figure 4-4 OJT Area (20 km^2)

(4) Evaluation of technology transfer

Through the technology transfer, most of knowledge and skills reached the level of achieving "Stable performance to carry out self-Creation and Self Update" and "Able to teach other technicians" with appropriate quality. As proof, the participants expanded a topographic map into the damaged area of the earthquake that occurred in November 2019 by themselves.

About the performance aspect, the speed of all participants' work was increased and arrived at appropriate level as future expansion of or Update of topographic map by themselves.

About the quality aspect, participants understood both of "Thematic" and "Logical" check and how to correct the errors with analogue methods and digital methods (e.g. GIS tools). Through the OJT, the number of errors was decreased to an acceptable level.

Table 4-13 Evaluation of Stereo Plotting and Digital Editing works OJT

Item	Details	Evaluation	Criteria
Setting	1) Setting of Stereo model 2) Comprehension of Photo Index 3) Comprehension of Specification (Feature, Code, Acquisition Rule, Tolerance, etc.)	5	5: Able to teach other technicians 4: Able to implement / operate independently 3: Able to understand the contents and practice them independently 2: Able to implement them if supported 1: Necessity of JPT's instructions
Importing Field Verification results	1) Comprehension of the result of "Field Verification" 2) Importing the result of "Field Verification" and categorizing into suitable code	5	
Photo Interpretation and Data capturing	1) Comprehension of Stereo Interpretation of Aerial photographs 2) Skill of 3D drawing point and line with GIS and Comprehension of required position for point and line. 3) Comprehension of method of sharing to "Field Completion" work	5	

Item	Details	Evaluation	Criteria
	4) Comprehension of post processing tools (Point/Polygon/3D Building/Center line/Basin Creation)		
	5) Skill of Contour line creation (Stereo plotting and DEM editing)	4	
Importing Field Completion results	1) Comprehension of the result of "Field Completion" 2) Importing the result of "Field Completion" and categorizing into suitable code 3) Modification of data based on "Field Completion"	5	
Digital Editing Quality Control	1) Comprehension of type of errors and check methods 2) Skill of Topology Check and Edit with GIS 3) Comprehension of reporting	5	

Figure 4-5 Result of the Training

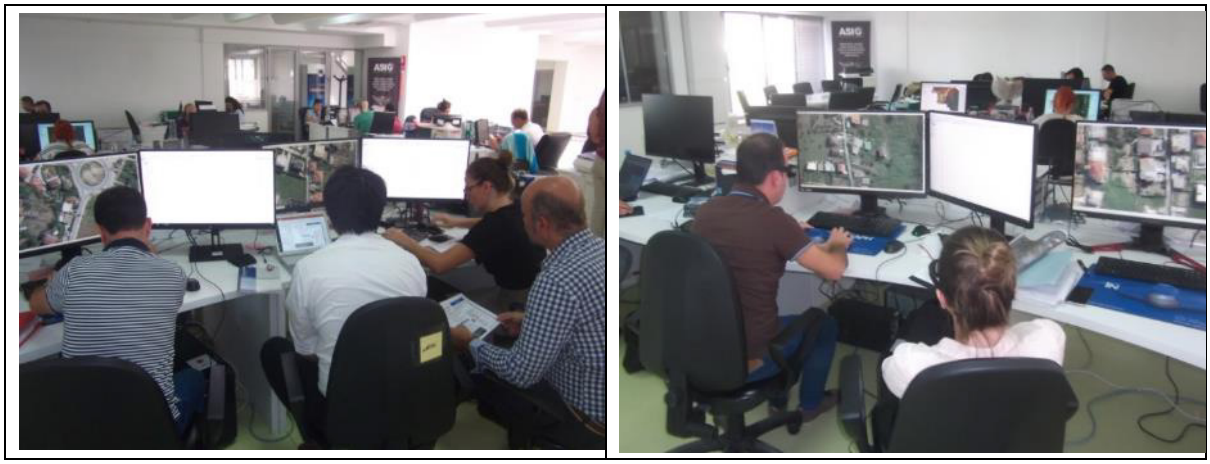


Photo 4-5 Technology transfer of stereo plotting

Improvement of the participants' performance is as shown below. For planimetric features, the speed at the end of this training shows the same level as Japanese operators. Contour lines were created by modifying aged

area based on Existing Lidar data (2015) with Photogrammetric DEM editing tool. For the future, appropriate methods would be selected from "Stereo plotting with new aerial photos", "Stereo matching and DEM editing with new aerial photos", "New Lidar data", and combinations thereof depending on the budget and period of the project.

Table 4-14 Evaluation of Stereo Plotting and Digital Editing Performance

Feature	Work speed (Number of captured features / Person-Day)			
	Sep-Nov 2018	Nov 2018	Dec 2018	July 2019
Building (Number of Buildings)	70	150	233	600
Transportation (Length: km)	1	10	17	27
Hydrography (Length: km)	1	8	8	11
Fence (Number of Fences)		100	90	770
Other points (Pole, Manhole, Spot Elev.)		500	100	1665
Total of Planimetric Features (Area: km^2 / Person-Day)			0.083	0.125

The quality of the data in OJT area (20 km^2) was checked twice during the Project. In the first check, a lot of dangle errors were detected because snapping was not well considered in the data capturing process, which was improved in the second check. This issue will be solved as the importance of data topology is properly understood by the participants.

Table 4-15 Evaluation of Stereo Plotting and Digital Editing Quality

Feature		Number of detected errors	
		June -July 2019	Sep 2019
Completeness	Excess	160	21
	Missing	240	204
Logical consistency	Polygon (LC)	10	0
	Building & Building Spot Elevation	300	0
	Dangle	1600	441
Thematic correctness		30	0
Positional Accuracy	TN, HY, BU	< 0.4m	

4.5. Field Completion

Technology transfer of field completion was conducted in the forms of lecture and on-site OJT. Regarding the topographical and features to be expressed on the digital topographic map which was determined in DPS version 0.1, ASIG staff in charge checked and collected information on site in the area of 20 km^2 where ASIG was

responsible for developing the topographic map data, out of 300 km^2 which constituted the entire target area of the Project.

(1) Contents, schedule, and participants

This technology transfer was conducted during May 2019 to July 2019. Table 4-16 lists the participants.

Table 4-16 Participants of field completion technology transfer

No.	Name	Position	Department
1	Dritan Prifti	Head of sector	Remote Sensing and Imagery sector
2	Boronica Margjeka	Specialist	Remote Sensing and Imagery sector
3	Ledia Aliu	Specialist	Remote Sensing and Imagery sector
4	Martin Rusi	Specialist	Remote Sensing and Imagery sector
5	Saimir Burba	Head of sector	Cartography sector
6	Bledar Sina	Specialist	Cartography sector
7	Brikena Sinjari	Specialist	Cartography sector
8	Esma Hoxha	Specialist	Cartography sector
9	Safete Mihali	Specialist	Cartography sector

(2) Activities carried out

Table 4-17 shows the contents of the technology transfer which covered all necessary items to be performed for field completion work.

Table 4-17 Contents of field completion technology transfer

Item	Description
Overview explanation (Lecture)	- Differences between field verification and field completion - Understanding ”unclear things” which plotting operators face during digital editing work

Preparation (OJT)	- Preparation of data for the field work
	  - Work layer (points/ lines/ polygons of the instructions)
	  - Orthophotos
	  - Work area (map index)
	- QGIS setting on PC
	  - Attribute fields of the work layer
	  - Symbol setting of the work layer
	  - Copy the data to tablet PCs
	- QField setting on tablet PCs
	  - The data display and confirmation

Item	Description
	- Arrangement of logistics, preparation of safety vests, etc.
Work in the field (OJT)	- Confirmation of ”unclear things” instructed by plotting operators and record - Survey of additional information
Work at office (OJT)	- Data backup of the results of daily work

In the lecture, the explanation focusing on "answering to the questions and responding to the instructions accurately," which was different from the field verification, was provided while mentioning some examples shown in Table 4-18.

Table 4-18 Examples of instructions and responses

Instruction/ question given by plotting operators	Incorrect response/ answer	Correct response/ answer
Confirm the classification	"Yes.", "OK.", or "Exists in the field"	Confirm in the field and answer "the code XX-XX is correct"
Confirm the geometry	"it was classified as XX"	Confirm in the field and draw and record the shape indicating the geometry

As described above, those who are in charge of the field completion are required to understand what the plotting operators need and respond correctly. Therefore, JPT invited the plotting operators to the lecture. All of the participants discussed and had a common understanding about the meanings of the instructions and how to answer.

In addition, JPT noted the important points needed to be borne in mind during the field completion by explaining the results of the analysis of the outputs of the field verification conducted by Lorenco & Co. The results of the analysis will be useful when ASIG outsources the work to a company in the future.

Classroom learning

Classroom learning

Photo 4-6 Lecture of field completion

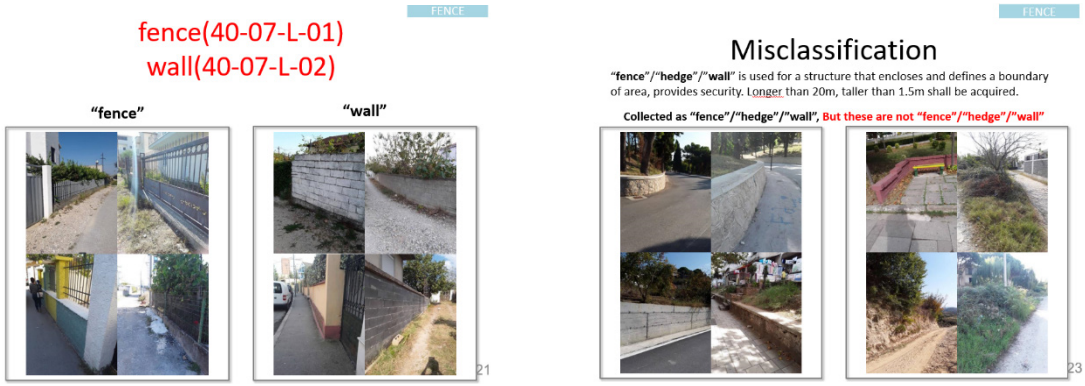


Figure 4-6 Examples of points to note (misclassification)

The participants visited the field and carried out work to answer the questions and respond to the instructions given by the plotting operators. OJT focused on how to handle the data added by the field completion work.

Photo 4-7 Field Completion work by the participants

（3） Evaluation of technology transfer

JPT confirmed that the participants performed all of the work from preparation to work in the office described above without any problems. In addition to this, the participants were able to respond to the given questions/ instructions while cooperating with the plotting operators, which is the most important point of the field completion work. From this, it was evaluated that the participants reached a level where they can properly carry out the work by themselves.

Table 4-19 Evaluation of field completion OJT

Item	Details	Evaluation	Criteria
Work preparation	1) Preparation of survey data 2) QGIS setting (preparation by GIS software on PC) 3) QField setting (preparation by GIS software on a portable tablet) 4) Vehicle arrangement and preparation of safety vests	5	5: Able to teach other technicians 4: Able to implement / operate independently 3: Able to understand the contents and practice them

Item	Details	Evaluation	Criteria
Field work by using tablet PCs	1) Survey of places for instructions by operator 2) Survey of specification target features 3) Confirm and record appropriate information (answer) for instructions	5	independently 2: Able to implement them if supported 1: Necessity of JPT's instructions
Work in the office	1) Backup of day-to-day survey data 2) Maintenance of survey result data	5	

4.6. Digital Compilation

During the OJT of Stereo plotting (data acquisition), the participants marked unclear/invisible items and anything where they had questions. These items were transferred to the participants of the filed completion technology transfer and confirmed in the field. The results of the field completion work were returned to the stereo plotting work where the participants continued data acquisition while referring to the results.

The technology transfer of digital completion was completed in the forms of lecture and on-site OJT, and is described in "4.4. Stereo Plotting and Compilation".

(1) Contents, schedule, and participants

This technology transfer was conducted during June 2019 to July 2019. Refer to Table 4-10 for details.

(2) Activities carried out

Table 4-10 (above) shows the contents of the technology transfer which covered all necessary items to be performed for Digital completion work.

Training was carried out for detection of area where participants have difficulty in photo interpretation, and the areas of needs annotation in the digital plotting process, and type and description of question to operators of "Field completion".

Then after "Field completion", training for importing and reflecting the result of "Field completion" was carried out.

Figure 4-7 Sample of Digital completion work (Left: Questioning, Right: Result)

(3) Evaluation of technology transfer

Contents and locations of questions given by the participants were appropriate for the work of the Field Completion.

Operators of the Digital Plotting took part in the Field Completion and were able to feedback questions to consider from by checking field directly.

The training of importing and reflecting of Field Completion was a good opportunity of revising the same work in the preceding process of Field Verification, and participants carried out this training without any problems. This shows that the participants can properly carry out the work by themselves (See Table 4-13).

4.7. Cartography and Generalization

JPT carried out the training of cartography in Albania through OJT, and JPT carried out the training of generalization from October to December 2020 online, as well as in August 2021 on site. The main topics of the sessions provided in August 2021 were discussion on generalization (verifying the request from ASIG) and exercise of generalization work.

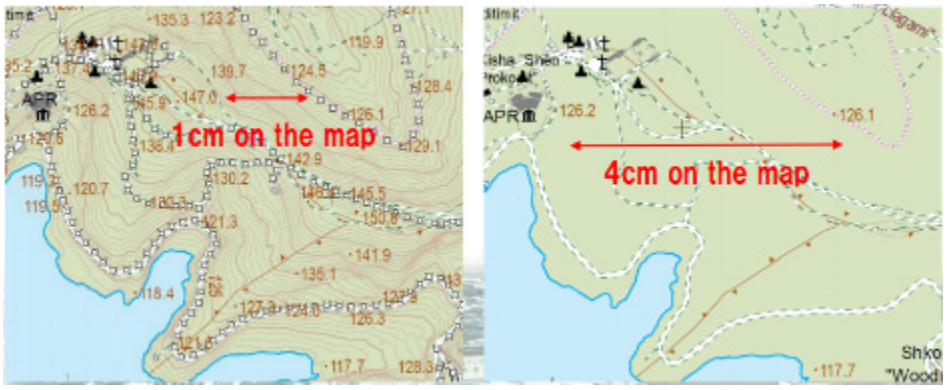


Figure 4-8 Sample of thinning (Left: Before, Right: After)

(1) Contents, schedule, and participants

Table 4-20 and Table 4-21 show the contents, schedule, and participants of the technology transfer.

Table 4-20 Schedule and contents of cartographic and generalization technology transfer

No.	Period	Contents	
1	May June 2019	Week 1 (13-17 May)	Preparation for technology transfer and discussion and confirmation of the contents of technology transfer
		Week 2 (20-24 May)	
		Week 3 (27-31 May)	Updating the Symbol Catalogue
		Week 4 (3-7 June)	
		Week 5 (10-14 June)	Discussion about specification for Generalization Updating the Symbol Catalogue

No.	Period	Contents	
			Symbol Creation Training
		Week 6 (17 -21 June)	Updating the Symbol Catalogue Discussion on finalizing symbol update document Symbol Creation Training Training manual creation
2	January - March 2020	Week 1 (27-31 Jan)	Preparation Lecture of Point symbol creation
		Week 2 (3-7 Feb)	Exercise of Point symbol creation Lecture of Line symbol creation
		Week 3 (10-14 Feb)	Exercise of Line symbol creation Lecture of Polygon symbol creation
		Week 4 (17-21 Feb)	Exercise of Polygon symbol creation Result check & feedback
		Week 5 (24-28 Feb)	Exercise
		Week 6 (2-6 March)	Training: cartographic adjustment lecture Evaluation / Manual update / reporting
3	November December 2020 (Remote)	Day 1 (9 Nov)	Introduction Discussion about schedule & contents of training Pre-requisite setting (mxd, index, marginal Information)
		Day 2 (17 Nov)	Scale base compilation rules Basic techniques of “Web base Compilation”
		Day 3 (24 Nov)	Exercise of 1/2000 to 1/5000 compilation
		Day 4 (2 Dec)	Technology transfer relating to incorporating field verification result Stereo plotting technology transfer
		Day 5 (9 Dec)	Evaluation & Discussion Feedback for next training
4	August 2021	Week 1 (2 -27 Aug)	Revision of previous Training Discussion about the Specification and the Criteria Discussion about required "Generalization" Methods and Outputs
		Week 2 (30-3 Sep)	Training of "Generalization" (1/5,000, 1/10,000) Revision of training and supplementary training
		Week 3 (7-10 Sep)	Discussion about manual (Required contents) Manual (Draft) preparation Evaluation

Table 4-21 Participants of cartographic generalization technology transfer

No.	Name	Position	Department
1	Saimir Burba	Head of sector	Directory of Geodesy and Cartography / Cartography Sector
2	Safete Mihale	Specialist	Cartography Sector
3	Brikena Sinjari	Ditto	Cartography Sector
4	Brunilda Tafa	Ditto	Cartography Sector
5	Arli Llabani	Ditto	Cartography Sector

（2） Results of preliminary confirmation and challenges

The following is the result of the experiences and abilities of the technology transfer participants regarding cartography, which were confirmed prior to the start of the technology transfer. For this reason, JPT decided to have the training starting with discussion of specification concerns about Map symbols and designing of symbols.

Table 4-22 Capability and experience originally held by those participating in the transfer of plotting technology

No.	Name	Cartographic Design	ArcGIS	Point Symbol	Line Symbol	Polygon Symbol
1	A	Fair	Fair	Fair	Fair	Fair
2	B	Fair	Good	Fair	Fair	Fair
3	C	Fair	Good	Fair	Fair	Fair
4	D	Poor	Poor	Poor	Poor	Poor
5	E	Fair	Fair	Fair	Fair	Fair

（3） Activities carried out

（a） Symbol creation

The OJT for symbol creation of “Point”, “Line”, and “Polygon” was carried out with the ArcGIS “style manger” tool. Participants acquired knowledge of designing symbols based on DPS and converting ArcGIS style files to ArcPro style format.

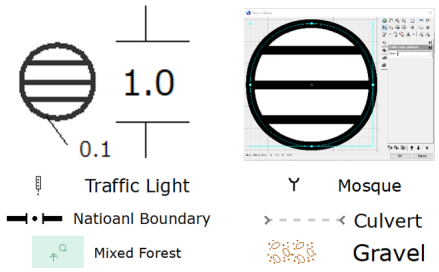


Figure 4-9 Created symbols (Point, Line, Polygon)

(b) Symbolization

The OJT for symbolization included conversion from Geodatabase to Representation with ArcGIS, Understanding of Representation Rules.

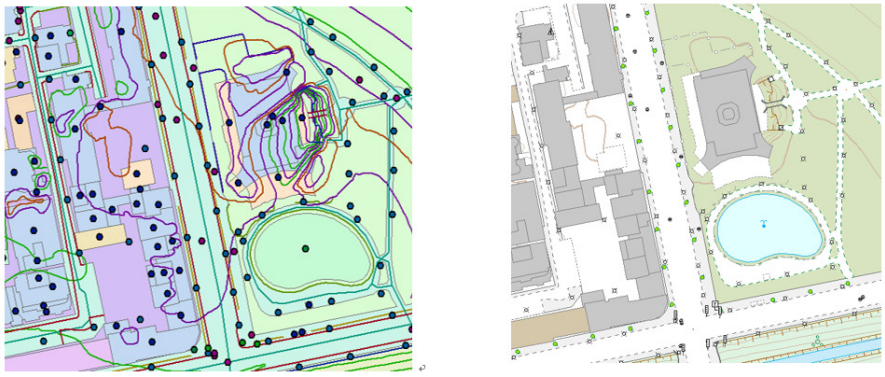


Figure 4-10 Symbolized Geodatabase

(c) Cartographic adjustment

The OJT for symbolization included understanding of Layer order, understanding of "Cartographic tools" in ArcGIS, and "Maplex Labeling Engine" of ArcGIS in order to adjust annotation visualization.

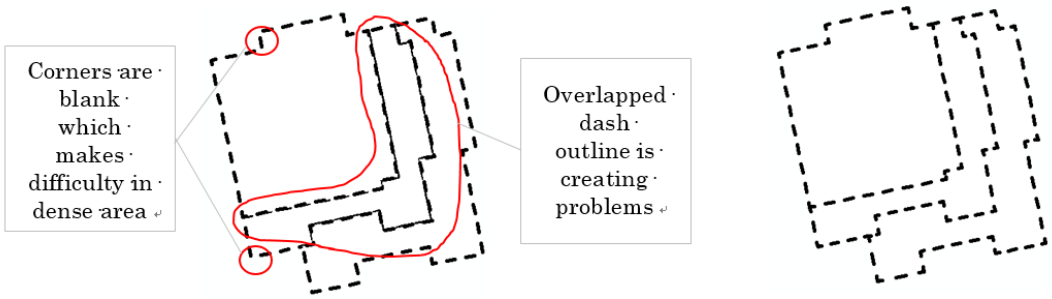


Figure 4-11 Cartographic Adjustment

(d) Generalization

OJT for Generalization included discussion of criteria between scales (1/2,000, 1/5,000, 1/10,000), and Manipulation of ArcGIS for generalization.

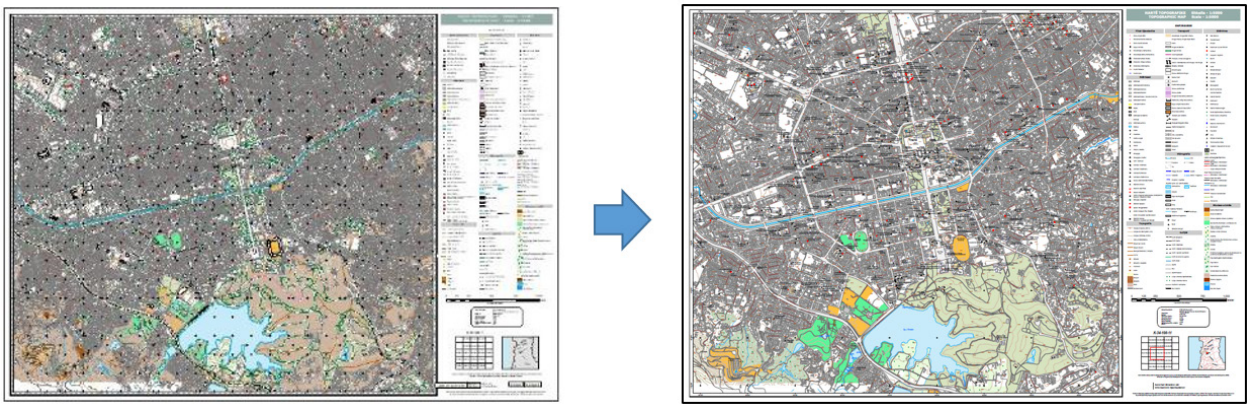


Figure 4-12 Generalized topographic map (1/5,000)

(e) Tutorial movie

The 1st Training of Generalization was carried out remotely through Web due to the COVID19 pandemic. Even the members of the Cartographic Sector had little experience in generalization. Therefore, JPT supplementary created a movie tutorial and improved effectiveness of the training.

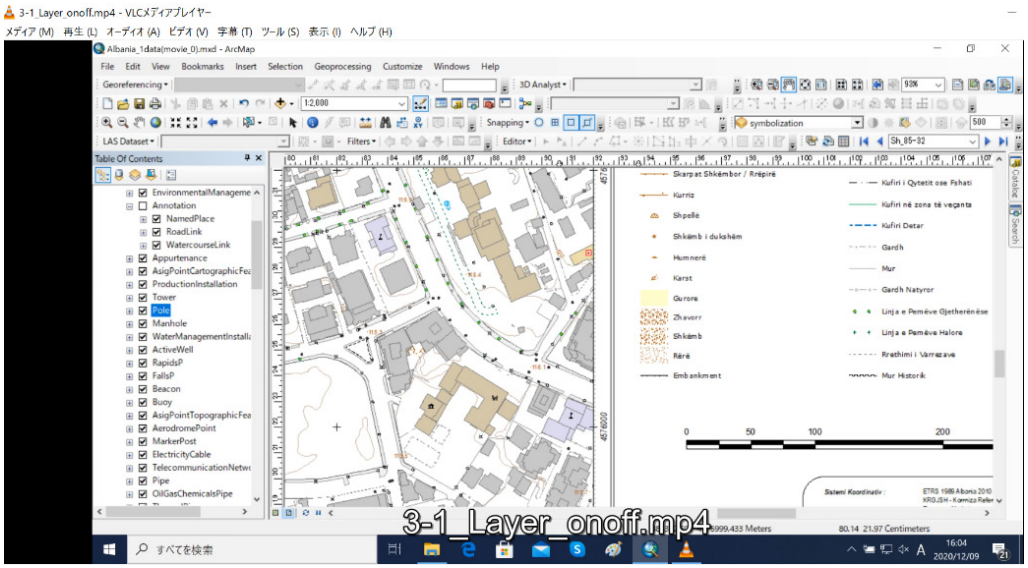


Figure 4-13 Example of the tutorial movie

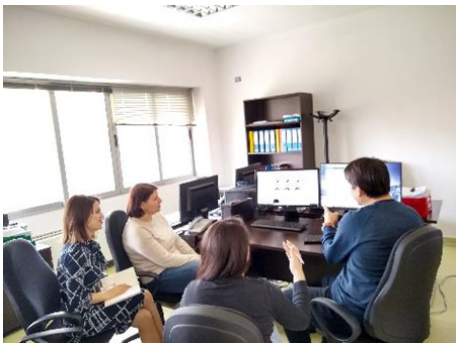



Photo 4-8 Technology transfer of symbol creation

（4） Evaluation of Technology Transfer

Through the technology transfer, most of knowledge and skills reached the level of achieved "Able to teach other technicians".

Regarding symbol creation, the participants are able to create new symbols from design size, color, and pattern. Regarding symbolization, the participants understood the printed 1/2000 map and had a required capacity of symbolization such as "Map layout","Transition", "Thinning", "Generalization", etc.

The participants also understood the difference among scales (1/2000, 1/5000, 1/0000) and defined the scale base criteria of symbolization. This shall be expanded to other scales in the future by ASIG.

Table 4-23 Evaluation of Stereo Plotting and Digital Editing works OJT

Item	Details	Evaluation	Criteria
Specification (Symbols, Criteria)	1) Discussion of "Map Symbol Catalogue" and its criteria 2) Discussion about criteria based on scale (1/2000, 1/5000, 1/10000)	5	5: Able to teach other technicians 4: Able to implement / operate independently 3: Able to understand the contents and practice them independently 2: Able to implement them if supported 1: Necessity of JPT's instructions
Symbol design and Creation	1) Comprehension and discussion of the symbols of each feature 2) Skills for Symbol creation with GIS	5	
Symbolization of Topographic data	1) Comprehension of printed map on each scale 2) Knowledge of "Transition" "Thinning", "Generalization", and its methods 3) Skill of "Representation" Tool in GIS	4	
Symbolization of marginal Information	1) Comprehension of the Marginal Information based on map scales 2) Training for modifying marginal Information	5	
Generalization	1) Skill of GIS Generalization Tools	4	

4.8. Data Structurization

Technology transfer was carried out on how to store the topographic map data, which is the final product, on the ASIG server. In the technology transfer, training was conducted on setting up a PostgreSQL database to be used in

the ArcGIS Enterprise Geodatabase format, creating an Enterprise Geodatabase, inputting topographic map data to the enterprise geodatabase, and backing up the database.

Also, Technology transfer related to data structuring was carried out remotely for the purpose of acquiring practical technology for utilizing the developed digital topographic map. In addition, technology transfer related to the installation of the digital topographic map data in the database was carried out onsite.

(1) Contents, schedule, and participants

Table 4-24 and Table 4-25 show the contents, schedule, and participants of the technology transfer.

Table 4-24 Schedule and contents of data structurization technology transfer

No.	Period	Contents	
1	February 2019	- Demonstration of contents of the technology transfer - Understanding of Vector Tile Generation on ESRI Environment	
2	February 2019	- Lecture for understanding PostgreSQL - Install PostgreSQL to Local environment - Create Enterprise Geodatabase - Configure Enterprise Geodatabase structure - Import existing map data to the database - Lecture for PostgreSQL/Enterprise Geodatabase creation, data installation and maintenance - Create new database, backup, recovery, and Transfer to other Database	
3	November December 2020 (Remote)	16 Nov	Briefing
		23 Nov	Exercise 1 Create 3D buildings
		3 Dec	Exercise 2 Create 3D continuous surface features
		10 Dec	Exercise 3 Generate a hazard map of landslide
		15 Dec	Exercise 4 Generate a map for selecting suitable places for photovoltaic power stations
		19 Dec	Database structure improvement and evaluation
4	October 2021	Installation of the digital topographic map data set to the server	

Table 4-25 Participants of data structurization technology transfer

No.	Category	Name	Position	Department
1	Data installation	Klaudio Collaku	Head of the sector	GIS sector
2		Erin Mlloja	Specialist	GIS sector
3		Ergert Sphillari	Specialist	GIS sector

No.	Category	Name	Position	Department
4		Eriona Shabani	Specialist	GIS sector
5		Erisa Garciu	Specialist	GIS sector
6	Data structuring	Saimir Burba	Head of sector	Cartography sector
7		Brikena Sinjari	Specialist	Cartography sector
8		Safete Mihali	Specialist	Cartography sector
9		Brunilda Tafa	Specialist	Cartography sector
10		Arli Llabani	Specialist	Cartography sector

(2) Activities carried out

Technology transfer related to the installation of the digital topographic map data

JPT provided hands-on training for understanding PostgreSQL and storing the topographic map data to the server. As a part of the technology transfer, training was provided in generation of ESRI vector tiles in ArcGIS environment.

- Install PostgreSQL to Local environment
- Create Enterprise Geodatabase
- Configure Enterprise Geodatabase structure
- Import topographic map data to the database
- Lecture for PostgreSQL/Enterprise Geodatabase creation, data installation and maintenance
- Create new database, backup, recovery, and Transfer to other Database
- Create ESRI vector tile set

Technology transfer related to data structuring

JPT provided the online training for the following GIS data processing.

- Create 3D buildings
- Create 3D continuous surface features
- Generate a hazard map of landslide
- Generate a map for selecting suitable places for photovoltaic power stations

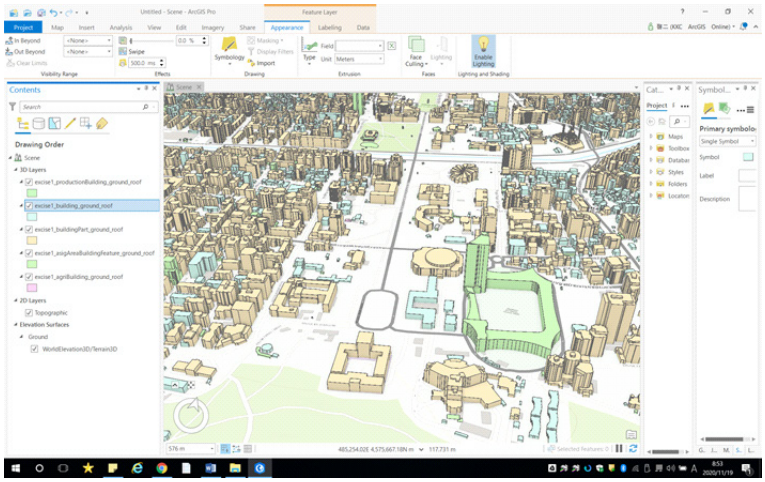


Figure 4-14 Sample of exercise of 3D building creation

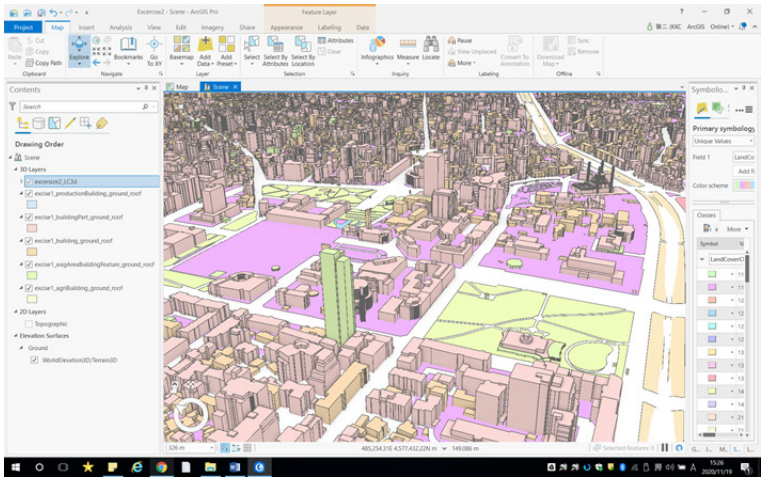


Figure 4-15 Sample of exercise of 3D continuous surface feature creation

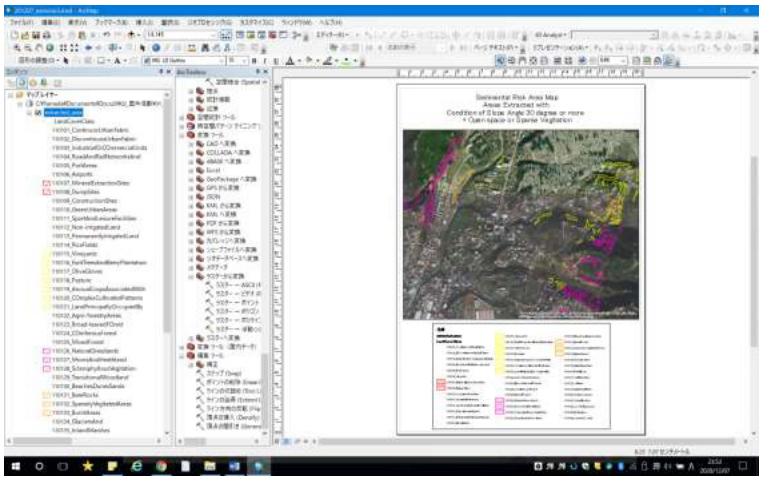


Figure 4-16 Sample of exercise of generation of a landslide hazard map

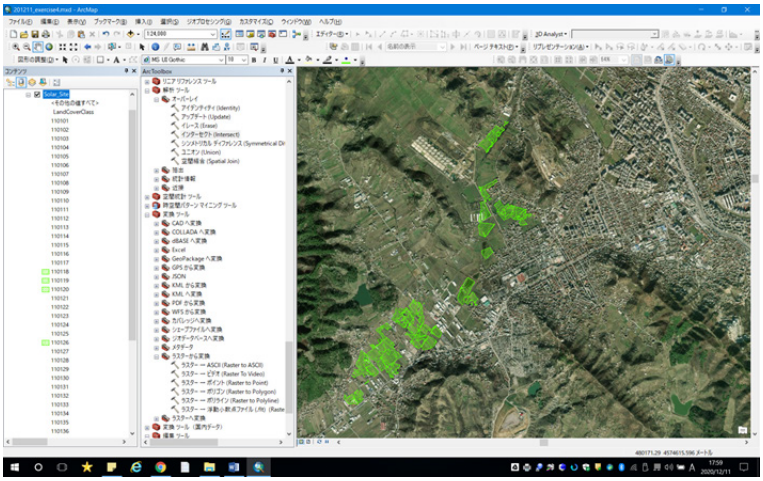


Figure 4-17 Sample of exercise of generation of a map for selecting suitable places for photovoltaic power

（3） Evaluation of technology transfer

Technology transfer related to the installation of the digital topographic map data

The participants did not have much experience in uploading data to online environments or working with relational databases. The training helped the participants understand the basic steps of those tasks. However, practical proficiency such as data storage and backup of actual data requires improvement of understanding of multiple operations in the future.

Also, all participants edit and process geospatial information using GIS in their daily work. They understand individual basic functions such as editing and analysis. On the other hand, there was a problem in formulating the content of the data to be created according to the purpose and combining the content and procedure of data processing according to the content.

Technology transfer related to data structuring

The participants understood that the outputs of the four kinds of exercises can be created as derivative products only from topographic map data, and they also understood the procedure for creating them. Through the technology transfer, JPT advised the participants to consider ideas for other derivative products and services that utilize the developed topographic map data.

4.9. UN Vector Tile Production

Technology transfer of UN vector tile production was conducted in the forms of online lectures and on-site OJT. Lectures from and discussions with GSI were remotely provided at some points of the technology transfer sessions.

（1） Contents, schedule, and participants

Table 4-26 and Table 4-27 show the contents, schedule, and the participants of the technology transfer.

Table 4-26 Schedule and contents of UN vector tile production technology transfer

No.	Date	Contents
1	15 Oct. 2020	Assembling a Raspberry Pi
2	21 Oct. 2020	OS installation on Raspberry Pi
1	29 Oct 2020	Installation of UNVT environment and setup of Raspberry Pi and the OS
2	25 Feb. 2021	Installation of UNVT environment and setup of Raspberry Pi and the OS (redo)
1	25 Feb. 2021	Conversion of sample data set to UNVT and operation check using Web Map Server Trouble support
2	16 Apr. 2021	
3	23 Apr. 2021	
4	25 May 2021	
1	30 Apr. 2021	Conversion of the project data to UNVT and operation check
1	24 Dec. 2020	Discussion and consideration of data display according to enlargement / reduction scale
2	21 Jan. 2021	
3	9 Feb. 2021	
1	11-22 Oct 2021 (on site)	Review of UN vector tile creation and control of data display (display scale, symbols)

Table 4-27 Participants of UN vector tile production technology transfer

No.	Name	Position	Department
1	Klaudio Collaku	Head of the sector	GIS sector
2	Erin Mlloja	Specialist	Ditto
3	Ergert Sphillari	Specialist	Ditto
4	Eriona Shabani	Specialist	Ditto
5	Erisa Garciu	Specialist	Ditto
6	Safete Mihali	Specialist	Cartography Sector

（2） Activity carried out

（a）Set up the server hardware and operating system to learn the operating environment of UNVT web map service

UNVT tools and web map server are constructed on a Linux server. The required specs of server environment depend on the estimated number of server accesses. This hardware does not have power like a general PC; however, the purpose of this training is gain the knowledge of UNVT and web map server, and Raspberry PI has enough power for this purpose.

JPT and ASIG built up the hardware from the scratch and installed the Raspbian OS. Some errors occurred during the UNVT setup, and the participants had to update/reinstall the latest version several times.

(b) Install and setup of the UNVT tools

UNVT tools are formed with several applications, and users need to install all of them and related libraries. JPT prepared the integrated one-line installer and documents to reduce the complexity of installation. The package and documents were provided through the Github portal.

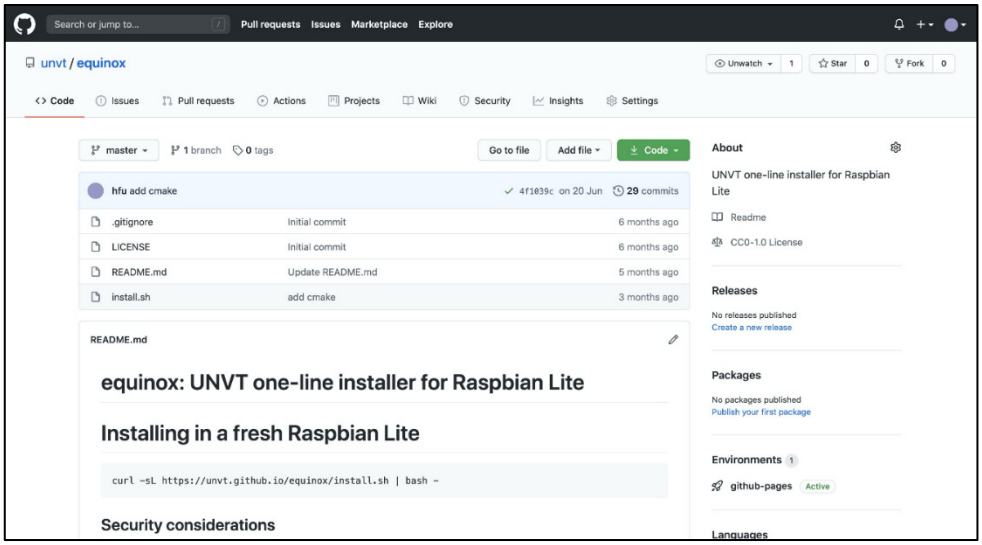


Figure 4-18 Install package on Github

The participants downloaded the integrated one-line installer from the Github portal and installed it to the Raspberry Pi. Because of the many unfamiliar operations, such as Github permission settings, command line input on Linux OS, and rewriting of definition files according to the own environment, the participants made setting mistakes and abnormal termination of installation, which seems to be due to the operation system. JPT tried to reinstall the OS and UNVT to find out the cause of failures; however, it was hard to check the system environment on remote session and it took a long time to resolve the error.

(c) Set up the web map portal with open dataset (data conversion and web server setup)

Small dataset of open data source was used for training of UN vector tile creation and web server construction as the first step, because small dataset was a good resource for trial and error.

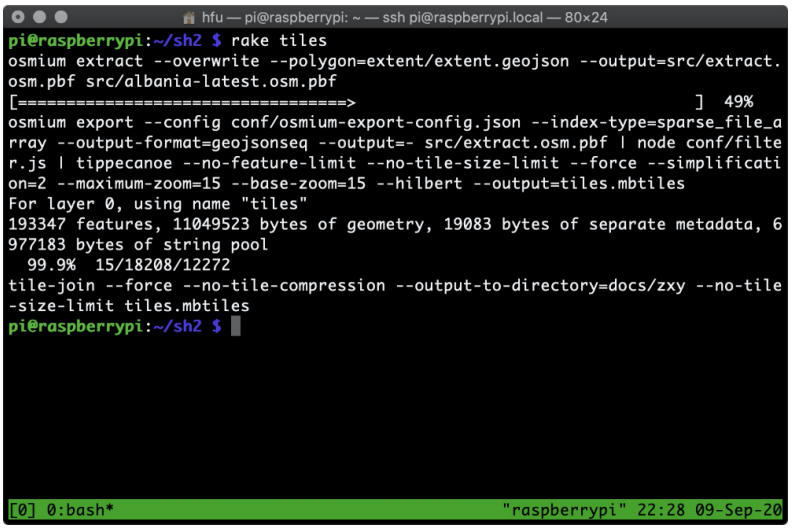


Figure 4-19 UN vector tile creation (command line)

The participants downloaded the sample of open data from Github portal. In this case as well, access permissions to Github and conversion errors occurred as in (b), and it took time to resolve the errors. In addition, although the web map server was able to start, an error occurred in which the map data were not displayed on the client browser. After clearing the environment and reinstalling the OS/UNVT, the operation was finally confirmed.

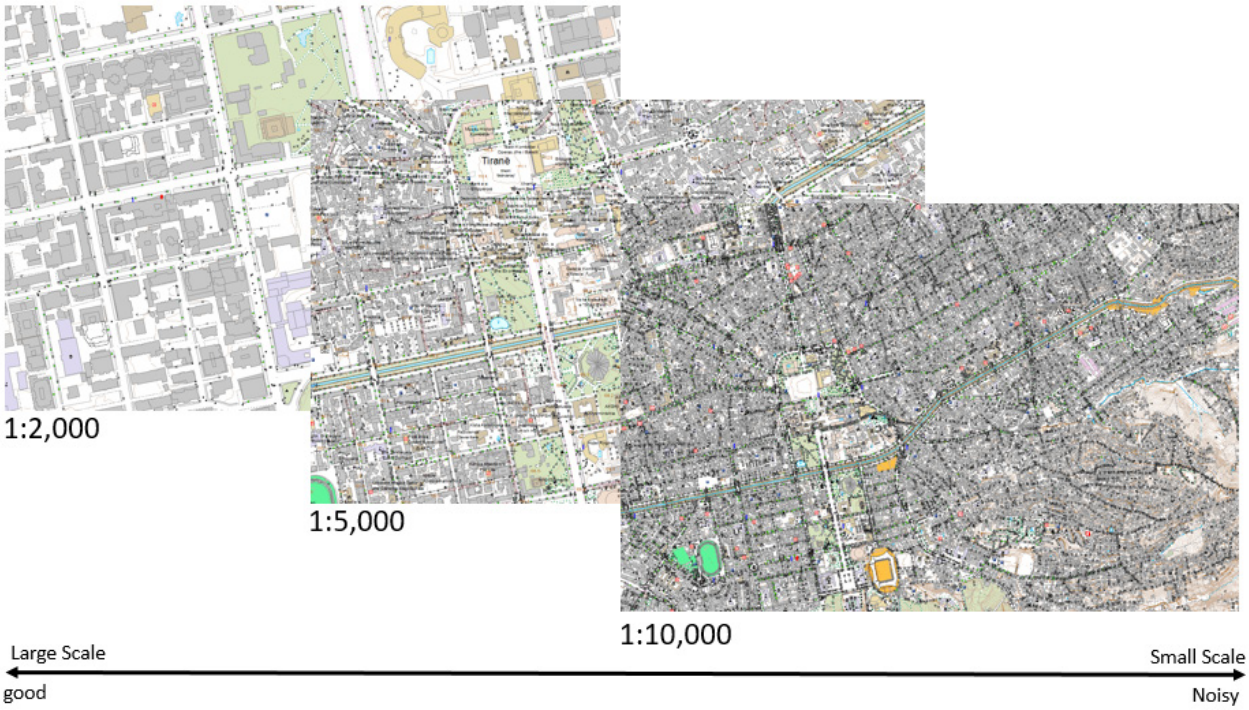


Figure 4-20 Display scale and geo-objects (need to optimize the drawing object in each scale)

(d) Set up the web map portal with project dataset (data conversion and web server setup)

The participants created the UN vector tile and web map service with project data. Because of the experience of working with the sample open dataset (step (c)), they had no significant problems during the process.

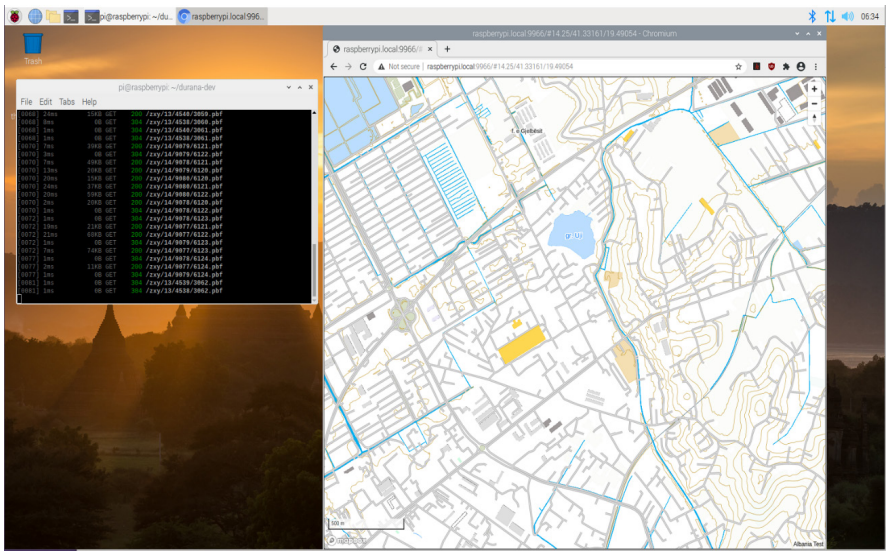


Figure 4-21 UNVT web map service with project data

(e) Optimize the data distribution (define the symbol and draw scale)

Regarding the map display scale and display features, provide the comparison table of the zoom level of UNVT and the scale close to each level, and which layer was displayed on which scale was discussed with ASIG.

Table 4-28 Zoom level of UNVT and approximate scale

Zoom Level	Approximate Scale	General Paper Map (Near Scale)
0	1:400,000,000	World Map
1	1:200,000,000	
2	1:100,000,000	
3	1:60,000,000	
4	1:30,000,000	
5	1:15,000,000	
6	1:8,000,000	
7	1:4,000,000	1:5,000,000
8	1:2,000,000	1:2,500,000
9	1:1,000,000	1:1,000,000
10	1:400,000	1:500,000
11	1:200,000	1:200,000
12	1:100,000	1:100,000
13	1:40,000	1:50,000
14	1:20,000	1:25,000
15	1:10,000	1:10,000
16	1:5,000	1:5,000
17	1:2,500	1:2,500
18	1:1,250	1:1,000
19	1:600	
20	1:300	1:500
21	1:150	
22	1:75	

As for implementation, definition file adjustment, data processing, and display verification will be repeated several times. For example, the symbol of roads should be changed in each scale. Simple symbols will be used for small scale and complex symbols will be used for large scale. It will require trial and error to find the suitable threshold scale and symbols for road layer's design change. Therefore JPT had done this training onsite.

（3） Evaluation of technology transfer

Before this training, the participants did not have knowledge of the UNVT. Through this training, the participants learned the following:

- How to set up the UNVT web map system on Linux environment.
- How to create vector tile data from project data (ArcGIS based data set).
- How to design the map layer on UNVT.
- How to modify and optimize UN vector tile data for web map system and open to the public.

As the result of this training, participants became able to do the following by themselves;

- Prepare the base environment for operating the UNVT.
- Create UN vector tile from their project data.
- Define the zoom level and symbols via definition file.
- Establish and provide the web map service.

4.10. Online Technology Transfer

Online technology transfer was carried out in the period of restriction to visit Albania due to the COVID19 pandemic, for the purpose of effective use of time, periodical communication, and support of self-training by the participants, early completion of OJT. The following are issues and propositions found through the online training.

Table 4-29 Issues of Online training

Technology transfer	Difficulty / Issues	Recommendation
All	- In comparison with face to face training, it is difficult to arrange schedule of both APT and JPT to keep enough time due to time difference. - It is difficult to prepare appropriate training contents corresponding to individual levels of trainees in the case of differing levels of skills and tasks between participants. - It is difficult to recognize comprehension level of training of participants.	- It is effective to prepare some type of manual, not only documented, but also a movie tutorial capturing desktop manipulation. - It is effective to arrange combination of online and face to face training.
Generalization	- It is difficult to start from "What is generalization" with a participant of the inexperienced level. - Features whose data size is huge are not suitable to online training because of time loss for displaying or processing. - It is difficult to carry out case by case training or complicated combination of tools in comparison to the basic manipulation and introduction of basic tools.	- It is effective to prepare training with specific images with introducing similar examples from other countries. - It is effective to carry out training distinguishing target of features, processes, and steps by taking advantage of both online and face to face training.
Data Structurization	- It was difficult to acquire practical techniques because the training was not hands-on, but consisted of multiple presentations of tasks and confirmation of the previous tasks. - For the reasons mentioned above, it was also difficult to grasp the individual proficiency level of the participants, and follow-up according to the level of proficiency was not possible.	- There is a need for technology transfer in an environment where hands-on training can be conducted, and the introduction of hands-on learning equipment such as wearable AR glasses should be considered in the future.
UN Vector Tile Production	- UNVT works with Linux environment (not with Windows). Compared with Windows, the knowledge of Linux is not sufficient, which caused difficulty in training and error handling. - Checked the error screen with USB web cam, but the image is not clear. Also it takes time to capture the image which should be taken. - There are limitations with meeting time, but web meetings are not limited by the date and are easy to hold frequently. This is a strong point.	- To study the basic knowledge is only dependent on each person. There is no other way. - Both sides need to deepen their knowledge about the construction of a remote environment so that they can accurately grasp the situation by using screen sharing. This is a basic requirement of remote training. - It is difficult to completely transfer technology by remote training alone. Onsite confirmation must be done.

5. Work Process Schedule

The work process schedule was as follows.

Work Item	Plan/ Actual	2017							2018											2019											2020											2021											2022	
		6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Collection, sorting, and analysis of relevant materials and information	Plan																																																									
	Actual																																																								
Discussion on map symbols, work criteria and specifications	Plan																																																							
	Actual																																																								
Validation of taken aerial photos and aerial triangulation outputs	Plan																																																							
	Actual																																																								
Aerial photography and orthophoto creation	Plan																																																							
	Actual																																																								
Field verification and Field completion	Plan																																																							
	Actual																																																								
Digital plotting, digital compilation, and digital compilation after field completion	Plan																																																							
	Actual																																																								
Map symbolization	Plan																																																							
	Actual																																																								
Digital data structurization	Plan																																																							
	Actual																																																								
Creation and management of data to be provided	Plan																																																						
	Actual																																																								
Promotion of utilization of geospatial information	Plan																																																						
	Actual																																																								
UN Vector Tile Production	Plan																																																						
	Actual																																																								
Creation of technology transfer plan and implementation of technology transfer	Plan																																																						
	Actual																																																								
Implementation of country-focused training	Plan																																																						
	Actual																																																								
Creation of work regulations	Plan																																																						
	Actual																																																								
Holding of JCC	Plan																																																						
	Actual																																																								
Holding of Regional Conference	Plan																																																						
	Actual																																																								
Holding of Project Conferences	Plan																																																						
	Actual																																																								
Creation of and discussion on Inception Report	Plan																																																						
	Actual																																																								
Creation of and discussion on Interim Report	Plan																																																						
	Actual																																																								
Creation of and discussion on Draft Final Report	Plan																																																						
	Actual																																																								
Creation of Final Report	Plan																																																						
	Actual																																																								

6. Project Implementation Organization and Personnel

6.1. Project Implementation Organization

The organization of Project members in Figure 6-1.

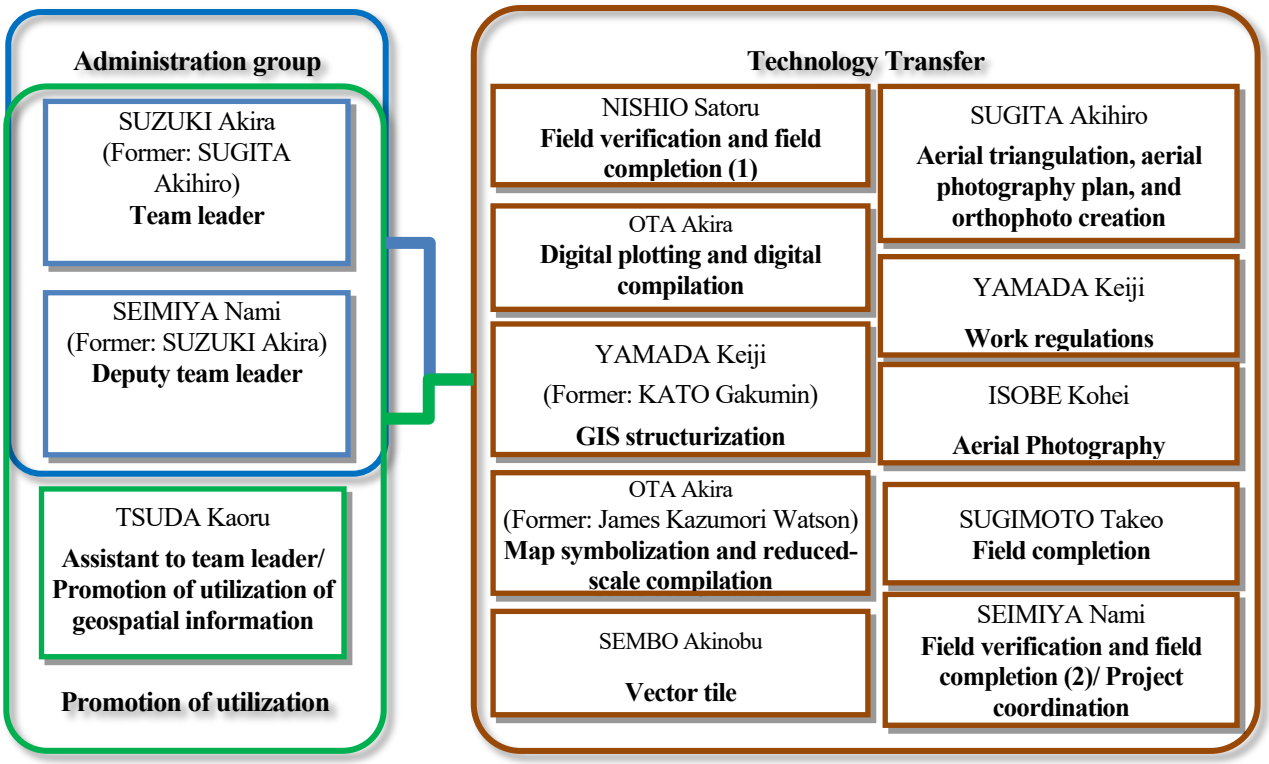
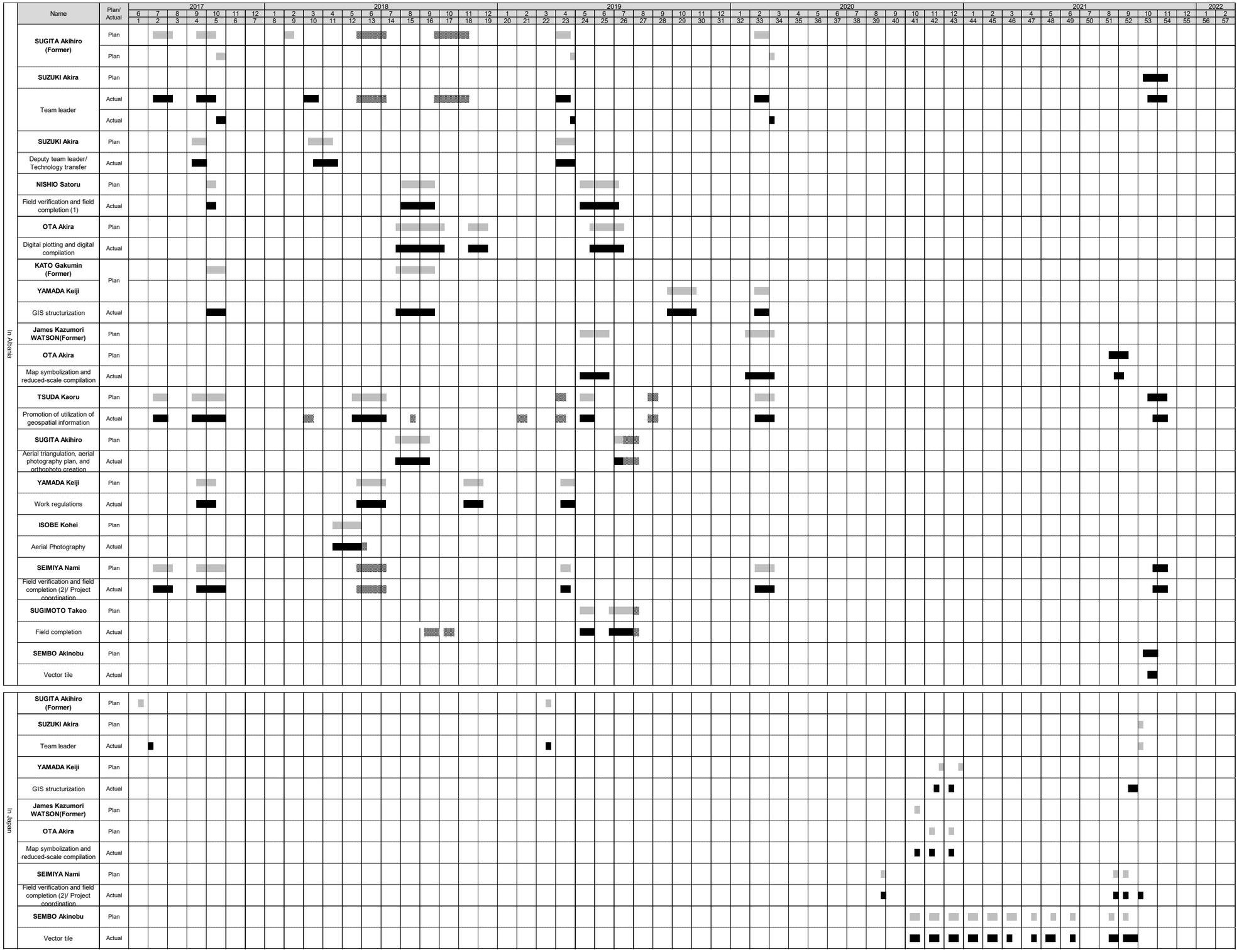


Figure 6-1 Organizational chart of the Project Team

6.2. Personnel Assignment

The personnel assignment was as follows.


In Albania
In Japan
Name
Plan/ Actual
2017
2018
2019
2020
2021
2022
SUGITA Akihiro (Former)
SUZUKI Akira
Team leader
SUZUKI Akira
Deputy team leader/ Technology transfer
NISHIO Satoru
Field verification and field completion (1)
OTA Akira
Digital plotting and digital compilation
KATO Gakumin (Former)
YAMADA Keiji
GIS structurization
James Kazumori WATSON(Former)
OTA Akira
Map symbolization and reduced-scale compilation
TSUDA Kaoru
Promotion of utilization of geospatial information
SUGITA Akihiro
Aerial triangulation, aerial photography plan, and orthophoto creation
YAMADA Keiji
Work regulations
ISOBE Kohei
Aerial Photography
SEIMIYA Nami
Field verification and field completion (2)/ Project coordination
SUGIMOTO Takeo
Field completion
SEMBO Akinobu
Vector tile
Plan
Actual