

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE UNITED NATIONS TRANSITIONAL ADMINISTRATION
IN EAST TIMOR (UNTAET)**

FINAL REPORT

FOR

THE STUDY ON URGENT ESTABLISHMENT OF

TOPOGRAPHIC MAPPING

IN EAST TIMOR

August 2000



ASIA AIR SURVEY CO., LTD. (AAS)

SSF
JR
00-147

Preface

In response to a request from the United Nations Transitional Administration in East Timor (hereinafter referred to as “UNTAET”), the Government of Japan decided to conduct “The Study on Urgent Establishment of Topographic Mapping in East Timor” and entrusted the Study to Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. WATANABE Toru of Asia Air Survey Co., Ltd. to East Timor, twice between February and September 2000.

The team held discussions with the officials concerned of UNTAET and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project in East Timor.

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

August, 2000

Kimio FUJITA

President

Japan International Cooperation Agency

Letter of Transmittal

August, 2000

Mr. Kimio FUJITA
President
Japan International Cooperation Agency

Dear Mr. Fujita

It is my great pleasure to submit herewith the Final Report for the Study on Urgent Establishment of Topographic Mapping in East Timor.

The study team which consists of Asia Air Survey Co., Ltd. (AAS) conducted field survey in East Timor between February 2000 and March 2000, and office work such as digital topographic mapping between May 2000 and August 2000 as per the contract with the Japan International Cooperation Agency.

During the field survey in East Timor, discussion with the officials of the United Nation Transitional Administration in East Timor (UNTAET) were held. Based on the results of the discussion with UNTAET, digital topographic maps, other final results and final report were prepared.

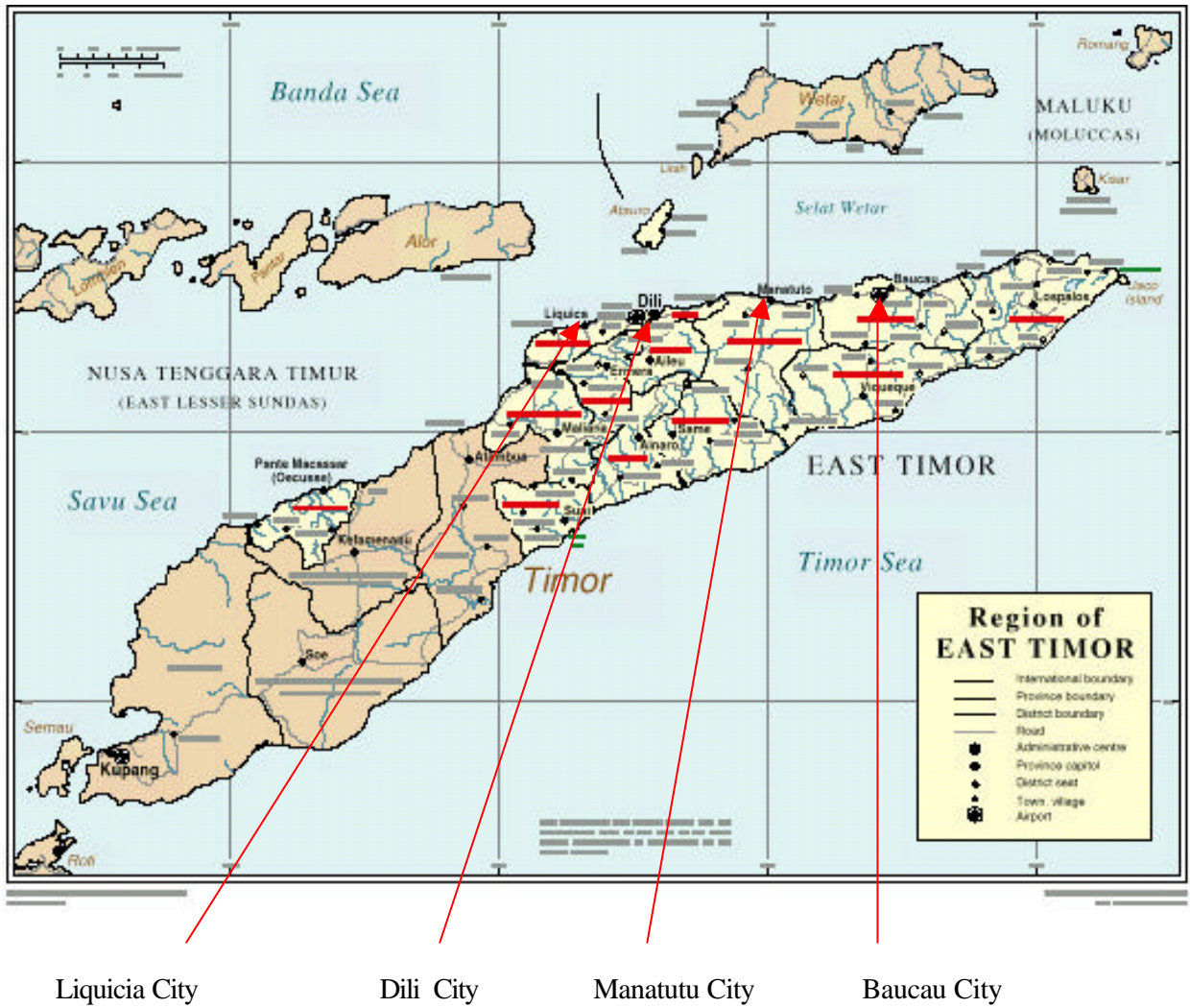
On behalf of the study team, I would like to express my heartfelt appreciation to the United Nation Transitional Administration in East Timor and other authorities concerned for their diligent cooperation and assistance and for the heartfelt hospitality which they extended to the study team during our stay in East Timor.

I am also greatly indebted to the Japan International Cooperation Agency, the Ministry of Foreign Affairs and the Embassy of Japan in Indonesia and Australia for giving us valuable suggestion and assistance during the preparation of this report.

Yours faithfully,

Toru Watanabe
Team Leader for the Study of Urgent Establishment
on Topographic Mapping in East Timor

Location Map of East Timor



The Study Area

1. Aerial photography area

- | | |
|------------------|---------------------|
| 1) Dili City | 107 km ² |
| 2) Manatutu City | 50 km ² |
| 3) Baucau City | 72 km ² |
| 4) Liquicia City | 28 km ² |

2. Digital topographic mapping and GIS data preparation area

- | | |
|--------------|---------------------------------|
| 1) Dili City | 107 km ² (83 sheets) |
|--------------|---------------------------------|

Aerial Photo at The Center of Dili City



Dili Port

Building without roof

UNTAET GPA

Container

Open Market

Date of aerial photography: 12:15 PM, 11 April 2000

Photo scale: Approx. 1:4,000

Field Photo



Panoramic view of Dili City



Jesus Point at Dili City



Central Office of UNTAET at Dili City



The house destroyed and burnt in September 1999 in Dili City

List of Abbreviation

B

BPN	Land Survey Department in Indonesia
BAKOSURTANAL	Geographic Survey Institute of Indonesia

C

CD-ROM	Compact Disk Read Only Memory
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E

EPS	Encapsulated Post Script
ESRI	Environmental System Research Institute, Inc.

G

GPS	Global Positioning System
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J

JICA	Japan International Cooperation Agency
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N

NZ	New Zealand
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P

PKF	Peace Keeping Force
-----	---------------------

S

SQD	Squadron
-----	----------

U

UNTAET	The Unites Nations Transitional Administration in East Timor
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Summary of the Study

1. Work Period

The work period of the Study is as follows:

Field work in East Timor	2000.2.17 ~ 2000.5.31
	2000.7.30 ~ 2000.8.8
Office work in Japan	2000.6.1 ~ 2000.8.31

2. Objects of the Study

The object of the Study are:

- 1) To create 1:2,000 scale digital topographic maps at Dili City and its surrounding area (107 km²)
- 2) To create 1:2,000 scale orthophoto maps at Dili City and its surrounding area (107 km²)
- 3) To create following GIS database at Dili City (107 km²)
 - 1:2,000 scale digital topographic map
 - 1:2,000 scale land condition map
 - 1:2,000 scale land use map
 - 1:2,000 urban facility map
- 4) To create above data as soon as possible for reconstruction of Dili City

3. JICA Study Team Organization

The list of the JICA Study team members is as follows:

Toru Watanabe	Team leader/Field identification
Manabu Kawaguchi	Ground control survey/Aerial photography
Hajime Goto	Land condition/Urban facility
Kazumi Suwabe	Database
Yoshitaka Gomi	GIS
Junichi Umezawa	Coordinator

4. Volume of Work

- 1) Aerial photography

Scale of aerial photos	1:8,000
Area to be covered by aerial photo	Dili City: 107 km ² Liquicia City: 28 km ² Manatutu City: 50 km ² Baucau City: 72 km ² Total: 257 km ²
2) Field work in East Timor	
Monumentation	11 points (New point)
Signalization	13 points for GPS point 16 points for leveling point
Leveling	88.4 km
Field identification	107 km ² for Dili City
3) Office work in Japan	
Aerial triangulation	202 models for Dili City
1:2,000 scale digital topographic mapping	107 km ² (83 sheets) for Dili City
1:2,000 scale orthophoto mapping	107 km ² (83 sheets) for Dili City
Creation of digital data for GIS	
Digital topographic data	107 km ² (83 sheets) for Dili City
Land use map	107 km ² (83 sheets) for Dili City
Land condition map	107 km ² (83 sheets) for Dili City
Urban facility map	107 km ² (83 sheets) for Dili City
Two times enlarged aerial photos	
Dili City	2 sets
Liquicia City	2 sets
Manatutu City	2 sets
Baucau City	2 sets
CD-ROM	
Digital topographic data	100 sets
GIS database file	5 sets
Additional request from UNTAET	
1:1,000 scale compiled topographic map	9 sheets, 2 sets
CD-ROM of above	2 sets
1:2,000 orthophotomap	5 sheets, 2 sets
CD-ROM of above	2 sets

5. Recommendation

Following is the JICA Study team's recommendation.

- 1) Necessity for modification of digital topographic maps and GIS data
- 2) Necessity for centralized management of digital topographic maps and GIS data
- 3) Necessity for department for research and management of basic materials such as digital topographic maps, GIS data and various statistic materials
- 4) Necessity for equipment for modification of digital topographic maps and GIS data
- 5) Necessity for technology transfer to people of East Timor

The Study on Urgent Establishment of Topographic Mapping in East Timor

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1 General

1.1 Introduction

In Response to the request of the UNTAET, the Government of Japan decided to conduct “the Study on Urgent Establishment of Topographic Mapping in East Timor” (hereinafter referred to as the “Study”).

This Study was carried out by Japan International Cooperation Agency, the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan. Agriculture Affairs Section of the UNTAET acted as the counterpart to the Study Team. The study area covers Dili City and its surrounding area in East Timor and the total study area is 107 km² for 1:2,000 scale digital topographic mapping and digital GIS data preparation. The Study also includes 1:8,000 scale aerial photography in Manatutu City, Baucau City and Liquicia City.

The scope of the Study agreed upon between the UNTAET and JICA is included in the document “Scope of Work for the Study on Urgent Establishment of Topographic Mapping in East Timor” on 12 January 2000 in Dili. However, the scope of the Study was modified based on the preliminary field check by JICA study team in and around Dili City and the discussion with the UNTAET.

The final scope of the Study agreed between the UNTAET and the JICA study team are described in the document “Inception Report for the Study on Urgent Establishment of Topographic Mapping in East Timor” and the “Minutes of Meeting for the Study on Urgent Establishment of Topographic Mapping in East Timor” on 10 March 2000.

The Study was started in the middle of February 2000 as a six-month-and-half program and completed at the end of August 2000. On the occasion of completion of the Study, we would like to submit the final report on the Study. It is expected that the results of the Study would be of use for re-construction of the infrastructures that was destroyed by the violence following the independence vote in September 1999 in East Timor.

1.2 Modification of Scope of the Study

Immediately after its arrival at Dili, the JICA Study Team executed the preliminary

field check on the study area and collection of the existing data and information necessary for the implementation of the Study. Based on the results of the preliminary field check and the data and information collection, several meetings were held between the UNTAET and the JICA Study Team, and the JICA Study Team prepared the Inception Report and submitted it to the UNTAET on 6 March 2000.

Finally, the UNTAET and the JICA Study Team mutually agreed to modify the scope of the Study as mentioned in the Appendix 2 “Minutes of Meeting for the Study on Urgent Establishment of Topographic Mapping in East Timor” on 10 March 2000.

The main points of modification of the scope of the Study agreed between the UNTAET and JICA Study Team are listed in Table 1.1 “Main Points of the Modification of the Scope of The Study”.

Table 1.1 “Main Points of the Modification of Scope of the Study”

Item of Work	Original Scope of Work	Inception Report and M/M
1. Aerial photography		
Scale of aerial photos	1:10,000	1:8,000
Area to be covered	Dili City and its surrounding area: 400 km ²	Dili City: 107 km ² Liquica City: 28 km ² Manatutu City: 50 km ² Baucau City: 72 km ² Total: 257 km ²
2. Topographic mapping		
Scale of topographic map	1:5,000	1:2,000
Area to be mapped	Dili City and its surrounding area: 400 km ²	Dili City: 107 km ²
Contour interval	2.5 m for flat area 10.0 m for mountain area	2.0 m for flat area 10.0 m for mountain area
3. GIS data		
Digital land use data Digital land condition data Digital urban facilities data	None	Dili City: 107 km ² 1:2,000
4. Enlarged aerial photos		
2-time enlarged photos	None	Liquicia City: 2 sets Manatutu City: 2 sets Baucau City: 2 sets

2. Preliminary Field Check and Data Collection

2.1 Existing GPS Points and Benchmarks

The JICA Study Team collected the existing geodetic control point data such as GPS points and benchmarks that would be used as reference points of horizontal coordinates and elevation for ground control point survey. Research was done in Dili City and Jakarta City of Indonesia in parallel.

The Study Team visited the UNTAET, CNRT, Interfet, PKF, Port Authority, etc. and explained the background and purpose of the Study, and requested for their cooperation in the Study. However, the JICA Study Team could not find any geodetic control point data in Dili City because the governmental documents were burnt out at the time of the violence following the independence vote in September 1999.

The JICA study Team collected geodetic control point data and descriptions on the GPS points and benchmarks that were established by BAKOSURTANAL in Cibinong, Bogor and BPN of Jakarta, Indonesia. Also, JICA Study Team obtained the GPS point data established by Australian Army, through an Australian survey company.

Based on the collected geodetic data and descriptions on GPS points and benchmarks, the JICA Study Team checked the present conditions of the monuments of GPS points and benchmarks. Finally, the JICA Study Team found that the existing GPS points and benchmarks were still available in the study area. Therefore, these existing GPS points and benchmarks were used as reference points for horizontal coordinates and elevation for the Study. The benchmarks and GPS points that were found by the JICA Study Team are shown on Table 2.1 “Existing Benchmarks in the Study Area” and Table 2.2 “Existing GPS Points in the Study Area”.

Table 2.1 “Existing Benchmarks in the Study Area”

No. of Benchmark	Location	Established by	Present Condition
TTG-0219	Bride of Comoro river	BAKOSURTANAL of Indonesia	Good
TTG-0220	In front of sub-district office at Fatuhada village	BAKOSURTANAL of Indonesia	Good
TTG-0157	In front of the UNTAET central building	BAKOSURTANAL of Indonesia	Good
TTG-0158	In front of village office at Culuhun village	BAKOSURTANAL of Indonesia	Good

Table 2.2 “The Existing GPS Point in the Study Area

No. of GPS point	Location	Established by	Present Condition
S-27004	In front of village office at Tibar village	BPN of Indonesia	Good
Airport	In front of control tower of Comoro Airport	Australian Army	Good
University	On the top of East Timor University of Dili	Australian Army	Good

The locations of the existing GPS points and benchmarks are shown in Figure 2.1 “Locations of Existing GPS Points and Benchmarks in the Study Area”.



Existing benchmark at TTG-0220 established by BAKOSURTANAL (In front of the sub-district office in Fatuhada village)

2.2 Existing topographic maps

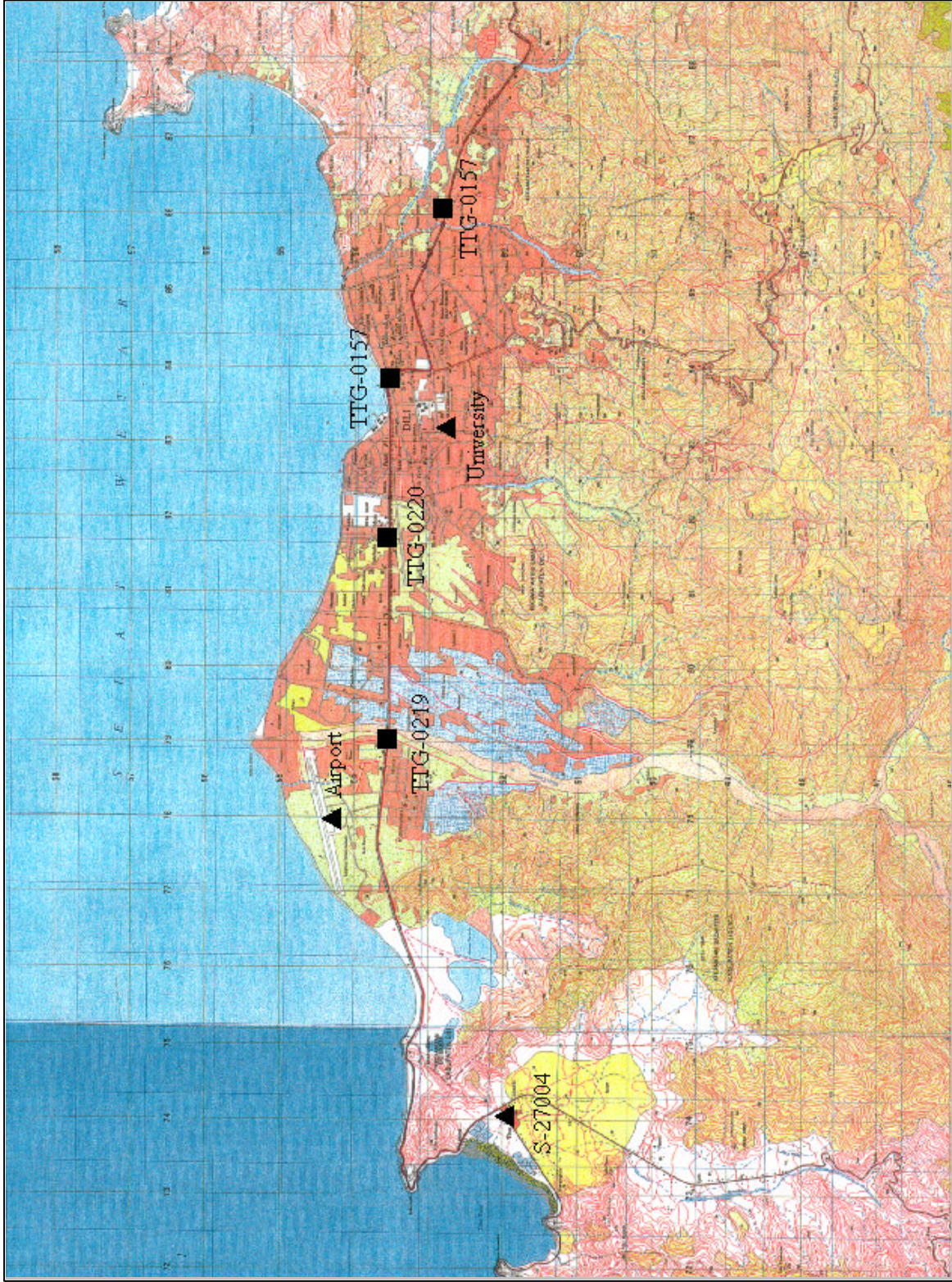
JICA Study Team also collected the existing topographic maps available in Dili City. The collected existing topographic maps were used for planning of ground control point survey and aerial photography.

At present, the available topographic maps in East Timor are available at the Map Cell Unit of Engineering Cops of PKF according to necessary procedures.

Table 2.3 Existing Topographic Maps in East Timor

Items	Contents
1:12,000 scale topographic map	Enlarged from 1:25,000 scale topographic maps by 1 st Topo Survey SQD of Australian Army.
1:25,000 scale topographic map	Re-print of 1:25,000 scale topographic maps originally prepared by BAKOSURTANAL of Indonesia. These maps cover the whole territory of East Timor.
1:50,000 scale topographic map	Compiled from 1:25,000 scale topographic maps prepared by BAKOSURTANAL of Indonesia. These maps cover the whole territory of East Timor.
1:250,000 scale topographic map	Joint operation graphics prepared and published by the Defense Mapping Agency, Topographic Center, U.S.A.

Figure 2.1 "Location of the Existing GPS Points and Benchmarks in the Study Area"



Note: Existing GPS points established by Australian Army and BPN of Indonesia
Existing benchmarks established by BAKOSURTANAL of Indonesia

3 Scope of The Study

3.1 Scope of the Study and the results

The scope of the Study originally planned in the Inception Report and the Minutes of Meeting, and the results actually performed by the JICA Study Team are shown in Table 3.1 “Scope of the Study and the Results”.

Table 3.1 “Scope of the Study and the Results”

Items	Planned	Performed
1. Aerial photography		
Scale of aerial photos	1:8,000	1:8,000
Area to be covered	Dili City: 107 km ² Liquicia City: 28 km ² Manatutu City: 50 km ² Baucau City: 72 km ² Total: 257 km ²	Dili City: 107 km ² Liquicia City: 28 km ² Manatutu City: 50 km ² Baucau City: 72 km ² Total: 257 km ²
2. Monumentation and pre-marking		
Monumentation	12 points for new points	11 points
Pre-marking	13 points for GPS points Approx. 17 points for elevation points	13 points for GPS points Approx. 16 points for elevation points
3. GPS survey	13 points	13 points
4. Leveling	Approx. 50 km	Approx. 88.4 km
5. Field check for topographic mapping and GIS data	Dili City: 107 km ²	Dili City: 107 km ²
6. GPS aerial triangulation	Approx. 180 models	202 models
7. Digital topographic mapping	Dili City: 107 km ²	Dili City: 107 km ²
8. Orthophoto mapping	Dili City: 107 km ² Total: 83 sheets	Dili City: 107 km ² Total: 83 sheets
9. Preparation of GIS data		
Digital topographic data Land use data Land condition data Urban facilities data	Dili City: 107 km ² Total: 83 sheets	Dili City: 107 km ² Total: 83 sheets

4. Subcontract

4.1 GPS Aerial Photography, GPS Observation and Aerial Triangulation

It was decided that 1:8,000 scale GPS aerial photography, GPS observation for ground control and aerial triangulation would be executed by the subcontract given to a survey and mapping company in Australia or New Zealand from the view point of security for aircraft operation under the control of UNTAET and PKF, and for the economical reason.

Three companies as described below were invited for the tender of GPS aerial photography, GPS observation and aerial triangulation for the Study. Finally, NZ Aerial Mapping Ltd. was selected as the subcontractor of GPS aerial photography, GPS observation and aerial triangulation.

1) NZ Aerial Mapping Ltd.

Head office: 15D Paul Matthews Road, North harbor Industrial estate, Albany,
New Zealand

2) Kevron Aerial Survey Pty Ltd.

Head office: P.O. Box 6325, Hay Street, East parth W.A. 6892, Australia

3) Pacific Geographics Pty Ltd.

Head office: P.O. Box 824, Sutherland NSW 1499, Australia

5. Organization and Work Schedule

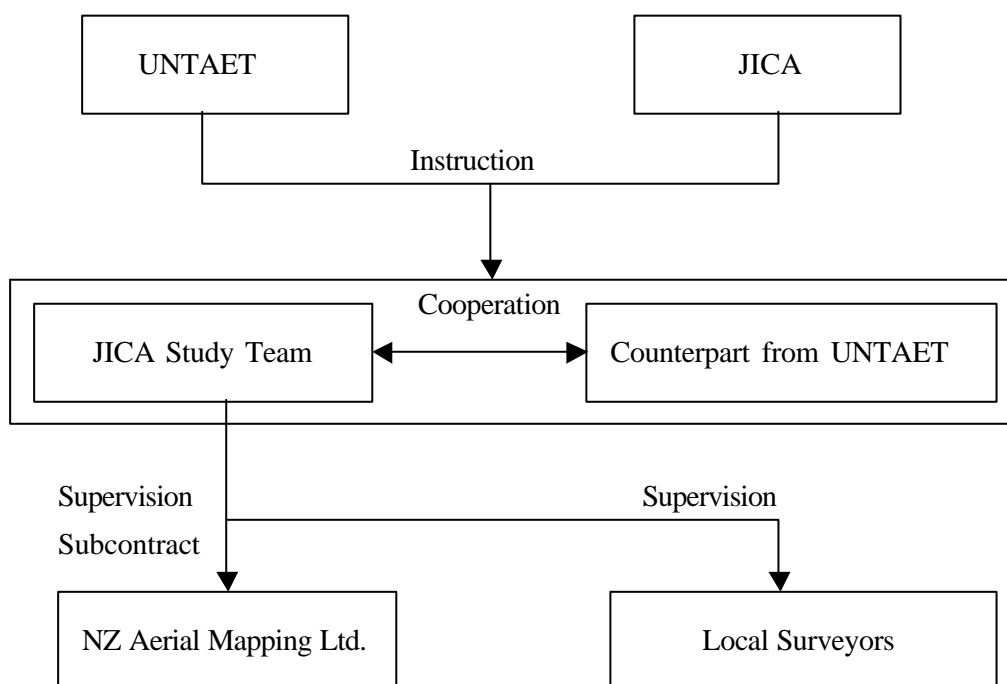
5.1 Study organization

GPS survey, GPS aerial photography and aerial triangulation were carried out by the subcontractor, NZ Aerial Mapping Ltd. under the supervision of the JICA Study team.

Monumentation, pre-marking, leveling, field identification and other necessary field surveys for land use, land condition and urban facilities data were carried out by the JICA Study Team with the cooperation of hired surveyors in East Timor.

Office works such as 1:2,000 scale digital topographic mapping, 1:2,000 scale orthophoto mapping, preparation of digital data for GIS were executed in Japan. The organization for implementation of the field operation is shown in Figure 5.1 “Study Organization”.

Figure 5.1 “Study Organization”



5.2 Organization of the JICA Study Team

The JICA Study Team consisted of the experts for the original assignments and actual

assignment schedules as shown in the Table-5.1 “Assignment and Assignment Schedule of JICA Study Team”.

Table 5.1 “Assignment and Assignment Schedule of JICA Study Team”

Assignment	Member	Original Assignment Period	Actual Assignment Period	Days
Team leader/ Field Identification	Toru Watanabe	2000.2.17~2000.5.31	2000.2.17~2000.5.31	105 days
		2000.7.10 ~2000.7.19	2000.7.30~2000.8.8	10 days
Ground control survey/ Aerial photography	Manabu Kawaguchi	2000.2.22~2000.5.21	2000.2.22~2000.5.31	100 days
Land condition/ Urban facilities	Hajime Goto	2000.3.13~2000.4.26	2000.4.2~2000.5.30	59 days
Database	Kazumi Suwabe	2000.3.19~2000.4.4	2000.3.19~2000.4.4	15 days
GIS	Yositaka Gomi	2000.5.2~2000.5.31	2000.7.10~2000.8.8	10 days
		2000.7.10~2000.7.19		
Coordinator	Junichi Umezawa	2000.2.25~2000.3.10	2000.2.25~2000.3.10	15 days
		2000.5.17~2000.5.31	2000.5.14~2000.5.30	17 days

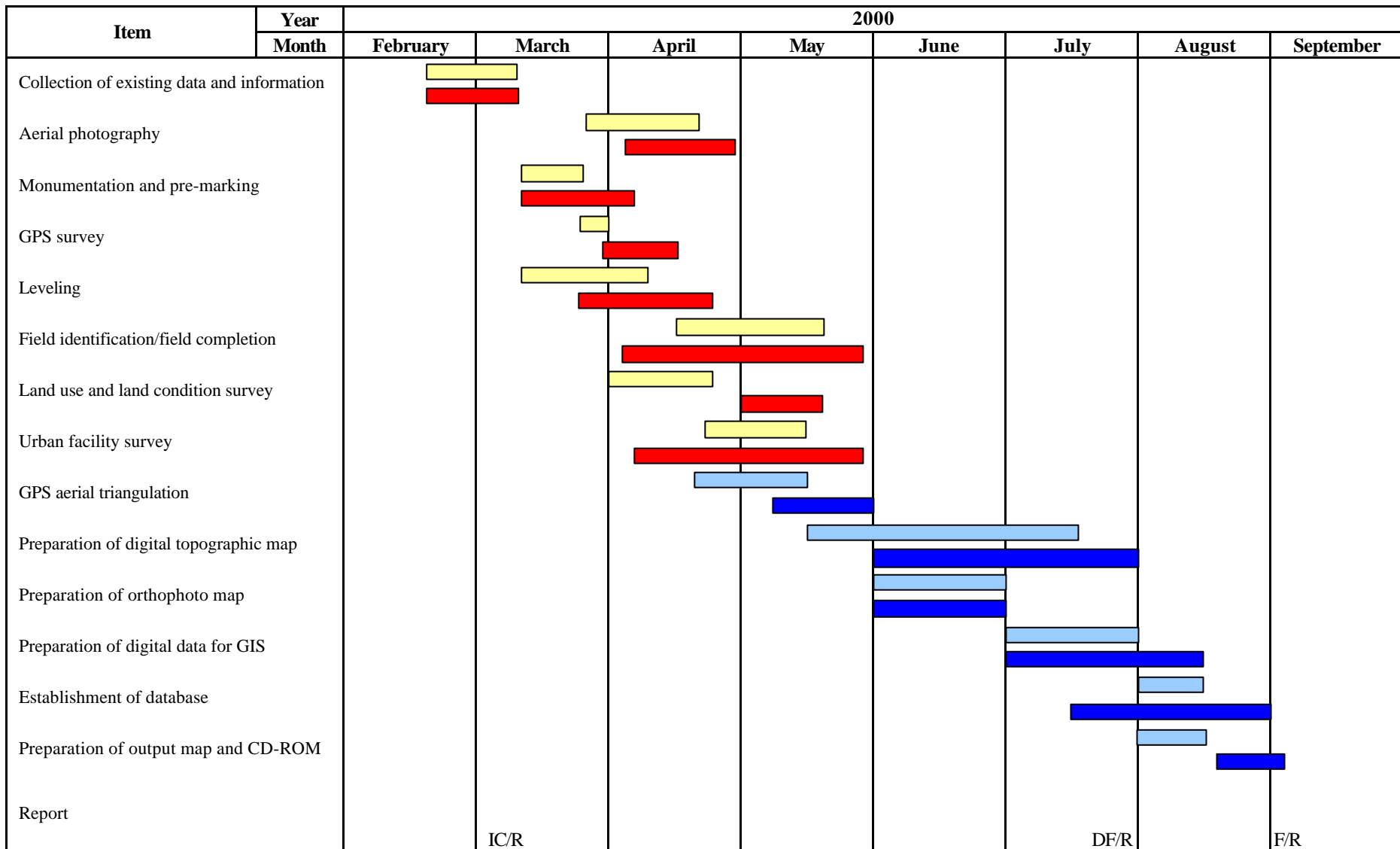
5.3 Work Progress

The original work schedule and the actual work progress are shown in the attached Table 5.2 “Original Work Schedule and Actual Work Progress of the Study”. Due to the modification of scope of the Study, the starting date of actual field operations were delayed approximately one month and JICA Study Team started the actual work of field operation from the middle of March 2000.

The original plan of aerial photography period was approximately one month including aircraft operation and photo processing. However, due to the cloudy and rainy weathers in the target area, the aerial photography actually took 23 days only for aircraft operation in East Timor.

Therefore, the actual office work including digital photogrammetric mapping and GIS data preparation was started from the beginning of June 2000 and finished in the middle of September 2000.

Table 5.2 "Original Work Schedule and Actual Work Progress of the Study"



11

Note:

Field work in East Timor (Original plan)
 Field work in East Timor (Actual)
 Submission of report (Original plan)

Office work in Japan (Original plan)
 Office work in Japan (Actual)
 Submission of report (Actual)

IC/R

DF/R

F/R

6. Ground Control Survey

6.1 Monumentation

Prior to commencement of GPS aerial photography, the location of horizontal and vertical control points necessary for execution of aerial triangulation were selected and checked at the sites. Concrete monuments were established on the selected horizontal and vertical points (GPS points). 13 concrete benchmarks including 2 existing benchmarks were established by BAKOSURTANAL and BPN of the Government of Indonesia.

The types and sizes of monuments are shown in Figure 6.1 “Monument Design” attached hereto. The locations of horizontal and vertical control points (GPS points) are shown in Figure 6.4 “Locations of GPS Points and GPS Observation Network” and Appendix 4 “Description of GPS Points”.

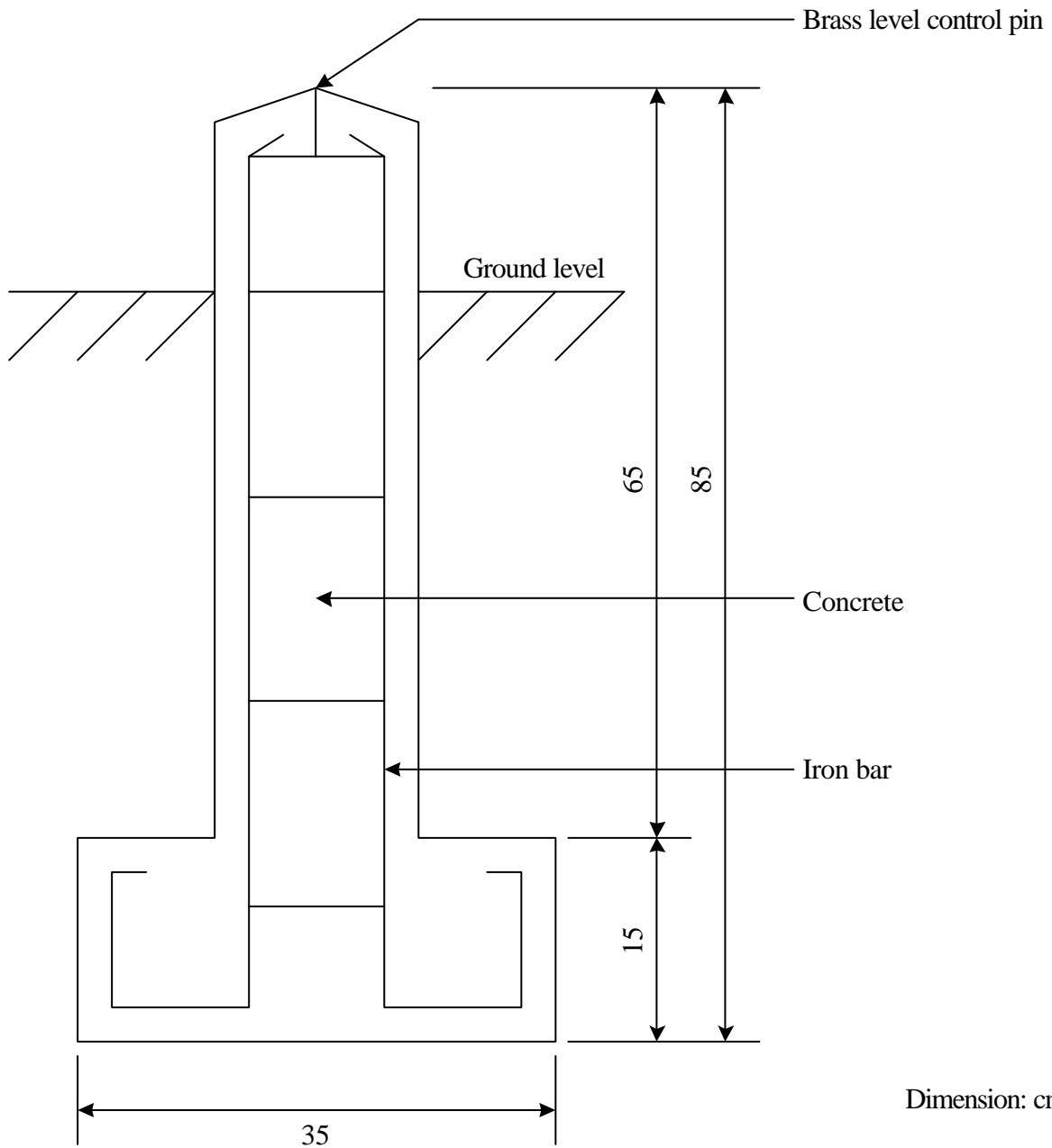
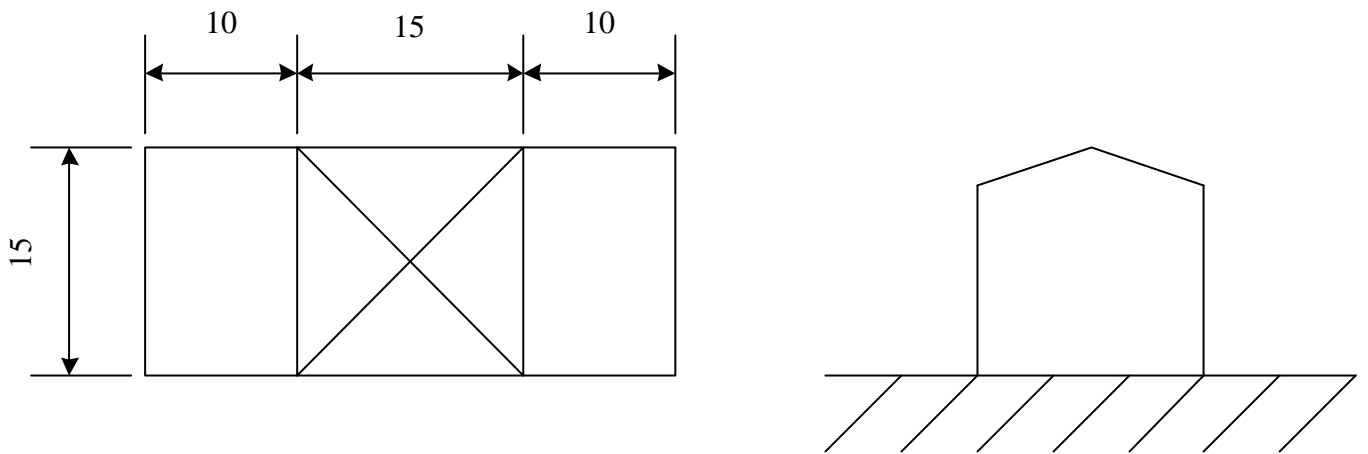


Preparation of concrete monuments for GPS points



Establishment of concrete monument at JICA-2 point

Figure 6.1 "Monument Design"



Dimension: cm

6.2 Pre-marking

Just before starting GPS aerial photography, pre-marks were established on the established horizontal and vertical control points (GPS points) and vertical control points (leveling points) necessary for GPS aerial triangulation.

The pre-marking was made on 13 points for horizontal and vertical control points (GPS points) and on 16 points for vertical control points (leveling points). The types and sizes of pre-marks are shown in Figure 6.2 “Pre-mark Design”. The locations of pre-marks are shown in Figure 6.3 “Locations of GPS Points and Benchmarks, and Leveling Routes”, and in Attachment 5 “Description of Leveling Points”.



Establishment of pre-mark
at TTG-0157

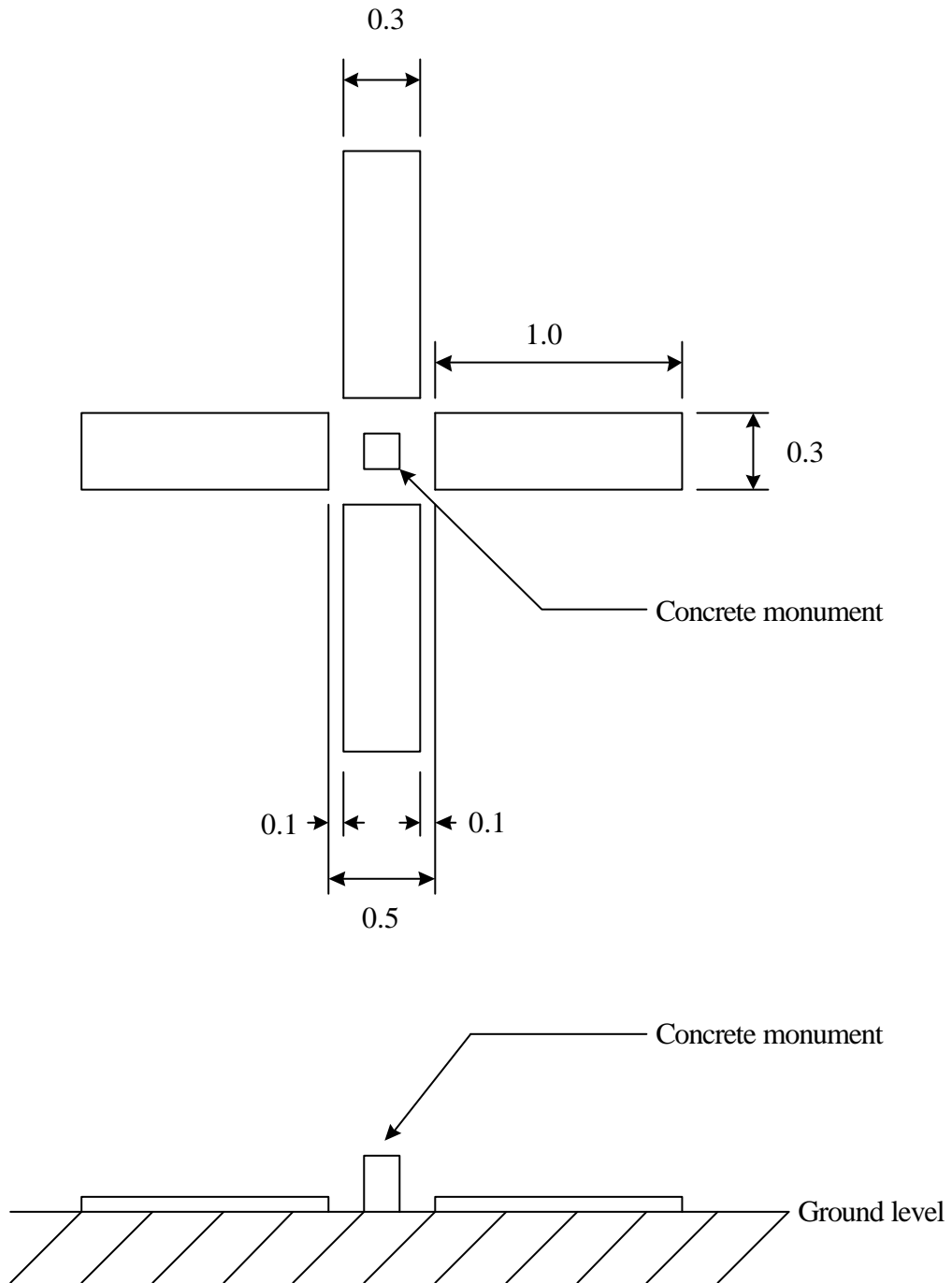
(In front of the main office
of the UNTAET)

6.3 Leveling

The direct leveling was carried out to decide the elevations of horizontal and vertical control points (GPS points), and the vertical control points (leveling points) necessary for implementation of aerial triangulation. The reference points to the direct leveling were the existing benchmarks established by BAKOSURTANAL of the Republic of Indonesia.

The number of benchmarks and the elevations of the reference points are shown in Table 6.1 “Reference Points for Elevation”, and the members that carried out the leveling work are shown in Table 6.2 “Members of Leveling Work”.

Figure 6.2 "Pre-mark Design"



Dimension: m

Table 6.1 “Reference Points for Elevations”

Number of Benchmark	Elevation
TTG-0157	3.636 m
TTG-0158	13.846 m
TTG-0219	22.098 m
TTG-0220	5.652 m

Table 6.2 “Member of Leveling Work”

Team	Name	Assignment
JICA Study Team	Mr. Toru Watanabe	Team leader/Field identification
JICA Study Team	Mr. M. Kawaguchi	Ground control survey/Aerial photography
Hired surveyor	Mr. Julio Correia	Surveyor, ex-government official of Agriculture Department of Indonesia
Hired surveyor	Mr. Manuel da Silva	Surveyor, ex-government official of Agriculture Department of Indonesia

The specified accuracy of direct leveling is $40 \text{ mm} \sqrt{S}$ (S = leveling route in km). The actual accuracy of direct leveling performed by the JICA Study Team is shown in Table 6.3 “Accuracy of Direct Leveling”.

The existing benchmarks were connected by direct leveling. Before starting the final calculation of the elevations of GPS points and leveling points, the elevations of the existing benchmarks were checked based on the obtained data. Finally, it was found that the elevation data of TTG-0220 had some troubles. Therefore, the elevation data of TTG-0220 was not used for the final calculation of leveling.

6.4 GPS observation

The GPS satellite survey was carried out to provide the horizontal coordinates of established concrete monuments (GPS points) necessary for GPS aerial triangulation. The static differential GPS observation method was applied to the survey. The method showed great advantage in the accuracy and efficiency, saving time and cost compared with the conventional survey method. The locations of GPS points were shown in Figure 6.4 “Locations of GPS Points and GPS Observation Network”. The members that carried out the GPS survey are shown in Table 6.4 “Members of GPS Survey”.

Table 6.3 "Accuracy of Direct Leveling"

From	To	Distance (Km)	Limit of Error (mm)	Mesarment Error (mm)	Result
S27004	JEP 2	4.3	82.946	21.000	OK
JEP 2	JICA 1	4.5	84.853	25.000	OK
S27004	JEP 1	2.5	63.246	17.000	OK
S27004	JICA 2	2.5	63.246	16.000	OK
JICA 2	JEP 3	4.5	84.853	22.000	OK
JEP 3	JICA 3	4.0	80.000	19.000	OK
JICA 3	JEP 4	2.8	66.933	16.000	OK
JEP 4	JEP 5	3.3	72.664	15.000	OK
JEP 5	JICA 4	2.3	60.663	13.000	OK
JEP 5	JEP 6	3.8	77.974	20.000	OK
JEP 5	JEP 7	2.5	63.246	11.000	OK
JEP 7	JEP 8	3.0	69.282	14.000	OK
JEP 8	JICA 5	2.8	66.933	17.000	OK
JICA 5	JEP 10	4.5	84.853	21.000	OK
JEP 5	JEP 9	5.5	93.808	23.000	OK
JEP 9	TTG157	4.0	80.000	19.000	OK
TTG157	JEP 11	1.3	45.607	9.000	OK
JEP 11	JEP 12	2.3	60.663	14.000	OK
JEP 12	JEP 13	5.0	89.443	22.000	OK
JEP 13	JICA 7	2.8	66.933	19.000	OK
TTG157	JEP 14	2.2	59.330	12.000	OK
JEP 14	JICA 10	5.8	96.333	21.000	OK
JICA 10	JEP 15	1.5	48.990	8.000	OK
JEP 15	JICA 11	6.5	101.980	24.000	OK
JEP 11	JEP 16	3.0	69.282	16.000	OK
JEP 16	JICA 9	1.2	43.818	7.000	OK

Note: Specified accuracy of direct leveling
 $40 \text{ mm } \sqrt{S}$ $S = \text{leveling route in km}$

Table 6.4 “Members of GPS Survey”

Name	Company
Mr. Mark Mialszygrosz	Staff of New Zealand Aerial Mapping
Mr. Ron Brown	Ditto
Mr. Jose Sobral	Ditto
Mr. Jaime Xavier Lopes	Ditto
Mr. Manuel Smih	Ditto



GPS observation in front of the control Tower at Comoro Airport
(Reference point for horizontal coordinates)

The specified accuracy of GPS observation is as follows:

Horizontal $2 \text{ cm} + 2 \text{ PPM} \times \text{distance}$

Vertical $5 \text{ cm} + 5 \text{ PPM} \times \text{distance}$

The actual accuracy of GPS observation is shown in Table 6.5 “Standard Deviation of GPS Observation”.

The reference points for horizontal coordinates are the GPS points established by the Australian Army. These GPS points are located in front of the control tower of Comoro Airport and on the top of the building of East Timor University. The coordinates of reference points for horizontal coordinates are shown in Table 6.6 “Reference Point for Horizontal Coordinates”.

Table 6.5 "Standard Deviation of GPS Observation"

Route		Distance	Tolerance	Standard Deviation of Observation	Remarks
From	To	(Km)	(mm)	(mm)	
University	Airport	5.702764	25.702764	1.42126704	
Airport	University	5.702763	25.702763	1.42126704	
Airport	JICA 1	7.314988	27.314988	4.579301257	
Airport	JICA 2	4.323658	24.323658	2.408318916	
Airport	JICA 3	1.918091	21.918091	1.486606875	
Airport	JICA 4	1.414178	21.414178	0.989949493	
Airport	JICA 5	4.141559	24.141559	2.58069758	
University	JICA 6	4.527951	24.527951	4.604345773	
University	JICA 7	3.016142	23.016142	2.360084744	
University	JICA 8	8.007297	28.007297	3.56931366	
University	JICA 9	4.972039	24.972039	4.801041554	
University	JICA 10	4.496047	24.496047	2.690724809	
University	JICA 11	6.313405	26.313405	2.805280735	
Airport	S27004	4.086373	24.086373	5.672741841	
Airport	Flight Base	0.373492	20.373492	0.781024967	
Airport	TTG 157	0.981200	20.981200	1.272792206	

Note: Tolerance of horizontal observation
 $2\text{cm} + 2\text{ PPM} \times \text{distance}$

Table 6.6 “Reference Points for Horizontal Coordinates”

Name of Point	Latitude	Longitude
Airport	-8°32'57.35070	125° 31'19.245
University	-8° 33'37.64770	125° 34'21.270

Note: WGS-84

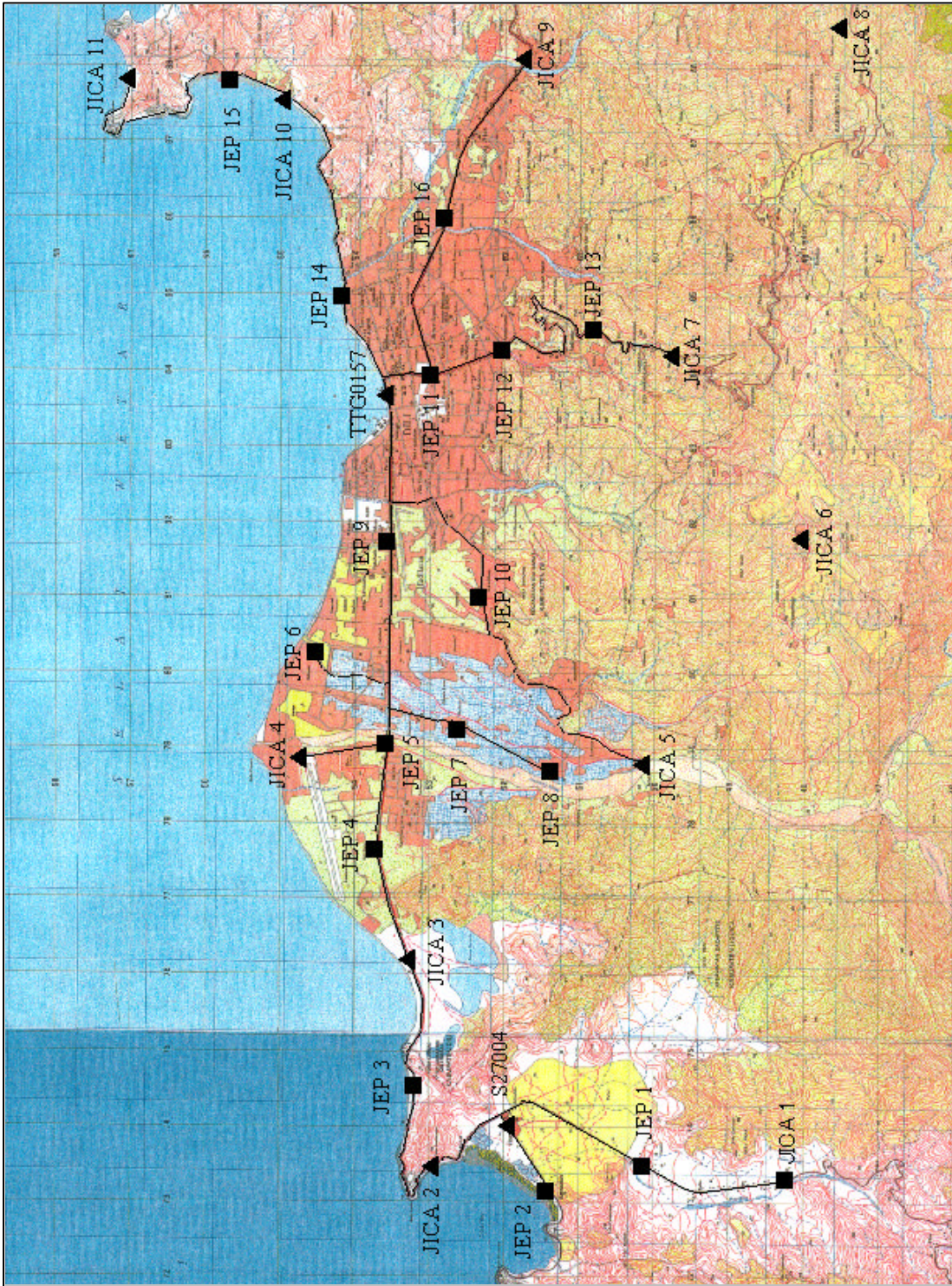
It was reported that there was a discrepancy of the horizontal coordinates of GPS points between BPN of Indonesia and Australian Army. According to the information from an Australian survey company, the discrepancy of the distance was approximately 1 - 2 m. Table 6.7 shows the discrepancy of coordinates of S-27004 that was established by BPN (Land Registration Office) of Indonesia located in Tibar Village.

Table 6.7 “Discrepancy of UTM Coordinates between GPS Points Established by Australian Army and BPN of Indonesia

S-27004	N	E	Distance
Data from BPN of Indonesia	9,051,950.8230	774,127.3890	----
Observation data based on GPS Point by Australian Army	9,051,952.0193	774,128.4827	----
Discrepancy	-1.1960	-1.0937	1.6206 m

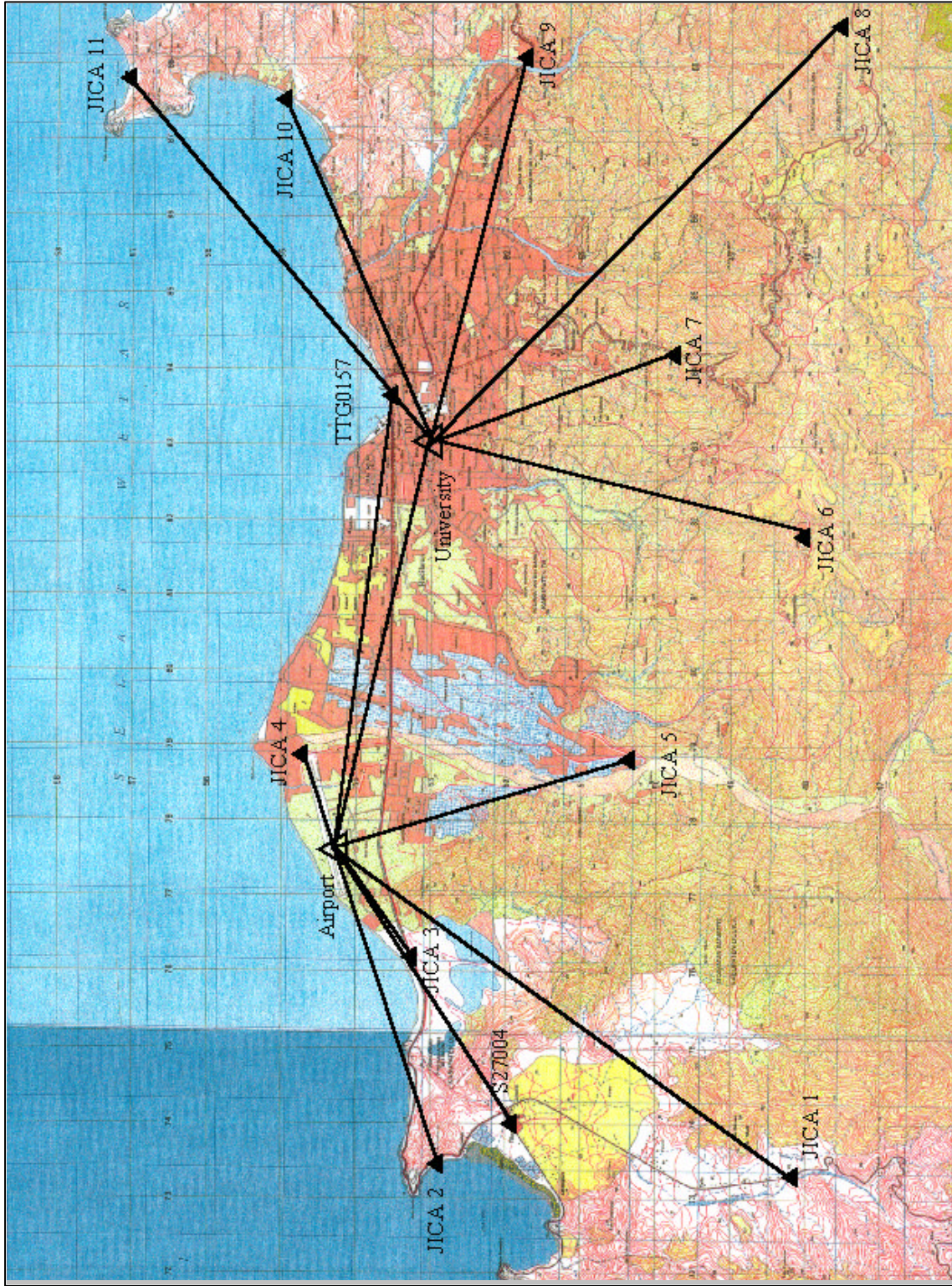
Note: WGS-83, U.T.M. Zone No.51

Figure 6.3 "Location of GPS Points and Benchmark, and Leveling Route"



Note: GPS point Benchmark
 Leveling route executed by JICA Study Team

Figure 6.4 "Location of GPS Points and GPS Observation Network"



Note: Existing GPS point established by Australian Army
 — GPS observation line
 New GPS point by JICA Study Team

7. Field Identification

Field identification was intended to acquire field data and information in preparing 1:2,000 scale digital topographic maps, urban facilities maps, land use maps and land condition maps. Field identification of urban facilities, land coverage and photo interpretation keys as well as ordinary field identification for the topographic mapping was carried out as a part of the field survey of the Study. Members that carried out the field identification are shown in Table 7.1 “Members of Field Identification”.

Table 7.1 “Member of Field Identification”

Team	Name	Assignment
JICA Study Team	Mr. Toru Watanabe	Team leader/Field identification
JICA Study Team	Mr. H. Goto	Land condition/urban facility
JICA Study Team	Mr. M. Kawaguchi	Ground control survey/Aerial photography
Hired surveyor	Mr. Julio Correia	Surveyor, ex-government official of Agriculture Department of Indonesia
Hired surveyor	Mr. Manuel da Silva	Surveyor, ex-government official of Agriculture Department of Indonesia

The 1:8,000 scale aerial photos, two-times enlarged aerial photos (in photo scale of approximately 1:4,000) and data sheets that were specially prepared for the field identification were used to record the acquired data and information. The samples of field data sheets are shown in Appendix 6 “Samples of Data Sheets”.

7.1 Field identification for Topographic Mapping

Field identification was carried out to identify all natural and artificial terrain features that are necessary for the 1:2,000 scale digital topographic mapping but difficult or impossible to identify by the photo interpretation. Those items were:

- 1) Names of governmental buildings and facilities;
- 2) Names of public buildings and facilities;
- 3) Names of roads and streets;*
- 4) Names of places;**
- 5) Administrative boundaries;***
- 6) Specific crops and vegetation; and
- 7) Underground or hidden canals and drainage.

Note:

- * Names of roads and streets were collected from the Village Office.
- ** Names of places were collected from the Village Office and the existing 1:25,000 scale topographic maps.
- *** According to the information from UNTAET Dili District Office, the administrative boundaries shown on the existing 1:25,000 scale topographic maps are reliable.

The terrain features or items identified in the field were shown on the aerial photographs with code numbers, and their detailed data and information were recorded in the field data sheets.

7.2 Inventory Survey for Urban Facilities Map

In addition to the ordinary field identification, further detailed data and information were acquired to be used for the urban facilities maps and GIS database. The field photographs of the terrain features were also taken and attached to the field data sheets.

7.2.1 Bridges

Seventeen (17) bridges were identified and recorded as the data and information which were names of the bridges and the rivers over which the bridges cross, the locations or addresses, types of bridge, lengths and widths, and conditions of the bridges. The locations and code numbers of the bridges were shown on the aerial photographs and the data and information were recorded in the field data sheets.

Field photos of the bridges were also taken and attached to the field data sheets. The details are shown in Appendix 6 “Samples of Data Sheets, Field Identification List - Bridges”.

7.2.2 Churches, Temples and Cemeteries

As the majority of the local population is the Catholic faithful, a large number of Catholic churches and chapels are found in and around the City. Several Protestant churches, Islamic mosques, Hindu and Chinese Buddhism temples are also found within the area.

The information identified and recorded includes names of the churches, chapels or

temples, and cemetery locations or addresses, religious classification and conditions of the buildings. The locations and code numbers of the churches, temples and cemeteries were shown on the aerial photographs, and the information was recorded in the field data sheets. Field photos of the churches, temples and cemeteries were also taken and attached to the field data sheets. The details are shown in Appendix 6 “Samples of Data Sheets, Field Identification List - Churches and Temples”.

7.2.3 Schools

There were approximately 50 of primary schools, junior high schools, high schools, vocational schools, and colleges and university in the mapping area. Information identified and recorded includes names of schools, locations or addresses, classification of schools, and conditions of the buildings and their usability.

The locations and code numbers of the schools were shown on the aerial photos and the information was recorded in the field data sheets. Field photos of the school were also taken and attached to the field data sheets. The details are shown in Appendix 6 “Samples of Data Sheets, Field Identification List – Schools and Colleges”.

7.2.4 Government Offices and Public Buildings

There were over 450 governmental and public buildings and facilities in the mapping area. Most of the buildings and facilities were owned by Indonesian Administration. Some of them were burnt, destroyed and closed down, and others were not burnt but simply closed down, or used for other purposes. All the buildings and facilities were identified in the fields, recorded and photographed.

The information identified and recorded includes the former (Indonesian Administration) names of buildings or facilities, their present names, locations or addresses, conditions of damages and usability, and additional information, if any. The locations and code numbers of the buildings or facilities were shown on the aerial photos and the information was recorded in the field data sheets. Field photos of the buildings or facilities were also taken and attached to the field data sheets. The details are shown in Appendix 6 “Samples of Data Sheets, Field Identification List - Government Offices and Public Buildings”.

7.2.5 Roads and Streets

The names of main roads and streets of approximately more than 1 km in length were identified in the field and recorded on the existing 1:25,000 topographic maps, showing their beginning and ending points. In the case that the road names were already changed from the Indonesian to Portuguese notation, the latter was adopted. Also, the Indonesian word “Jalan” for road and street was translated into the Portuguese word “Rua” or “Estrada”.

7.2.6 Names of Places and Administrative Boundaries

The names of small villages, administrative villages, towns, country and province have not been decided officially due to the special situation of this country. For this mapping and GIS data, all the names of places and administrative boundaries were adopted from the existing 1:25,000 scale topographic maps, which were prepared by BAKOSURTANAL (Indonesian National Survey and Mapping Agency) in 1992. However, a tentative plan on the administrative areas for example was proposed by the CNRT as shown in Table 7.2 “Names of Administration Units”.

Table 7.2 “Name of Administration Unit”

CNRT Proposal	Indonesian Administrative Area	English
Aldaia	Kampung	Small village
Sucu	Desa	Village
Zona	Kecamatan	Town
Distric	Kabupaten	Country
Region	Propinci	Province

7.2.7 Rivers, streams, canal and drainage

The names of rivers were adopted from the existing 1:25,000 scale topographic maps and identified in the field. These names will not be changed even in the new administration. Irrigation canals were identified in the field and shown on the aerial photos. Locations of drainage canals were adopted from the existing data that was prepared by the Indonesian Administration.

7.2.8 Historical sites and objects

The historical sites and objects inherited from the Portuguese Period, such as fortresses and bridges, were identified and shown on the aerial photos. The detailed

data and information were also recorded in the field data sheet.



Fortress in Portuguese Period

7.3 Identification and Classification of Land Coverage for Land Use Map

As most of the land coverage was readily identified by the photo interpretation, the field identification or classification was not usually required. However, the items as described below were identified in the field due to their difficulty in photo interpretation or special usefulness.

1) **Banyan trees**

The old banyan trees that were planted in the Portuguese period are found in the Dili City and have become kind of historical monument and also create a characteristic landscape. According to the request from Agriculture Section of UNTAET, the rows of banyan trees were identified in the field and shown on the aerial photos.



Banyan trees planted in the Portuguese period

2) **Eucalyptus**

Eucalyptus trees were imported and planted to prevent the soil erosion on the steep slopes of mountainsides. According to the request from Agriculture Section of UNTAET, the typical area covered by the Eucalyptus trees were identified and shown on the aerial photos for photo interpretation at the time of 1:2,000 scale digital mapping for their special usefulness for soil erosion prevention planning.



Eucalyptus trees planted at the slope of mountain

To help the photo interpretation, keys for photo interpretation data sheets were prepared and details of terrain features such as athletic field, park, historical site, cemetery, light house, fuel storage, pipe line, tower, monument, dumping site, fish pond, paddy field and farm, swamp were photographed and recorded. The keys for photo interpretation data sheets are included in Appendix 7 “Keys for Photo Interpretation Data Sheets”.

As cultivated lands such as paddy fields, farms, plantations are readily identified by the photo interpretation, the field identification on these items was not applied except coffee plantations which are covered by canopies of tall trees to avoid the direct sunshine to the coffee plants.

7.4 **Photo Interpretation for Land Condition Maps**

Land condition maps can be prepared by using the field identification data from topographic maps, urban facilities maps and land use maps, and the photo interpretation by means of a plotting machine. Therefore, no special field identification survey for land condition maps was carried out.

8. GPS Aerial Photography

8.1 Flight permission

After finishing the monumentation and pre-marking, GPS aerial photography in a scale of 1:8,000 covering the mapping area of approximately 107 km² was carried out by NZ Aerial Mapping Ltd to prepare 1:2,000 digital topographic maps for Dili City and its surrounding area. Furthermore, 1:8,000 scale aerial photos covering Manatutu City, Baucau City and Liquicia City were executed for future use.

Before the aircraft of NZ Aerial Mapping Ltd. for aerial photography arrived at Comoro Airport in East Timor, JICA Study Team submitted necessary documents for flight operation in East Timor to Civil Aviation Section of the UNTAET for approval. It took about one week to obtain the necessary permission from the UNTAET. The copy of permission of flight operation for this Study is shown in Attachment-3 “Copy of Permission of Flight Operation”.



Aircraft of NZ Aerial Mapping Ltd. for aerial photography
(At Comoro Airport)

8.2 Equipment and Members for Aerial Photography

NZ Aerial Mapping Ltd. dispatched an aircraft, pilot and cameraman, and necessary equipment such as aerial camera and GPS equipment to Comoro Airport in East Timor for the execution of GPS aerial photography. The equipment list used for GPS aerial photography is shown in Table 8.1 “Equipment for GPS Aerial Photography” and the members of GPS aerial photography is shown in Table 8.2 “Members of GPS Aerial Photography”.

Table 8.1 “Equipment for GPS Aerial Photography”

Item	Type	Number
Aircraft	Rockwell 690b Twin-engined turbine	1 unit
Aerial camera	Leica RC30 forward motion compensated	1 unit
Lens	Leica UAGA 153 mm focal length	1 unit
GPS (Aircraft station)	Novatel (geodetic precision)	1 unit
GPS (Ground station)	Leica (Dual frequency)	1 unit

Table 8.2 “Members of GPS Aerial Photography”

Assignment	Name	Period in Dili	Days
Pilot	Adam Currey	2000.4.8 ~ 2000.4.30	23 days
Cameraman	Ian MacDougal	2000.4.5 ~ 2000.4.30	26 days

8.3 Results of Aerial Photography

1:8,000 scale GPS aerial photography in Dili City, Manatutu City, Baucau City and Liquicia City were executed by NZ Aerial Mapping Ltd. The results of GPS aerial photography executed by NZ Aerial Mapping Ltd. are shown in Table 8.3 “Results of GPS Aerial Photography in Dili City”, Table 8.4 “Results of Aerial Photography in Manatutu City”, Table 8.5 “Results of Aerial Photography in Baucau City”, Table 8.6 “Results of Aerial Photography in Liquicia City”, and in Table 8.7 “Final Results of Aerial Photography”.

Table 8.3 “Results of GPS Aerial Photography in Dili City”

Run Number	Frame Number	Date of Aerial Photography	Photo Scale (Average)	Number of Sheets
Run – 1	161 – 165	2000.4.11	1:8,000	5 sheets
Run – 2	16 – 21	2000.4.12	1:8,000	6 sheets
Run – 3	22 – 39	2000.4.12	1:8,000	18 sheets
Run – 4	139 – 160	2000.4.11	1:8,000	22 sheets
Run – 5	115 – 138	2000.4.11	1:8,000	24 sheets
Run – 6	91 – 114	2000.4.11	1:8,000	24 sheets
Run – 7	67 – 90	2000.4.11	1:8,000	24 sheets
Run – 8	81 – 101	2000.4.20	1:8,000	21 sheets
Run – 9 (Tie run)	180 – 189	2000.4.11	1:8,000	10 sheets
Run – 10 (Tie run)	166 - 179	2000.4.11	1:8,000	14 sheets
Run – 11 (Tie run)	190 – 200	2000.4.11	1:8,000	11 sheets
Run – 12 (Tie run)	1 – 9	2000.4.12	1:8,000	9 sheets

Run – 13 (Tie run)	10 – 15	2000.4.12	1:8,000	6 sheets
Run – 14 (Tie run)	131 – 144	2000.4.24	1:8,000	14 sheets
Run – 15 (Tie run)	145 – 153	2000.4.24	1:8,000	9 sheets
Total				217 sheets
Covered Area				107 km ²

Table 8.4 “Results of Aerial Photography in Manatutu City”

Run Number	Frame Number	Date of Aerial Photography	Photo Scale (Average)	Number of Sheets
Run – 1	13 – 19	2000.4.10	1:8,000	7 sheets
Run – 2	1 – 12	2000.4.10	1:8,000	12 sheets
Run – 3	236 – 249	2000.4.11	1:8,000	14 sheets
Run – 4	219 – 235	2000.4.11	1:8,000	17 sheets
Run – 5	201 – 218	2000.4.11	1:8,000	18 sheets
Run – 6	20 - 32	2000.4.10	1:8,000	13 sheets
Total				81 sheets
Covered Area				50 km ²

Table 8.5 “Results of Aerial Photography in Baucau City”

Run Number	Frame Number	Date of Aerial Photography	Photo Scale (Average)	Number of Sheets
Run – 1	69 – 80	2000.4.16	1:8,000	12 sheets
Run – 2	172 – 189	2000.4.30	1:8,000	18 sheets
Run – 3	190 – 208	2000.4.30	1:8,000	19 sheets
Run – 4	209 – 227	2000.4.30	1:8,000	19 sheets
Run – 5	154 – 171	2000.4.29	1:8,000	18 sheets
Run – 6	51 – 68	2000.4.16	1:8,000	18 sheets
Total				104 sheets
Covered Area				72 km ²

Table 8.6 “Results of Aerial Photography in Liquicia City”

Run Number	Frame Number	Date of Aerial Photography	Photo Scale (Average)	Number of Sheet
Run – 1	33 – 38	2000.4.10	1:8,000	6 sheets
Run – 2	40 – 50	2000.4.12	1:8,000	11 sheets
Run – 3	115 – 127	2000.4.20	1:8,000	13 sheets
Run – 4	102 – 114	2000.4.20	1:8,000	13 sheets
Total				43 sheets
Covered Area				28 km ²

Table 8.7 “Final Results of Aerial Photography”

Item	Dili City	Manatutu City	Baucau City	Liquicia City
Area covered by photos	107 km ²	50 km ²	72 km ²	28 km ²
Photo scale	1:8,000	1:8,000	1:8,000	1:8,000
Number of main runs	8 runs	6 runs	6 runs	4 runs
Number of tie runs	7 runs	-----	-----	-----
Number of photos	217 sheets	81 sheets	104 sheets	43 sheets

The flight index of each aerial photography area is shown in Figure 8.1 “Flight Index Map of Dili City”, Figure 8.2 “Flight Index Map of Manatutu City”, Figure 8.3 “Flight Index Map of Baucau City” and in Figure 8.4 “Flight Index Map of Liquicia City”.

Figure 8.1 "Photo Index Map of Dili City"

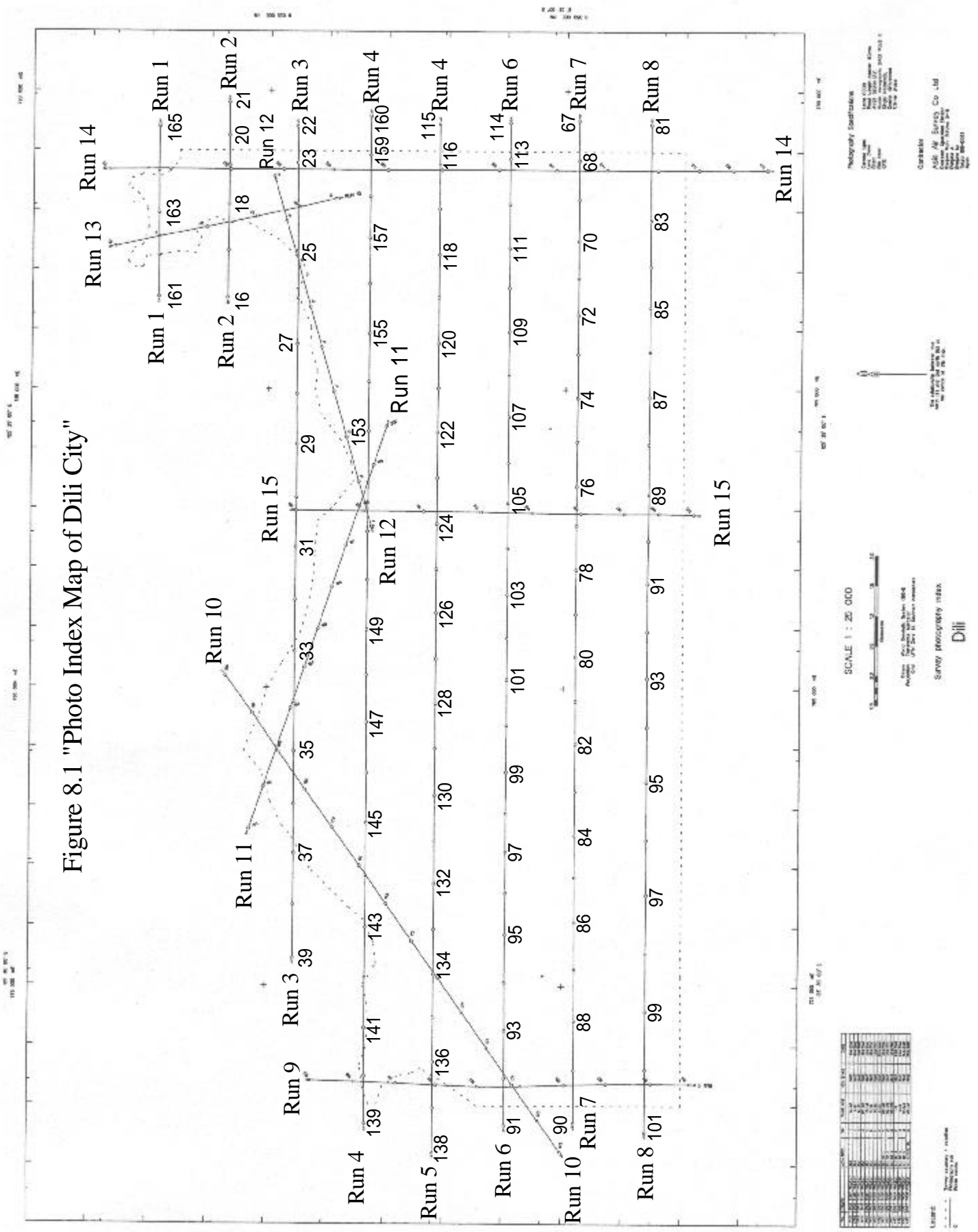
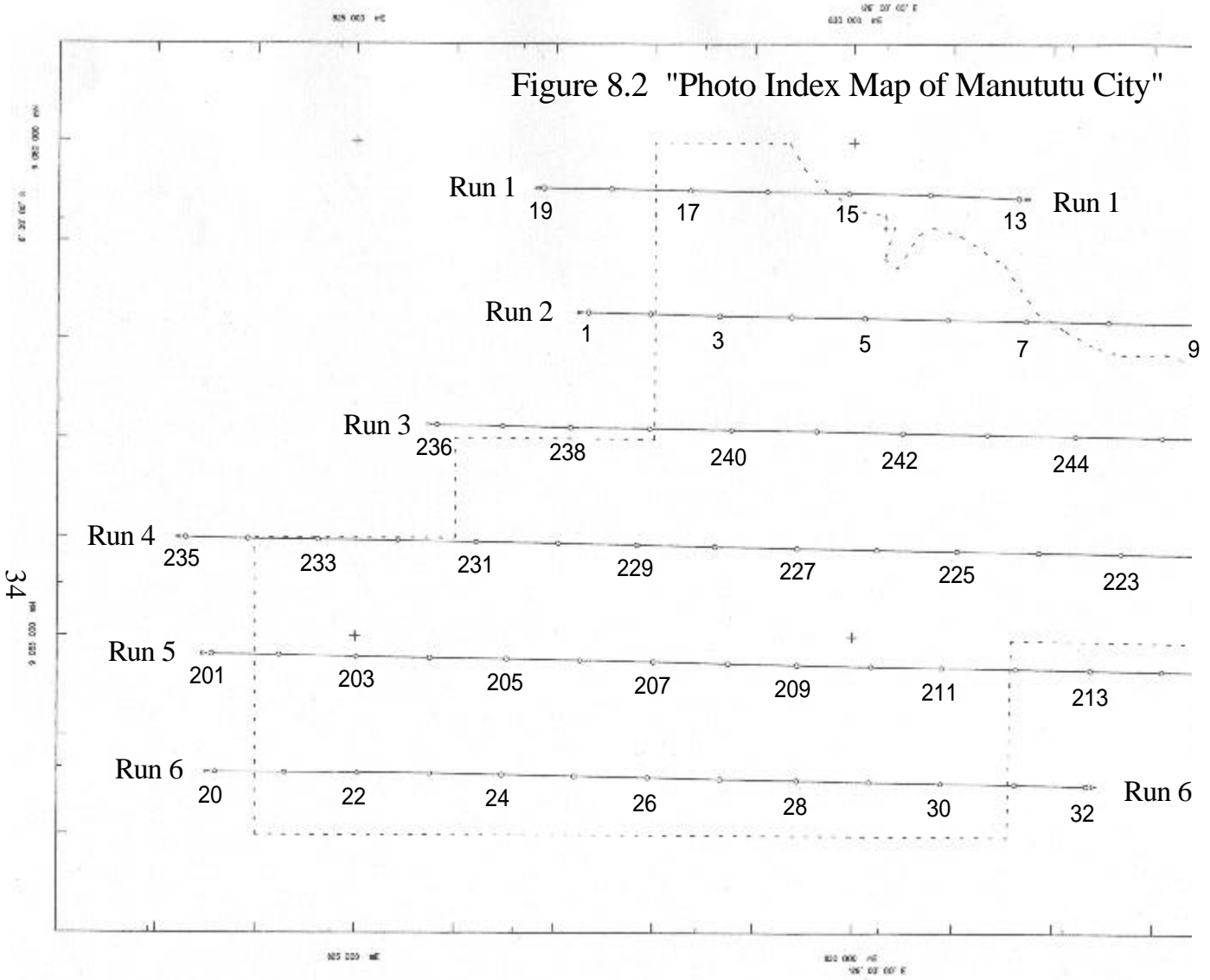


Figure 8.2 "Photo Index Map of Manututu City"



NO.	PROPERTY	AREA (SQ. M)	VAL.	PRICE (K)	NO. ACRES	VAL.
1	1000 1000 1000	1000	1	1000	1000	1000
2	1000 1000 1000	1000	2	1000	1000	1000
3	1000 1000 1000	1000	3	1000	1000	1000
4	1000 1000 1000	1000	4	1000	1000	1000

SCALE 1 : 25 000



Date: 1984
 Projection: UTM
 Zone: 16S 20° 00' E

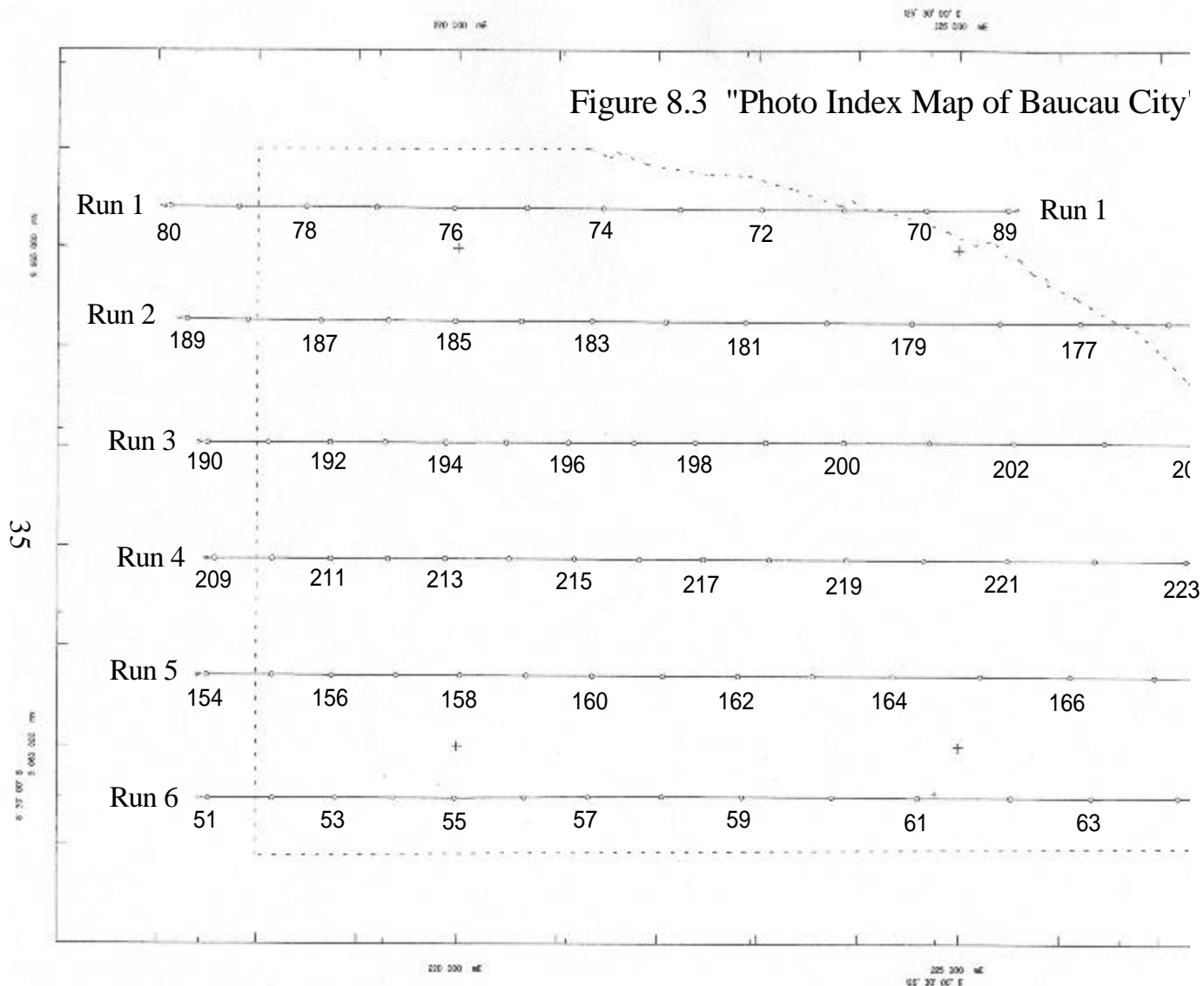
Survey photography index

Manututu

Legend:
 - - - Survey boundary / boundary
 - - - Photographic run
 o Point control

The numbers
 (1) north and
 (2) east

Figure 8.3 "Photo Index Map of Baucau City"



Sta	Point	Photo	Dist	Photo	Photo	Photo
80	101	102	103	104	105	106
189	190	191	192	193	194	195
190	191	192	193	194	195	196
209	210	211	212	213	214	215
154	155	156	157	158	159	160
51	52	53	54	55	56	57

SCALE 1 : 25 000



System: World Geodetic System - 1984
 Projection: Transverse Mercator
 Unit: Meter, Eastern Hemisphere

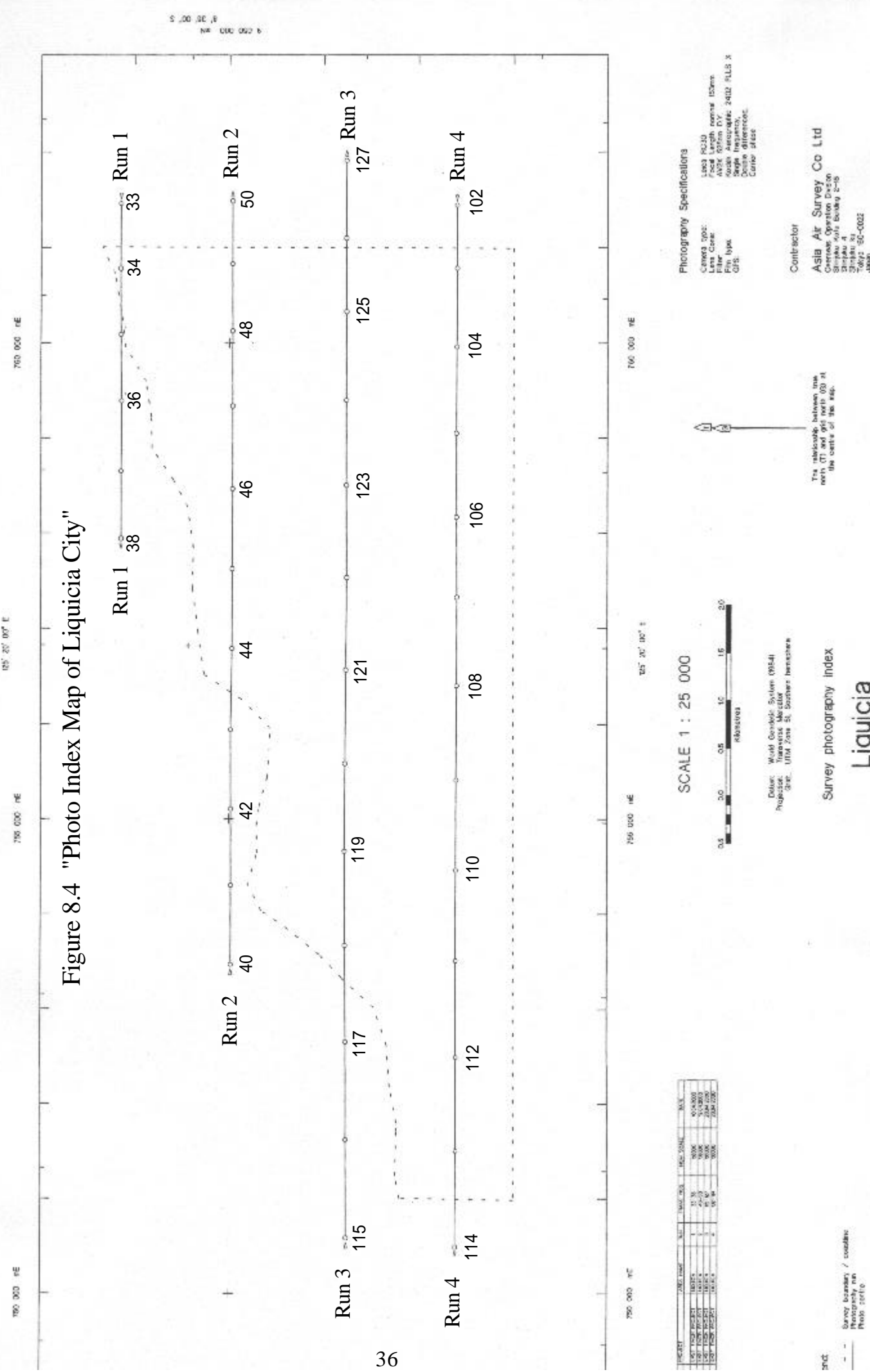
Survey photography index

Baucau

Legend:
 - - - Survey boundary / coastline
 - - - Photostation
 + Photo station

The index
 map is
 in use

Figure 8.4 "Photo Index Map of Liquecia City"



ITEM	VALUE	UNIT	MAX. DIS.	MAX. ZONE	MAX. S.A.
1.01	1000	mm	10	1000	0.00000
1.02	1000	mm	10	1000	0.00000
1.03	1000	mm	10	1000	0.00000
1.04	1000	mm	10	1000	0.00000

Photography Specifications
 Camera: 9030
 Lens: 80mm
 Focal Length: nominal 80mm
 Filter: None
 Film Type: 35mm
 Exposure: 1/1000
 Shutter: 1/1000
 Center: 0.00000

Contractor
 Asia Air Survey Co Ltd
 Camera Operation Division
 Shimizu 4-1-1
 Shimizu 41
 4102 5C-0022
 Japan

SCALE 1 : 25 000

0.5 1.0 1.5 2.0
 meters

Model: World Geodetic System (WGS84)
 Projection: Universal Mercator
 Datum: UTM Zone 52, Southern Hemisphere

The relationship between the north (N) and grid north (GN) at the centre of this map.

Survey photography index
Liquecia

Legend:
 - - - Survey boundary / coastline
 - - - Photogrammetry run
 - - - Photo centre

9. Digital Mapping

9.1 Aerial Triangulation

The aerial triangulation established photo control points as the stereo models covering each mapping area. The stereo models were corrected and adjusted in their tilts and scales based on the vertical and horizontal ground controls previously established by the ground control survey.

The 1:8,000 scale aerial photos of 202 stereo models in 15 flight runs and the PATB aerial triangulation program were used for the aerial triangulation. The accuracy of aerial triangulation can be estimated by the residual errors in the vertical and horizontal ground controls after stereo model adjustment. The residuals in horizontal ground controls after lock adjustment are shown in Table 9.1 “Residuals of Horizontal Control Points after Block Adjustment”

Table 9.1 “Residuals of Horizontal Control Points after Block Adjustment”

Point No.	Adjusted X (m)	Adjusted Y (m)	rx (m)	ry (m)
JICA-1	773347.194	9048133.303	0.002	- 0.050
JICA-2	773459.141	9052906.026	0.039	0.077
JICA-3	775961.944	9053113.481	0.030	- 0.054
JICA-4	778909.961	9054663.375	- 0.101	- 0.140
JICA-5	778849.698	9050112.238	- 0.196	0.107
JICA-6	782419.349	9048373.482	0.277	0.156
JICA-7	784354.976	9050028.581	- 0.017	0.126
JICA-8	789237.087	9047631.375	0.026	0.107
JICA-9	788052.720	9051761.536	- 0.089	- 0.105
JICA-10	787327.634	9054552.884	0.025	- 0.118
JICA-11	787939.500	9056956.431	0.065	0.003
TTG-0157	783808.623	9053554.497	0.094	- 0.133
S.27004	774128.325	9051952.043	- 0.157	0.024

The residuals in vertical ground controls after lock adjustment are shown in Table 9.2 “Residuals of Vertical Control Points after Block Adjustment”

Table 9.2 “Residuals of Vertical Control Points after Block Adjustment”

Point No.	Adjusted H (m)	rz (m)
JICA-1	118.287	- 0.038
JICA-2	5.480	- 0.073
JICA-3	3.920	0.030
JICA-4	7.097	0.113
JICA-5	59.525	- 0.001
JICA-6	629.435	0.125
JICA-7	307.866	0.048
JICA-8	964.731	- 0.019
JICA-9	63.086	- 0.159
JICA-10	2.499	- 0.126
JICA-11	4.019	0.132
TTG-0157	3.556	0.010
S.27004	4.502	- 0.099
JEP-1	32.551	0.012
JEP-2	3.871	- 0.170
JEP-3	4.295	0.045
JEP-4	12.841	0.100
JEP-5	22.657	0.078
JEP-6	5.604	- 0.084
JEP-7	28.388	0.164
JEP-8	43.914	0.022
JEP-9	5.974	- 0.046
JEP-10	21.238	0.027
JEP-12	30.573	0.016
JEP-13	210.225	0.087
JEP-14	4.393	- 0.147
JEP-15	4.142	0.066
JEP-16	13.598	- 0.112

The mean values of standard deviation of terrain points by terrain system are shown in Table 9.3 “Mean Values of Standard Deviation of Terrain Points by Terrain System”, the minimum standard deviation of terrain points by terrain system in Table 9.4 “Minimum Standard Deviation of Terrain Points by Terrain System” and the maximum standard deviation of terrain points by terrain system in Table 9.5 “Maximum Standard Deviation of Terrain Points by Terrain System”.

Table 9.3 “Mean Values of Standard Deviation of Terrain Points by Terrain System

Coordinates	Standard Deviation (m)
In x	0.090
In y	0.094
In z	0.144

Table 9.4 “Minimum Standard Deviation of Terrain Points by Terrain System

Coordinate	Point No.	Standard Deviation (m)
In x at point no.	5012705	0.061
In y at point no.	5012705	0.063
In z at point no.	5012705	0.084

Table 9.5 “Maximum Standard Deviation of Terrain Points by Terrain System

Coordinate	Point No.	Standard Deviation (m)
In x at point no.	1301001	0.235
In y at point no.	202101	0.242
In z at point no.	202101	0.354

9.2 Legends and Symbols for Digital Topographic Maps

The JICA Study Team proposed tentative samples of legends, symbols and marginal information for the 1:2,000 scale digital topographic maps based on the existing 1:25,000 scale topographic maps created by BAKOSURTANAL of Indonesia and the 1:5,000 scale topographic maps popularly used by the Ministry of Public Works of Indonesia.

The proposed samples of legends, symbols and marginal information were submitted to the UNTAET for discussions. Finally, some modifications were made to those legends, symbols and marginal information and agreed between the UNTAET and the JICA Study Team. The main modifications are as follows:

- 1) Addition of the symbols for plantation trees (Eucalyptus trees) for topographic maps
- 2) Addition of the symbols for conservation and protection sites for land use maps
- 3) Classification of valuable plants (Banyan trees) for topographic maps and urban facilities maps
- 4) Classification of historical sites for land use maps

In the processes of the digital mapping and GIS data creation, however, some other modifications were made to the legends, symbols, marginal information and

classification of GIS data to create more suitable data for topographic maps and GIS data.

The legends, symbols and marginal information that were finally adopted by the JICA Study Team are shown in Figure 9.1 “Symbols for 1:2,000 Scale Topographic Maps”.

9.3 Digital Topographic Mapping

The 1:2,000 scale digital topographic maps were created using the DSR-15 analytical plotter based on the basis of the 1:8,000 scale aerial photos and the results of aerial triangulation. The outline specifications of the 1:2,000 scale digital topographic maps are as follows:

1) Mapping scale	1:2,000
2) Total number of sheet	83 sheets
3) Mapping area	107 km ²
4) Sheet size	50 cm × 80 cm
5) Contour interval	2 m for flat area 10 m for mountain area
6) Sheet index	Shown in Figure 9.2 “Sheet Index of 1:2,000 Scale Digital Topographic Map”

The target area covered by the 1:2,000 scale digital topographic map created in this Study has the following special characteristics that are different from other areas:

- 1) Many buildings were damaged by riots in September 1999 and most of them remained as damaged at the time of map creation.
- 2) The ownership and forms of use mainly of public buildings and facilities are complicated having the past background compared with those in other areas, and the ownership and form of use are classified into three types as follows:
 - (a) Public facilities and buildings in the Indonesian period that remain damaged and unused since they were damaged by violence following the independence vote in September 1999

Example: Indonesian Period: Office of Ministry of Public Works
Present time: Remains damaged and abandoned

- (b) Public facilities and buildings in the Indonesian period that were damaged or undamaged, but restored by any UN organization, being in use.

Example: Indonesian Period: Office of the Government of East Timor,
Indonesia
Present time: Central Office of UNTAET

- (c) Public facilities and buildings in the Indonesian period that were damaged or undamaged, but are now used for the same purposes as in the Indonesian period.

Example: Indonesian Period: Elementary school
Present time: Still used as an elementary school.

On the other hand, East Timor and Dili City have the following serious problems in the fields related to topographic maps at present:

- 1) Since the land use data was damaged by violence in September 1999, many disputes have arisen in connection with land ownership within Dili City. In order to settle these disputes, it is required to develop a large scale of topographic maps, to make a land-use survey promptly and to build a database system ensuring the results of the land use survey to be properly arranged on the newly developed topographic maps of large scale.
- 2) The facilities and buildings owned by the former Indonesian Government will belong to East Timor after its independence, but what facilities and buildings in what areas are not grasped exactly. Therefore, it is required to define these unclear facilities and buildings to become the national properties of East Timor, before UNTAET turns over its reins to the future Government of East Timor.
- 3) A number of public facilities, buildings and houses within Dili City were damaged by violence in September 1999, but it is required to make a survey of what levels of damages those buildings and houses in which areas were subjected to and to

prepare the survey report promptly as the basic materials for the reconstruction plan of Dili City.

In the background as described above, the Study Team determined that the 1:2,000 scale digital topographic maps and GIS data to be created in this Study should be different from the general topographic maps and GIS data created for other areas and decided to create those maps and GIS data under the following policies:

<Policies of creating 1:2,000 scale digital topographic maps>

1) Damaged and undamaged buildings and houses

To classify the damaged and undamaged buildings and houses on the 1:2,000 scale digital topographic maps to be created in the following way:

a. Ordinary houses

To classify those ordinary houses by photo interpretation in plotting based on whether the roofs exist or not as follows:

Ordinary houses with roofs: Undamaged houses – drawn by full lines

Ordinary houses without roofs: Damaged houses – drawn by broken lines

Example:



Damaged house



Undamaged house

b. Public facilities and buildings

To determine damaged or undamaged public facilities and buildings basically in the same way as ordinary houses using photo interpretation in plotting. However, many of those public facilities and buildings are now being used by UNTAET or RKF after they have been restored. Therefore, a field study sheet will be prepared to verify each of the public facilities and buildings on the spot and check whether it has a roof, whether burnt or not, its restored status and whether in use or unused. This data will be incorporated in the urban facilities GIS data.

2) Representation of symbols for public facilities and buildings

As mentioned previously, there are three forms of ownership and use of public facilities and buildings. Therefore, it is necessary to represent a facility or building in any of those forms. In the 1:2,000 digital topographic maps, the following methods of representing the building symbols were adopted.

- (a) If the ownership and the purpose of use or any public facility or building in the Indonesian period are the same those at present, the symbol of the currently used facility or building is used.

Example: Indonesian Period: Elementary school
Present time: Elementary school – Use the symbol for elementary school

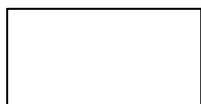
- (b) If the ownership and purpose of use of any public facility or building in the Indonesian period are different from those at present, the symbol for the currently used public facility or building is used.

Example: Indonesian Period: Office of the Government of East Timor
Present time: UNTAET – Use the symbol for UNTAET

- (c) If any public facility or building in the Indonesian period remains damaged and unused, the symbol for the public facility or building in the Indonesian period is used. However, the bold lines are used to represent the building to define that it is not classified into the present ownership and purpose of use.

Example: Indonesian Period: Office of the Ministry of Public Works of Indonesia – Use the old symbol for the public office.

Present time: Unused and abandoned



Ordinary building



Building with the symbol used in Indonesian Period

- (d) For the buildings and facilities owned or related to the Indonesian military, the symbols for the facilities of Indonesian military are used.

- (e) For the buildings and houses, the information obtained during the period from early April when aerial photography was made to around the end of May 2000 when the field survey was made was represented on the topographic maps and GIS data.

9.4 Digital Orthophoto Maps

Based on the results of aerial triangulation and digital data from positive film scanning, Digital terrain models were prepared. 1:2,000 scale digital orthophoto maps were created using the digital terrain models and 1:8,000 scale aerial photo images.

The outline of digital orthophoto maps will be described as follows:

1) Scale of digital orthophoto map	1:2,000
2) Number of sheets	83 sheets
3) Mapping area	107 m ²
4) Sheet size	50 cm × 75 cm
5) Contour interval	2 m for flat area 10 m for mountain area
6) Sheet index	Same as 1:2,000 digital topographic map

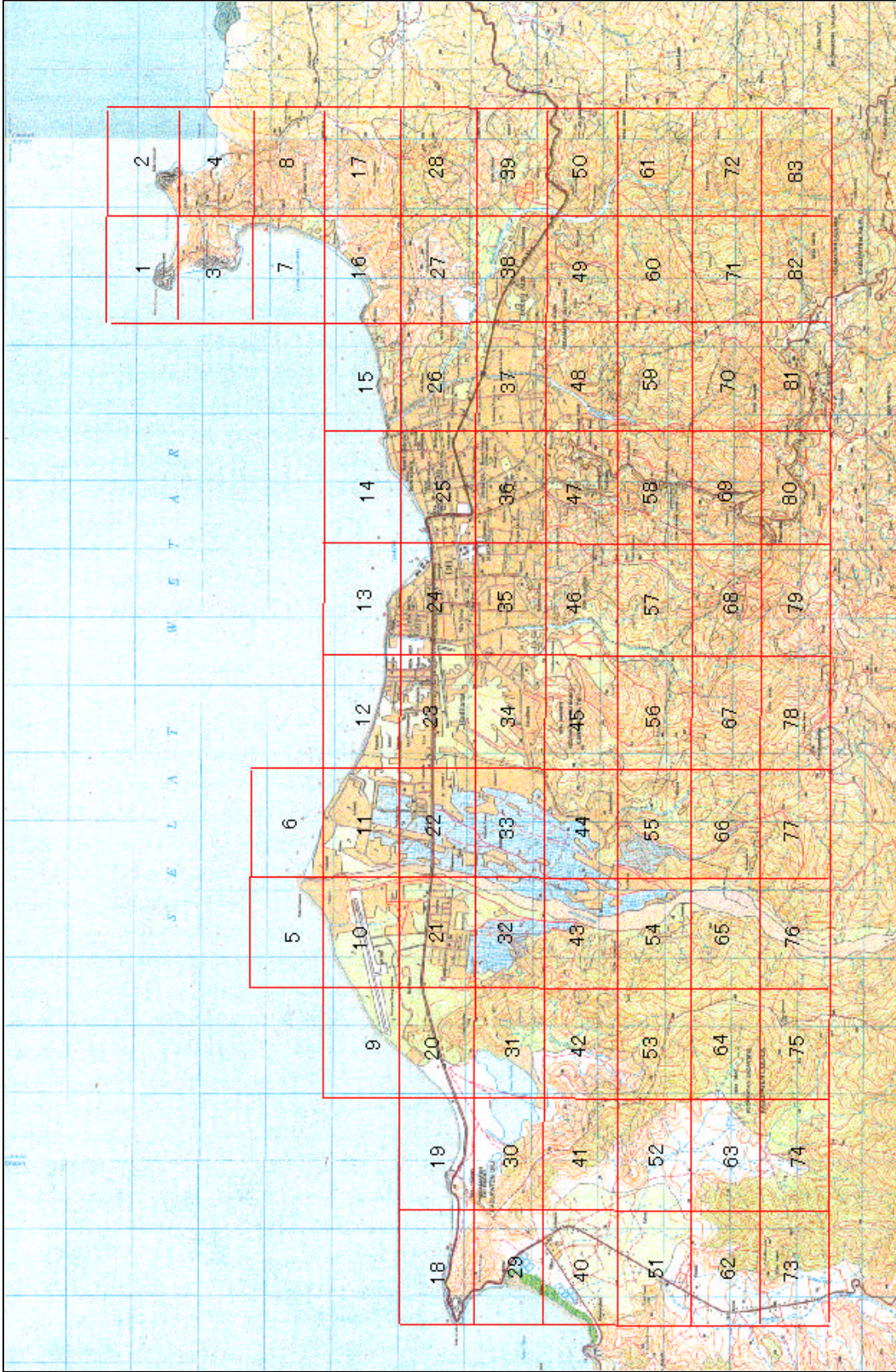
9.5 CD-ROM for 1:2,000 Scale Digital Topographic Map

After completion of 1:2,000 scale digital topographic mapping, CD-ROM for digital topographic data was created as a final product. The format used is EPS format. Therefore, this CD-ROM can be opened by “Photo Shop” program and “Arc View” program.

Figure 9.1 "Symbols for 1:2,000 Scale Topographic Maps"

	Geodetic point and contour		Reservoir
	GPS point		Tower and parabol (Antenna, microwave, etc.)
	Benchmark		Monument
	Contour line (2.0m)		Meteorological station
	Contour Index (0.5m)		Dumping site
	Spot elevation		Embankment, artificial coastal protection, and artificial cutting slope
Road			Water gate
	Road < 2.0 m width Paved road / Under construction road		Fish pond
	Road < 2.0 m width Unpaved road / Under construction road	Vegetation	
	Road 1-2m width Paved road / Under construction road		Boundary of vegetation
	Road 1-2m width Unpaved road		Boundary of paddy field unit
	Foot path > 1.0 m width		Paddy field
	Tunnel		Rainfall paddy field
	Digging road		Irrigated paddy field
	Heaped road		Cultivated land
	Distance marker		Mixed garden/plantation
Bridge			Rubber
	Concrete bridge		Coffee
	Iron bridge		Coconut tree
	Wooden bridge		Mangrove
	Aqueduct bridge		Forest
Administrative boundary			Plantation tree/Eucalypt
	National boundary		Bush
	District boundary		Bamboo
	Sub-district boundary		Grass
	Village boundary		Swamp Forest
	Military facility (Indonesia)		Swamp grass
	Public facility		Conservation area (Natural park, protection area, etc.)
	United nation	Natural feature	
	Building and facility of UNTAFET		Sand
	Building and facility of PKF		River
	Public Office		Stream
	Governmental office		Cliff
	District office		Rock out crop
	Sub-district office		Coral
	Village office		Water fall
	Police station		Stream direction
	Fire station		Swamp
	Hospital		Lake and pond
	Health center		
	Telecommunication Office		
	Bank		
	Market		
	Post Office		
	School		
	Primary school		
	Secondary school		
	High school		
	University/College		
	Library		
	Institute		
	Athlete field		
	Park		
	Historical site		
	Valuable plant(Banana tree)		
	Church/Temple		
	Christian		
	Islam		
	Buddhist		
	Hindu		
	Cemetery		
	Christian		
	Islam		
	Buddhist		
	Hindu		
	Traffic		
	Bus terminal		
	Airport and Air Strip		
	Helipad		
	Port(Harbour)		
	Light house		
Artificial feature			
	House / Building with roof		
	House / Building without roof		
	Wall/fence Concrete wall		
	Wire fence		
	Hotel		
	Factory		
	Warehouse		
	Gasoline station		
	Fuel storage		
	Pipe line		
	Electric power station		
	High voltage electric power transmission line and tower		
	Water supply station		
	Water tank		
	Water pipe line		
	Drainage and irrigation canal > 2.0m width		
	Drainage and irrigation canal < 2.0m width		
	Culvert		
	Aqueduct		

Figure 9.2 "Sheet Index of 1:2,000 Scale Digital Topographic Map, Urban Facility Map, Land Use Map and Land Condition Map"



Note: Sheet size and sheet number

25

10. Creation of Digital Data for GIS

10.1 Urban Facilities Maps

The Study Team made efforts to collect the existing materials related to the urban facilities in Dili City, but most of all these materials had been abandoned during the dispute in September 1999 except that only the existing materials related to drainage canals could be collected.

Therefore, the Study Team made the field survey of urban facilities as described in Section 7.2 “Inventory Survey of Urban Facilities Maps”, prepared the survey results in the field survey table to create the GIS urban facilities maps based on this data.

The items classified in the final urban facilities maps are shown in Table 10.1 “Classification of Urban Facility Maps”.

10.2 Land Use Maps

The land use maps are intended for the legends to be used for the land use planning for the urban areas, and the items that were obtainable on the 1:2,000 scale topographic maps were classified as shown in the table below. In addition, the items for conservation areas and protection areas were added through discussions with UNTAET with the intention to regulate any disordered land development in the future redevelopment.

The land use maps were created by classifying the status of land use on the basis of the 1:2,000 scale digital topographic maps in accordance with the classification items. The information on the conservation and protection areas was supplied by UNTAET. The classification items on the final land use maps are shown in Table 10.2 “Classification of Land Use Maps” and the GIS data was entered in the system as polygon data.

10.3 Land Condition Maps

For the land condition maps, the terrain factors of developed areas were classified as shown in Table 10.3 “Classification of Land Condition Maps”. The land condition maps were created on the basis of the 1:2,000 digital topographic maps created in the Study, especially based on topographic map sheets using mainly the slope items and

the aerial photo interpretation. The GIS data was entered into the system as polygon data.

10.4 GIS System

Geographic Information System (GIS) is a tool used to organize and display spatial information using computer. Moreover, GIS can quickly search and analyze these map features and their attributes, which is very difficult when using paper maps. Another advantage of using GIS is that it can present very complex and technical data visible, which is very easy to understand not only professionals but also non-specialists.

For the Study, GIS software Arc View (Ver.3.1) has been selected. Arc View is a desktop geographic information system made by Environmental Systems Research Institute, Inc. (ESRI). With Arc View, any data can be loaded and linked to geographic locations and display it graphically as maps, charts and tables.

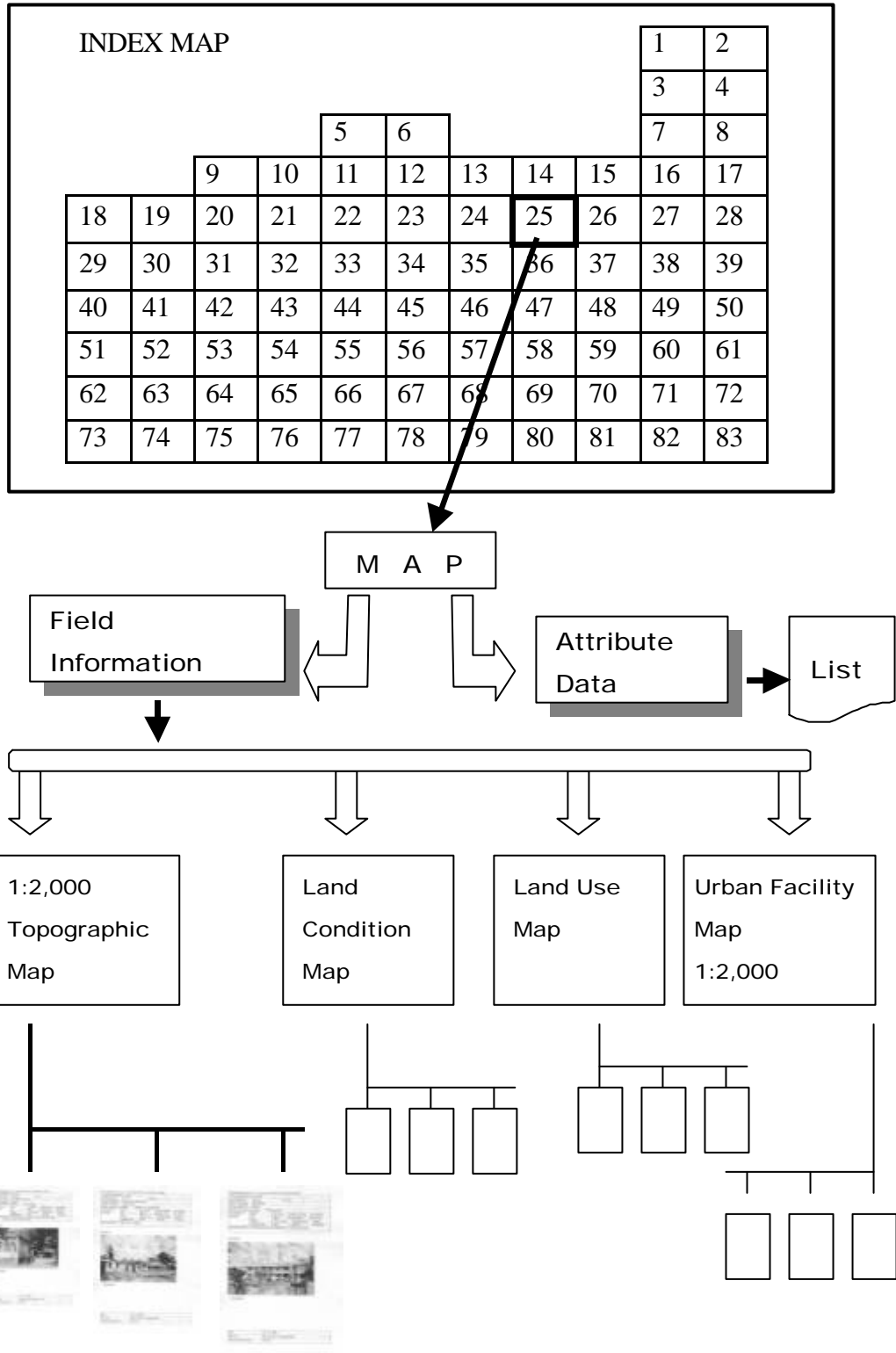
Data from dozens of sources can consolidate on GIS and the various relationships between factors such as social environment and land use, land condition or urban facility can be examined. It is also possible to monitor changes in these factors over time. This enables the UNTAET members to understand the condition of the target area.

However, in order to conduct the process smoothly and effectively, preparation of GIS database was arranged. First the base maps were made in vector format for storage. The next step is to compile all field survey data and check them for completeness or collect missing information.

When the data is compiled and all source records are complete, these data will be attached to the corresponding graphic data features. Then graphic data and attribute data are explicitly linked, so that there is 1 to 1 correspondences between map features and attribute data records. After this process is finished, GIS can quickly search through map data, looking for features with certain characteristics or inspecting spatial relationships among features.

Figure 10.1 “Flow Showing Map Features and Their Attributes Using GIS in the Study” shows the outline of GIS system established in the Study.

Figure 10.1 “Flow Showing Map Features and Their Attributes Using GIS in the Study”



(Field data sheet)

Table 10.2 "Classification of Land Use Map"

Land use map		Future of GIS data		
Item of Classification	Details	Point	Line	Polygon
Settlement	House and building			○
Public facility	Public facility (Water, Electricity)			○
	Park			○
	Open space, athletic field			○
	Religious facilities			○
	Religious related facilities			○
Open space	Historical site			○
	Warehouse, factory			○
Traffic facility	Open space			○
	Road			○
Protection area	Traffic facility			○
	Natural park			○
Agriculture facility	Valuable plant			○
	Paddy field			○
Vegetation	Cultivate land			○
	Garden plantation, tree crop			○
	Mangrove			○
	Plantation tree (Eucalyptus)			○
	Mush, forest			○
	Glass			○
	Swamp			○
	Lake, marsh, pond			○
River			○	
	Seashore			○

Table 10.3 "Classification of Land Condition Map"

Land condition map		Future of GIS data		
Item of Classification	Details	Point	Line	Polygon
Mountaeous area	Slope < 30%			○
Hill side	10% < Slope < 30%			○
Plane	Slope < 10%			○
Terrace				○
Fan				○
Swamp				○
River				○
Pond, lake, Marsh				○
Sea				○

11. **Additional Request from the Land and Property Section of UNTAET**

By the additional request from the Land and Property Section of UNTAET, the 1:1,000 scale digital topographic maps were compiled from the 1:2,000 scale digital topographic maps, and the 1:2,000 scale orthophoto maps without contour lines were created. The request letter from the Land and Property Section of UNTAET is shown in Appendix 8 “Additional Request from the Land and Property Section of UNTAET”. The location of the covered area in the digital topographic map compiled in the 1:1,000 scale is shown in Figure 11.1 “Sheet Index of 1:1,000 Scale Compiled Digital Topographic Maps”.

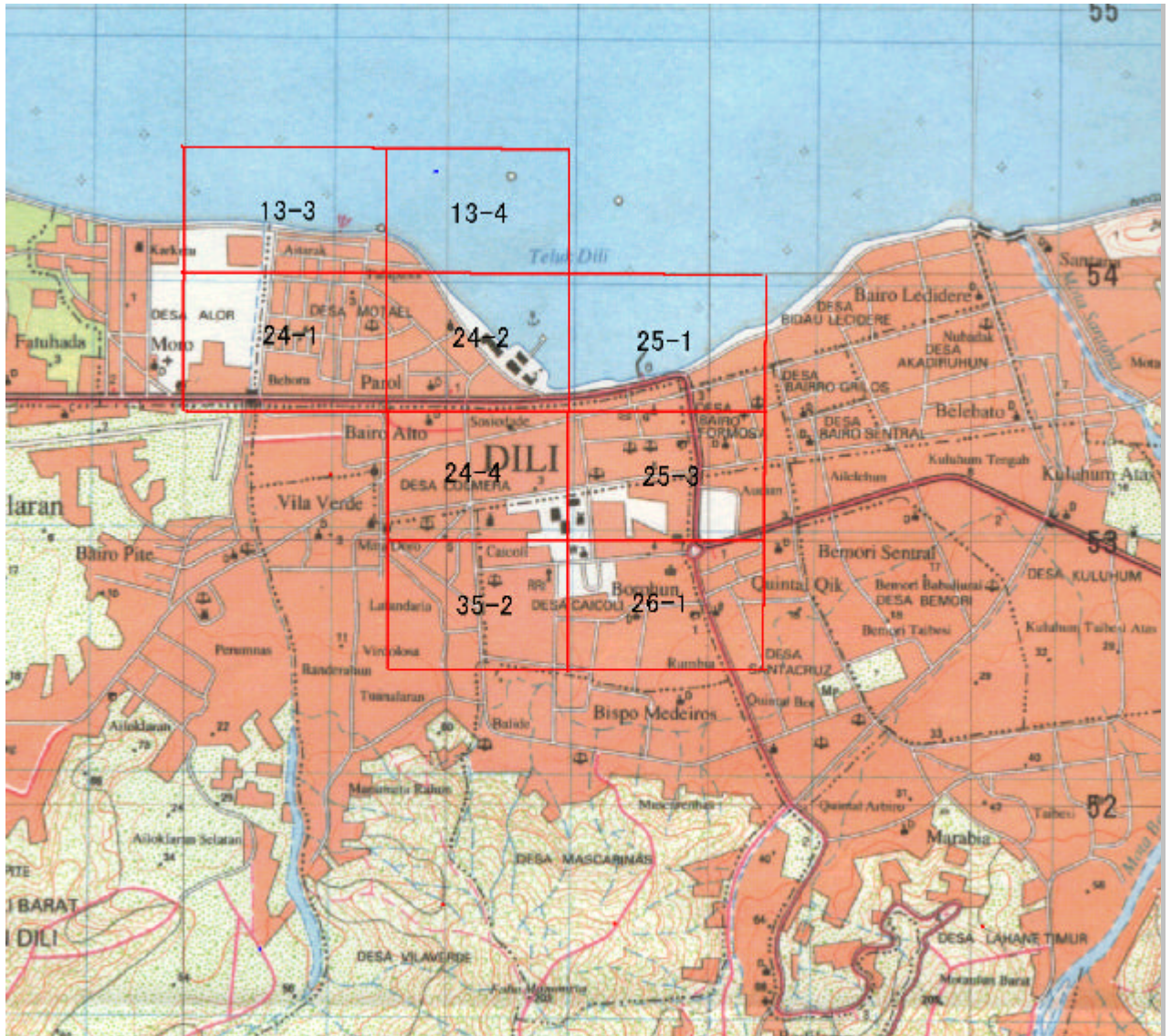
The final products to be delivered for the additional request from the Land and Property Section of UNTAET are shown in Table 11.1 “Final Products for Additional Request from UNTAET”.

CD-ROM for digital data of 1:1,000 scale compiled topographic map and orthophoto map was created as a final products. The format used for digital data of 1:1,000 scale compiled topographic maps and orthophoto maps is EPS format. Therefore, this CD-ROM can be opened by “Photo Shop” program and “Arc View” program.

Table 11.1 “Final Products for Additional Request From UNTAET

Final Product	Volume
1:2,000 scale orthophoto map without contour lines (Photo images)	2 sets
1:2,000 scale orthophoto map digital data (CD-ROM)	2 sets
1:1,000 scale compiled digital topographic map (Paper output)	2 sets
1:1,000 scale compiled digital topographic map data (CD-ROM)	2 sets

Figure 11.1 “Sheet Index of Compiled 1:1,000 Scale Digital Topographic Map”



Note:

24-2

Sheet size and sheet number

12. Final Products

The final products as described below will be delivered to the UNTAET and JICA from the JICA Study Team by the middle of September 2000 in Dili and Tokyo respectively.

12.1 Survey and Mapping Data

- 1) Aerial photos
 - a) Negative films 1 set
 - b) Contact prints 3 sets (2 sets for JICA)
 - c) 2-times enlarged photo 2 sets
(Manatutu, Baucau and Liquicia City)
 - d) Flight index maps 1 set
- 2) Ground control point survey (Dili City)
 - a) Table of coordinates of control points 1 set
 - b) Description of control points 1 set
- 3) GPS aerial triangulation (Dili City)
 - a) Final results of GPS aerial triangulation 1 set
- 4) 1:2,000 scale digital topographic maps
 - a) CD-ROM (EPS format) 100 sets (4 sets for JICA)
- 5) Database files
 - a) CD-ROM (Arc View format) 5 sets
- 6) Output of digital data for GIS (Paper sheet)
 - a) 1:2,000 scale topographic maps 5 sets
 - b) 1:2,000 scale land use maps 5 sets
 - c) 1:2,000 scale land condition maps 5 sets
 - d) 1:2,000 scale urban facilities maps 5 sets
- 7) Output of topographic maps (Transparent plastic sheets)
 - a) 1:2,000 scale topographic maps 5 sets
 - b) 1:2,000 scale land use maps 5 sets

- | | |
|---|----------------------------|
| c) 1:2,000 scale land condition maps | 5 sets |
| d) 1:2,000 scale urban facility maps | 5 sets |
| 8) Output of orthophoto maps (Paper sheets) | |
| a) 1:2,000 scale orthophoto maps | 5 sheets (4 sets for JICA) |

12.2 Additional Request from the Land and Property of UNTAET

- | | |
|--|--------|
| 1) 1:1,000 scale compiled digital topographic maps | |
| a) Paper outputs | 2 sets |
| b) Digital data (CD-ROM)(EPS format) | 2 sets |
| 2) 1:2,000 scale orthophoto maps without contour lines | |
| a) Photo images | 2 sets |
| b) Digital data (CD-ROM)(EPS format) | 2 sets |

12.3 Reports

- | | |
|----------------------------|----------------------------|
| 1) Inception Report | 30 sets (10 sets for JICA) |
| 2) Outline of field survey | 5 sets (2 sets for JICA) |
| 3) Draft Final Report | |
| a) Main report (English) | 30 sets (10 sets for JICA) |
| b) Summary (English) | 30 sets (10 sets for JICA) |
| c) Summary (Japanese) | 10 sets (10 sets for JICA) |
| d) Manual (English) | 30 sets (10 sets for JICA) |
| 4) Final Report | |
| a) Main report (English) | 40 sets (10 sets for JICA) |
| b) Summary (English) | 30 sets (10 sets for JICA) |
| c) Summary (Japanese) | 10 sets (10 sets for JICA) |
| d) Manual (English) | 30 sets (10 sets for JICA) |
| e) MO of above reports | 1 set (1 set for JICA) |

13. Conclusion and Recommendations

13.1 Conclusion

The usable topographic maps for Dili City in East Timor had basically been only the 1:25,000 scale topographic maps that were made up by BAKOSURTANAL, Indonesia in 1990's (two types of aerial photos taken in the 1980's and the 1990's). In addition, other topographic maps of larger scale had also been partly available, but those maps had been expanded and compiled from the 1:25,000 scale topographic maps.

Therefore, the accuracy of these topographic maps was the same as that of the 1:25,000 scale maps, and the information contained in those maps was that obtained in the middle of the 1980's and early in the 1990's. The topographic maps available for the Dili City and its environs have already been inadequate at present because of large changes in the land use and road conditions.

One of the important objectives for creation of the 1:2,000 scale topographic maps and GIS data in this Study was that those maps should be prepared as soon as possible for use as basic materials to promote the reconstruction of urban facilities in Dili City which is about start and to solve the problems (especially dispute related to land ownership) that the Dili City, the largest city in East Timor has.

However, the existing materials necessary for creation of digital topographic maps, especially GIS data had mostly been lost since the dispute in September 1999 and usable existing materials were not available. Thus, the Study Team had to collect various types of information necessary for creation of digital topographic maps and GIS data through field verification.

In addition, many of the urban facilities, buildings and ordinary houses had been damaged since the dispute in September 1999 in the target areas to be covered by the digital topographic maps and GIS data to be created in this Study. Some of the governmental facilities and buildings used in the Indonesian period are used by UNTAET and RKF, but others are abandoned. Therefore, the specific circumstances that Dili City is currently situated and other many conditions had been considered in regard to the applications of the topographic maps and GIS data to be created. The Study had also been made through many trials and errors in determining how the information on these new conditions should be represented on the digital topographic maps and GIS data.

As described above, there were many difficulties in this Study for creation of digital topographic maps and GIS data in terms of the required time and its contents compared with the works for other ordinary areas. It is also anticipated that those topographic maps and GIS data will readily be subject to secular changes as the reconstruction of Dili City is making progress.

However, it is expected that the created digital topographic maps and GIS data will be effectively used as the basic materials for the reconstruction of the urban facilities and solution of various problems in Dili City and its environs.

13.2 Recommendations

13.2.1 Necessity for Modification of Digital Topographic Maps and GIS Data

The Dili City is in the course of rapid restoration from the disaster following the dispute in September 1999 owing to the assistance by many countries and investment by the private sector. However, the 1:2,000 digital topographic maps and GIS data created in the Study are based on the information from the aerial photos taken for a short period from the beginning to the end of April, 2000 and the result of field survey carried out for a period from the middle of April, 2000 to the end of May, 2000.

The restoration from the disaster in Dili City is now speeded up compared with that at the time when the Study Team started the Study in East Timor. Therefore, the digital topographic maps and GIS data (especially the urban facilities data) will shortly have many discrepancies from the actual conditions unless they are modified continuously.

In particular, the following data should be modified readily and continuously:

- 1) Digital topographic maps
 - a) Symbols for public facilities, etc.

The buildings and facilities marked with the symbols as the facilities of UN organizations such as UNTAET and PKT will have to be modified whenever the use of UNTAET or PKF, etc. terminates.
 - b) Symbols for damaged buildings and houses

As the damaged buildings and houses are represented by broken lines, the representations of these buildings and houses should be changed into the

symbols (full lines) for undamaged buildings and houses.

c) Symbols for facilities and buildings of Indonesian military

The facilities and buildings of Indonesian military are marked with the symbol () as such on the topographic maps. The basic principle of topographic maps is that the present purpose or status of use of the facilities and buildings should be represented on the maps. On the topographic maps created in the Study, the facilities and buildings used by the Indonesian military are marked with the special symbol. However, these facilities and buildings will be reused for other purposes of use in future and the symbol for those facilities will have to be changed accordingly.

d) Representation and symbols for governmental facilities and buildings in the Indonesian period that are not used currently

The governmental facilities and buildings in the Indonesian period that are not used currently are represented with bold lines and marked with the symbols for the purposes of use in the Indonesian period. The representations and symbols for these facilities and buildings will also have to be changed if they are reused for other purposes of use.

13.2.2 Necessity for Centralized Management of Digital Topographic Maps and GIS Data

It is necessary to modify the contents of the basic materials such as topographic maps, GIS data and various statistic materials as the time elapses. However, if individual departments and sections modify only the contents required for them for their own use, it will become unclear what data is modified and what data should be modified in future. To grasp the status of the data and information clearly, it is necessary to make centralized management of the topographic maps, GIS data and other various statistic materials.

Although the study of the data required for modification should be made by individual departments and sections, it is necessary to build a system to ensure that the modified data will be sent to any department or section in charge of centralized data management, which will modify the database and manage it.

With this system, all the departments and sections will be able to make their necessary

plans based on the same basic materials such as topographic maps, GIS data and various statistic materials.

13.2.3 Necessity for Department for Research and Management of Basic Materials such as Digital Topographic Maps, GIS Data and Various Statistic Materials

The UNTAET has no organization for centralized management of the created topographic maps, GIS data and various statistic materials at present. However, such an organization has to work in a sober way, but it is indispensable to execute the administrative programs.

This organization will also be indispensable even after the power is transferred from UNTAET to the Government of East Timor. Therefore, it is deemed to be necessary that a section in charge of research and management of various basic materials within the UNTAET organization will be set up at present and that this section will educate and train the people of East Timor for the procedures of collecting such basic materials, modifying various types of data including topographic maps and managing those basic materials.

13.2.4 Necessary Equipment for Modification of Digital Topographic Maps and GIS Data

UNTAET is not provided with any equipment required for modification of digital topographic maps and GIS data. In future, it is necessary to procure the equipment necessary for modifying the digital topographic maps and GIS data on a regular basis.

13.2.5 Necessity for Technology transfer to People of East Timor

As described in Section 13.2.3 “Necessity for Department for Research and Management of Basic Materials such as Digital Topographic Maps, GIS Data and Various Statistic Materials”, it is deemed to be necessary to transfer the technologies such as the procedures of collecting the basic materials, modifying various types of data including topographic maps and managing the basic materials to the people of East Timor in the present and following stages. However, it was difficult to transfer those technologies to them during implementation of the Study because one of the main objectives of the Study was to urgently create the 1:2,000 scale topographic maps and GIS data as the basic materials required at present.

Therefore, it is the realistically best way that the technology transfer such as

acquisition of various types of data and data management, including the procedures of creating digital topographic maps and modifying the created maps and data, will be implemented through long- and short-term dispatch of experts.

Appendices

- Appendix 1 Scope of Work for the Study on Urgent Establishment of Topographic Mapping in East Timor (12 January 2000)
- Appendix 2 Minutes of Meeting for the Study on Urgent Establishment of Topographic Mapping in East Timor (10 March 2000)
- Appendix 3 Approval to Operate Air Service in Support of Aerial Mapping Survey (4 April 2000)
- Appendix 4 Camera Calibration Certificate
- Appendix 5 Description of GPS Point
- Appendix 6 Description of Leveling Point
- Appendix 7 Samples of Data Sheets
- Appendix 8 Sample of Key for Photo Interpretation Data Sheet
- Appendix 9 Additional Request from the Land and Property Section of UNTAET

**Appendix 1 Scope of Work for the Study on Urgent Establishment
of Topographic Mapping in East Timor (12 January 2000)**

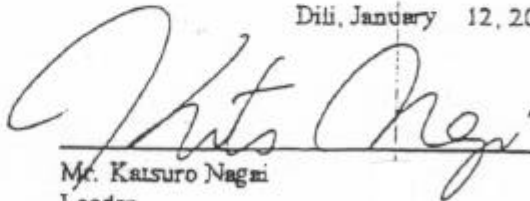
SCOPE OF WORK
FOR
THE STUDY ON
URGENT ESTABLISHMENT OF
TOPOGRAPHIC MAPPING
IN EAST TIMOR

AGREED UPON BETWEEN
UNITED NATIONS TRANSITIONAL ADMINISTRATION IN EAST TIMOR
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Dili, January 12, 2000



Mr. Sergio Vieira de Mello
Special Representative of the
Secretary-General
The United Nations Transitional
Administration in East Timor



Mr. Katsuro Nagai
Leader

The Japanese Economic Cooperation Mission

I. INTRODUCTION

In response to the request of the United Nations Transitional Administration in East Timor (hereinafter referred to as "UNTAET"), the Government of Japan decided to conduct "The Study on Urgent Establishment of Topographic Mapping in East Timor" (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 the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of UNTAET.

The present document sets forth the scope of work for the Study.

II. Objectives of the Study

Mindful of the work of others in this field, and wishing fully to coordinate with them, the objectives of the Study are:

- 1) to prepare digital topographic maps of 1:5,000 covering the built-up area, and
- 2) to pursue technology transfer to counterpart personnel.

The digital topographic maps to be prepared under the Study will assist in implementing various plans for reconstruction and rehabilitation in East Timor.

III. Study Area

The Study will cover the existing built-up area of about 400km² in Dili and its surrounding area.

IV. Scope of the Study

1. Aerial photography

Black and white aerial photos covering the prepared area will be taken at the scale of 1:10,000.

2. Ground control point survey

Ground control point survey with GPS survey will be conducted to determine the horizontal and vertical coordinates of ground control points.

3. Aerial triangulation

Aerial triangulation will be conducted to establish photo points.

4. Field identification

Topographic information will be identified through the field survey using the aerial photos. Administrative boundaries and geographical names shall be determined based on existing information.

5. Plotting
Plotting will be conducted to prepare 1:5,000 scale digital topographic data. Existing maps will be utilized to the extent possible.
6. Field completion
Field completion will be conducted in the Study area to identify natural and artificial terrain features, geographic names and boundaries which are difficult or impossible to recognize on the aerial photos.
7. Compilation
Compilation of the plotted data will be conducted based on the result of field identification.
8. Structurization
Topological structurization will be conducted for completion of digital topographic data.
9. Preparation of printing film
Printing films will be prepared using laser-plotter at the scale of 1:5,000.

V. Study Schedule

The Study will be carried out with the tentative schedule as attached in the Annex I. The schedule is tentative and subject to be modified when both sides agree upon any necessity that may arise during the course of the Study.

VI. Reports and Final Products

JICA shall prepare and submit the following reports in English to UNTAET :

1. Inception Report:
Twenty (20) copies at the commencement of the study in East Timor. This report will describe the Study schedule, methodology and Study Team members assignment as well as the outline of the field survey.
2. Draft Final Report :
Twenty (20) copies at the time of final field work. The UNTAET side shall submit their comments within one (1) month after the receipt of the Draft Final Report.
3. Final Report:
Thirty (30) copies within one (1) month after the receipt of the comments on the Draft Final Report.

4. Topographic mapping products
- | | |
|--|----------|
| (1) Negative films of aerial photos | 1 set |
| (2) Contact prints of aerial photos | 1 set |
| (3) Result of ground control point survey | 1 set |
| (4) 1:5,000 scale topographic maps (printing films) | 1 set |
| (5) 1:5,000 scale digital topographic data (e.g. CD-ROM) | 100 sets |

VII. UNDERTAKINGS OF UNTAET

1. To facilitate the smooth conduct of the Study, UNTAET will 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 East Timor for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees;
- (3) to exempt the members of the Team from taxes, duties, fees and any other charges on equipment, vehicles, machinery and other materials brought into and out of East Timor 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 remittances as well as the utilization of the funds introduced into East Timor from Japan in connection with the implementation of the Study;
- (6) to secure permission for the Team to enter 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 and maps related to the Study out of East Timor to Japan;
- (8) to provide medical services as needed. Its expenses shall be chargeable to the members of the Team.

2. UNTAET 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 member of the Team.

3. UNTAET shall act as a counterpart agency to the Japanese Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. UNTAET shall, at its own expense, provide the Team with the following, in cooperation with other organizations concerned:

- (1) Available data and information related to the Study,
- (2) Counterpart personnel and supporting staff,
- (3) Credentials or identification cards to the member of the Team.

VIII. UNDERTAKINGS OF JICA

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

1. to dispatch, at its own expense, the Team to East Timor,
2. to pursue technology transfer to counterparts personnel in the course of the Study.

IX. CONSULTATION

JICA and UNTAET will consult with each other in respect of any matter that may arise from or in connection with the Study.

THE STUDY ON
URGENT ESTABLISHMENT OF
TOPOGRAPHIC MAPPING
...IN EAST TIMOR...

TENTATIVE SCHEDULE

MONTH	1	2	3	4	5	6
DESCRIPTION						
WORK IN EAST TIMOR	▲	■	■		■	
WORK IN JAPAN				■		
REPORT PRESENTATION	▲				▲	▲
	IC/R				DF./R	F/R

NOTE : IC/R : Inception Report
 : DF/R : Draft Final Report
 : F/R : Final Report

**Appendix 2 Minutes of Meeting for the Study on Urgent Establishment
of Topographic Mapping in East Timor (10 March 2000)**

MINUTES OF MEETING
FOR
THE STUDY ON URGENT REHABILITATION IN EAST TIMOR
AND
THE STUDY ON URGENT ESTABLISHMENT OF TOPOGRAPHIC
MAPPING IN EAST TIMOR
AND
THE STUDY ON URGENT IMPROVEMENT PROJECT FOR
WATER SUPPLY SYSTEM IN EAST TIMOR

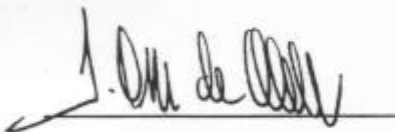
AGREED BETWEEN

THE UNITED NATIONS TRANSITIONAL ADMINISTRATION
IN EAST TIMOR

AND

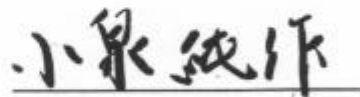
JAPAN INTERNATIONAL COOPERATION AGENCY

Dili March 10, 2000



Mr. Sergio de Mello

Special Representative of the
Secretary General,
United Nations Transitional
Administration in East Timor



Mr. Junsaku KOIZUMI

Special Technical Advisor,
Japan International Cooperation Agency



Mr. Haruo SAKASHITA

Team Leader of the Study
Team (Infrastructure)
Japan International
Cooperation Agency



Mr. Toru WATANABE

Team Leader of the Study
Team (Topo map)
Japan International
Cooperation Agency



Mr. Kazufumi MOMOSE

Team Leader of the Study
Team (Water)
Japan International
Cooperation Agency

1. Depending on the Scope of Work for the Study agreed upon between Administration of the United Nations Transitional Administration in East Timor (hereinafter referred to as "UNTAET") and Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan on January 12, 2000 in Dili. JICA has dispatched an official mission with the Study Teams, headed by Mr. Junsaku Koizumi and arrived on the 19th February, 2000 in Dili. The Mission held a series of discussions, exchanged views with counterparts of UNTAET and other organizations concerned including Mr. TAKAHASHI, (Deputy SRSG for Humanitarian Assistance & Emergency Rehabilitation) and Mr. CADY, (Deputy SRSG for Governance & Public Administration) with preparatory field survey. The names of the counterparts are listed in the Attachment-1.
2. The Mission comprises the following three study teams;
 - (a) The study on urgent rehabilitation plan in East Timor
 - (b) The study on urgent establishment of topographic mapping in East Timor
 - (c) The study on urgent improvement project for water supply system in East Timor
3. Through discussions, exchanges of views and preparatory field surveys, UNTAET and JICA have agreed that some stipulations of Scope of Work should be modified to meet the needs including quick projects as follows;

3-1 Modification of Scope of Work

- (a) The study on urgent establishment of topographic mapping
 - Scale of digital topographic mapping (from 1:5,000 to 1:2,000)
 - Area of digital topographic mapping (from 400 sq.km to 107 sq.km)
 - Scale of aerial photography (from 1:10,000 to 1:8,000)
 - Aerial photography area (from 400 sq.km to 257 sq.km including Dili, Liquica, Manatutu and Baucau City)
 - Contour interval of digital topographic mapping
 - Preparation of digital data for GIS
 - Undertaking of UNTAET for flight permission of aerial photography
- (b) The Scope of Work for the infrastructure (roads, bridges, power, ports and irrigation) has been revised by adding quick projects
- (c) The Scope of Work for the study on urgent improvement project for water supply system has been revised by adding quick projects.

3-2 Quick Projects (QP)

Both sides agreed that the JICA Study Teams will conduct Quick Projects (hereinafter referred to as "QP") as follows;

(a) The study on urgent rehabilitation plan for roads and bridges includes the following Quick Projects which will be completed in June, 2000 ;

- Road rehabilitation of the section, Dili – Aileu – Ainaro
- Road rehabilitation of the section, Baucau –Laga – Samalart – J.C. of Southern coastal road, and,
- Routine maintenance for road shoulders from Dili to Baucau.

(b) The study on urgent improvement project for water supply system includes the following Quick Projects, which will be completed in December, 2000.

- Leakage control and rehabilitation of distribution pipe of Dili water supply
- Transmission main repair of Manatuto
- Improvement of water supply and sanitation systems in approximately 10 primary schools in Dili, Aileu and Lautem (Fuiloro) districts

4. JICA study Teams submitted twenty (20) copies of each Inception report to UNTAET, based on the modified scope of the Studies mentioned above, and explained the approach, methodology, plan of operations, study organization and schedule in accordance with each inception report. UNTAET accepted the Inception reports in principle.

5. Department of infrastructure, UNTAET has agreed to provide the following office spaces to JICA Study Teams until the end of the study, starting March 11, 2000 ;

- 100m² (2nd floor of former PLN building) for infrastructure study team,
- 75m² for water supply study team (western – end of the new water office located at Jacinto Cardido St.

Notes (1) The provision of the office spaces will be free of charge to the JICA study teams.

(2) JICA study teams at their own cost will renovate the office spaces and provide furniture and appliances.

(3) The study teams will be evacuated from the office spaces, leaving furniture and appliances at the end of studies.

6. Main points of discussions by each study are as per Attachment-2.



A. Attendant List of the Meeting at 16:00 on March 10, 2000**UNTAET**

- | | | |
|----|---------------------|---|
| 1. | Mr. Sergio de Mello | Special Representative of Secretary General |
| 2. | | |

JICA

- | | | |
|----|-----------------------|--|
| 1. | Mr. Junsaku Koizumi | Special Technical Advisor |
| 2. | Mr. Takayuki Nakagawa | Staff of JICA Headquarter |
| 3. | Mr. Nobuo Iwai | Staff of JICA Headquarter |
| 4. | Mr. Takeshi Watanabe | Assistant Resident Representative, Dili Office |
| 5. | Mr. Eishun Tokumori | Assistant Resident Representative, Dili Office |

Study Team

- | | | |
|----|---------------------|--|
| 1. | Mr. Kazufumi Momose | Team Leader of the JICA Study for Water |
| 2. | Mr. Toru Watanabe | Team Leader of the JICA Study for Topo map |
| 3. | Mr. Haruo Sakashita | Team Leader of the JICA Study for Infrastructure |

B. List of Counterparts, UNTAET**1. Infrastructure Department**

- | | | |
|----|--------------------|--|
| 1. | Mr. Bob Churcher | Head of Infrastructure |
| 2. | Mr. Diego Zorrilla | Infrastructure Division |
| 3. | Mr. Phil Piper | Manager, Road Section |
| 4. | Mr. Owen Peake | Manager, Power Section |
| 5. | Mr. Graham Costin | Manager, Water and Sanitation Section |
| 6. | Mr. Graham Jackson | Water and Sanitation Section |
| 7. | Mr. Dino da Saliva | Assistant to Mr. Peake and Fuel distribution coordinator |
| 8. | Mr. Mohd. Ahmed | Manager, Port Management Section |
| 9. | Mr. Edgar Pacheco | Port Management Section |

2. Agricultural Affairs Department

- | | | |
|----|----------------------------|-------------------------------|
| 1. | Mr. Serge Veruniau | Acting Head of Agriculture |
| 2. | Mr. Jose Abel | Civil Affairs Officer |
| 3. | Mr. M. Auzib | Civil Affairs Officer |
| 4. | Mr. Chen Zhijun | Civil Affairs Officer |
| 5. | Mr. Sindyigaya Living tone | Civil Affairs Officer |
| 6. | Ms. Maria Reginal Ismail | Civil Affairs Officer |
| 7. | Mr. Jurmi Wangeluk | Environmental Protection Unit |

A. The Study on Urgent Rehabilitation in East Timor

1. The counterpart of the Study Team is Department of Infrastructure, UNTAET.
2. Target Year for Urgent Rehabilitation Plan is the end of year 2002

B. The Study on Urgent Establishment of Topographic Mapping in East Timor

1. The counterpart of the Study Team is Agriculture Section of UNTAET.
2. UNTAET requested to change the scale of digital topographic maps to be prepared by the Study from the viewpoint of effective use by every sections of UNTAET. Both side agreed that the scale to be prepared by the Study is 1:2,000 instead of 1:5,000.
3. UNTAET requested to change the digital topographic mapping area to be prepared by the Study from the viewpoint of land use, vegetation and topographic condition. Both side agreed that the digital topographic mapping area to be covered by the Study is 107 sq.kms of Dili City instead of 400sq.kms. The detailed digital topographic mapping area is shown in the attached map of Inception report.
4. Both sides agreed that the scale of aerial photography is 1:8,000 instead of 1:10,000.
5. UNATET requested the Study Team to include Liquica City, Manatutu City and Baucau City in aerial photography area to support urgent rehabilitation program of UNTAET. Both side agreed that the area to be covered by 1:8,000 scale aerial photos is as follows:

a) Dili City	107 sq.km
b) Liquica City	28 sq.km
c) Manatutu City	50 sq.km
d) Baucau City	72 sq.km
e) Total	257 sq.km
6. Both sides agreed that the contour interval of 1:2,000 scale digital topographic maps is as follows:
 - a) 2.0 m interval contour for flat area
 - b) 10.0 m interval contours for mountain area and steep slope
7. Both sides agreed that following 1:2,000 scale digital data for GIS will be prepared in the Study.
 - a) Digital land use data for GIS by field check and photo interpretation

- b) Digital land condition data for GIS by field check and photo interpretation
- c) Digital urban facilities data for GIS mainly by the data provided from UNTAET

8. The JICA Study Team requested to UNTAET to secure permission of aerial photography by foreign registered aircraft for the Study and UNTAET agreed that request.
9. Both sides agreed that the language to be used for digital topographic map and digital data for GIS is English.
10. Both sides agreed that the existing elevation and horizontal coordinates points which were established by the Indonesian Government will be used as a reference point.
11. Both sides agreed that the digital topographic maps and digital data for GIS to be prepared by the Study will be open to the public use.

C. The Study on Urgent Improvement Project for Water Supply System in East Timor

1. The counterpart of the Study Team is Water & Sanitation section of UNTAET.
2. Target Year for Urgent Improvement Program is Year 2003.
3. The Study shall cover following 15 towns (Dili, Atauro, Manatuto, Baucau, Lospalos, Viqueque, Same, Ainaro, Aileu, Maubisse, Gleno, Ermera, Liqica, Suai, and Maliana). However, the Study in Suai, and Maliana towns shall be based on available documents at the Office of Water and Sanitation (no site visits).
4. Water supply system of Dili would be drawn on a GIS map with a scale, 1 to 2,000 which is scheduled to be prepared in August 2000 by other JICA Study Team for topographic map, while maps with a scale of 1 to 5,000 would be applied to the remaining 14 towns. UNTAET requested the JICA Study Team to arrange plotter, scanner and digitizer at its own cost. The JICA Study Team agreed to convey their request to JICA Headquarters in Tokyo.

**Appendix 3 Approval to Operate Air Service in Support of Aerial
Mapping Survey (4 April 2000)**

UNITED NATIONS

NATIONS UNIES

UNTAET

United Nations Transitional Administration in East Timor

GOVERNANCE AND PUBLIC ADMINISTRATION

4 April 2000

New Zealand Aerial Mapping Limited
PO Box 300-322
Albany New Zealand
Attention: Anna Southern

4 April 2000

Dear Ms. Southern

Approval to Operate Air Service in Support of Aerial Mapping Survey

I am writing concerning the arrangements for your company to conduct air operations in East Timor in support of the Japanese Government sponsored aerial mapping project.

UNTAET is happy to grant your company the approval to operate over the period from 4 April to 15 June, subject to written confirmation from your company that you will abide by the following terms and conditions:

1. The aircraft shall be regularly maintained inspected and serviced in accordance with the requirements of all relevant laws and regulations of its certificate of airworthiness and in accordance with the appropriate service manuals. If the airworthiness certificate is cancelled then approval shall be cancelled
2. The operator shall notify Aviation Unit, UNTAET immediately by the quickest possible means and in writing of any changes to the terms and conditions

of the insurance cover or a change in the underwriter providing the cover. If the operator's insurance cover is cancelled then the approval is cancelled.

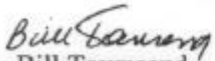
3. The operator shall notify the Aviation Unit, UNTAET immediately by the quickest possible means and in writing of all accidents or claims, which arise out of or are in any way connected with the services performed under this approval.
4. The operator shall operate the aircraft in accordance with all relevant laws and regulations.
5. The operator shall provide all safety equipment required by all the applicable laws and regulations and shall ensure that they are properly maintained.
6. The operator shall ensure that all crew of the aircraft possess and retain minimum qualifications established under the applicable air navigation laws and regulations and the qualifications required by the insurance underwriters providing the insurance required by this approval.
7. The operator shall maintain a manifest that shall include the identity details of each passenger and crew member and details of any cargo carried.

I am attaching a note that sets out the arrangements to be made with the Air Operations Cell, United Nations Peace Keeping Force Headquarters to give notification of air movements.

Please note also that your company will also be liable to pay landing fees at the rates according to the attached schedule.

In conclusion I wish you every success with this venture,

Yours sincerely,


Bill Townsend
Acting Chief Aviation Unit
UNTAET

AIRPORT CHARGES

Date of Effect to be advised

Airports: Comoro (Dili) & Baucau

Currency: USD

1. Landing Charge (based on the MTOW of aircraft)

International Operations

Up to	5000 kgs.	\$ 40.00		
5001 -	10000 kgs.	\$200.00	plus	\$5.00 per ton or part thereof
10001 -	15000 kgs.	\$250.00	plus	\$5.00 per ton or part thereof
15001 -	30000 kgs.	\$275.00	plus	\$5.00 per ton or part thereof
30001 -	50000 kgs.	\$300.00	plus	\$5.00 per ton or part thereof
50000 +		\$325.00	plus	\$5.00 per ton or part thereof

Helipad. All aircraft types \$40.00 per landing.

Domestic operations (fix wing only) 50% of International rate.

2. Passenger Service Charge. \$10.00 International departing only.
To be collected by the Airlines at the point of sale.
3. Air Navigation Charges. Waived until further notice.
4. Parking. Waived until further notice.
5. Runway lighting. Waived until further notice.
6. Security Charges. Waived until further notice.
7. C.I.Q. Waived until further notice.

APPROVALS FOR FLIGHTS INTO EAST TIMOR

1. Approval is required for all air movements into East Timor.
2. The following procedures apply for all charter and recreational type flights. (Separate arrangements apply for the approval of scheduled air services).
3. The request should include details of:

Aircraft type and registration
Maximum Licensed Take Off Weight
Crew composition
Call sign and Expected Flight Schedule
Purpose of the Flight

4. These details should be forwarded to:

Air Operations Cell, UNPKF
For: Wing Commander Metz
Fax (61) 895534717

Civil Aviation Unit, G&PA
For: Bill Townsend/ Emil Domankusic
Fax (61) 889422198

5. In addition to the fax message seeking clearance, **applicants must also make a telephone call to the Air Operations Cell to obtain a slot time.** The phone number for Air Operations Cell is (61) 895534732.
6. Aircraft, crew passengers and cargo have to comply with East Timor regulations as to entry, clearance, immigration, customs and quarantine.
7. Possession of the flight clearance does not exempt an operator from compliance with any of the technical operating rules for airworthiness compliance.

Appendix 4 Camera Calibration Certificate

CAMERA CALIBRATION CERTIFICATE

CAMERA TYPE : RC30
LENS TYPE : 15/4 UAG-S
LENS NO. : 13213

Calibration date: 29.06.1999

SwissOptic AG, Heerbrugg

 **swissoptic**
SwissOptic AG
Heinrich-Wild-Strasse
CH-9435 Heerbrugg
Schweiz



RC30

15/4 UAG-S

No. 13213

29.06.1999

Aperture: 4.0
 Filter on goniometer: VIS (400 - 700 NM)
 Filter on camera: -
 C.F.L. : 152.872 mm

Radial distortion (micrometers) referred to principal point of symmetry (PPS)
 (Positive values denote image displacement away from center)

Radius mm	Half - Sides				Mean
	1	3	2	4	
10	0.2	-0.6	0.0	-0.1	-0.1
20	-0.3	-1.0	-0.2	-0.4	-0.4
30	-0.6	-1.4	-0.3	-1.0	-0.8
40	-1.1	-1.6	-1.1	-1.2	-1.2
50	-1.2	-2.2	-1.2	-1.2	-1.4
60	-1.8	-2.1	-1.0	-1.4	-1.5
70	-0.8	-1.6	-1.0	-0.6	-1.0
80	-0.3	0.0	-0.6	0.6	0.0
90	1.3	1.1	-0.1	1.5	0.9
100	1.8	2.0	1.3	2.1	1.8
110	2.7	2.3	2.3	2.7	2.5
120	2.7	2.4	1.6	2.5	2.3
130	1.4	1.4	0.9	1.0	1.1
140	-1.5	-0.7	-1.3	-2.3	-1.4
148	-3.1	-2.7	-2.7	-4.5	-3.2

Photographic resolution (line pairs per millimeter)

International 3-line test-chart, contrast (log) : 2.0

Aperture: 4.0
 Filter: 450 NM
 Film: KODAK PANATOMIC X 2412
 Developer: KODAK HC110

Angle (deg)	0	5	10	15	20	25	30	35	40	45
Radial:	117	117	103	90	98	95	101	108	101	83
Tangential:	117	116	101	97	92	86	88	88	77	59

AWAR (Area weighted average resolution) in lp/mm: 94

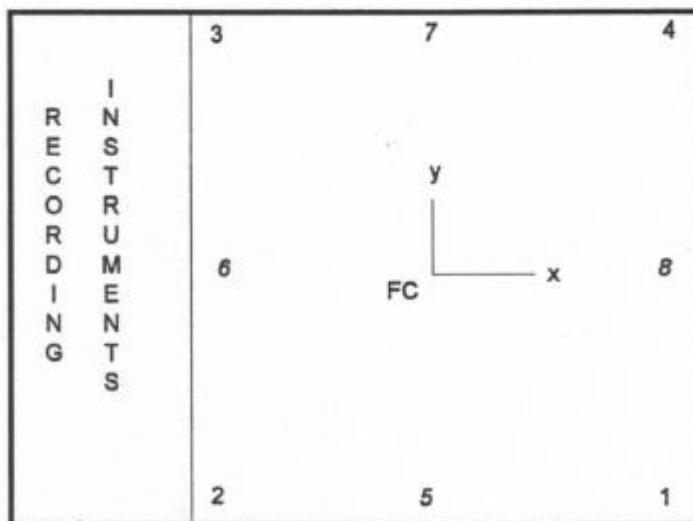
FD 157

**Principal point of autocollimation (PPA) and
principal point of symmetry (PPS)
referred to central cross (FC), see diagram**

	x (mm)	y (mm)
PPA	0.003	0.011
PPS	0.006	0.004

Fiducial marks, referred to central cross (FC)

	x (mm)	y (mm)		x (mm)	y (mm)
1	106.001	-106.001	5	-0.001	-110.000
2	-106.006	-106.004	6	-110.007	-0.002
3	-106.002	106.002	7	0.001	110.001
4	106.006	106.004	8	109.999	0.003



as seen on focal plane frame

RC30

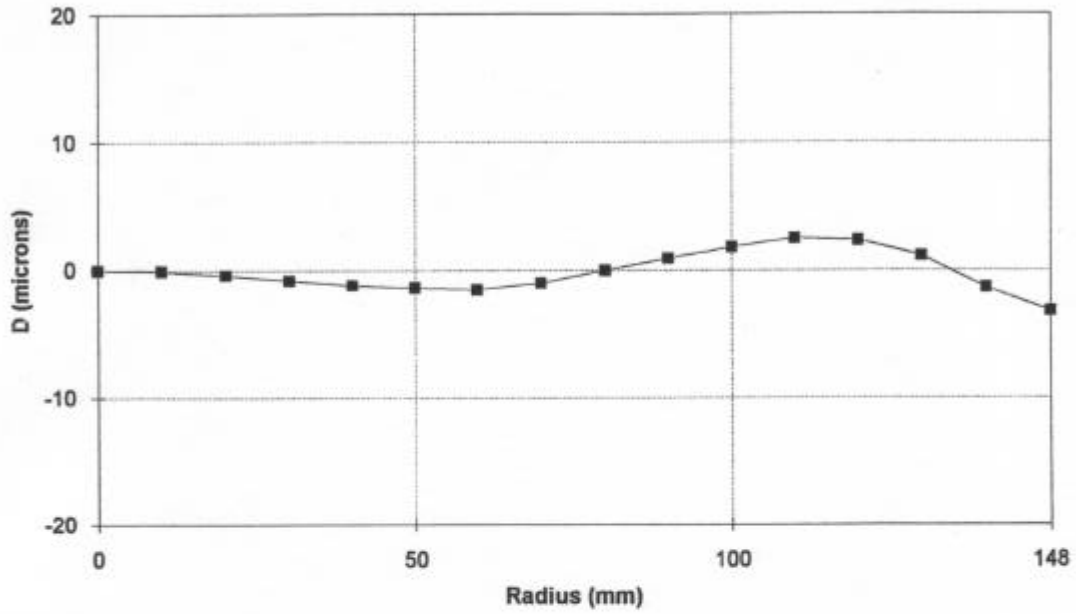
15/4 UAG-S

No. 13213

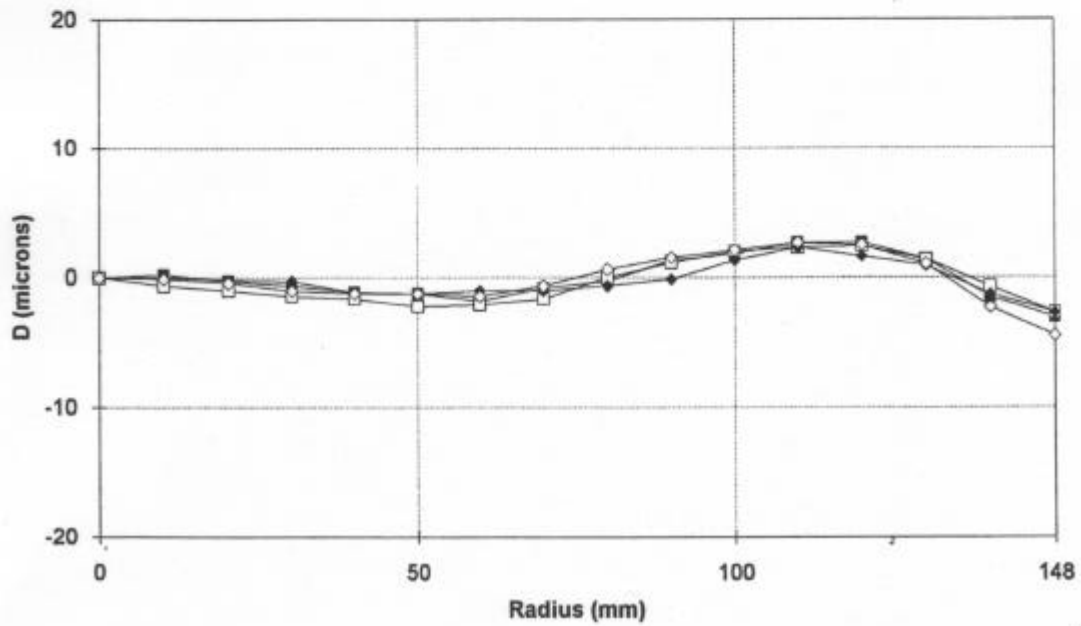
29.06.1999

Aperture: 4.0
Filter on goniometer: VIS (400 - 700 NM)
Filter on camera: --
C.F.L. : 152.872 mm

Mean radial distortion



Radial distortion for semi-diagonals referred to PPS



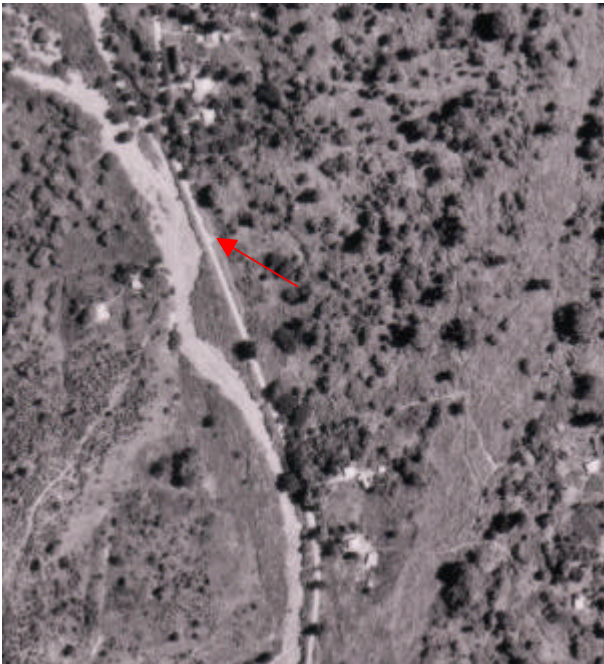
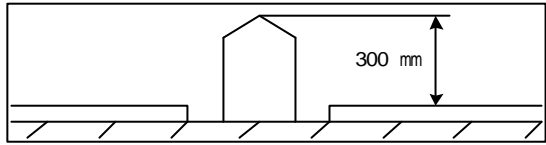
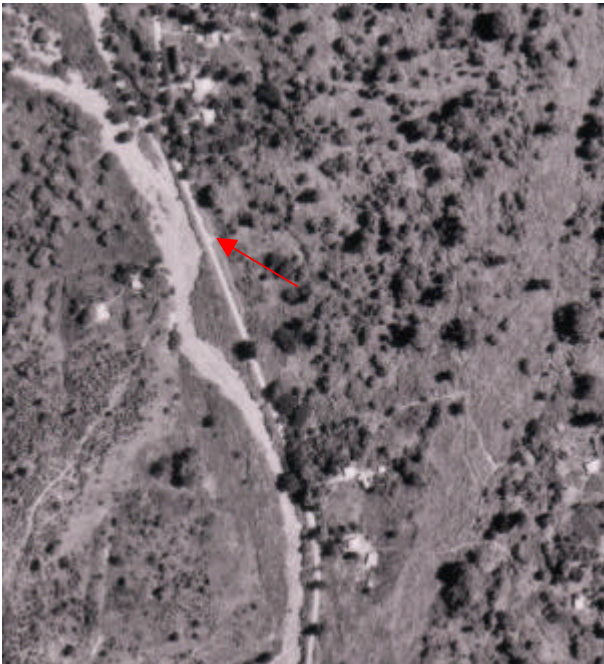
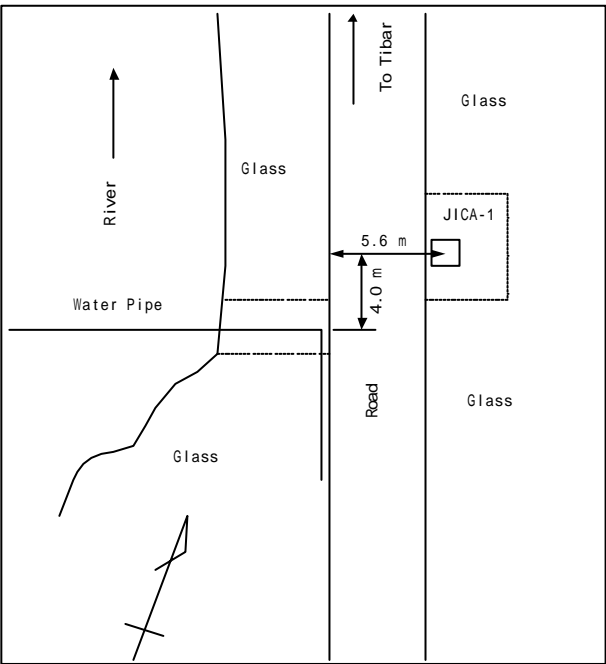


■ 1 □ 3 ● 2 ◇ 4

FO 787

Appendix 5 Description of GPS Point

DESCRIPTION OF GPS POINT

Point No.	JICA - 1	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 1	9,048,133.3530	773,347.1925	118.625 m
Location	4 km south from Tibar Village and 2.6 m off the road on the eastern side		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
			
Aerial Photo		Sketch	
			

DESCRIPTION OF GPS POINT

Point No.	JICA - 2	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 2	9,052,905.9497	773,459.1027	5.913 m
Location	1 km from Tibar Village to Dili and 6.5 m off the northern side of the road		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		

Location Map

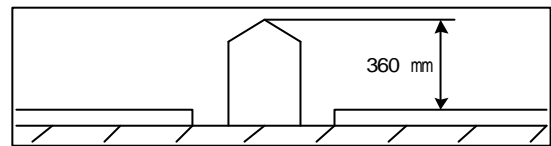


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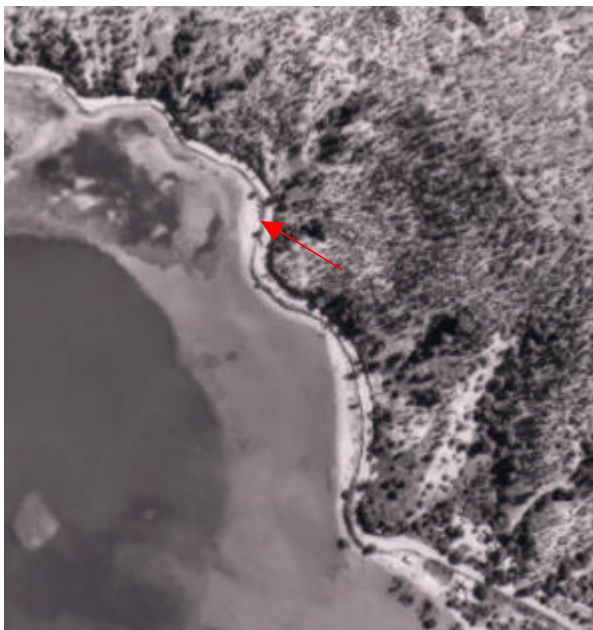
Field Photo



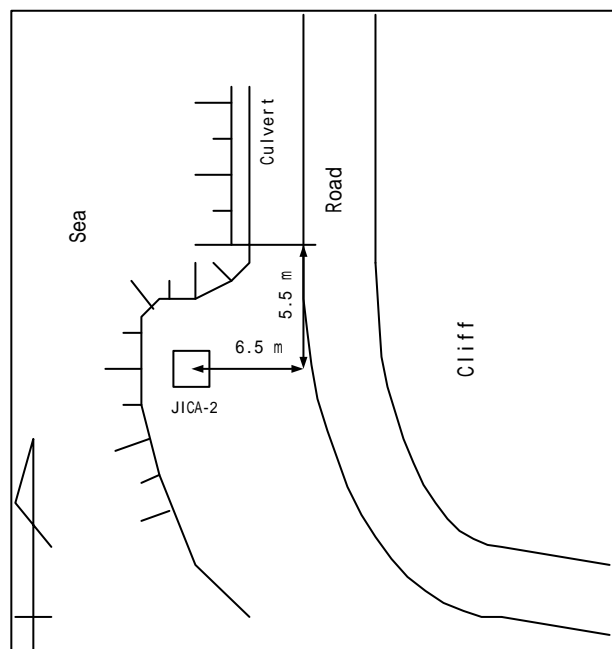
Profile





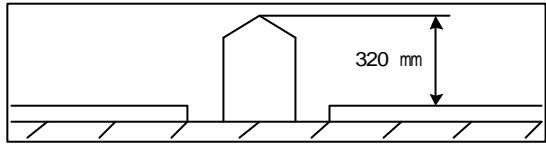

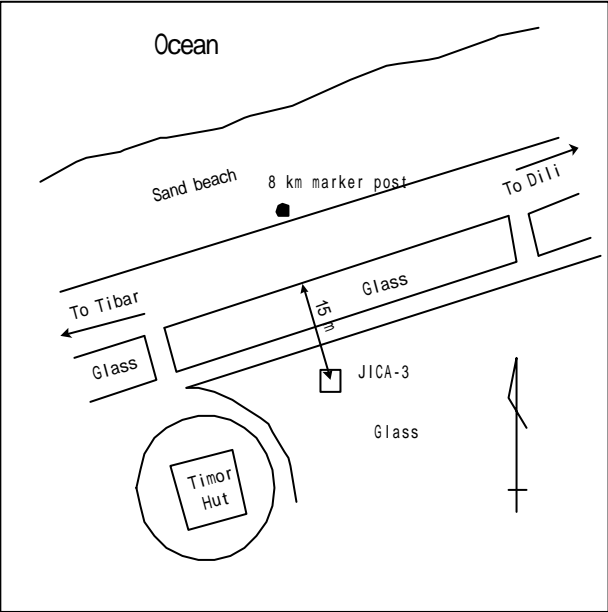
Aerial Photo





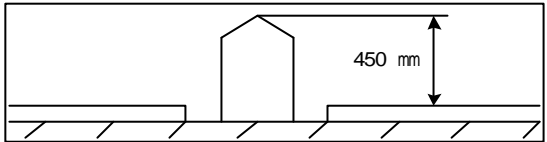

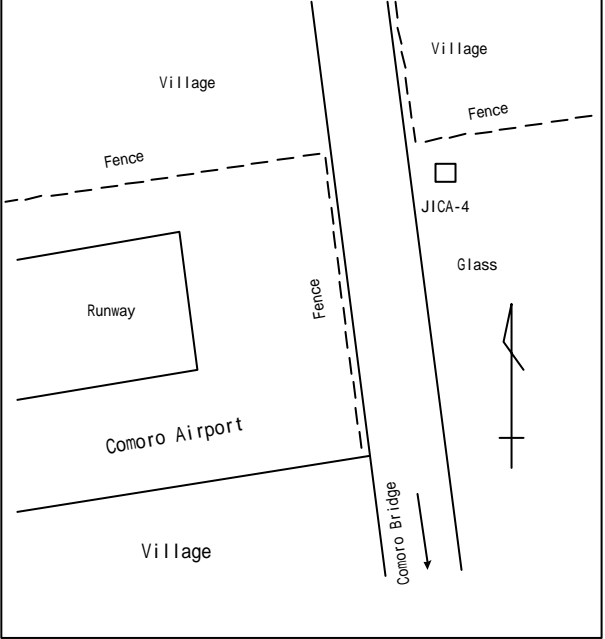
Sketch



DESCRIPTION OF GPS POINT

Point No.	JICA - 3	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 3	9,053,113.5351	755,961.9145	4.210 m
Location	Adjacent to prominent Timorese hut 8 km west from Dili and 15 m off the road		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
1:25,000		Profile	
			
Aerial Photo		Sketch	
			

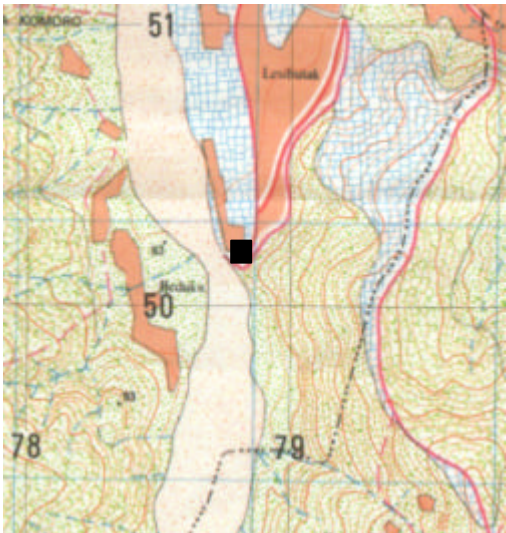

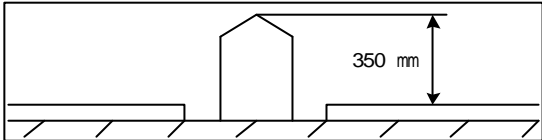
DESCRIPTION OF GPS POINT


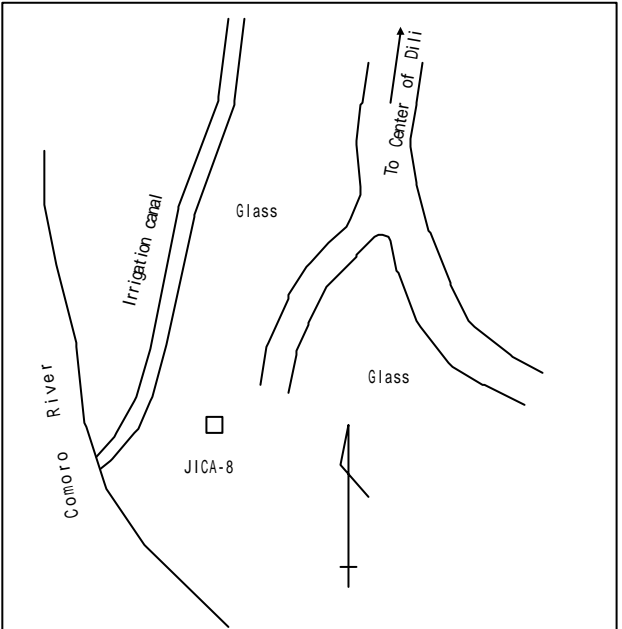
Point No.	JICA - 4	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 4	9,054,663.5153	778,910.0623	7.434 m
Location	Monument is located by dirt track, 75 m west from the western end of Comoro bridge		
Date of establishment	2000/3/22		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

1:25,000

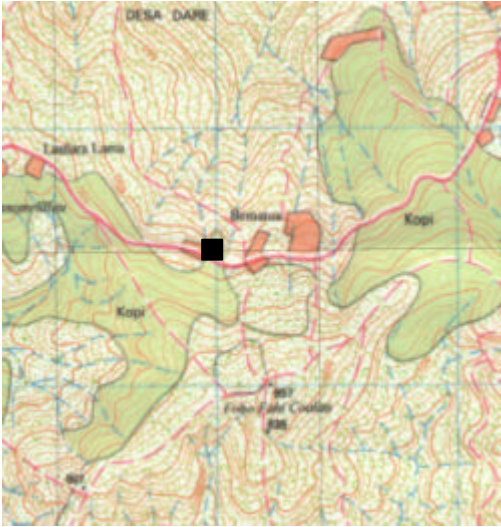

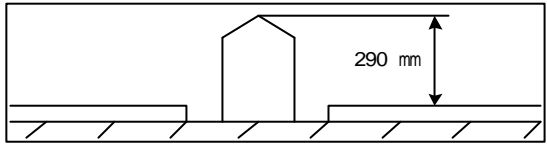
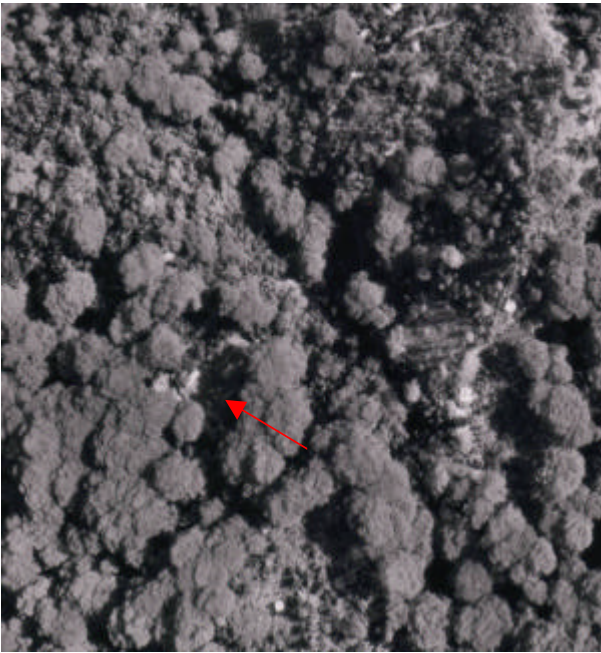
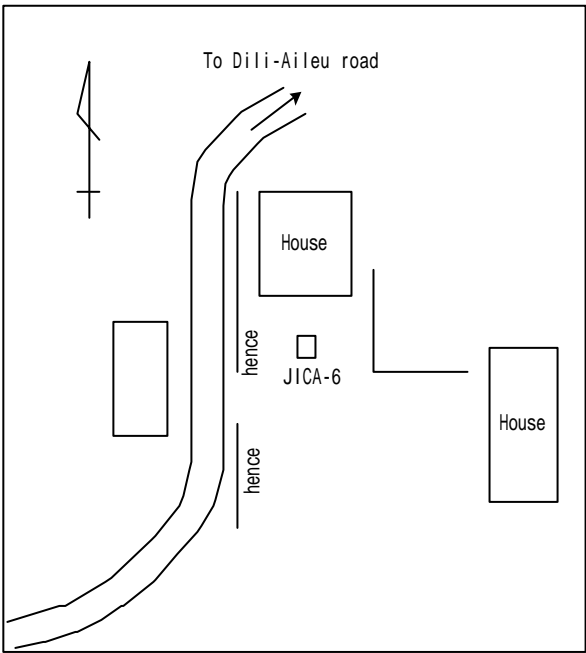
DESCRIPTION OF GPS POINT

Point No.	JICA - 5	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 5	9,050,112.1313	778,849.8949	59.876 m
Location	Beside the intake of irrigation canal at Lwsibutak Village		
Date of establishment	2000/3/22		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokia GSA 2300 Level:Topcon AT-M3		

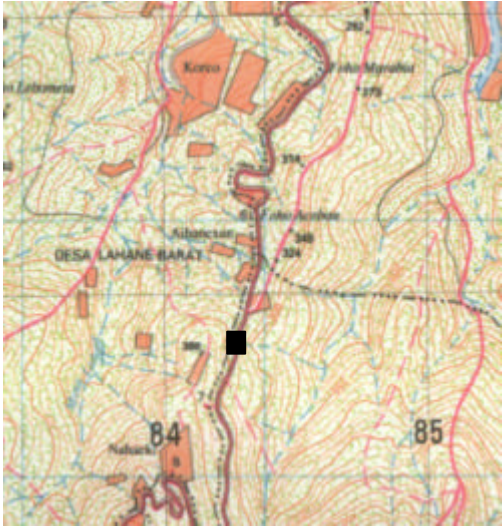


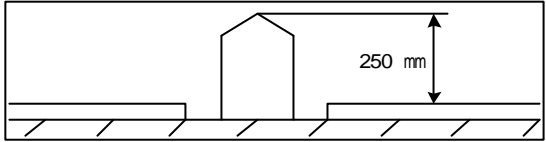

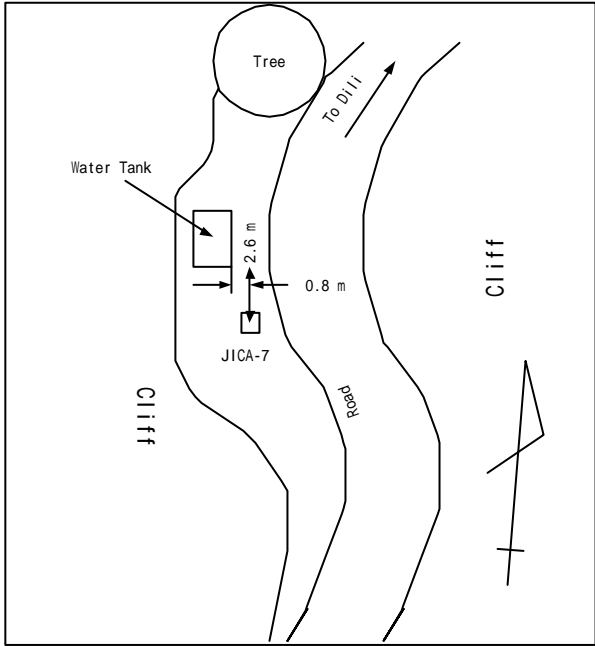
Location Map	Field Photo
 <p style="text-align: right; margin-top: 5px;">1:25,000</p>	
	Profile
	

Aerial Photo	Sketch
	



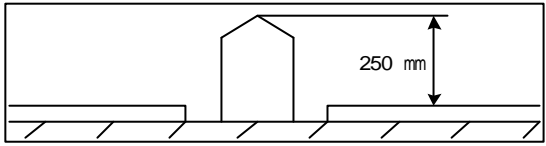
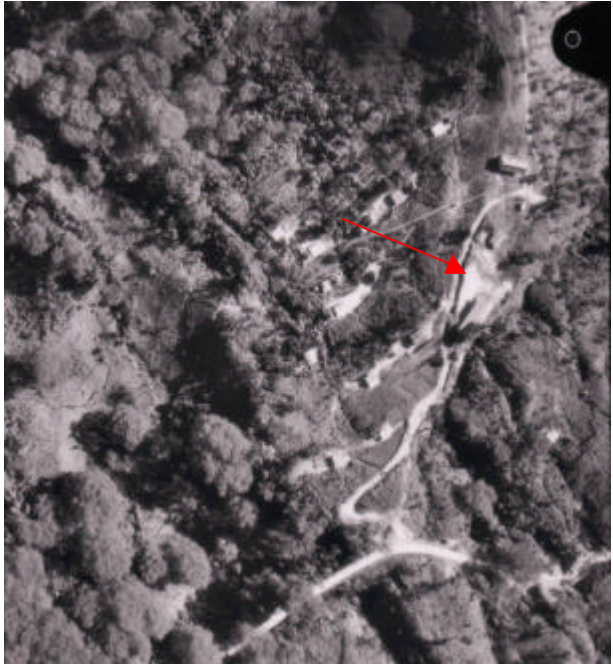
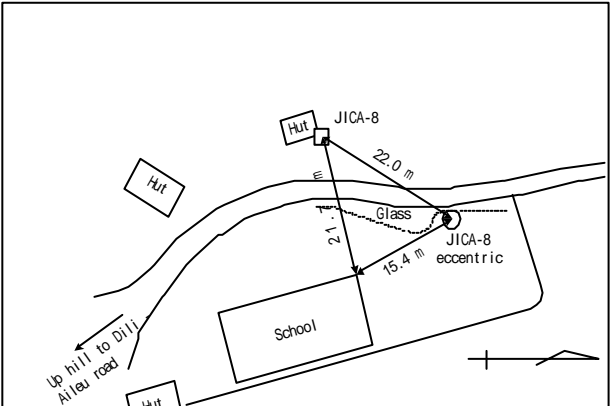
DESCRIPTION OF GPS POINT

Point No.	JICA - 6	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 6	9,048,373.3269	782,419.0727	629.6 m
			(from GPS observation)
Location	Biara Susteran, Laulara		
Date of establishment	2000/3/28		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
1:25,000			
Aerial Photo		Sketch	
			

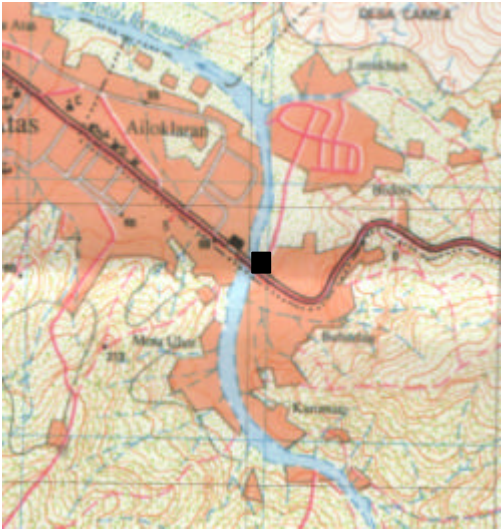


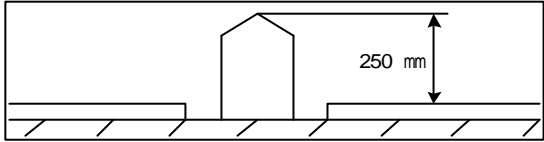

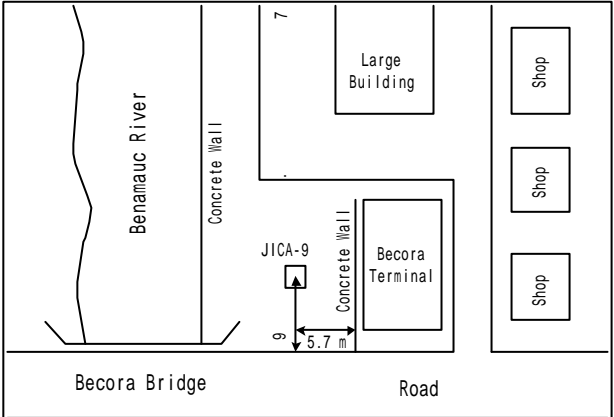

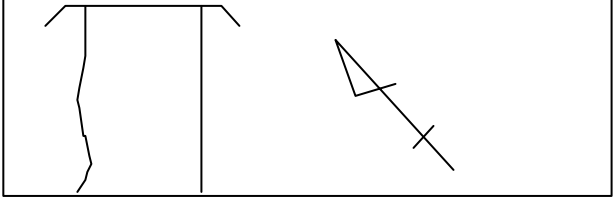
DESCRIPTION OF GPS POINT

Point No.	JICA - 7	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 7	9,050,028.4553	784,354.9911	308.068 m
Location	6.4 km from Dili on the Aileu road and adjacent to prominent concrete water tank		
Date of establishment	2000/3/24		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
			
<p style="text-align: right;">1:25,000</p>		<p style="text-align: center;">Profile</p>	
<p style="text-align: center;">Aerial Photo</p>		<p style="text-align: center;">Sketch</p>	
			




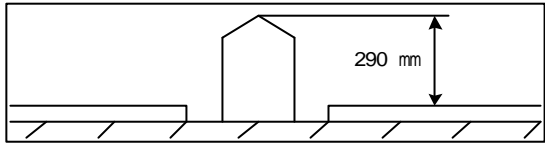

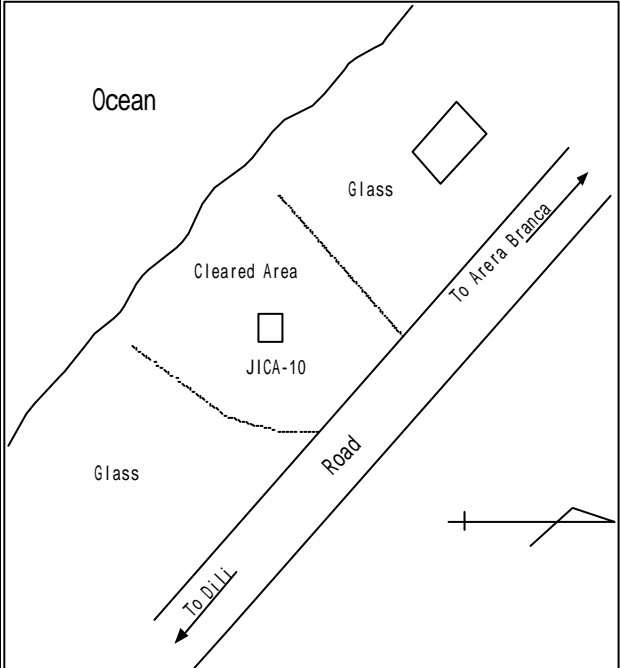
DESCRIPTION OF GPS POINT

Point No.	JICA - 8	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 8			
Eccentric point (pre-mark)	9,047,631.2683	789,237.0611	965.0 m
			(From GPS observation)
Location	In front of the School located along the road from Dili to Aileu.		
Date of establishment	2000/3/26		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
		<p>JICA 8 concrete monument was not used because hut was built alongside after mark placed.</p> <p>JICA 9 eccentric nail is in tree stump. Top of stump is 375 mm above ground level.</p>	




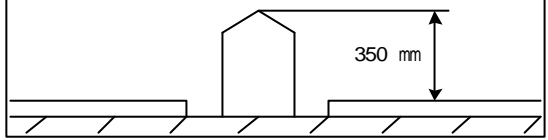

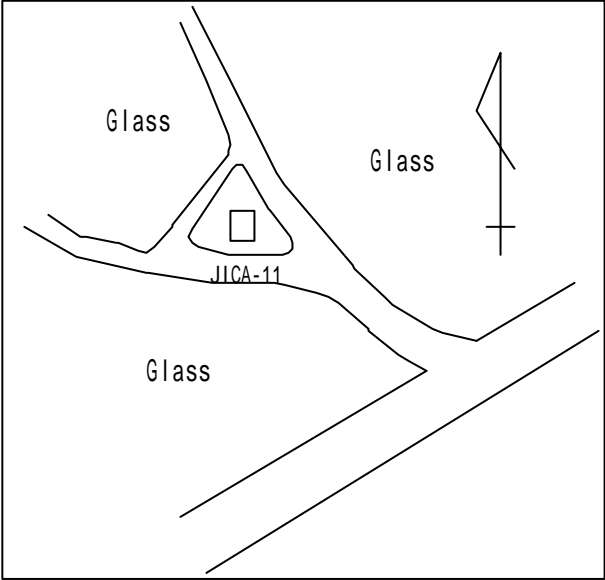
DESCRIPTION OF GPS POINT

Point No.	JICA - 9	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 9	9,051,761.6414	788,052.8096	63.495 m
Location	Becora Terminal on the western side between the terminal side and the drainage ca		
Date of establishment	2000/3/30		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
			
Aerial Photo		Sketch	
			
			




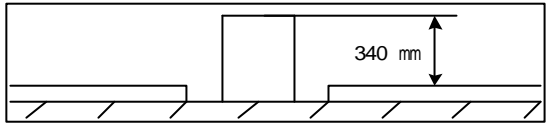

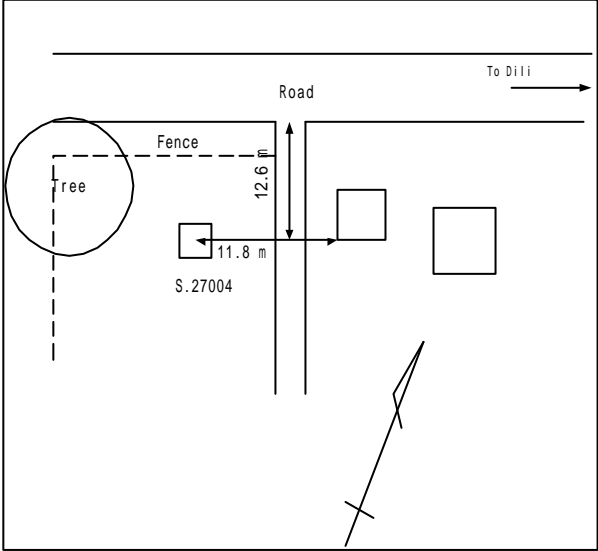
DESCRIPTION OF GPS POINT

Point No.	JICA - 10	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 10	9,054,553.0024	787,327.6098	2.915 m
Location	2.5 km from JEP 14 along the road to Areta Branca and 20 m off the nothern side of		
Date of establishment	2000/3/24		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
			
Aerial Photo		Sketch	
			

DESCRIPTION OF GPS POINT

Point No.	JICA - 11	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JICA - 11	9,056,956.4286	787,939.4357	4.237 m
Location	Center of the coast of Fatocama Bay		
Date of establishment	2000/3/28		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
			
			
Aerial Photo		Sketch	
			

DESCRIPTION OF GPS POINT

Point No.	S.27004	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
S.27004	9,051,952.0193	774,128.4827	4.941 m
Location	In front of Village Office of Tibar Village		
Date of establishment	Established by BPN of the Republic of Indonesia		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		
Location Map		Field Photo	
 <p style="text-align: right; margin-right: 50px;">1:25,000</p>			
		Profile	
			
Aerial Photo		Sketch	
			

DESCRIPTION OF GPS POINT

Point No.	TTG 0157	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
TTG-0157	9,055,399.0029	783,820.8695	3.636 m
Location	In front of UNTAET Building of Dili City		
Date of establishment	Established by BAKOSURTANAL of the Republic of Indonesia		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	GPS:Sokkia GSA 2300 Level:Topcon AT-M3		

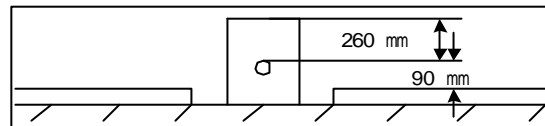
Location Map	Field Photo
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1:25,000



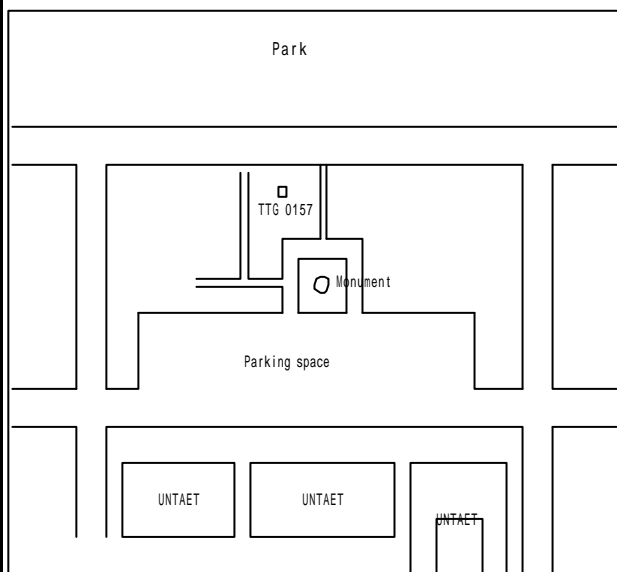
Profile



Aerial Photo	Sketch
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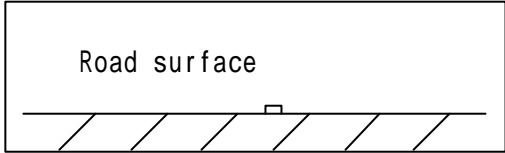

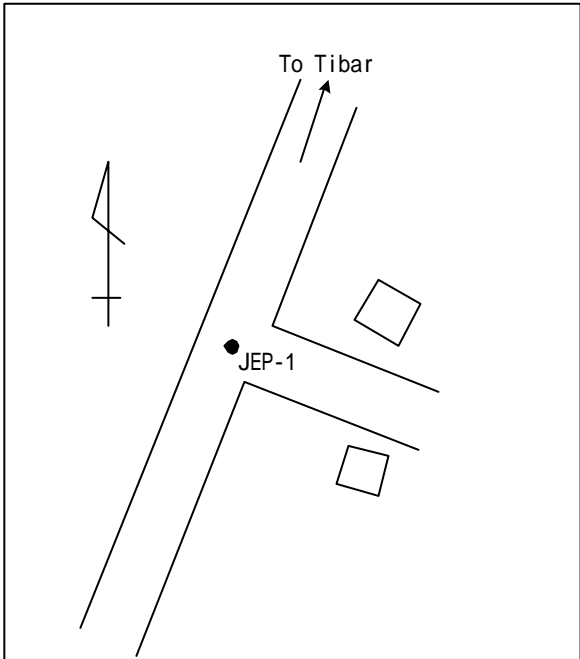


Park



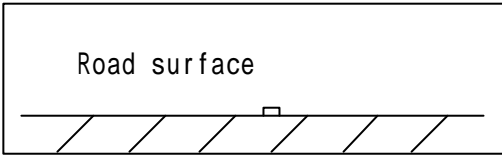

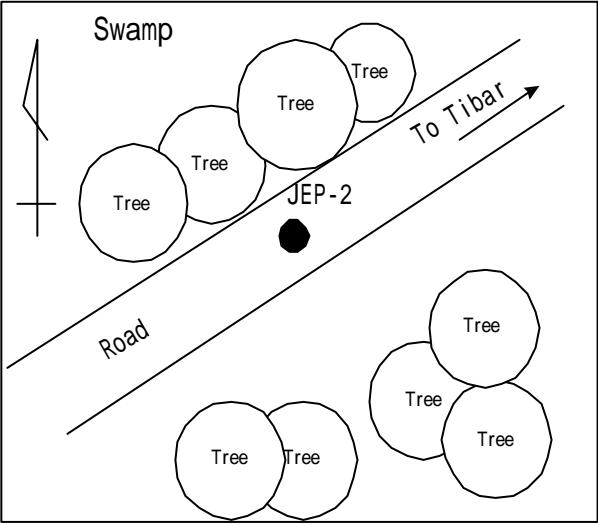


Appendix 6 Description of Leveling Point



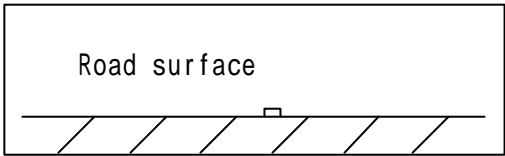

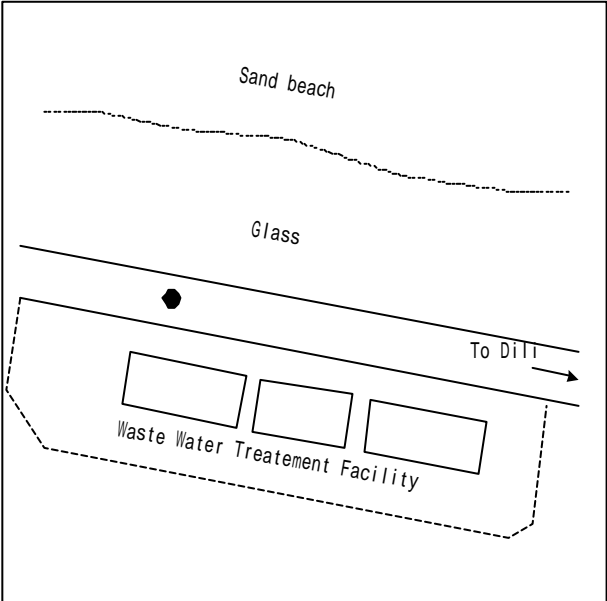
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 1	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 1			32.539 m
Location	1.5 km south from Tibar Village and center or the road		
Date of establishment	2000/3/22		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
		1:25,000	
Aerial Photo		Sketch	
			



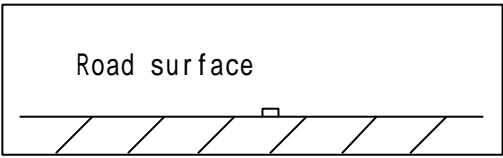

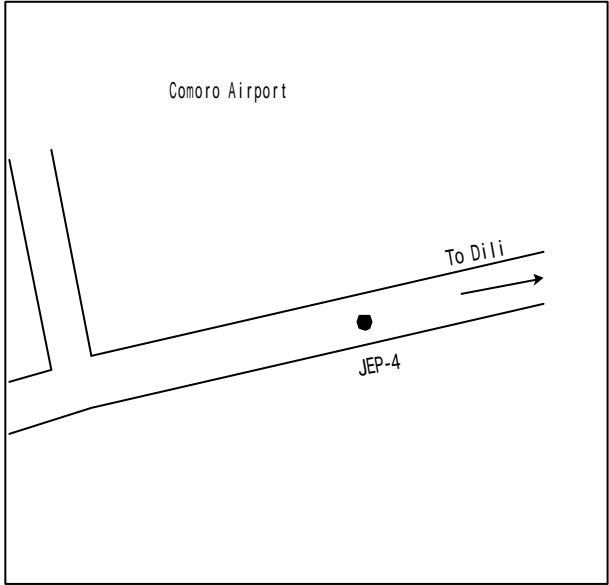
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 2	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 2			4.041 m
Location	1.0 km west from Tibar Village and center of the road		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
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		Profile	
			
Aerial Photo		Sketch	
			

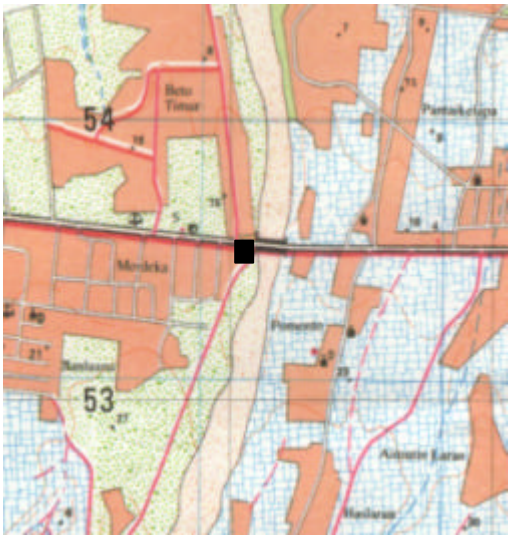


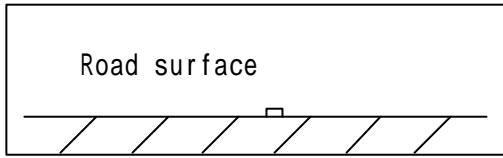

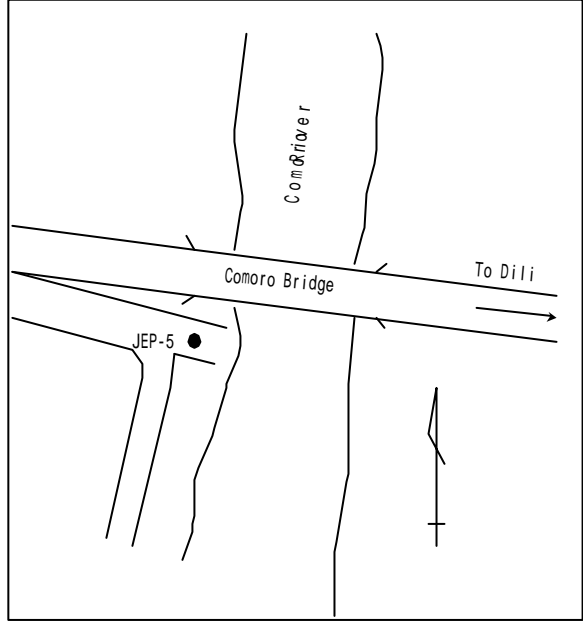
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 3	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 3			4.250 m
Location	In front of Waste Water Treatment Facility and center of the road		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

DESCRIPTION OF LEVELING POINT

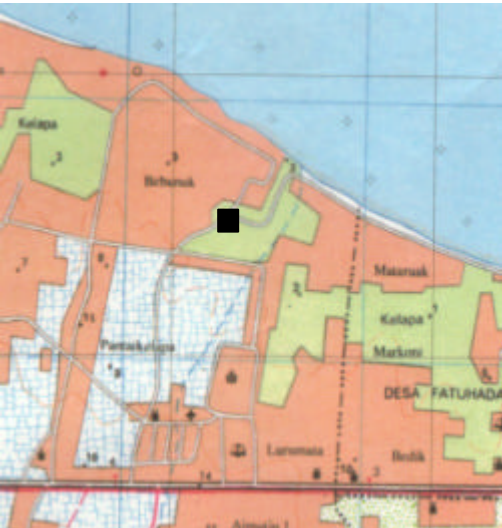


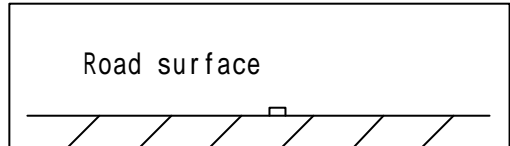

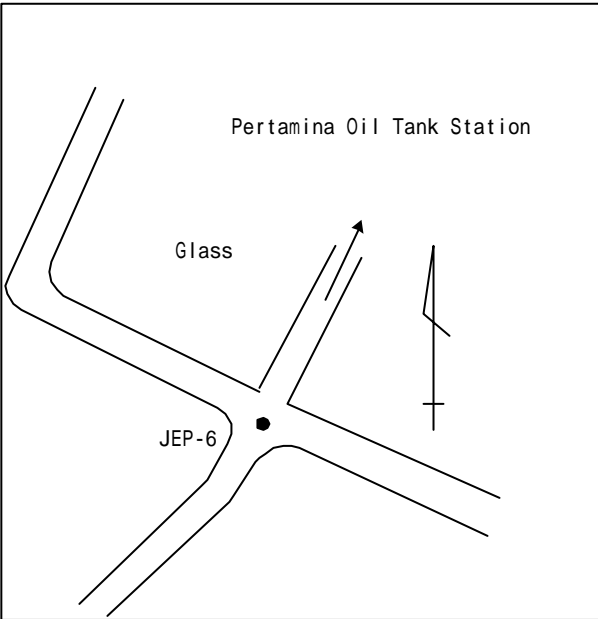
Point No.	JEP - 4	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 4			12.741 m
Location	0.5 km west from the rotary to Comoro Airport and center of the road		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

DESCRIPTION OF LEVELING POINT

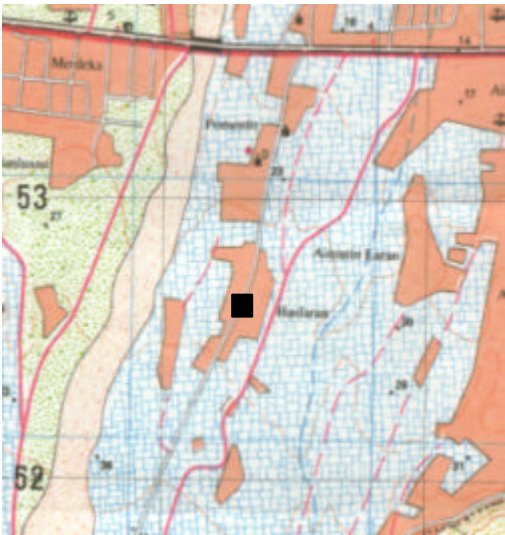

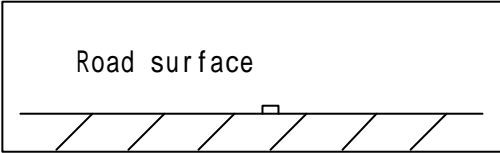

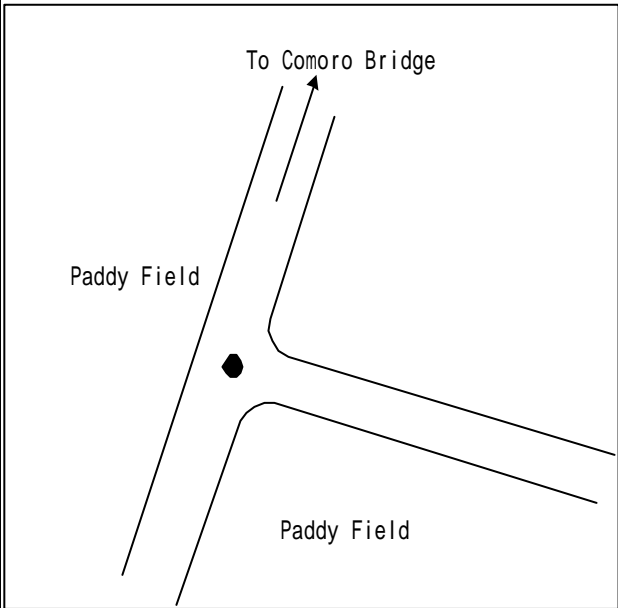
Point No.	JEP - 5	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 5			22.579 m
Location	Southern side of the Comoro Bridge and the center of the old road		
Date of establishment	2000/3/22		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

1:25,000

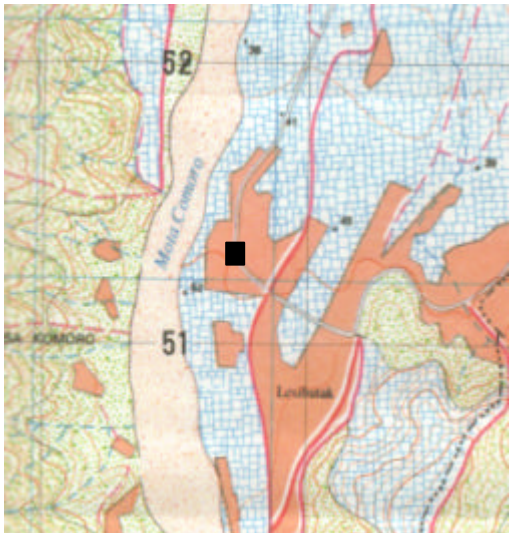


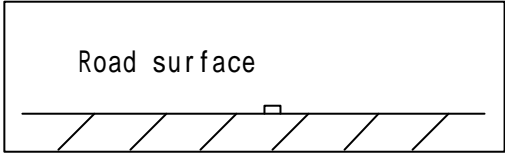

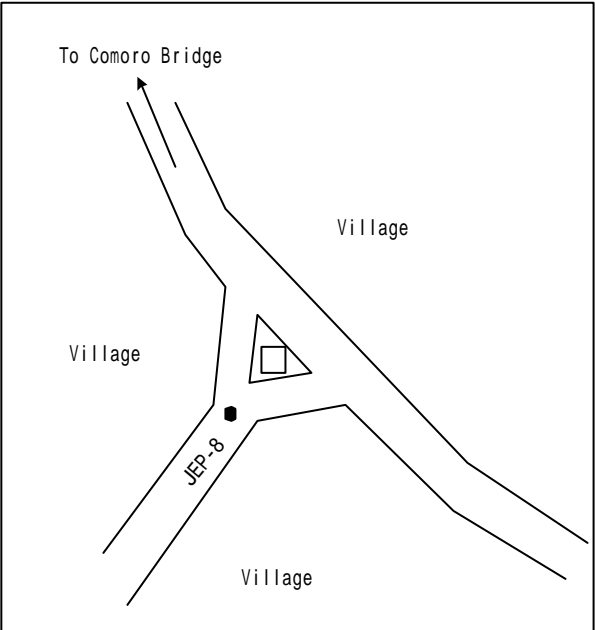
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 6	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 6			5.688 m
Location	In front of the Prutamina Oil Tank Station and the center of the road junction		
Date of establishment	2000/3/20		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
			
<p style="text-align: right;">1:25,000</p>		<p style="text-align: center;">Road surface</p>	
Aerial Photo		Sketch	
			




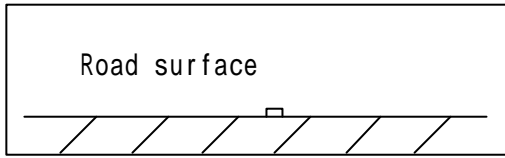
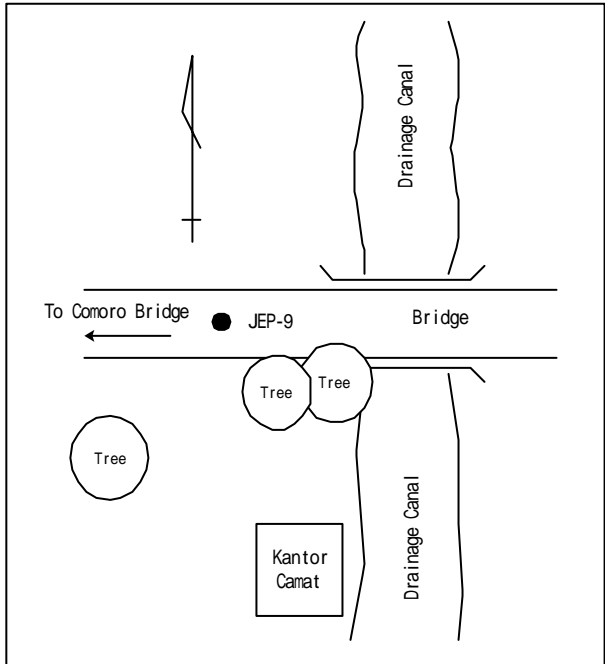
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 7	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 7			28.224 m
Location	1 km from the road between Comoro Airport and Dili City and the center of the road		
Date of establishment	2000/3/24		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
1:25,000		Profile	
			
Aerial Photo		Sketch	
			



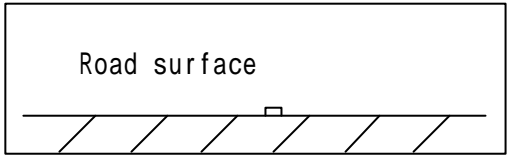
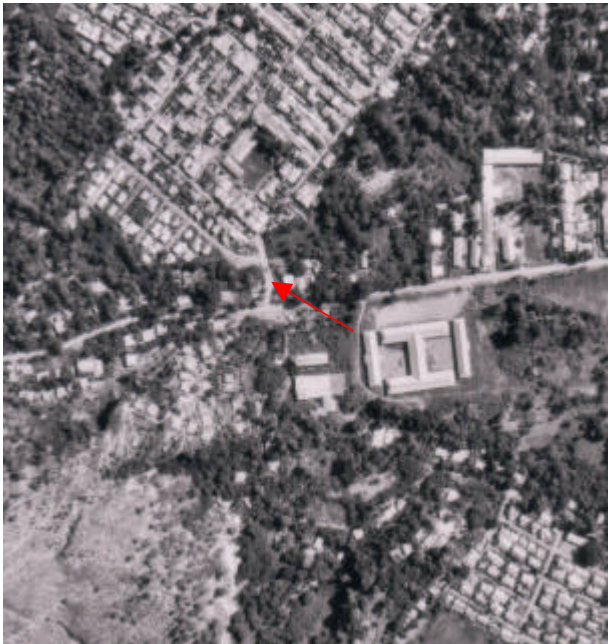
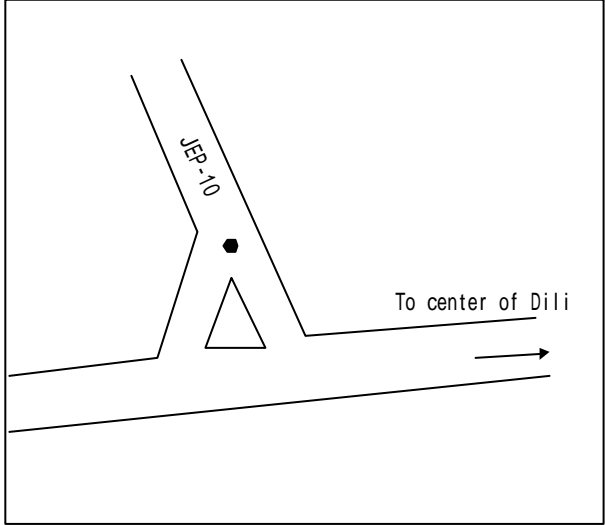
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 8	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 8			43.892 m
Location	2 km from the road between Comoro Airport and Dili City and the corner of the tria		
Date of establishment	2000/3/26		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

DESCRIPTION OF LEVELING POINT

Point No.	JEP - 9	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 9			6.020 m
Location	In fron to the Kantor Camat and the center of the road		
Date of establishment	2000/3/30		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		<p style="text-align: center;">Profile</p> 	
<p style="text-align: right;">1:25,000</p>		<p style="text-align: center;">Sketch</p> 	

DESCRIPTION OF LEVELING POINT

Point No.	JEP - 10	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 10			21.211 m
Location	The corner of the triangle of the road at Kakaulidung Village		
Date of establishment	2000/3/24		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level: Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

1:25,000

DESCRIPTION OF LEVELING POINT

Point No.	JEP - 11	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 11			4.715 m
Location	In front of the rotary to the central market		
Date of establishment	2000/3/26		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		

Location Map

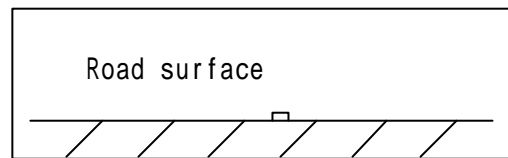


1:25,000

Field Photo



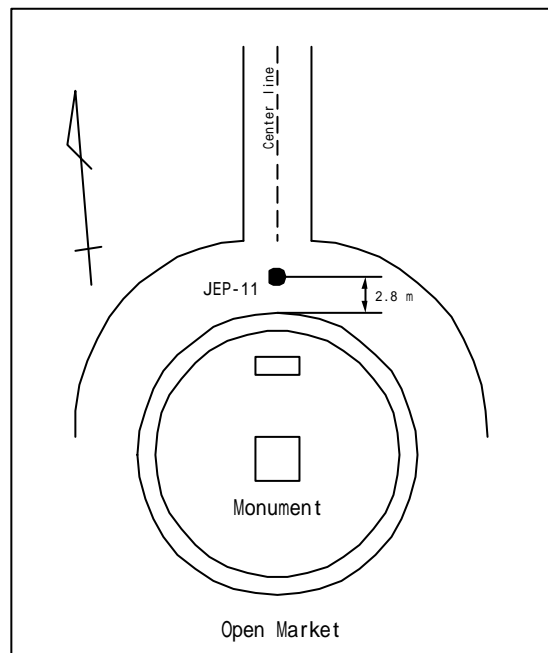
Profile





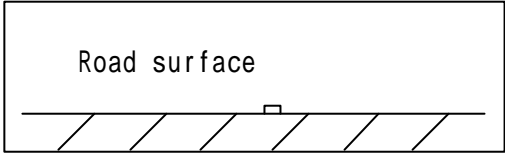

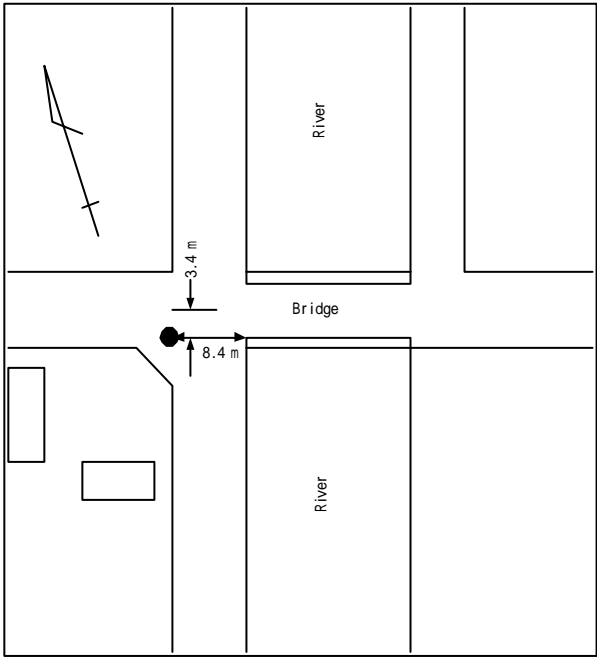
Aerial Photo



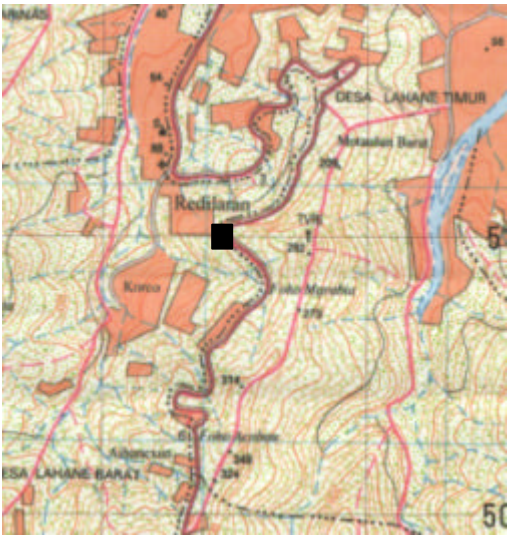

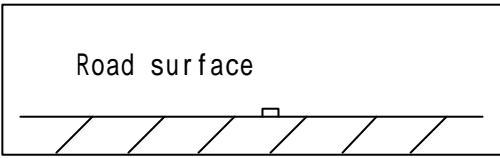
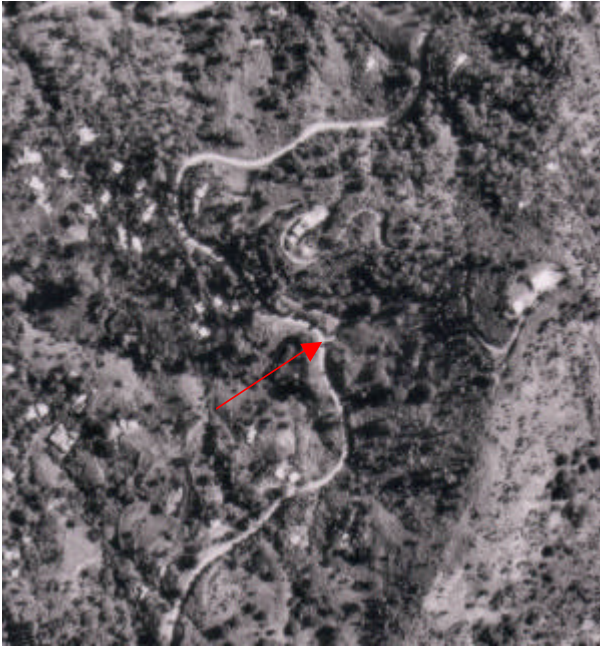
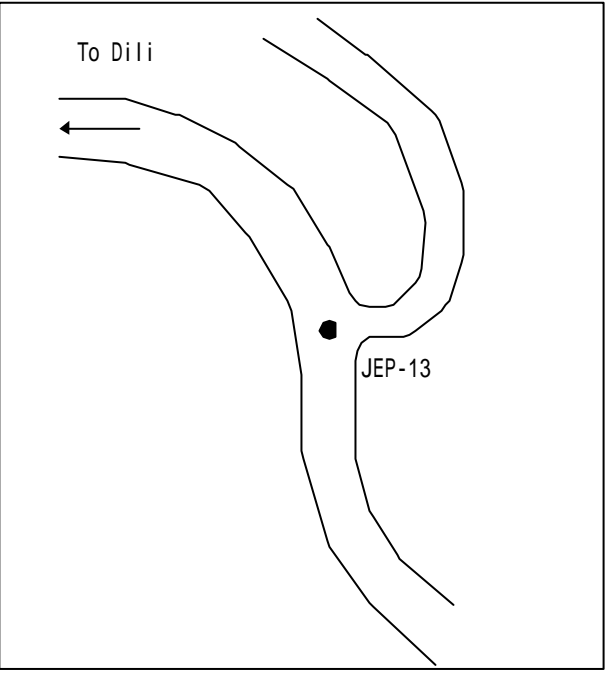
Sketch





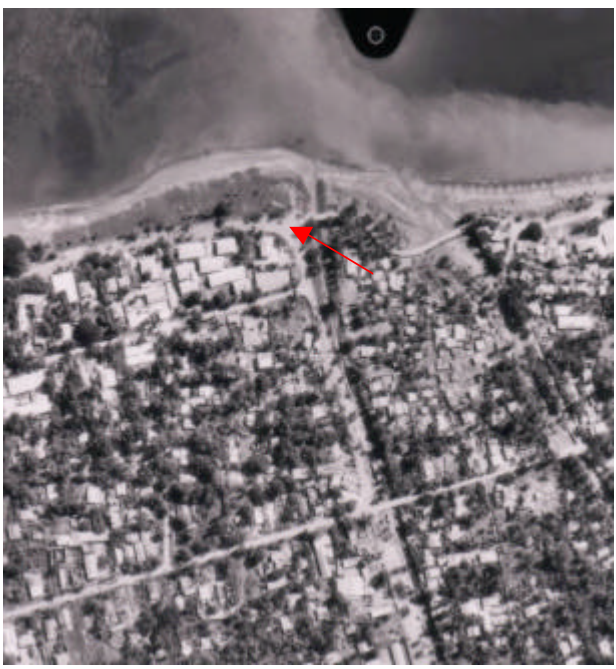
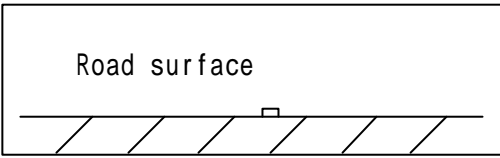
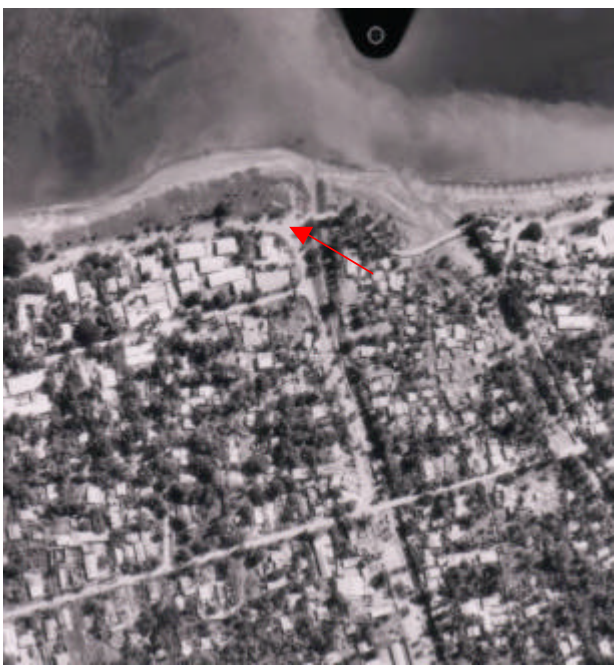
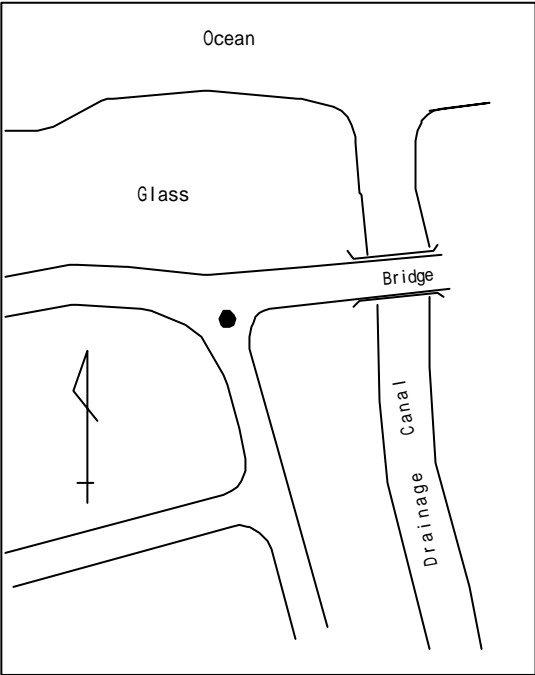
DESCRIPTION OF LEVELING POINT

Point No.	JEP - 12	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 12			30.557 m
Location	1 km south from the rotary at central market and the corner of the road		
Date of establishment	2000/3/30		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
 <p style="text-align: right; margin-right: 50px;">1:25,000</p>			
		Profile	
			
Aerial Photo		Sketch	
			

DESCRIPTION OF LEVELING POINT



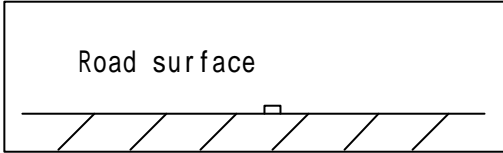

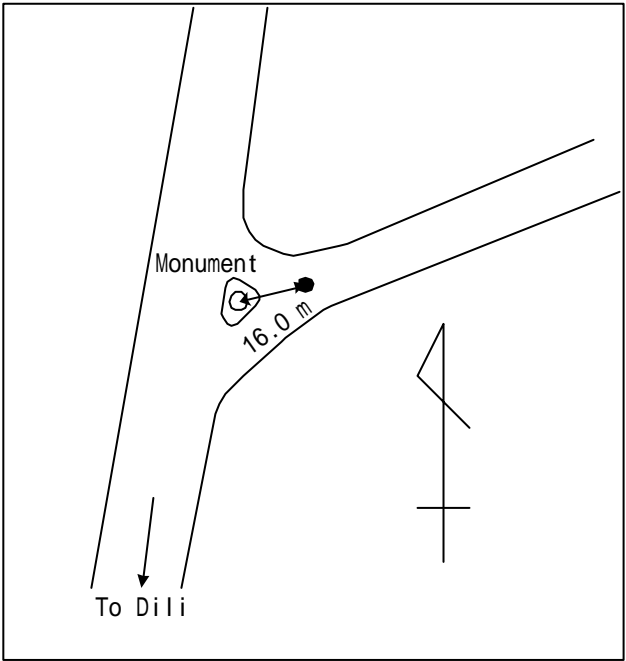
Point No.	JEP - 13	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 13			210.138 m
Location	The center of junction between the road from Dili to Aileu and to telecommunication		
Date of establishment	2000/4/3		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
		1:25,000	
Aerial Photo		Sketch	
			

DESCRIPTION OF LEVELING POINT

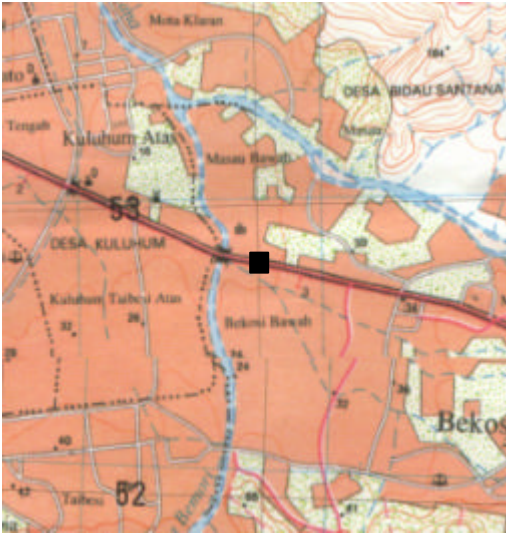

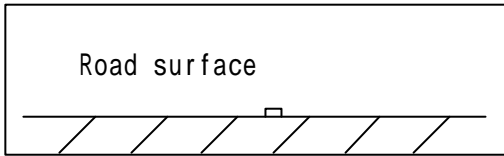

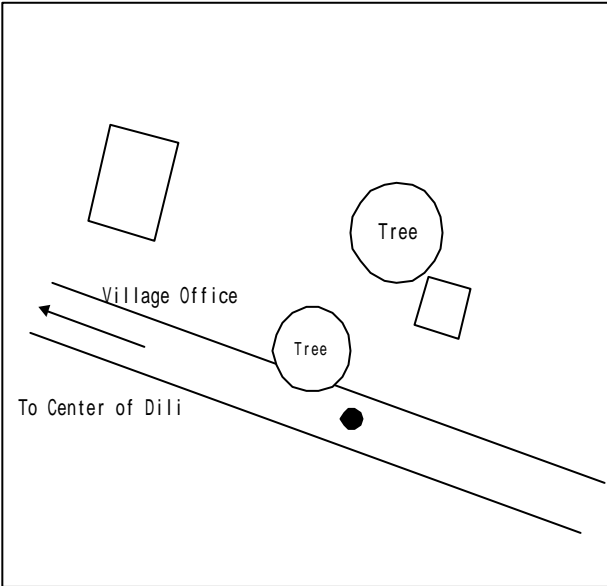
Point No.	JEP - 14	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 14			4.540 m
Location	The center of the junction of coastal road (1.5 km east from UNTAET Building)		
Date of establishment	2000/4/6		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

1:25,000

DESCRIPTION OF LEVELING POINT

Point No.	JEP - 15	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 15			4.076 m
Location	The center of the junction of the road (5 km from UNTAET Building)		
	2000/4/6		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
 <p style="text-align: right; margin-right: 50px;">1:25,000</p>			
		Profile	
			
Aerial Photo		Sketch	
			

DESCRIPTION OF LEVELING POINT

Point No.	JEP - 16	Map sheet No.	
Ellipsoid	WGS-84	Projection/Coordinates	U.T.M.
		Zone No.	No. 51
Point	Horizontal coordinates		Elevation
	(N)	(E)	
JEP - 16			13.710 m
Location	In front of the Village Office at Kuluhum Village		
Date of establishment	2000/4/8		
Name of surveyor	Mr. Manabu Kawaguchi, Mr. Toru Watanabe, Mr. Julio, Mr. Manuel		
Equipment	Level:Topcon AT-M3		
Location Map		Field Photo	
			
		Profile	
			
Aerial Photo		Sketch	
			

1:25,000

Appendix 7 Samples of Data Sheets

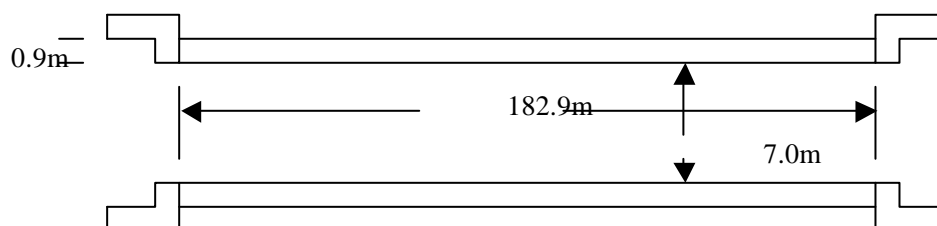
Field Identification List – Bridge

Field Identification No. B-9			
Aerial photo No.	R-5,147	List No.	
Name of bridge	Jembatan Comoro		
Location/Address	Comoro		
Name of the river	Sungai Comoro		
Types	Iron	Concrete	Wooden
Sizes	Length 182.9 m		Width 7.0 m
Conditions of Damages	Passable by vehicles		Impassable by vehicles
	Status	Proper	Partially damaged Repair required
Remarks:			

Field Photo



Description:



Date	08 / 04 / 2000
Surveyor	Julio Corrua / Manual Silva
Checked/Approved by:	H. Goto

Field Identification List – Church and mosque

Field Identification No. C-10				
Aerial photo No.	R-4,147	List No.		
Name of church /mosque/temple		Igreja Sao Jose		
Location/Address	Aimutin			
Religious classification	Christian	Islamic	Hindi	Buddhism
Conditions of Damages	Roof	Existing	Not existing	
	Fire	Burnt	Not burnt	
	Usage	Closed down	Partially using	Using
	Rehabilitation	Non	Partially done	Completed
Remarks: Rehabilitation is not necessary.				

Field Photo



Description:

Date	10 / 04 / 2000
Surveyor	Julio Correia / Manuel da Silva
Checked/Approved by:	H. Goto

Field Identification List – Government Offices and public buildings

Field Identification No. G-36				
Aerial photo No.	R-5,121	List No.		
Name of Building				
Location/Address	Balide			
Former name of the building	Kantor PM (Polisi Militer)			
Conditions of Damages	Roof	Existing	Partially existing	Not existing
	Fire	Burnt	Partially burnt	Not burnt
	Usage	Closed down	Partially using	Using
	Rehabilitation	Non	Partially	Completed
Remarks: Kantor = Office, PM = Polisi Militer = Military Police				

Field Photo



Description:

Date	19 / 04 / 2000
Surveyor	Julio Correia / Manuel da Silva
Checked/Approved by:	H. Goto

Field Identification List – Schools and colleges

Field Identification No. S-3			
Aerial photo No.	R-5,119	List No.	
Name of school	SMPN 3		
Location/Address	Becusse, Becora		
Classification	Primary	Secondary	High school College/University
Conditions of Damages	Roof	Existing	Not existing
	Fire	Burnt	Not burnt
	Usage	Closed down	Partially using Using
	Rehabilitation	Non	Partially Completed
Remarks: The building was partially burnt.			
SMPN = Sekolah Menengah Pertama = National junior high school			

Field Photo






Description:

Date	11 / 04 / 2000
Surveyor	Julio Correia / Manuel da Silva
Checked/Approved by:	H. Goto

Appendix 8 Sample of Key for Photo Interpretation Data Sheet

Keys for Photo Interpretation

Flight line	Run-9	Photo No.	94 / 95	Land coverage	Paddy field	Code No.	K-19
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Field Photo	Stereo Aerial Photo	
		

Remarks:

Date	5, May 2000	Surveyor (s)	Julio Correia / Manuel da Silva	Checked by	H. Goto
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Keys for Photo Interpretation

Flight line	Run-17	Photo No.	56 / 57	Land coverage	Mangrove	Code No.	K-24
-------------	--------	-----------	---------	---------------	----------	----------	------




Field Photo	Stereo Aerial Photo	
		

Remarks:

Date	5, May 2000	Surveyor (s)	Julio Correia / Manuel da Silva	Checked by	H. Goto
------	-------------	--------------	---------------------------------	------------	---------

Keys for Photo Interpretation

Flight line	Run-9	Photo No.	94 / 95	Land coverage	Farm land	Code No.	K-26
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Field Photo	Stereo Aerial Photo	
		

Remarks:

Date	5, May 2000	Surveyor (s)	Julio Correia / Manuel da Silva	Checked by	H. Goto
------	-------------	--------------	---------------------------------	------------	---------

Keys for Photo Interpretation

Flight line	Run-8	Photo No.	21 / 22	Land coverage	Grass Land	Code No.	K-2
-------------	-------	-----------	---------	---------------	------------	----------	-----

Field Photo	Stereo Aerial Photo	
 <p>A color photograph showing a grassy hillside under a cloudy sky. In the foreground, there are some trees and a fence line.</p>	 <p>A black and white aerial photograph, the left pair of a stereo image, showing a top-down view of the same grassy hillside. The terrain appears textured with grass and some small structures or paths.</p>	 <p>A black and white aerial photograph, the right pair of a stereo image, showing the same grassy hillside from a slightly different perspective to create a 3D effect when viewed.</p>

Remarks:

Date	5, May 2000	Surveyor (s)	Julio Correia / Manuel da Silva	Checked by	H. Goto
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**Appendix 9 Additional Request from the Land and Property Section
of UNTAET**

UNITED NATIONS



NATIONS UNIES

UNTAET

United Nations Transitional Administration in East Timor

Land and Property Unit – GPA
DILI, EAST TIMOR

JICA
Village of Farol
Dili
EAST TIMOR

13 June 2000

Dear Sirs

JICA AERIAL MAPPING PROJECT

The Land and Property Unit of GPA, UNTAET in Dili, East Timor, notes that the Government of Japan through JICA has initiated a topographic mapping project covering the City of Dili with aerial photography at a scale of 1:8,000 and orthophoto maps at a scale of 1:2,000.

It is understood that this project, which also includes aerial photography coverage of the cities of Baucau, Liquicá and Manatuto, is already well advanced. The aerial photography, maps and survey control produced through as outputs from this project will be of considerable interest and value for the operations of the Land and Property Unit

The responsibilities of the Land and Property Unit include investigating abandoned properties and land disputes as well as re-establishing the land registration and cadastral survey systems. These activities require suitable maps to aid in identifying the locations of the individually owned land parcels and buildings, however most of the previous records and maps were destroyed during the violence following the independence vote last year and new maps will be required as soon as possible.

While for some of the Unit's activities the proposed 1:2,000 scale orthophoto maps will be satisfactory, a scale of 1:1,000 is better suited to land registration when mapping the small sized urban allotments in Dili and including on the maps other essential information such as allotment identifiers.

We would therefore be grateful if you could advise if it is possible to include as part of your project the production of orthophoto maps at 1:1,000 scale that can be used for land registration and as a base for cadastral mapping. This might be achieved by enlarging the original orthophoto negatives or digital data. While it is appreciated that there will be a resulting degradation in the accuracy and resolution,

this would be acceptable in order to obtain the larger scale needed to support urban cadastral mapping in Dili.

It has also been noted that the project schedule provides for the 1:2,000 scale orthophoto maps to be produced during the month of June, 2,000. While this would generally fit with our proposals for re-establishing initial registration activities in July/August, we are commencing about 19 June, 2,000, a cadastral mapping project within in the villages of Farol and Colmera for which suitable base maps will be required. The location of the area to be covered by the project is indicated on the attached map of the city of Dili.

This project is aimed at developing a process suitable for identifying and mapping all individual land parcels, initially in the pilot project area, but later intended for expansion to other villages in Dili and East Timor. We would therefore also be interested in learning if the 1:2,000 scale orthophoto maps and either 1:1,000 scale enlargements (or alternatively 1:1,000 scale air photo enlargements) covering project area could be made available for this pilot about the middle of June. We would prefer not to have contours on the orthophotos as they would obscure ground details. We require paper copies for field work but also require digital data since we also intend to digitally construct the boundary lines as an overlay to the orthophoto image.

In summary the map products we are seeking covering the indicated area in order to support this cadastral mapping pilot project are as follows:

1. 2 copies of 1:2,000 scale orthophoto maps on photographic paper;
2. 2 copies of 1:1,000 scale orthophoto enlargements on photographic paper (enlarged from 1:2,000 scale orthophoto maps or digital data);
3. 1 positive film copy of 1:1,000 scale orthophoto enlargements for dyeline copying
4. Digital orthophoto map data.

After completion of the pilot project this work would be extended to all areas of Dili and similar products would be required for the total area mapped. Later this year it is also expected that registration activities may be commenced in other district centres with the aerial photography coverage at 1:8,000 scale of Baucau, Manatuto and Liquicia initially being suitable for this purpose in the form of 1:1,000 scale air photo enlargements.

I would be grateful if you could advise if the above requests can be satisfied and what further action is required on our part to initiate the work and arrange supply.

Yours sincerely



Nigel Thomson
Legal Counsel, UNTAET Land and Property Unit

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DILI - EAST TIMOR

