Republic of Djibouti
Topographic Section Department of Equipment

The Project for Managing Digital Topographic Data in Djibouti City in the Republic of Djibouti

(Technical Cooperation Project in the form of Development Study)

Final Report

March 2014

Japan International Cooperation Agency (JICA)

PASCO CORPORATION

EI
JR
14-048

Republic of Djibouti
Topographic Section Department of Equipment

Currency exchange rates

Unit: Djiboutian Franc (DJF)

US$1 = 177.88 DJF (interbank rate as of February 2014)

US$1 =102.46 JPY (interbank rate as of February 2014)

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List of Abbreviations

2D	2 Dimension
3D	3 Dimension (Stereo)
CAD	Computer Aided Design
DEM	Digital Elevation Model
DF/R	Draft Final Report
EU	European Union
GIS	Geographic Information System
GNSS	Global Navigation Satellite System(s)
GPS	Global Positioning System
GRS80	Geodetic Reference System 1980
IC/R	Inception Report
IT/R	Interim Report
IGS	International GNSS Service
ITRF	International Terrestrial Reference Frame
JICA	Japan International Cooperation Agency
MET	Ministry of Equipment and Transports
MM	Minutes of Meeting
OJT	On the Job Training
PDF	Portable Document Format
R/D	Record of Discussion
SHP	Shapefile
TIFF	Tagged Image File Format
TM	Transverse Mercator
TSDE	Topographic Section Department of Equipment
UPS	Uninterruptible Power Supply

1. Outline of the Study

1-1. Background of the Study

In the City of Djibouti, the capital city of the Republic of Djibouti, the recent economic development in the Republic and advancement of desertification in the countryside have accelerated the inflow of population into the City, resulting in a concentration of 350 thousand persons, about 43% of the total population (about 820,000), in the City. The incoming people are living in a disorderly manner in a suburban area not yet developed for residential purposes, where infrastructure such as roads and water and sewerage systems is underdeveloped, obstructing socio-economic stabilization.

Under such circumstances, the Government of Djibouti is preparing to establish a development plan in order to address urban problems in the suburbs of the City. However, the basic data to be used for planning, *i.e.*, the existing large-scale topographic maps are outdated and do not identify the range of the urban area that is expanding year by year according to the population growth. Although donors such as the EU, World Bank, and French Agency for Development, are implementing projects for developing infrastructure such as water and sewerage systems in the suburbs of the City, the lack of topographic maps is requiring them to implement current-condition surveys and topographic surveys in each project. Therefore, there is a high need for developing comprehensive, large-scale digital topographic maps for the entire City that can be used for current-condition identification and draft planning. Against such a background, the Government of Djibouti requested the Government of Japan for technical assistance for developing data of large-scale digital topographic maps of the City.

In response, the Japan International Cooperation Agency dispatched a Study Team for establishing a detailed plan in September 2011, discussed with the Ministry of Equipment and Transport (hereinafter referred to as MET), an implementing organization of the Government of Djibouti, regarding digital geographic information in the center and suburban area of the City, reached an agreement, and signed a Record of Discussion (R/D) as of September 14, 2011. This project was implemented for a duration of two years from March 2012 based on the R/D.

1-2. Objectives of the Study

This Study has the following objectives:

(1) To carry out aerial photography of the central city and surrounding area of Djibouti City (an area of 300km^2) in Djibouti and to create the orthophotos on the scale of 1/2,500 (with a ground resolution of 20cm).

(2) To create digital topographic maps on the scale of 1/2,500 and GIS basic data of the central area of Djibouti City (an area of about 100km^2).

(3) To carry out technology transfer to the Topographic Section, Department of Equipment

(hereinafter referred to as "TSDE") of MET which is the counterpart agency in Djibouti, so as to give them an understanding of topographic mapping technology and partial correction (updating of the "geographic information data").

1-3. Target Areas of the Study

The target areas for aerial photography and developing the orthophotos and digital topographic map in this Study are shown below.

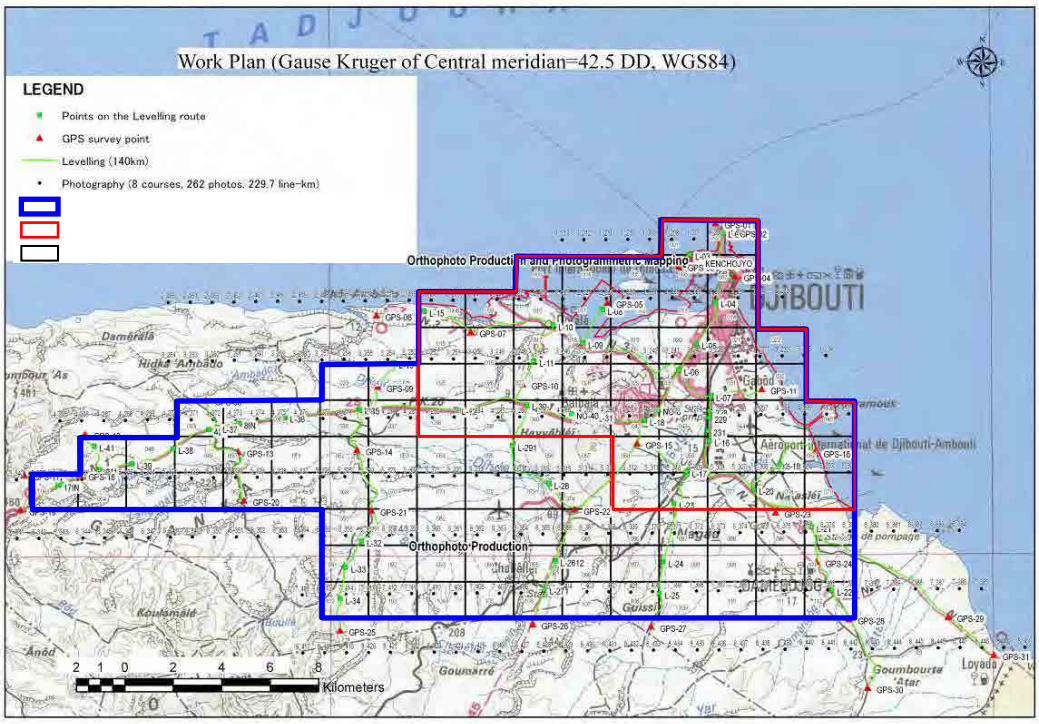


Figure 1 Target Area of the Study

1-4. Work Items and Volume

The work items and volume of this Study are shown below.

Table 1 Work Items and Volume

Work	Work Volume	Description	Remarks
Control point survey / Installation of aerial markers	34 points	Orientation origin: 2 points Control points: 32 points	Work in Djibouti (Technology transfer)
Leveling	28 routes	Simple leveling Route length: 143km	Work in Djibouti (Technology transfer)
Aerial photography	8 courses, 262 images	Image resolution: 20cm	Work in Djibouti
Aerial triangulation	256 models		Work in Japan Work in Djibouti (Technology transfer)
Creation of orthophotos	112 sheets ($300km^2$)	Color images Image resolution: 20cm	Work in Japan
Field verification Field completion	49 sheets ($110km^2$)	1/2,500	Work in Djibouti (Technology transfer)
Digital plotting / compilation	49 sheets ($110km^2$)	1/2,500	Work in Japan, Work in Djibouti (Technology transfer in updating)
Digital compilation after field completion	49 sheets ($110km^2$)	1/2,500	Work in Japan, Work in Djibouti (Technology transfer in updating)
Map symbolization	49 sheets ($110km^2$)	1/2,500	Work in Japan, Work in Djibouti (Technology transfer in updating)
Digital data structurization	49 sheets ($110km^2$)	1/2,500	Work in Japan, Work in Djibouti (Technology transfer in updating)

1-5. Final Outputs

The following lists the outputs from this Study.

Table 2 Reports Prepared and Outputs Created in the Study

Item		Quantity	Remarks
(1) Study report	Inception Report (IC/R)	5 copies in Japanese 15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Progress Report (PR/R)	5 copies in Japanese 15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Interim Report (IT/R)	5 copies in Japanese 15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Draft Final Report (DF/R)		
	Main report	15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Summary	15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Summary in Japanese	10 copies in Japanese	
	Work manual	2 copies in French	Submit 1 copy in French to the Government of Djibouti.
	Final Report (F/R)		
	Main report	15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Summary	15 copies in French 15 copies in English	Submit 10 copies in French and 10 copies in English to the Government of Djibouti.
	Summary in Japanese	10 copies in Japanese	
	Work manual	2 copies in French	Submit 1 copy in French and to the Government of Djibouti.
(2) Outputs	1) Orthophoto maps	2 sets	Submit 1 set to the Government of Djibouti.
	2) Field verification results	1 set	Submit 1 set to the Government of Djibouti.
	3) Aerial triangulation results	1 set	Submit 1 set to the Government of Djibouti.
	4) Digital data files		
	1/2,500 topographic mapping data	2 sets	Submit 1 set to the Government of Djibouti.
	1/2,500 GIS basic data	2 sets	Submit 1 set to the Government of Djibouti.
	1/2,500 topographic mapping data in PDF format	3 sets	Submit 1 set to the Government of Djibouti.
	Digital aerial photo data	1 set	Submit 1 set to the Government of Djibouti.
	Final report	1 set	
	5) Booklet	1 set	A3 size: 100 sets Original map size: 5 sets
	6) Report on quality management	1 set	

1-6. Items Discussed

The topics and details of discussion between the Study Team and TSDE of MET, a counterpart organization in this Study, are shown in the table below.

Table 3 Discussion Topics with the Counterpart

Discussion topic	Timing	Details	Remarks
Inception Report	March 2012	Work area, work amount, work policies, and final outputs	The counterpart agreed with the Study Team's proposal.
Specifications of topographic maps	March 2012	Reference coordinate system, map symbols, and GIS basic data specifications	Determined through discussion
Technology transfer	March 2012	Technology transfer items, equipment, and workers	The counterpart agreed with the Study Team's proposal.
Progress Report	October 2012	Work progress, subsequent work schedule, and utilization promotion study	The counterpart agreed with the Study Team's report and proposal.
Interim Report	September 2013	Work progress, utilization promotion, and achievement level of technology transfer	The counterpart agreed with the Study Team's report and proposal.
Draft Final Report	January 2014	Proposal on geographic information data utilization and TSDE enhancement	The counterpart agreed with the Study Team's report and proposal.

Block Symbols

	Block Symbol Names for Object (ByBlock color)	Block Symbol Names for LEGEND (ByLayer color)	Symbols	Nom
1	221900	2219		Tunnel for Road (トンネル:車道)
2	223800	2238		Boulevard trees (並木)
3	241900	2419		Tunnel for Railway (トンネル:鉄道)
4	242100	2421		Bus stop (バス停)
5	350300	3503		Administrative Building for ministry (行政施設:省)
6	350400	3504		Tribunal (裁判所)
7	350500	3505		Police station (警察署)
8	350700	3507		Tax Office (税務署)
9	350900	3509		Post Office (郵便局)
10	351000	3510		Forest Reserve (保護林)
11	351100	3511		Meteorological weather station (気象観測所)
12	351500	3515		Police box (派出所)
13	351600	3516		Fire station (消防署)
14	351800	3518		Embassy and International organisation (大使館及び国際機関)
15	351900	3519		Other Administrative Building (行政施設:その他)

Figure 2 Determined Topographic Map Symbols (example)

1-7. Workflow

The outline of workflow in this Study is shown below.

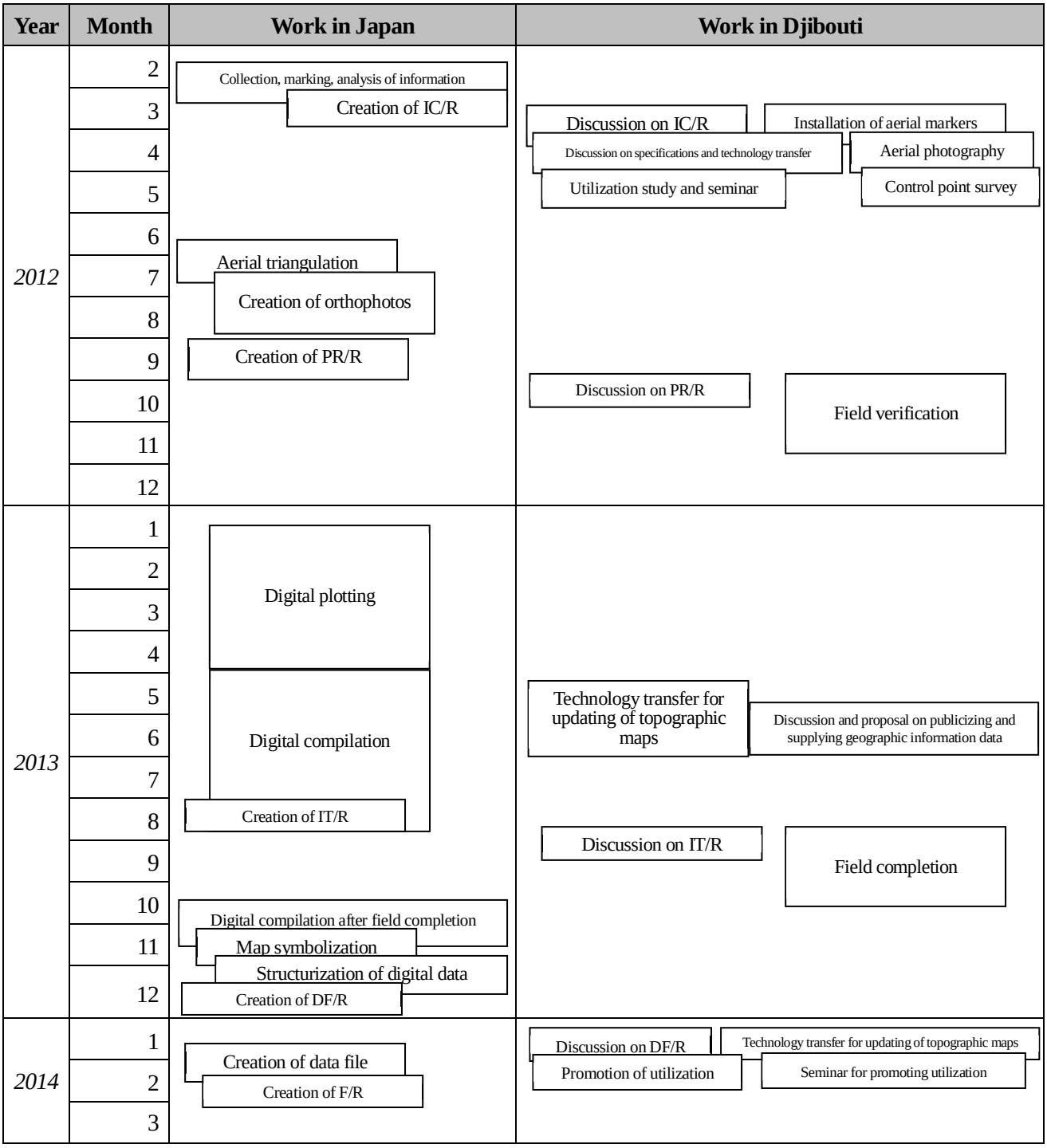


Figure 3 Project Workflow

1-8. Work Assigned to Study Team Members

The names and work assignments of the members of the Study Team are shown below.

Table 4 Names of Study Team Members and Work Assigned

Name	Survey operations under charge	Details of operations
Masakuni NAKAYAMA	Team Leader / Digital compilation	- Management and supervision on the study operations in general - Planning and evaluation of technology transfer (including holding of seminars) - Coordination with relevant organizations
Daikichi NAKAJIMA	Aerial photography	- Management of aerial photography
Atsushi MOCHIZUKI	Control point survey 1	- Guidance, management, and technology transfer on GNSS observation and leveling - Technology transfer on pricking
Tadaaki TOMITA	Control point survey 2	
Daikichi NAKAJIMA	Field verification / Field completion 1	- Guidance and technology transfer on field verification and field completion for topographic maps
Toshiyuki WAKABAYASHI	Field verification / Field completion 2	
Tadahiko SEKIGUCHI	Field verification / Field completion 3	
Daikichi NAKAJIMA	Updating of topographic maps (technology transfer)	- Guidance and technology transfer on technologies required to update topographic maps
Kaoru TSUDA	Utilization promotion	- Guidance and technology transfer on creating a system required to promote utilization (including holding of seminars)
Akira OTA		
Tomohiro KOYAMA	Interpreter	- Interpretation and translation
Tomoyuki OTANI		
Takashi SHIRAI	Operation coordination / Assistance in field verification and field completion	- Operation coordination as well as guidance and technology transfer on field verification and field completion for topographic maps
Hayato FUKUOKA		
James WATSON		

2. Study Outputs and Proposals

This section describes the outputs of this Study and the achievement levels for the study purposes. It also provides proposals on the system for using the study outputs continually after the end of this project.

2-1. Study Outputs

(1) Development of large-scale geographic information data

The following geographic information data has been developed in this Study. This information, being large-scale (meeting the 1/2,500 level specifications) and digital data, is expected to be applied to a wide range of uses for the development of the City of Djibouti and the Republic of Djibouti.

Table 5 Geographic Information Data Developed in the Study

Geographic information type	Specification	Quantity	Remarks	Common uses
Orthophotos	20 cm resolution	300 km^2 112 map sheets	See Chapter 3-11	Land use survey Vegetation survey Housing survey Land readjustment
Topographic maps	1/2,500 level	110 km^2 49 map sheets	See Chapter 3-21	Urban planning Road/railroad planning Water/sewerage system planning/management Disaster prevention/security planning GIS basic data
GIS basic data	1/2,500 level	110 km^2 49 map sheets	See Chapter 3-22	Distribution planning/management Facility planning/management Irrigation planning Afforestation planning Port planning/management River improvement planning Landscape planning Agricultural planning/management Topographic analysis analysis/survey

(2) Outputs of technology transfer

The technology transfer in this Study was provided with a focus on “partial revision (updating of geographic information data)” to allow the TSDE staff to update the above spatial

information continuously.

On the other hand, the "topographic mapping technology" was transferred with a focus on theory. The technology transfer items were determined through discussion with TSDE before the technology transfer was implemented.

The TSDE engineers were inexperienced in the basic work procedures such as the operation of equipment to be used. In consideration of this point, the technology transfer was implemented according to the goals set for each process, and the achievement levels of the technology transfer goals were evaluated as shown in the table below.

As a result of technology transfer, the TSDE staff attained a technical level with which they could conduct "partial revision (updating of geographic information data)" and understood the theory of "topographic mapping technology."

Table 6 Outputs of Technology Transfer

Item	Operation details	Goal setting	Achievement level	Current technical level
Installation of aerial markers	Installation of aerial markers	Capability of conducting the same operation as in training	The engineers understood appropriate materials, forms, and colors of aerial markers corresponding to image resolutions of photos and conditions on the ground. The installation work performance improved as they repeated the operation.	Capability of installing aerial markers required for aerial photography on their own
Control point survey and analysis	Field reconnaissance for selection of control points	Capability of conducting the same operation as in training (survey planning and GNSS observation and analysis)	The engineers understood the basic items such as coordinate systems and map projection.	Capability of making a control point installation plan using topographic maps and selecting and installing control points in the field using a handheld GPS
			The engineers understood point allocation according to the photographing plan. In the future, TSDE can plan point allocation on its own when conducting new control point survey.	
			The engineers understood the basic operations of handheld GPS receivers such as registration of points and point names.	
	GNSS observation		The engineers understood basics and basic operations of GNSS survey. They can conduct static observation of new points by themselves. Applicative operations such as kinematic survey are also possible.	Capability of planning and conducting observation in GNSS survey on their own
	GNSS analysis		The engineers understood basic operations of analysis software. They understood how to examine the analysis results and set limit values. They can conduct observation and analysis of TSDE's own new control points network.	Capability of downloading GNSS observation data and conducting baseline analysis, and 3D net adjustment calculation
Leveling and pricking	Leveling and pricking	Capability of conducting observation and calculation using digital levels	The engineers were able to conduct observation using digital levels. They were able to prick necessary points on photos.	Capability of conducting observation and calculation in leveling
Field	Pre-interpre	Capability of	The engineers understood what to do in field	Capability of conducting

verification	tation	applying the technology to updating of topographic maps	verification and the verification items (map symbols).	pre-interpretation without problems
	Field verification		The engineers learned to check the verification items without much trouble using the handheld GPS and Orthophotos.	Capability of acquiring planimetric features and reflecting them on the topographic mapping data using the handheld GPS
	Marking of field verification results		The engineers understood what to do in the check and marking process (omissions, errors, and edge matching between map sheets).	Capability of marking on digital maps
Updating of topographic maps	Updating of topographic maps	Learning of basic knowledge and computer operations required to update topographic maps	The engineers understood the procedures for digital plotting and digital compilation. They understood the method of map symbolization. They need to continue to receive training on computer operations.	Acquisition of basic understanding

(3) Outputs of promotion of utilization

To promote effective and widespread use of geographic information data developed in this Study, TSDE and the Study Team carried out the activities listed in the table below. After the study by and information exchange among stakeholder organizations and potential user organizations, the stakeholder meeting for geographic information data was launched.

Table 7 Activities for Promoting Utilization

Activity	Timing	Details	Remarks
Fact-finding survey on promotion of geographic information data	March 2012	Survey of stakeholder organizations and potential user organizations and needs survey	See Chapter 3-6
Utilization promotion seminar 1	March 2012	Explanation on project outline and utilization examples and questions and answers	See Chapter 3-7 and Appendix-5
Discussion and proposal of methods for publicizing and supplying geographic information data (Stakeholder survey)	June 2013	Individual explanation to stakeholder organizations and potential user organizations, demonstration of GIS utilization Fact-finding, discussion, etc. on publicizing and supply of geographic information data	See Chapter 3-16
Discussion and proposal of methods for publicizing and supplying geographic information data (Stakeholder meeting 1)	September 2013	Exchange and sharing of information on sharing and updating of geographic information data Fact-finding, discussion, etc. on publicizing and supply of geographic information data	See Chapter 3-18 and Appendix-9
Stakeholder meeting 2	January 2014	Proposal on data publicizing and supply system	See Chapter 3-25
Utilization promotion seminar 2	January 2014	Project output report Proposal on utilization	See Chapter 3-26

Table 8 Relationship between Relevant Organizations and the Study

Organization		Utilization promotion seminar 1	Stakeholder survey	Stakeholder meeting		Utilization promotion seminar 2
				1	2	
1	Topographic Section, Department of Equipment (TSDE), Ministry of Equipment and Transport	○	○	○	○	○
2	Department of Statistics and Population (DISED)	○	○			○
3	Djibouti Center for Research Studies (CERD)	○	○	○	○	○
4	Djibouti Electricity (EDD)	○	○	○	○	
5	Department of Cadaster		○			○
6	Djibouti National Water and Sanitation Office (ONEAD)	○	○	○		○
7	Department of Housing and Urban Planning	○	○	○	○	○
8	Department of Environment		○		○	○
9	Division of Large Construction, Department of Agriculture		○			
10	Djibouti Road Maintenance Office (OVD)		○			
11	Department of Citizen Protection, Ministry of Interior and Decentralization		○	○	○	○
12	Djibouti City Hall		○	○		○
13	University of Djibouti		○			○
14	Djibouti Ports & Free Zones Authority				○	○
15	Djibouti Social Development Agency				○	○
16	Djibouti International Airport				○	
17	Civil Aviation Authority				○	○
18	Port of Djibouti				○	○
19	National Office of Copyright and Related Rights				○	○
20	Disaster Risk Management Office				○	
21	Department of Maritime Affairs				○	○
22	Djibouti Telecom					○
23	Road Maintenance Fund					○
24	National Meteorological Agency					○
25	Office of Industrial Property and Commerce					○
26	Djibouti Railway Company					○
27	Coast Guard					○
28	Central Laboratory of Building and Equipment					○
29	UNDP Representative Office					○
30	WFP Representative Office					○

2-2. Proposal on Utilization of Geographic Information Data and TSDE

To have the geographic information data developed in this Study updated by TSDE continuously using the technology transferred in this Study and put it to continuous, widespread use in the Republic of Djibouti, it is advisable to construct and manage a system for utilizing geographic information data centered around TSDE in collaboration with organizations in and out of the Republic.

In this regard, proposals on the following items from the middle and long-term perspectives are summarized:

- Proposal on the operation of stakeholder meetings
- Proposal on development of a system for publicizing and supplying data
- Proposal on enhancement of TSDE

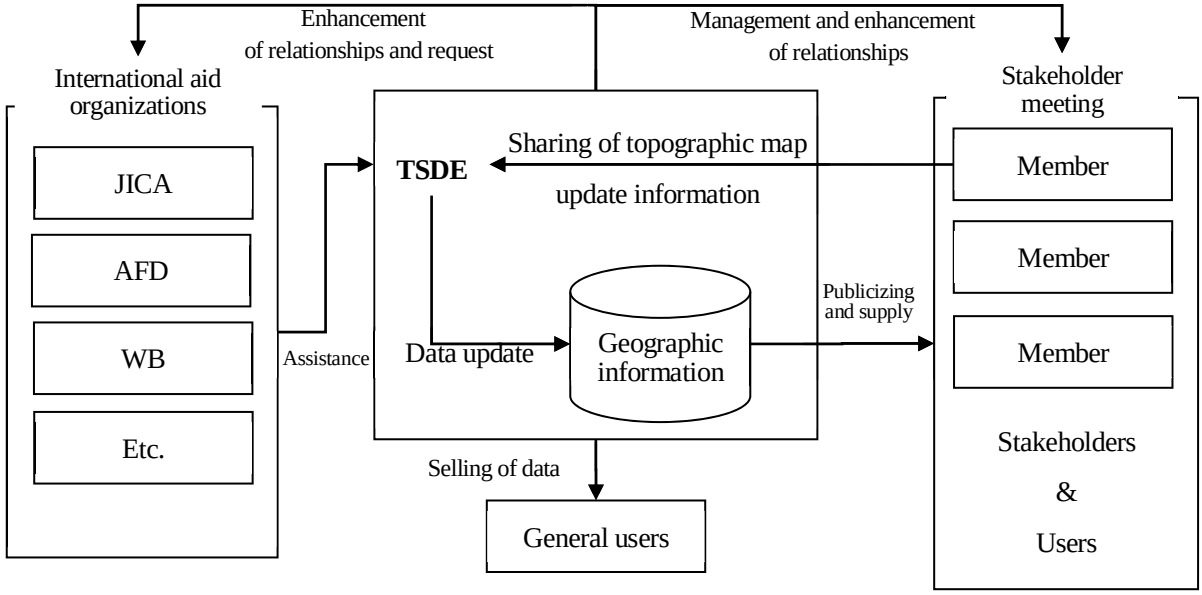


Figure 4 System for Updating and Utilizing Geographic Information Data (conceptual diagram)

2-2-1. Proposal on Holding of Stakeholder Meetings

On January 21, 2014, the second stakeholder meeting was held in succession to the first stakeholder meeting (September 2013) which was aimed at becoming Djibouti's central organization for "utilizing" and "updating" the outputs of this Study.

In the second stakeholder meeting, the participants shared information again on the overview of the Project and utilization of the outputs and exchanged opinions on the importance of continuously holding stakeholder meetings in relation to the establishment of an organization required to "utilize" and "update" the geographic information data.

In the meeting, the Study Team made the proposal shown below as the term-by-term goals for the

management of stakeholder meetings to be held in the future.

For the management of meetings in the future, the assumed leader is the "Ministry of Equipment and Transport" and the assumed permanent members are "Djibouti Electricity (EDD)," the "National Water and Sanitation Office of Djibouti (ONEAD)," "Djibouti Telecom," "Djibouti Center for Research Studies (CERD)," the "Ministry of Housing, Urban Planning, Environment, and Land Management," the "National Office **of** Copyright and Related Rights," and the "Topographic Section."

Furthermore, the immediate goal is for the stakeholder meeting to establish a basic sharing system for digital topographic maps by around April 2014 when the outputs of this Study are supplied from JICA to Djibouti. This goal was included in the speech made by the Vice-Minister of the Ministry of Equipment and Transport and is expected to be achieved.

Table 9 Middle and Long-term Goals of Stakeholder Meetings

Item	Timing	Goals
Stakeholder meeting	By the end of study (by April 2014)	Selection of the leader Screening of permanent members Decision on management rules (such as frequency of meeting) Schedule and setting of goals by term Establishment of a system for "sharing" and "utilizing" geographic information data
	Middle-term goals	Division of roles among organizations in sharing and updating of geographic information data Discussion on roles and rules in continuous holding of stakeholder meetings, extraction of problems in sharing and updating geographic information data continuously, and discussion on necessary enhancement of organizations and human resources, improvement of equipment, etc.
	Long-term goal	Continuous sharing/updating and publicizing/supply of geographic information data

2-2-2. Proposal on Development of System for Publicizing and Supplying Data

Through the utilization promotion seminars, stakeholder survey, and stakeholder meetings, the stakeholder organizations were able to share information on the content of the topographic map information data and utilization effects. However, it is considered necessary to establish and enhance rules and systems for publicizing (supplying and selling) and managing (sharing and updating) the digital topographic maps through continuous management by the stakeholder meeting. Therefore, the Study Team made proposals as shown below.

Table 10 Middle and Long-term Goals of Data Supply

Item	Timing	Goals
Improvement of sales channels	Middle-term goal	Conduct market research and estimate on geographic information to set appropriate prices at which to sell the study outputs (DJF 3,000 to 5,000 per printed map seems appropriate). Among the permanent members of the stakeholder meeting, an organization that has experience in selling topographic maps (*e.g.*, CERD) will take the initiative in managing the supply and sale of data.
	Long-term goal	Enhance the TSDE organization and improve the sales system by TSDE both on hardware and software bases.
Handling of software copies	Middle-term goal	Prevent illegal transfer to a third party using papers (Application for supply of digital topographic data) (Appendix-1).
	Long-term goal	Make internal rules about handling of applications to the National Office of Copyright and Related Rights and digital geographic information according to the examples of neighboring countries.

2-2-3. Proposals on Enhancement of TSDE

To ensure continuous update and utilization of geographic information data, it is indispensable to enhance TSDE in terms of organization and finance. The proposals on the enhancement of TSDE are summarized in the table below.

(1) Proposals on organizational enhancement of TSDE

Even before this Study, TSDE had been considering organizational upgrade (National Directorate of Topography and Geodesy: Direction national de Topographie et de la Géodésie) and enhancement. In the September 2013 interview that the Study Team had with the Minister of Equipment and Transport, the upper organization of TSDE, the minister gave positive answers about the organizational enhancement of the Topographic Section.

If the sections of this organization (Administration Section, Geodesy Section, Mapping Section, and Topography Section) have an equivalent scale (in terms of human resources and equipment) to the current Topographic Section, Department of Equipment and gain a budget with which they can carry out the operations listed in the table below according to middle and long-term goals, there will be a higher possibility that TSDE takes the initiative of the relevant organizations to promote continuous utilization and updating of topographic mapping data.

Table 11 Organizational Enhancement and Middle and Long-term Operation Goals

Department		Middle-term goal	Long-term goal
National Directorate of Topography and Geodesy		Fostering of engineers	Unification of information regarding topography, mapping, photogrammetry, and geodesy Fostering of experts and senior engineers
	Administration Section	Administration Enhancement of relations with public organizations in Djibouti Establishment of cooperative structure with private companies and donors of developed countries	Administration Operation of selling geographic information data
	Geodesy Section Mapping Section Topography Section	Development of networks of control points and benchmarks in Djibouti and its periphery Updating of topographic maps (Secular change correction) Cooperation in creation of control maps for urban infrastructure Survey operation related to improvement of urban infrastructure	Development of networks of high-accuracy national benchmarks Creation and printing of various topographic maps Creation of ortho images Development of spatial information database Development of new road maps and creation of road management maps

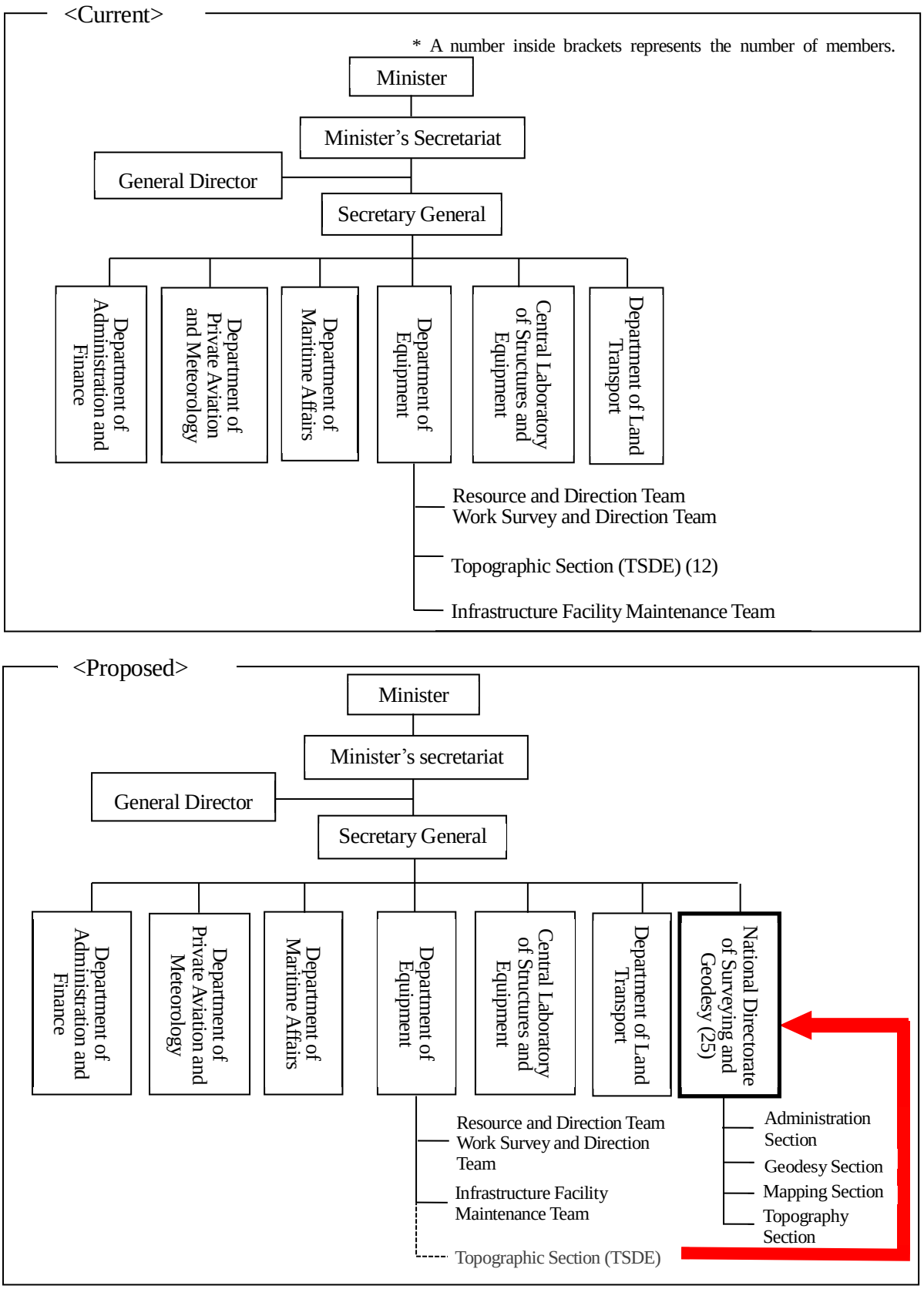


Figure 5 Concept of Organizational Enhancement of TSDE (upper: current, lower: conceived)

(2) Proposal on technology enhancement of TSDE

The technology of control point survey (GPS survey, leveling, etc.) was smoothly transferred to improve the operation efficiency of TSDE, by giving lectures on theories and OJT using the latest digital equipment based on the technology of ground survey, etc. carried out by TSDE before this Study.

The technology transfer for "partial revision (updating of geographic information data)" successfully transferred the method of updating data using the existing equipment and the equipment to be provided in this Study. In the future, it is advisable to actually carry out updating operations using information on topographic data updating (design charts, completion charts, etc.) to be acquired from stakeholder organizations in order to brush up and learn efficient use of the technologies acquired in the technology transfer of this Study. Furthermore, opportunities for review and repeated practice should be gained through actual work regarding the practical applications and quality control using the GIS software, which remained as future tasks in the technology transfer of this Study.

Although the long-term goal of TSDE is expected to be creation of new topographic maps, this Study covered only theory-based transfer of technologies related to such operation (aerial triangulation in digital photogrammetry system, creation of DTM and ortho images, and acquisition of 3D data in stereo environments). To put the technologies to actual use, therefore, it is necessary to learn new technologies such as software operation procedures, etc.

Regarding this matter, it is advisable to develop a photogrammetry system and learn the technologies for acquiring 3D data in a stereo environment when the TSDE engineers are accustomed to the topographic map updating work and can carry out the work efficiently.

When the engineers learn the 3D data acquisition technology, it is advisable to select hardware and software according to the operators' technical level and scales of work and budget. One of the possible solutions is to utilize the dispatch of experts from international aid organizations.

3. Details and Results of Work Done

3-1. Collection, Sorting and Analysis of Related Materials and Information [Work in Japan]

The map symbols (Draft) were prepared based on the materials collected by the Preliminary Study Team, the results of the study made by PASCO and the information procured in Japan. The collected materials are listed below.

Table 12 List of Collected Materials

Source	No.	Contents
Materials related to TSDE	1	Government Ordinance for Public Works, Urbanization and Housing Organization (1990)
	2	List of Officials of Topographic Section
	3	List of Survey Equipment owned by Topographic Section
	4	Topographic Maps owned by Topographic Section (including the maps of Djibouti City)
	5	Report on 2008 Activities of Topographic Section
	6	Recommendations for Setup of Survey Department
	7	Main Statistics in the Country of Djibouti
	8	Road Route Maps of Djibouti
Others	1	Range of Barbara District for Topographic Mapping (French Agency of Development)
	2	Recommendation for Topographic Mapping of Barbara District (GeoBase)
	3	Recommendation for Topographic Mapping of Barbara District (Urbaplan)
	4	Materials of Djibouti Mapping Project (World Bank)
	5	Waste Treatment Facility Plan Map for the South of the International Airport of Djibouti (Delegation of the EU to Djibouti)
	6	Report on the Study of Mini-Dam Construction (Department of Large Energy and Water Works)
	7	Electricity Plant Management Diagram (Electricité de Djibouti)
	8	Brochure regarding investment in Djibouti (National Investment Promotion Agency)

3-2. Preparation of Inception Report (IC/R) [Work in Japan]

The Inception Report was prepared through analysis and examination of the Terms of Reference (TOR), the Report on the Preliminary Study and the above-mentioned collected materials. The issues pointed out in the meeting for discussion of the Inception Report held on March 8, 2012 were reflected in the Inception Report and English and French-language versions of the report were also prepared.

3-3. Explanation and Discussion of Inception Report (IC/R) [Work in Djibouti]

The Study Team discussed the content of the Inception Report with MET and explained the details of study, implementation policies, etc. The contents of explanation and discussion were summarized in minutes of meeting (M/M), which were signed by both the parties on mutual agreement (Appendix-3).

3-4. Discussion of Specifications [Work in Djibouti]

MET and the Study Team made discussions on the specifications of the 1/2,500 digital topographic maps and orthophotos to be created and determined to use the specifications of the topographic maps in this Study shown below in the discussion.

Table 13 Topographic Map Specifications Determined

Item	Matters Determined
Height criteria	As per the results of survey of existing benchmarks
Reference ellipsoid	GRS80
World geodetic system	ITRF2005
Central meridian	42°30′E
False_Easting (m)	130000.000
False_Northing (m)	0.000
Scale factor	0.9999
Items acquired for plotting	213 items
Contour intervals	Index contour: 10m; Intermediate contour: 2m
Map sheet size	1.5km × 2km
Annotation	Cette carte topographique a été réalisée conjointement par l'Agence Japonaise de Coopération Internationale (JICA) et le Gouvernement de la République de Djibouti, dans le cadre du Programme de Coopération Technique du Gouvernement du Japon.

Figure 6 Printed Map based on Determined Topographic Map Specifications

3-5. Collection and Sorting of Existing Materials [Work in Djibouti]

In addition to the information collected in the preparatory and preliminary works in Japan, related materials and information were also collected in Djibouti through the exchange of information with the counterparts and organizations related to other ongoing projects in Djibouti; information on the collected materials was incorporated into the Project under this Study and was used as reference materials for the utilization of the topographic mapping data and GIS basic data to be created in this Study.

3-5-1. Information on Existing Survey Results

The collection of existing survey results and field reconnaissance found some existing benchmarks and control points that can be used in this operation.

Table 14 Collection of Survey Results

Information	Description	Reflection on the Study
Existing control point	Origin N.8 and other several control points were confirmed. 	There were several existing control points, but their accuracy on the world geodetic system could not be confirmed. In this Study, therefore, two control points were selected and observed by the GNSS continuously for 48 hours in order to determine the coordinates of the control points in the world geodetic system through baseline analysis with the GIS points in neighboring countries.
Existing benchmark	Several benchmarks that can be used in this Study were confirmed. 	Several benchmarks were checked and after confirming that they could be used in this Study, those marks were included in the leveling routes to determine the elevation of each new benchmark.

3-5-2. Information on Agencies Expected to Utilize the Outputs of the Study

Following the collection of existing materials and the information available in Djibouti, interviews were held with the following agencies on the utilization of the outputs of the Project. The results of the interviews are provided in the next chapter.

Table 15 List of Interviewees

Name		Agency	Title
1	Ahmed Hassan Moyaleh	MET	Technical Adviser
2	Mohamed Moussa Ibrahim		Minister
3	Adou Ali Adou		Secretary
4	Mahdi Abdillahi Sougouleh		Vice Director of Department of Equipment
5	Hassan Ahmed Ibrahim		Chief of TSDE
6	Mohamed Ali Hassan		Director of Department of Equipment
7	Oumar Sow	Ministry of Housing, Urban Planning, Environment and Land Management	Urban Planning Expert
8	Warsama Ali		Mapping and City Planning Expert
9	Mohamed Ali Houssain		Vice Director
10	Nachoian Ahmed	Ministry of Water, Energy and Natural Resources	Water and Sanitary Survey Planning
11	Abdourahman Houssein		Assistant Director of Planning Department, Water and Sanitary Survey Planning

3-6. Fact-finding Survey on Promotion of Geographic Information Data [Work in Djibouti]

The results of interview survey on the above organizations have been summarized as basic data for future popularization methods and utilization promotion with a focus on distribution and selling statuses of geographic information data and the Djiboutian people's understanding of maps, etc. Consequently, the following problems were found as of the timing of interviews.

Table 16 Interview Results

Organization	Survey result
Ministry of Equipment and Transport (MET)	TSDE did not supply spatial information such as topographic maps and aerial photos to government organizations for a long time. Therefore, it does not exchange information nor share owned data with relevant organizations at all. To establish the Master Plan for Djibouti City, the Ministry of Housing, Urban Planning, Environment, and Land Management needs orthophotos and topographic maps, which must be provided by TSDE. Therefore, the rules for supplying spatial information (regarding duplication, storage, secondary usage, etc.) must be established promptly.
Ministry of Housing, Urban Planning, Environment, and Land Management	This ministry has started establishing master plans for five cities except for Djibouti City and already carried out aerial photography (resolution of 10 cm). This ministry, which is also going to establish the master plan of Djibouti city, intends to be supplied with topographic maps and orthophotos that will be developed in this Study. However, the scope of work in this Study does not cover the entire master plan area, and this ministry wants JICA to expand the range of orthophotos and topographic maps to be created.
Ministry of Water, Energy, and Natural Resources	The water and hygiene survey plan section is examining the improvement of water pipe network maps and pipeline ledgers. The current water pipe network maps (paper) are based on the topographic maps created by France more than 20 years ago and do not match the current status. Accurate information cannot be entered on them. Consequently, water pipes were accidentally broken during construction of roads and houses. The ministry wants to put the water pipe ledgers into an electronic form based on digital maps created in this Study and supply them to the government and parties concerned with construction.

3-7. Holding of (First) Seminars to Promote Utilization [Work in Djibouti]

A seminar to promote the utilization of topographic mapping data was held in the conference room of the Sheraton Hotel on March 24, 2012, during the preparation of this Study. Before the seminar, the outline of it was explained to the press including TV, radio, and newspaper reporters who were requested to cover it in their programs and articles.

In the seminar, an outline of this Study and the present status / problems of the geographic information in Djibouti were explained and discussed, and a request for cooperation in this Study was made. A total of 35 delegates participated in this seminar: 29 delegates from governmental agencies, international organizations and the press, and 6 members of the Study Team. Participants included 3 Ministers in the Government of Djibouti. (See Appendix-5.)

A number of questions and instructive comments about the aerial photography, target range of the plotting and the method of acquiring geographic information were put forward by the participants. The Ministry of Housing, Urban Planning, Environment and Land Management expressed a desire to expand the range of development of topographic mapping data, and there were strong indications of the need for and high expectations of up-to-date and reliable geographic information.

Figure 7 Scenes at the First Seminar

3-8. Control Point Survey [Work in Djibouti]

The aerial markers were installed and the control point survey conducted in accordance with the workflow shown below. As a result of the GNSS survey and leveling, the coordinates and heights (H) of the control points in the world geodetic system (ITRF2005) were acquired as shown below. In addition, the "List of Aerial Markers" and the "List of Pricking Points" were prepared so as to allow subsequent aerial triangulation work to be carried out efficiently.

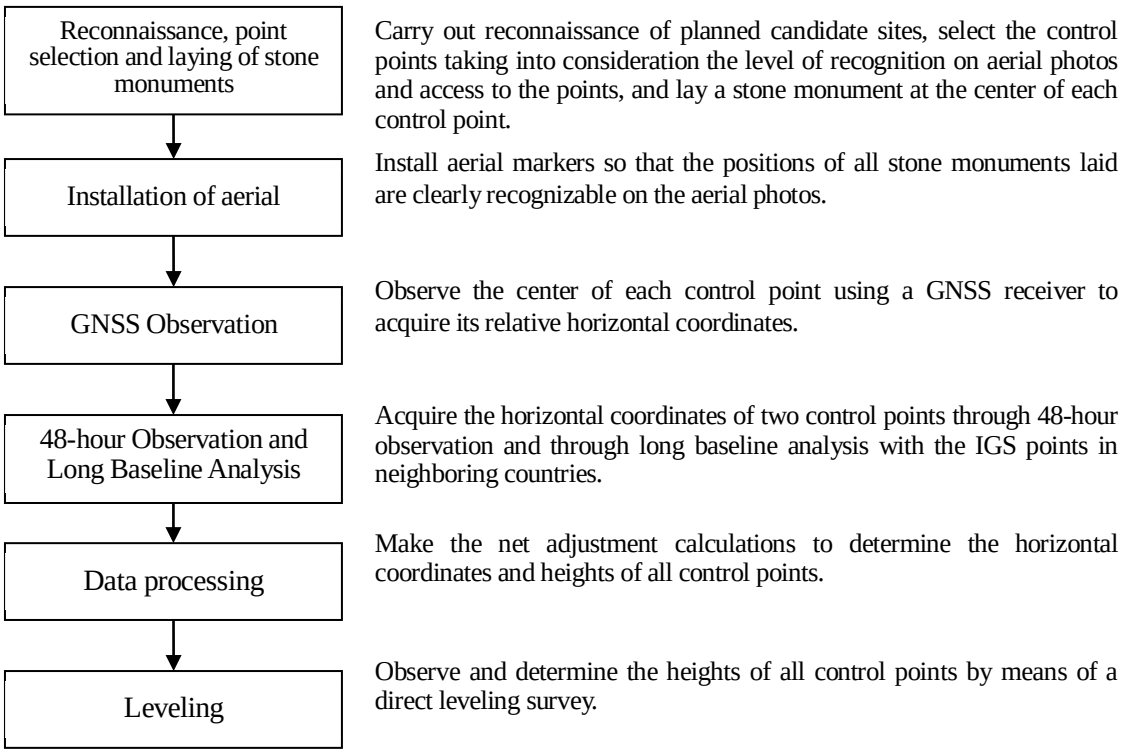


Figure 8 Flow of Control Point Survey Work

3-8-1. Reconnaissance, Point Selection and Installation (Monumentation)

The field reconnaissance of the planned candidate control points was carried out by the TSDE engineers using the topographic maps and handy GPS receivers, with the cooperation of the members of the Study Team. A total of 31 control points were selected that were easily recognizable on aerial photos. A reinforced concrete pile 40cm long was placed at the center of each point and a 20cm × 20cm hole dug around the pile. The hole was enclosed in a frame into which concrete was poured, thus securing the control point (monumentation).

Figure 9 Installation of Control Points

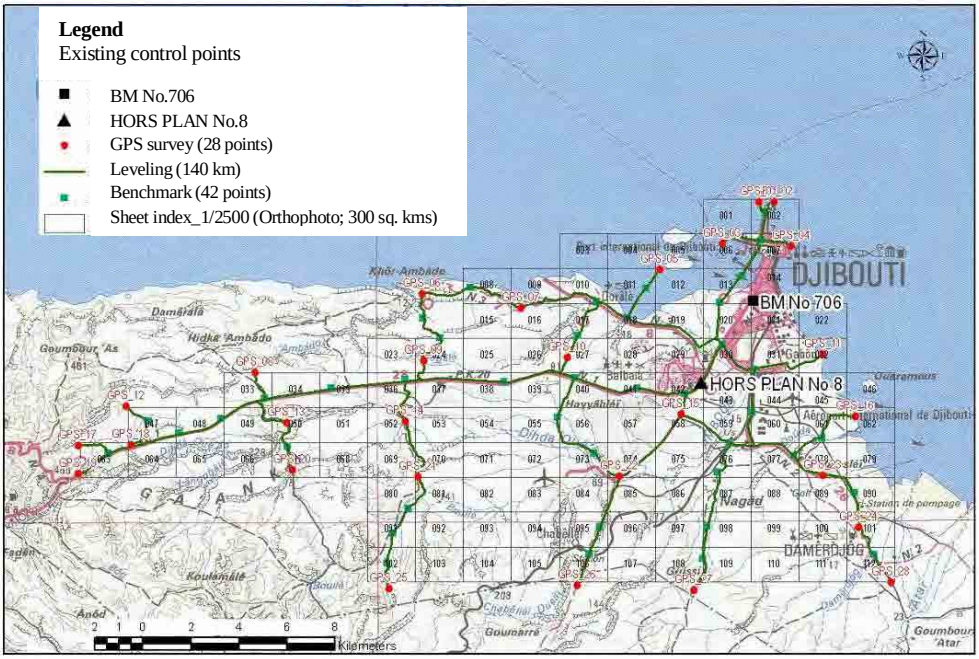


Figure 10 Map of Control Points

3-8-2. Installation of Aerial Markers

In parallel with the installation of control points, the aerial markers were installed so that each of the control points was clearly visible in the aerial photo and available for use as a benchmark for aerial triangulation. The aerial markers were designed to be white in color to provide a good contrast against its surroundings and in the form of cross. The length and width of each arm of the cross were 50 cm and 20 cm, respectively. To install the marker, the ground at the control point was dug out to a depth of approx. 5cm. This was filled with gravel and concrete was poured over the gravel. When concrete had set, the surface was painted with white paint.

Figure 11 Installation of Aerial Markers

3-8-3. GNSS Observation (Static positioning)

The 34 control points at which the aerial markers had been installed were observed using 4 GNSS receivers in the static positioning method, in which 4 control points are surveyed simultaneously (1 session) in accordance with the specifications given below. The observation accuracy per baseline was within 5ppm × baseline length.

The GNSS observation network map is shown below. Appropriate values were preset for the elevation angle and the number of satellites as well as the observation time in order to obtain high-accuracy positioning results.

Table 17 Specifications and Limit Values for GNSS Observation

	Item	Specifications or Limit Values	Remarks
A	GNSS receiver	Leica GS10 Double-frequency	4 units
B	Measuring accuracy	±5ppm×distance	Limit value
C	Elevation angle	15° or more	
D	Number of satellites	6 satellites or more	
E	Observation time	60 minutes or more	Per session
F	Epoch interval	15 sec.	
G	Maximum baseline length	Approx. 10km	

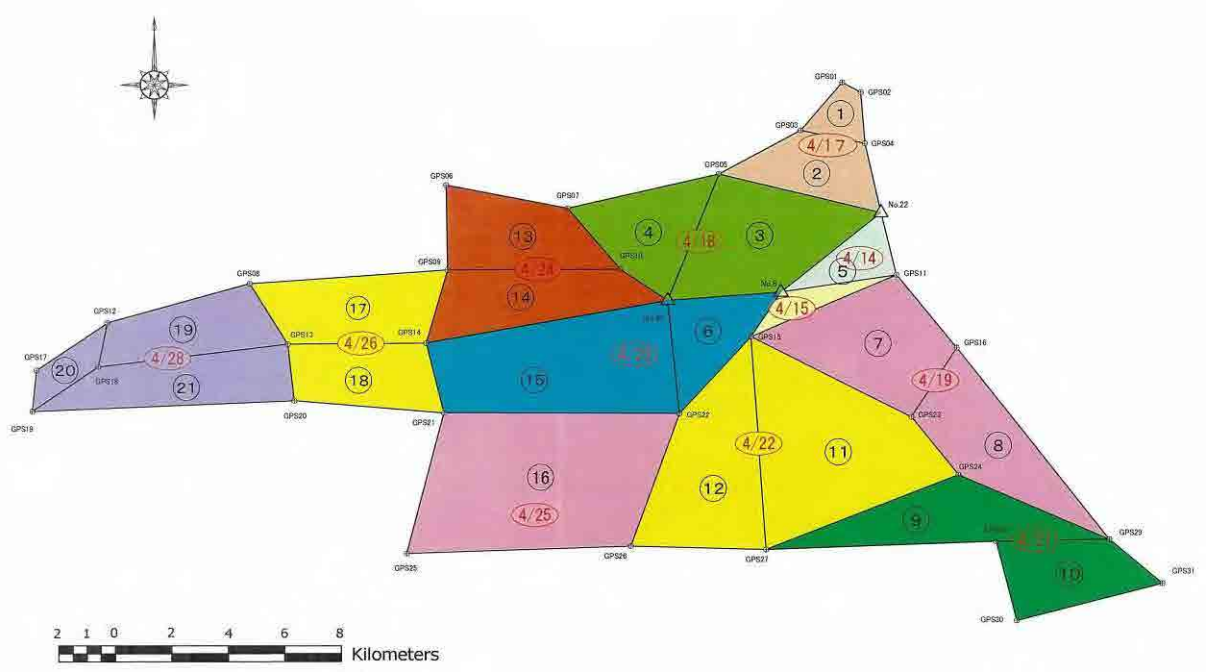


Figure 12 GNSS Observation Network Map (Session Implementation Map)


Figure 13 GNSS Observation (Left: GNSS observation; Right: Leica GS10 GNSS receiver)

3-8-4. 48-hour Observation/Long Baseline Analysis

As it was difficult to verify the accuracy of the existing control points on the world geodetic system as described above, No. 8 and 2 points of GPS18 were used as new reference origins for GNSS observation (static positioning) for a continuous 48 hours over 3 days, from April 8 to 10, 2012. Long baseline analysis between these observation data and the IGS points in neighboring countries was carried out to determine the latitude and longitude on the world geodetic system (ITRF2005).

The results are shown below. The coordinate values were adopted as the reference values for net adjustment of the GNSS observation network.

Table 18 Origins for GNSS Survey and Results of Long Baseline Analysis (ITRF2005)

Selected control point	Name of control point	Latitude	Longitude	Ellipsoidal elevation (m)
NO_8	NO.8	11°33′11.3857250″N	43°07′22.5391163″E	25.4007
GPS18	GPS18	11°31′45.1762378″N	42°54′14.7938461″E	345.7863

3-8-5. Data Processing

The net adjustment calculations were made using Leica Geo Office software based on the results of the GNSS observation.

First, a free-net analysis (without fixed points) was made to check the accuracy of the observations. Then, the reference origin (No. 8, GPS18) that had been determined using the GRS80 ellipsoid and the ITRF2005 world geodetic system was fixed in order to connect all the control points. Next, the net adjustment calculations were made. The resulting final coordinates were TM coordinates for which the central meridian was set to 42.5°.

The closure errors of the baseline vector between control points in the GNSS observation after the data processing are shown below. For all baselines, ambiguity (uncertainty) was resolved and fix solutions were obtained.

Table 19 Closure Error of Baseline Vector (Maximum) Limit Value: 0.10

Control point	dx	dy	dz
GPS1～GPS31	0.059	0.058	0.013

3-8-6. Leveling

In this Study, 9 surveyors (staff members) of TSDE and 8 workers divided into 4 groups participated in the leveling work under the control and supervision of the Study Team members during the period March 29 to April 15. On the routes where the calculated leveling differences in the two-way surveys exceeded the limit value, the surveys were repeated as necessary over the period April 16 to 18.

(1) Elevation Reference

When the survey results described above were checked, it was found that the only existing bench marks that could be used in this Study were 4 points within Djibouti City, in the east of the study area.

Figure 14 Existing Benchmarks (Left: No. 706; Right: R.N.228)

(2) Leveling Routes

The Study Team drew up a plan for the selection of leveling routes on the topographic map as part of the work in Japan before departure for Djibouti. Following this plan, the Study Team verified the existing benchmarks in Djibouti and discussed local conditions such as road conditions with the TSDE surveyors in order to make a final determination of the leveling routes.

For new routes for simple leveling, a survey to check the existing benchmarks was conducted to check that their elevations were correct before the leveling survey was started from those points. The figure below shows that the leveling was carried out on a total of 28 routes, the total length of which was 143km.

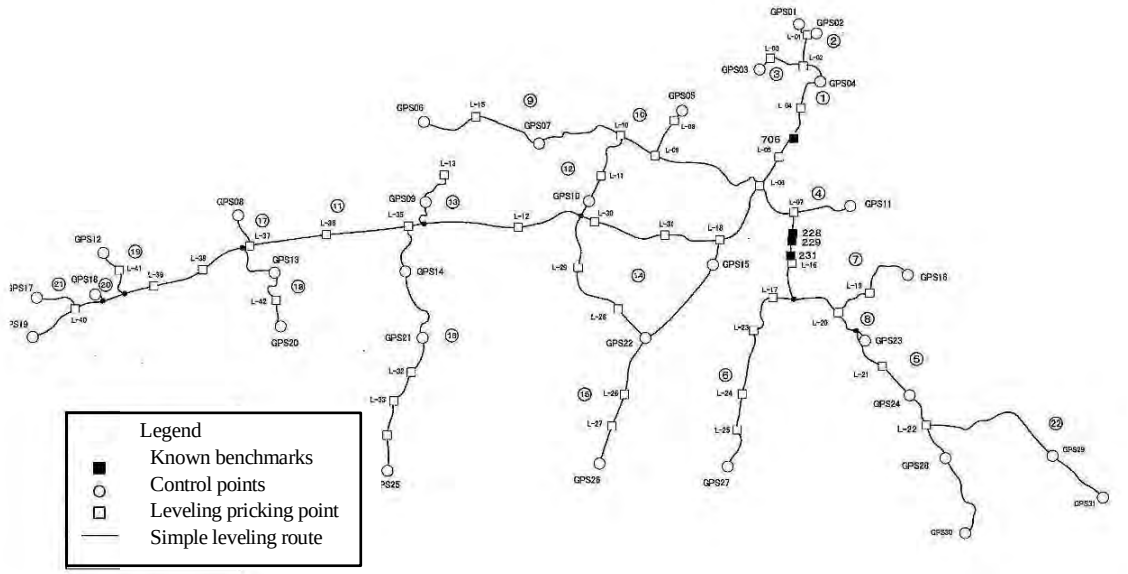


Figure 15 Simple Leveling Survey Map

(3) Leveling Survey and Calculations

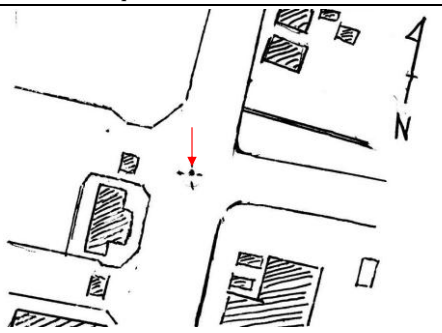
The leveling survey of the pricking points and the newly-installed GNSS points (control points) was carried out in accordance with the specifications given below. The data observed each day were calculated and checked each time they were observed. Those routes that exceeded the limit value were resurveyed. Before the final heights were calculated, the survey results were checked to ensure that they did not exceed the limit value.

Table 20 Specifications and Limit Values for Leveling

	Item	Specifications or Limit Value	Remarks
A	Equipment	Leica Sprinter 150M	4 units
B	Measuring Accuracy	±40mm√S	S: Distance between points in km
C	Observation	2 observation sessions (two-way)	
D	Pricking Point	At intervals of approx. 3km	On simple leveling route
E	Other	Observation of each horizontal point	Handy GPS

Figure 16 Leveling Work (Left: Leveling operation; Right: Control point observation)

CARACTÉRISTIQUES DE PIQUAGE POINT

Nom	Garmin-GPS		H (m)
	Longitude	Latitude	
Level-01	**E43° 08′ 51.8″**	**N11° 37′ 09.5″**	**2.138**
Croquis de la station et sa autour		**Photographie de la station (près)**	
			
Photographie de la station (milieu)		**Photograph of Aerial [C 1 No. 206]**	
			

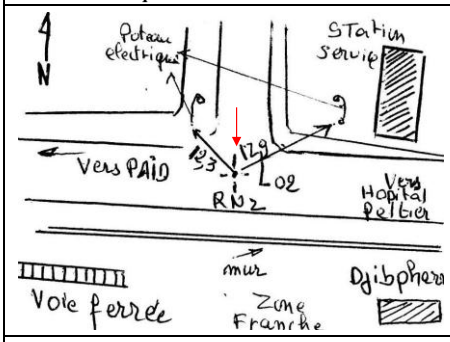
Nom	Garmin-GPS		H (m)
	Longitude	Latitude	
Level-02	**E43° 08′ 45.5″**	**N11° 36′ 30.4″**	**2.779**
Croquis de la station et sa autour		**Photographie de la station (près)**	
			
Photographie de la station (milieu)		**Photograph of Aerial [C 1 No. 206]**	
			

Figure 17 Benchmark Detail Register

Table 21 List of Geodetic Coordinates of Control Points

Control point	ITRF2005				Elevation	
GPS01	Lat.	11° 37' 22.20349" N	Lon.	43° 08' 42.23573" E	H	2.951 m
GPS02	Lat.	11° 37' 10.29375" N	Lon.	43° 09' 03.01778" E	H	2.350 m
GPS03	Lat.	11° 36' 25.23043" N	Lon.	43° 07' 51.93154" E	H	2.579 m
GPS04	Lat.	11° 36' 10.65139" N	Lon.	43° 09' 08.46440" E	H	6.864 m
GPS05	Lat.	11° 35' 35.46806" N	Lon.	43° 06' 14.28054" E	H	3.621 m
GPS06	Lat.	11° 35' 19.24176" N	Lon.	43° 00' 59.60672" E	H	58.500 m
GPS07	Lat.	11° 34' 56.75284" N	Lon.	43° 03' 08.18751" E	H	47.688 m
GPS08	Lat.	11° 33' 25.62816" N	Lon.	42° 57' 07.29129" E	H	210.184 m
GPS09	Lat.	11° 33' 43.25365" N	Lon.	43° 01' 01.28183" E	H	146.157 m
GPS10	Lat.	11° 33' 46.19489" N	Lon.	43° 04' 18.83725" E	H	89.197 m
GPS11	Lat.	11° 33' 38.90705" N	Lon.	43° 09' 44.62980" E	H	2.934 m
GPS12	Lat.	11° 32' 40.22756" N	Lon.	42° 54' 22.05384" E	H	318.523 m
GPS13	Lat.	11° 32' 15.96879" N	Lon.	42° 57' 50.59293" E	H	226.525 m
GPS14	Lat.	11° 32' 18.28128" N	Lon.	43° 00' 32.76661" E	H	150.439 m
GPS15	Lat.	11° 32' 26.25348" N	Lon.	43° 06' 54.34260" E	H	39.595 m
GPS16	Lat.	11° 32' 14.06704" N	Lon.	43° 10' 56.50237" E	H	1.298 m
GPS17	Lat.	11° 31' 45.12826" N	Lon.	42° 52' 59.54991" E	H	466.112 m
GPS18	Lat.	11° 31' 45.17624" N	Lon.	42° 54' 14.79385" E	H	358.238 m
GPS19	Lat.	11° 30' 58.37569" N	Lon.	42° 52' 54.11585" E	H	463.161 m
GPS20	Lat.	11° 31' 10.88254" N	Lon.	42° 57' 58.55375" E	H	234.873 m
GPS21	Lat.	11° 30' 57.18780" N	Lon.	43° 00' 52.36456" E	H	153.054 m
GPS22	Lat.	11° 30' 57.87367" N	Lon.	43° 05' 29.56040" E	H	53.338 m
GPS23	Lat.	11° 30' 53.31414" N	Lon.	43° 10' 02.90515" E	H	38.778 m
GPS24	Lat.	11° 29' 46.78964" N	Lon.	43° 10' 58.79726" E	H	7.550 m
GPS25	Lat.	11° 28' 15.99326" N	Lon.	43° 00' 09.40944" E	H	233.839 m
GPS26	Lat.	11° 28' 23.87734" N	Lon.	43° 04' 32.91991" E	H	176.307 m
GPS27	Lat.	11° 28' 20.32328" N	Lon.	43° 07' 13.18170" E	H	100.792 m
GPS28	Lat.	11° 28' 29.85544" N	Lon.	43° 11' 42.71470" E	H	14.540 m
GPS29	Lat.	11° 28' 32.63250" N	Lon.	43° 13' 57.91054" E	H	4.243 m
GPS30	Lat.	11° 26' 57.22700" N	Lon.	43° 12' 07.97330" E	H	71.319 m
GPS31	Lat.	11° 27' 41.14292" N	Lon.	43° 14' 59.81272" E	H	2.642 m
No.22	Lat.	11° 34' 44.70669" N	Lon.	43° 09' 31.92113" E	H	9.624 m
No.40	Lat.	11° 33' 06.22425" N	Lon.	43° 05' 24.90712" E	H	127.190 m
No.8	Lat.	11° 33' 11.38572" N	Lon.	43° 07' 22.53912" E	H	38.721 m

3-9. Aerial Photography [Work in Djibouti]

In this Study, aerial photography was conducted by means of the digital aerial camera using the most up-to-date GNSS /IMU technology in the following workflow:

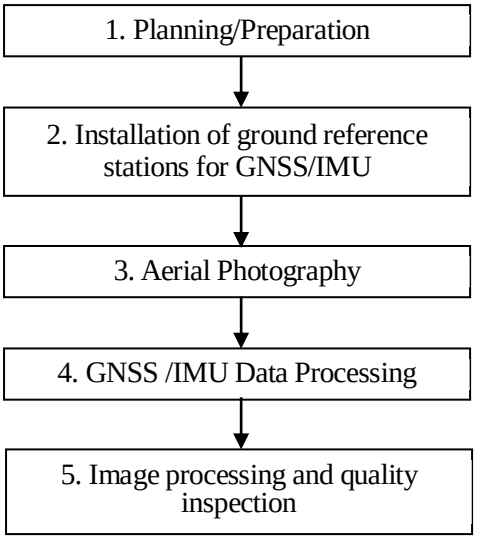


Figure 18 Aerial Photography Workflow

3-9-1. Planning and Preparation

The aerial photography courses were selected in the east-to-west direction in order to secure the overlap rate and side lap rate specified. The aerial photography work was conducted on the photography routes shown in the figure below in order to avoid an imperfect model of the shore lines and to obtain a higher degree of accuracy in aerial triangulation.

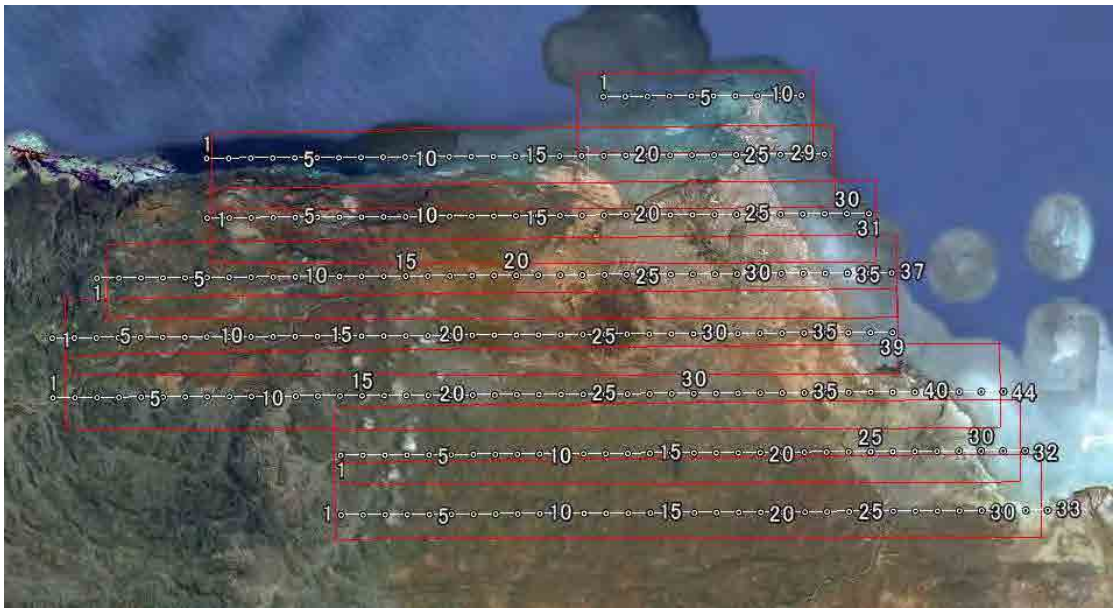


Figure 19 Implementation Map for Aerial Photography

3-9-2. Installation of Ground Reference Stations for GNSS/IMU

As a result of reconnaissance of ground reference stations that can be used as GPS/IMU base stations, the GPS04 and GPS11 control points in Djibouti City were selected as the ground reference stations to be used for data acquisition, where GNSS receivers and antennas were installed.

In the photography, the above ground reference stations and GNSS receivers installed on aircraft were used to conduct simultaneous observation to record the positions and inclinations of cameras during aerial photography.

Table 22 GNSS/IMU Survey

Control Point	GPS Receiver Site	GPS Receiver Model	Data Recording Interval (sec.)
GPS04	In Djibouti City	Leica GS10 GPS	1.0
GPS11	In Djibouti City	Leica GS10 GPS	1.0
CCNS4	Aircraft	CCNS4 GPS navigation system Aerocontrol IMUIIe system	0.5

3-9-3. Aerial Photography

Aerial photography was conducted according to the specifications shown below. After photography, the aerial photos were checked to ensure that they had the quality required for subsequent operations, digital plotting and creation of orthophotos.

Table 23 Specifications for Aerial Photography

Item	Specifications
Ground resolution	20cm
Type of photography	Digital color photography (TIFF format)
Photographic courses	8 courses; Total flight length: approx. 229.7km
Number of photo images	Approx. 262 sheets
Aircraft used for photography	Piper PA-23 (Aztec) Reg. F-GORP
Camera	Digital camera for aerial photography (Vexcel UCXp*)
Altitude above ground level	3,400 – 3,650m
Overlap	Overlap rate : 60±5% Side lap rate: 30±5%
Tolerable cloudiness	Less than 3% over 5 continuous photo sheets
Requirements for photography	The coordinates of the principal point of a photo were obtained by DGPS* and the elevation angle was obtained by IMU*.

*UCXp: UltraCam-Xp, Airbone digital camera by Vexcel
*DGPS: Differential GPS using technology to enhance the measuring accuracy of GPS.
*IMU: Inertial Measurement Unit using the principle of inertia

Figure 20 Photographic Equipment (Left: Airplane; Right: Digital camera, GNSS/IMU)

3-9-4. GNSS/IMU Data Processing

The GNSS observation data (0.5 to one second intervals) and IMU data (1/200 second intervals) that were obtained during aerial photography were analyzed in combination to calculate and determine with high accuracy the camera positions and inclinations (exterior orientation elements) when each of the photos were taken. The GrafNav software (version 8.2) was used for the analysis.

3-9-5. Image Processing and Quality Inspection

The image processing from acquired raw images to final TIFF images was conducted using the Microsoft Ultramap image processing software (version 2.1). After that, images were corrected by adjusting the color balances, minimizing the hot spot effects of sunlight, and processing of shaded areas of mountains so that the subsequent operations such as aerial triangulation and digital plotting can be properly conducted.

After image processing, photos for inspection were created according to the Survey Specifications and then inspected for obstructions such as clouds and halation, appropriateness of overlaps and sidelaps, and conformance of image merge processing. The Study Team members in charge conducted inspections on the principal point base line length, rotation (κ), inclination angle (ω, φ), and track deviations from the calculated exterior orientation parameters and created an accuracy control table according to the Survey Operation Manual of JICA.

3-10. Aerial Triangulation [Work in Japan]

The aerial triangulation was conducted using aerial photo image data that had undergone image processing, exterior orientation elements calculated in the GNSS/IMU data processing, and coordinates of control points as shown in the flowchart below.

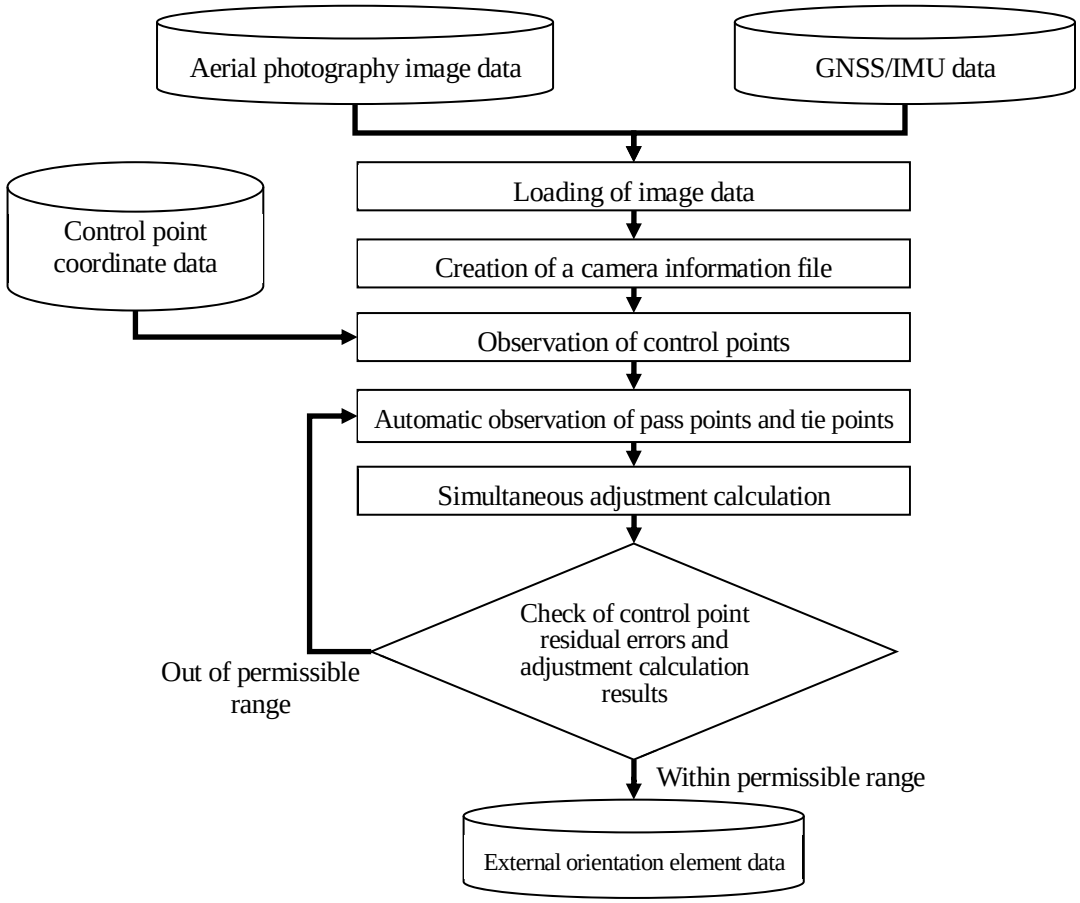


Figure 21 Aerial Triangulation Workflow

3-10-1. Loading of Image Data

The aerial photo image data that had undergone image processing was imported and loaded into the software using the exterior orientation elements calculated in GNSS/IMU. These aerial photo images and the control points have a positional relationship shown in the figure below.

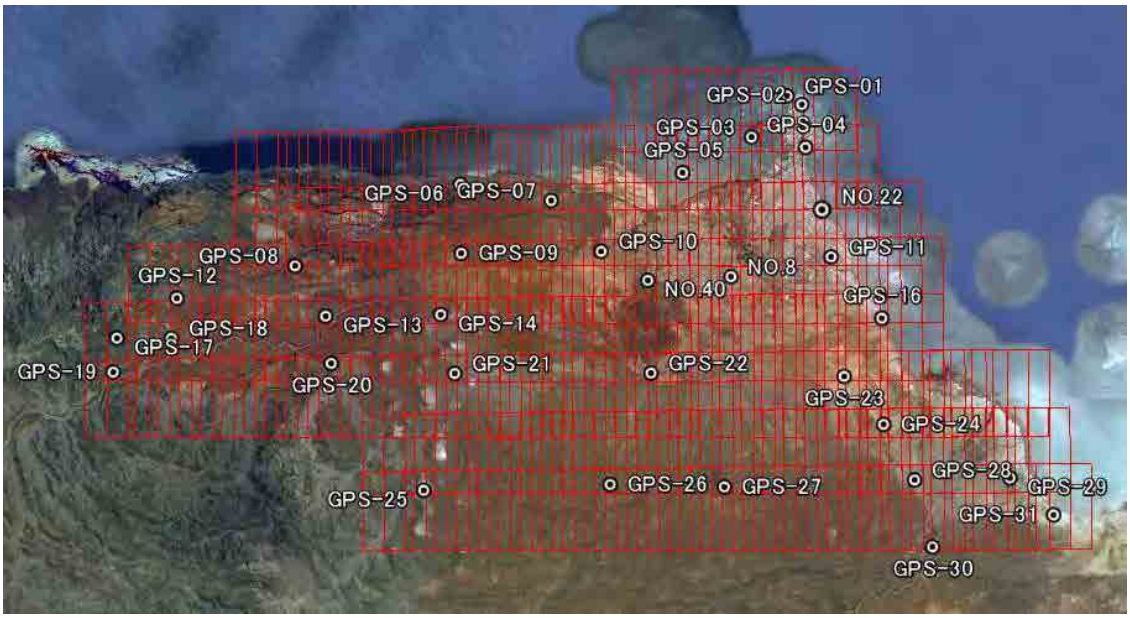


Figure 22 Positions of Aerial Photo Images and Control Points

3-10-2. Creation of a Camera Information File

The data on the specifications of the digital camera used for the aerial photography (including focal length, image size, pixel size, principal point and rotation) were entered in the software to create the camera file.

3-10-3. Observation of Control Points

Aerial markers (control points) were checked on aerial photo images, and the coordinate values of central positions on the photos were observed.

Figure 23 Observation of Aerial markers (Control Points)

3-10-4. Automatic Observation of Pass Points and Tie Points

Using the image matching technology of digital photogrammetry, pass points and tie points in the overlapping of neighboring photos were automatically observed, and the results were visually inspected.

Figure 24 Automatic Observation of Pass Points and Tie Points

3-10-5. Simultaneous Adjustment Calculation

The simultaneous adjustment calculation was conducted using the Bundle adjustment method, *i.e.*, connecting in space the points corresponding to the observed control points and pass points/tie points in the photos and identifying the relations between the photos to calculate the exterior orientation elements of each image in the entire model. The residual errors and limit values of control points after the adjustment calculation were as shown in the table below.

Table 24 Residual Errors of Control Points

Block		Resolution 20cm	
		Residual Error	Limit Value
Standard Deviation (m)	Horizontal Position	0.05	0.50
	Elevation	0.04	0.50
Maximum (m)	Horizontal Position	0.10	1.00
	Elevation	0.12	1.00

3-10-6. Acquisition of External Orientation Elements

The coordinate values and elevation angle of the principal point of each photo image were obtained from the results of the simultaneous adjustment calculation of the results of the aerial triangulation.

	1	2	3	4	5	6	7
1	Photo_ID	Omega	Phi	Kappa	Easting	Northing	Height
2	1000204	-0.031587958	0.036662954	-3.123143094	202148.611	1284679.784	3349.27
3	1000205	-0.022069033	0.025539643	-3.093418152	201243.891	1284671.132	3342.439
4	1000206	-0.044416547	0.054135992	-3.055732879	200331.18	1284672.428	3339.671
5	1000207	-0.028497537	0.0109864	-3.10595228	199428.864	1284649.509	3333.078
6	1000208	-0.0350309	0.043765398	-3.083405465	198526.134	1284637.532	3336.332
7	2000214	0.001489116	0.001341459	0.01021132	185870.294	1282101.695	3473.967
8	2000215	0.00322328	0.00185353	0.009831923	186781.374	1282112.051	3472.388
9	2000216	0.001952502	0.0014844	0.011559733	187680.48	1282125.758	3481.054
10	2000217	0.002469294	0.00144827	0.012097839	188586.188	1282129.513	3492.877
11	2000218	0.003337949	0.002062444	0.011188181	189490.339	1282128.924	3488.573
12	2000219	0.003735357	0.001405853	0.010010146	190402.389	1282137.835	3476.325
13	2000220	0.002183409	0.001474974	0.010582376	191300.939	1282155.956	3477.307
14	2000221	0.001195378	0.001861392	0.009585916	192205.463	1282164.744	3484.951
15	2000222	0.001795423	0.001616347	0.010617252	19311.092	1282164.081	3476.661
16	2000223	0.002546268	0.002301209	0.010964582	194017.013	1282176.286	3480.269
17	2000224	0.002324781	0.001418425	0.010995418	194920.071	1282187.504	3484.286
18	2000225	0.003529583	0.001523663	0.010624201	195824.486	1282194.581	3485.935
19	2000226	0.003501311	0.001765564	0.00987884	196726.368	1282203.243	3487.409
20	2000227	0.003102328	0.001855102	0.011234863	197636.939	1282202.954	3477.18

Figure 25 Examples of External Orientation Elements

3-11. Creation of Orthophotos [Work in Japan]

Orthophotos were created using the digital aerial photo image data and data on the external orientation elements obtained from the aerial triangulation. In creating the orthophoto images, the method of using 20m-grid DEM (digital elevation model), which was automatically extracted and corrected by correlation of stereo model images, to correct the heights in the digital aerial photos and to transform the orthophotos into a horizontal coordinate system was used. As an orthophoto image was created for each model unit, the work of edge matching between models (mosaic processing) was carried out to create an ortho-image of the entire area of work. After that, the map sheets were divided into the 1/2,500-scale map sheets.

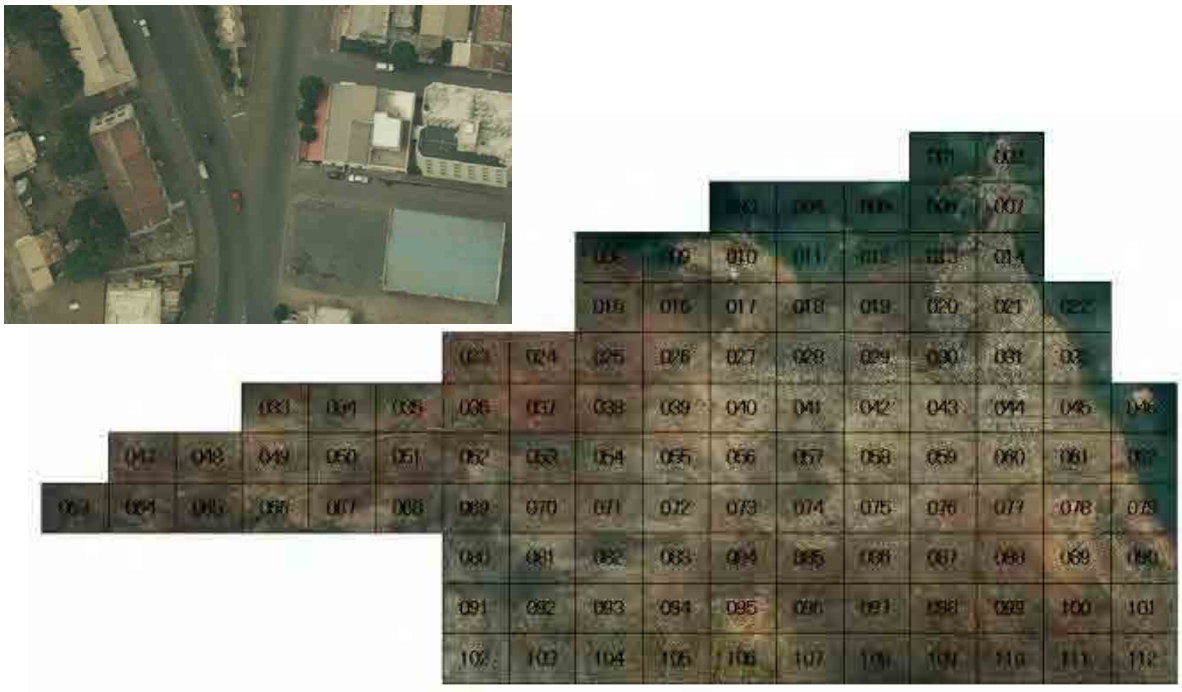


Figure 26 Created Orthophoto Image

3-12. Preparation of Progress Report (PR/R) [Work in Japan]

The details and results of works done so far and the progress of those works were summarized to prepare the Progress Report. The created report was explained to and approved by JICA before it was brought to Djibouti.

3-13. Explanation and Discussion of Progress Report (PR/R) [Work in Djibouti]

The explanation of the Progress Report was made to MET so that discussions could be held with them on a series of processes, from the control point survey and aerial photography to aerial triangulation and orthophoto creation, the results of the promotion of the utilization of the outputs in this Study, and future plans. In the meeting for the explanation and discussions, the presentation of the details of the PR/R was provided using PowerPoint. The discussions were recorded as the minutes of proceedings, which were signed by both parties (See Appendix-6).

3-14. Field Verification [Work in Djibouti]

The objects not easily identifiable in aerial photos such as planimetric features and buildings, linear objects (electric transmission lines and pipelines), public facilities (including water places), road types, administrative boundaries, annotations, etc. were identified and checked in the study area using photo maps, *i.e.*, outputs of orthophoto images. Regarding these target objects, existing materials were collected and an interview survey was conducted at MET and other public organizations. The flowchart of the field verification is shown below.

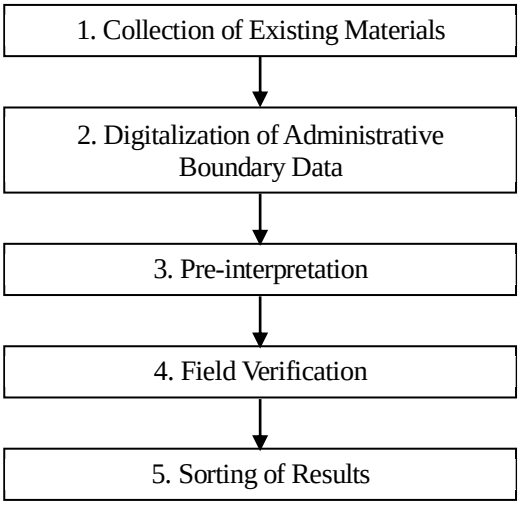


Figure 27 Field Verification Workflow

3-14-1. Collection of Existing Materials

The following topographic maps were acquired for the identification of items to be verified in the field identification and as supplemental information for the field identification:

Table 25 Existing Topographic Maps Acquired

Scale	Year of Creation	Quantity (Sheets)	Remarks
1/500	1970	76	Created by SOFRATOP
1/1,000	1982	23	Created by SOFRATOP
1/5,000	1989	3	Created by IGN, France
1/10,000	1989	3	Created by IGN, France
1/20,000	1989	5	Created by IGN, France
1/100,000	1962	6	Created by IGN, France

*SOFRATOP: A French private company

3-14-2. Digitalization of Administrative Boundary Data

Administrative boundaries and administrative names were verified in the field verification using the data on them acquired from TSDE. The vector data created with the CAD software were corrected on the basis of the information obtained from the interview survey of residents in the study areas.

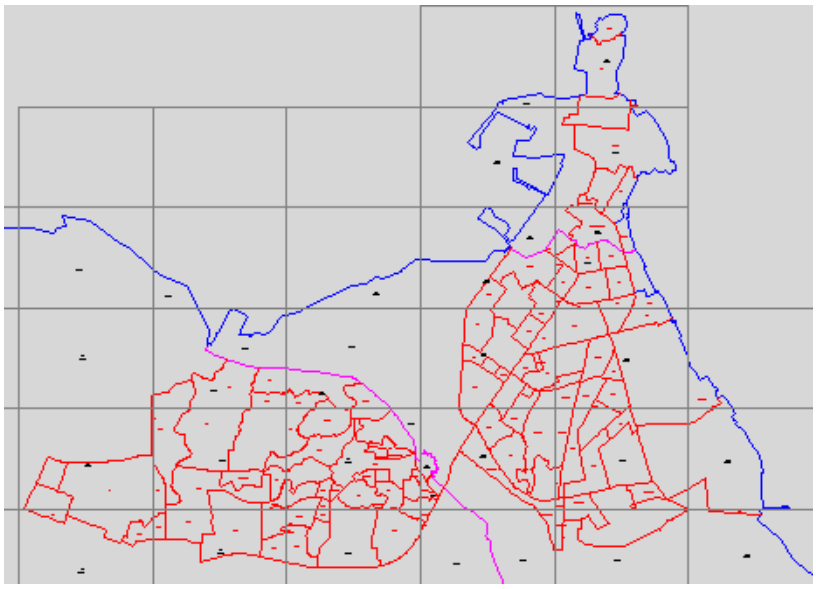


Figure 28 Digitalized Administrative Boundary Data

3-14-3. Pre-interpretation

A map symbol chart for field verification was created before the field verification was conducted. The pre-interpretation operation was conducted by comparing the existing topographic maps and the photo interpretation results. The planimetric features identified in the pre-interpretation operation were marked and summarized on the photo maps for field verification.

Table 26 Equipment and Materials Used in Pre-interpretation

	Description	Remarks
1	Black/white printed orthophoto maps (1/2,500)	1 map size: 40cm×55cm
2	Rotring pens and pencils	Red, green and blue
3	Drawing board	
4	Athlon tape and convex measure	50m
5	Eraser	

Figure 29 List of Symbols for Field Verification

3-14-4. Field Verification

The field verification was conducted in three teams (each consisting of four persons, a Japanese engineer, a Djiboutian counterpart engineer, a survey assistant, and a driver). Out of the 213 types of planimetric features represented on topographic maps, 161 types that could not be correctly interpreted on the aerial photos were verified, and the results were marked on the photo maps using pens in ink colors listed in the symbol chart for field verification. The names of roads, wadis, hospitals, airports, and central government ministries and agencies were also checked in the field verification.

For the sake of efficient operation, one special team was organized to carry out the survey on administrative boundaries, administrative names, and road widths.

The field verification was not conducted on mountains, ports, and military facilities because of difficulty of access to them. They were investigated through desk-based photo interpretation.

Figure 30 Field Verification Operation (Left: Pre-interpretation, Right: Interview Survey)

3-14-5. Sorting of Results

The results of field identification were marked on photo maps for field identification which were then scanned into a digital form so that they were easy to use in subsequent operations.

Figure 31 Example of Photo Map with Field Identification Results Marked on It

3-15. Digital Plotting and Compilation [Work in Japan]

The aerial photo image data was imported into a digital plotter based on the aerial triangulation results to create stereo models. The created stereo images were seen in stereoscopic view on the digital plotter to carry out the digital plotting operation in which 3D coordinates of topographic and planimetric features were obtained.

While referring to image data of the field verification results, the forms and positions of topographic and planimetric features were entered as coordinate data to create blank digital plotting map data.

In the digital compilation, the data after the digital plotting was processed in the connection processing,

closure processing, joining processing between neat lines, etc. and was added with annotation data to develop compiled topographic mapping data. For the digital compilation operation, AutoCAD Map3D, CAD software, was used to unify the application with digital plotting and thus improve the operation efficiency.

Questions asked during the digital plotting and digital compilation operations and points that could not be easily identified in photo interpretation were selected as targets of field completion.

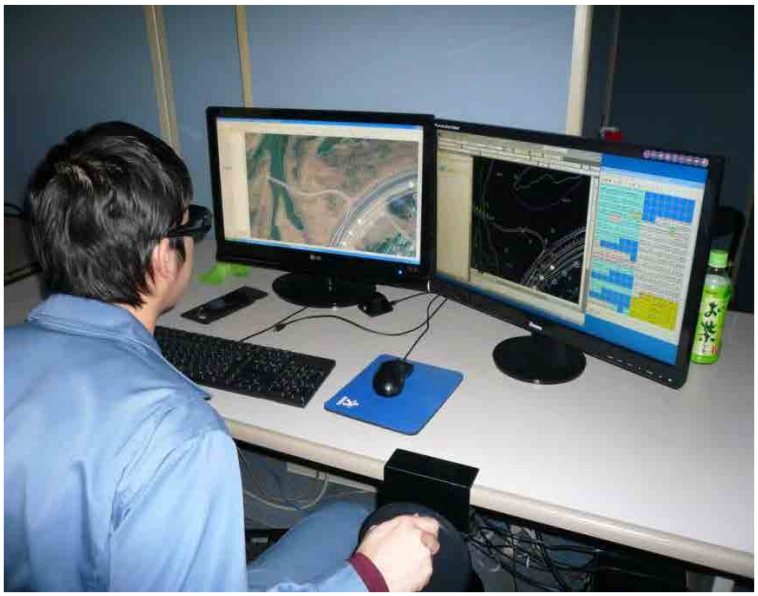


Figure 32 Digital Plotting Operation

Figure 33 Digital Plotting Data

3-16. Discussion and Proposal of Methods for the Publicizing and Supply of Geographic Information Data [Work in Japan]

The draft plan for data disclosure and dissemination methods was formulated. Based on this draft plan, discussions on the mapping data dissemination method, how to keep mapping data up to date and future PR activities were held at meetings with the persons in charge from ministries of Djibouti related to geographic information data.

Table 27 Items for Discussion

Category	Work Items (and Information to be Acquired)
Means of Distribution	➢ Types, selling methods, amounts, purchasers, etc. of geographic information (both paper and data forms) sold or procured at present ➢ Measures to protect copyright in the case of digital sales ➢ Examination, problems, etc. of distribution channel organizations for output data of this Study
Users	➢ Simple GIS demonstration using the output data of this Study (from the Study Team to the related Djiboutian agencies) ➢ Quantities of hardware and software in possession of relevant agencies ➢ Specific ideas for utilization of the output data of this survey by the relevant organizations ➢ Implementation of technology transfer and participation in the final seminar in this Study for the engineers of the relevant organizations

3-16-1. Review of Methods of Providing Geographic Information

Summarized below are the results of past and present interview surveys of related agencies regarding the provision of geographic information (both paper and data forms). Agencies experienced in handling or marketing topographic maps and thematic maps in the past and at present were the Djibouti Center for Research Studies: Centre d'Études et de Recherche de Djibouti (CERD), the Department of Statistics and Population: Direction de la Statistiques et des Études Démographiques (DISED), and the Department of Housing and Urban Planning.

If the output data is to be supplied after the completion of this Study, it is necessary to examine a proper price for it in consideration of the topographic map printing cost (including labor cost), equipment depreciation cost, topographic map update cost, maintenance cost, and consumable item cost while referring to the information of prices of thematic maps and topographic maps currently available in the Republic of Djibouti.

Table 28 Status of Provision of Topographic Mapping Data

Name of Agency		Materials Handled (Topographic and Thematic Maps)	Price (DJF/Sheet)	Remarks
1	Djibouti Center for Research Studies (CERD), Ministry of Higher Education	Various types of thematic map (1/100,000: Vegetation maps, topographic maps, geological maps, etc.)	6,000	Currently on sale All printed maps (printed by IGN, France) The data may be purchased, but is limited to academic or public use.
		Topographic maps (1/100,000)	1,500	
		Topographic maps (1/200,000)	2,500	
2	Department of Housing and Urban Planning, Ministry of Housing, Urban Planning, Environment and Land Management	Topographic maps (1/5,000)	2,500	All printed maps Out of stock and currently not on sale.
		Topographic maps (1/10,000)	2,500	
3	Department of Statistics and Population (DISED), Ministry of Higher Education	Various types of land boundary map		Distributed free of charge (with the permission of the Director General of the Department of Statistics)

Figure 34 Development of Physical Infrastructure for Sales Contact(Left: Current TSDE; Right: CERD)

3-16-2. Survey of Topographic Mapping Data Users

In order to discuss and review methods of updating and the wider utilization of topographic mapping data, interview surveys, including demonstrations of the data created in this Study, were carried out of those public agencies that could be expected to be users, based on the results of past surveys of related agencies.

A demonstration including the introduction of free GIS software was also given to agencies that had no software which enabled browsing and editing of vector and raster data, to enable them to share actual images relating to the utilization of the outputs of this Study, when the interview surveys were conducted at those agencies.

Many officials of the related agencies showed a great deal of interest in the demonstration of GIS utilization, and active exchanges of opinions with them took place. (For the questionnaire, refer to Appendix-7.)

Table 29 Results of User Survey

Name of Agency		Equipment Owned	Materials Owned	Utilization to be Expected
1	Department of Statistics and Population (DISED)	ArcGIS: 2 sets	Census data (Text)	Relation of census results to positional information Detailing and updating of land boundary information
2	Djibouti Center for Research Studies (CERD)	ArcGIS: 3 sets	Various types of thematic data	Creation and analysis of hazard maps (floods and earthquakes) of Djibouti City
3	Electricité de Djibouti (Electricity of Djibouti)	AutoCAD: 5 sets	Electrical facility data (transmission lines, towers, etc.)	Planning and management of electrical facilities Efficient construction and rehabilitation works through shared use of underground facility information (ONEAD, Djibouti Telecom)
4	Cadastral Division	INFOCAD: 3 sets Conversion to ArcGIS is under consideration	Land boundary data	Detailing and updating of boundary information
5	Djibouti National Water and Sanitation Office (ONEAD)	ArcGIS: Several sets AutoCAD: Several sets	Positional data of wells; Service water and sewer data	Management of facilities such as wells, and service water and sewage works; Digitalization of rainwater gutter maps; Efficient construction and rehabilitation works through shared use of underground facility information (Electricity of Djibouti and Djibouti Telecom)
6	Department of Housing and Urban Planning	ArcGIS: 1 set AutoCAD: 1 set	Basic urban planning maps	Detailing of basic urban plans
7	Department of Environment	ArcGIS: 1 set	Forest distribution data; Mangrove distribution data	Updating of forest and mangrove distribution
8	Division of Large Construction, Department of Agriculture	ArcGIS: 1 set AutoCAD: 1 set	Embankment data (shared use with other agencies)	Management, analysis and planning of embankment data
9	Office de la Voirie de Djibouti (OVD) (Djibouti Road Maintenance Office)	None		Retrieval of garbage collection routes; Waste volume control; Control of illegal dumping sites
10	Department of Citizen Protection, Ministry of Interior and Decentralization	None	Register of accidents (Traffic accidents, diseases, fires, etc.)	Management of information on buildings with fire risk, route retrieval, fire history management, and retrieval of areas problematic for fire engine activity
11	Djibouti City Hall	ArcGIS: 1 set Illustrator: 1 unit		Detailing of basic urban plans
12	University of Djibouti	ArcGIS: 32 sets		Use as educational tools

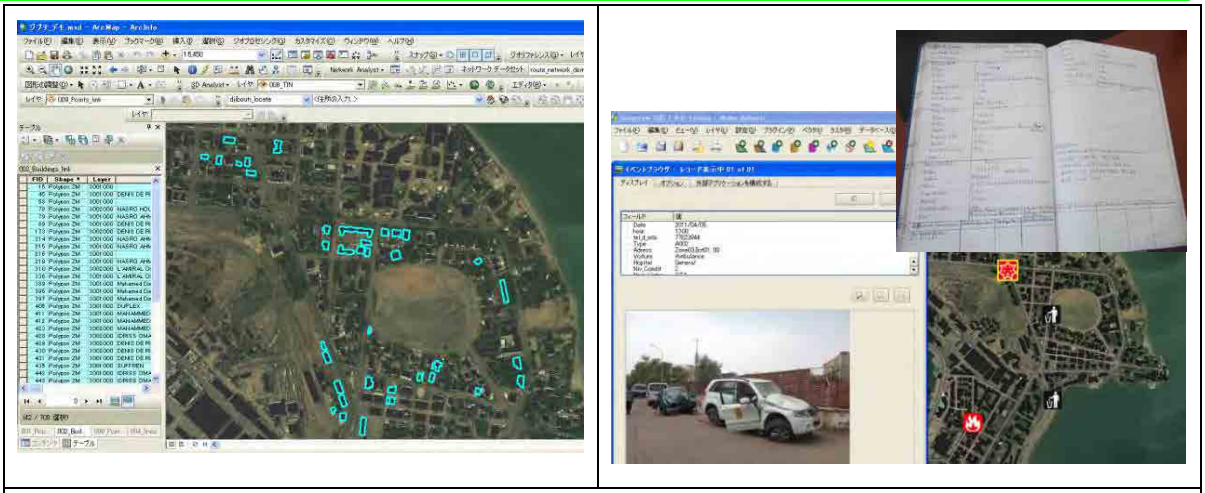


Figure 35 Examples of Utilization (Left: ArcGIS; Right: Free GIS Software)

3-16-3. Problems and Other Matters in Promotion of Geographic Information Data

Based on the questions asked in the interview survey conducted in the current operation in Djibouti and the results of field work, the possible problems in promotion of the output data of this study are as shown below.

- Which agency will actually exert leadership in the shared use of data (for marketing, management and updating of data)? (It was advised that it would be difficult for any agency other than the higher rank of agency, such as the Presidential Office, or for any agency under the direct control of a Ministry, to coordinate with other agencies.)
- Which agency using what system will be responsible for data updating, and will it be provided with sufficient personnel and equipment? To what scale will personnel and equipment be required? Will technology transfer as part of this Study be essential in raising their technical level to an adequate level?
- Which agency using what system will be responsible for data marketing, and how will the selling prices and measures against illegal copying of digital data be determined?

The results of discussions held in this Study will be compiled into the final plan for the promotion of geographic information, and recommendations will be made at the final seminar. At the final seminar, publicity activities will include requesting the mass media to report on this Study and introducing details of the work carried out in this Study in the form of visually impressive data, including orthophotos. At the same time, posters will be prepared and distributed to advertise the completion of the new geographic information data in the very near future.

3-17. Preparation of Interim Report (IT/R) [Work in Japan]

The details, results and progress of the work done were summarized to prepare the Interim Report. The created report was explained and examined in a meeting with JICA, modified to reflect the examination results, translated into English and French, and bound into book form.

3-18. Explanation and Discussion on Interim Report (IT/R) [Work in Djibouti]

3-18-1. Explanation and Discussion on Interim Report

The created interim report was explained to and discussed with MET. For the explanation and discussion, a PowerPoint slide that summarized the contents was prepared and used in the presentation. The contents of discussion were summarized in minutes of meeting (M/M), which were signed by both the parties (See Appendix-8).

Figure 36 Discussion on Interim Report (Left: Discussion on report, Right: Explanation of technology transfer to stakeholders)

3-18-2. First Stakeholder Meeting

A stakeholder meeting on the utilization of topographic data was held, attended by the current and future relevant organizations as stakeholders and users. The agenda and comments made by participating and other organizations are shown below (See Appendix-9 for the meeting minutes).

All the participating organizations gave positive responses about the importance of data update and sharing. About the operation, however, there were many topics that needed continued discussion after the end of this study period, such as enhancement of expert staff and equipment and establishment of a department in charge. Therefore, the discussion will be continued in the second stakeholder meeting to be held at the time of explanation and discussion on the Draft Final Report.

- Explanation of outline and progress of the project
- Discussion on data sharing
- Discussion on the data update system
- Discussion on the digital data sales system

Table 30 Participating Organizations and Comments in First Stakeholder Meeting

Organization name		No. of participants	Comments
1	Ministry of Equipment and Transport	5 including cabinet chief	Will support the operation by making the most of the information owned by the organizations. As for the establishment of an organization for updating and utilization of data, the stakeholders should take time to establish a system.
2	Department of Citizen Protection, Ministry of Interior and Decentralization	1, deputy chief	This organization takes charge of construction permits for structures and disasters. It is positive about technical improvement of expert staff and data sharing.
3	City of Djibouti	2 including deputy mayor	Wants to consider positively human resource development, establishment of a department in charge of topographic maps, and cooperation with the stakeholder committees.
4	Department of Housing and Urban Planning (DHU)	2 including director	To provide coordination in the topographic mapping operation including data update, it is necessary to open a department in charge, which must have two or three experts and required equipment. This organization agrees to share data owned by it.
5	Djibouti Electricity (EDD)	2 engineers	Supplies the owned data.
6	Djibouti Center for Research Studies (CERD)	1, secretary general	The establishment of an information sharing network is important. To manage and update the result of this study, it is necessary to establish an organization in charge. For this purpose, the needs and scope of investment (securing of budget and equipment) must be identified. The utilization of existing telecommunication tools can be examined.
7	Djibouti National Water and Sanitation Office (ONEAD)	1, section chief	Supplies the owned data.
8	JICA Djibouti Office	1, advisor	
9	JICA Study Team	5 including team leader	

3-19. Field Completion Survey [Work in Djibouti]

In the field completion survey, unknown places found in the digital plotting and digital compilation operations and important items for user organizations are checked after the pre-interpretation operation using 1/2,500 maps created using the data that had undergone digital plotting/compilation as shown in the flowchart below.

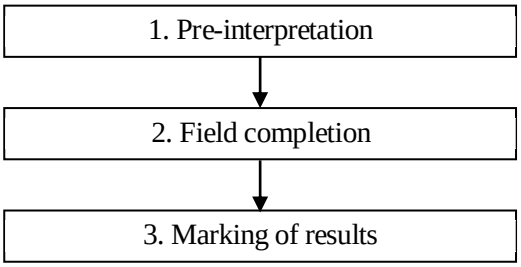


Figure 37 Field Completion Survey Operation Flow

3-19-1. Pre-interpretation

From September 4 to September 13, pre-interpretation (desk research using output maps) was conducted in collaboration with the TSDE staff. As a result of the pre-interpretation, the following priority items were selected for the field completion survey.

Table 31 Priority Items for Field Completion Survey

Item	Relevant users
Classifications and names of public buildings	Department of Housing and Urban Planning
Roadside trees	
Material storage yard	
Administrative boundaries and administrative names	
Enclosures (bars, fences) that border ownership boundaries	Department of Cadaster
Water places (pumps, wells, stop cocks)	Djibouti National Water and Sanitation Office (ONEAD)
Transformers	Djibouti Electricity (EDD)

3-19-2. Field Completion Survey

From September 14 to October 7, the field completion survey was conducted in three teams while referring to the items selected in the pre-interpretation.

Figure 38 Field Completion Survey Operation (Left: Field completion survey, Right: Marking of results)

3-19-3. Marking of Results

The results of the field completion survey were marked on the blank digital plotting maps.

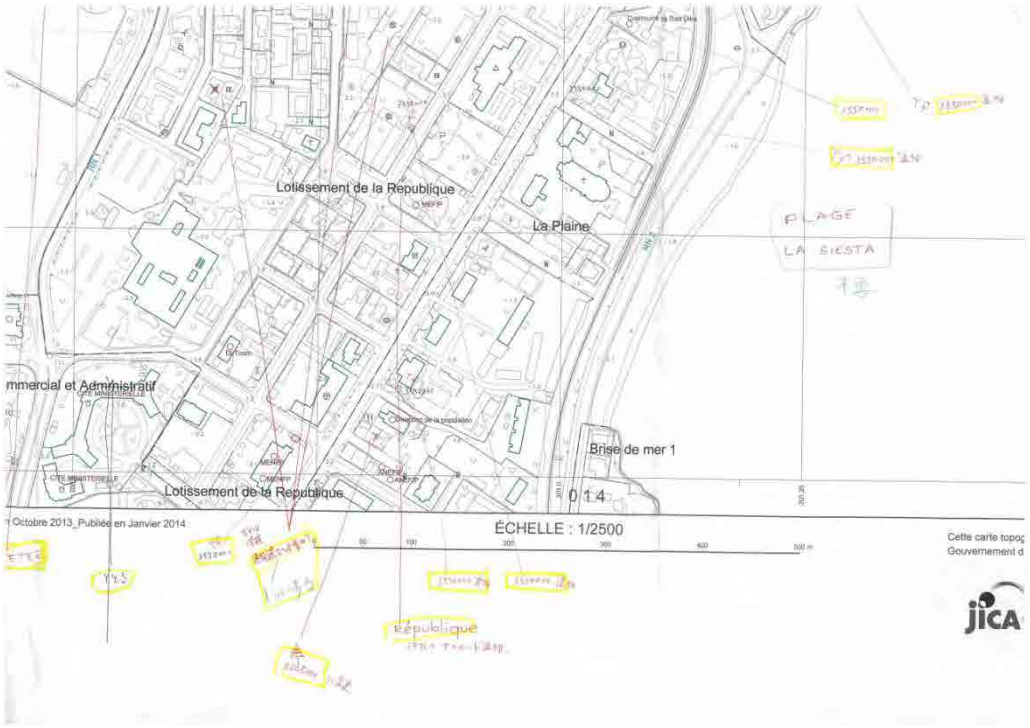


Figure 39 Blank Digital Plotting Map (example) with Field Completion Survey Results

3-20. Digital Compilation after Field Completion [Work in Japan]

After the field completion survey, the digital compilation was conducted to correct and modify digital compilation data based on the survey results.

3-21. Map Symbolization of Topographic Maps [Work in Japan]

Map symbols were added to the topographic mapping data that had undergone digital compilation after field completion based on the map symbol specifications determined in the Discussion of Specifications. The map symbolization processing was conducted using the AutoCAD software on the above topographic mapping data to create 1/2,500 printed map data. A check list (accuracy control table) that listed map symbolization targets and map symbols was created to ensure that there would be no omission in map symbolization.

The CAD data that had undergone the map symbolization was used to create topographic mapping data files (DWG data) and files for output (PDF data).

Figure 40 Map Symbolization (example)

3-22. Structurization of Digital Data [Work in Japan]

The topographic mapping data created in the digital compilation after field completion underwent the structurization of digital data based on the data structurization specifications determined in the discussion of specifications so that it can be used for GIS. The GIS basic data created in the structurization has been converted into the Shape data format, which is practical, user-friendly, and highly versatile. Based on the

discussion with C/P, the data for the target area in this operation has been saved to one file.

The created outputs are a GIS basic data with metadata and data with an indicated data structure (including the schema type).

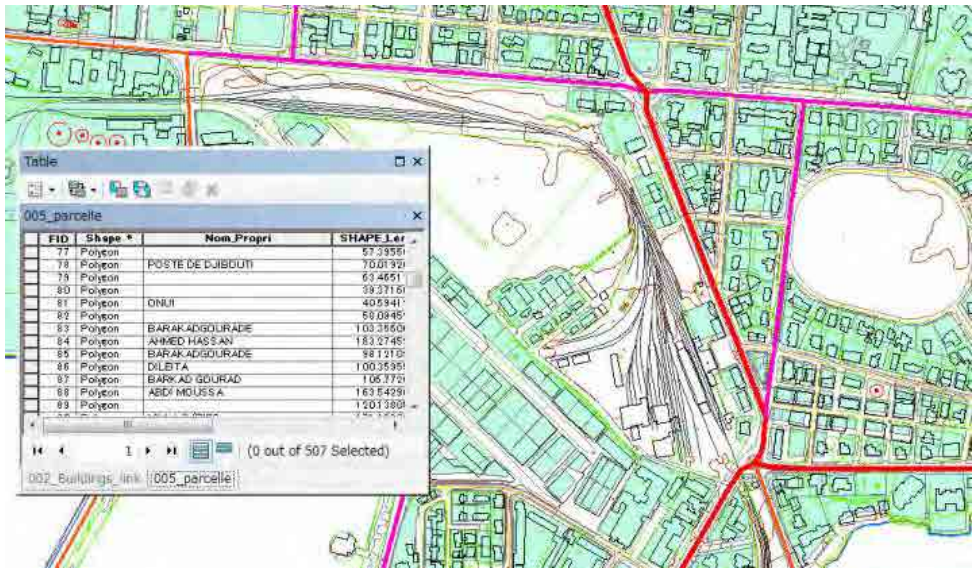


Figure 41 Digital Data Structurization (example)

3-23. Creation of Draft Final Report (DF/R) [Work in Japan]

A Draft Final Report was created to summarize the operations conducted so far, and was approved after the discussion meeting with JICA. The work manuals created in the process of technology transfer were included in the report. These work manuals are provided as a separate volume in consideration of the convenience in the future.

3-24. Explanation and Discussion on Draft Final Report (DF/R) [Work in Djibouti]

The content of the Draft Final Report was explained to the Djiboutian side, and the creation of the Final Report will be discussed. The contents of discussion were summarized in minutes of meeting (M/M), which were signed by both the parties (See Appendix-10).

3-25. Promotion of Utilization [Work in Djibouti]

The second stakeholder meeting was held on January 21, 2014 to give a final presentation and an opportunity for opinion exchange on utilization promotion to mainly the engineers in the stakeholder organizations that participated in the seminars, discussions, and the first stakeholder meeting (see the table below) so far. The meeting was attended by about 30 persons from 17 organizations (see Appendix-11) and concerned the study outputs and proposals on how to distribute and maintain the geographic information data to be created.

For the distribution of geographic information data, the first goal was set to establish a system consisting mainly of permanent members of the stakeholder meeting by around April 2014 when the outputs of this Study are provided from JICA to Djibouti. For the handling of digital data, creation of rules about application/registration to the "National Office of Copyright and Related Rights," a member organization, and handling of them were set as urgent tasks.

This meeting was covered in TV programs on the same day and newspapers on the next day, and thus became widely known throughout Djibouti. The newspaper articles also mentioned the final seminar to be held at a later date and served as good advertisements of the seminar.

Table 32 List of Participants for the 2nd Stakeholder Meeting

Organization		Number of participants
1	Department of Equipment	2
2	Djibouti Center for Research Studies (CERD)	1
3	Djibouti Ports & Free Zones Authority	1
4	Department of Housing and Urban Planning (DHU)	2
5	Department of Environment	2
6	Department of Citizen Protection	1
7	Djibouti Electricity (EDD)	2
8	Djibouti Social Development Agency (ADDS)	1
9	Djibouti International Airport	3
10	Civil Aviation Authority	1
11	Port of Djibouti	1
12	National Office of Copyright and Related Rights	1
13	Disaster Risk Management	1
14	Department of Maritime Affairs	1
15	Topography Section, Department of Equipment (STDE)	1
16	JICA Djibouti Office	1
17	JICA Study Team	5

3-26. Holding of Seminars for Promoting Utilization [Work in Djibouti]

3-26-1. Final Seminar

On January 26, 2014, a seminar for promoting popularization and utilization of geographic information was held. The seminar was attended by about 60 persons from 29 organizations listed below, including the "Minister of Equipment and Transport," "Minister of Housing, Urban Planning, Environment, and Land Management," "Secretary of State on National Solidarity of Djibouti," and "Commissioner on Policies" (See Appendix-12).

At the seminar, presentations on the following themes were given to widely inform attendees of the Project

and make proposals on information sharing on utilization and update of geographic information after the Project completion and development of a system in Djibouti for this operation.

- Final report of this Study and utilization of GCP outputs (Study Team)
- Example of utilization of digital topographic maps and GIS data (Study Team and CERD staff)
- About TSDE (Topographic Section, Department of Equipment) (TSDE chief)
- Report on OJT outputs and how to update the outputs (TSDE staff)
- How to supply outputs and maintain geographic information in the future (Deputy Vice-Minister, Ministry of Equipment and Transport)

This seminar was also covered in TV programs on the same day and newspapers later and thus became widely known throughout Djibouti.




Figure 42　Final Seminar（Upper Left : Opening ceremony, Upper Right : Participants, Lower Left：Study Team Presentation, Lower Right：TSDE presentation）

Table 33　List of Participants for the Final Seminar

Participating Organization			
1	Department of Equipment	16	Port of Djibouti
2	Djibouti Center for Research Studies (CERD)	17	Civil Aviation Authority
3	University of Djibouti	18	National Office of Copyright and Related Rights
4	Djibouti Ports & Free Zones Authority	19	Office of Industrial Property and Commerce
5	Department of Housing and Urban Planning	20	Djibouti Railway Company
6	Department of Environment	21	Coast Guard
7	Mayor of Djibouti	22	Department of Maritime Affairs
8	Department of Citizen Protection	23	Central Laboratory of Building and Equipment
9	Department of Statistics and Population (DISED)	24	Djibouti Maritime Training Center
10	Department of Lands and Land Conservation	25	UNDP Representative Office
11	National Water and Sanitation Office of Djibouti (ONEAD)	26	WFP Representative Office
12	Djibouti Telecom	27	Embassy of Japan
13	Djibouti Social Development Agency	28	JICA Djibouti Office
14	Road Maintenance Fund	29	JICA Study Team
15	National Meteorological Agency		

3-26-2. Lecture in Djibouti University

On January 26, 2014, a lecture was delivered at the University of Djibouti, regarding the overview of this Study, examples of utilizing geographic information, and handling of digital data. About 40 students who majored in geodesy, topography, cartography, and GIS-related courses attentively listened to this lecture. In the second half of the lecture, questions and answers were exchanged actively.

The students belong to an information-literate generation. Since the time when they become active members of society is close to the time when the utilization of the outputs of this Study gets under way, they are expected to contribute to promoting the utilization, further accelerating the utilization of geographic information data in Djibouti in the future.

Figure 43　Lecture in University（Left：Lecture, Right：Q&A）

3-27. Creation of Data Files [Work in Japan]

The following digital data files were created as outputs of this study such as topographic maps.

i. 1/2,500 topographic mapping data (DGW file)
ii. GIS basic data (Shape file)
iii. 1/2,500 topographic mapping data (PDF file)
iv. Digital aerial photo data (TIFF file)
v. Orthophoto map data (TIFF file)

The created digital data files will be saved to a HDD or DVD-R for delivery.

3-28. Creation of Final Report (F/R) [Work in Japan]

The Draft Final Report was expanded and corrected based on the comments on it made by the Djiboutian side and completed as a Final Report, which is to be delivered to JICA.

4. Technology Transfer

So far technology transfer in this Study has been carried out on the control point survey, installation of aerial markers and updating of topographic maps for the following items and ranges.

Table 34 Summary of Technology Transfer

Item	Matter Determined	Target Range
Workers in Djibouti	TSDE will provide at least 8 technical personnel and one full-time technical coordinator.	All the field work and indoor work for control point surveys and field verification
Item of Technology Transfer	Installation of aerial markers (OJT)	32 sites within about 300km^2 in all study areas including the range of orthophoto development
	Control point survey and analysis (OJT)	32 points within about 300km^2 in all study areas including the range of orthophoto development
	Leveling and calculation processing (OJT)	32 control points in the total length of 142km
	GNSS analysis and leveling calculation processing (OJT)	32 control points
	Field verification (OJT)	About 110km^2 in the areas for 1/2,500 digital topographic map development
Updating of Topographic Maps	Technical guidance necessary for updating of topographic maps	About 110km^2 in the areas for 1/2,500 digital topographic map development

The equipment and materials listed in the table below were procured for the technology transfer. The equipment and materials procured in Japan were transported by the Study Team, and TSDE of MET carried out an acceptance inspection of those items procured by the Study Team (from Kenya and Djibouti) in October 2012 and those procured by JICA in May 2013.

Table 35 Equipment and Materials for Technology Transfer

Name of Equipment	Q'ty	Remarks
Software for GIS data updating ArcGIS (ArcInfo)	1	Procurement in Kenya by the Study Team
Software for map updating AutoCAD Map 3D	1	
Desk-top personal computer (PC)	2	Procurement in Djibouti by the Study Team
Liquid crystal monitors	2	
Uninterruptible power supply (UPS)	2	
Hard disk for data management	1	
Set of consumables for the network LAN cable (5) and hub (1)	1	
Color laser printer and consumables (A3)	1	
Plotter-cum-scanner and consumables for map printout (A0)	1	Procurement by JICA
GNSS surveying material and equipment (including accessories)	4	Procurement in Japan by the Study Team
Digital camera (including accessories)	4	
Simple stereoscope	8	
Medium-sized stereoscope with a reflective mirror	1	
Handy GPS	4	
Leveling equipment (digital)	4	

4-1. Details of Technology Transfer

4-1-1. Technology Transfer on Control Point Survey and Installation of Aerial Markers

(1) Reconnaissance, Point Selection and Installation

The technology transfer on reconnaissance, selection and installation of control points was conducted taking into consideration the main points shown below.

The reconnaissance, selection and installation of control points were intended to give the counterpart staff an understanding of the basic knowledge of "control point survey" and "aerial photography" and to deepen their understanding of the correlation of the positions of control points on the topographic map and aerial photo images, and their positions on the Earth.

With regard to objectives and applications following completion of the technology transfer, it is expected that the transferred technology will be applied to independent work by TSDE and to subsequent and other work in this Study.

Table 36 Outcomes of Technology Transfer on Reconnaissance, Selection and Installation

Main Points	Outcomes for TSDE
Understanding of the basic knowledge of control point survey	Application to other work
Control point distribution to match the photographic plan	Application to other work
Operation of handy GPS terminals	Application to other work (Finding planimetric features and registration of their positions)
Selection of points that are easily recognizable on images	Application to other works (Improvement of photo interpretation capacity, etc.)

Figure 44 Technology Transfer for Reconnaissance, Selection and Installation of Control Points (Left: GNSS Antenna Installation; Right: Handy GPS Operation)

(2) GNSS Observation (Static Positioning) and Simple Leveling

The GNSS survey was carried out by 9 TSDE surveyors and a number of locally-employed survey assistants in cooperation with the Study Team members. They were grouped into 4 teams, each team consisting of 2 TSDE surveyors and 2 survey assistants. The TSDE survey engineers were furnished with training in GNSS receiver operation for 2 days, on April 19 before the start of GNSS observation and on April 30 during the survey period. In the GNSS observation, stress was placed on basic operations such as installation of the GNSS antenna, operation of the GNSS receiver and GNSS data analysis.

In the leveling survey, 4 work groups were again formed, each group consisting of 2 TSDE surveyors and 2 survey assistants. The TSDE survey engineers were furnished with training in digital level operation on March 28, before the start of leveling observation. As operation of the digital level was more complicated than operation of an ordinary auto level, a thorough explanation of and training in operation of the digital level were provided.

Table 37 Outcomes of Technology Transfer on GNSS Observation and Leveling

Item	Main Points	Outcomes for TSDE
GNSS observation	Installation of GNSS antenna Operation of GNSS receiver	Control point survey by GNSS observation Utilization of GNSS data analysis and results
GNSS analysis	Operation of analysis software Understanding of analyzed results	
Leveling observation	Operation of digital level Confirmation of survey procedure	Leveling by means of digital level Examination of computed results and accuracy control
Calculation processing	Inspection of measured data Examination of computed results	

Figure 45 Scenes of OJT (Left: Measurement of GNSS antenna height; Right: Leveling)

(3) Installation of Aerial Markers

In the technology transfer for the installation of aerial markers, importance was attached to the materials, size, form and color of each signal. Through OJT the TSDE survey engineers were able to deepen their basic understanding of aerial photography and digital photo images during the work to install the aerial markers.

Table 38 Outcomes of Technology Transfer for the Installation of Aerial Markers

Item	Main Points	Outcomes for TSDE
Aerial marker	Understanding of aerial photography	Improvement in photo interpretation capacity
	Selection of materials	
	Selection of size, form and color	

Figure 46 Scenes of OJT

4-1-2. Technology Transfer in Field Verification

The TSDE engineers were not experienced in field verification or in working with aerial photos. Therefore, technology transfer was carried out focusing on their understanding of basic work procedures, photo interpretation and the digitalization of outputs.

In the pre-interpretation work, the list of symbols for the items of field verification was prepared to enhance their understanding, and training in the operation of the handy GPS receivers used in the control point survey was also repeated as OJT in the field verification. In addition, the relationship of planimetric features in the field and in the orthophotos was properly checked before the results of field verification were entered in the orthophotos, in order to enhance the photo interpretation skills of the engineers.

The engineers became accustomed to managing the completed field verification items in an Excel file, scanning the orthophotos showing the results, and arranging the resulting digital data.

Table 39 Outcomes of Technology Transfer in Field Verification

Main Points	Outcomes for TSDE
Pre-interpretation	Higher understanding of field verification items
Field verification	Familiarization with effective methods of utilization of handy GPS; Interpretation of orthophotos; Application in digital plotting Process control
Arrangement of field verification results	Understanding of digitalization; Improved quality

Figure 47 Technology Transfer (Left: Road width measurement; Right: Verification of planimetric features)

CHECK LIST : Layer Specification - Djibouti 1: 2,500 Scale Digit

CHECI	DWG		名 称
	Object Type	Code (CAD Layer)	
			国境界
☐OK	Polyline	1102000	Region境界
☐OK	Polyline	1103000	Commune境界
			~~カルテー境界~~
☐OK	Text (LABEL POIN	*81102000*	リジオン名
☐OK	Text (LABEL POIN	*81103000*	コミューン名
☐OK	Text (LABEL POIN	*81104000*	カルテー名
☐OK	Polyline	2109000	建設中の道路(舗装区別は調査しない)
☐OK	Polyline	2106000	庭園路等(舗装区別は調査

Figure 48 Field Verification Progress and Quality Control Table

4-1-3. Technology Transfer on Updating of Topographic Maps

The TSDE engineers' level of technology was elementary because they were inexperienced in computer operation and updating of topographic maps. Taking this into account, and in order to allow them for a

limited period to attempt independent work related to the future updating of the topographic maps, it is necessary for them to understand the basic work procedure beforehand and become familiar with computer operation.

In the first technology transfer carried out in April 2012, therefore, technology transfer in aerial triangulation and digital plotting was carried out mainly through lectures, with an emphasis on the buildup of basic theoretical understanding and capacity. The second technology transfer, carried out from May to June 2013, concentrated on practical exercises using the software.

The software used for topographic map updating was Autodesk's "AutoCAD" for data compilation and ESRI's "ArcGIS" for GIS modeling.

Table 40 Outcomes of Technology Transfer on Updating of Topographic Maps

Item	Main Points	Outcomes for TSDE
Updating of Topographic Maps	Understanding of digital plotting and digital compilation procedures	Acquisition of basic capacity for updating of topographic maps
	Understanding of map symbolization method	
	Familiarization with computer operation	

Figure 49 Technology Transfer (Left: AutoCAD, Right: ArcGIS)

4-2. Outputs of Technology Transfer

In this Study, the technology transfer for the field works such as the installation of aerial markers, control point survey and leveling and the analysis and calculation processing work was carried out through OJT.

As a result of technology transfer through a series of survey works, data analysis and calculation, the TSDE survey engineers achieved a certain level of understanding though they were inexperienced in those works, and became familiar with the flow of field work and the operation of survey equipment.

In the technology transfer for updating of topographic maps, the basic work flow, including digital plotting

and compilation procedures and map symbolization method, was understood; but with respect to some items of applied operations such as GIS application, quality control and meta data creation, computer operation using software did not necessarily reach the required level, because for some participants this Study was their first experience of operating a personal computer.

Technology transfer in aerial triangulation, DSM creation, creation of orthophotos and 3D plotting for which no software was procured was carried out by means of theoretical lectures only, but these theories appeared to have been fully understood.

Table 41 Level of Achievement in Transfer of Topographic Map Updating Technology

Item		Trainee 1	Trainee 2	Trainee 3	Average
1	Planning and preparation for GIS data creation	△	△	◎	○
2	Creation of symbols	△	○	◎	○
3	Creation of 2D polygon lines	○	△	◎	○
4	Control point survey Field verification	○	○	○	○
5	Aerial triangulation DSM Creation of orthophotos	△	○	○	○
6	3D data creation (Points, lines, polygons and texts)	△	△	△	△
7	Pre-interpretation of existing topographic maps	◎	△	◎	◎
8	Georeferencing	◎	△	◎	◎
9	Definition of topographic map projection	◎	△	◎	◎
10	2D data acquisition (Points, lines, polygons and texts)	△	△	◎	○
11	Quality control of acquired DWG data	△	△	○	△
12	Data compilation	△	◎	◎	◎
13	Symbolization of 1/2,500 topographic maps	△	◎	◎	◎
14	Data conversion from DWG to Shape	◎	◎	◎	◎
15	Transformation of coordinate system	△	◎	◎	◎
16	Meta data	△	△	◎	○
17	Preparation of attributes table	△	◎	○	○
18	Various types of data	△	△	◎	○
19	GIS applied operations	△	△	○	△

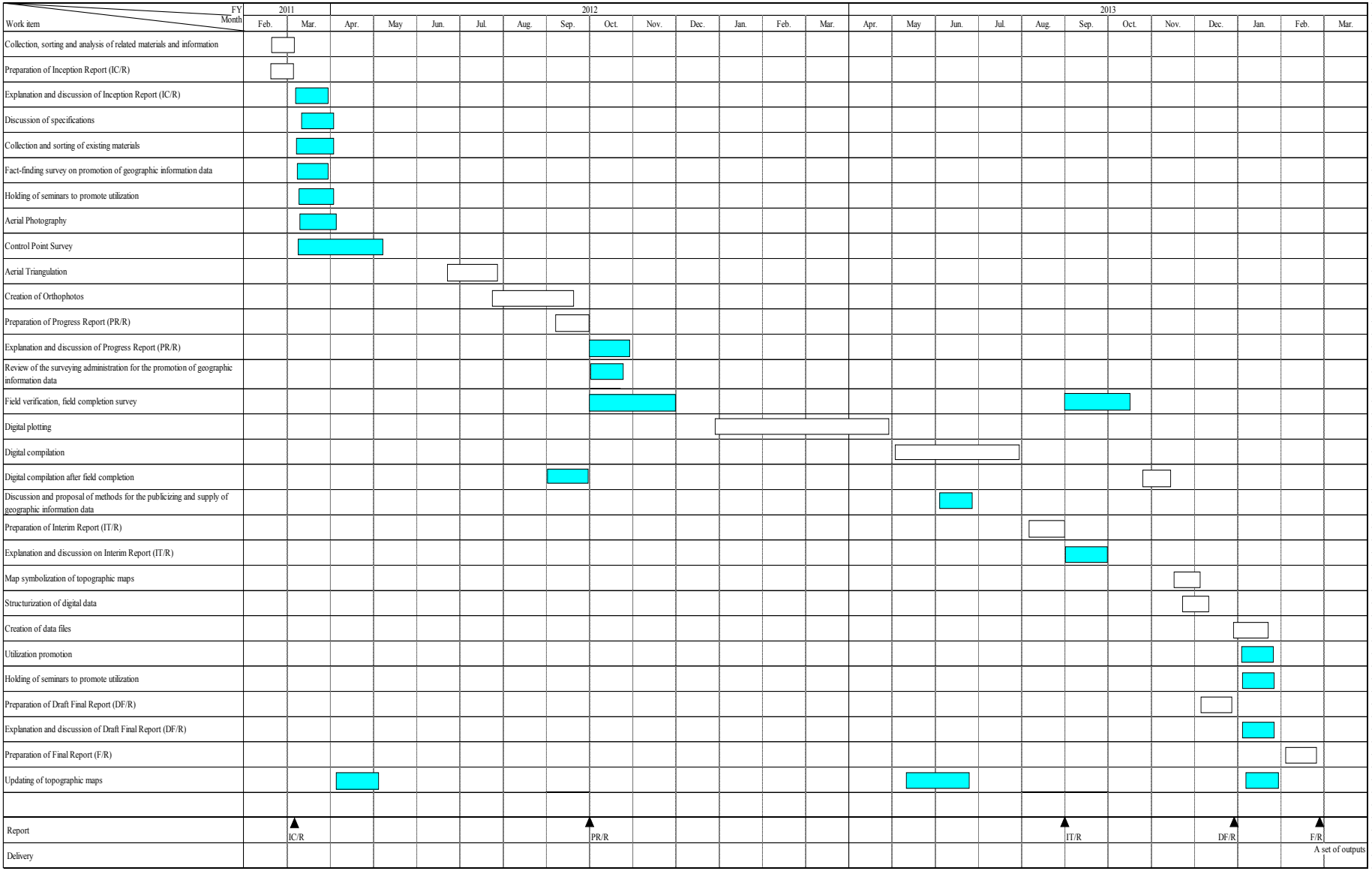
Note: Legends for achievement levels - △: Understanding of theory, ○: Understanding of theory and contents of practices, ◎: Attainment of application level

5. Schedule of Work and Dispatch of Personnel

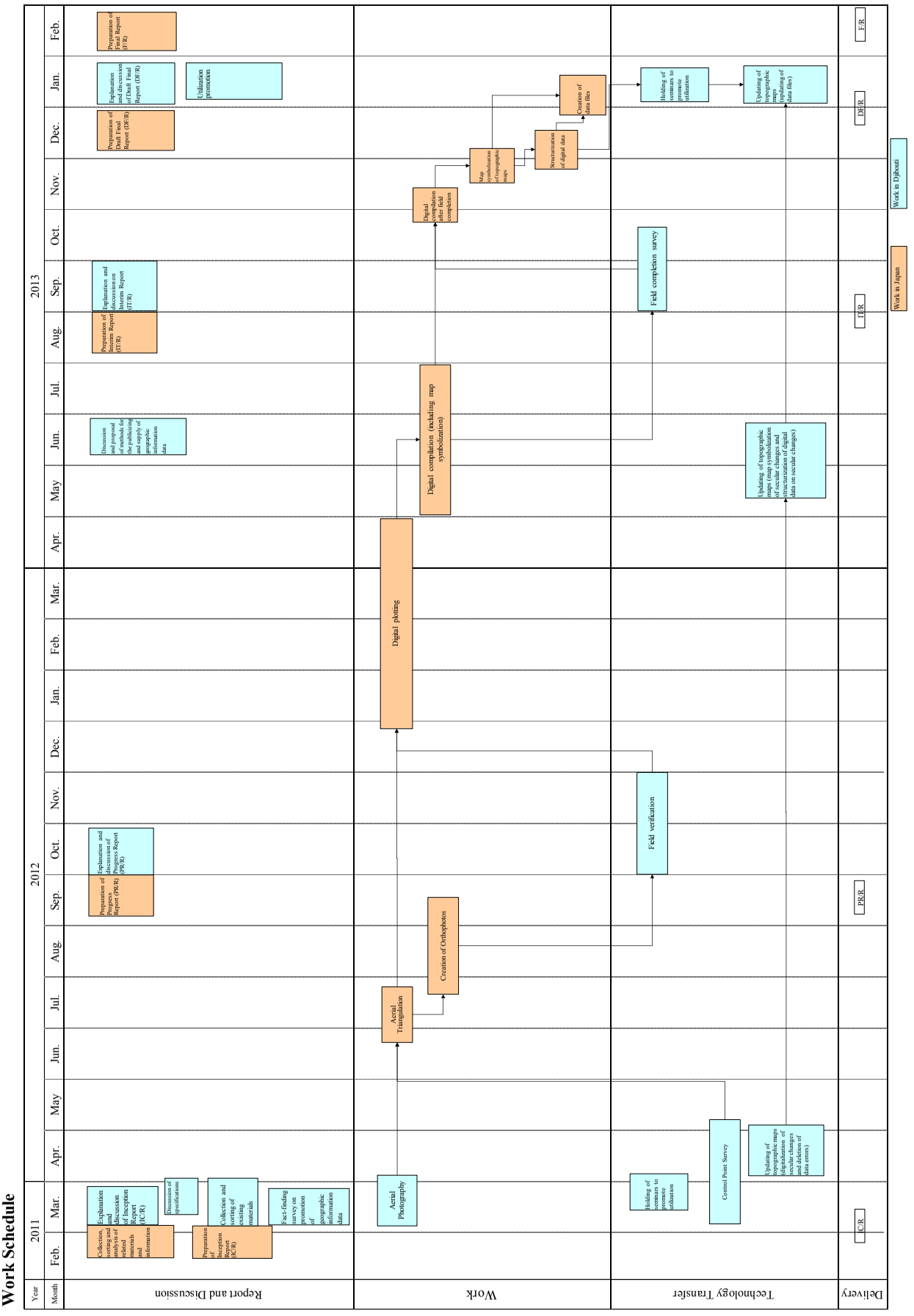
5-1. Work Schedule and Project Flowchart

The work schedule in this study and a project implementation flowchart are shown on the next page.

Form-5 Work Plan



Work Schedule



5-2. Dispatch of Personnel

The dispatch of personnel in this Study was as shown in the table below.

Personnel Plan

	Survey operations under charge	Name	Agency	Rank		2012 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	2013 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	2014 Jan.	Feb.	Mar.	Total Djibouti	Total Japan
Work in Djibouti	Team Leader / digital compilation	Masakuni NAKAYAMA	PASCO	2			3/12	30	4/10					10/2	20	10/21										9/1	40	10/10		21			**3.70**	
	Supervisor of Aerial Photography	Daikichi NAKAJIMA	PASCO	4			3/13	30	4/11																								**1.00**	
	Control point survey (1)	Atsushi MOCHIZUKI	PASCO (Advance)	3			3/13	60		5/11																							**2.00**	
	Control point survey (2)	Tadaaki TOMITA	PASCO (Kyoritsu Setsubi)	4			3/13	60		5/11																							**2.00**	
	Field verification and field completion (1)	Daikichi NAKAJIMA	PASCO	3										10/2	60	11/30										9/2	45	10/16					**3.50**	
	Field verification and field completion (2)	Toshiyuki WAKABAYASHI	PASCO	4										10/2	60	11/30										9/2	45	10/16					**3.50**	
	Field verification and field completion (3)	Tadahiko SEKIGUCHI	PASCO	5										10/2	60	11/30										9/2	45	10/16					**3.50**	
	Updating od topographic maps (technology transfer)	Daikichi NAKAJIMA	PASCO	4				4/12	30	5/11										5/10	45	6/23								21			**3.20**	
	Utilization promotion	Kaoru TSUDA	PASCO	4	Before change		3/12	17	3/28												16									21			**1.80**	
		Kaoru TSUDA	PASCO	4	After change			17																									**0.60**	
		Akira OTA	PASCO	4	After change															6/10	16	6/25								21			**1.20**	
	Interpretation	Tomohiro KOYAMA	PASCO (Technostaff)	4	Before change		3/13	30	4/11					10/4	30	11/2											30			21			**3.70**	
		Tomohiro KOYAMA	PASCO (Technostaff)	4	After change			30																		9/2	30	10/1		21			**2.70**	
		Tomoyuki OTANI	PASCO (Technostaff)	4	After change										30																		**1.00**	
	Operation coordination / assistance in field verification and field completion	Takashi SHIRAI	PASCO	4	Before change		3/13	30	4/11						60															21			**3.70**	
		Takashi SHIRAI	PASCO	4	After change			30																									**1.00**	
		Hayato FUKUOKA	PASCO	4	After change									10/2	60	11/30																		
		James WATSON	PASCO	6	After change																									21			**0.70**	
																																25.90	
																																27.90	
Work in Japan	Team Leader / digital compilation	Masakuni NAKAYAMA	PASCO	2			2/28	9	3/9																					12			**0.70**	
	Control point survey (1)	Atsushi MOCHIZUKI	PASCO (Advance)	3			3/2	6	3/9																								**0.20**	
	Field verification and field completion (1)	Daikichi NAKAJIMA	PASCO	3											6																		**0.20**	
																																	1.10	
	Report	Submission term (Shown with △ and names of the report)						△ IC/R						△ PR/R												△ IT/R			△ DF/R	△ F/R			
		Work in Japan																																
		(Man/Month Total)																																
Stage/Total																																		

Legend: Work in Djibouti; Work in Japan

Appendix – 1

Application Form (sample) for providing Topographic and Cartographic products

DEMANDE DE FOURNITURE DE DONNEES TOPOGRAPHIQUES NUMERIQUES

A l'attention de Monsieur _____ ,
Service Topographique,
Ministère de l'Equipement et des Transports

Veuillez bien vouloir nous fournir des données topographiques numériques pour le(s) motif(s) suivant(s).

Nous nous engageons à utiliser les données fournies dans le respect des conditions ci-dessous indiquées.

1. Motifs d'utilisation

2. Type de données souhaitées, et zone de couverture
   - Type
     □ Carte topograpbique (données numériques)
     □ Orthophoto (données numériques)
     □ Carte topographique (imprimée)
     □ Orthophoto (imprimée)

   -Zone de couverture
   Voir l'index ci-attaché

3. Nom de la structure / Nom de l'agent utilisateur :

4. Autres éléments à spécifier

【 Conditions à respecter 】
- Suivre les indications du Service Topographique pour l'utilisation des données Topographiques
- Utiliser ces données uniquement pour le(s) motif(s) mentionné (s) sur ce formulaire de demande
- Ne pas copier les données fournies, ni prêter à un tiers

Le demandeur s'engage à respecter ce qui précède et consent à ce que l'utilisation de ces données topographique numériques soit interrompue et que toutes les données soient récupérées en cas de violation de ces conditions.

Le 2014

Signature

年　　月　　日

ジブチ国
設備運輸省　設備局地形図課
担当者　様

所属
氏名　　㊞

デジタル地理データ提供申請書

デジタル地理データの提供を、下記の理由により申請します。
なお、提供を受けたデジタル地理データの利用に当たっては、下記の事項を遵守することを誓約します。

記

1．使用目的

2．提供を希望するデジタル地理データの種類及び範囲

- 種類【□地形図データ　□オルソフォトデータ　□地形図（出力）□オルソフォト（出力）】
- 範囲　別紙「索引図」の通り

3．使用する職員等の氏名

4．その他特記事項

【遵守すべき事項】

- デジタル地理データの利用にあたっては、地形図課の指導に従います。
- 本申請書に記載の使用目的以外には利用しません。
- 提供を受けたデジタル地理データを無断で複製及び貸与いたしません。
- 以上の事項に違反した場合は、デジタル地理データの使用を停止され、データを引き上げることに同意いたしします。

Appendix – 2

Application form of distribution for photographic and Cartographic products in Republic of Senegal

République du Sénégal
Un Peuple – Un But – Une Foi

Ministère l'Aménagement du Territoire et des Collectivités locales
---
anat
Agence nationale de l'Aménagement du Territoire

Règlement intérieur de fixation des prix et d'utilisation secondaire des produits JSMAP

1. Objectifs et champ d'application du règlement intérieur

- L'objectifs du règlement intérieur est d'améliorer l'utilisation des produits fournis par JSMAP-ANAT, y compris celles qui en découlent, et de contribuer ainsi au développement du Sénégal.
- Ce règlement intérieur est appliqué pour les produits suivants, qui sont appelés ci-après avec les prix qui en découlent.

(1) Données sur les cartes topographiques au 1:50.000 (CD-R) image	15 000
(2) Carte topographique au 1:50.000 (Carte imprimée)	4 000
(3) Carte topographique au 1:50.000 (Sortie de traceur)	7 500
(4) Données d'image Ortho-rectifié Pan-sharpen 1:50.000 (CD-R)	30 000
(5) Données d'image Ortho-rectifié Pan-sharpen au 1:50.000 (Sortie de traceur)	10 000
(6) Données sur les cartes topographiques au 1:50.000 (CD-R) Vecteur	
• Par couche et par feuille complète	12 000
• Par couche et par feuille partielle	6 000
• Ensemble des couches d'une feuille (5)	50 000
• Par couche pour les 30 000 km^2 de la zone du projet	60 000
• Toute la base des 30 000 km^2 de la zone du projet	300 000

2. Accord de Licence

- L'accord de licence est introduit pour les produits qui sont fournis sous forme de données numériques parmi les produits ci-dessus.
- L'accord de licence ne décrit pas la date d'expiration.
- L'accord de licence identique est appliqué pour un usage interne et à l'utilisation secondaire des produits applicables concernés. Il s'agit d'accroître l'utilisation secondaire des produits par le secteur privé.
- L'utilisation secondaire requiert une demande adressée à l'ANAT qui décrit les détails du produit secondaire. Le formulaire de demande est à demander auprès de l'ANAT.

3. Prix

- En principe, le prix est calculé comme le coût nécessaire à la reproduction du produit avec une partie du coût d'entretien du produit original. Les recettes provenant de la vente de produits sont affectées à une partie du budget réservé à l'entretien du produit d'origine.
- Le même prix est appliqué pour tout le monde afin de faciliter l'utilisation secondaire par le secteur privé).
- Lorsqu'un utilisateur achète un même produits sur un volume conséquent, le prix est réduit. Il en est de même si un certain nombre de terminaux utilisent les mêmes produits numériques applicables. Ces taux de réduction avec la méthode de calcul du prix sont définis par l'ANAT.
- Une organisation est considérée comme un utilisateur.

4. Agent de distribution de produits cartographiques

- La licence de distribution est délivré à ceux qui distribuent des produits applicables afin d'accroître la vente des produits. Le prix des produits devrait être le même, et la commission de vente est défini séparément.

Application de l'élaboration de ce produit secondaire JSMAP

<table>
<tr><td>Nom du produit</td><td colspan="5">☐ Données de cartes topographiques au 1:50,000 (CD-R)
☐ Données d’image Ortho-rectifiée Pan-sharpened au 1:50,000 (CD-R)</td></tr>
<tr><td>Partie du produit à utiliser</td><td colspan="5">ND28-XII ( )
ND28-XVIII ( )
ND28-XX ( )
ND28-XXI ( )
ND28-XXIII ( )
ND28-XXIV ( )
NE28-II ( )
NE28-III ( )
NE28-IV ( )
NE28-V ( )</td></tr>
<tr><td>Objectifs de l'utilisation</td><td colspan="5"></td></tr>
<tr><td>Explication de de produit secondaire</td><td colspan="5"></td></tr>
<tr><td rowspan="6">Répartition de produits de secondaire</td><td rowspan="2">Publication
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☐CD, DVD</td><td>Nom de publication</td><td>Echelle de carte</td><td>Nombre de publication</td><td>Date de publication</td></tr>
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☐recherche
☐télécharge ment</td><td>Nom de site Web & URL</td><td>Nom de carte</td><td>Echelle de carte</td><td>Date de télé-chargement</td></tr>
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<tr><td rowspan="2">Autres</td><td colspan="4">Détail</td></tr>
<tr><td colspan="4"></td></tr>
</table>

ANNEXE 1

Nom:
Fonction :
Société :
Adresse :
Téléphone / Fax :
E-mail:

(Date)

A Monsieur le Directeur général de l'ANAT

Monsieur,

Je viens par cette présente solliciter auprès de votre bienveillance l'autorisation de développer un sous produit à partir des données JSMAP pour un usage :

1 : commercial (x)

2 : privé (x).

Je m'engage à respecter les conditions d'utilisation de vos produits et m'expose en cas de violation desdites conditions à des sanctions.

Veuillez agréer, Monsieur, l'expression de mes sentiments distingués.

(Signature)
(x) rayer la mention inutile

ANNEXE 2

Licence d'utilisation secondaire de produit JSMAP

A M. / Mme……..

Je fais suite à votre demande datée du……dans laquelle vous souhaitez développer des produits secondaires à l'aide du produit JSMAP, pour vous marquez mon accord suivant les conditions ci-après :

1. Articles
1-1 Références du produit à utiliser :
1-2 Champs d'application de l'autorisation :
1-3 Objectifs :
1-4 Nom du produit secondaire :
1-5 Clause de commercialisation du produit secondaire :
2. Numéro d'approbation…….
3. Conditions d'utilisation
Le produit de JSMAP doit être utilisé uniquement aux fins décrites dans la demande et non à d'autres fins.
Le numéro d'approbation ci-dessus doit être clairement mentionné sur le produit secondaire avec la notification du droit d'auteur du produit original.

Ce sous-produit est fabriqué en utilisant le produit (© ANAT et la JICA)
(Numéro d'approbation : …….)
Ce produit secondaire doit être distribué suivant les termes de l'accord ci-dessus. Si le demandeur envisage une utilisation autre que décrite dans sa demande, un autre accord est nécessaire. L es Droits d'auteur détenus

par l'ANAT et la JICA doivent être respectés sous peine de sanctions devant les juridictions compétentes.

(Cachet et signature)

ANNEXE 3
Accord de Licence Utilisateur final de JSMAP

Sommaire

L'ANAT fournit le Produit à l'Utilisateur Final conformément aux termes et conditions du présent Accord de Licence pour l'Utilisateur Final de JSMAP, définis ci-dessous.

1. Définition

a. Utilisateur Final: la personne, entité commerciale légale, entité publique ou toute autre entité légale qui obtienne le Produit
b. JSMAP: L'étude sur le Projet de Cartographie Topographique Numérique pour le Nord du Sénégal soutenue par la JICA, dont le cadre 54 feuilles de carte topographique numérique à l'échelle 1:50.000 et l'image ortho-rectifiée pan-sharpened ont été crées
c. Produit: une feuille numérique de carte topographique numérique à l'échelle 1:50.000 ou image ortho-rectifiée pan-sharpened créée dans JSMAP
d. ANAT: Agence Nationale de l'Aménagement du Territoire
e. JICA: Agence japonaise de coopération internationale

2. Octroi de licence

2-1 La licence non-exclusive, non-cessible est accordé à l'Utilisateur final pour ;

a. utiliser le Produit uniquement pour son usage purement interne,
b. rendre le Produit disponible pour les contractants pour l'usage interne au nom de l'Utilisateur Final,
c. mettre l'image provenant du Produit dans des rapports de recherche ou des publications d'autre type avec mention de la reconnaissance du droit d'auteur stipulée à l'article 4 ci-dessous,
d. utiliser l'image dérivée du Produit, tant qu'il n'est pas équivalente à la sortie de traceur du Produit, des affiches, des calendriers, des brochures et autres imprimés avec mention de la reconnaissance du droit d'auteur stipulée à l'article 4 ci-dessous,
e. utiliser l'image jusqu'à la taille 1024 x 768, qui est dérivée du Produit, sur Internet avec mention de la reconnaissance du droit d'auteur stipulée à l'article 4 ci-dessous,

2-2 L'utilisateur final doit présenter une demande à l'ANAT à l'avance si il / elle fait des produits dérivés, à partir de laquelle tout ou partie du produit ne peut être reproduit, et de le distribuer à un tiers.

3. Obligation de l'Utilisateur final

L'Utilisateur final doit observer les termes suivants.

a. Des copies du Produit ne doivent pas être produites, sauf pour la sauvegarde.
b. Le Produit, y compris les produits dérivés à partir desquels tout ou partie du Produit peut être reproduit, ne devrait pas être transféré à un tiers.
c. Le produit ne doit pas être utilisé à des fins illégales, trompeuses, mensongères ou contraire à l'éthique sinon d'une manière qui pourrait nuire à la réputation du Produit ou de toute autre personne.

4 Reconnaissance des droits

4-1 L'Utilisateur final reconnaît que l'ANAT et la JICA sont propriétaires du droit d'auteur du Produit.

4-2 Lors de la distribution du Produit ou des dérivées à un tiers dans les limites autorisées en vertu du présent Accord, l'Utilisateur final doit mettre la notice de copyright ci-dessous.

Dans le cas où tout ou une partie du Produit est inclus ou reproduit	ANAT, JICA
Dans le cas où tout ou une partie du Produit n'est pas inclus, ni reproduit	Ceci est produit en utilisant le produit ANAT, JICA

5. Garanties et indemnités

5-1 Le produit est garanti conforme aux Spécifications applicables.

5-2 Que le Produit est approprié à votre destination ou objectif n'est pas garanti.

5-3 Lorsque le produit n'est pas utilisable pour des raisons telles que des lésions de supports ou de non-conformité aux Spécifications applicables, l'ANAT remplace le Produit si l'Utilisateur Final si celui-ci retourne dans les 3 jours suivant la réception. Si l'ANAT ne peut pas remplacer le Produit, il rembourse le montant d'achat payé par l'Utilisateur Final.

6. Juridiction et loi applicable

L'Accord sera régi par le droit sénégalais et tous les litiges découlant du présent Accord sera soumis à la juridiction exclusive de la Cour sénégalaise.

ANNEXE 4
Calcul du prix des produits JSMAP

1. Gamme de produits pour le calcul du prix

Les articles suivants compose la gamme de produits pour le calcul des prix dans ce document.

(1) Données sur les cartes topographiques au 1:50.000 (CD-R) image	15 000
(2) Carte topographique au 1:50.000 (Carte imprimée)	4 000
(3) Carte topographique au 1:50.000 (Sortie de traceur)	7 500
(4) Données d'image Ortho-rectifié Pan-sharpen 1:50.000 (CD-R)	30 000
(5) Données d'image Ortho-rectifié Pan-sharpen au 1:50.000 (Sortie de traceur)	10 000
(6) Données sur les cartes topographiques au 1:50.000 (CD-R) Vecteur	
• Par couche et par feuille complète	12 000
• Par couche et par feuille partielle	6 000
• Ensemble des couches d'une feuille (5)	50 000
• Par couche pour les 30 000 km^2 de la zone du projet	60 000
• Toute la base des 30 000 km^2 de la zone du projet	300 000

2. Composition des prix : cf. tableau ci-dessus

3. Coût de la reproduction

(1) Procédé de reproduction

Le processus de reproduction des produits A à E sont les suivantes:

Produit	Processus
A & D	1) Recevoir un bon de commande de produit CD-R et d'argent correspondant à la commande à la boutique de cartes 2) Traiter l'argent et produire une quittance chez le comptable 3) Produire le produit CD-R selon la commande sur le site de production de CD-R 4) Préparer l'accord de licence sur le site de production de CD-R 5) Livrer le produit CD-R à l'utilisateur à la boutique de cartes
B	1) Recevoir un bon de commande de carte en papier et d'argent correspondant à la commande à la boutique de cartes 2) Traiter l'argent et produire une quittance chez le comptable 3) Livrer la carte en papier à l'utilisateur à la boutique de cartes
C & E	1) Recevoir un bon de commande de sortie de traceur et d'argent correspondant à la commande à la boutique de la carte 2) Traiter l'argent et produire une quittance chez le comptable 3) Produire la sortie de traceur selon la commande sur le site de production de sortie de traceur 4) Livrer la sortie de traceur à l'utilisateur à la boutique de cartes

(2) Calcul du "Coût de main-d'œuvre direct", du "Coût des matériaux» et du "Coût de machines"

* Coût de main d'œuvre directe: calculer le à partir du temps nécessaire pour chaque opération de "(1) Procédé de reproduction" et du prix unitaire de la personne impliquée dans le travail
* Coût des matériaux: calculer le à partir de matériaux et de leur volume requis pour chaque opération de "(1) Procédé de reproduction" et de leurs prix unitaires.
* Coût de machines : calculer le à partir de l'estimation du temps d'utilisation des machines nécessaires pour chaque opération "(1) Procédé de reproduction" et de leurs prix unitaires.

(3) Prix unitaire

* Main-d'œuvre directe: calculer le salaire par jour en divisant le salaire mensuel par 21
* Matériel: prix de marché de CD-R, de papier A4, de rouleau de papier A0, cartouche d'encre pour A4 et de cartouche d'encre pour A0
* Machines: ordinateur, imprimante A4, et traceur A0 sont utilisés dans le processus de reproduction. En supposant que ces machines fonctionnent de 5 ans et 150 jours (50 jours pour traceur A0) par an, calculer le prix unitaire par jour à partir de leur prix de marché.

4. Coût pour la promotion de ventes

Calculé sur la base de 10% du coût de main-d'œuvre directe

5. Frais généraux administratifs

Calculé sur la base de 30% du coût main-d'œuvre directe

6. Coût à affecter à la maintenance des données

* Les données originales des produits A, B et C sont les données de carte topographique au 1: 50.000, qui sont celles du produit A
* Les données originales des produits D et E sont les données d'image Ortho-rectifiée Pan-sharpen au 1:50,000, qui sont celles du produit D
* Par conséquent, les coûts de maintenance des données ne sont considérés que pour les produits A et D.
* Le montant de coûts est calculé pour plusieurs cas. Ceux-ci sont de 0%, 10%, 50% et 66% du prix.

7. Prix calculés

Les prix calculés sont les suivants:

Cost to be allocated for data maintenance (as percentage of price) / product	0%	10%	50%	66%
A: Données de Carte Topographique au 1:50,000 (CD-R)	2,500	2,800	5,000	7,500
B: Carte Topographique au 1:50,000 (Carte imprimée)	4,800			
C: Carte Topographique au 1:50,000 (Sortie de traceur)	4,200			
D: Donnée d'Image Ortho-rectified Pan-sharpen Image au 1:50,000 (CD-R)	2,500	2,800	5,000	7,500
E: Image Ortho-rectified Pan-sharpen Image au 1:50,000 (Sortie de traceur)	7,000			

ANNEXE 5

Réduction de prix en fonction du produit et du nombre de terminaux à utiliser

1. Méthode de calcul du prix de produits achetés par des utilisateurs

- Le Produit Applicable est vendu par une feuille de carte topographique à l'échelle 1:50,000 ou en forme de données correspondant à une feuille, qui est, ci-après appelé "unité de zone". Le prix d'une unité de zone sans aucune réduction est défini pour chaque produit et appelé "prix unitaire".
- Le prix de l'achat de produits par un utilisateur est la somme des prix d'achat de chacun des produits achetés par un utilisateurs.
- Le prix de chaque produit est calculé sur la base de prix unitaire de chaque produit, compte tenu du taux de réduction en fonction de la zone de produit et le nombre de terminaux à utiliser. Le nombre de terminaux à utiliser est physiquement identique au nombre d'achats de même produit par un utilisateur. La méthode de calcul est la suivante:
  - ✓ Pour chaque achat du produit par un utilisateur,
    - Le prix de chaque unité de zone est calculée sur la base de prix unitaire et le taux de réduction dépend du nombre de terminaux à utiliser
    - Ensuite, additionner les unités utilisateur achète. Mettons S.
    - Le prix de chaque achat de produits par un utilisateur est calculé après application du taux de réduction selon la zone de produit acheté par l'utilisateur de S.

2. La réduction du prix en fonction du nombre de terminaux à utiliser

- Taux de réduction est lié avec le terminal à utiliser est décrit dans le Tableau 1.

Table 1

Nombre de terminaux à utiliser	Taux de réduction
1	1.0
2 to 3	0.9
4 to 6	0.85
7 to 10	0.80
Plus de 10	0.75

- Par exemple, si le nombre de terminaux à utiliser est de 7:
  Taux de réduction de la 1ère terminal: 1,0
  Taux de réduction de 2e et 3e terminaux: 0,9
  Taux de réduction de 4^{e} à 6e terminaux: 0,85
  Taux de réduction de 7e terminal: 0,8
  Prix total est de (1,0 +0,9 * 2 +0,85 * 3 +0,8) * prix unitaire = 6,15 * prix unitaire

3. La réduction de prix en fonction de la zone de produit à utiliser

- Le taux de réduction lié à la zone de produit à utiliser est décrit dans le tableau 2.

Table 2

Zone de produit à utiliser	Taux de réduction
jusqu'à 50 zones unitaires	1.0
plus de 50 à 500 zones unitaires	0.5
plus de 500 à 2,500 zones unitaires	0.25
plus de 2,500 à 5,000 zones unitaires	0.125
plus de 5,000 zones unitaires	0.0625

*zone unitaire : zone correspondant à une feuille de carte topographique à l'échelle 1:50,000

- Par exemple, si la zone de produit à utiliser est de 60 zones unitaires:
  - Classer les zones unitaires à utiliser dans l'ordre croissant de prix correspondant à zone unitaire (Après avoir examiné le taux de réduction en fonction du nombre de terminaux à utiliser, le prix correspondant à la zone unitaire ne peut pas être le même)
  - Jusqu'à 50ème, le taux de réduction est de 1,0
  - De 51ème à 60ème, le taux de réduction est de 0,5
  - Par conséquent, le prix total des achats de produits par utilisateur est

$$\sum_{k=\text{1ère zone unitaire}}^{\text{50ème zone unitaire}} (\text{prix de produit de k-ème zone unitaire}) \times 1.0$$

$$+ \sum_{k=\text{51 ère zone unitaire}}^{\text{60ème zone unitaire}} (\text{prix de produit de k-ème zone unitaire}) \times 0.5$$

Appendix – 3

Minutes of Meeting
on the Inception Report (IC/R)

Minutes of Meeting
On
Project For
Managing Digital Topographic Data
In
Djibouti City
In
Republic of Djibouti
(Technical Cooperation Project in the form of Development Study)

Agreed upon between
Ministry of Equipment and Transport
And
Japan International Cooperation Agency

Djibouti City, 15th March 2012

Mr. Hasan Ahmed Ibrahim
Chief, Topographic Section
Department of Equipment
Ministry of Equipment and Transports

Mr. Masakuni Nakayama
Team leader of the Study Team,
Japan International Cooperation Agency
(JICA)

Witness by

Mr.Mohamed Ali Hassan
Director
Department of Equipment
Ministry of Equipment and Transports

The JICA Study Team (hereinafter referred to as "the Team") headed by Mr. Masakuni Nakayama visited Djibouti from 14th March, 2012 in order to carry out the Project for Managing Digital Topographic Data in Djibouti City in Republic of Djibouti (hereinafter referred to as "the Study"). Minister De Equipment Tranceportation (hereinafter referred to as "MET") is a counterpart of the Team.

During the meeting on explanation of the Inception Report to MET, the Team and MET discussed the several matters as followings and the Team answered the questions raised by MET. Both sides eventually agreed upon the below.

Before proceeding to have questions on the Inception Report, The Team outlined the project and highlighted significance of the surveys aud the Team members elaborated on the essence of methodology and measurements in accordance with the Inception Report that was prepared in Japan.

The followiug questions were followed by the counterpart and related organization to the explanation of the inception report. Significant issues of the question and the replies to them are as follows.

1. Reconfirmation of the Project period

Counterpart reconfirmed the schedule of the Project to the Team. The Team answered that the Project period is 24 months. In order to complete the Project on schedule, however, the flight permission for aerial photo shooting shall be given to the Team at the earliest possible date. The Counterpart replied that the permission will be issued in a short time since the required application document had been submitted to the Civil Aviation and the Security Office. The Counterpart added that they will continue to contact the related organizations to obtain the permission.

2. Film processing

The Counterpart asked the Team about the film processing after taking aerial photos. The Team answered that since the latest digital camera is used for the Project the film processing needed for analogue camera is not conducted.

3. Training after the Project

A question on training program after the completion of the Project was raised by the Counterpart. The Team answered that no additional training program is planned after the Project and it might be possible for the Counterpart to apply to the survey training course program organized by JICA.

Cooperation for the seminar

The Team requested to the Counterpart to cooperate with the staff of the Team to organize the seminar which will be held on 24th of March. The Counterpart accepted to the offer from the Team.

Appendix

List of Attendants

MET Side

-Minister De Equipment Tranceportation -

Mr. Mohamed Ali Hassan Director, Department of Equipment Ministry of Equipment and Transports

Mr. Ahmed Hassan Moyaleh Conseller technique en charge des affaires administratives et financiers

Mr. Hasan Ahamed Ibrahim Chief, Topographic Section, Department of Equipment

Mr. Abdillahi Aden Maidan Engineer, Topographic Section, Department of equipment

Japanese side

-JICA Study Team-

Mr. Masaknni Nakayama	Team Leader/Digital Editing
Mr. Daikichi Nakajima	Aerial Photography
Mr. Atsushi Mochizuki	Control Point Survey (1)
Mr. Tadaaki Tomita	Control Point Survey (2)
Mr. Mr. Tomohiro Koyama	Interpreter
Mr. Kaoru Tsuda	Utilization Promotion
Mr. Takashi Shirai	Coordinator

Appendix - 4

Map Symbols 1/2,500

Minutes of Meeting
On
Project For
Managing Digital Topographic Data In Djibouti City
In Republic of Djibouti
(Techinical Cooperation Project in the form of Development Study)
Agreed upon between
Ministry of Equipment and Transport
And
Japan International Cooperation Agency

The JICA Study Team in charge of the study for the Project for Managing Digital Topographic Data in Djibouti City in Republic of Djibouti (hereinafter referred to as "the Team") and its counterpart, Minister of Equipment and Transports of Djibouti (hereinafter referred to as "MET) had a meeting to define the features and annotations for 1: 2,500 Scale Digital Data. Both parties have agreed on following points:

1) Digital data at 1/2500 levels will be constructed with 213 features and annotations mentioned on the list here attached
2) The definition of each word has been confirmed mutually and necessary explanations have been given by members of the Team to MET.
3) The number of features and annotations is definitive, but the names mentioned can be modified if necessary through discussions of both parties

Djibouti City, 08 april 2012

Mr. Hassan Ahmed Ibrahim
Chief, Topographic Section
Department of Equipement
Ministry of Equipement and Transports

Mr. Masakuni Nakayama
Team leader of the Study Team,
Japan International Cooperation Agency
(JICA)

Witness by,

Mr. Mohamed Ali Hassan
Director
Department of Equipment
Ministry of Equipment and Transports

Appendix 1 : List of Attendants
Appendix 2: Feature Catalog For Djibouti

Appendix

List of Attendants

MET Side

- Ministry of Equipment and Transports-

Mr. Mohamed Ali Hassan. Director. Department of Equipment, Ministry of Equipment and Transports
Mr. Hassan Ahamed Ibrahim, Chief, Topographic Section, Department of Equipment
Mr. Abdillahi Aden Maidan, Engineer, Topographic Section, Department of Equipment

Japanese side

- JICA Study Team-

Mr. Masakuni NAKAYAMA	Team Leader / Digital Editing
Mr. Daikichi NAKAJIMA	Aerial Photography
Mr Tomohiro KOYAMA	Interpreter

Digital data at 1/2500 levels is constructed with the undermentioned 213 features and annotations.

Feature Catalog for Djibouti 1: 2,500 Scale Digital Data

ID	Code Numbe	Type	名 称	Name	Définition
1	11010000	Line	国境界	National Border	Frontière
2	11020000	Line	リジオン境界	Boundary of Region	Limite de région
3	11030000	Line	コミューン境界	Boundary of Commune	Limite de commune
4	2101000	Polygon	真幅道路	Wide Road (true shape), (width>2m)	Route (largeur > 2m)
5	2203000	Polygon	真形道路橋・高架部	Wide Road Bridge, Elevated Part of Road (width>2m)	Pont de route de largeur > 2m, et Passage supérieur
6	2411000	Polygon	立体交差(道路橋) (width>2m)	Overpass (width>2m)	échangeur (largeur > 2m)
7	2109000	Polygon	建設中 (舗装区別は調査しない)	Road Under Construction(The pavement distinction is not investigated.)	Route en construction (Pas de distinction des types de revêtement)
8	2106000	Polygon	庭園路等(舗装区別は調査しない)	Garden Road (The pavement dist nction is not	Voie amenagée (Pas de distinction des types de revêtement)
9	*Road code+R*	Point	舗装道路 (width>2m)	Pavement Road (width>2m)	Route revêtue (largeur>2m)
10	*Road code+N*	Point	非舗装道路(width>2m)	Unpaved Road (width>2m)	Route non revêtue (largeur>2m)
11	*Road code+P*	Point	不明路	Uncerting bundary road	Piste (largeur>2m)
12	2100000	Line	舗装区分の変化する箇所	Place where different pavements meet	Ligne de séparation de différentes catégories de revêtement de chauss
13	2100001	Line	ポリゴンを生成する為の追加の道路縁(道路の終点部分を閉じる為の補助線)	Supplementary Line (The border of the terminal line of a road object)	Ligne supplémentaire pour faire une polygone fermée.
14	2102000	Line	軽車道	Single Line Type of Road (1m<width<1.9m)	Simple ligne définissant le type des routes (1m<largeur<1.9m)
15	2103000	Line	徒歩道	Foot Path (width<0.9m)	Sentier (largeur < 0.9m)
16	2205000	Line	徒橋	Foot Bridge (width<2m)	Pont pour les piétons (largeur < 1.9m)
17	2211000	Line	横断歩道橋(外形)	Overpass (outline)	Passerelle (contour)
18	2213000	Line	歩道	Sidewalk (Imaginary Line)	Trottoir
19	2226000	Line	分離帯	Separator	Terre plein central
20	2000000	Line	道路中心線	Centerline of road	Ligne axiale de route
21	2215000	Point	地下鉄等の出入口(真形・記号)	Subway Entrance/Exit (outline/symbol)	Entrée / Sortie de métro (contour / symbole)
22	2219000	Point	道路のトンネル(真形・記号)	Road Tunnel (outline/symbol)	Tunnel routier (contour / symbole)
23	2238000	Point	並木	Street Plant	Rangée d'arbres
24	2301000	Line	鉄道	Railway	Voie ferrée
25	2401000	Line	鉄道橋・高架部	Railway Bridge (Elevated Part)	Pont ferroviaire (Partie surélevée)
26	2402000	Line	盛土の上の鉄道	Levee Carrying Railway	Voie ferrée (Partie remblayée)
27	2424000	Line	プラットホーム	Platform	Plate-forme
28	2419000	Point	鉄道トンネルの出入口記号	Railway Tunnel (symbols for Entrance/Exit)	Tunnel ferroviaire (symbole d'entrée et de sortie)
29	2421000	Point	駅	Railway Stop/Station	Arrêt/Station ferroviaire
30	3001000	Polygon	普通建物/小物体(外形)	Building (outline)	Bâtiment ordinare (contour)
31	3002000	Polygon	堅ろう建物/小物体(外形)	Concrete Building/Structure (outline)	Bâtiment en dur (contour)
32	3404000	Polygon	プール	Swimming Pool	Piscine
33	3002340	Line	堅ろう建物外付階段(外形線)	Exterior Stairway with Concrete Building (outline)	Escalier extérieur de bâtiment en béton (contour)
34	3002350	Line	堅ろう建物外付階段 (外形線) (ポーチ ひさし)	Exterior Stairway with Concrete Building (porch canopy)	Escalier extérieur,balcon ou auvent de bâtiment en béton (contour)
35	3001340	Line	普通建物外付階段(外形線)	Exterior Stairway with Ordinary Building (outline)	Escalier extérieur de bâtiment ordinaire (contour)
36	3001350	Line	普通建物外付階段(ポーチ ひさし)	Exterior Stairway with Ordinary Building (porch	Escalier extérieur,balcon ou auvent de bâtiment ordinaire (contour)

37	3402000	Line	屋門(通路部の)	Supplemantary Line for Roof Gate	Ligne supplementaire pour le toiture de portail d'entreé
38	30010000	Polygon	普通建物/小物体(外形)	Building (outline)	Bâtiment ordinare (contour)
39	30020000	Polygon	堅ろう建物/小物体(外形)	Concrete Building/Structure (outline)	Bâtiment en dur (contour)
40	3001310	Polygon	中庭線(普通建物)	patio line (Ordinary Building)	ligne de patio (bâtiment ordinaire)
41	3001320	Polygon	棟割(普通建物)	separation line (Building)	séparation des locaux (batiment ordinaire)
42	3002310	Polygon	中庭線(堅ろう建物)	patio line (Concrete Building)	ligne de patio (bâtiment en dur)
43	3002320	Polygon	棟割(堅ろう建物)	separation line (Concrete Building)	séparation des locaux (bâtiment en dur)
44	3001000	Point	普通建物ﾗﾍﾞﾙ点	LABEL Point for Ordinary Building	Point Label pour bâtiment (Structure ordinaire)
45	3002000	Point	堅ろう建物ﾗﾍﾞﾙ点	LABEL point for Concrete Building	Point Label pour construction en dur
46	3503000	Point	官公署(中央)	Administrative Agency (Commune, Region office)	Bureaux Administratifs (centraux)
47	3504000	Point	裁判所	Court Office	Tribunal
48	3505000	Point	警察署	Police station	Commissariat de police
49	3507000	Point	税務署	Tax Office	Bureaux de fiscalité
50	3509000	Point	郵便局	Post Office	Bureau de poste (PTT)
51	3510000	Point	森林管理署	Forest Management Office	Garde forestière
52	3511000	Point	気象観測所	Meterelogical Office	Station de météorologie
53	3515000	Point	交番・駐在所	Police	Poste de police
54	3516000	Point	消防署	Fire Station	Caserne de pompiers
55	3518000	Point	大使館、国際機関等	Embassy, International Organizations	Ambassade et organisation internationale
56	3519000	Point	役場支所及び出張所	Administration branch office	Bureaux administratifs (régionaux, communaux...)
57	3520000	Point	モスク	Mosqu	Mosquée
58	3523000	Point	キリスト教会	Church	Eglise
59	3525000	Point	幼稚園・保育園	Nursery/Kindergarten	Garderie / Ecole maternelle
60	*School code+U*	Point	大学・専門学校	University, College	Université / Ecole professionnelle
61	*School code+L*	Point	高校	Higth School	Lycée
62	*School code_E*	Point	小学校・中学校	Primary school and junior high school	Ecole primaire / Collège
63	3526000	Point	公会堂・公民館	Public Hall	Salle publique
64	3527000	Point	博物館	Museum	Musée
65	3528000	Point	老人ホーム	Nursing Home	Maison de retraite
66	3531000	Point	保健所	Public Health Center	Centre de santé publique
67	3532000	Point	病院	Hospital	Hôpital
68	3533000	Point	運動場 及びスタジアム	Sport Center /Studium	Terrain de sport / stade
69	3534000	Point	銀行	Bank	Banque
70	3535000	Point	廃屋	Ruins	Bâtiment en ruine
71	3536000	Point	独立した農場	Farm	Ferme
72	3539000	Point	マーケット	Market	Marché
73	3540000	Point	ホテル	Hotel	Hôtel
74	3545000	Point	倉庫	Warehouse	Entrepôt
75	3546000	Point	火薬庫	Pawder magazine	Poudrière
76	3548000	Point	工場	Factory	Usine
77	3549000	Point	火力発電所	Thermal Power Station	Centrale électrique thermique
78	3550000	Point	変電所	Substation (Power Plant)	Poste de transformateur
79	3552000	Point	下水処理場、浄水場	Sewage Disposal, Filtration Plant	Centre de traitement des eaux usées et d'eau potable
80	3556000	Point	給水塔	Water Tower	Château d'eau
81	3560000	Point	ガソリンスタンド	Gasoline Stand	Station-service
82	3561000	Point	ヘリポート	Heliport	Héliport

83	3570000	Point	空港及び付帯施設	Airport with Facilities	Aéroport et installations connexes
84	4227000	Point	貯水槽	Reservoir	Réservoir d'eau
85	4236000	Point	電波塔(記号)	Tv, Radio Mast (symbol outline)	Antenne de relais (télévision, radio, télécommunication) (symbole, contour)
86	4202000	Point	記念碑(記号)	Monument (symbol)	Monument (symbole)
87	4203000	Point	立像(記号)	Statue (symbol)	Statue (symbol)
88	4228000	Point	起重機(記号)	Crane (symbol)	Grue (symbol)
89	4239000	Point	風車(記号)	Windmill (symbol)	Moulin à vent (symbol)
90	4241000	Point	灯台(記号)	Lighthouse (symbol)	Phare (symbol)
91	4243000	Point	灯標(記号)	Sea Light Beacon (symbol)	Feu(symbol)
92	4219000	Point	坑口(真形,記号)	Culvert (Pith mouth symbol, outline)	buse(symbol)
93	7206000	Point	洞口(記号)	Cave Moot (symbol)	Grotte (symbole)
94	7201000	Point	土がけ 崩土 (記号)	Soil Cliff (symbol)	Falaise(symbole)
95	7211000	Point	岩がけ(記号)	Stone Cliff(symbol)	Falaise en rocher(symbole)
96	7213000	Point	散岩	Scattered Rock (Minimum)	Cailloux éparpillés
97	4224000	Point	井戸(水),(記号)	Well (water)	Puits et forage(eau)
98	4225000	Point	公共水栓(記号)	Public Water Faucet	Borne-fontaine publique
99	4226000	Point	整備された泉や水源(記号)	Improved Spring	Source d'eau aménagée
100	4261000	Line	輸送管 地上	Pipe (On ground)	Conduite au sol
101	4262000	Line	輸送管 空間	Pipe (above ground)	Conduite surélevée
102	4266000	Line	送電線の鉄塔	Tower for Power Line	Pylône
103	4265000	Line	送電線	Power Line	Câble électrique
104	5101000	Polygon	河川(真幅)	Wide River and canal (width>2m)	Rivières et canaux (largeur>2m)
105	5103000	Polygon	かれ川(真幅)	Wide Intermitted River (width>2m)	Oued (largeur>2m)
106	5105000	Polygon	湖、池、沼	Lake, Pond, Bog	Lac, Etang, Mare
107	5111000	Polygon	窪地	Intermitent Pond/Lake	cuvette
108	*Tank code+E*	Point	タンク(水)	Tank (water)	Réservoir (eau)
109	*Tank code+G*	Point	タンク(ガス)	Tank (gas)	Réservoir (gaz)
110	*Tank code+P*	Point	タンク(石油)	Tank (petrol)	Réservoir (pétrole)
111	5100000	Point	海岸線から海の領域ポリゴンを生成する為のラベル点	Label point for Shoreline polygon	Point Label servant à créer la polygone de la mer suivant la côte
112	5101000	Point	河川(真幅)	Wide River and canal (width>2m)	Rivières et canaux (largeur>2m)
113	4231000	Line	タンク(外形線)	Tank (outline)	Reservoir (contour)
114	51000000	Line	海岸線	Shoreline (Ocean)	Ligne côtière
115	5202000	Line	桟橋 鉄･ｺﾝｸﾘｰﾄ	Pier (Iron/Concrete)	Jetée (metallique/béton)
116	5203000	Line	桟橋 木	Pier (wood)	Jetée (bois)
117	5211000	Line	防波堤	Break Water	Brise-lames
118	5265000	Line	ドック	Dock	Quai
119	5102000	Line	細流	Stream (River/Canal), (width<1.9m)	Cours d'eau (Rivières et canaux) (largeur<1.9m)
120	5104000	Line	かれ川	Intermitted River (width<1.9m)	Oued (largeur<1.9m)
121	5221000	Point	渡船発着所	Boat Station	Quai d'embacation
122	5241000	Point	流水方向	Water flow Direction	Sens du courant
123	6212000	Point	駐車場	Parking	Parking
124	6215000	Point	墓地	Cemetery	Cimetière
125	6216000	Point	廃棄物集積場	Refuse Dump	Décharge d'ordures
126	6231000	Point	採砂場、採石場、石切り場	Quarry	Carrière

127	6218000	Point	空港内の滑走路と誘導路	Airstrip and Taxiway	Piste d'atterissage et bretelles
128	6262000	Point	公園	Park	Parc
129	6201000	Line	区域界	Boundary of Particular Area	Limites de parcelle ou de concession
130	6311000	Point	田	Paddy Field	Rizière
131	6312000	Point	塩田	Salt farm	Marais salant
132	6313000	Point	畑	Cultivated Field	Champs de culture
133	6314000	Point	さとうきび畑	Sugarcane Plantation	Plantation de canne à sucre
134	6318000	Point	茶畑	Tea Plantation	Plantation de thé
135	6319000	Point	果樹園	Orchard	Plantation de fruits (verger)
136	6321000	Point	その他の樹木畑	Other Trees Plantation	Autre plantation des arbres
137	6322000	Point	ユーカリ	Eucalyptus	Eucalyptus
138	6323000	Point	牧草地(草地)	Meadow (Grass land)	Pâture(Prairie)
139	6324000	Point	ヤシ	Palm Tree	Palmier
140	6326000	Point	コーヒー	Coffee	Caféier
141	6327000	Point	綿花	Cotton	Coton
142	6328000	Point	パピルス	Papyrus Tree	Papyrus
143	6329000	Point	低木、潅木	Shurb with Grass	Arbrisseau
144	6330000	Point	アカシア	Acacia	Acacia
145	6331000	Point	広葉樹林、針葉樹林	Broad Leaf Forest, Needle Leaf Forest	Forêt latifoliée, Forêt de conifères
146	6334000	Point	樹木の無くなったはげた所	Bare Land	Terre sans végétation (terre nue)
147	6338000	Point	湿地	Swamp, Marsh	Marais
148	6340000	Point	砂れき地	Sand Area/Conglomerate	terre sablonneuse et caillouteuse
149	6301000	Line	植生界	Vegetation Boundary	Limite de végétation
150	6302000	Line	耕地界	Farmland Boundary	Limite de terrain agricole
151	6214000	Point	庭木	Garden Tree	Arbre de jardin
152	4221000	Point	独立広葉樹、独立針葉樹	Independent Trees	Latifolié isolé, Conifère isolé
153	7101000	Line	等高線(計曲線)	Index Contour Line (10m interval)	Courbe de niveau maîtresse
154	7102000	Line	等高線(主曲線)	Intermediate Contour Line (2m interval)	Courbes de niveau normale
155	7103000	Line	等高線(補助曲線)	Auxiliary Contour Line	Courbe de niveau intercalaire
156	7105000	Line	凹地(計曲線)	Depression Intermediate	Courbe de dépression (maîtresse)
157	7106000	Line	凹地(主曲線)	Depression Intermediate	Courbe de dépression (normale)
158	7107000	Line	凹地(補助曲線)	Depression Auxiliary	Courbe de dépression (intercalaire)
159	6130000	Line	さく	Fence	Clôture en fil de fer
160	6140000	Line	へい	Wall	Mur de clôture
161	6120000	Line	生垣	Hedge	Haie
162	5227000	Line	せき(記号)	Weir (symbol)	Barrage (symbole)
163	5227110	Line	せき(上流部)	Weir (upstream side)	Barrage (côté en amont)
164	5227120	Line	せき(下流部)	Weir (downstream side)	Barrage (côté en aval)
165	5228000	Line	水門	Sluice Gate	Écluse de régulation
166	5232000	Line	透過水制	Permeable	Ouvrages hydrauliques de protection
167	6101110	Line	人工斜面(上)	Artificial Slope Hachure (upper side), Cutting	Haut talus
168	6101120	Line	人工斜面(下)	Artificial Slope Hachure (lower side), Cutting	Bas talus
169	6102000	Line	土提(記号)	Embankment (width< 1.9m)	Endiguement (largeur < 1.9m)
170	6110110	Line	被覆(上)	Revetment (upper side), width>2m	Revêtement et talus revêtus (côté supérieur), largeur > 2m
171	6110120	Line	被覆(下)	lake, Pond, Bog	Revêtement et talus revêtus (côté inférieur), largeur > 2m
172	6110000	Line	被覆(記号)	Revetment (width<1.9m)	Revêtement (largeur < 1.9m) (symbole)

173	7201110	Line	土がけ 崩土(上)	Soil Cliff (upper line), width>2m	Falaise (ligne supérieure), largeur > 2m
174	7201120	Line	土がけ 崩土(下)	Soil Cliff (lower line), width>2m	Falaise (ligne inférieure), largeur > 2m
175	7202000	Line	雨裂	Rain Gully	Ravin
176	7211110	Line	岩がけ(上)	Earth Cliff (upper line), width>2m	Falaise en rocher (ligne supérieure), largeur > 2m
177	7211120	Line	岩がけ(下)	Earth Cliff (lower line), width>2m	Falaise en rocher (ligne inférieure), largeur > 2m
178	7212000	Line	露岩	Bare Rock	Rocher apparent
179	7214000	Line	さんご礁	Coral Reef	Récifs coraux
180	7301000	Point	三角点(記号 標高値)	Triangulation Point	Point de triangulation
181	7302000	Point	国家水準点(記号 標高値)	Bench Mark	Bornes de nivellement existantes
182	7303000	Point	GPS点等	GPS Point	Point de GPS
183	7311000	Point	標石を有しない簡易水準点	Spot Elevation Point without Stone Post	Points de repère de nivellement sans pierre de bornage
184	7312000	Point	図化機測定の標高点	Spot Elevation Point Base on Photogrammetric Survey (100m pitch)	Point côté
185	7501000	Point	グリッドデータ	Grid Points Data	Grid Points Data (point semis)
186	7510000	Point	ランダムポイント	Random Points Data	Random Points Data (point de sommet)
187	7521000	Line	ブレークライン	Break Line Data	Lignes de crête et de talweg (Break Line Data)
	The code number of the annotation adds 8 to the head of the code number of feature.ここから下のコード番号は上記の				L'ajout d'un "8" au début des numéros donne les codes d'annotation
188	81102000	Text(annota	リジオン名	Region Name	Nom de région
189	81103000	Text	コミューン名	Commune Name	Nom de commune
190	81104000	Text	カルテー名	Quartier Name	Nom de quartier
191	82101000	Text	真幅道路名	Road Name	Nom de route
192	82219000	Text	道路のトンネル記号名	Road Tunnel (symbol) Name	Nom de tunnel routier (symbole)
193	82301000	Text	鉄道名	Railway Name	Nom de voie ferrée
194	82421000	Text	駅名	Railway Stop/Station Name	Nom de arret/statión ferroviaire
195	83503000	Text	官公署官公署(中央)	Administrative Agency (Commune, Region office)	Bureaux Administratifs (centraux)
196	83519000	Text	役場支所及び出張所名	Branch Office	Bureaux administratifs (régionaux, communaux...)
197	83532000	Text	病院名	Hospital	Nom de l'hôpital
198	83570000	Text	空港名	Airport with Facilities	Nom d'aéroport et installations connexes
199	85101000	Text	河川(真幅)名	Wide River and Drainage (width>2m)	Nom de rivieres (largeur>2m)
200	85103000	Text	かれ川(真幅)名	Wide Intermitted River (width>2m)	Nom de l'oued (largeur>2m)
201	85105000	Text	湖、池、沼名	Lake, Pond, Bog	Nom de lac, etang, mare
202	85102000	Text	細流名	Stream (River/Canal), (width<1.9m)	Cours d'eau (Rivières et canaux)(largeur<1.9m)
203	86262000	Text	公園名	Park	Nom de parc
204	8151000	Text	岬・崎・鼻・岩礁名	Cape/Cay Name	Nom de cap / banc de sable
205	8151000	Text	河岸・川原・洲,滝・浜・磯名	Riverside/Cay/Waterfall/Beach Name	Rivage, lit de riviere, banc de sable, chute d'eau, plage, rivage
206	8151000	Text	山・島名	Mountain/Island Name	Nom de montagne / île
207	85221000	Text	渡船発着所名	Ferry Station	Nom de quai d'embacation
208	8171000	Text	小峰・丘・塚名	Hill/Mound Name	Nom de colline
209	8171000	Text	谷・沢名	Valley Name	Nom de vallée
210	8181000	Text	説明注記	Anotation of Explanation	sigle d'annotation de symbole
211	87101000	Text	等高線数値	Contour Value	Valeur de courbe de niveau
212	8199000	Point	指示点	Reference Point Name	Point indicateur de lieu
213	MAP_INDEX	Line	図郭線	Neatline	Cadre

Appendix – 6

Minutes of Meeting
on the Progress Report (PR/R)

Minutes of Meeting

On

Project For

Managing Digital Topographic Data

In

Djibouti City

In

Republic of Djibouti

(Technical Cooperation Project In the form of Development Study)

Agreed upon between

Ministry of Equipment and Transports

And

Japan International Cooperation Agency

Djibouti City, 7th October 2012

Mr. Hasan Ahmed Ibrahim	Mr. Masakuni Nakayama
Chief, Topographic Section	Team leader of the Study Team
Department of Equipment	Japan International Cooperation Agency
Ministry of Equipment and Transports	(JICA)

Witness by

Mr. Mohamed Ali Hassan

Director /Department of Equipment

Ministry of Equipment and Transports

Date and place of the meeting : 7th October 2012 at Meeting Room of the Ministry of Equipment and Transports

Purpose of the meeting

Explanation of Progress Report

The Team Leader, Mr. Nakayama, gave an explanation of the progress report. On the other hand, the chief engineer, Mr. Nakajima, submitted requests for accomplishing planned works. The two parties have consulted together to find solutions.

Details

1. Explanation of the Progress Report

Mr. Nakayama gave the explanation of the progress report and explained the work schedule in Djibouti over two months. Djibouti party understood these explanations and both parties have agreed these topics.

2. Collection of documents

Nakajima: A map showing the boundaries of municipalities is necessary because it is not possible to verify them on the study site.

Hassan: This document has been requested to the authorities concerned and will be available in the next few days.

The Secretary General, Mr. Adou, added that if Mr. Hassan cannot meet the needs, he would take necessary measures, such as written requests.

3. Works in areas where access is difficult.

Nakajima: To enter the port area was very difficult and took a long time during the last mission.

Adou: Mr. Hassan will accompany the study team to enter the port.

Nakajima: The necessary documents will be prepared for working in the port area. Several round trips needed at the last stay.

Adou: The request for authorization to enter the port will be presented to the port director. What day the team enters the port?

Nakayama: The exact schedule will be communicated by M. Nakajima to Mr. Hassan.

4. Others

Adou: I hope both parties share the expectations of the other party and work to achieve common goals.

All members have agreed.

List of Attendants

Djibouti Side

- Ministry of Equipment and Transports -

Mr. Adou Ali Adou, Général Secretary, Ministry of Equipment and Transports

Mr. Mohamed Ali Hassan, Director, Department of Equipment

Mr. Hassan Ahmed Ibrahim, Chef; Topographic Section, Department of Equipment

Mr. Abdillahi Aden Maidan, Engineer, Topographic Section, Department of Equipment

Japanese Side

- JICA Study Team -

Mr. Masakuni Nakayama, Team Leader/ Digital editing

Mr. Daikichi Nakajima, Aerial photography

Mr. Tadahiko Sekiguchi, Field study/ Additional survey

Mr. Toshiyuki Wakabayashi, Field study/ Additional survey

Mr. Hayato Fukuoka, Coordinator

Mr. Tomoyuki Otani, Interpreter

Appendix – 8

Minutes of Meeting
on the Interim Report (IT/R)

Minutes of Meeting

On

Project For

Managing Digital Topographic Data

In

Djibouti City

In

Republic of Djibouti

(Technical Cooperation Project In the form of Development Study)

Agreed upon between

Ministry of Equipment and Transports

And

Japan International Cooperation Agency

Djibouti City, 9th September 2013

Mr. Hassan Ahmed Ibrahim
Chief, Topographic Section
Department of Equipment
Ministry of Equipment and Transports

Mr. Masakuni Nakayama
Team leader of the Study Team
Japan International Cooperation Agency
(JICA)

Witness by

Mr. Mohamed Ali Hassan
Director, Department of Equipment
Ministry of Equipment and Transports

Date and place of the meeting : 9th September 2013 at Meeting Room of the Ministry of Equipment and Transports

Purpose of the meeting

- Illustration of works carried out by the Study Team to the present time
- Explanation about the contents of interim report by the Study Team
- Explanation about works to be carried out (On site complementary topographic survey)
- Questions and answers session, and discussion between both parties

1. Illustration of works carried out

Mr. Nakajima gave an explanation about the works carried out for present time:

- Orthophotos covering 300km2 (112 leaves) have been made
- Topographicals maps covering 100km2 (49 leaves) have been made

Following the questions asked by the Djiboutian party, and the answers given by the Study Team, concerning the maps created.

Question: Do the names of roads appear on the printed maps?

Answer: The names of the national roads are mentioned on the printed maps which will be submitted at the end of the project. Names of other roads are not appeared, but it is possible to add subsequently on the digital data.

Question: There is a former map, which contains useful information. Is that used for the mapping work within the present project?

Answer: The Study Team, during previous collection work of documents, had acquired that former map. The collected documents has been reflected on the new maps, in theory.

2. Explanation about the contents of interim report by the Study Team

The Study Team has submitted the interim report to the Djiboutian party, 10 copies of French version and 10 copies of English version.

The Team Leader, Mr. Nakayama, gave an explanation about the contents of interim report to the Djiboutian party, as well as the schedule of the present mission:

- On the occasion of this mission, which is the 4th dispatch of the Study Team within the present project, a complementary survey will be carried out with Djiboutian counterparts during the period from 03 September to 15 October.
- In addition of the works above-mentioned, the Study Team would like to have a meeting during its stay in Djibouti with different authorities concerned, to discuss about management and utilization of the digital data and the topographical maps which will be supplied to the Djiboutian party at the end of the project.

The Djiboutian party is agree for this point. Both parties are agree to call a first meeting of different authorities on Monday 16th September.

Chef of Topographic Section will prepare a list of participants.

The Djiboutian party hopes an assistance by Japanese experts after achievement of the project, for 1 year, to ensure an efficacious utilization and a good management of the digital data and the topographical maps supplied:

- 1 expert specialist in update of the data
- 1 expert specialist in GIS

In response, the Study Team suggested that it would be better to submit a request officially to Japanese authority.

The Djiboutian party suggested to arrange a courtesy visit to the Minister of Equipment and Transports, with a session of presentation of the project. Both parties agree to schedule the visit on Thursday 12 September.

3. Other issues

The Djiboutian party informed the Study Team that some administrative organs would like to know if it is possible to acquire a software to ensure the visualization of cartographical images in 3D.

The Study Team suggested that it would be better to submit a request to JICA with justification of necessity and that if the Djiboutian party would like to use it within the technology transfer provided by present project, as it will be finished on January 2014, the request should be prepared as soon as possible.

List of Attendants

Djibouti Side

- Ministry of Equipment and Transports -

Mr. Adou Ali Adou, Général Secretary

Mr. Mohamed Ali Hassan, Director, Department of Equipment

Mr. Mahdi Abdillahi Sougouleh, Dupty Director, Department of Equipment

Mr. Hassan Ahmed Ibrahim, Chef; Topographic Section, Department of Equipment

Mr. Abdillahi Aden Maidan, Engineer, Topographic Section, Department of Equipment

Japanese Side

- JICA Study Team -

Mr. Masakuni Nakayama, Team Leader/ Digital editing

Mr. Daikichi Nakajima, Field study/ Additional survey

Mr. Tadahiko Sekiguchi, Field study/ Additional survey

Mr. Toshiyuki Wakabayashi, Field study/ Additional survey

Mr. Tomohiro Koyama, Interpreter

Appendix - 9

Minutes of
Stake Holder Meeting (1st)
September 2013

Minutes of Meeting

On

Project For

Managing Digital Topographic Data

In

Djibouti City

In

Republic of Djibouti

(Technical Cooperation Project In the form of Development Study)

Agreed upon between

Ministry of Equipment and Transports

And

Japan International Cooperation Agency

Djibouti City, 19th September 2013

Mr. Hassan Ahmed Ibrahim
Chief, Topographic Section
Department of Equipment
Ministry of Equipment and Transports

Mr. Masakuni Nakayama
Team leader of the Study Team
Japan International Cooperation Agency
(JICA)

Witness by

Mr. Mohamed Ali Hassan
Director Department of Equipment
Ministry of Equipment and Transports

Date and place of the meeting : 19th September 2013 at Meeting Room of the Ministry of Equipment and Transports

Purpose of the meeting

- To explain the project outline to different institutions and agencies of Djibouti, which will use the topographic maps and the digital data supplied by the project.
- To have a discussion between different actors about the challenges to be met in order to ensure an effective use of the topographic maps and digital data, in particular:
  - Setting up a data sharing mechanism
  - Establishment of an institutional system for data update
  - Establishment of a digital data selling system

1. Opening of the meeting

After an opening address by Mr. Adou Ali Adou, General Secretary of the Ministry of Equipment and Transportation, Mr. Mohamed Ali Hassan, Director of Equipment, gave an explanation of the project background and its objectives to the Djiboutian participants.

2. Presentation of the project

Mr. Nakayama, Chief of Japanese study team, presented to the Djiboutian participants the contents of the project and its progress, using supporting documents (attached herewith) that Japanese party had prepared before the meeting:

- The project is implemented for a term of two years. The orthophotos, the topographic maps and the digital data covering the project area will be finalized by January 2014, to be submitted to the Djiboutian party.
- This is the 4th mission in the framework of the project, which consists in finalizing the draft maps prepared up to the present time, through an on-site complementary survey.
- This mission has another objective, which is to discuss with different actors of Djiboutian side about the effective and sustainable use of the products of the project, the data updating, as well as the establishment of a system for these matters.

3. Explanation of process and specifications of the products

Mr. Nakajima, Chief engineer of the Study Team, gave an explanation using the orthophotos and the topographic maps which are prepared up to the present time.

- Topographic data in AutoCAD and DWG format have been made, and the

symbolization has been done on the basis of the results of the studies carried out during the first year of the project.

- The maps, consisting of 49 leaves, cover almost all residential areas apart from the south area behind the airport.

- The orthophotos have been made on a larger area then the area targeted for cartographic work. For the districts which has not been covered by the cartographic work in the framework of this project, the maps should be produced by the Topographic Section of the Ministry of Equipment and Transportation.

- GIS data has also been prepared using ESRI software (Shape and Geodatabase format)

- Three types of data have been created, i.e., Orthophotos, Topographic map data (AutoCAD et DWG format) and GIS data (ESRI : Shape, Geodatabase format)

- The metric system used is not the UTM. In the framework of the project, the latest world geodetic system is used. After selecting two orientation points in Djibouti, we have implemented a measurement taking one existing point in Ethiopia and another point in a neighbor country, to determine latitude and longitude. We produce plane figures using Gauss-Krüger method.

4. Discussion between Japanese Study Team and concerned institutions

1) Suggestions and hopes concerning the effective use of data and data update (Mr.Nakayama, Study Team)

- There are three challenges, as follows : Setting up a data sharing mechanism, establishment of a institutional system for data update, and establishment of a digital data selling system.
- We suppose that the Topographic Section will be the principal organ for update of topographic maps.
- For updating the topographic maps, it will be necessary to implement modifications along with the situations changing with the times, on the basis of the information coming from different structures such as EDD, ONEAD, DHU, Department of Cadastre etc,.
- The maps that we produce will be used as base maps. These base maps will be exploitable by integrating thematical data collected and managed by different structures.
- We would like to hear opinions from the participants of this meeting, who are future users of the products developed by the project.

2) Actual situation and Challenges to be met (Director of Equipment)

- To put the topographic data to practical use, it will be necessary to establish a committee which will coordinate works of different organizations concerned.
- Concerning the data management, we should put in place an institutional system for data update as well as a selling system of topographic maps.
- We wish dispatch of two Japanese experts, to ensure good management and data update practices, after the end of the project.
- Meanwhile, there are two old maps in PDF format, one presenting the east side of Djibouti-city, and the other the west side. These maps should be completed in terms of toponymie.

3) Exchange of opinions

(DHU)

- DHU will be a main and leading user of topographic data. This department have to play a role in the coordination concerning mapping, including data update. However, at the present time, it doesn't have enough materials nor personnel. We need assistance to be better equipped with sufficient materials and personnel, and in particular, the personnel training is one of the most important issues. In any case, a section with two or three qualified staffs, taking care only about data update. The section in question will need appropriate materials and specialized personnel, who will eventually be trained by Japanese technical cooperation.

(Study Team -Mr.Nakajama)

- We have already implemented a technical transfert programme concerning the mapping towards staffs of the Topographic section since more than 2 months, and they have acquired the knowledge needed for producing and updating the maps. In my opinion, it would be better to put the Topographic section in charge of data update, while the Commitee which will be established by different institutions, including DHU, will play a role in the general coordination.

(DHU)

We have no objection to the idea that data update will be mainly carried out by the Ministry of Equipement since it is better equipped than other departments concerned by topographic maps. We just hope that the Ministry of Equipment will share updated information with all other stakeholders, who also have to implement small updates

continuously.

(CERD)
This is a very important issue, for which we cannot make a decision at this meeting. We have to continue to discuss in order to find out an optimal solution. In all over Djibouti, there are a lot of institutions working in the field of geographical information collecting. Other than the Department of Equipment, DHU continues important works concerning the housing of Djibouti-city. There are also many other departments intervening directly or indirectly in the works concerned by geographical information.
Also CERD has a geographic database covering all the territory of Djibouti.,
It is necessary to create a work network. For example, DHU offers takes the information concerning the housing, CERD provides available data by which other institutions complete theirs, etc. It is a veritable data sharing between different institutions.
We should create a complete organism whom role is especially updating the data established through the project implemented by Japan. To create what doesn't exist, investment, infrastructures, budgets etc., will be needed. We should take in consideration all these issues, and think over very carefully about a network of different institutions. The existing telecommunication tools can be used also, efficiently.

(Civil Protection)
All of construction permits are issued through the Civil Protection.
When a disaster occurs, we need the maps.
Therefore, we need to participate in training programs with other related structures, when there is an occasion.

(General Secretary / Director of Equipment)
We are now in the final phase of the implementation of the project. The important thing is to support the works in progress, by providing as much information as possible. For the data updating issue as well as the establishment of the commitee, we shall take the time to think over together in order to create a system.

(Deputy mayor)
Once the city maps have been completed and actualized by this project, we will take necessary measures to ensure the personnel training, the setting up of a section in

charge of the cartography, etc. We are ready to collaborate for the creation of the committee.

(Study Team - M.Nakajima)
The project prepares digital data. As these products are digital, data can be copied and delivered easily between users. Therefore, distribution with payment would not be a realistic solution.
Is there any regulation that controls the data sharing between administrative structures, in Djibouti?

(Director of Equipment)
Our department as well as CERD have managing and selling experiences. Selling system have existed also. However, the clients were mainly private consultants, and we were selling printed maps but not digital data.

(DHU)
The selling system exists at public companies level, such as EDD, ONEAD etc. However it is difficult for the administrative structures to buy and sell the products, as these structures are operated operated with government budget.

(Equipe japonaise – M.Nakayama)
We are here together today for a first discussion on the subject of setting up of the commitee and the data sharing system. The ideas discussed today should find a concret shape. That is why we suggest holding of a second meeting very soon.

(CERD)
It is also important to evaluate the human resources, financial matters etc that each structure needs to achieving our common goals, from the point of view of the data updating as well as the efficient use of data.

List of participants

Djiboutian side

- Ministry of Equipment and Transportation -

Mr. Adou Ali Adou, General Secretary

Mr. Mohamed Ali Hassan, Director of Equipment

Mr. Mahdi Abdillahi Sougouleh, Dupty Director of Equipment

Mr. Hassan Ahmed Ibrahim, Cheif of Topographic Section, Department of Equipment

Mr. Abdillahi Aden Maidan, Engeneer, Topographic Section, Department of Equipment

- Ministry of Interior-

Mr. Abdoulkader Abayazid Moussa, Dupty Director, Civil Protection

- Djibouti-City -

Mr. Houssein Kamil Kayad, Dupty mayor

Mr. Yacin Abdi, Technical Director

- Ministry of Housing and Urbanism -

Mr Mohamed Elmi, Department of Environment

Mr Mohamed Ali Houssein, Dupty Director of Housing (DHU)

- EDD -

Mr. Adem Djama, Chief of Research Division

Ms. Zahra Hassan, Department of Research and Planning

- CERD -

Mr. Julludin Mohamed, General Director

- ONEAD -

Mr. Nachwan Ahmed, Chief of Research Section

Japanese side

- Bureau de la JICA à Djibuti-

Ms. Yasue Miyanaka, in charge of Project Formulation

- Study Team -

Mr. Masakuni Nakayama, Team Leader/ Digital editing

Mr. Daikichi Nakajima, Field study/ Additional survey

Mr. Tadahiko Sekiguchi, Field study/ Additional survey

Mr. Toshiyuki Wakabayashi, Field study/ Additional survey

Mr. Tomohiro Koyama, Interpreter

Appendix – 10

Minutes of Meeting
on the Draft Final Report (DF/R)

Minutes of Meeting

On

Project For

Managing Digital Topographic Data

In

Djibouti City

In

Republic of Djibouti

(Technical Cooperation Project In the form of Development Study)

Agreed upon between

Ministry of Equipment and Transports

And

Japan International Cooperation Agency

Djibouti City, January 23rd, 2014

Mr. Hassan Ahmed Ibrahim
Chief, Topographic Section
Department of Equipment
Ministry of Equipment and Transports

Mr. Masakuni Nakayama
Team leader of the Study Team
Japan International Cooperation Agency
(JICA)

Witness by

DIRECTION DE L'EQUIPEMENT
Le Directeur

Mr. Mahdi Abdillahi Sougouleh
Director
Department of Equipment
Ministry of Equipment and Transports

Date and place of the meeting: January 23rd, 2014 at Meeting Room of the Ministry of Equipment and Transports.

The meeting has been enforced with TSDE members and JICA study team, under the attendance of the minister of TSDE and the Deputy Director of Urban Planning in the Ministry of Housing, Urban Planning and Environment. JICA study team had explained by power point based on the project outline and draft final report. TSDE has agreed the contents of the draft final report and received the following items from the JICA study team:

1. Ten sets of Draft Final Report (English)
2. Ten sets of Draft Final Report (French)
3. Ten sets of Draft Final Report Summary (English)
4. Ten sets of Draft Final Report Summary (French)
5. Five sets of A0 size booklet
6. Fifty sets of A3 size booklet

Purpose of the meeting

- Illustration of works carried out by the Study Team to the present time
- Explanation about the contents of Draft Final Report by the Study Team
- Explanation about works to be carried out (Final seminar, Stakeholder meeting)

Questions and Answers

1. Additional mapping
   Djibouti side: what kind of procedure is necessary for additional mapping work in the cause of rapidly developing urbanism in the surrounding of the centre city?
   Study team side: explained the agreed work area of this project and recommended to submit an application letter to JICA for the additional mapping.

2. Acquiring ortho maps
   Djibouti side: how can we acquire ortho map as soon as possible for the utilization in master plan preparation?
   Study team: this project work will be completed in the end of January 2014, and the final results will be handed over by JICA in March 2014. The study team does not have any authority to change this schedule. The study team will report this issue to JICA and ask for decisions.

3. About the final seminar and stakeholder meeting
   Under the discussion, the schedule procedure for the final seminar and stakeholder meeting was agreed as followed:
   a. Final seminar: January 25th, 2014
   b. Stakeholder meeting: January 20th, 2014
   c. The final seminar invitation list (draft) will be prepared by Djibouti side and discussed by the study team
   d. The invitation letter for final seminar will be prepared and sent by Djibouti side
   e. Djibouti side will make arrangements to invite media (ex. TV, newspaper....) journalists for the final seminar

Appendix

List of Attendants

Djibouti Side

- Ministry of Equipment and Transports -

Mr. Moussa Ahmed/ Minister; Ministry of Equipment and Transports

Mr. Said Nouh Hassan/ Secretary General

Mr. Mahdi Abdillahi Sougouleh/ Director; Department of Equipments

Mr. Souleiman Moumin/ Assistant Director; Department of Equipments

Mr. Hassan Ahmed Ibrahim/ Chief; Topographic Section, Department of Equipment

Mr. Souleiman Mohamed Hassan/Chief; Control Section, Department of Equipment

Mr. Elad Moussa/ Engineer; Topographic Section, Department of Equipment

- Ministry of Housing, Urban Planning and Environment -

Ms. Amina Abdi/ Secretary General; Ministry of Housing, Urban Planning and Environment

Japan Side

- JICA Study Team -

Mr. Masakuni Nakayama, Team Leader/ Digital editing

Mr. Daikichi Nakajima, Field study/ Technology transfer

Mr. Akira Ota, Field study/ Utilization promoter

Mr. James Kazumori Watson/ Coordinator

Mr. Tomohiro Koyama/ Interpreter

Appendix – 11

Participants List

Stake Holder Meeting (2nd)

January 2014

<List du 2e Réunion des acteurs concernés>

	Organisation		Title	Nom
1	Direction de l'Equipement	1	Direction de l'Equipement	Mahdi Abdillahi Souleiman.
2	Centre d'Etude et des Recherche de Djibouti(CERD)	2	Coordinateur projet Centre de Biogaz	(BAYGFDRE) SANATAR ABDI OSMAN
3	Université de Djibouti			
4	Autorités des ports et des Zones franches	1	chargé de projet	mahad abdi ceden
5	Direction de l'Habitat et de l'Urbanisme	2	Chef SPRV - Sous Directeur	MOHAMED ALI KAOURAH et HABIB ABRA ALI MOHAMED
6	Direction de l'Environnement / IDRISS ISMAEL NOUR Sous-directeur	2	Houssein Ricache Robleh / Directeur de l'Environnement	Mohamed Elmi Obsieh / cadre à la Direction de l'Environnement
7	Mairie de Djibouti			
8	Protection Civile	1	directeur adjoint DNPC	Abdoul Salam Abdoulkader Abdillahi
9	Statistiques et des Etudes Démographiques			
10	Domaines et de la Conservation Foncière			
11	Génie civil de l'Armée nationale			
12	Office National de l'Eau et de l'Assainissement de Djibouti(ONEAD)			
13	Electricité de Djibouti (EDD)	2	DJAMA ALI DJAMA Chef de Division BEP	SERVICE INTERCONNEXION Aden Djama Mousse
14	Djibouti Télécom			
15	ADDS	1	Chef de projet PARRUD	Emmanuel PAILLART.
16	FER			
17	AID	2+1	Responsable Infrastructures	Mariam Ahmed Mohamed
18	Agence Nationale de la Météorologique			
19	Aviation civile	1	Directeur Aviation civile	ALMIS HAID
20	Port de Djibouti	1	Ingénieur des projets	Mohamed. Kayeh
21	Office National de droits d'Auteurs et des droits Voisins	1	Directeur adjoint	Naguib Ali Kayed
22	Organisation Djiboutienne de la Protection Industrielle et Commerciale(ODPIC)			
23	Géstion des Risques et des Catastrophes	1	Consultant	Sagal yassin - Abazid ibrahim.
24	Education Nationale et de la Formation professionnelle			
25	STDE			
26	JICA Djibouti	1	Yasue Miyanaka ⟷	Project formulation Adviser
27	Aeroport International de Djibouti		Mariam Ahmed	Chef Div Exploitation Générale
28	〃 〃		Ibrahim Moussa FARAH	Chargé des Normes et Procédures
27	DIRECTION ENVIRONNEMENT		IDRISS ISMAEL NOUR	Sous - Directeur -
29	Direction des AFFAIRES MARITIMES	1	ALI-MIRAH CHEHEM DAOUD	Directeur

Appendix – 12

Participants List

Utilization Promotion Seminar (Last)

January 2014

- Séminaire Final -
Liste des participants

26 Janvier, 2014

Nbre	Institution	Fonction	Nom (Caractère d'imprimerie)	Signature
	COMITE TECHNIQUE			
1	Direction de l'Equipement M.E.T	S.G	SAID NOUH HASSAN	
	Direction de l'Equipement	Directeur Equipement	HAMID ABDILLAHI SOULEILEH	
	Direction de l'Equipement	TECHNICIEN TOPOGRAPHE	MOHAMED NOUR KARIEH	
	Direction de l'Equipement	Technicie Topographig	Abdillahi Ali DOUALEH	
	Direction de l'Equipement	chef Service Topographie	Hassan Ahmed	
2	Centre d'Etude et des Recherche de Djibouti -CERD	Chercheur / Coordinateur Projet GRDZ II	SAMATAR ABDI OSMAN	
	Centre d'Etude et des Recherche de Djibouti -CERD	Dr. CERD	Jalludin Mohamed	
	Centre d'Etude et des Recherche de Djibouti -CERD			
3	Université de Djibouti	Directrice du Centre de Recherche de l'IUD	AYAN MAHAMOUD MOHAMED	
	Université de Djibouti	Enseignant - chercheur	WAISS ELMI RAYALEH	
	Université de Djibouti			
	Université de Djibouti			
4	Autorités des ports et des Zones franches			
5	Direction de l'Habitat et de l'Urbanisme	Directeur de HU	Mohamed Ali Houssein (Sami)	
	Direction de l'Habitat et de l'Urbanisme	S/Directeur contrôle et Reglementation	Ali Omar Chirwa	
	Direction de l'Habitat et de l'Urbanisme			
	Direction de l'Habitat et de l'Urbanisme			
	Direction de l'Habitat et de l'Urbanisme			
	Direction de l'equipement	S Topographe	KAHIN HAROUN HASSAN	
	Direction de l'equipement	Topographe	~~Abdillahi Ades~~ Jaidan ELAD - MOUSSA - OSAMA	
	Direction de l'equipement			

- Séminaire Final -
Liste des participants

26 Janvier, 2014

Nbre	Institution	Fonction	Nom (Caractère d'imprimerie)	Signature
6	Direction de l'environnement	Sous-Directeur de l'Environnement	Abdoulkader Ahmed Assoued	
	Direction de l'environnement			
	Direction de l'environnement			
	Direction de l'environnement			
	Direction de l'environnement			
7	Maire de Djibouti	Adjoint du - aire	Hassan Ismail Kayad	
8	Direction de la Protection Civile			
	Direction de la Protection Civile			
	Direction de la Protection Civile			
9	Direction des Statistiques et des Etudes Démographiques	Directeur	Idriss Ali Goulta	
10	Direction des Domaines et de la Conservation Foncière	Directeur	Hassan Jabanoud Barreh	
11	ONEAD			
	ONEAD			
	ONEAD	Directeur Assainissement	Rodwan Abdillahi	
	ONEAD	Directeur d'exp	Ali Youssouf	
	ONEAD	Responsable du projet	MEIKE HOUMED ATTALED	
	ONEAD	Chef de service	Nacherdan Ahmed	
12	EDD			

- Séminaire Final -
Liste des participants

26 Janvier, 2014

Nbre	INSTITUTION	Fonction	Nom (Caractère d'imprimerie)	Signature
13	DjiboutiTelecom	DGPI	Kassim M. WAISS	
14	ADDS			
	ADDS			
	ADDS			
	ADDS	CP BAD	ATHEO HASSAN	
	ADDS	Chef de Projet BID	Ibrahim Ali Ibrahim Amateh	
	ADDS	Technicien	Ali Meaka Ali	
15	FER	Directeur	Mahamoud MOUSSA AHMED	
16	AID			
	AID			
	AID			
	AID			
	AID			
17	Agence Nationale de la Météorologie	Directeur General	OSMAN SAID SAID	
		Directeur Adjoint	Abdourahman Y. NOUR	

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26 Janvier, 2014

Nbre	INSTITUTION	Fonction	Nom (Caractère d'imprimerie)	Signature
19	Aviation civile	Conseiller Juridique	Daoud Ali Abdou	
	Aviation civile	Chef de Service Administratif	Aïnanche Said Chirreh	
	Aviation civile			
	Aviation civile			
20	Office National du droit d'Auteurs et des droits Voisins			
	Office National du droit d'Auteurs et des droits Voisins			
	Office National du droit d'Auteurs et des droits Voisins			
	Office National du droit d'Auteurs et des droits Voisins	Directeur adjoint	Naguib Ali Kayed	
	Office National du droit d'Auteurs et des droits Voisins			
21	ODPIC	Chef de Service	Bandjin Omar Bandjin	
LISTE PROTOCOLAIRE du Ministére de l'Equipement et des Transports				
28	Direction Administrative et Financière			
29	Direction des Transports Terrestres			
30	Société Djiboutienne des Chemins de Fer	Directeur Général	Mohamed Abdi Ibrahim	
31	Garde -Côtes	Commandant de la GC	Lt col WAIS	
32	Direction des Affaires Maritimes	Directeur	ALI-MIRAH CHEHEM DAOUD	
33	Laboratoire Central du Bâtiment et de l'équipement	Directeur	Dr A. ADAM	
34	Centre de Formation Maritime de Djibouti	Directrice	Mme Houssein Doualeh	

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Liste des participants

26 Janvier, 2014

Nbre	INSTITUTION	Fonction	Nom (Caractère d'imprimerie)	Signature
LISTE PROTOCOLAIRE DES ORGANISATIONS & INTERNATIONALES				
35	Mr. MAHBUB MAALIM,Secrétaire Executive de l'IGAD			
36	Mme HODAN HAJI- MOHAMOUD, Représentante Résidente du PNUD	Economiste	Anwar Said	
37	Dr. RAYANA BOU HAKA' Représentante Résidente de l' OMS			
38	Mme MARIE.ANTOINETTE OKIMBA Représentante de l'UNICEF			
39	Mme IOSEFA MARRATO, Représentante Résidente du PAM	Responsable suivi et evaluation	Omar Simaneh Bath	
LISTE Coté Japonais				
71	Ambassade du Japon	Ambassador	Atsushi Nishioka	
	Ambassade du Japon		Tatsuro Unuma	
72	JICA Djibouti	R.R.	HARADA Katsunori	原田勝典
	JICA Djibouti	PFA.	Miyanaka Yasue	宮中康二
73	Equipe d'Etude de la JICA		NAKAYAMA	中山正和
	Equipe d'Etude de la JICA		Akira OTA	大田章
	Equipe d'Etude de la JICA			
	Equipe d'Etude de la JICA	Coordinator	James Kazunori Watson	
	Equipe d'Etude de la JICA		KOYAMA	
64	Ministre de l'Habitat, de l'Urbanisme et de l'Environnement, M. MOHAMED MOUSSA IBRAHIM BALALA	CT/MHUEAT	Hamed Mohamed Hem	

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Liste des participants

26 Janvier, 2014

Nbre	INSTITUTION	Title	Nom (Caractère d'imprimerie)	Signature
1	Direction de l'equipement	Chef de Service	Souleiman Mohamed Hassan	
2	Direction de l'equipement	Informaticien	ZAKARIA Omar DOUALEH	
3	Banque Mondiale	Consultante	Nawa Abdi Farah	
4	Ismael Osman Farah			
5				
6		Directeur Budget DNPC	Abdourahman Mahamoud	
7	MOHAMED Ali Kaoureh	Chef SPRV / DHU		
8	Agence Française de Développement	Thomas STOUF		
9	Direction de l'Environnement	Cadre	Ahmed Hachim Ahmed	
10				
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12				
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14				
15				
16	60 Mohamed Hassan Gueli, Magistrat - Cour des comptes.			
17				
18	52 MOUSSA WAIS DOUALEH			
19	Conseiller chargé la Sous-Direction des Ressources humaines			
20				