

(3) Compilation	1:4,000	300 km ² (40 sheets)
	1:10,000	2,000 km ² (61 sheets)
		(Reduced compilation was made for 300 km ²)
(4) Field completion	1:4,000	300 km ² (40 sheets)
	1:10,000	1,700 km ² (57 sheets)
(5) Drafting (inking)	1:4,000	300 km ² (40 sheets)

2-6 Plan and Results

Items of Work	Plan	Results	Remarks
Aerial Triangulation	422 models	425 models	
Stereo Plotting			
1:4,000	300 km ²	300 km ²	40 sheets
1:10,000	1,700 km ²	1,700 km ²	57 sheets
Compilation			
1:4,000	300 km ²	300 km ²	40 sheets
1:10,000	2,000 km ²	2,000 km ²	61 sheets
Field Completion			
1:4,000	300 km ²	300 km ²	40 sheets
1:10,000	1,700 km ²	1,700 km ²	57 sheets
Drafting			
1:4,000	300 km ²	300 km ²	40 sheets

2-7 Survey Equipment

Main equipment and instruments used for the second year work are as follows:

(1) Aerial triangulation

Pricking device	PUG-II (WILD)	2 sets
Stereo comparator	STECOMETER (ZEISS)	1 set
Comuter	FACOM M-360R (FUJITSU)	1 set

(2) Stereo plotting

Automatic drawing device	XYNETICS (DAINI SEIKOSHA)	1 set
Stereo plotter	STEREO PLOTTER A8 (WILD)	3 sets
	PLANIMAT D2 (ZEISS)	1 set
	PLANICART E2 (ZEISS)	2 sets

(3) Field completion

Total station (Transit with distance meter)	SET-III (SOKKISHA)	1 set
Auto level	NIKON AE (NIKON)	2 sets
Plane table	(TAMURA MFG.)	4 sets

2-8 Survey Schedule

Survey schedule of the second year field work is shown in the Appendix-1.

2-9 Supervision of Field Work

During the second year field work, JICA sent the following technical advisor and JICA staff to Bangkok for technical meeting with the Thai side including BMA and supervision of the field work:

Kiyoshi MIURA Head of National Large Scale Mapping Div.,
Topographic Dept., Geographical Survey Institute
(GSI), Ministry of Construction
December 4, 1987 - December 10, 1987
January 23, 1988 - January 29, 1988

Takeshi NAKANO Deputy Head of First Development Survey Div., Social
Development Cooperation Dept., JICA
January 19, 1988 - January 27, 1988

2-10 Technical Meetings with Thai Side

Technical meetings with Thai side were held at the time of initiation of the field work in early December, 1987 and at the time of completion of the field work in late January 1988. The minutes of discussion is shown in the Appendix-2.

2-11 Cooperation of Thai Counterparts

BMA and RTSD counterparts were assigned for the field work. The counterparts gave close cooperation to the Japanese survey team in conducting guide in the field and negotiation with local inhabitants as well as in confirmation of geographical names, etc.

Names of the counterparts are listed as follows:

	BMA	RTSD
Headquarters	Mr. CHAILURT	Mr. RONNACHAI
Field Completion	Mr. SURIYA Mr. SURASAK Mr. SUPPACHAI Mr. PREECHA Mr. SUPOTT	Mr. SUPPAREK Mr. PANDIT Mr. WIRAT Mr. SIRIWAT Mr. UTHAI

While, RTSD counterparts who participated in the office work in Japan were as follows:

Name	Period
Mr. SOMSAK Mr. KRID	June 22, 1987 - September 30, 1987
Mr. CHAMNONG Mr. BOONLERT	September 22, 1987 - December 31, 1987
Mr. RATCHAI Mr. PATTHANAPONG	December 22, 1987 - April 7, 1988

3. Aerial Triangulation

3.1 Outline of Work

Aerial triangulation was conducted to obtain geodetic coordinates of pass and tie points necessary for stereo plotting based on results of the ground control points and leveling points.

(1) Specifications

Photo scale: 1:20,000
Number of courses: 17 courses
Number of models: 425 models
Control points: 82 points (planimetry)
225 points (height)
Adjustment computation: Block adjustment method (Independent model)

(2) Main instruments

Pricking device: PUG-II (WILD)
Stereo comparator: STECOMETER (ZEISS JENA)
Computer: FACOM M-360R (FUJITSU)

(3) Camera and other data

Camera: RC-10 (WILD)
Focus length: 153.79 mm
Lens: AVIOGON
Distortion: (see the following table)

Radius	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	145	Grad
Distortion	0	-2	-3	-4	-4	-4	-4	-1	1	3	4	3	2	-1	0	0	μ

3.2 Point Selection and Pricking

Selection of pass points, tie points, etc. was conducted using contact prints. In consideration of block adjustment by independent model method, 6 pass points were selected per model and 1 tie point per model

was selected in the area overlapped with the adjacent course. Positions of pass points and tie points were enclosed with red circles (diameter: approx. 7 mm) on the contact prints.

Pricking device (PUG-II) was used for transferring the points on diapositives and marking was then conducted on diapositives with red circles of approx. 7 mm diameter. Transfer of control points were conducted on diapositives using pricking device stereoscopically according to description sheets of ground control points, leveling points.

3-3 Measurement of Photo Coordinates

Coordinate measurement of fiducial marks at the four corners of the photo, control points, pass points and tie points was conducted at the measuring unit of 1μ using the Stecometer.

3-4 Inner Orientation

Residual of the fiducial marks were transformed to the coordinate system whose origin was the project center of camera, and measurement of the fiducial marks of 4 corners was conducted by using the Hermet's transformation. Mean square error and the maximum of the fiducial mark residuals were as follows:

Mean square Error	Maximum	Remark
13.3 μ	20.0 μ	JICA SPECS. LIMIT Max. 30 μ

3-5 Relative Orientation

Relative orientation was conducted using all pricked points of model and refraction was corrected. Mean square error and the maximum of the residual parallax on the diapositives in the relative orientation are as follows:

Mean square error	Maximum	Remark
6.7 μ	19.9 μ	JICA SPECS. LIMIT Max. 30 μ

3-6 Successive Orientation

Successive orientation was conducted using all pass points included in the common area with the adjacent model.

Mean square error and the maximum of discrepancies in the successive orientation are as follows:

Mean square error			Maximum			Remark
X	Y	Z	X	Y	Z	
$\%$	$\%$	$\%$	$\%$	$\%$	$\%$	JICA SPECS. LIMIT Max. 0.5 $\%$
0.01	0.11	0.15	0.04	0.35	0.35	

3-7 Adjustment Computation

Simultaneous adjustment computation, forming the entire project area into one block, was carried out on planimetry and height by the independent model method. All points, without any neglects of control point, were used for the adjustment computation. The aerial triangulation network is shown in Fig. 1.

Mean square error and the maximum of the residual of control points and the discrepancy of tie points in the adjustment computation of aerial triangulation are as follows:

Residual of control points

Number of Courses	Number of Models	Number of control points		Residual of control points (Planimetry)		Residual of control points (Height)		Remarks
		Planimetry	Height	Mean square error	Maximum	Mean square error	Maximum	
Courses 17	Models 425	Points 82	Points 225	m 0.52	m 1.13 (0.38%)	m 0.39	m 1.10 (0.37%)	JICA SPECS. LIMIT Planimetry 0.8% Height 0.8%

Discrepancy of tie points

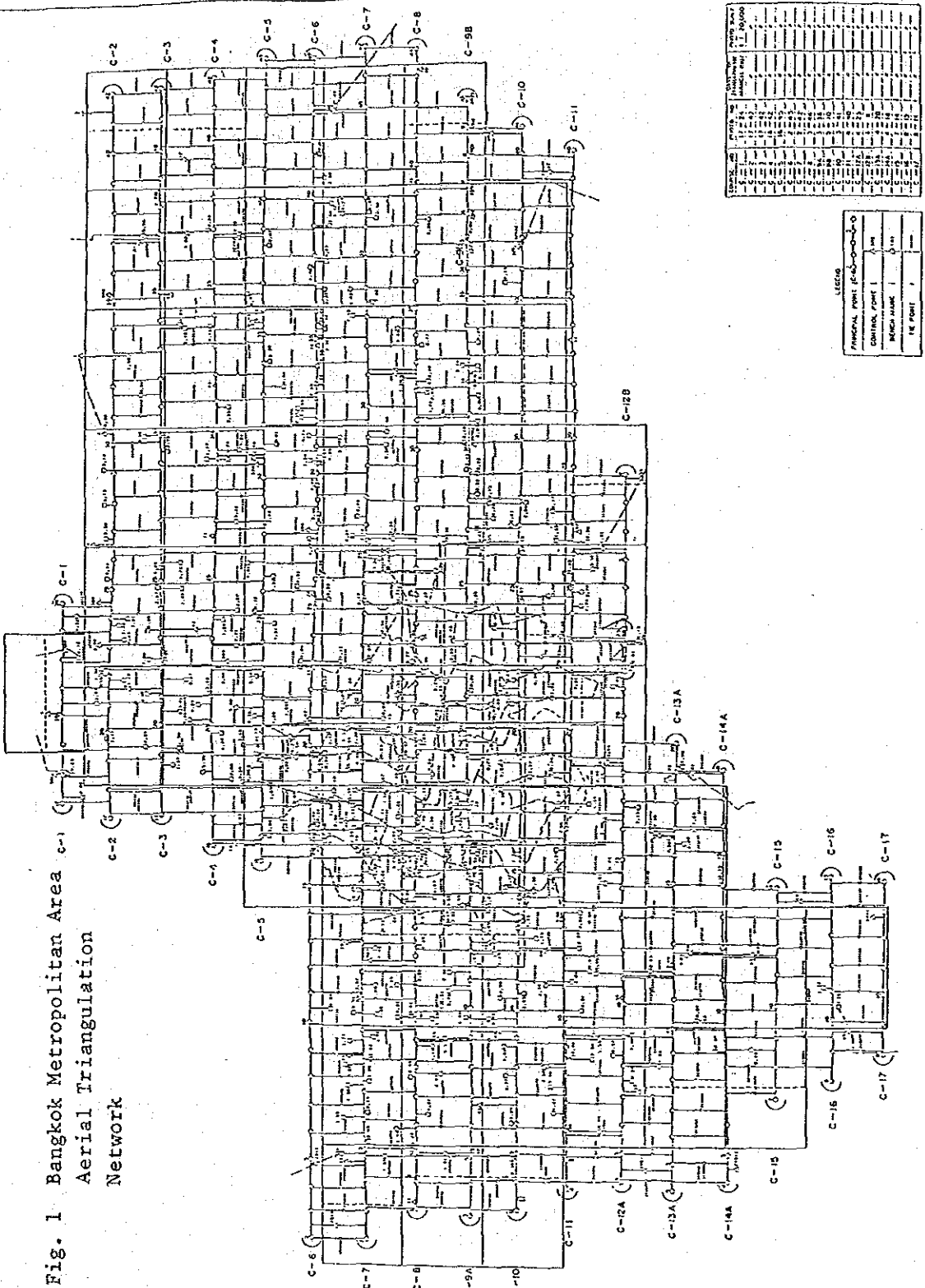
Planimetry		Height		Remarks
Mean square error	Maximum	Mean square error	Maximum	
m 0.24	m 0.54 (0.18%)	m 0.19	m 0.64 (0.21%)	JICA SPECS. LIMIT Planimetry 0.8% Height 0.8%

Such excellent results with accuracy of largely less than the limits of the specifications were attributable to the following facts:

- The control points were well distributed.
- The aerial triangulation was conducted using the program of block adjustment method (independent model).
- The aerial photography was implemented exactly following the flight courses specified in the original plan.

BANGKOK METROPOLITAN AREA AERIAL TRIANGULATION NETWORK

Fig. 1 Bangkok Metropolitan Area Aerial Triangulation Network



LEGEND

PRINCIPAL POINT	(Symbol)
CONTROL POINT	(Symbol)
ADJUTANT POINT	(Symbol)
TRIP POINT	(Symbol)

POINT NO.	POINT NAME	CLASSIFICATION	COORDINATES	HEIGHT	REMARKS
1					
2					
3					
4					
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100					

4. Stereo Plotting

4-1 Outline of Work

Stereo plotting was conducted by stereo plotter based on results of the aerial triangulation, the field identification, etc.

4-2 Specifications

Plotting scale: Same as the scale of each map

Coverage: 300 km² for the 1:4,000 topographic map
1,700 km² for the 1:10,000 topographic map

Restitution instrument: STEREO PLOTTER A8
PLANIMAT D2
PLANICART E2

Projection: UTM

Neat lines:
1:4,000 topo. map: 2.5 x 3.75 km (62.5 x 93.75 cm on the map)
1:10,000 topo. map: 5.0 x 7.0 km (50.0 x 75.0 cm on the map)

Sheet index: Code numbers and sheet names are shown in Fig. 2 and 3.

Sheet materials: Plotting sheet polyester base #500
Control point sheet polyester base #300

Plotting of control points: Automatic drafting machine XYNETICS

Accuracy: Planimetry Class A
Height Class A

Measuring interval for spot height: in every 5 cm on the map
including control points.

Contour line: 2 m contour intervals

4-3 Stereo Plotting

(1) Plotting of control points, etc.

Automatic drafting machine was used for plotting the sheet lines, control points, pass points, tie points, etc. on the plotting sheets with a plotting error of less than 0.2 mm on the map.

(2) Orientation

The relative orientation was carried out by using 6 pass points. Results of the relative orientation residual parallax were not exceeding 0.02 mm on diapositives.

The absolute orientation was conducted by using pass points, tie points, control points, leveling points. Results of the absolute orientation were entered in the record sheet of orientation. According to the results, the maximum errors of the absolute orientation are as follows:

Scale	Planimetry (on the map)	Height	Remark
1:4,000	0.2 mm	0.3 m	JICA SPECS. LIMIT Planimetry 0.3 mm
1:10,000	0.3 mm	0.5 m	Height 0.5 m

(3) Plotting

- 1) Technical instructions regarding specifications for plotting were given to machine operators and explanation was made with respect to application of the symbols and specification, practical method of the plotting and the matching, etc. so as to attain unified and homogeneous results among the operators work.
- 2) Plotting, based on the symbol and specifications agreed between Japan and Thailand, was carried out using the field identification results in the order of linear features (roads, rivers, railways, etc.), buildings, vegetation and contour lines.

3) Color assignment for plotting was as follows:

Black: Roads presented to scale, railways, buildings

Red: Symbolized roads, indicated points, fences, small objects, revetment

Green: Vegetation boundaries, vegetation symbols, roads in park

Orange: Contour lines

Violet: Coastal lines, rivers, lakes, fish ponds, salt beds

4) The project area covers urbanized and congested districts. The crowded symbolization being expected, attention was paid to the plotting so as not to make unclear presentation. Buildings were plotted each by each.

5) In the delineation of contour lines, attention was paid so as not to sacrifice the elevation accuracy and not to deform the presentation of topography.

6) Spot heights were measured twice independently and the mean was adopted. The measuring unit of 0.1 m was specified. The measuring interval for spot height was approx. 5 cm on the map including control point. The positions were pricked on the control point data sheets and the plotting manuscripts, and the measured values were recorded on the control point data maps. The spot heights were selected according to the following principles:

o Main fork of roads

o Junction of rivers

o High points or depressions in the area

o Other points indispensable for clear presentation of topography

7) Consistency between spot height and contour line was checked.

8) Matching of sheets was made not by tie-strip but direct matching.

4.4 Inspection

After the completion of stereo plotting, the plotting manuscripts were checked by comparing with the aerial photos used for field identification, the data collected, the symbol and specifications, etc. Errors and omissions were corrected and supplemented respectively.

While, uncertain items were marked for the convenience of confirmation to be made in the field completion.

TOPOGRAPHIC MAPPING SHEET INDEX
FOR
1:4,000

Fig. 2 Topographic Mapping Sheet Index
for 1:4,000

6-4-B 7-3-A PRACHA CHUK		7-3-C HO WANG			
6-4-D BANG SON	10-2-B BANG SU	10-2-A BANG PHLAT	11-1-A SUAN CHATUCHAK	11-1-B LAT PHRAO	
10-1-D TALING CHAN	10-2-D DUSTI	10-2-C BANG YIKHAN	11-1-C DIN DAENG	11-1-D HUAI KHUANG	11-2-C KHLONG CHAN
10-3-B PHRAN NOK	10-4-B URUPHONG	10-4-A PHRA NAKRON	11-3-A MAKOSAN	11-3-B PHRONG SAMSEY	11-4-B RANKHAMHENG
10-3-D KHLONG BANG WAEX	10-4-D BANG RAK	10-4-C WONG WIAN YAI	11-3-C SUAN LUMPINI	11-3-D EKKAMAI	11-4-C HUA MARK
14-1-B BANG KHUN THIAN	14-2-B YANAWA	14-2-A KHONG THEP BRIDGE	15-1-A KHONG TOEI	15-1-B PHRA KHANONG	15-2-A ONNUT
	14-2-D RAMA 9 BRIDGE	14-2-C RAT BURANA	15-1-C BANG KACHAO	15-1-D BANG CHAK	15-2-C UDOM SUK
	14-4-B 15-3-A PAK LAT		15-3-B BANG NA		

LEGEND

11-1-A
SUAN CHATUCHAK

— CODE NUMBER
— SHEET NAME

TOPOGRAPHIC MAPPING SHEET INDEX
FOR
1 : 10,000

Fig. 3 Topographic Mapping Sheet Index
for 1:10,000

	9-1 PHUTTA WORTHON	9-2 BAN KHLONG BANG KHUSSI	9-3 KATJUA BAEK	13-1 BAN SONGE USAM	3-3 BAN TALAT MAI DOK MUANG	3-4 BAN TALAT WAT KO	4-3 BAN KHLONG SAM WA	4-4 BAN KHLONG PAET	4E-4 BAN KHLONG SIP SI
	9-2 BAN KHLONG BANG KHUSSI	9-4 BAN KHLONG BANG PHAI	10-1 TALING CHAN	10-2 DUSIT	7-1 BANG PHEN	7-2 BAN BUA MOK	8-1 BAN KHLONG TAYAN TOK	8-2 BAN BACH CHAOD	8E-2 BANG NAM PHED
	13-2 ZONG KHACHA	13-4 BAN KHLONG BANG BON	10-3 KHLONG BANG WAK	10-4 PIRA NAKHON	7-3 WASETSART	7-4 BAN KO DON	8-3 MIR BURI	8-4 BAN KO	8E-4 BAN BUNG THONGLANG
	13-2 ZONG KHACHA	13-4 BAN KHLONG BANG BON	14-1 PHASI CHARDEN	14-2 BAT BURANA	11-1 HUA KHUANG	11-2 BANG MARI	12-1 BAN KHLONG LO LAE	12-2 BAN HUNG BUA	12E-2 BAN BUNG LAN KHLO
	17-2 BAN BANAY	17-4 BAN KO PHO	10-3 KHLONG BANG WAK	10-4 PIRA NAKHON	11-3 MAKSASAN	11-4 HUA WAK	12-3 BAN KHLONG HUNG	12-4 LAT WANGANG	12E-4 BAN LAW TOTING
	17-2 BAN BANAY	17-4 BAN KO PHO	14-3 BANG KHUR THAN	14-4 BAN KHLONG BANG MOT	15-1 PIRA KHANGONG	15-2 BAN NONG BON	16-1 BAN MANAM THUT	16-2 BANG PHLI	16E-1 BAN THAP YAO
	18-1 BAN HUA KHABU	18-3 BAN LUK WUA	18-1 BAN HUA KHABU	18-2 BAN KHONG YA SON	15-3 PIRA PRABENG	15-4 BAN KHONG BAN DAENG	16-3 BAN KHONG BANG KHEE YAI		
	18-1 BAN HUA KHABU	18-3 BAN LUK WUA	18-1 BAN HUA KHABU	18-2 BAN KHONG YA SON	15-3 PIRA PRABENG	15-4 BAN KHONG BAN DAENG	16-3 BAN KHONG BANG KHEE YAI		
	18-3 BAN LUK WUA	18S-1 KHLONG SI KHUAM	18-1 BAN HUA KHABU	18-2 BAN KHONG YA SON	15-3 PIRA PRABENG	15-4 BAN KHONG BAN DAENG	16-3 BAN KHONG BANG KHEE YAI		

LEGEND

— CODE NUMBER
— SHEET NAME

8-3
MIR BURI



1 : 4,000
MAPPING AREA

5. Compilation

5-1 Outline of Work

The compilation was conducted by using the plotting manuscripts, the field identification results, etc. according to the symbols and specifications agreed between Japan and Thailand.

5-2 Specifications

(1) Scale and coverage of the compilation

1:4,000	300 km ²
1:10,000	2,000 km ² *

* The compilation for 300 km² was made by the reduced compilation of the 1:4,000 plotting manuscripts.

(2) Number of sheets

1:4,000	40 sheets
1:10,000	61 sheets

(3) Neat lines

1:4,000	2.5 x 3.75 km (62.5 x 93.75 cm on the map)
1:10,000	5.0 x 7.5 km (50.0 x 75.0 cm on the map)*

* Extension was made for 3 sheets (4E-3, 4E-4 and 18S-1).

(4) Papers

Shrink-proof papers were used for the compilation as follows:

Compilation manuscripts:	polyester base #500
Data sheets	: polyester base #300

(5) Mechanical plotting

Neat lines, ground control points, etc. were plotted by automatic plotting machine. Discrepancy of neat lines and diagonal lines in length were limited less than 0.3 mm and 0.4 mm respectively.

5-3 Compilation

- (1) The compilation manuscripts were made in accordance with the JICA specifications for Overseas Surveying as well as with the symbol and specifications for 1:4,000 and 1:10,000 topographical maps which were discussed and agreed between Japan and Thailand. In view of the uniformity of map presentation, operational instructions were prepared for the unified compilation work.
- (2) The compilation was made by overlay method, and planimetric features and contoured lines were drawn on the same sheets.
- (3) The reduced compilation (1:10,000) was made by the photo-processing method after the completion of 1:4,000 map compilation, and selection of spot heights and annotations were conducted.
- (4) In view of the efficiency of the subsequent work such as field completion, drafting, etc., ground control point data sheet, annotation data sheet and road source map were prepared. With regard to the annotation data sheet which contains so many features to be presented, two kinds of data sheet: general annotation sheet (administrative names, geographical names, building names, etc.); and road annotation sheet (road names) were separately prepared.
- (5) The color assignment for the compilation was defined as follows:
Black: Roads drawn to scale, railways, buildings, spot heights
Red: Symbol roads, administrative boundaries, small features, fence/wall, function symbols
Green: Vegetation boundaries, vegetation, parks
Orange: Contour lines
Violet: Sea and rivers, water body such as lake and pond, fish ponds, salt bed
- (6) The compilation was carefully carried out so as not to make any mistakes or omissions. In case uncertain items found, necessary instructions were made on the overlay for the reference of the field completion.

5-4 Details of Compilation

- (1) Administrative boundaries and names were presented based on data provided by BMA.
- (2) Roads with more than 2 m in width for the 1:4,000 topographic map as well as those with more than 5 m in width for the 1:10,000 topographic map were drawn to scale and others were symbolized.
- (3) Railways were presented in single line running along the center line of the track for both of the single track and double track.
- (4) Buildings were presented as the isolated buildings on the 1:4,000 topographical map. On the 1:10,000 topographical map, presentation of the building was divided into the isolated buildings and the generalized area. Regarding such presentation, much efforts were exerted so as not to spoil the harmonious presentation of the urban area.
- (5) Solid buildings were marked with "k" and prominent buildings were colored in brown for better presentation.
- (6) With regard to the area for which the reduced compilation was made from 1:4,000 to 1:10,000, particular attention was paid to the planimetric features, vegetation, spot heights, etc. so as to keep consistency with the area for which the direct 1:10,000 plotting and compilation were made.
- (7) Particular attention was paid to the presentation of the depressions, the roads and the contour lines along rivers.
- (8) Matching was made directly on the compilation manuscripts.
- (9) Data sheets

The control point data sheet presented ground control points, leveling points and spot heights.

On the annotation data sheet, names or abbreviations were presented in consideration of the type of building and the space available. In particular, the annotation sheets of English version were prepared by the photo lettering in order to use those sheets as material for the preparation of Thai annotation sheets.

5-5 Inspection

After the completion of the compilation work, the compilation manuscripts were checked and corrected on overlaid sheets paying attentions to the collation with the field identification photos and data, the relation between contour lines and spot heights, the conformity with the symbol and specifications, etc. At the same time, uncertain items were marked as the items to be confirmed in the field completion.

6. Field Completion

6-1 Outline of Work

In the field completion, administrative boundaries, geographical names and other names were presented on the compilation manuscripts based on data provided by BMA, and then, in case necessary, the important items presented on the manuscripts were confirmed along with the supplementary or checking survey on the changes after aerial photography in the field.

6-2 Specifications

(1) Scale and coverage

1:4,000	300 km ²
1:10,000	1,700 km ² (in the field work)
	2,000 km ² (in the indoor work)

(2) Number of sheets

1:4,000	40 sheets
1:10,000	57 sheets (in the field work)
	61 sheets (in the indoor work)

(3) Data and reference materials

Main data and reference materials prepared for the field completion were as follows:

Compilation manuscripts ... Copies of polyester base (#250)

Compilation manuscripts ... Blue prints (Delmina SSP)

Ground control point data sheets

Annotation data sheets

Annotation sheets in English version

Road source map

Aerial photos used for the field identification

Symbol and specifications agreed between Japan and Thailand

Data provided by BMA

6-3 Preparatory Work in Japan

- (1) Plan of the field completion was formulated in consideration of the contents of work, the amount of correction of the changes after aerial photography, the work period, the schedule of succeeding work, etc.

The survey team was organized with the members who had participated in the field identification conducted in 1987.

- (2) Preliminary study was made precisely on the compilation manuscripts, and the uncertain items found in the course of plotting and compilation work as well as the items to be confirmed in the field were all marked.
- (3) Major changes after aerial photography for which supplementary survey being considered necessary were marked.
- (4) Matching to adjoining sheets was checked.
- (5) Sample maps were prepared for the confirmation of detailed specifications for drafting and printing, color tone, etc. as a reference material for the technical discussions with BMA.
- (6) Extension sample sheets were prepared by the Japanese side as the draft sheets.
- (7) Operational plan of the field completion was prepared in consideration of the above items.

6-4 Preparation of Field Work

For the preparation of field work, 4 headquarters members of the team arrived in Bangkok on December 1, 1987. The team started with the meeting with the Japanese organizations concerned as well as with BMA for the preliminary arrangements. At the same time, the team made arrangements for accommodations, take-over of the survey instruments, hiring of vehicles and laborers, etc.

- (1) Headquarters and accommodations

The following headquarters office was offered in the BMA building as one of the undertakings of BMA:

Address: Dinso Rd., Bangkok 10200

The accommodations were set up at the following address:

Bangkok Center Hotel: 328 Rama IV Rd., Bangkok

The hotel is situated near by the headquarters office and almost in the center of the project area as well as occupied convenient location for transportation.

(2) Communications

For business communications between Tokyo and Bangkok, telephone and telex were used. Communications in the project area were made by public telephones.

6-5 Formation of Field Party

Each party consisted of the team member, counterpart and labour with one vehicle.

6-6 Method of Work

- (1) To attain uniformed map presentation, operation manual was prepared so that unified confirmation work was made possible in the field completion.
- (2) The survey work was carried out by the way of extending its work coverage from the Center of Bangkok metropolitan area to its suburban area.
- (3) According to the detailed work plan, copies of the compilation manuscripts were carried in the field, and check and confirmation were conducted with regard to the suitability of plotting and compilation made on the manuscripts.
- (4) Major changes after aerial photography (bridge, highway, park, etc.) were surveyed and corrected by using TOTAL STATION (SET-III) and supplemented on the diapositives (polyester base). Small changes (housing development, etc.) were corrected by using plain table.

6-7 Details of Field Completion

- (1) The field completion proceeded according to the sheet assignment of which each party was in charge.
- (2) Annotation presented on the sheets was, with particular attention, checked and confirmed in the field according to various data concerned.
- (3) To compare the annotation in English version with those in Thai version, the annotation list was prepared with respect to name, letter size and type for each sheet as shown in Table 1.
- (4) Preliminary study on the changes after aerial photography was carried out based on the information of construction work, etc. provided by BMA.
- (5) Checking survey is described in the following paragraph 6-8.

6-8 Checking Survey

The checking survey was conducted with respect to planimetry and heights covering 11 sheets of 1:4,000 map and 13 sheets of 1:10,000 map. As for planimetry, two points being clearly identifiable were selected and the distance between two points was measured by using TOTAL STATION (Set III) and measuring tape (cloth). By comparing with the distance measured on the map, accuracy was checked.

Regarding heights, the spot heights and contour lines, particularly the contour lines of 0 m area, presented on the plotting manuscripts were checked by using AUTO LEVEL in the field with respect to accuracy. The accuracy obtained in the checking survey is as follows:

	Scale	Number of spots	Mean square error	Remarks
Planimetry	1:4,000	10 spots	0.25 mm on the map	JICA SPECS. LIMIT less than 0.5 mm on the map
	1:10,000	13 spots	0.16 mm on the map	
Height	1:4,000	91 spots	0.30 m	JICA SPECS. LIMIT less than 0.67 m
	1:10,000	77 spots	0.23 m	

ANNOTATION LIST

SCALE 1/ SHEET NO. -- -

Table 1 Annotation List

NO. SIZE	THAI	ENGLISH	SIZE	CHECKING			MEMO
				ENG, THAI	TYPE	POSITION	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Based on the results of the checking survey, the following areas are identified as the 0 m area:

Code No.	Sheet names	Number of areas (area)	Coverage (km ²)
11-1-B	LAT PHARAO	1	0.003
11-1-C	DIN DAENG	3	0.009
11-1-D	HUAI KHWANG	15	1.145
11-2-C	KHLONG CHAN	8	0.084
11-2-D	BANG KAPI	6	0.116
11-3-B	KHLONG SAMSEN	4	0.978
11-3-D	EKKAMAI	1	0.030
11-4-A	RAMKHAMHAENG	4	0.408
11-4-B	LAM SALI	2	0.035
11-4-C	HUA MARK	18	0.402
15-1-D	BANG CHAK	1	0.017
15-2-A	ONNUT	1	0.009
15-2-C	UDOM SUK	1	0.033
15-3-B	BANG NA	5	0.051
	Total	70	3.320

The 0 m areas are shown in Fig. 4.

6-9 Cooperation of Thai Side

(1) Assignment of the counterparts

The qualified counterparts were assigned by BMA and RTSD for the field completion. The counterparts made close cooperation in conducting guide in the field, negotiation with the local inhabitants and confirmation of the geographical names, etc.

(2) Preparation of the annotation sheets in Thai version

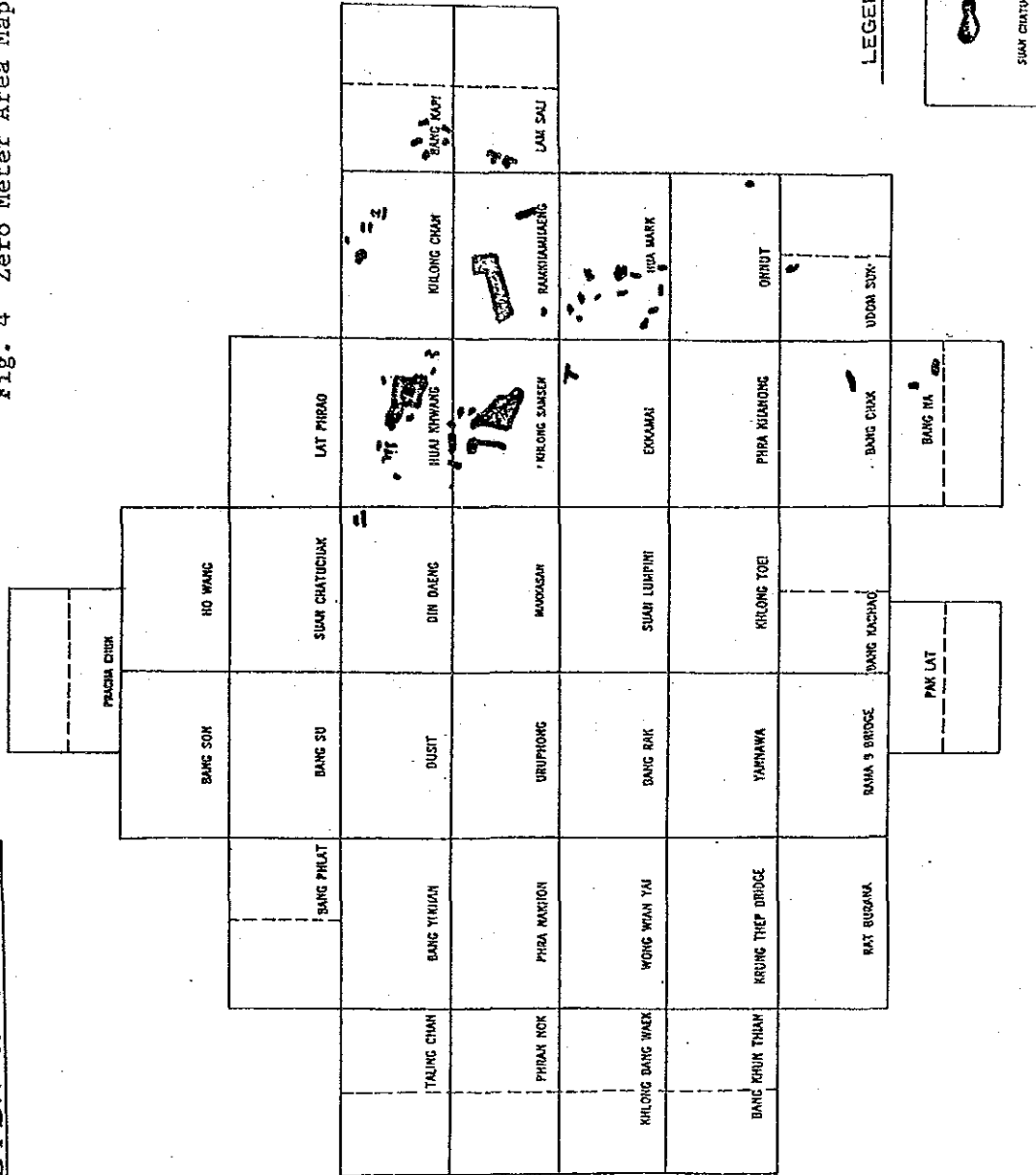
The Thai annotation sheets (40 sheets for the 1:4,000 map, 61 sheets for the 1:10,000 map, 101 sheets in total) were prepared by the photo lettering process by RTSD.

(3) Confirmation of the administrative names and boundaries

BMA conducted confirmation of the administrative names and boundaries presented on the blue prints of the whole sheets (101 sheets.)

ZERO METER AREA MAP

Fig. 4 Zero Meter Area Map



(4) Definition of the sheet names

The names of the whole sheets (101 sheets) were defined by BMA.

(5) Confirmation of the annotation list

The annotation list containing the annotation in English and Thai version of the whole sheets (101 sheets) was confirmed by BMA and RTSD.

(6) Technical discussion

The active opinions were presented by Thai side with respect to the map specifications in the technical discussions.

(7) Offer of the headquarters office

BMA provided the survey team with the headquarters office in the BMA building.

(8) Others

Data and information necessary for the work were provided.

6-10 Work in Japan

Correction of the compilation manuscripts based on the results of the field completion was partly continued in Japan and completed due to the fact that priority was given on the field operation.

(1) Results of the field completion were incorporated in the compilation manuscripts and the original manuscripts of topographic map were completed.

(2) Proofreading of the ground control point data sheet, annotation data sheet, etc. was conducted, and the preparation of the data sheets for drafting was completed.

(3) Final check was carried out on the following:

1) Matching to adjoining sheets

The continuity of the matching made after the supplementary survey was checked.

2) With regard to the items presented after the supplementary survey, consistency with other items or data was checked.

3) Presentation on the compilation manuscripts was checked so as not to make any omissions.

7. Drafting

7-1 Outline of Work

The drafting was carried out by the inking method based on the original manuscripts of the 1:4,000 topographic map and according to its symbol and specifications which were agreed between Japan and Thailand.

7-2 Specifications

Scale: 1:4,000

Number of sheets: English version 40 sheets

Thai version 40 sheets

Coverage: 300 km²

Neat line: 2.5 x 3.75 km (62.5 x 93.75 cm)

Method of drafting: Inking

Materials used:

Final drafting sheets for

1:4,000 topographic map: Polyester base (#500)

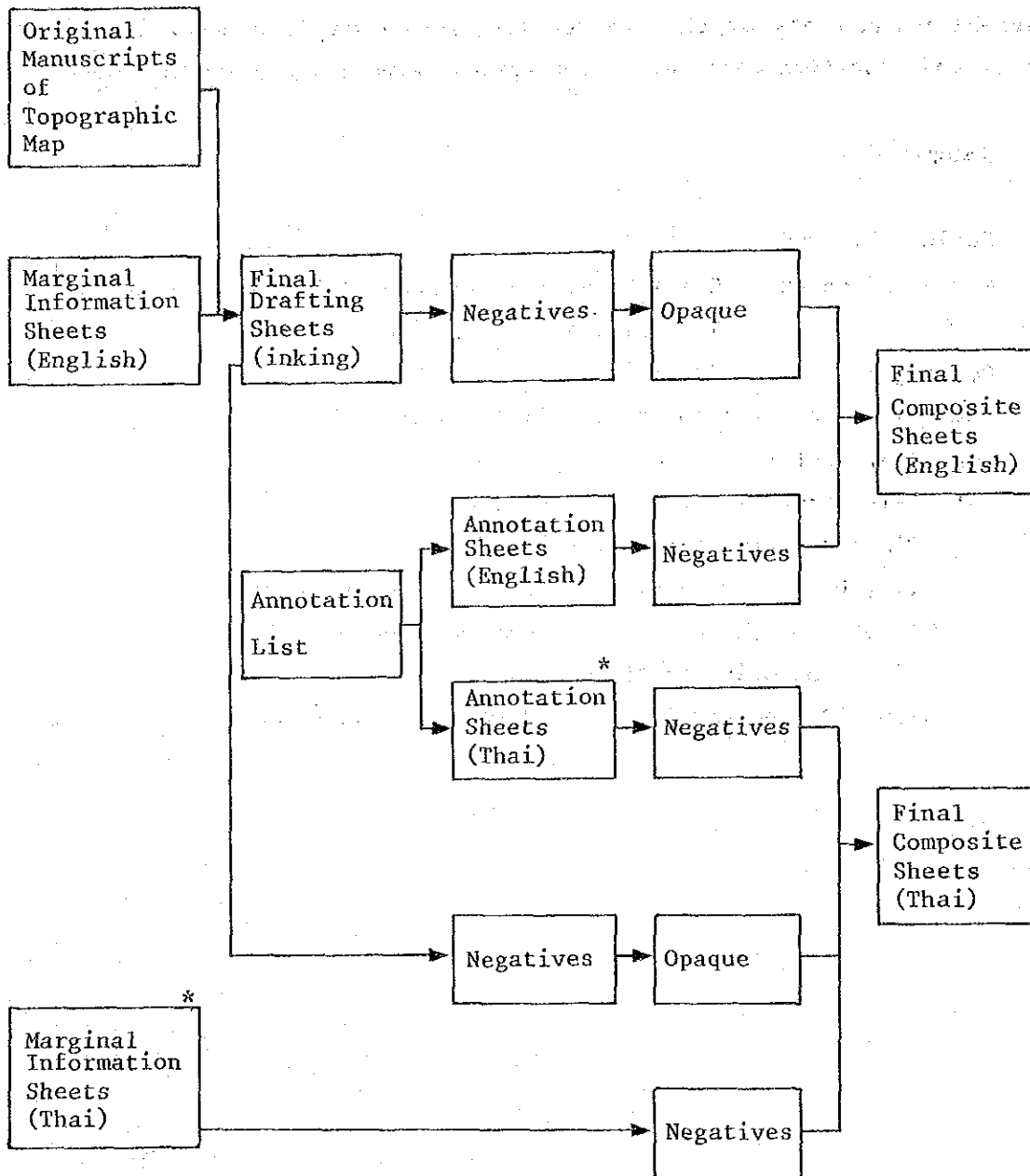
Annotation sheets: Polyester base (#300)

Final composite sheet for

1:4,000 topographic map: Polyester base (#500)

7-3 Drafting

(1) Work flow of the drafting is shown as follows:



*to be carried out by Thai side.

(2) Details of the drafting

- 1) The drafting of topography and planimetric features was conducted so as not to make any discrepancies in planimetry and indistinct presentation of lines.
- 2) Attention was paid so as to keep even density of inking for the delineation of lines.
- 3) For the determination of positions of annotation, attention was also paid so as not to spoil the surrounding planimetric features and grid crosses.

7-4 Inspection

After the completion of the drafting, the final composite sheets in English and Thai were checked on their blue prints as to the contents of presentation. Errors and omissions were then corrected and supplemented respectively.

After the checking, the accuracy control table was prepared.

8. Review of Second Year Work

The review of the second year work of the topographic mapping of Bangkok metropolitan area, Thailand is outlined as follows:

- (1) In the aerial triangulation, no control point was neglected in the adjustment computation and the accuracy obtained was twice as high as the accuracy defined in the specifications.

This is considered attributable to the fact that the first year ground control point survey was conducted based on the well balanced point distribution which was made possible by the use of the high observation towers despite of the unfavourable work conditions such as bad intervisibility in the flat area.

- (2) In the stereo plotting, it was possible to plot the buildings as isolated buildings each by each for the accurate and detailed presentation of the 1:4,000 topographic map although the 1:4,000 mapping area was extremely congested with so many buildings and houses.
- (3) The reduced compilation from 1:4,000 to 10,000 was efficiently completed with the unified results owing to the formulation of criteria for the selection of annotation and spot heights.
- (4) In the field completion, close cooperation of BMA and RTSD counterparts was given to the supplementary survey of the uncertain items found in the course of the plotting and compilation work as well as to the field reconfirmation of the annotation in English and Thai version.

As one of the major changes after aerial photography brought about after the field identification which had been conducted in the first year, Rama 9 Bridge is to be noted. For the efficient implementation of the correction of such major changes, the use of TOTAL STATION (SET-III) was very effective.

- (5) Regarding the drafting, the sheets for topography and the sheets for annotation were separately prepared. The annotation sheets were also separately prepared for English version and Thai version. As English annotation and Thai annotation being different in letter size and length, the mask sheet preparation and the superimposition method

were employed. Topographic features which might be vanished by the imposition of annotation were limited to the minimum, and the work was completed with excellent results.

- (6) At the technical meetings with BMA and RTSD, discussions were made on so many items regarding marginal information, glossary, sheet names, administrative boundaries and names, confirmation of annotation, preparation of the Thai annotation, etc. which resulted in the considerable amount of work. However, the work was conducted on schedule owing to the close cooperation of the Thai counterpart organizations.

Furthermore, proper and detailed technological transfer to the Thai counterparts was successfully attained with regard to the work schedule and accuracy control at the every important stage of work such as the survey planning, the field completion for changes after aerial photography, the confirmation of geographical boundaries and names, the evaluation of survey results, etc. which were carried out by the Japanese survey team.

9. Views on Third Year Work.

In the third year, the drafting (scribing) of the 1:10,000 topographic map and the printing shall be carried out in Japan and Thailand respectively. From results of the study on the second year work and the related data and information, the views on the third year work are summarized as follows:

- (1) It is necessary to conduct proof printing of the whole sheets for the proofreading to check the color tone of the printed map and the state of the composition of the whole color separation plates. It is also necessary to send the whole proofs to Thailand as the sample maps.
- (2) To attain the unified and high quality of the final products, it is necessary to prepare the specifications for printing which contain process, method, etc. of printing.
- (3) Printing work shall be carried out by the Thai side during the period from early December, 1988 to late February 1989 according to the Minutes of Discussion. Therefore, the materials necessary for printing are to be delivered to the Thai side by the end of September 1988 at the latest.

Because of weighing as heavy as almost 15 ton and being so voluminous, the materials are to be sent to Thailand as sea cargo. It is therefore necessary to thoroughly investigate the period for and to set up the measures for such marine transportation.

- (4) For the initiation of the printing work, Thai side requested to dispatch the Japanese expert group to Thailand for guidance of plate composition and color scheme. It is also considered necessary to prepare the measures for responding to the request.

APPENDICES

1. Schedule of Field Survey Work	(1)
2. Minutes of Discussion	(4)
2-1 At the time of the initiation of the field work (December 1987)	(4)
2-2 At the time of the completion of the field work (January 1988)	(19)

1. Schedule of Field Survey Work

Period: December 1, 1987 - January 29, 1988

<u>Date</u>	<u>Description</u>
December	
1 Tue	Arrival of Team Leader Kanakubo and 3 team members (Headquarters) in Bangkok
2 Wed	Courtesy call on BMA
3 Thu	Technical meeting with BMA
4 Fri	Courtesy call on RTSD; Arrival of Technical Advisor Mimura and 10 team members in Bangkok
5 Sat	National Holiday (His Majesty the King's Birthday)
6 Sun	Data arrangement
7 Mon	Courtesy call on JICA office and Japanese Embassy; Check-up on survey instruments
8 Tue	Technical meeting with BMA and RTSD; Field reconnaissance
9 Wed	Signing on the minutes of discussion; Field reconnaissance
10 Thu	National Holiday (Constitution Day); Departure of Advisor Mimura and Team Leader Kanakubo from Bangkok
11 Fri	Technical discussion with BMA; Field completion
12 Sat	Field completion
13 Sun	Data arrangement
14 Mon	Technical discussion with BMA and RTSD; Field completion; Checking survey
15 Tue	Technical discussion with BMA; Field completion; Checking survey
16 Wed	Technical discussion with BMA; Field completion; Checking survey
17 Thu	Technical discussion with BMA and RTSD; Field completion; Checking survey
18 Fri	Field completion; Checking survey
19 Sat	Field completion; Checking survey
20 Sun	Data arrangement
21 Mon	Technical discussion with BMA; Field completion; Checking survey
22 Tue	Field completion, Checking survey
23 Wed	Field completion; Checking survey

<u>Date</u>	<u>Description</u>
December	
24 Thu	Technical discussion with BMA; Field completion; Checking survey
25 Fri	Field completion; Checking survey
26 Sat	Field completion; Checking survey
27 Sun	Data arrangement
28 Mon	Technical discussion with BMA; Field completion; Checking survey
29 Tue	Technical discussion with BMA; Field completion; Checking survey
30 Wed	Technical discussion with BMA; Field completion; Checking survey
31 Thu	National Holiday (New Year's Eve)
January	
1 Fri	National Holiday (New Year's Day)
2 Sat	Data arrangement
3 Sun	Data arrangement
4 Mon	Field completion; Checking survey
5 Tue	Field completion; Checking survey
6 Wed	Technical discussion with RTSD; Field completion; Checking survey
7 Thu	Technical discussion with BMA; Field completion; Checking survey
8 Fri	Technical discussion with BMA; Field completion; Checking survey
9 Sat	Field completion; Checking survey
10 Sun	Data arrangement
11 Mon	Technical discussion with BMA and RTSD; Field completion
12 Tue	Technical discussion with BMA; Field completion
13 Wed	Technical discussion with BMA; Field completion
14 Thu	Field completion
15 Fri	Field completion
16 Sat	Field completion
17 Sun	Data arrangement
18 Mon	Technical discussion with BMA; Field completion
19 Tue	Arrival of JICA Staff Nakano in Bangkok; Field completion
20 Wed	Arrival of Team Leader Kanakubo in Bangkok; Field completion
21 Thu	Technical meeting with BMA; Field completion
22 Fri	Technical meeting with BMA and RTSD; Field completion
23 Sat	Arrival of Technical Advisor Mimura in Bangkok; Field completion

<u>Date</u>	<u>Description</u>
January	
24 Sun	Data arrangement
25 Mon	Technical meeting with BMA
26 Tue	Technical meeting with BMA and RTSD; Signing on the minutes of discussion; Packing of the survey instruments
27 Wed	Departure of JICA Staff Nakano and 10 team members from Bangkok
28 Thu	Reporting at JICA office and Japanese Embassy
29 Fri	Departure of Technical Advisor Mimura, Team Leader Kanakubo and Headquarters members from Bangkok

2. Minutes of Discussion

2-1 At the time of the initiation of the field work

MINUTES OF DISCUSSION
ON
TOPOGRAPHIC MAPPING PROJECT OF BANGKOK METROPOLITAN AREA
BETWEEN
THE BANGKOK METROPOLITAN ADMINISTRATION
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY SURVEY TEAM
ON
DECEMBER 9, 1987
BANGKOK THAILAND

Wicha Jiwalai

DR. WICHA JIWALAI
DEPUTY GOVERNOR
BANGKOK METROPOLITAN ADMINISTRATION

Tositomo Kanakubo

MR. TOSITOMO KANAKUBO
LEADER
JICA SURVEY TEAM

The Japanese Survey Team organized by JICA and headed by Mr. Tositomo KANAKUBO visited the Kingdom of Thailand on 1st of December, 1987 to carry out the second year survey work for the Topographic Mapping of Bangkok Metropolitan Area.

Prior to the commencement of the work, a joint meeting was held on 7th of December, 1987, and the following items were discussed and mutually agreed by and between the Bangkok Metropolitan Administration (hereinafter referred to as BMA) and JICA Survey Team.

1. Second Year Plan of Operation

The Plan of Operation for the second year survey work was proposed and explained by the JICA Survey Team and agreed by BMA.

2. Sheet names

BMA shall determine names of each sheet both 1/4,000 and 1/10,000 scale of maps and supply to the JICA Survey Team the name list in English by 20th of January, 1988.

3. Topographic Maps with Thai annotation and their marginal information including sheet name.

Both side confirmed that the maps with Thai annotation and their marginal information hereunder mentioned would be prepared by Thai side. JICA Survey Team requests that completion of this work should be by 20th January, 1988. BMA expresses intention to meet the requirement as possible as the Thai side can.

- (1) 40 sheets of 1/4,000 topographic map
- (2) 1 sheet of marginal information for 1/4,000 topographic map
- (3) 61 sheets of 1/10,000 topographic map
- (4) 1 sheet of marginal information for 1/10,000 topographic map

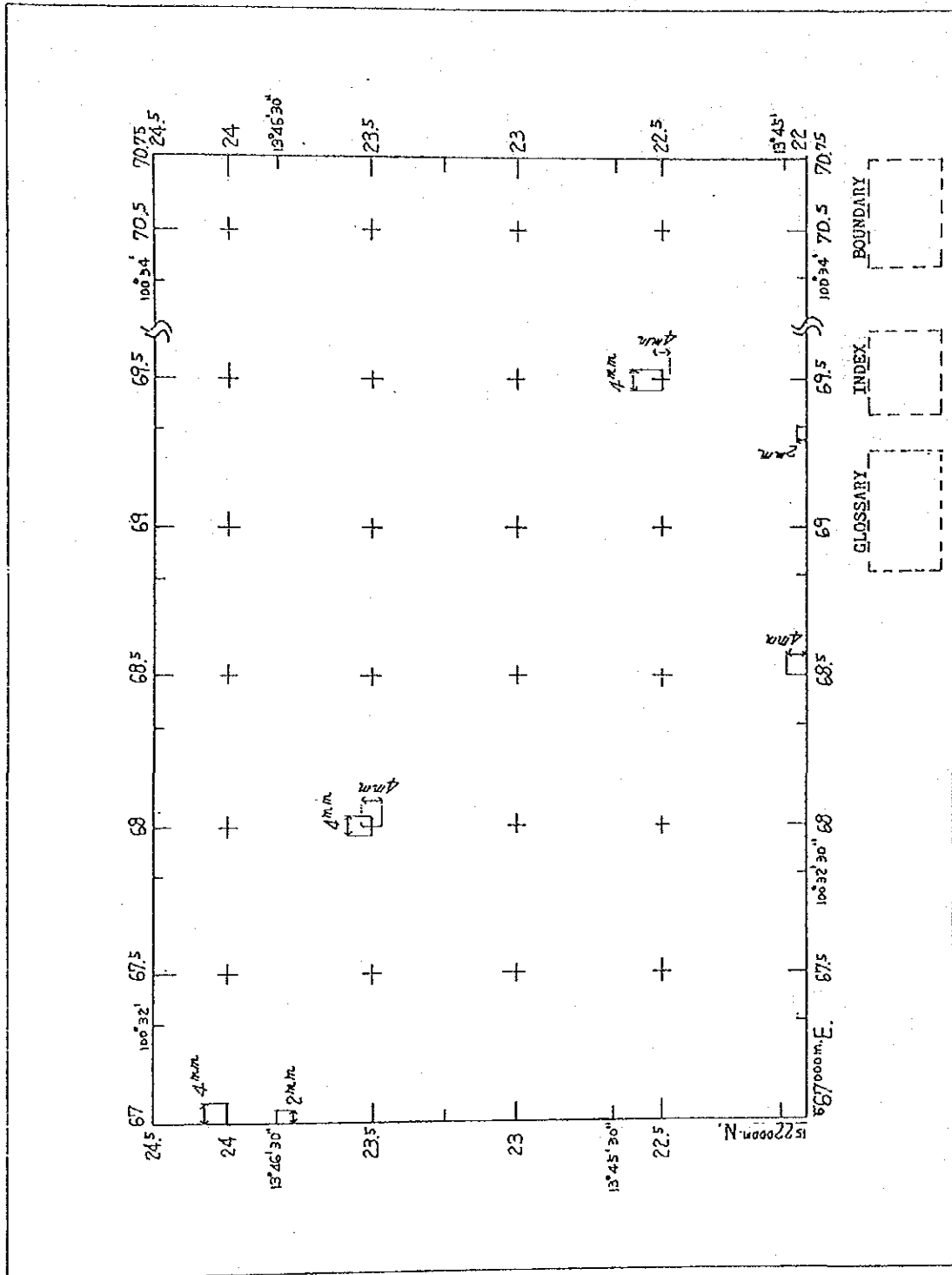
4. Checking of administrative boundaries and names

Checking of administrative boundaries and names noted on compilation manuscripts will be done by Thai side.

5. In case that an area to be mapped is too small in a sheet, the area shall be mapped on extended part from neatline of adjacent sheet.
6. Contents of map was confirmed by both side as follows;
- (1) Cross mark for grid and coordinates shown on Appendix 1 and 2 shall be delineated on the final results.
 - (2) Magnetic north shall not be mentioned because of unavailability of the data.
 - (3) Remark on road and railway for place name connected to destination shall not be mentioned.
 - (4) Some symbols shown on appendix 3 shall be added and some others shall be changed.
7. Color tone (Hue, Value and Chroma) for printing of 1/10,000 Topographic map was suggested by JICA Survey Team as follows and Thai side agreed.

Red	2.5 R	4/12
Brown	7.5 YR	7/10
Green	5 GY	7/10
Blue	10 B	6/10
Grey	7.5 P	5/3
Black		2/N

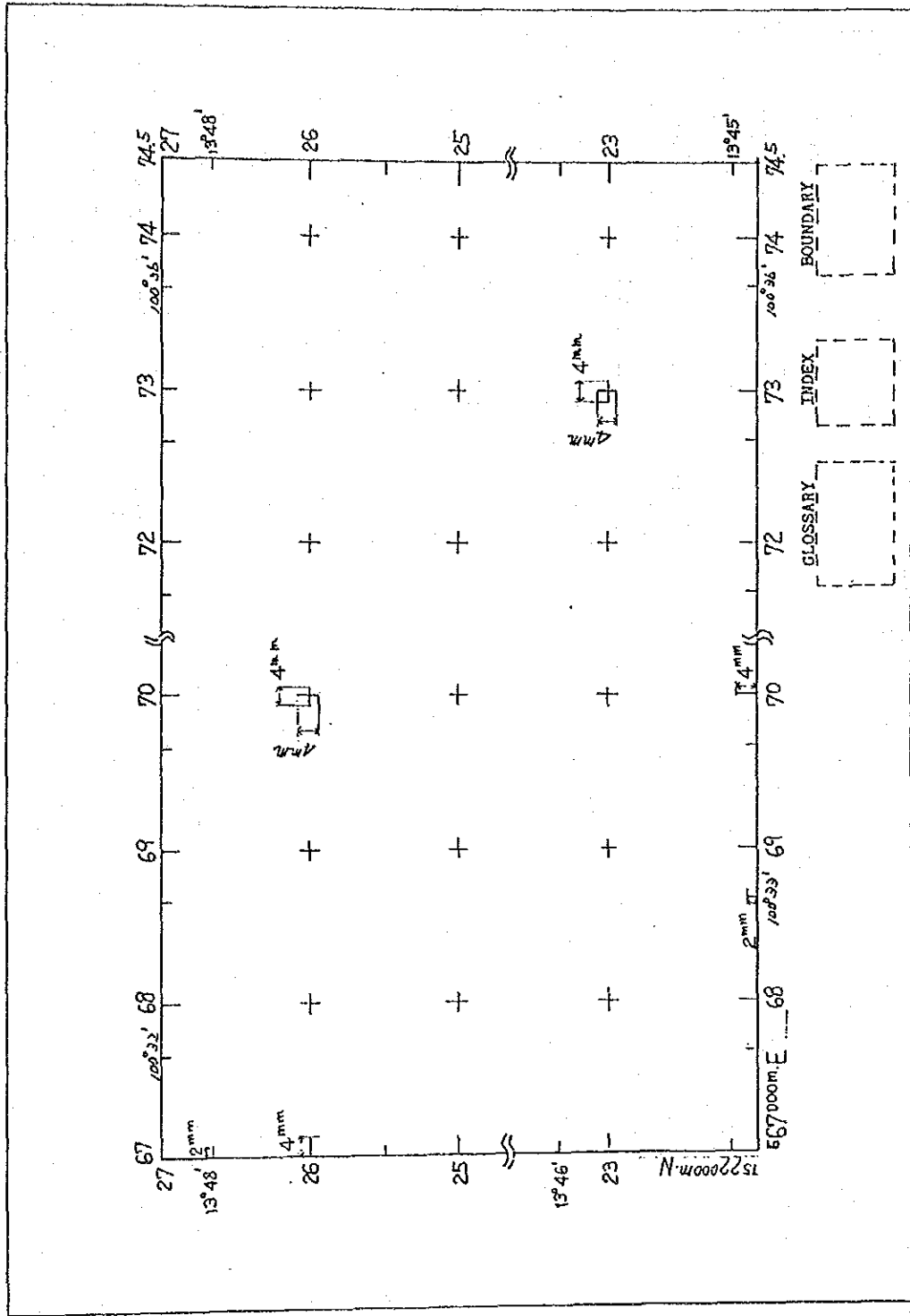
APPENDIX 1 GRID AND COORDINATES FOR 1:4,000



Wicha

T. K.

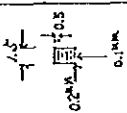
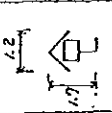
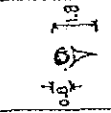
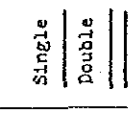
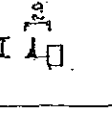




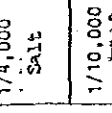
APPENDIX 2 GRID AND COORDINATES FOR 1:10,000



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APPENDIX 3 AMENDMENT OF SYMBOLS FOR 1:4,000 AND 1/10,000

CLASSIFICATION	NO	NAME OF SYMBOL	SYMBOL	LINE-SIZE (mm)	COLOR	FIELD IDENTIFICATION	COMPIATION	SPECIFICATION	S/H
Ra	1	Stone Step		0.10 0.20	Black	Same as Symbol Red	Same as Symbol Black	Applied to a case of 2.5 mm in length or more on map. Smaller one may be expressed when considered necessary.	Newly added
M	2	Shrine of the Household God		0.15	Black	- do -	- do -	Applied to an area of 3m x 3m or more at site or to be principal landmark.	-do-
M	3	Golf Course		0.15	Black	- do -	- do -	The symbol set up besides the club house.	-do-
Rw	4	Railway		0.3	Black	Single Double	- do -		Changed
Bs	5	School		0.5	Black			In case of symbol and specification (Draft) of 1/4,000, symbol  was changed to 	-do-
W	6	Salt Pan		0.15	Black Blue	Salt	Salt	Name of symbol was changed salt pan from salt bed.	-do-

PLAN OF OPERATION
FOR
TOPOGRAPHIC MAPPING
OF
BANGKOK METROPOLITAN AREA

(Second Year Work)

DECEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

(JICA)

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Plan of Operation
of the 2nd Year Work for Topographic
Mapping of Bangkok Metropolitan Area

1. Background

Topographic Mapping of Bangkok Metropolitan Area was set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand signed on March 19, 1986 for the three year work.

The first year work which consisted of aerial photography, ground control point survey and field identification was completed on July 30, 1987.

The second year work which consists of aerial triangulation, stereo plotting, compilation, field completion, drafting(1/4,000) was started from August 11, 1987.

2. Outline of the Second Year Work

As the 2nd Year Work, following works will be completed:

a) Aerial triangulation	425 Models
b) Stereo plotting	
1/4,000	300 sq. kms
1/10,000	1,700 sq. kms
c) Map compilation	
1/4,000	300 sq. kms (40 sheets)
1/10,000	2,000 sq. kms (61 sheets)
d) Field completion	2,000 sp. kms
e) Drafting	
1/4,000	300 sq. kms (40 sheets)

Among the above works, the work of a) through c) (Domestic Work) have completed and the copies of the compilation manuscript have been brought into Thailand for the map compilation work to be carried out in Thailand from early December, 1987 through the end of January, 1988.

3. Field Completion Work

3-1 Work Contents

In order to supplement the geographical information, topographic features and contour lines drawn by the stereo-plotter, following field completion work shall be conducted:

- a) Uncertain items during the course of the stereo-plotting and/or compilation work, shall be checked and confirmed.
- b) Major changes after the aerial photography done in the first year shall be corrected. If necessary, supplementary survey will be conducted using total station, plain table and level.
- c) Survey data to be provided by BMA shall be incorporated in the compilation manuscripts.

3-2 Formation of JICA Survey Team and Schedule

Name	Assignment	1987 December	1988 January
(Head quarters) Tositomo Kanakubo	Leader	1 10	20 29
Isao Ikeshima	Deputy leader	1	29
Chozo Obara	Mapping planner	1	29
(Field completion) Yoshikazu Ibusuki	Chief surveyor	1	29
Kazuo Furukata	Surveyor	4	27
Mitsuo Sunaoshi	"	4	27
Kazuo Tabuchi	"	4	27
Yasuo Hongo	"	4	27
Mitsuyoshi Takahashi	"	4	27
Kazuhiro Ishizuka	"	4	27
Hiroshi Saitoh	"	4	27
Yasuki Kondo	"	4	27
Akimasa Takahashi	"	4	27
Masashi Kita	"	4	27

3-3 Party Formation Plan

Work	Number of chief surveyor	Field parties		
		Number of party	Break-down of a party	Total number of surveyor
Field completion	1	5	2 Japanese surveyors 1 BMA counterpart	10 Japanese surveyors 5 BMA counterparts

3-4 Office Space to be Provided by BMA

Number of room	Space	Period
1	10m x 5m	2 months

- 1) The rooms shall be equipped with ordinally facilities such as telephone, air condition, lock, proper lightings, etc.
- 2) Data, survey materials and instruments shall be stored in the rooms.

4. Data and Specifications to be Discussed and Confirmed During the Field Work

4-1 Data Prepared by JICA Survey Team

- a) Second copy of compilation manuscript 101 x 2 sheets
- b) Delumina copy of compilation manuscript 101 x 1 sheets
- c) Copy of English annotation sheet 101 x 2 sheets
- d) Copy of English marginal information sheets
(1/4,000, 1/10,000) 2 sheets
- e) Sample of drafting sheet (1/4,000, 1/10,000) 1 sheet
- f) Sample of color proof for printing (1/10,000) 1 sheet
- g) Polyester sheet for Thai annotation 101 sheets
- h) Others data
(Mapping sheet index : refer appendix 1)

4-2 Data Prepared by BMA

- a) Confirmation data of administive names and boundaries
- b) Thai annotation sheet (1/4,000) 40 sheets
" (1/10,000) 61 sheets
- c) Thai marginal information sheet (1/4,000) 40 sheets
" (1/10,000) 61 sheets

4-3 Specification to be Finalized by the Field Completion

- a) Specification of amendatory and additional symbols
(Refer appendix 2)
- b) Specification of marginal information sheet
- c) Specification of photo-composition style (Refer appendix 3)
- d) Specification of printing map

5. Succeeding Work to be Conducted in Japan

Original manuscript of the field completion shall be made using the scribed sheets (1/10,000) and the polyester sheets (1/4,000).

6. Specification of Thai Annotation Sheet

- a) Period of preparation

From Dec.7, 1987 to Jan. 22, 1988

- b) Number of map sheets

Topographic map (1/4,000) 40 sheets

Topographic map (1/10,000) 61 sheets

- c) Annotation method

Photo composition and stick or lettering

- d) Character size and style

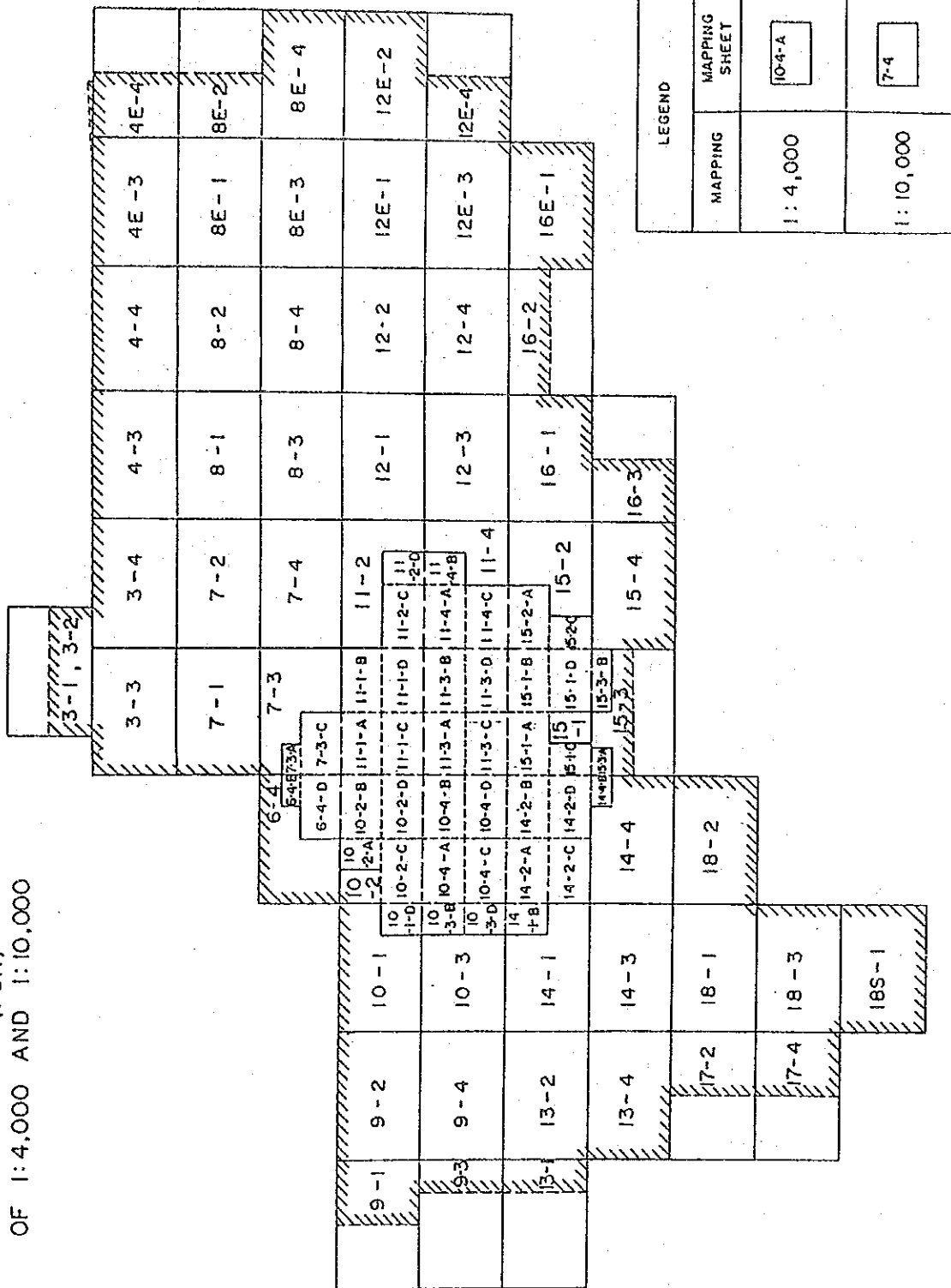
Size and style of Thai annotation should be same as English one

- e) Position of stick

Same position as in the English annotation sheets

TOPOGRAPHIC MAPPING SHEET INDEX
 (FOR)
 OF 1:4,000 AND 1:10,000

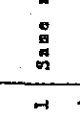


Appendix 1



AMENDATORY AND ADDITIONAL SYMBOLS (Draft)

Appendix 2

FOR 1:4,000 AND 1:10,000

Class- sifi- cation	No.	Name of Symbol	Symbol	Line Size (mm)	Color	Field Identification	Compilation	Specifications	S/W
	1	Spot Height	432.1	Dot: 0.3	Black			Elevation point described by plotter; one point per 5cm square Unit of expression: 0.1m unit (Unit: 1m → 0.1m)	Change
H	2	Way Side Statue		0.15	Black	Same as Symbol Red	Same as Symbol Black	Applied to an area of 3m x 3m or more at site or to be principal target.	NEW
Ra	3	Stone Step		0.10 0.20	Black	Same as Symbol Red	Same as Symbol Black	Applied to a case of 2.5mm in; length or more on map. Smaller one may be expressed when considered necessary.	NEW
Rv	4	Railway		0.30	Black	single double Red	Same as Symbol Black	Indicate national railway. Distinguish between single track line and double.	Change

Topographic Mapping of Bangkok Metropolitan Area
Photo-composition Style of English (Draft)

Classification		Style	Rank	mm	Color	Size 1/10,000	Name	Remark
Boundary	Metropolis	E08-42-5%	20	4.5			Bangkok Metropolis	
	Province	E08-24-C	16	3.5			SAMUT PRAKAN PROVINCE	
	Dissect	//	//	//			BANG KAPI DISTRICT	
	Town	//	14	3.0				
	Village	E08-24-5%	14	3.0			Ban Khlong Bang Bon	
New Residence	Development Area	//	12	2.5			Mu Ban Sala Daeng	
Building	School	//	10	2.2			Wat Hong School	
	Post Office	//	//	//			Khlong Sip Post Office	
	Temple	//	//	//			Sala Daeng Temple	
Miscellaneous Landmark Features	Monument	E08-24-5%	8	1.8			Omachey Monument	
	Park	E05-14-5%	10	2.2			Rampin Park	
	Air Port	E05-14-C	//	//			DOH MAJANG AIR PORT	
Road	National Highway	E08-25-C	//	//			TIANGHAI PAHOLTOHIN	
	Express Way	//	//	//			DIN DAENG PORT EXPRESSWAY	
	Provincial Road	//	//	//			TIANGHAI SUKUMVIT	
	Another Road	//	//	//			SOI WANIT	
	Rail Way	Rail Way	//	//	//		NORTHERN RAIL WAY LINE	
	Station	//	//	//			HUA LAMPONG ST.	
	Road Under Construction	E08-25-5%	8	1.8			Road Construction	
Plantation		E05-14-5%	//	//				
River	Large	E01-25-C	18	4.0			CHAO PHRAYA RIVER	
	Middle	//	14	3.0			KHLONG MAHANAK	
	Small	//	10	2.2			SAKHILA DITCH	
Sea	Gulf	//	18	4.0			GULF OF THAILAND	
	Beach	E01-24-5%	10	2.2			Pataya Beach	

2-2 At the time of the completion of the field work

MINUTES OF DISCUSSION

ON

TOPOGRAPHIC MAPPING PROJECT OF BANGKOK METROPOLITAN AREA

BETWEEN

THE BANGKOK METROPOLITAN ADMINISTRATION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

ON

JANUARY 26, 1988

BANGKOK THAILAND

Wicha Jiwalai

DR. WICHA JIWALAI
DEPUTY GOVERNOR

BANGKOK METROPOLITAN ADMINISTRATION

J. Kanakubo

MR. TOSITOMO KANAKUBO
LEADER

JICA SURVEY TEAM

Minutes of Discussion
on
Topographic Mapping Project of Bangkok Metropolitan Area

The Japanese Survey Team organized by JICA and headed by Mr. Tositomo KANAKUBO stayed at the Kingdom of Thailand from 1st of December 1987 till 26th of January 1988 to carry out the second year survey work for the Topographic Mapping of Bangkok Metropolitan Area.

Upon the completion of field completion work in the second year survey work, a joint meeting was held during the period of 21st to 26th of January 1988, and the following items were discussed and mutually agreed upon between the Bangkok Metropolitan Administration (hereinafter referred to as BMA) and JICA Survey Team.

List of attendants is shown in Annex A.

I. SECOND YEAR WORK

I-1 Progress of the 2nd Year Work

<u>Items of Work</u>	<u>Coverage</u>	<u>Progress at Present</u>
Aerial Triangulation	425 models	100%
Stereo-plotting 1: 4,000	300 Km ² 40 Sheets	100%
1:10,000	1,700 Km ² 57 Sheets	100%
Compilation 1: 4,000	300 Km ² 40 Sheets	100%
1:10,000	2,000 Km ² 61 Sheets	100%
Field Completion	2,000 Km ²	100%
Drafting 1: 4,000	300 Km ² 40 Sheets	*

*Expected to be completed by the end of
March 1988.

I-2 Field Completion

1) Style and Size of Annotation

Style and size of annotation in Thai and English shall be in Appendix 1-1 and 1-2.

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2) Marginal Information

- (1) Glossary as shown in Appendix 1-3 shall be mentioned on the map of English annotation.
- (2) One part of explanation of marginal information shall be changed as shown in Appendix 2-1, 2-2, 2-3 and 2-4.

3) Spot Height

Spot height on map of 1:4,000 and 1:10,000 shall be shown in meter with one decimal point.

4) Data and Map List

The data and map which JICA Survey Team received from Thai side are as follows:

(1) Map for Administrative Name and Boundary

1:4,000 40 sheets

1:10,000 61 sheets

(2) List of Annotation in Thai and English

1:4,000 40 sheets

1:10,000 61 sheets

(3) List of Sheet Name

as shown in Appendix 2-5, 2-6.

(4) Annotation Sheet

1:4,000 40 sheets

As for 1:10,000 the map for 61 sheets shall be sent to Japan side by February 29, 1988.

I-3. Delivery of the ground control point survey results

The Japanese side handed over to the Thai side the survey results of ground control points as shown in Appendix 3-1.

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II. THIRD YEAR WORK

In the 3rd year (Final year), the following work is expected to be carried out:

Drafting (1:10,000)	2,000 Km ²	61 sheets
Printing (1:10,000)	2,000 Km ²	61 sheets

As to the 3rd year work the both sides confirmed that the drafting shall be conducted by the Japanese side in Japan and the printing shall be carried out by the Thai side in the reproduction facilities of Royal Thai Survey Department (hereinafter referred to as RTSD) using the materials to be provided by the Japanese side. Both sides also confirmed to make close cooperation for smooth implementation of the Work.

III. PROCESS OF THE FINAL PRODUCT PREPARATION

The process of the final product preparation to be carried out by both sides is as follows:

III-1. Drafting

1:4,000 topographic map:

The Japanese side shall send one set of the final draft sheets to the Thai side by the middle of April 1988.

1:10,000 topographic map:

Checking on the surprints shall be made by the Thai counterpart in Japan. The Japanese side shall send the surprints checked by the counterpart to Thailand by the middle of July 1988 for the final confirmation by the Thai side. The Thai side shall make final check and return them to Japan by the middle of August 1988.

III-2. Proof printing

The Japanese side shall complete the proof printing of 1:10,000 Topographic map by the end of September 1988.

III-3. Modification of the specifications of topographic map

The Japanese side shall make slight symbol modifications and map color adjustment for better map representation of the final products.

III-4. Provision of the reference and consumable materials for printing

The Japanese side shall provide to the Thai side with the reference and consumable materials for printing by the end of September 1988. The Thai side shall be in charge of custom clearance, transportation to warehouse and storage under proper temperature and humidity at its expenses.

1) Reference materials

Specification for printing	1 set
Composite films (Negative)	1 set
Proof (sample map)	61 sheets (1 set)

2) Consumable materials

PS aluminum plate (74.1 x 92.5 cm)	450 sheets
Printing paper (75 x 95 cm)	100,000 sheets
Printing ink (2 Kg/can)	200 cans (for the above)
Blanket Rubber (113.5 x 130 cm)	4 sheets
Gum Airobic	15 gallon
Others	1 set

Thai side strongly requested, considering usefulness of the map, to increase the account of consumable materials which would be enough for printing 1,500 sets of 1:10,000 topographic Map in Thai version instead of 500 sets originally agreed in the Scope of Work (The number of printing paper shall be 171,000 sheets for 2,000 sets). Japanese side stated to convey this request to the JICA Headquarters for its consideration.

III-5. Dispatch of the Japanese expert group for printing

The Thai side requested the Japanese side to dispatch the expert group for guidance of plate composition and color scheme.

The Japanese side shall take necessary measures for dispatching the expert group for initiation of the printing work as well as for confirmation of the completion of the printing process.

III-6. Completion of the project

- (1) The work of topographic map of 1:4,000 shall be completed upon the consignment of the original manuscripts from Japan to Thailand by the end of September 1988. The Thai side shall obtain the approval from the authorities concerned to send at least one set of the blue print copies in order for Japanese side to confirm the completion of the work of producing 1:4,000 topographic map. Japanese side shall keep above map confidentially and send back them to Thai side after the confirmation.
- (2) The work for topographic map 1:10,000 shall be completed upon the completion of the Printing work in RTSD printing facilities by the end of Feb. 1989. Thai side shall obtain the approval from the authorities concerned to send at least one set (1 set : 122 sheets) of each of English and Thai editions with security stamp to JICA by the end of March 1989 in order for Japanese side to confirm the completion of the work of producing 1:10,000 topographic map. Japanese side shall keep above map confidentially and send back them to Thai side after the confirmation.
- (3) Japanese side shall submit BMA 50 copies of final report in English version by the end of March, 1989.
- (4) The technical cooperation program for this project shall be finalized by the completion of the above works.

IV. SEMINAR

Thai side requested Japanese side to cooperate in the occasion of holding seminar for technology transfer of topographic mapping and utilization of the topographic map in March 1989.

Japanese side stated to convey this request to JICA Headquarters for its consideration.

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List of Attendants

THAI SIDE :

Bangkok Metropolitan Administration

Dr. Wicha Jiwalai	Deputy Governor
Mr. Bampen Jatoorapreuk	Director General, Department of Public Works
Mr. Supot Pongkidakan	Chief of Public Works Planning Sub-Division
Mr. Chailurt Panjatevakupt	Staff of Public Works Planning Sub-Division

The Royal Thai Survey Department

Maj. Gen. Thamnoon Udomsorayuth
Col. Anan Phunsanong
Lt. Col. Somsak Nuanurai
Lt. Col. Ronnachai Bamphenyu

JAPANESE SIDE :

G.S.I

Mr. K. Mimura	Technical Advisor
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JICA Headquarters

Mr. T. Nakano	Deputy Head, Social Development Cooperation Department
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JICA Thailand Office

Mr. T. Hino	Assistant Resident Representative
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JICA Survey Team

Mr. T. Kanakubo	Leader
Mr. I. Ikeshima	Deputy Leader
Mr. C. Obara	Mapping Leader

SAMPLE OF PHOTO LETERING
1/4,000

ITEM	ENGLISH		THAI	
	STYLE	SIZE	TYPE	SIZE
ADMINISTRATION				
PROVINCE	E08-24-C	16	A	20
		CHANGWAT SAMUT PRAKAN		จังหวัดสมุทรปราการ
DISTRICT	E08-24-C	16	A	20
		KHET BANG KAPI		เขตบางกะปิ
VILLAGE	E08-24-C/L	14	A	18
		Ban Khlong Dang Bon		บ้านคลองด่าน
NEW RESIDENCE	E08-24-C/L	12	A	16
		Mu Ban Sae Dang		หมู่บ้านสวน
BUILDING				
SCHOOL	E08-24-C/L	9	A	12
		Wat Hong Saeng		วัดหงษ์สำเภา
POST OFFICE	E08-24-C/L	9	A	12
		Along the Post Office		สำนักงานไปรษณีย์
TEMPLE	E08-24-C/L	9	A	12
		Esa Dang		ศาลเจ้า
MONUMENT				
	E08-24-C/L	8	A	10
		Changyee Monumnt		อนุสาวรีย์ชัยสมรภูมิ
PARK	E05-14-C/L	10	A	12
		Suan Lumpini		สวนลุม
AIRPORT	E05-14-C	10	A	12
		BANGKOK INTERNATIONAL AIRPORT		ท่าอากาศยานนานาชาติ
ROAD				
NATIONAL ROAD	E08-25-C	10	A	12
		THANON PHRACHIN		ถนนพหลโยธิน
HIGHWAY	E08-25-C	10	A	12
		CHALERM PHRAKON		ทางด่วนเฉลิมพระเกียรติ
PROVINCIAL ROAD	E08-25-C	10	A	12
		PHRACHU SINDHURIT		ถนนพระราม 5
LANE/STREET	E08-25-C	10	A	10
		SOI WANG		ซอยวัง
RAILWAY				
RAILWAY	E08-25-C	10	A	12
		NORTHER RAILWAY LINE		ทางรถไฟเหนือ
STATION	E08-25-C	9	A	10
		BANGKOK RAILWAY ST.		สถานีรถไฟกรุงเทพ
CONSTRUCTION	E08-25-C/L	8	A	10
		Road Construction		การก่อสร้าง
RIVER				
RIVER (LARGE)	E01-25-C	18	B	24
		MAE NAM CHAO PHRAYA		แม่น้ำเจ้าพระยา
(MEDIUM)	E01-25-C	14	B	18
		KILONG MAHANK		คลองมหาชัย
(SMALL)	E01-25-C	10	B	12
		CHI SANGA		คลอง
SEA				
GULF	E01-25-C	18	B	24
		GULF OF THAILAND		อ่าวไทย
BEACH	E01-24-C/L	10	B	12
		Phray Beach		ชายหาด

NOTE : A TYPE IS UP RIGIT LETTER
B TYPE IS SLANT LETTER

Remarks: Above sample is for type of letter only

Wicha T.K.

SAMPLE OF PHOTO LETTERING
1/10,000

ITEM	ENGLISH			THAI		
	STYLE	SIZE		TYPE	SIZE	
ADMINISTRATION	E08-24-C	3-5	CHANGWAT SAMUT PRAKAN	A	16	จังหวัดสมุทรปราการ
DISTRICT	E08-24-C	3-5	KHET BANG KAPI	A	16	เขตบางกะปิ
VILLAGE	E08-24-C/L	3-0	Ban Khlong Bang Bon	A	14	บ้านคลองบอน
NEW RESIDENCE	E08-24-C/L	2-2	Mae Nam Sae Duang	A	10	หมู่บ้านสวน
BUILDING	E08-24-C/L	1-8	Wat Hong Saeng	A	8	วัดหงษ์สำเริง
POST OFFICE	E08-24-C/L	1-8	Building the Post Office	A	8	สำนักงานไปรษณีย์
TEMPLE	E08-24-C/L	1-8	Sae Duang	A	8	สวนสวน
MONUMENT	E08-24-C/L	1-8	Demerley Monument	A	8	อนุสาวรีย์ประชาธิปไตย
PARK	E05-14-C/L	1-8	Stuen Lumpini	A	8	สวนลุม
AIRPORT	E05-14-C	1-8	BANGKOK INTERNATIONAL AIRPORT	A	8	ท่าอากาศยานนานาชาติ
ROAD	E08-25-C	2-2	THANON PHAKYOTIM	A	10	ถนนพญาไท
HIGHWAY	E08-25-C	2-2	CHALERM PHANAKOM	A	10	ทางด่วนเฉลิมกรุง
PROVINCIAL ROAD	E08-25-C	1-8	RAMON SUKHVIT	A	8	ถนนสุขุมวิท
LANE/STREET	E08-25-C	1-8	SOI SAHAY	A	8	ซอยสุขุมวิท
RAILWAY	E08-25-C	2-2	NORTHER RAILWAY LINE	A	10	ทางรถไฟเหนือ
STATION	E08-25-C	1-8	BANGKOK RAILWAY ST.	A	8	สถานีรถไฟกรุงเทพ
CONSTRUCTION	E08-25-C/L	1-8	Red Construction	A	8	การก่อสร้าง
RIVER	E01-25-C	3-5	MAE NAM CHAO PHRAYA	B	16	แม่น้ำเจ้าพระยา
(MEDIUM)	E01-25-C	2-6	KHLONG MAHANAK	B	12	คลองมหานาค
(SMALL)	E01-25-C	1-8	SAI KHONG	B	8	คลองสวน
SEA	E01-25-C	3-5	GULF OF THAILAND	B	16	อ่าวไทย
BEACH	E01-24-C/L	1-8	Phray Beach	B	8	ชายหาด

Remarks: Above sample is for type of letter only.
NOTE : A TYPE IS UP RIGHT LETTER
B TYPE IS SLANT LETTER

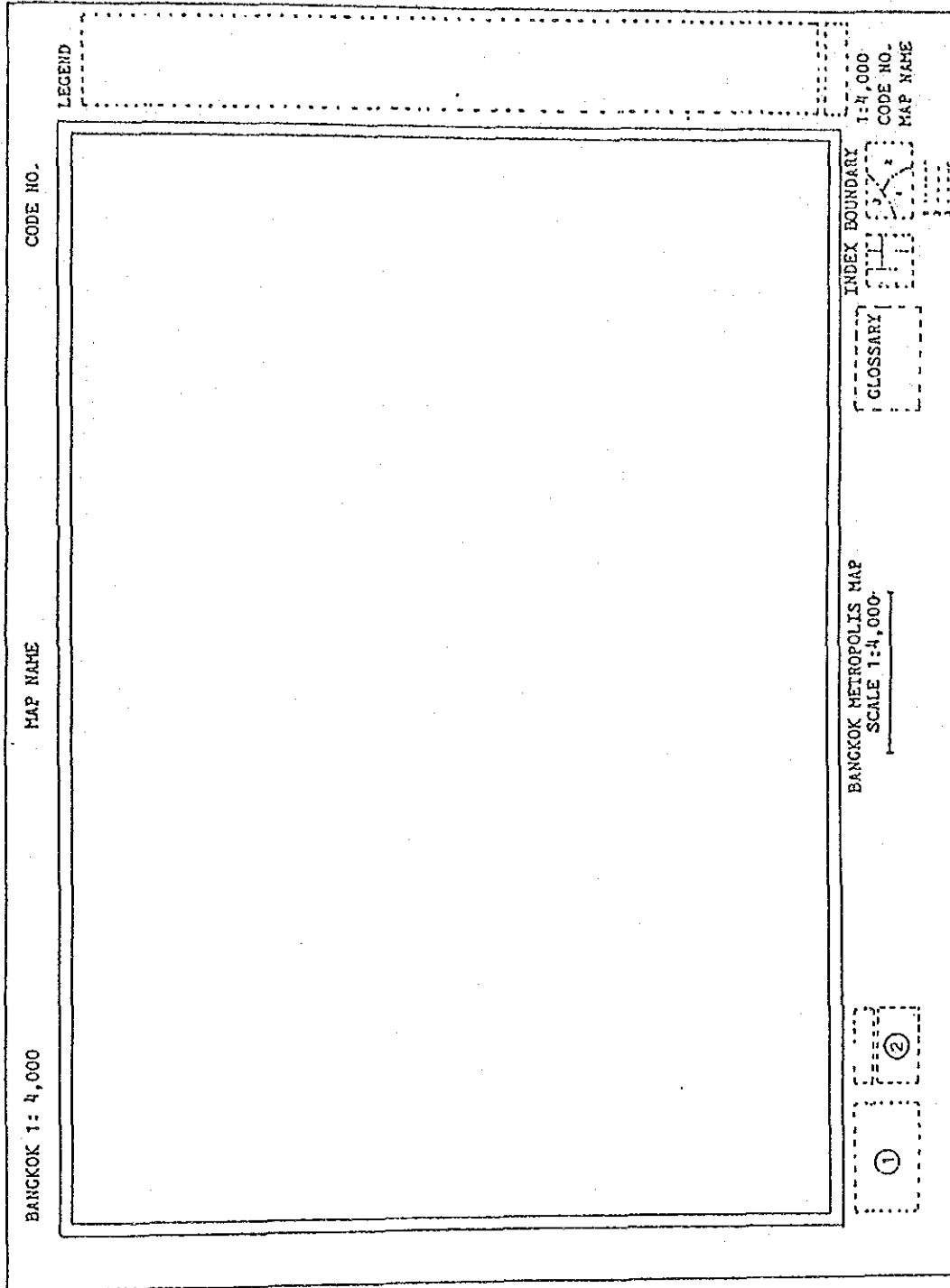
Wichan J.K.

GLOSSARY

AMPHOE	.....SECONDARY ADMINISTRATIVE DIVISION, DISTRICT
BAN	.....VILLAGE
BUNG	.....POND
CHANGWAT	.....PRIMARY ADMINISTRATIVE DIVISION, PROVINCE
KHET	.....SECONDARY ADMINISTRATIVE DIVISION, DISTRICT
KHLONG	.....CANAL
LAM	.....DITCH
MAE NAM	.....RIVER
MU BAN	.....HOUSING ESTATE
SOI	.....LANE, STREET
SUAN	.....PUBLIC PARK
THANON	.....ROAD
WAT	.....TEMPLE

Wicha T.K.

MARGINAL INFORMATION
FOR
1:4,000



CODE NO.

MAP NAME

BANGKOK 1: 4,000

SYMBOL MARKS OF
AGENCIES CONCERNED

1:4,000
CODE NO.
MAP NAME

INDEX BOUNDARY

GLOSSARY

BANGKOK METROPOLIS MAP

SCALE 1:4,000

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① This map was produced under cooperation between the Royal Thai Government and the Government of Japan. The Bangkok Metropolitan Administration served as implementing agency in closed coordination with the Royal Thai Survey Department.

Aerial Photography : March 1987
 Field Survey Work : Japan International Cooperation Agency (JICA)
 March to June 1987

Plotting, Compilation and Drafting : July 1987 to March 1988
 Printing : Royal Thai Survey Department 1988
 Distributor : Bangkok Metropolitan Administration (BMA)
 Dinso Road, Bangkok, Thailand.

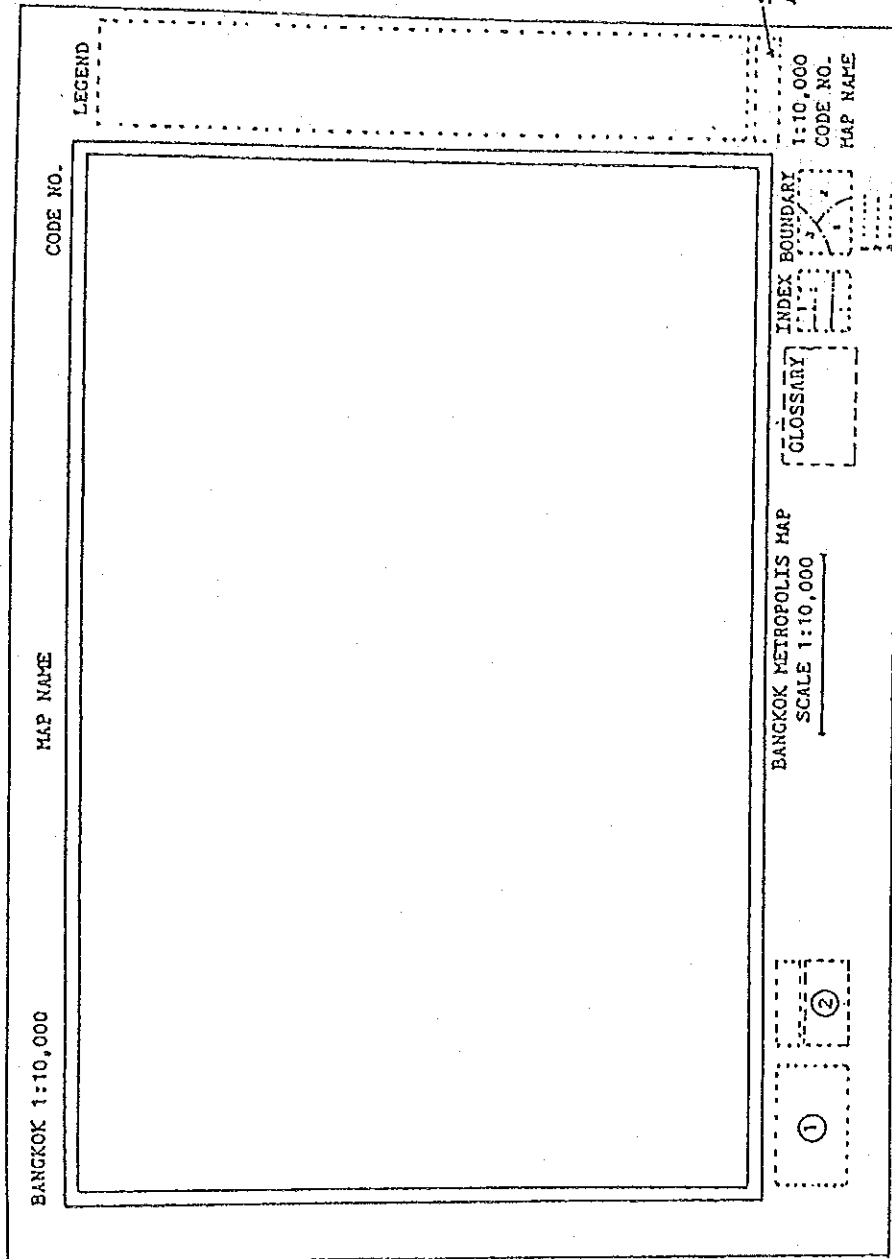
① This map was produced under cooperation between the Royal Thai Government and the Government of Japan. Department of Public Works, Bangkok Metropolitan Administration (BMA) served as implementing agency in closed coordination with the Royal Thai Survey Department, Supreme Command Headquarters.

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 Field Survey Work : March to June 1987 by JICA
 Field Completion : December 1987 to January 1988 by JICA
 Plotting, Compilation and Drafting : July 1987 to March 1988 by JICA
 Distributor : Department of Public Works, BMA.

② Users are urged to refer corrections and comment for increasing the usefulness of this map to the Department of Public Works, Bangkok Metropolitan Administration, Mit Maitri Road, Khet Huai Khwang, Bangkok 10400.

Wicha T.K.

MARGINAL INFORMATION
OF
1:10,000



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T.K.

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Wicha T.K.

LIST OF SHEET NAME

(1)

1:4,000

SHEET NO.	THAI	ENGLISH
6-4-B, 7-3-A	ประชาชื่น	PRACHA CHUN
6-4-D	บางซ่อน	BANG SON
7-3-C	หวัง	HO WANG
10-1-D	ทลิ่งชัน	TALING CHAN
10-2-A	บางพลัด	BANG PHLAT
10-2-B	บางซื่อ	BANG SU
10-2-C	บางยี่ขัน	BANG YIKHAN
10-2-D	ดุสิต	DUSIT
10-3-B	พรวนนก	PHRAN NOK
10-3-D	คลองบางแวก	KHLONG BANG WAEK
10-4-A	พระนคร	PHRA NAKHON
10-4-B	อุรุพงษ์	URUPHONG
10-4-C	วงเวียนใหญ่	WONG WIAN YAI
10-4-D	บางรัก	BANG RAK
11-1-A	สวนจตุจักร	SUAN CHATUCHAK
11-1-B	ลาดพร้าว	LAT PHRAO
11-1-C	ดินแดง	DIN DAENG
11-1-D	ห้วยขวาง	HUAI KHUANG
11-2-C	คลองจั่น	KHLONG CHAN
11-2-D	บางกะปิ	BANG KAPI
11-3-A	มักกะสัน	MAKKASAM
11-3-B	คลองสามเสน	KHLONG SAMSEN
11-3-C	สวนลุมพินี	SUAN LUMPINI
11-3-D	เอกมัย	EKKAMAI
11-4-A	รามคำแหง	RAMKHAMHAENG
11-4-B	ลำสาลี	LAM SALI
11-4-C	หัวหมาก	HUA MARK
14-1-B	บางขุนเทียน	BANG KHUN THIAN
14-2-A	สะพานกรุงเทพ	KRUNG THEP BRIDGE

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LIST OF SHEET NAME

(2)

1:4,000

SHEET NO.	THAI	ENGLISH
14-2-B	ยานนาวา	YANNAWA
14-2-C	ราชบุรีระ	RAT BURANA
14-2-D	สะพานพระรามเก้า	RAMA 9 BRIDGE
14-4-B, 15-3-B	ปากลึก	PAK LAT
15-1-A	คลองเตย	KHLONG TOEI
15-1-B	พระโขนง	PHRA KHANONG
15-1-C	บางกะเจ้า	BANG KACHAO
15-1-D	บางจาก	BANG CHAK
15-2-A	อ่อนนุช	ONNUT
15-2-C	อุทมสุข	UDOM SUK
15-3-B	บางนา	BANG NA

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LIST OF SHEET NAME

(1)

1:10,000

SHEET NO.	THAI	ENGLISH
3-1, 3-2	ลำลูกกา	LAM LUK KA
3-3	บ้านตลาดใหม่ก่อนเมือง	BAN TALAT MAI DON MUANG
3-4	บ้านตลาดวัดเกาะ	BAN TALAT WAT KO
4-3	บ้านคลองสามวา	BAN KHLONG SAM WA
4-4	บ้านคลองแปด	BAN KHLONG PAET
4E-3	บ้านคลองสิบสอง	BAN KHLONG SIP SONG
4E-4	บ้านคลองสิบสี่	BAN KHLONG SIP SI
6-4	บางซ่อน	BANG SON
7-1	บางเขน	BANG KHEN
7-2	บ้านบัวมน	BAN BUA MOM
7-3	เกษตรศาสตร์	KASETSART
7-4	บ้านเกาะดอน	BAN KO DON
8-1	บ้านคลองตะวันตก	BAN KHLONG TAWAN TOK
8-2	บ้านแบ่นชะโด	BAN BAEN CHADO
8-3	มีนบุรี	MIN BURI
8-4	บ้านเกาะ	BAN KO
8E-1	หนองจอก	NONG CHOK
8E-2	บางน้ำเปรี้ยว	BANG NAM PREEO
8E-3	บ้านคลองยุกใหม่	BAN KHLONG YUK MAI
8E-4	บ้านบึงทองหลาง	BAN BUNG THONGLANG
9-1	พุทธมณฑล	PHUTTHA MONTHON
9-2	บ้านคลองบางขุนศรี	BAN KHLONG BANG KHUNSI
9-3	กระทุ่มแบน	KRATHUM BAEN
9-4	บ้านคลองบางไผ่	BAN KHLONG BANG PHAI
10-1	ตลิ่งชัน	TALING CHAN
10-2	ดุสิต	DUSIT
10-3	คลองบางแวก	KHLONG BANG WAEK
10-4	พระนคร	PHRA NAKHON
11-1	ห้วยขวาง	HUAI KHWANG

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LIST OF SHEET NAME

(2)

1:10,000

SHEET NO.	THAI	ENGLISH
11 -2	บางกะปิ	BANG KAPI
11 -3	มักกะสัน	MAKKASAN
11 -4	หัวหมาก	HUA MAK
12 -1	บ้านคลองหลอด	BAN KHLONG LO LAE
12 -2	บ้านบึงบัว	BAN BUNG BUA
12 -3	บ้านคลองหนึ่ง	BAN KHLONG NUNG
12 -4	ลาดกระบัง	LAT KRABANG
12E-1	บ้านลำแขก	BAN LAM KHAEK
12E-2	บ้านบึงลำไย	BAN BUNG LAM KHLO
12E-3	บ้านอ้ายแนน	BAN AI BAEN
12E-4	บ้านลำต้อยติ่ง	BAN LAM TOITING
13 -1	บ้านสะแกงาม	BAN SAKAE NGAM
13 -2	หนองแขม	NONG KHAEM
13 -4	บ้านคลองบางบอน	BAN KHLONG BANG BON
14 -1	ภาษีเจริญ	PHASI CHAROEN
14 -2	ราษฎร์บูรณะ	RAT BURANA
14 -3	บางขุนเทียน	BANG KHUN THIAN
14 -4	บ้านคลองบางมด	BAN KHLONG BANG MOT
15 -1	พระโขนง	PHRA KHANONG
15 -2	บ้านหนองบอน	BAN NONG BON
15 -3	พระประแดง	PHRA PRADAENG
15 -4	บ้านคลองหนามแดง	BAN KHLONG NAM DAENG
16 -1	บ้านมะขามเทศ	BAN MAKHAM THET
16 -2	บางพลี	BANG PHLI
16 -3	บ้านคลองบางแก้วใหญ่	BAN KHLONG BANG KAE0 YAI
16E-1	บ้านทับยาว	BAN THAP YAO
17 -2	บ้านระนาย	BAN RAHAN
17 -4	บ้านเกาะโพธิ์	BAN KO PHO
18 -1	บ้านหัวกระบือ	BAN HUA KRABU

Wiche T.K.

LIST OF SHEET NAME

(3)

1:10,000

SHEET NO.	THAI	ENGLISH
18 -2	บ้านคลองตาสอน	BAN KHLONG TA SON
18 -3	บ้านลูกวัว	BAN LUK WUA
18S-1	คลองศรีกุ่มาร	KHLONG SI KUMAN

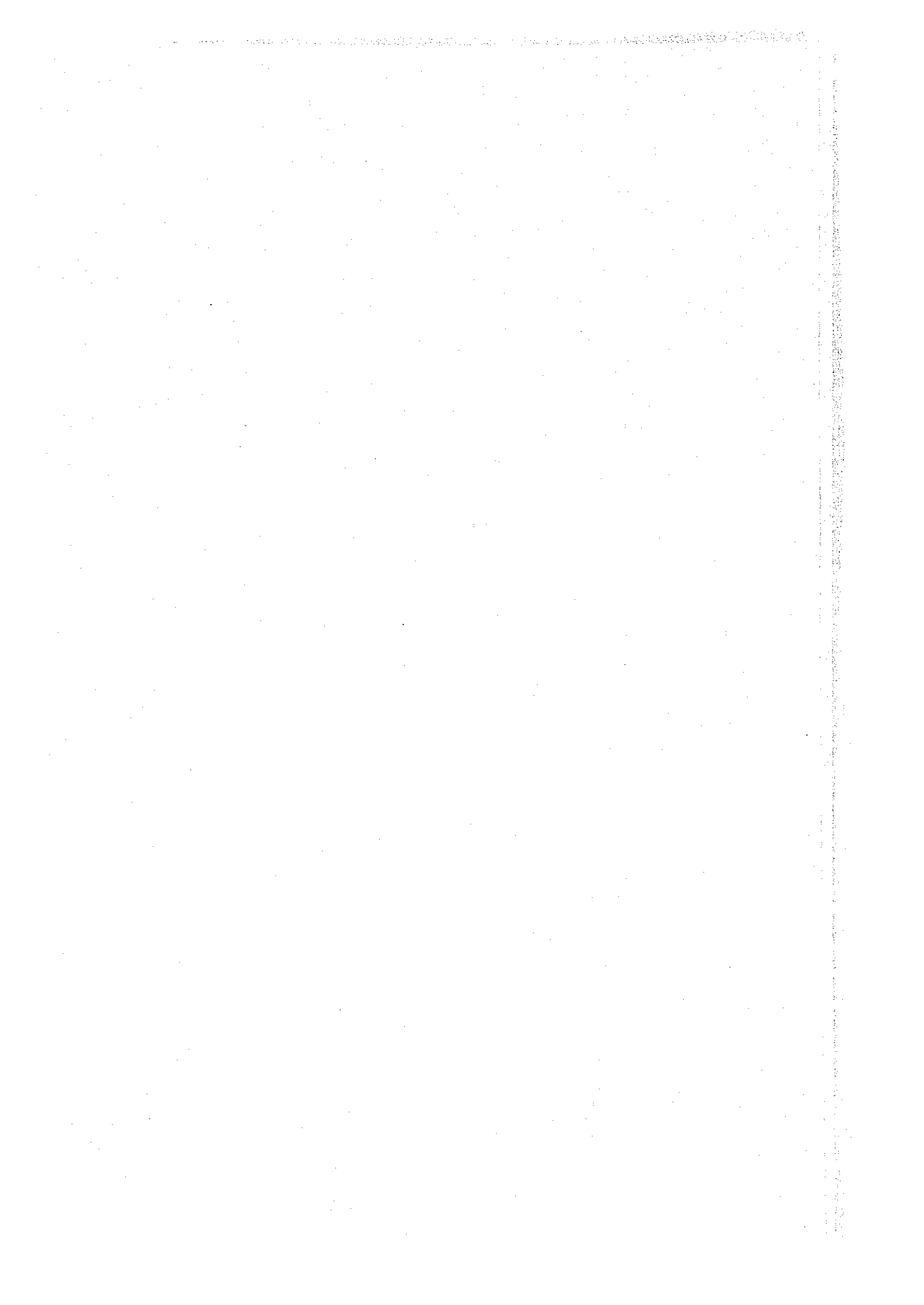
Wichu T.K.

List of the Final Results of
the Ground Control Point Survey

1. Horizontal control
 - (1) Observation and calculation sheet for control point
2. Vertical control survey
 - (1) Observation and calculation sheet for determination of control point height
 - (2) Levelling note and result (3rd order levelling)
 - (3) Levelling note and result (supplemental levelling)
3. Computation sheets
 - (1) Original draft result
 - (2) Calculation sheet
4. Field notes
 - (1) Distance observation sheet (3rd order control point survey)
 - (2) Horizontal angle observation sheet
 - (3) Vertical angle observation sheet
5. Description of Points
 - (1) Control point description
 - (2) Final result and description
 - (3) Bench mark description No.1
 - (4) -ditto- No.2
 - (5) -ditto- No.3
 - (6) -ditto- No.4
 - (7) -ditto- No.5
 - (8) -ditto- No.6

Total 17 Files

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JICA