

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NATIONAL GEOGRAPHIC AND HYDROGRAPHIC INSTITUTE**

**THE ESTABLISHMENT OF A DATABASE
FOR GEOGRAPHIC INFORMATION SYSTEMS
OF THE CAPITAL AREA
IN THE
REPUBLIC OF MADAGASCAR**

**FINAL REPORT
(Summary)**

November 1999

KOKUSAI KOGYO CO., LTD.



Seminar (handing over of the results)



Seminar (explanation of the project outline)



Workshop (database construction)



Workshop (geographic information system)



**Signing of the Inception Report MM
(November 12, 1998)**



**Explanation and discussions on the Inception
Report (November 9, 1998)**



Signing of the Interim Report MM (June 25, 1999)



**Explanation and discussions on the Interim Report
(June 21, 1999)**



**Signing of the Draft Final Report MM
(September 14, 1999)**



**Explanation and discussions on the Draft Final
Report (September 13, 1999)**

PREFACE

In response to a request from the Government of the Republic of Madagascar, the Government of Japan decided to conduct the study on the Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Isao Ikeshima of Kokusai Kogyo Co., Ltd. to Madagascar, four times between October 1998 and September 1999.

The team held discussions with the officials concerned of the Government of the Republic of Madagascar, and conducted field surveys, such as aerial photography and control point survey, at the study area. Upon returning to Japan, the team conducted further studies, such as aerial triangulation, digital plotting and compilation and database macro programming, and prepared the database for Geographic Information Systems, together with this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to all the officials concerned of the Government of Madagascar for their close cooperation extended to the team.

November 1999



Kimio Fujita

President

Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Kimio Fujita
Director
Japan International Cooperation Agency

Dear Sir,

It is a great honor to submit herewith the final report of the Study on the "Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar".

The study team, led by me, implemented the study from October 1998 to November 1999 in accordance with the contract established with the Japan International Cooperation Agency (JICA).

The study team carried out discussions with the concerned officials of the Government of the Republic of Madagascar and field surveys, e.g. aerial photography, control point survey, etc. at the site. In Japan, aerial triangulation, digital plotting and compilation, and facility management system macro-programming were carried out to construct the GIS database system. This report summarizes the details of the database construction work and the proposals for the utilization of the database in the future.

On behalf of the team, I wish to express my heartfelt appreciation to the concerned officials of the Government of Madagascar and the concerned agencies for the warm friendship and cooperation they have extended to us during our stay in Madagascar.

I also wish to express my sincere gratitude to JICA, the Ministry of Foreign Affairs, the Ministry of Construction, and the Embassy of Japan in Madagascar, as well as the government authorities concerned for the valuable advice and cooperation they have provided us in the course of the site surveys and preparation of the final report.

Yours Sincerely,

November 1999



Isao Ikeshima
Study Team Leader
Establishment of a Database for Geographic
Information Systems of the Capital Area in
the Republic of Madagascar

LIST OF ABBREVIATIONS

AGETIPA	Executive Agency for Public Infrastructure Works of Antananarivo
BDU	Urban Development Bureau
DF/R	Draft Final Report
F/R	Final Report
FTM	Foiben-Taosarintanin'i Madagasikara (National Geographic and Hydrographic Institute)
GIS	Geographic Information System
GPS	Global Positioning System
IC/R	Inception Report
IMS	Infrastructure Management System
IT/R	Interim Report
JICA	Japan International Cooperation Agency
JIRAMA	Electricity and Water Company of Madagascar
M/M	Minutes of Meeting
S/W	Scope of Work
TELMA	Telecom Malagasy
TOR	Terms of Reference
UNDP	United Nations Development Program
WGS84	World Geodetic System 84

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CHAPTER 1 OUTLINE OF THE STUDY

Table 1.1 Outline of the Study shows a summary of the work.

Table 1.1 Outline of the Study

Items	Outline of the Work	Work Volume
Collection of relevant data	Confirmation of contents and collection of data and materials for the database	
Air signal installation	Installation of air signals prior to aerial photography (implemented by FTM)	21 points
Aerial photography	1:20,000 black and white photographs (implemented by FTM)	7 courses, 123 photos
Ground control point survey	Calculation of horizontal position by GPS (implemented by FTM) Height calculations by simple leveling (implemented by FTM)	New 17 points 55km: leveling
Compression & correction of 1:2,000 and 1:500 data	Compression of existing 1:2000 and 1:500 data into 1:10,000 for correction.	1:2,000 data: 34 km ² 1:500 data: 52 km ²
Aerial triangulation	Use of the ground control point survey results for triangulation using the bundle block calculation method.	7 courses, 98 models
Digital plotting and digital compilation of urban base map data	Available and usable existing data were utilised. Those that were not were subject to digital plotting and digital compilation for the production of a 1:10,000 topographic map.	250 km ²
Interpretation and compilation of land condition and land use data	Data interpretation, classification, and compilation were done using aerial photographs, satellite images and existing data.	250 km ²
Collection and production of urban facility data	Collection and production of data on waterworks, sewerage, electricity, communications, and roads.	15 km ²
IMS macro-programming	Macro-programming of urban facility (waterworks, sewerage, electricity, communications, roads) system	
Field survey, digitization, and structuring of urban base map data, land condition data, and land use data.	Field surveys to confirm topographic information, administrative divisions and places, etc., undecipherable on aerial photos and existing topographic maps, for digitization and structuring.	
Workshop	Workshop on geographic information production method, operation and maintenance, utilization method, etc.	
Preparation of Final Report	Receive the comments made by the Government of the Republic of Madagascar on the draft final report, and incorporating and revising those deemed necessary for the final report.	Main : English: 5 copies French: 10 copies
Preparation of IMS User's Manual	Manual on database structure and specifications and compilation of operation method.	English: 10 copies French: 20 copies
Production of CD-ROM, 1:10,000 output maps	Storage of databases in CD-ROM and production of 1:10,000 output maps.	CD-ROM: 50 sets Output map: 20 sets each

CHAPTER 2 OBJECTIVES OF THE STUDY

The objectives of this study are: (1) to construct a geographic information system (GIS) database (urban base map (topographic map) data, land condition data, and land use data; 1:10,000 scale level) for the preparation of an urban infrastructure development plan and urban plan for Antananarivo City and its surrounding areas, and (2) to construct urban facility databases (roads, waterworks, sewerage, and electricity and communications facilities) for the pilot area (15km² of the study area).

The study also aimed to transfer techniques to the counterparts through the conduct of the work and workshops.

Fig. 2.1 Study Area Location Map shows the scope of the study.

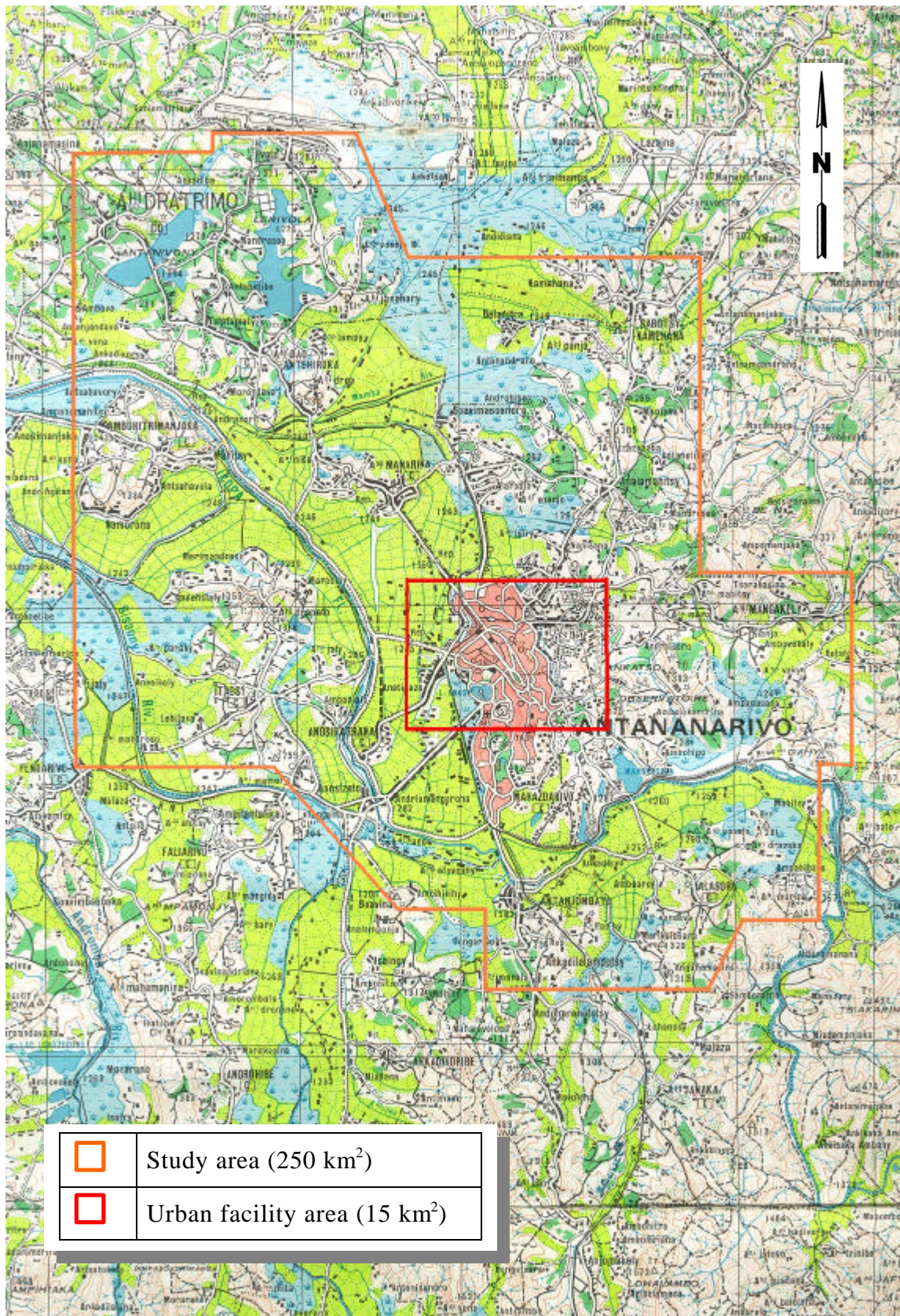


Fig. 2.1 Study Area Location Map

CHAPTER 3 CONTENT OF THE STUDY

3.1 Background of the Study

Antananarivo City, the capital of the Republic of Madagascar, is the largest city in the country with a population of 1.6 million (1994 estimate). As in other developing nations, urban and rural standards of living significantly differ, resulting in the huge influx of rural migrants to the urban area. Accordingly, the drastic increase in the city's population is feared to result in the further deterioration of the living environment as urban infrastructures become incapable of coping with the situation.

Given this condition, the preparation of an urban development plan for the city is urgently required. Although an urban development plan was created in 1974 with the help of the French government, the plan has only been revised once, in 1982.

The French government also extended assistance in the production of topographic maps essential to planning. Topographic maps at a scale of 1:50,000 to 1:100,000 were produced around 1930, and another at a scale of 1:100,000 was produced 60 years ago and revised in 1975.

In 1985, the basic policy for urban planning in Antananarivo was formulated through the United Nations Development Program (UNDP). However, concrete plans could not be made due to the absence of basic information, e.g. latest topographic maps, making the provision of geographic data for the improvement of urban facilities an urgent concern. Madagascar also lacks the technology and experience in large scale topographic mapping, digitizing, and the construction of geographic information systems, which are needed for urban planning.

Given this background, the Government of Madagascar requested assistance from the Japanese government in August 1996 for the production of a large scale map and the construction of GIS databases in order to formulate an urban development plan and urban infrastructure improvement plan.

In response to the request, the Japanese government dispatched a preparatory study team to Madagascar, 10 to 28 February 1998, and then a preliminary study team from 27 June to 6 July 1998. During this period, the preliminary study team held discussions with relevant government agencies in Madagascar and concluded the Scope of Work. The study commenced in October 1998 and was completed in November 1999.

3.2 Study Specifications

This study constructed the urban base map database, land condition database, land use database, and urban facility databases according to the following specifications.

Urban base map database

- The survey standards adopted for urban base map production are as follows.

Reference ellipsoid: Hayford International (1924 ellipsoid)

Projection Method: Laborde Madagascar Projection

- Aerial photography was carried out in black and white, at a scale of 1:20,000
- For ground control point survey, GPS was carried out for horizontal positioning and direct leveling for height.

The observation accuracy adopted for direct leveling was the accuracy for ordinary leveling (within 50mm \pm S error of closure from one known point to another, with S representing observation distance; a discrepancy of within 20mm \pm S for double running observation; with S for observation distance) stipulated in the Base Mapping Regulations of JICA.

- The bundle method and block adjustment were adopted for aerial triangulation.
- Digital plotting was carried out at a scale of 1:10,000, with an interval of 5m between intermediate contours and 2.5m between supplementary contours.
- The map symbols used were the symbols for digital mapping concluded through discussions with the FTM.
- A unified code system and layer configuration for topographic and planimetric features were established in accordance with the map symbols.
- Data in each topographic database were classified into points, lines, and surface data.
- Topographic map characteristics were allocated to each data whenever necessary.

Land Condition Database and Land Use Database

- The land condition map was divided into 19 categories, largely classifying the study area into 3 sections (hills, plain, others) and further subdividing these sections.
- The land use map was divided into 14 categories using the symbols of the urban base map as a basis.
- Each data was made into a polygon data.

Urban Facility Databases

- Each facility database is made up of feature data representing the physical components (pipes, manholes, overhead wiring, cables, etc.) of each facility and attribute data for secular information.
- Data on map features consist of point, line and surface data, each allocated a symbol showing the characteristics of the facility involved whenever necessary.
- Attribute data consists of secular information (pipe diameter, length, height, date of construction, etc.).
- The map feature data and attribute data were linked using ID numbers.

3.3 Details of the Study

3.3.1 Urban Base Map

An urban base map at a scale level of 1:10,000 was produced covering Antananarivo City, the national capital, and its surrounding areas (250 km²). In contrast with a normal topographic map at a scale of 1:10,000, this urban base map is very detailed with all houses delineated individually and 5m intermediate contours, and has various uses therefore.

The conduct of digital plotting and digital compilation also enables the adjustment of this map into different scales.

Fig. 3.1 Urban Base Map Production Flowchart shows the overall work progress.

Fig. 3.2 Urban Base Map at 1:10,000 shows a sample of the urban base map at a scale of 1:10,000.

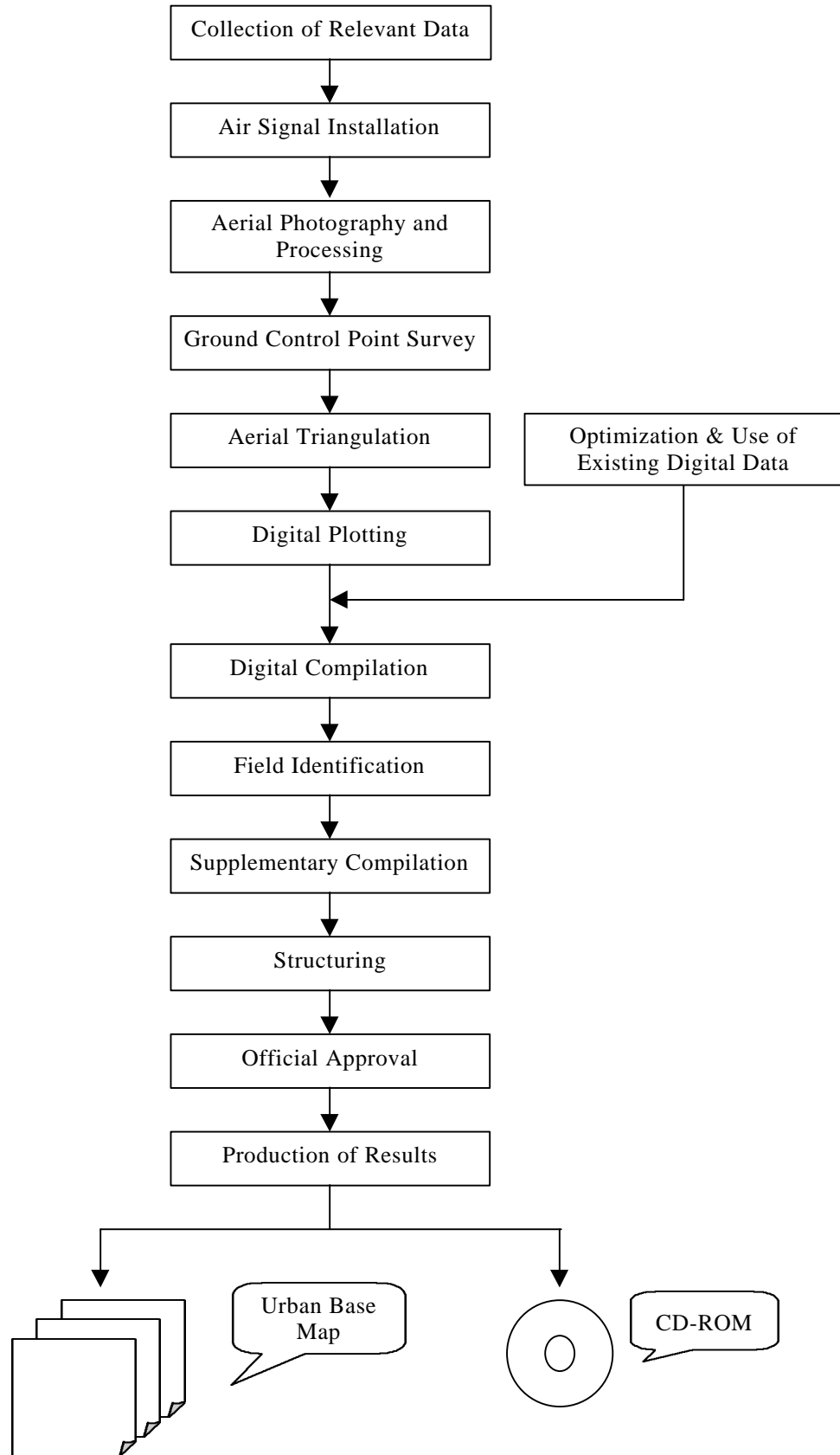


Fig. 3.1 Urban Base Map Production Flowchart

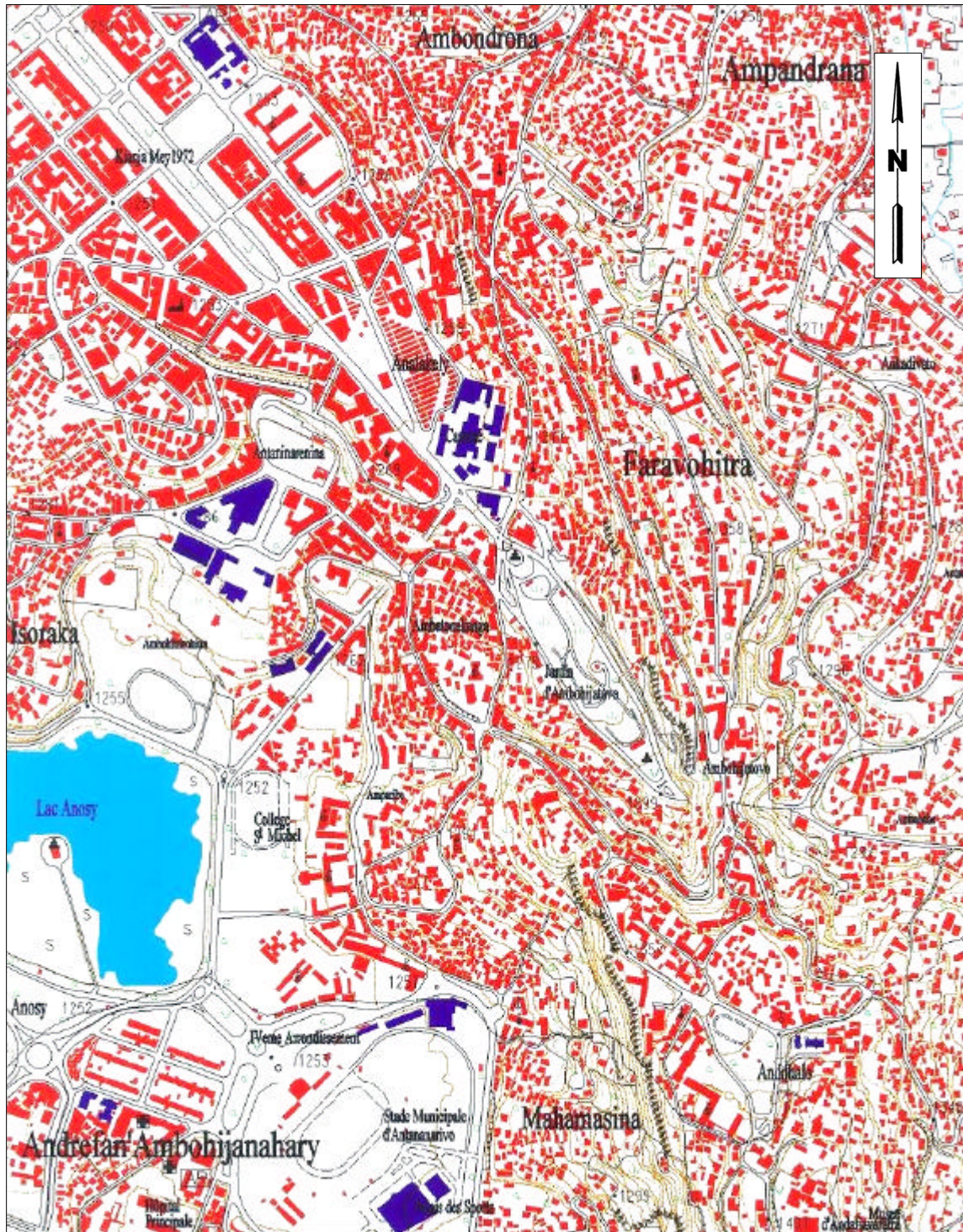


Fig. 3.2 Urban Base Map at 1:10,000

3.3.2 Land Condition Map

A land condition map covering Antananarivo City, the national capital, and its surroundings (250km²) was produced.

The geomorphological features of the city were largely categorized into a hilly area, a plain area, and others, and these were further classified into detailed categories, all in all totaling 19. Each category was allocated a specified color and digital data was produced, in order to enable the use of the map to determine areas in danger of flooding or collapse. *Fig. 3.3 Land Condition Map Production Flowchart* shows the overall work progress.

Fig. 3.4 Land Condition Map at 1:10,000 shows a sample of the land condition map at a scale of 1:10,000.

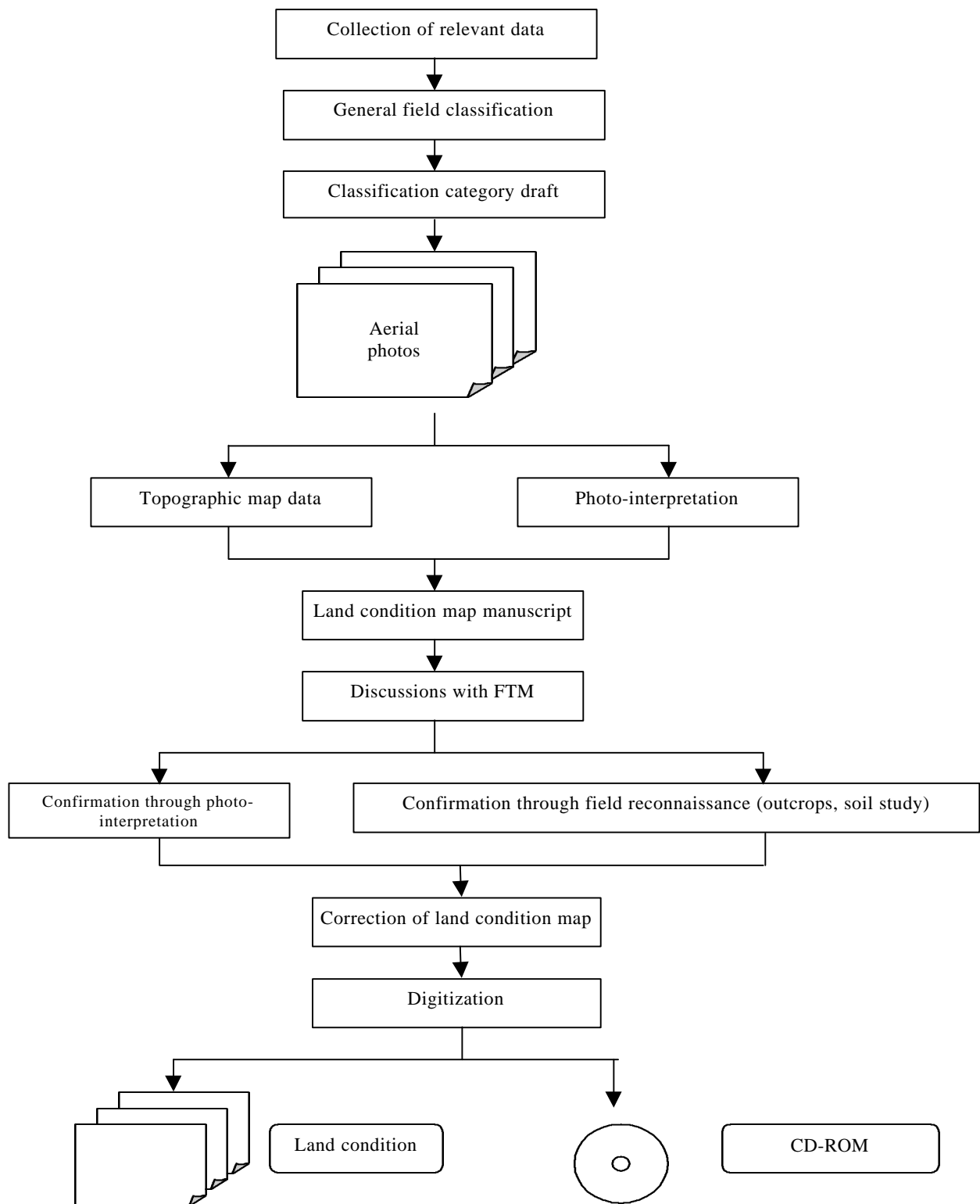


Fig. 3.3 Land Condition Map Production Flowchart

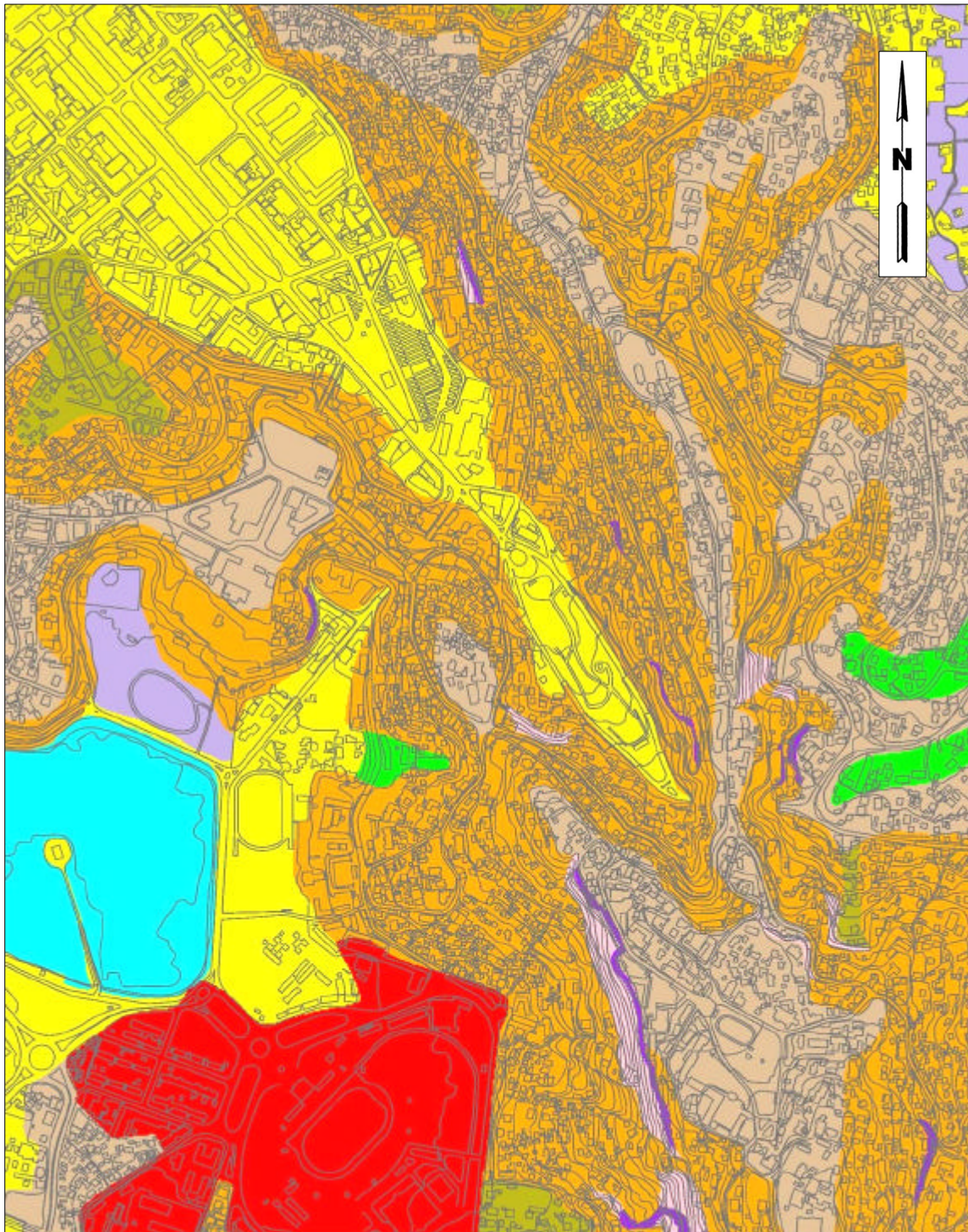


Fig. 3.4 Land Condition Map at 1:10,000

3.3.3 Land Use Map

A land use map was produced covering the same area (250 km²) as the land condition map.

The land use map classifies the area into forests, grassland, cultivated land, city and towns, water area, and others, each of which were then broken down in more detail (14 categories). Each category was allocated a specified color and digital data were produced in order to use the map in determining land use conditions. It is also considered that superimposing the map with the land condition map would be useful in the future formulation of urban development plans.

Fig. 3.5 Land Use Map Production Flowchart shows the overall work progress.

Fig. 3.6 Land Use Map at 1:10,000 shows a sample of the land use map at a scale of 1:10,000.

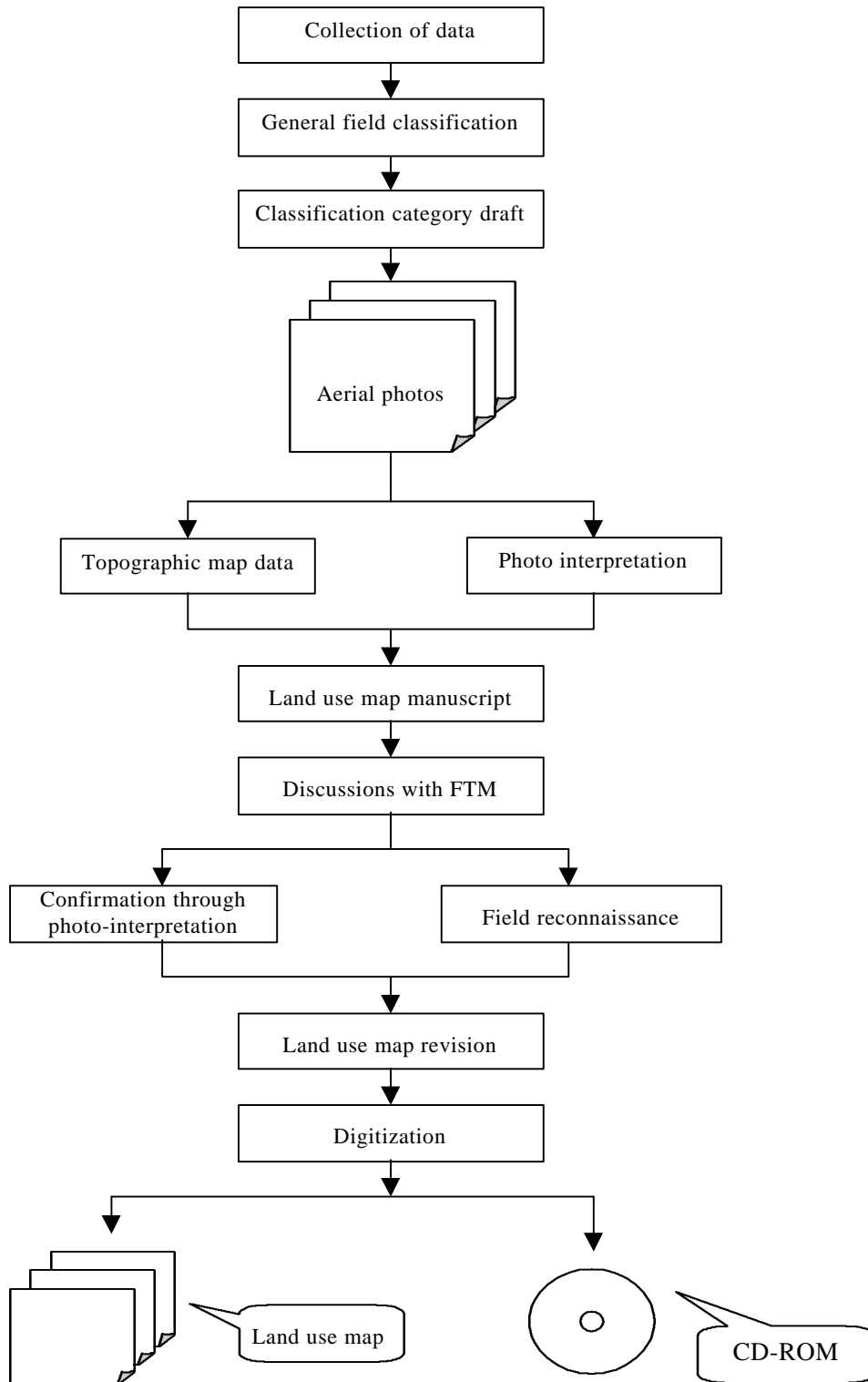


Fig. 3.5 Land Use Map Production Flowchart

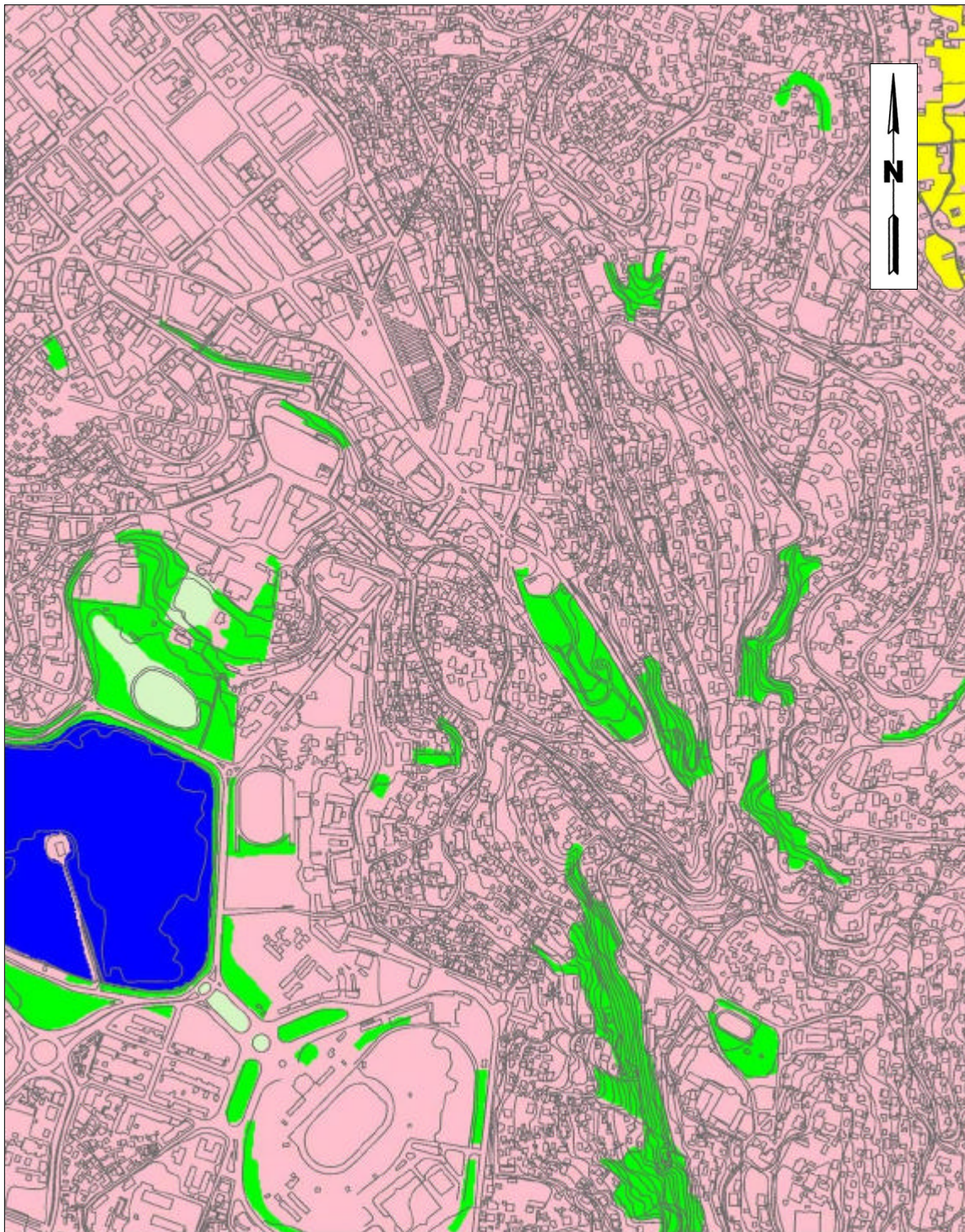


Fig. 3.6 Land Use Map at 1:10,000

3.3.4 Urban Facility Databases

Of the study area, 15 km² was designated as the pilot area, and urban facility databases (roads, waterworks, sewerage, electric and communication facilities) were constructed (GIS).

Graphic and attribute data were used to represent data on roads, i.e. length, width. For waterworks, the use of GIS made it possible to understand the condition of conduits and valves. For sewerage, GIS enabled the representation and summing up of the location and material of conduits and manholes. The use of GIS for electrical facilities enabled the understanding of the condition of cables, electric poles, substations, and transformers. For communications facilities, GIS made it possible to understand the condition of manholes, electric posts, distribution devices, connections, exchange, etc., and allow their calculation. *Fig. 3.7 Data Collection and Urban Facility Database Construction Flowchart* shows the work progress.

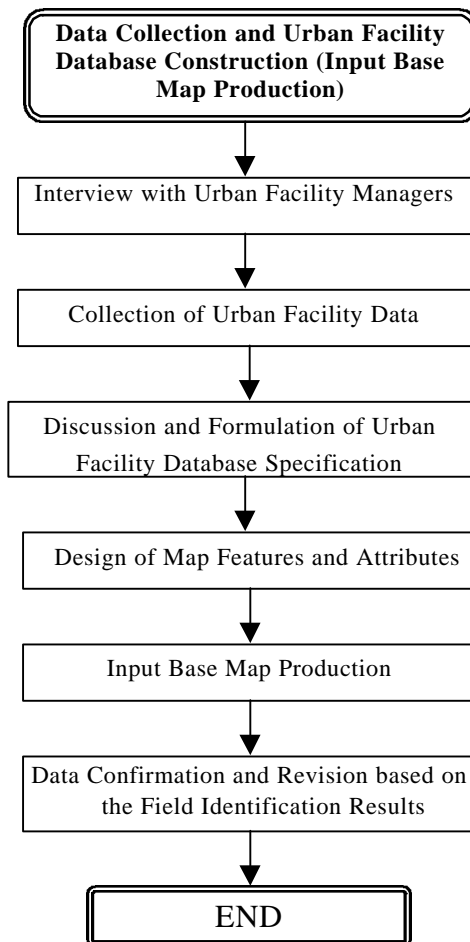


Fig. 3.7 Data Collection and Urban Facility Database Construction Flowchart

The urban facility data were digitized using the input base map as a reference and a digitizer, for the construction of each urban facility database. Fig. 3.8 Urban Facility Data Digitization Flowchart shows the work progress.

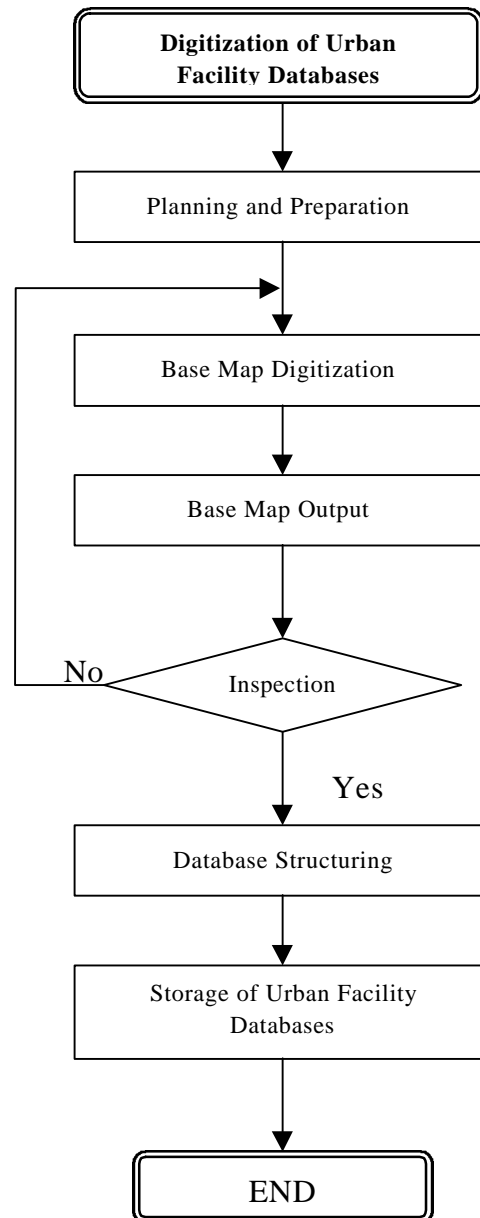


Fig. 3.8 Urban Facility Data Digitization Flowchart

Figures 3.9 to 3.13 show samples of urban facility maps.



Fig. 3.9 Road Facility Map



Fig. 3.10 Waterworks Facility Map



Fig. 3.11 Sewerage Facility Map



Fig. 3.12 Electrical Facility Map



Fig. 3.13 Communications Facility Map

CHAPTER 4 GIS SYSTEM

4.1 System Components

The hardware and software for use with the introduction of GIS were examined.

(1) Hardware Considerations

When examining which hardware to choose, the following points were taken into consideration:

- It must be the latest possible hardware, able to withstand further upgrades.
- Maintenance can be easily performed in Madagascar.
- It must be compatible with existing hardware.

(2) Software Considerations

When examining which software to choose, the following points were taken into consideration:

- The software must offer upgrades and a support system.
- It must have functions which are compatible with future GIS needs.
- Data must be usable with other software currently in use.

After examining all the above considerations, a latest Gateway desktop personal computer was selected for its compatibility with existing hardware and its facility of maintenance.

For software, ArcView was selected for its compatibility with existing software and its capacity to be used with future GIS applications.

4.1.1 Hardware

Based on the GIS system to be used, the primary hardware components of the GIS system consist of:

- Gateway desktop computer; E-5250 450 Xeon dual processor
- Gateway VX1100 21" color monitor
- Calcomp 34480 Drawing Board III (A0) digitizing tablet
- HP Designjet 750C plus (A0) printer

The computer and monitor are used for storing, viewing, editing, and analyzing the infrastructure data. The digitizing tablet is used for input and correction of the infrastructure data. The printer is used for creating printed maps of various infrastructure themes.

4.1.2 Software

Based on the GIS system to be used, the primary software components of the GIS system consist of:

(1) GIS Software

a) ArcView GIS

ArcView GIS, a desktop GIS software, is used to visualize, explore, query, and analyze geographic data. ArcView GIS was used to create the IMS (Infrastructure Management System) interface.

b) Network Analyst

This is an optional software module for ArcView GIS. It provides additional analysis functions to solve network and routing problems.

c) Spatial Analyst

This is an optional software module for ArcView GIS. It provides additional analysis functions to model, analyze, and create spatial data and grids, and solve spatial problems.

(2) Other Software

a) Windows NT4 Operating System (service pack 4)

Windows NT4 provides a professional workstation environment that is both reliable and secure. As with other versions of Windows, the user interface is familiar and easy to use.

b) Microsoft Office 97 Professional

A full featured professional office suite featuring a word processor, spreadsheet, database, presentation graphics, and image editing. These tools are used to add and modify infrastructure data attributes, create reports, and manipulate graphics and images.

4.2 GIS System Structure

4.2.1 GIS System Design

The GIS system was designed to provide two main functions, an interface which focuses on the infrastructure data, and a general desktop GIS. This was accomplished by a dual installation of the ArcView GIS software and optional modules. One installation was used to develop and create the IMS interface to the GIS functions, and the other version is a standard installation of ArcView GIS. The diagram illustrates the relation of the design.

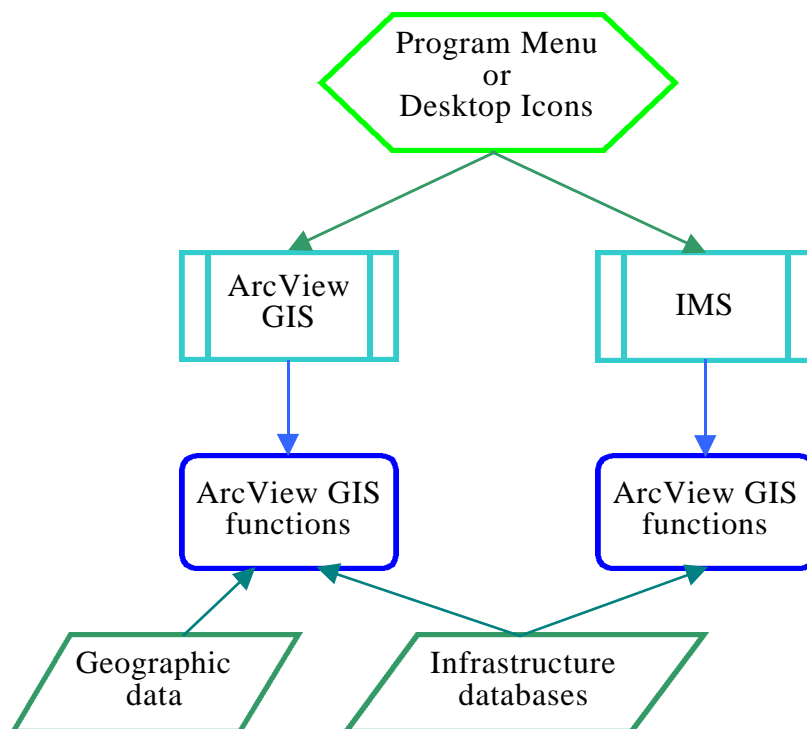


Fig. 4.1 Hardware Configuration

4.2.2 Database Integration

A key element of GIS is the ability to link or join descriptive attributes to the graphical data based on direct or proximal conditions. In most cases there is a common item such as an unique ID which can be used to link the graphical and attribute data. Where there is no direct link, a spatial link can be established based on proximity of features to each other. Linking attribute data to graphical data provides increased flexibility and analytical options for both the graphical and attribute data.

4.3 Macro-Programming

A series of macro programs were created to establish and control the IMS interface, and provide a series of preset views of the infrastructure data.

4.3.1 IMS Interface

The IMS interface establishes a direct link to the graphical and attribute data in the infrastructure databases. It is intended to be an introduction to Facilities Management. The opening screen proudly displays the FTM logo and credits for the data. A series of preset views has been established which correspond to the individual map sheets. There is a view for each infrastructure theme. From any of these views, features can be selected and analyzed, updated, or output to a printer or file. All of these functions correspond to the ArcView GIS functions so that there is no need to learn a new commands and functions if the user is already familiar with Arcview GIS.

4.3.2 IMS Functions

(1) Input

Data input of graphical and/or attribute data will occur when there is a need to add to, modify, or maintain the infrastructure data. Graphical and attribute data can be input through any of several methods which include digitizing, on-screen digitizing, ascii coordinate input (interactive or from a file), and data conversion from other formats.

Typically, graphical data is digitized from a manuscript such as a map. Subsequently the graphical data are checked and edited if necessary. Alternatively, the data may be digitized with a different software and the resulting file converted to a format compatible with Arcview GIS. Attribute data is typically entered using a spreadsheet software such as Excel or a database software such as Access, or directly into dBase. If not in dBase format, the attribute data are converted into dBase format to be used with the graphical data in Arcview GIS.

(2) Analysis

GIS is a tool that is especially useful to visualize, explore, query, and analyze data geographically. It can be used to solve problems, identify hidden trends and relationships, and understand geographic relationships. Arcview GIS has many methods to analyze the graphical and attribute data using spatial, surface, statistical, and network functions. Particularly useful are the spatial and network functions for analysis of infrastructure data. Spatial statistics and analysis can be used to determine quantities, volumes, and zones of proximal distance. Network functions are used for routing and planning service areas. Additionally, the attributes can be statistically analyzed to quantify data and identify trends. Combining data from 2 or more sources can be very useful for planning of new facilities. This is one of the strongest features of GIS and geographical analysis.

(3) Output

The Arcview GIS provides a flexible and intuitive method for producing printed maps of the infrastructure data. There are many standard map layouts that can be used or modified at any scale and popular size. For special cases a custom map layout can be created. Map layouts, graphical data, and attributes can also be exported to other popular formats, enabling these data to be used directly in reports, spreadsheets, and other software. The final map layouts can also be saved to a file for printing later or at another location.

CHAPTER 5 TECHNICAL TRANSFER

This project was implemented making use of various technologies, from aerial photography to GIS database construction. Some of these technologies were transferred to the FTM.

5.1 On-the-job Training

(1) Air Signal Installation

This was carried out with the cooperation of FTM, and the agency staff were trained on the following in the course of the work: manner of allotting points/marks, deciding the air signal size and material.

(2) Aerial Photography and Processing

This was carried out with the cooperation of FTM, and the agency staff learned the techniques involved in aerial photography planning, etc., during the course of the work.

(3) Ground Control Survey

This was carried out with the cooperation of FTM, and the agency staff learned the techniques involved in the calculation of measured data, effective calculation methods, and concluding re-surveys.

(4) Production of and Input Base Map

Initially, this was not included in the scope for technology transfer. However, as a part of the database construction work, it's inclusion was inevitable. Transfer of technology relevant to this work was fully discussed with the FTM and carried out.

(5) Digitization of Urban Facility Data

This was carried out with the cooperation of FTM, and the agency staff were trained in the detailed processes and simple data inspection methods during the course of the work.

(6) Others

Due to the strong interest shown in the planning, management, and quality control methods of the above survey work, the technologies involved were covered in the technology transfer operations after thorough discussions with the FTM. In addition, questions in the standard work volume led to explanations of the empirical figures of Japan.

5.2 Seminar

The project outline presentation and the handing over of the results ceremony were held at a seminar as per the following schedule:

1. Date and time 15 September 1999, 09:30 12:00
2. Venue Hilton Hotel
3. Participants Ministère de l'Aménagement du Territoire et de la Ville (9 persons), JIRAMA (4 persons), TELMA (2 persons), BPPA (2 persons), Japanese Embassy in Madagascar (3 persons), JICA (6 persons), Sumitomo Corporation (1 person), FTM (16 persons), press (11 persons), total (54 persons)
4. Time schedule

09:30-10:00	Opening Address by FTM
10:00-10:30	Explanation of the Project Outline
10:30-10:45	Coffee Break
10:45-11:00	Explanation of the GIS System
11:00-11:15	GIS Use and Applications
11:15-11:30	Greetings by the Japanese Government Side
11:30-11:45	Handing Over of the Results Ceremony
11:45-12:00	Greetings by His Excellency Mr. Minister of Ministère de l'Aménagement du Territoire et de la Ville
12:00	Closing Address by FTM

5.3 Workshop

A workshop was held on database construction for FTM technicians, and on SIG for FTM executives/technicians and related organizations as per the following schedule:

1. Date and Time 16 to 27 September 1999, 08:45-15:30
2. Venue FTM
3. Participants FTM, JIRAMA, TELMA, AGETIPA

(1) Database construction

Participants: FTM technicians (6 persons)

Period: From 16 to 17 September 1999

Content:

- Graphic data input method
- Database structure (graphic data, attribute data, etc.)
- Data input method using MicroStation
- Production of input base map and application

(2) GIS

Participants: FTM technicians (6 persons)

Period: From 16 to 27 September 1999

Content:

- Introduction of each database
- GIS software
- ArcExplorer
- IMS
- Spatial Analyst
- PowerPoint

Participants: FTM executives (6 persons)

Period: From 22 to 27 September 1999

Content:

- Introduction and applications of each database, analysis using GIS
- Introduction of ArcExplorer, utilization on Internet
- Copyrights
- Introduction to PowerPoint, creation of a presentation

Participants: Related organizations (8 persons)

Period: From 20 to 24 September 1999

Content:

- Introduction of ArcExplorer
- Q&A session on ArcExplorer and databases

CHAPTER 6 RESULTS

The results to be handed over to FTM by JICA are as outlined below:

1.	Inception Report	
	English	5 copies
	French	10 copies
2.	Interim Report	
	English	5 copies
	French	10 copies
3.	Draft Final Report	
	English	5 copies
	French	10 copies
4.	Final Report	
	English	5 copies
	French	10 copies
5.	Digital Map databases	
	CD-ROM	50 copies
6.	IMS User's Manual	
	English	10 copies
	French	20 copies
7.	Plotted Maps	
	1:10,000 topographic map	20 copies
	1:10,000 land use map	20 copies
	1:10,000 land condition map	20 copies
	1:10,000 urban facility map	20 copies
8.	Aerial Photographs	
	1:20,000 negatives	1 set
	1:20,000 contact prints	3 sets

The reproduction of the survey results produced and the CD-ROM to be created for the handling of these results for academic research and socio-economic development, and not for profiteering, will be allowed under the authority of JICA and FTM.

CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

This study not only aimed to produce a 1:10,000 scale-level urban base map and construct land condition and land use databases for Antananarivo City and its surroundings (250 km²), it also constructed urban facility databases (road, waterworks, sewerage, electricity, communications) for the pilot area (15 km² of the study area). With the cooperation of various relevant agencies, particularly FTM, field surveys and the corresponding work in Japan were carried out smoothly in about a year, from October 1998 to November 1999.

The surveys carried out this time tried to use as much of the existing 1:500 and 1:2,000 digital data as was possible in consideration of work efficiency and to cut costs, although surveys were carried out to gain data on areas that were totally without any past records. During the conduct of the survey work, technical transfer – in aerial photography and ground control survey – was carried out in the form of on-the-job training. Overall, FTM is highly technologically capable, a qualification that is forecast to further improve through actual involvement in the project implementation process.

As also mentioned in the earlier reports, topographic maps of the country were produced by the French in 1930 at scales of 1:100,000, 1:50,000, and 1:10,000, all of which have been revised only in 1975. The nation did not have a highly accurate and good quality topographic map that would be useful in the preparation of calamity (e.g. earthquakes, flooding) countermeasures and urban development planning. These deficiencies only impede any action that could be taken to counteract the following problems that further intensify in Antananarivo City and its surroundings. The databases constructed in this study are expected to strongly contribute in solving these critical problems.

Soil erosion in the hills due to the excessive urbanization.

Flooding in the plains in the rainy season due to poor drainage conditions.

Development of slums due to drastic influx of rural migrants.

The use of the constructed databases would enable predicting the occurrence of soil erosion, designating areas that will be flooded, determining the installation of effective drainage facilities and the construction of various urban facilities, as well as restricting population inflow that would render these urban facilities inefficient. These databases are also expected to contribute significantly to the formulation of an urban development plan that would be in harmony with natural and social environmental conditions. The republic is famous for its rich forest resources and indigenous fauna and flora species, however, unplanned development projects implemented in recent years have rapidly destroyed these resources. These databases are therefore expected to fundamentally contribute to the preservation

and conservation of the natural environment.

In contrast with the use of analog data, the digitized data will facilitate the alteration of map scale, revision and preservation of secular changes, etc., and meeting the diversified needs of the users.

Being an experimental task (pilot study), the use of the urban facility databases may be limited at present. FTM, however, is expected to become capable of independently operating these databases for other uses through the experience and skills gained from on-the-job training, training in Japan, workshop at the site, etc, carried out under this project – activities that mainly focused on GIS data update and expansion techniques.

However, as the databases created in the course of this study are incomplete, necessary data must be added in the future in order to move toward the full use of GIS as explained below.

The use of GIS would provide topographic map data (contours, water system, vegetation, villages, farmlands) useful in classifying the elevation, slopes, water system, vegetation, land use conditions, etc., in the study area.

Data on urban facilities (road, waterworks, sewerage, electrical facilities, communications facilities) can be used for the management and planning of the expansion of these urban facilities.

Land condition data (geomorphological classification) can be used to determine the dangers of collapse and flooding. As for the land use data, overlaying the land use classification data with the land condition data would provide the fundamental information necessary for the formulation of the following development plans: housing development, industrial area development, commercial area development.

We seriously hope that these will be useful for the formulation of an urban development plan for the city of Antananarivo, and sincerely express our heartfelt gratitude to every person and agency concerned for the cooperation they have given us during the course of the study.

APPENDIX

Scope of Work (S/W)	3 July 1998
Minutes of Meeting (M/M)	3 July 1998
Minutes of Meeting (M/M)	12 November 1998
Minutes of Meeting (M/M)	25 June 1999
Minutes of Meeting (M/M)	14 September 1999

SCOPE OF WORK

ON

THE ESTABLISHMENT OF A DATABASE
FOR GEOGRAPHIC INFORMATION SYSTEMS
OF THE CAPITAL AREA

IN

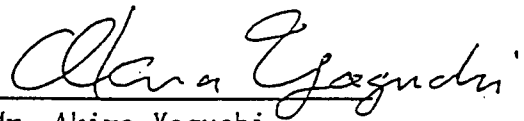
THE REPUBLIC OF MADAGASCAR

AGREED UPON BETWEEN
MINISTRY OF TERRITORIAL AND URBAN MANAGEMENT
AND

JAPAN INTERNATIONAL COOPERATION AGENCY
in Antananarivo, Madagascar, on 3, July 1998



Mr. Andriamboavonjy Amédée
Director of Cabinet of Minister
Ministry of Territorial and
Urban Management
President of Council of
Administration
National Geographic and
Hydrographic Institute



Mr. Akira Yaguchi
Leader,
Preliminary Study Team
Japan International Cooperation
Agency

A. INTRODUCTION

In response to the request of the Government of the Republic of Madagascar (hereinafter referred to as "Madagascar"), the Government of Japan (hereinafter referred to as "Japan") decided to implement the Establishment of a Database for Geographic Information Systems of the Capital Area (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of Japan, will undertake the Study, in close cooperation with the authorities concerned of Madagascar.

The present document sets forth the Scope of Work with regard to the Study.

B. OBJECTIVE OF THE STUDY

The objective of the Study is to prepare a digital map database at the scale level of 1/10,000 as the base for Geographic Information Systems. The database shall consist of digital urban topographic base map data, digital land use data, digital land condition data and digital urban facility data. Existing map data shall be utilized as much as possible.

C. STUDY AREA

The Study area is the Antananarivo Metropolitan Area of approximately 250km² defined in the Appendix.

D. SCOPE OF THE STUDY

In order to achieve the above mentioned objective, the Study shall cover the following items:

1. Collection of basic information:

- (1) existing map data and aerial photographs,
- (2) existing control point data,
- (3) existing geographic information,
- (4) existing facility data and
- (5) information on expected Geographic Information System applications.

2. Control point survey:

Existing control point data shall be utilized as much as possible, while supplementary control point survey shall be carried out.

3. Aerial photography:

Aerial photographs shall be taken at the scale of approximately 1/20,000. Aerial photo signals shall be set if necessary, prior to the commencement of the aerial photography.

4. Database Design:

Reconnaissance survey shall be conducted in the Study area to determine the classification of data items. Design of the digital map database to be prepared in the Study shall be conducted.

A handwritten signature in black ink, appearing to be 'C. Y.', located in the bottom right corner of the page.

5. Aerial triangulation:

Aerial triangulation shall be carried out by the block adjustment method.

6. Digital topographic and land use data acquisition:

Digital stereo plotting shall be carried out at the scale level of 1/10,000.

7. Field identification:

Information on topography, land use and land condition shall be identified in the field.

8. Land condition mapping:

Manuscript maps of land condition shall be prepared based on the aerial photo interpretation and the field identification..

9. Database compilation:

The digital stereo plotting data, the result of the field identification and the land condition mapping, and the existing map data shall be compiled into a digital map database.

10. Field completion:

Supplementary information on topography, land use and land condition shall be identified in the field. Administrative boundaries and geographical names shall be verified. The collected information shall be added to the digital map database.

11. Database installation:

The digital map database prepared in the Study shall be installed into a database management system.

E. STUDY SCHEDULE

The Study shall be conducted in accordance with the attached tentative schedule.

F. REPORTS AND FINAL PRODUCTS

JICA shall prepare the followings and submit them to Madagascar. In case any doubt arises in their interpretation, English text shall prevail.

1. Inception Report:

Inception Report shall be submitted at the commencement of the Study. Five (5) copies in English and ten (10) copies in French shall be submitted.

2. Interim Report:

Interim Report shall be submitted within 8 months after the beginning of the Study. Five (5) copies in English and ten (10) copies in French shall be submitted.

3. Draft Final Report:

Draft Final Report shall be submitted within 11 months after the beginning of the Study. Five (5) copies in English and ten (10) copies in

French shall be submitted.

4. Final Report:

Final Report shall be submitted at the end of the whole Study. Five (5) copies in English and ten (10) copies in French shall be submitted.

5. Digital Map Database:

The digital map database described in the "B. Objective of the Study" shall be submitted at the end of the whole Study. Fifty (50) copies shall be submitted in the form of CD-ROM.

6. Handling Manual for database:

The handling manual for the digital map database shall be submitted at the end of the whole Study. Ten (10) copies in English and twenty (20) copies in French shall be submitted.

7. Plotted Maps:

The digital urban topographic base map data, digital land use data, digital land condition data and digital urban facility data shall be plotted at the scale of 1/10,000. Twenty (20) copies for each data shall be submitted at the end of the whole Study.

8. Aerial Photographs:

One (1) set of negative film and three (3) copies of aerial photographs at the scale of approximately 1/20,000 taken in the Study shall be submitted at the end of the whole Study.

G. UNDERTAKINGS OF MADAGASCAR

1. To facilitate the smooth implementation of the Study, Madagascar shall take the following necessary measures;

(1) to secure the safety of the Japanese Study Team (hereinafter referred to as "the Team"),

(2) to permit the members of the Team to enter, leave and sojourn in Madagascar for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees,

(3) to exempt the members of the Team from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into Madagascar for the conduct of the Study,

(4) to exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study,

(5) to provide necessary facilities to the Team for the remittance as well as utilization of the funds introduced into Madagascar from Japan in connection with the implementation of the Study,

(6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,

(7) to secure permission for the Team to take all data and documents (including photographs) related to the Study out of Madagascar to Japan,

(8) to provide the medical services as needed. Its expenses will be chargeable on members of the Team.

2. The Government of Madagascar shall bear claims, if any arises against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Team.
3. The National Geographic and Hydrographic Institute (hereinafter referred to as "FTM") shall act as counterpart agency to the Team and also as coordinating body in relation with other relevant organizations concerned for the smooth implementation of the Study.
4. FTM shall, at its own expenses, provide the Team with the followings in cooperation with other organizations concerned;
 - (1) available data (including map data) and information related to the Study,
 - (2) counterpart personnel,
 - (3) suitable air-conditioned office space with office equipment and furniture in Antananarivo,
 - (4) credentials or identification cards,
 - (5) vehicles with drivers.

H. UNDERTAKINGS OF JICA

For the implementation of the Study, JICA shall take the following measures;

1. to dispatch, at its own expenses, the Team to Madagascar,
2. to pursue technology transfer to Madagascar counterpart personnel in the course of the Study.

I. OTHERS

1. JICA and FTM shall consult with each other in respect of any matter that may arise from or in connection with the Study.
2. The Scope of Work and the Minutes of Meeting on the Scope of Work are prepared both in English and French. When any doubt arises in their interpretation, English text shall prevail.
3. When any doubt arises in the interpretation of the documents concerned with the Study, the English text shall prevail.

CE

F

Attachment

TENTATIVE SCHEDULE

(STUDY TEAM)

The Establishment of a Database for Geographic Information Systems

of the Capital Area

in

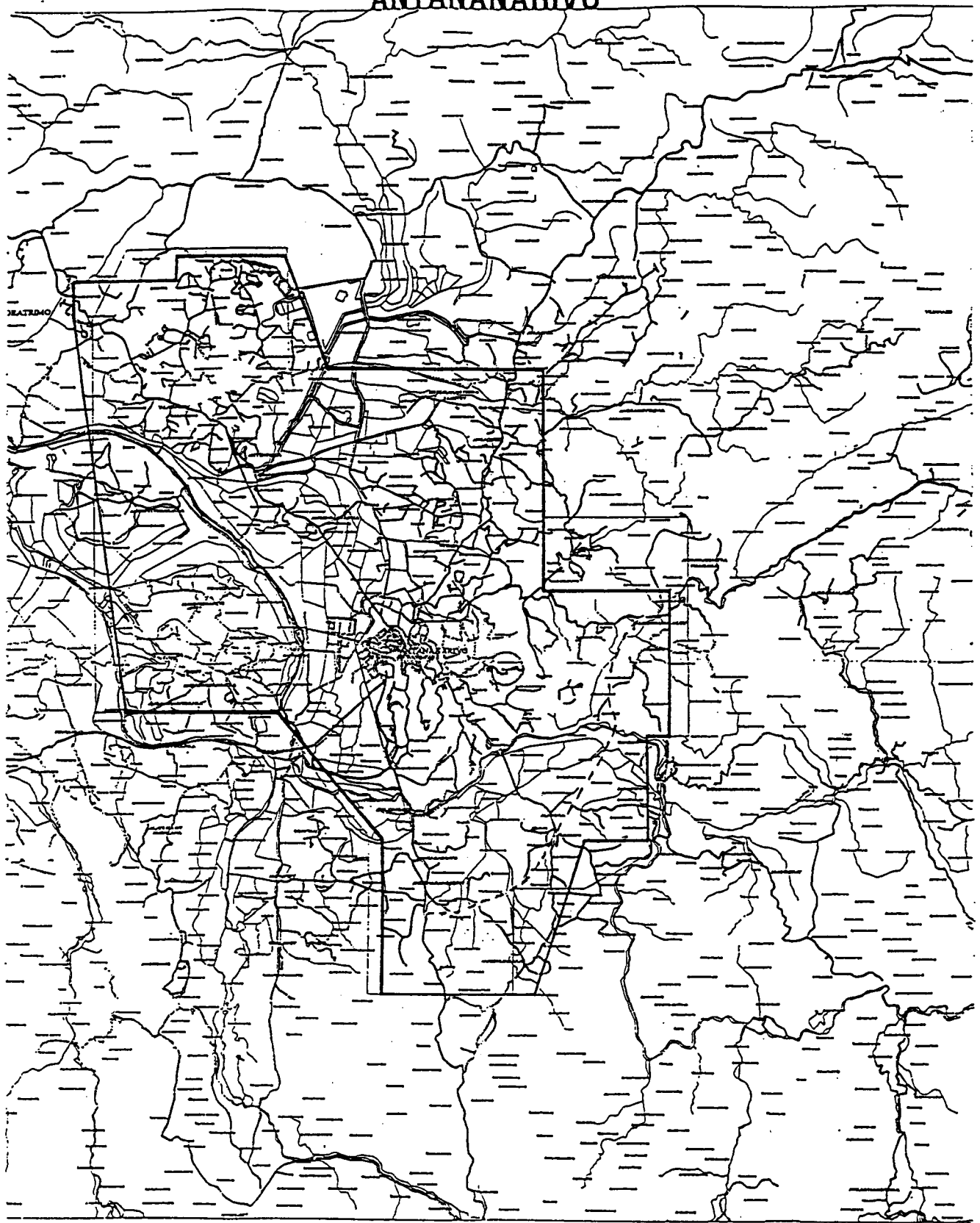
The Republic of Madagascar

Month	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th		
Field Work														
Work in Japan														
Reports	▲ IC/R			▲ IT/R					▲ DR/F		▲ F/R		F/P	

- Note :
- IC/R : Inception Report
 - IT/R : Interim Report
 - DF/R : Draft Final Report
 - F/R : Final Report
 - F/P : Final Product

CLG
E

ANTANANARIVU



- Route principale
- - - Route en projet
- Reseau hydrographique
- Limite contractuelle

Echelle 1/100.000

O.G. S

MINUTES OF MEETING
UPON
THE PRELIMINARY STUDY

FOR

THE ESTABLISHMENT OF A DATABASE
FOR GEOGRAPHIC INFORMATION SYSTEMS
OF THE CAPITAL AREA
IN
THE REPUBLIC OF MADAGASCAR

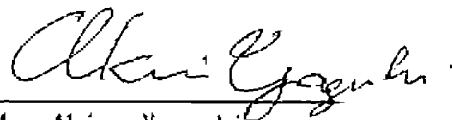
AGREED UPON BETWEEN

MINISTRY OF TERRITORIAL AND URBAN MANAGEMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

In Antananarivo, Madagascar, on 3, July 1998



Mr. Andriamboavonjy Amédée
Director of Cabinet of Minister
Ministry of Territorial and
Urban Management
President of Council of
Administration
National Geographic and
Hydrographic Institute



Mr. Akira Yaguchi
Leader,
Preliminary Study Team
Japan International Cooperation
Agency

The Japanese Preliminary Study Team (hereinafter referred to as the "Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Akira YAGUCHI visited the Republic of Madagascar from the 28th of June to the 5th of July, 1998 to study preliminarily for "The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar" (hereinafter referred to as "the Study") in response to the request from the Government of the Republic of Madagascar.

The Team had a series of discussions and exchanged views with the representatives of the National Geographic and Hydrographic Institute (hereinafter referred to as "FTM") and other organizations concerned. (See Appendix for the attendants.)

Through the discussions, both sides have completed the Scope of Work and confirmed the following points:

1. Objective of the Study

The objective of the Study was agreed to be the preparation of a digital map database at the scale level of 1/10,000 as the base for Geographic Information Systems. It was also agreed that the database shall consist of digital urban topographic base map data, digital land use data, digital land condition data and digital urban facility data, and that existing map data shall be utilized as much as possible.

2. Study Area

The Study Area was agreed to cover the Antananarivo Metropolitan Area of approximately 250km².

3. Provision of the FTM personnel

FTM promised to provide FTM engineers and technicians in order to implement the Study.

4. Use of the existing map data

Both sides agreed that the existing map data such as those for the taxation inventory planning of the Department of Topographic Service, for instance, shall be utilized as much as possible if their accuracy was verified. It was also agreed that FTM shall guarantee the use of those map data.

5. Administrative boundaries and geographical names

Administrative boundaries and geographical names shall be verified by the FTM.

6. Study Equipment

FTM requested the Team that the Study equipment indispensable to maintain and to improve the technology to be transferred to FTM in the course of implementing the Study shall be provided to FTM. The Team promised to convey the request to the JICA headquarters.

A.Y.

A.

7. Alternation of schedule in aerial photography

Both sides agreed that if the aerial photography failed to be completed in one year after the commencement of the Study, other measures alternative to the new aerial photography shall be discussed by both sides.

8. Vehicles

FTM explained the difficulty in providing the vehicles, and the Team promised to convey the situation to the JICA headquarters.

9. Training

FTM requested that Madagascar counterpart personnel take advantage of training in Japan related to the Study to promote an effective technology transfer. The Team promised to convey the request to the JICA Headquarters.

10. Steering Committee or Working Group

Both sides agreed that a Steering Committee or a Working Group consisting of the governmental organizations concerned with the Geographic Information System, shall be established in order that the digital map database prepared in the Study shall be fully utilized by those organizations.

11. Information Disclosure

Both sides agreed that the digital map data prepared in the Study shall be widely disclosed to the public. Both sides further confirmed the importance continuously to discuss the consolidation of the distribution system of digital data in cooperation with the Steering Committee.

12. Others

Both sides agreed that daily allowances and accommodation fees arising from assignments of FTM personnel in the course of implementing the Study shall be borne by FTM.

The Minutes of Meeting are prepared both in English and French. When any doubt arises in their interpretation, English text shall prevail.

A. G.

APPENDIX

List of attendants to the discussions

Madagascar side :

National Geographic and Hydrographic Institute (FTM)

Mr. RAZAFINAKANGA Andrianjafimbelo	Director General
Mrs. RANDRIANANDRANA Noëlle	Director General Adjoin
Mr. ANDRIAMPARANY Naina	Technical Counselor of Director General
Mr. NARY Herilalao Iarivo	Director of Basic Geographic Information
Mrs. RAZANAMALALA Vacarivary Angelnette	Director of Edition Works
Mr. RAKOTOZAFY Robert	Director Marketing and Commercial
Mr. RAKOTOARISON Max Simon	Chef de Department Geodesy and Hydrographic
Ms. NARY Herimima Sarivo	Chief of Division of Digital Mapping
Mr. Nicolas LAMBERT	Technical Assistant

Office of Vice Primer Minister charged of Finances and Economy

Direction General of Economy and Plan

Mrs. RASOAVOLOLONA Jeanne	Director of Public Investments
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Ministry of Foreign Affairs

Mr. FENO Jeannot	Director of Bilateral Cooperation
Mr. RATEFINANAHDRY Jean de Dieu	Chief of Division of Technical, Economical, and Financial Cooperation

Ministry of Territorial and Urban Management

Mr. RAMANANTSOA Herivelona	Minister of Territorial and Urban Management
Mr. ANDRIAMBOAVONJY Amédée M.	Director of Cabinet of Minister President of Council of Administration of FTM

Ministry of Territorial and Urban Management

Department of Topographic Service, Office of Landed Pilot Operations

Mr. RAMAMONJISOA Aimé	Chef of Project
Mr. RAZAFINDRAICAVO Henry	Chef Provincial Topographic
Mr. David CAILLEAU	Assistant Engineer, CPF

Antananarivo City

Mr. RAZANAMASY Guy Willy	Mayor of Antananarivo City
--------------------------	----------------------------

Japanese side :

Preliminary study Team

Mr. YAGUCHI Akira	Chef de mission
Mr. NARAWA Mutsumi	Planning of studies
Mr. EGAWA Yoshitake	Planning of basic mapping and of transfer of technology
Mr. MORITA Toshiyuki	Interpret

Embassy of Japan at Antananarivo

Mr. TSUKAHARA Shigeru	Second Secretary
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A.C.F.

A.C.F.

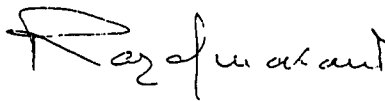
**MINUTES OF MEETING
FOR**

**THE ESTABLISHMENT OF A DATABASE
FOR GEOGRAPHIC INFORMATION SYSTEMS
OF THE CAPITAL AREA IN THE
REPUBLIC OF MADAGASCAR**

AGREED UPON BETWEEN

**NATIONAL GEOGRAPHIC AND HYDROGRAPHIC INSTITUTE,
MINISTRY OF TERRITORIAL AND URBAN MANAGEMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY**

ANTANANARIVO, 12 NOVEMBER 1998



RAZAFINAKANGA Andrianjafimbeto
Director General
National Geographic and Hydrographic Institute



Isao IKESHIMA
Leader
JICA Study Team
Japan International Cooperation Agency

Japan International Cooperation Agency Study Team for the “The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar” (hereinafter referred to as “JICA Study Team”), and the National Geographic and Hydrographic Institute (hereinafter referred to as “FTM”) held a meeting concerning the Inception Report on “The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar” on the 9th day of November 1998, from 9:00 a.m. to 4:00 p.m. The meeting took place at “FTM” office in a friendly atmosphere. The members who attended the meeting are listed in Appendix-1. The conclusions of the discussions were as follows:

1. “FTM” agreed on the Inception Report prepared by “JICA Study Team”.
2. “FTM” side requested the following to the Team:
 - (1) Since the Presidential residence is situated in the southernmost part of the study area, aerial photography and plotting works cannot be conducted in a zone extending on 18 km². Accordingly, this zone shall be cut from the study area.

On the other hand, it was requested to include in the study area a 18 km² area located north-east of Soavina City in the south-west area of the capital Antananarivo City, where urbanisation is growing fast.
 - (2) FTM personnel expressed a strong desire to have training opportunity in Japan.

“JICA Study Team” promised to convey these requests to the JICA headquarter.

APPENDIX-1

LIST OF ATTENDANTS

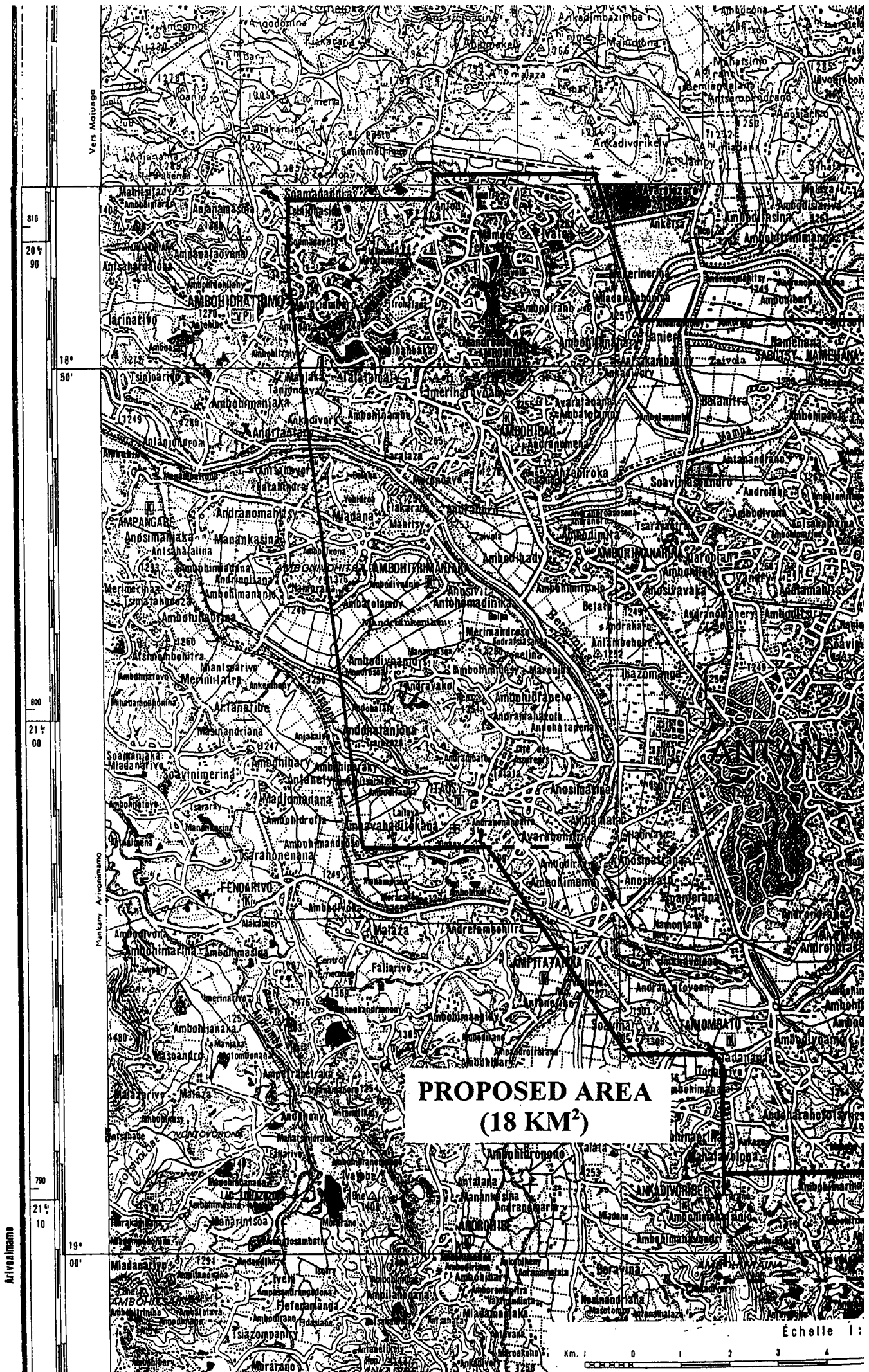
Malagasy Side:

Mr. RAZAFINAKANGA Andrianjafimbelo	Director General FTM
Mr. RAKOTOZAFY Robert	Director of Marketing and Sales FTM
Mr. RAVELOMANANTSOA Josoa	Business Engineer Marketing and Sales Division FTM
Mr. NARY Herilalao Iarivo	Director of Basic Geographic Information FTM
Mr. RAHAINGOALISON Narizo	Director of Geographic Information FTM
Ms. RATOVOARISON Nivo	Chief of Hydrography Division FTM
Mr. RAKOTOVAO Manarivo	Chief of Research Department FTM
Mr. LI Han Ting	Chief of Remote Sensing Division FTM

Japanese Side:

Mr. Isao IKESHIMA	Leader of JICA Study Team
Mr. Mamoru TAKAHASHI	Database Engineer
Mr. Ken-ichi SHIBATA	Land Use and Land Condition Engineer
Mr. Morten STRAND	Surveyor
Ms. Marie-Line CHARLES	Interpreter
Ms. Odile GAYON	Coordinator
Mr. Katsuo TANAKA	JICA
Mr. Yoshitake EGAWA	Technical Advisor, JICA

f l



**PROPOSED AREA
(18 KM²)**

Arivoaimamo

Vert. Matjuanga

Manjary Arivoaimamo

Échelle 1:





**CUT AREA
(18 KM²)**

1:100,000

18° 50'	60	90
18° 56'	60	90
18° 52'	60	90
18° 58'	60	90
18° 54'	60	90
18° 60'	60	90

MINUTES OF MEETING

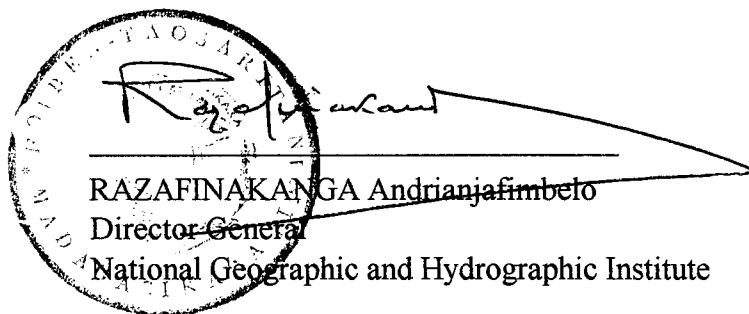
FOR


**THE ESTABLISHMENT OF A DATABASE
FOR GEOGRAPHIC INFORMATION SYSTEMS
OF THE CAPITAL AREA IN THE
REPUBLIC OF MADAGASCAR**

AGREED UPON BETWEEN

**NATIONAL GEOGRAPHIC AND HYDROGRAPHIC INSTITUTE,
MINISTRY OF TERRITORIAL AND URBAN MANAGEMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY**

ANTANANARIVO, THE 25TH OF JUNE, 1999




Isao IKESHIMA
Leader
JICA Study Team
Japan International Cooperation Agency

The Japan International Cooperation Agency Study Team for “The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar” (hereafter referred to as “JICA Study Team”), and the National Geographic and Hydrographic Institute (hereinafter referred to as “FTM”) held a meeting concerning the Interim report on “The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar” on the 21st day of June, 1999, from 9:30 a.m. to 3:30 p.m. The meeting took place at the FTM office in a friendly atmosphere. The attendants of the meeting are listed in Appendix-1.

The conclusions of the discussions were as follows:

1. FTM agreed on the Interim report prepared by JICA Study Team.

2. The JICA Study Team handed over the following final results to the FTM:

-Interim Report:

English	5 copies
French	10 copies

-Aerial Photographs:

negative films (approximately 1/20,000)	1 set
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3. FTM requested to the JICA Study Team that the following equipment that JICA has provided for the Study, be donated to FTM:

- Personal Computer and accessories Gateway E-5250 450	1 unit
- Inkjet Printer and accessories HP 750 Plus (A0)	1 unit
- Digitizer and accessories Digitizer board (NS Calcomp 34480) Digitizer stand (NS Calcomp 34480)	1 unit
- GIS Software ESRI Arc View 3.1	1 set
- Application Softwares:	
. Software ESRI Network Analyst	1 set
. Software ESRI Spatial Analyst	1 set
. Software MS Office 97 Pro	1 set
- Projector EPSON ELP 7200	1 unit
- Uninterruptable Power Supply APC SU 1400I (and UPS software APC AP9007)	1 unit
- Transformer TOYODEN TK-3	1 unit

The JICA Study Team promised to convey this request to the JICA headquarter.

LIST OF ATTENDANTS**Malagasy Side:**

Mr. RAZAFINAKANGA Andrianjafimbelo	Director General, FTM
Mr. RAKOTOZAFY Robert	Director of Marketing and Sales Division, FTM
Mr. NARY Herilalao Iarivo	Director of Basic Geographic Information, FTM
Mr. RAHAINGOALISON Narizo	Director of Geographic Information, FTM
Mr. RANJALAHY Marc	Business Engineer 2, FTM
Mr. RAKOTOVAO Manarivo	Chief of R & D Department, FTM
Mr. RAJAONARISON J. Désiré	Chief of Database Department, FTM
Mr. RABEMALAZAMANANA	Chief of Geomatic Division, FTM
Mr. ANDRIATSIMIANGY J. Robson	Chief of Laboratory, FTM
Mr. RAKOTO Rahetindralambo	Chief of Photogrammetry Division, FTM
Mr. LI Han Ting	Chief of Remote Sensing Division, FTM
Ms. RAKOTOVOARISON Nivoharimanga	Chief of Hydrography Division, FTM

Japanese Side:

Mr. Isao IKESHIMA	Leader of the JICA Study Team
Mr. Mamoru TAKAHASHI	Database design Engineer
Mr. James WILKINSON	Database management system design Engineer
Mr. Satoru NISHIO	Survey on urban facility data Engineer
Mr. Ken-ichi SHIBATA	Land Use and Land Condition Engineer
Miss Marie-Line CHARLES	Interpreter
Miss Odile GAYON	Coordinator
Mr. Akira SAITO	Japanese Embassy

MINUTES OF MEETING

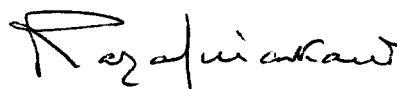
FOR

**THE ESTABLISHMENT OF A DATABASE
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AGREED UPON BETWEEN

**NATIONAL GEOGRAPHIC AND HYDROGRAPHIC INSTITUTE,
MINISTRY OF TERRITORIAL AND URBAN MANAGEMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY**

ANTANANARIVO, THE 14TH OF SEPTEMBER 1999



RAZAFINAKANGA Andrianjafimbelo
Director General
National Geographic and Hydrographic Institute



Isao IKESHIMA
Leader
JICA Study Team
Japan International Cooperation Agency

The Japan International Cooperation Agency Study Team for “The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar” (hereafter referred to as “JICA Study Team”), and the National Geographic and Hydrographic Institute (hereinafter referred to as “FTM”) held a meeting concerning the Draft Final Report on “The Establishment of a Database for Geographic Information Systems of the Capital Area in the Republic of Madagascar” on the 13th day of September, 1999, from 9:30 a.m. to 12:00 a.m. The meeting took place at the FTM office in a friendly atmosphere. The attendants of the meeting are listed in Appendix-1.

The conclusions of the discussions were as follows:

1. FTM agreed on the Draft final report prepared by JICA Study Team.
2. The JICA Study Team handed over the following final results to the FTM:

-Draft Final Report:

English	5 copies
French	10 copies

-Aerial Photographs:

Aerial photographs (approximately 1/20,000)	3 copies
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3. As mentioned in the Minutes of Meeting signed on June 25th, 1999, the JICA Study Team conveyed to the JICA Headquarter the FTM request for the donation of equipment provided for the Study. The JICA Headquarter agreed to donate the following equipment to FTM.

- Personal Computer and accessories Gateway E-5250 450	1 unit
- Inkjet Printer and accessories HP 750 Plus (A0)	1 unit
- Digitizer and accessories Digitizer board (NS Calcomp 34480) Digitizer stand (NS Calcomp 34480)	1 unit
- GIS Software ESRI Arc View 3.1	1 set
- Application Softwares:	
. Software ESRI Network Analyst	1 set
. Software ESRI Spatial Analyst	1 set
. Software MS Office 97 Pro	1 set
- Projector EPSON ELP 7200	1 unit
- Uninterruptable Power Supply APC SU 1400I (and UPS software APC AP9007)	1 unit
- Transformer TOYODEN TK-3	1 unit

LIST OF ATTENDANTS**Malagasy Side:**

Mr. RAZAFINAKANGA Andrianjafimbelo	Director General, FTM
Mr. RAKOTOZAFY Robert	Director of Marketing and Sales Division, FTM
Mr. NARY Herilalao Iarivo	Director of Basic Geographic Information, FTM
Mr. RAHAINGOALISON Narizo	Director of Geographic Information, FTM
Mr. RAVELOMAMANTSOA Josoa	Business Engineer, Marketing & Sales Division, FTM
Mr. RAKOTOVAO Manarivo	Chief of R & D Department, FTM
Mr. ANDRIANTSIMIANGY J. Robson	Chief of Laboratory, FTM
Mr. ANDRIAMANANA Malala	Chief of Aerial Flight Department, FTM
Mr. RAKOTONANDRASANA Velosoa	Database Operator, FTM
Ms. RAKOTOVOARISON Nivoharimanga	Chief of Hydrography Division, FTM
Ms. NARY Herinirina	Chief of Mapping Department, FTM
Ms. RANDRIAMANANA Lydia	Chief of Database Division, FTM
Mr. RAKOTOARISON Max	Follow-up and Planning, FTM
Mr. RABOKOSON Julien Astina	Management Control, General Direction, FTM
Mr. RAMINOHARIZAKA Paul	Chief of Topographic Division, FTM
Mr. RANDRIANAIVO Eugène	Chief of Control and Photo-interpretation Division, FTM
Mr. RAJEMISON Michel	Chief of Geodetic Surveying Division, FTM

Japanese Side:

Mr. Isao IKESHIMA	Leader of the JICA Study Team
Mr. Mamoru TAKAHASHI	Database design Engineer
Mr. James WILKINSON	Database management system design Engineer
Miss Marie-Line CHARLES	Interpreter
Miss Odile GAYON	Coordinator
Mr. Akira SAITO	Japanese Embassy
Mr. Hisashi MORI	Technical Advisor, JICA