社会開発協力部報告書

REPORT ON ESTABLISHMENT OF GRAPHIC INFORMATION BASE PROJECT OF NATIONAL CAPITAL REGION REPUBLIC OF THE PHILIPPINES

(FIRST YEAR WORK)

- Ground Control Point Survey • Pricking
- Field Identification (Contoured Map & Land Use Map)
- Aerial Triangulation
- Stereo Plotting

March 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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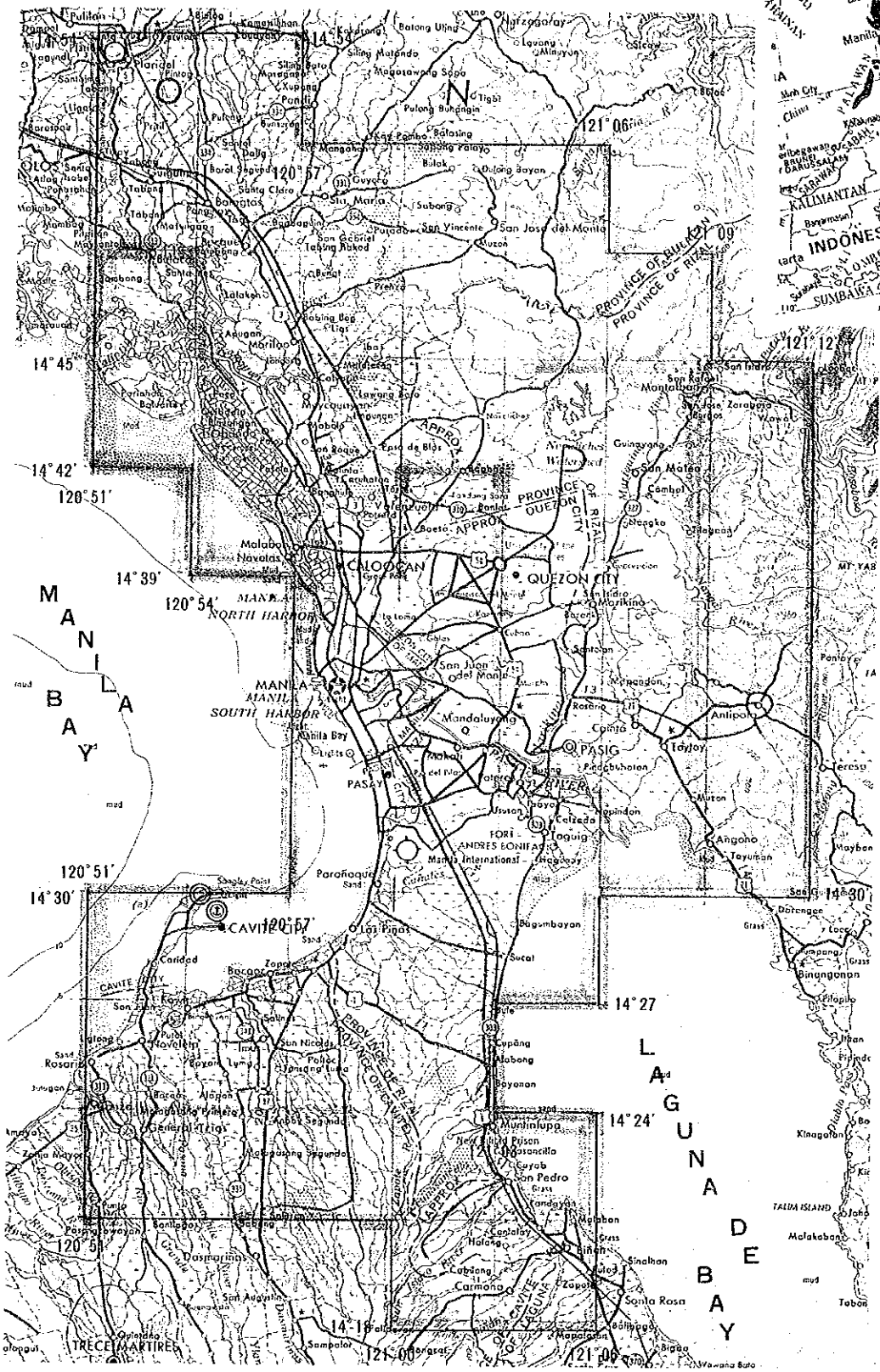
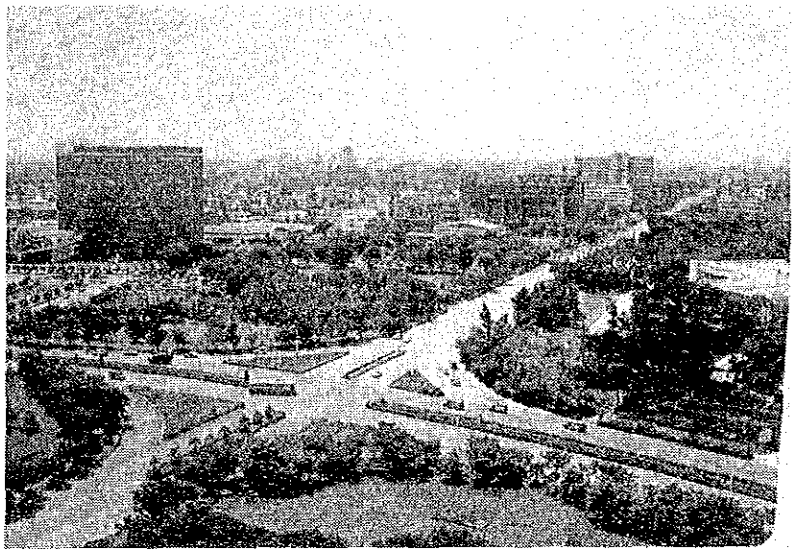
Location Map for Establishment of Graphic Information Base Project of National Capital Region



0 5 10 15 km

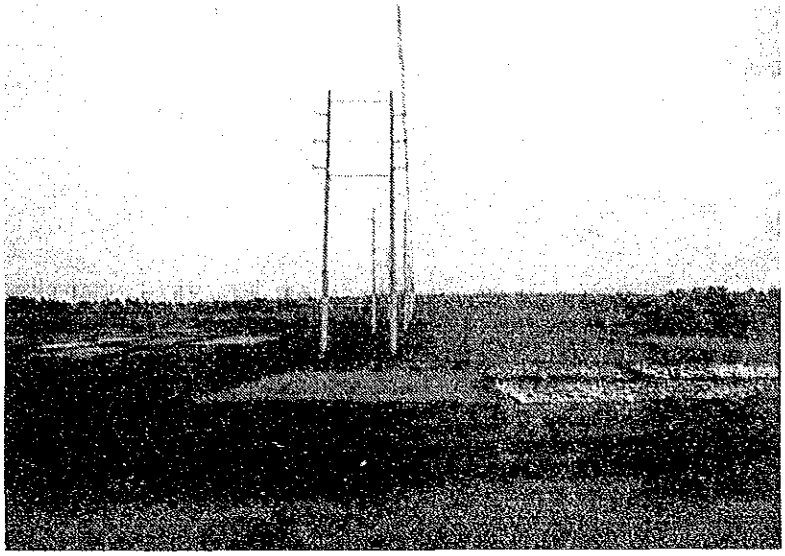
Contoured map :
Planimetric map
Land use map :
Land Conditi on map :

Roxas Boulvard, Manila and high-storied buildings

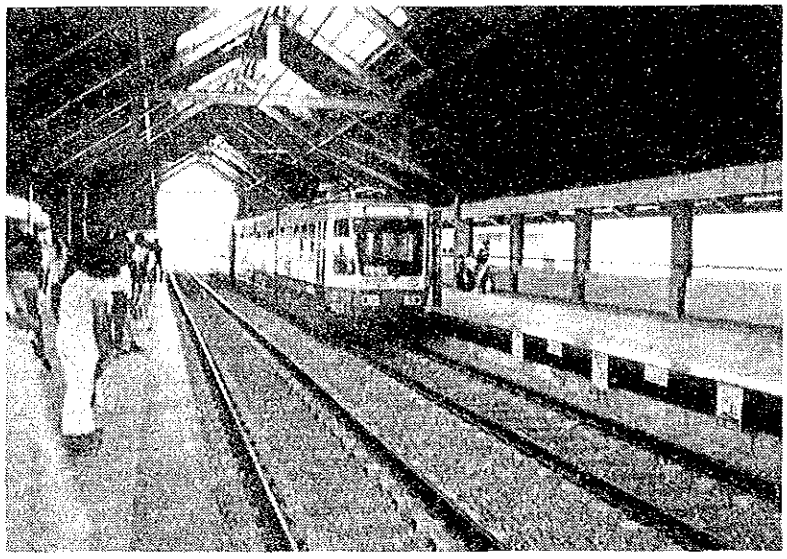


Distant view of Makati and Manila City from Memorial Tower, Quezon City

Bulacan area, where roads are flooded by heavy rain shower



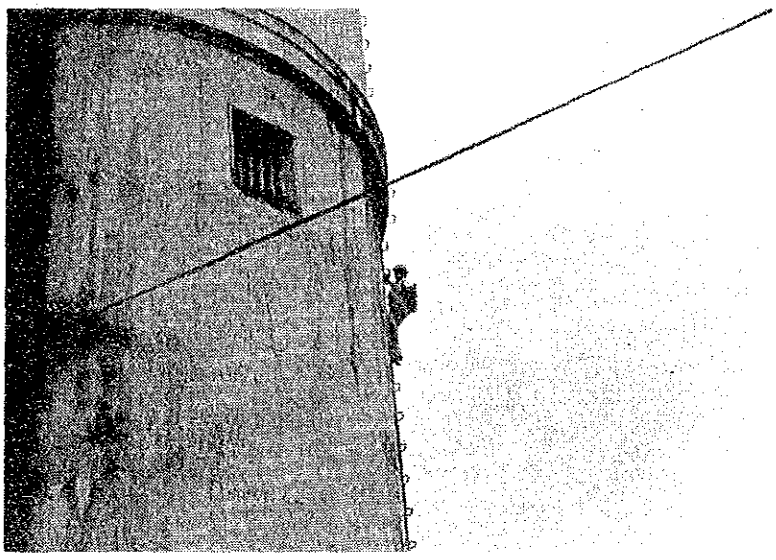
Flat rural area
around Cavite City



Light Rail Transit
running through western
district of Metro Manila
(newly built elevated
railway)

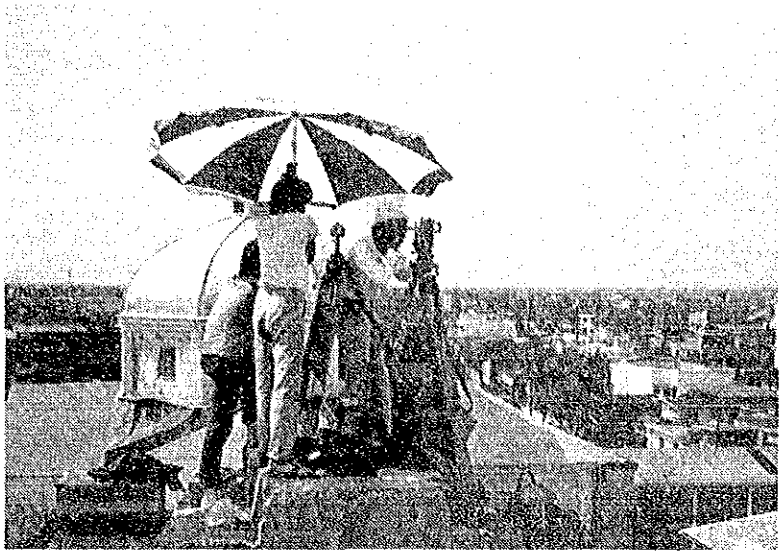
National Railway
in southern area of
Metro Manila

Observation at newly established control point on the roof of Malabon Church



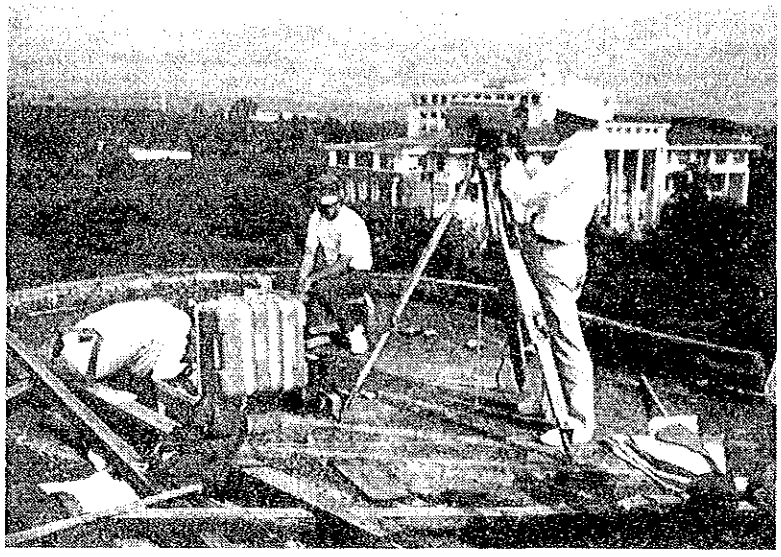
Team member who climb up water tank to the point BAKULARAN (triangulation point about 30 m high)

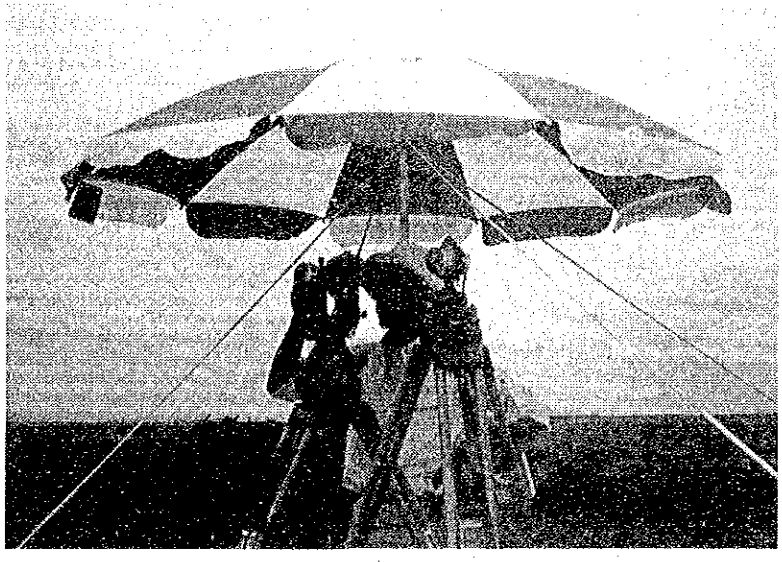
Selection of ground control point (offcoast Obando, Manila Bay)



Observation on the roof
(horizontal angle)

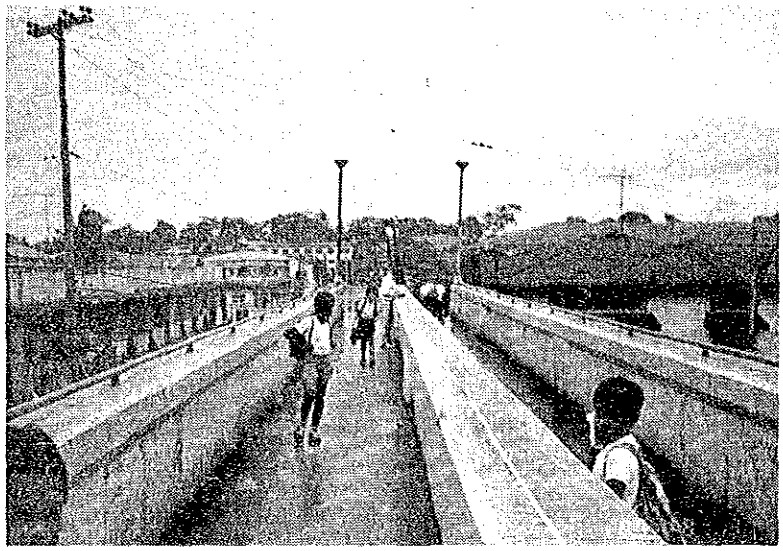
Preparation for distance measuring (at ENGINEERING triangulation point)



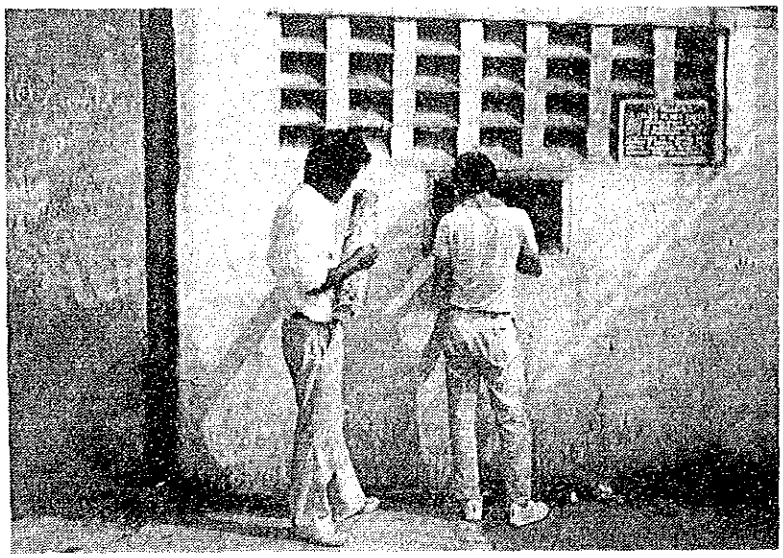


Observation of vertical angle (BROWN triangulation point)

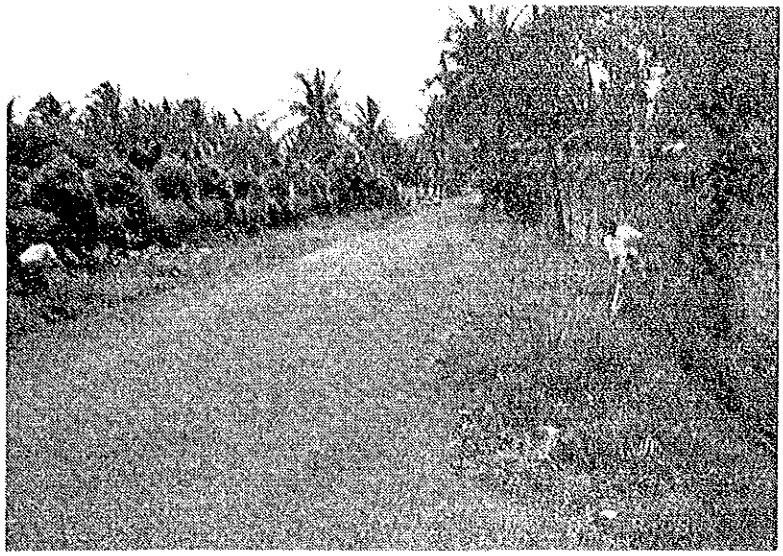
Field indentification at mountain foot area, north-east of Metro Manila



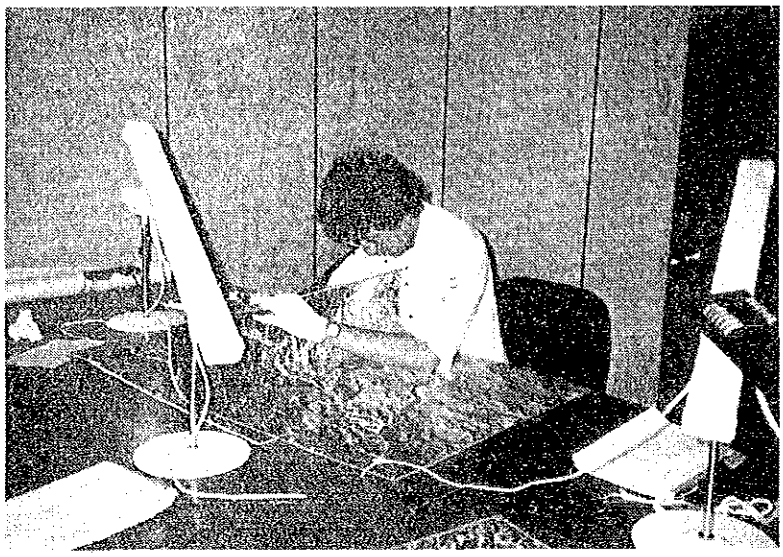
Pedestrian overpass in Manila City



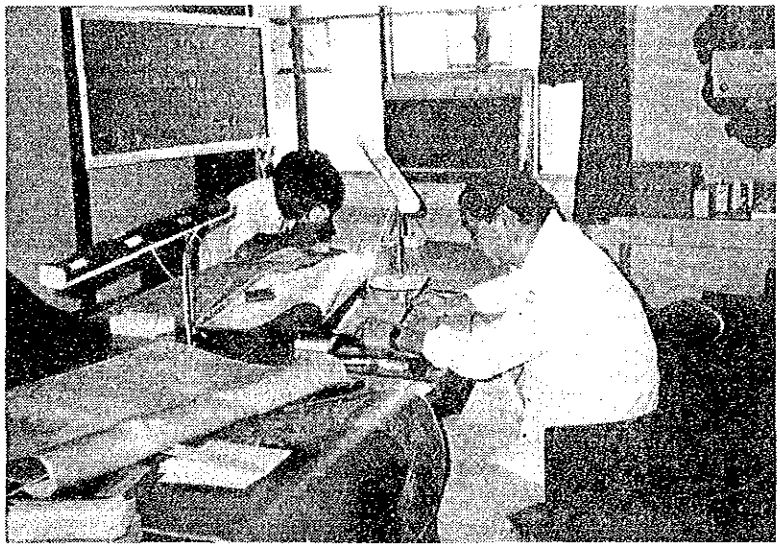
Survey on name of building



Measuring road width
in residential area,
Manila City



Preliminary photo-
interpretation
(at Headquarters)



Compilation work after
field survey
(at Headquarters)

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Appendeces

1. Background of the Project

The environment of the Metro Manila Region, the political, economic and cultural center of the Republic of the Philippines, has been deteriorating due to overcrowding, inadequate urban infrastructure, e.g., roads and housing area, increasing illegally inhabited areas, chronically inundated areas, caused by a drastic influx of population. In particular, the majority of the metropolitan population live together in small houses, creating a serious urban problem.

The Philippine Government has been making efforts to solve the problems through the Metropolitan Manila Commission (MMC) by formulating an urban redevelopment program, enforcing restrictions on land use and taking measures against flooding on a priority basis.

Faced with so many urban problems, in order to systematically solve them in terms of urban policy, it is necessary first to correctly ascertain the present condition in the Metro Manila Region and its environs. However, the maps available of the metropolitan area, which are the basic material necessary for carrying out various urban plans, are inadequate. Therefore, an urgent task is to prepare topographical maps which correctly express the present condition of the urban structure of the metropolitan area. The Philippine Government requested the Japanese Government in March 1984 for technical cooperation in mapping the Metro Manila Region.

In response to the request for technical cooperation, the Japanese Government sent a contact mission in January 1985 and a preliminary survey team in March of the same year to the Philippines to discuss with the Bureau of Coast and Geodetic Survey (BCGS), the survey organization of the Philippine Government, on the proposed technical cooperation as well as to conduct a field survey and data collection. As a result, based on Implementing Arrangement (I/A) concluded in March 1985 between the two governments concerned, it was decided that technical cooperation be carried out under a four-year program starting in 1985 for the establishment of graphic information base project of National Capital Region.

Outline of the project is as follows:

	Scope of work	
Ground Control Point Survey	Newly established	12 points
Leveling	Re-survey	300 km
Pricking	Control point	25 points
Pricking	Bench marks	100 points
Aerial triangulation		120 models
Contoured map	Scale 1:10,000	1,500 km^2(57 sheets)
Planimetric map	"	1,500 km^2(57 sheets)
Land use map	"	823 km^2(33 sheets)
Land condition map	"	424 km^2(16 sheets)

2. Outline of the Project

2-1 Purposes

The first year work of the project was to include ground control point survey, leveling, pricking and field identification, which are necessary field work for preparing maps, along with the processing of aerial photographs, aerial triangulation and stereo plotting to be carried out in Japan.

2-2 Outline of the Project Area

The project area (approximately 1,500km^2), extended around Manila, the capital of the Philippines, borders in the east on the southern end of the Sierra Madre mountain range which runs from the northeast of Luzon and on Manila Bay in the west. It is adjacent to the central plain of Luzon in the northwest and to the river delta area. The Laguna de Bay lies in the southeast. The area is adjacent to foot of the volcanic mountains which include Mt. Taal.

The National Capital Region, the project area, includes four cities, Manila, Quezon, Caloocan and Pasay, and 13 minicipalities such as Makati, Malabon, Valenzuela and Parañaque. The so-called city area, where government agencies, public buildings, shopping and residential areas are concentrated, lies inside the Edosa Ring Road (E DE LOS SANTOS AVE) of the National Capital Region. The roads and buildings become fewer outside the Ring Road with the scenery gradually assuming a pastoral tone.

2-3 Period of the Field Work

Headquarters	July 18 - October 19 '85
Field Identification Party	July 25 - October 12 '85
Ground Control Point Survey Party	August 21 - October 12 '85

2-4 Members of the Survey Team

Leader (General)	Masayoshi Takasaki	July 18 - July 28 '85, October 3 - October 13 '85

Deputy Leader (Deputy General)	Kenzo Motojima	July 18 - October 19' 85
Headquarters (Coordinator)	Hiroshi Kimura	"
Member (Chief Surveyor)	Masaji Koyama	August 13 - October 12 '85
Member (Chief Surveyor)	Isao Furukawa	July 18 - October 19 '85
Member (Ground Control Point Survey)	Kazuyoshi Iba	August 21 - October 12 '85
Member (")	Kozo Toyoda	"
Member (")	Fukuo Izumikawa	"
Member (")	Hideo Hattori	"
Member (")	Yoshichika Mochizuki	"
Member (")	Shingo Niijima	"
Member (Field Identification)	Takashi Yokoi	July 25 - October 12 '85
Member (")	Tokushichi Kanno	"
Member (")	Masumi Ikuno	"
Member (")	Yasuo Furukawa	"
Member (")	Tatsujiro Kubo	"

Member	Mitsuo Hasegawa	July 25	- October 12 '85
(Field Identification)			
Member	Shozo Shimoda		"
(")			
Member	Hiyoshi Saiki		"
(")			
Member	Masanobu Ishii		"
(")			
Member	Masataka Miyazaki		"
(")			
Member	Sadao Ishiguro		"
(")			
Member	Atsushi Okuizumi	July 18	- October 19 ' 85
(")			

2-5 Volume of Work

Item of Work	Volume	Remarks
Ground control point survey	12 points	2 points by BCGS
Leveling	300 km	Resurvey by BCGS
Pricking (Ground control points)	25 points	
" (Leveling)	100 points	
Field identification (Contoured map)	Approx. 1,500 km^2	
" (Land use map)	823 km^2	
Aerial trianguration	120 models	
Stereo plotting	Approx. 1,500 km^2	57 sheets (1:10,000)

2-6 Survey Equipment

(1) Photo Processing

Contact print:	MR-4 Valuable Doching Contact Printer	1	set
Diapositive :	Veribrom Processer (Kodak)	1	"
Enlarger :	E-4 (WILD)	1	"
Dryer :	MRP-4448A (YOKOYAMA)	1	"

(2) Field Identification

Electromagnetic distance meter:	Rangemaster III (K & E)	1	"
	HP380A (Hewlett-Packard)	2	"
Theodrite :	WILD T3 (WILD)	2	"
	WILD T2 (")	2	"
Level :	Auto Level B2 (SOKKISHA)	2	"
Radio :	Walkie-Talkie FM Transceiver A-137 (ANY)	8	"
Slidax :	TDK-BM (TDK)	1	"
	POWER SUPPLY EDM-1208 (ARAKI)	1	"
Generator :	HONDA EM 400 (HONDA)	2	"
Reflector :	K & E Prizm	12	"
Barometer :	Baromec Altimeter (WEGRETTI & BAMBRA)	4	"
Thermometer:	Electric Thermometer (TAMAYA)	4	"
Target :	Helio Trope	5	"
	Signal Lamp	5	"
	Binocular	8	"
	Prizm	1	"
Plane Table:		2	"

(3) Aerial Triangulation

Pricking device :	PUG III·IV (WILD)	2	"
Coordinate measurement device:	Stecometer (ZEISS)	1	"
Computer :	ACOS 350 (NEC)	1	"

(4) Stereo Plotting

Automatic drawing device:	S7000M/RS4015 (MUSASHI)	1	"
Stereo plotter :	Autograph A-7 (WILD)	6	"
" :	Stereo Plotter A-8 (WILD)	6	"
" :	Metro Graph	4	"
" :	Aviolyt BC-1	4	"

2-7 Plan and Result

Item of Work	Plan	Results	Remarks
Ground control point survey	12 points	12 points	
Leveling	300 km	300 km	
Pricking (Control point)	25 points	28 points	
" (Leveling point)	100 points	120 points	
Field identification (Contoured maps)	Approx. 1,500 km^2	Approx. 1,500 km^2	
Field identification (Land use map)	823 km^2	823 km^2	
Aerial trianguration	120 models	123 models	
Stereo plotting	Approx. 1,500 km^2	Approx. 1,500 km^2	

2-8 Outline of the Survey Schedule

Outline of the survey schedule is shown in the Appendix.

2-9 Technical Meetings with BCGS

The mapping project consists of production of contoured map, planimetric map, land use map and land condition map of National Capital Region at the scale of 1:10,000. As the expression of each map differs due to its own purpose, technical meetings were held with BCGS on the detailed specifications including map symbols, map colors, etc. during the field survey period.

(1) Technical meeting at the first phase

Period: July 29 ∿ August 8 '85

In regard to the contoured map symbols incorporated in I/A, draft map symbols and their application prepared by the Japanese side were discussed by the both sides. As for present land use classification of I/A, definition, application and applicable landmarks of symbols for land use map were

also discussed. Discussions were further made on the detailed specifications of planimetric map. After a series of these discussions, proposals on revision or supplement of map symbols and new specifications were submitted by BCGS, and both sides agreed to make further study on these items.

(2) Meeting on ground control survey

Period: August 10 ∿ September 9 '85

In regards to the existing control points and bench marks in the project area, BCGS made technical explanation on present status of control points including distribution, availability, accuracy, etc. Based upon the explanation, the Japanese side revised its work plan and established detailed plan of operation for ground control point survey, pricking and other work. Undertakings carried out by BCGS were also discussed and their work plan were confirmed.

(3) Second phase technical meeting

Period: September 10 ∿ October 5 '85

Since the first phase meeting, technical study had been continued by each side. Upon entering into the second phase meeting on the confirmation of specifications and application of each kind of map from September 10 '85, BCGS proposed and requested to adopt new specifications for classifications of road surface and major plantations (6) as well as expression of congested housing area and map color with reference to the contoured map.

Although discussions were further made on specifications & applications of planimetric and land use maps, definite image of maps to be produced could not be finalized because of non-availability of sample maps. Therefore, as shown in the minutes of meeting agreed on October 11 '85 between JICA and BCGS, the both sides agreed to resume discussion in succeeding meeting based upon sample maps which are to be prepared by the Japanese side.

2-10 Undertaking of BCGS

BCGS made close cooperation to the field survey including ground control point survey, re-survey along the leveling routes. BCGS counterpart specialized in geodesy or topography was appointed to each field party and a part of the field identification work was carried out by them. Responding

to request of the Japanese side for provision of information necessary for mapping work, BCGS organized separate party and conducted the field identification by using aerial photographs.

BCGS counterparts made their best efforts in such hard conditions as early morning attendance and late overtime work, as request by the Japanese side, despite unfavorable transportation condition in Manila.

Permissions for using roof space, entering into private properties, etc. were also smoothly secured by BCGS without causing any inconveniences to the field work.

BCGS counterparts participated in the field work are as follows:

Ground control point survey

LT. RIZALITO G. BOLIGAO

EN. ROMEO P. JACOB

EN. BENJAMIN P. ESTUR JR.

Field identification

LT. ALEJANDRO U. CARAGAY

EN. FRANCIS P. CARLOS

EN. VICENTE T. TABIRAO JR.

EN. HERNANDO R. RAPOSAS

EN. STEVE S. ABALAYAN

EN. VIRGILIO C. ALIGORO

EN. JESULITO A. REAL

3. Preparation Work in Japan

3-1 Outline

Upon starting preparation for the field work, the followings were taken into consideration:

1) Aerial photographs covering the project area are already available.
2) Maps to be produced shall be 1:10,000 maps which express cartographic information in proportion to the actual size.
3) Based upon contoured map, planimetric map, land use map and land condition map shall also be prepared in different specifications.
4) BCGS shall participate in part of the field survey.

During the period of the preparation work, production of aerial photos for the field survey use was conducted as negatives of the aerial photos were available from BCGS. Also, preparation of draft specifications for map symbols & application of each map and related studies were carried out.

3-2 Specifications, etc. of Ground Control Point Survey

As for the ground control point survey and pricking, it was decided to adopt closed traversing method using electromagnetic distance meter based upon JICA Specifications for Overseas Surveying. According to reference materials obtained so far, specifications, work method, observation accuracy, etc. were studied and survey equipment and materials were also selected based on work plan.

3-3 Study on Specifications for Symbol and Application

Contoured map symbols which were prepared by BCGS and set forth in I/A, their details and application were not finalized. Therefore, according to related specifications of 1:10,000 map of Japan as well as advise of Manila Map Symbol Study Group, map symbols were individually studied and their applications (draft) were prepared.

As for land use map, its classification defined in I/A, definition & application, main applicable landmarks, expression method were studied.

Draft specifications of land use map to be prepared by combination of color separation plates of contoured map, were also studied.

3-4 Photo Processing

Aerial photographs necessary for mapping work were prepared by using negative films which were taken by BCGS in 1982.

(1) Elements of aerial photography

1)	Camera	:	RMK-A
2)	Photographing altitude	:	16,050 ~ 16,720 ft.
3)	Focus length	:	152.85 mm
4)	Scale	:	1:32,000
5)	Time of photography	:	February ~ April, 1982

(2) Results of work

1)	Contact positive films	:	138	sheets	
2)	Contact prints	:	138	"	
3)	2-time enlargements	:	136	"	(BM Pricking)
4)	3.2-time enlargements	:	136	"	(Field identification of contoured map)
5)	" "	:	74	"	(Land use map)
6)	" "	:	40	"	(Land condition map)
7)	4.0-time enlargements	:	34	"	(Pricking of existing control points)

Among the BCGS's aerial photos, suitable photos were so selected as to obtain 60% overlap because their overlaps ranged 80% to 90%.

3-5 Preliminary Photo Interpretation

Preliminary photo interpretation for field identification of contoured map and land use map was made based upon existing data. However, as data was old and difficult to be identified on the aerial photos, the preliminary interpretation was unable to be satisfactorily done and limited to delineate field work areas, sheet lines and survey area per model.

By interpretation of aerial photos covering the project area, furthermore, outline of present structural status of Metro Manila Region was studied and general plan of the field survey was established.

4. Field Work

4-1 Preparation of the Field Work

4-1-1 Outline

For preparation of the field work, Motojima, Deputy Leader and other 3 members left Japan on July 18, 1985. After arrival at Manila, the team carried out take-over of survey equipment & materials sent from Japan, arrangement of survey vehicles, opening of bank accounts, preparation of accomodating and office facilities, hiring of laborers, etc. as well as initial meeting with BCGS. Furthermore, collections of data & information necessary for the field work and reconnaissance of the project area were conducted.

4-1-2 Headquarters and accomodation

Headquarters and accomodation of the team were set up in the Quezon City located 15 km north-east of Manila City as follows:

Name : Metropolitan Apartelle

Address: 131 Malakas St., Quezon City

Quezon City is situated nearly in the center of the project area and occupy not only important place of the main highway (EDSA Ring Road) connecting Manila City and sub-urban area but also most favorable location for survey work.

4-1-3 Communications

For communication between Tokyo and Manila as well as within the project area, public telephone was used without any problem. Communications between observation points of ground control points, where telephone service not available, was carried out by FM transceivers sent from Tokyo, whose permission for use and frequency adjustment was arranged in Manila before use.

4-1-4 ID Cards

ID cards were issued by BCGS to all of the survey team members and always carried with them during the survey period. The cards were

effectively used, to avoid unnecessary trouble, particularly in such places as alleys where the field work sometimes needed to enter.

4-2 Ground Control Point Survey

4-2-1 Plan of ground control net

In the course of planning ground control net, new control points were planned for the purpose of establishment of a ground control net in the National Capital Region coordinating with existing triangulation points in the project area and preparation of picture points for aerial triangulation.

4-2-2 Selection of points

The project area is situated in metropolitan area including Manila City. Manila Bay exists west to the area. Northern and east-southern part of the area are hilly. Rice fields are remarkably found in the southern area. Those areas have variety of land feature and vegetation. Coconut trees sometimes interrupted visibility for observations. Some of existing control points were lost at the time of the field work being conducted. Selection of points were carried out using the top of tall buildings, eccentric observations, etc., which are adapted to the situation at site, to form traversing net. (Fig.-1)

The following attentions were paid specially on selecting new points for traversing.

The points are to be:

(1) easily identified as picture points for aerial triangulation and located in the place convenient to pricking,

(2) situated with no danger to personnel during observation and without any difficulty in access,

(3) and available as ground control points in the future as well as established in good condition for maintaining themselves as permanent monuments.

4-2-3 Monumentation

BCGS explained and coordinated with local people, who own the site for monument, to conduct monumentation on newly planned traversing points. Monumentations are subject to BCGS' specifications. (Fig.-2)

4-2-4 Observation

(1) Determination of distances

Rangemaster III and Hewllet Packard 3808A were used for measuring. Each side was measured twice and difference between first measuring and the second was specified less than 1:40,000. In the case of long distance, meteorological observations on temperature and barometric pressure were made at both observation points.

(2) Observation of horizontal angle

In the process of planning, distances among the proposed ground control points were predicted to exceed standard side-length of third-order traversing. Wild T2, therefore, was used for main observation and Wild T3 was carried with Wild T2 for completion of observation on those long distances. Measurements were made twice at each observation. Observed results were subject to meet the accuracy of second-order traversing. Double angle difference was specified as 12" and observation error as 7". Mean observed value was unified to show up to one tenth of second. In case signals were far, helio-tropes and signal lamps were used to maintain good observation accuracy.

(3) Observation of vertical angle

Two sets of observation were carried out simultaneously between two points targetting each other. One set consists of a pair of measurement. Time interval was 20 minutes in average. Descrepancy of altitude multipliers was specified within 10".

4-2-5 Leveling

Direct leveling was executed from existing bench mark to two triangulation points (IZURA 1985, CARLOS) to determine average elevation of existing triangulation points and new control points. Duplicate leveling line and less than 20 mm $\sqrt{S}$ (S: single line in km) of discrepancy were

Fig.-1 Network of Ground Control Points

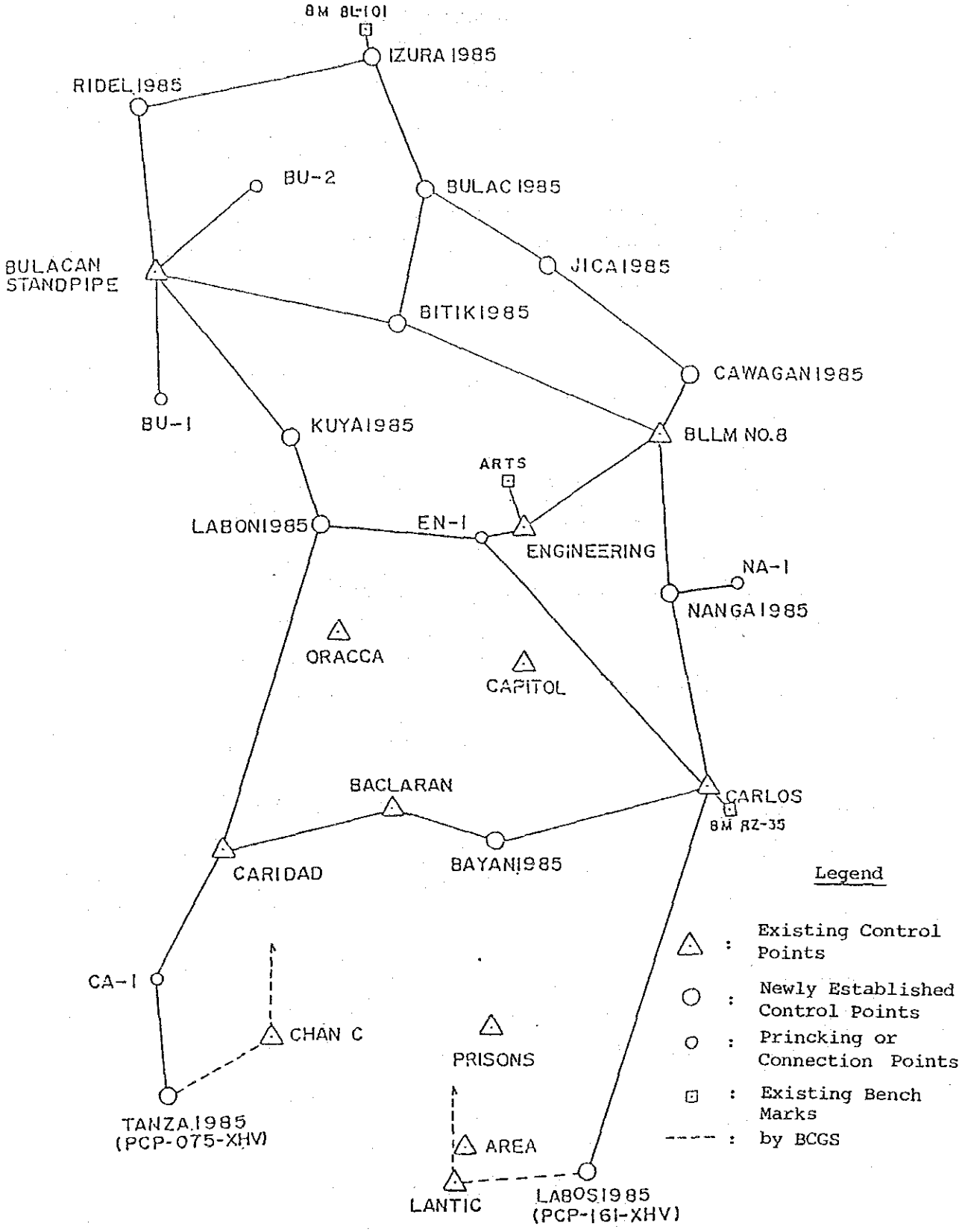
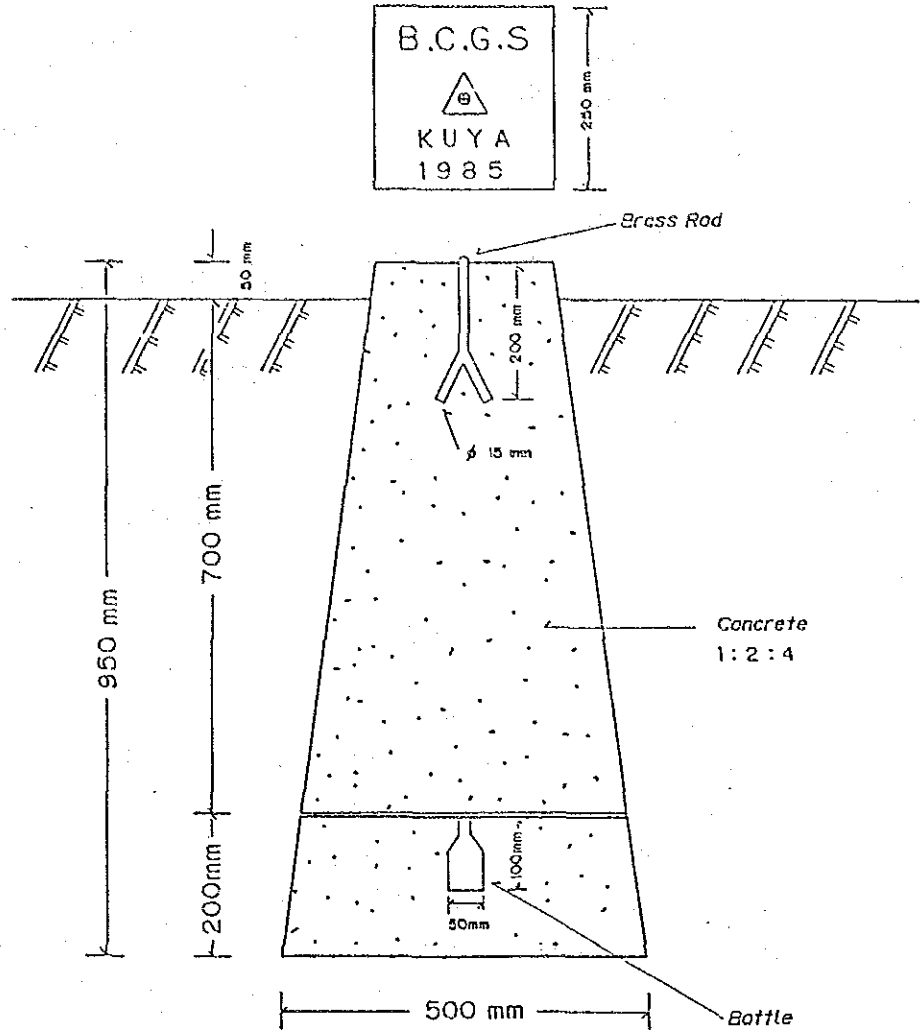
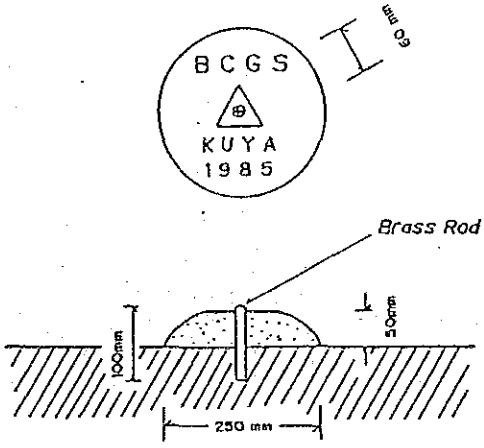


Fig.-2 Monumentation of Ground Control Point



Roof Top



specified. Average elevation of triangulation point ENGINEERING was obtained for enhancing accuracy of all elevations.

4-2-6 Computation

(1) Rough computation

1) Computation of coordinates

Computation of coordinates was carried out by fixing one triangulation point and one direction and using observed vertical angle and corrected distance in meteorological factor, grade and projection. The computation was done to verify closure of loop and confirmed as complete good results.

It was assumed that the existing triangulation points in the project area had approximate 20 cm of error, as value of the two sides of existing triangulation points CARIDAD-BACLARAN and ENGINEERING-BLLM No.8, which composed a part of proposed ground control net, were proven to be 28 cm and 22 cm respectively shorter than the value newly observed this time. Therefore, another computation for tying of existing triangulation points was carried out in addition to computation of closure to obtain the accuracy of each route. All of three existing triangulation points used for the proposed traversing net were considered as available given points in the net, since the accuracy of all the traversing routes met the specified accuracy of 1:25,000. (Table-1, Fig.-3)

2) Elevation computation

Elevations were computed using the observed vertical angle and the distance corrected on meteorological factor and projection. This computation was executed in order to verify the closure of elevations of the loop not related to any given point. All results were confirmed as good and acceptable.

On the other hand, the accuracy of closure was inspected by comparing the value of differences in elevations of traversing routes obtained from the above computation and the value of the existing bench marks. The results were as follows:

No.	Route	Difference of elevation	Existing results	Difference	Allowance
1	IZURA ∿ BLLM ∿ ENGI	- 9.53	- 9.12	-0.41	±0.59
2	IZURA ∿ BULAC ∿ ENGI	- 9.53	- 9.12	-0.41	±0.74
3	IZURA ∿ BLLM ∿ CARLOS	+84.41	+85.59	-0.58	±0.65
4	ENGI ∿ BLLM ∿ CARLOS	+93.94	+94.21	-0.27	±0.53
5	ENGI ∿ EN-I ∿ CARLOS	+93.99	+94.21	-0.22	±0.60

The route starting at IZURA was 50 cm lower than others. This route, however, obtained sufficient accuracy regarding the closure of the loops. Therefore, the above difference of 50 cm was concluded as the discrepancy caused from the existing bench mark BL-101. All existing bench marks were considered as given points, as the differences of all routes in this elevation computation were within the specified accuracy.

(2) Precise computation

1) Computation of coordinates

Factors used for precise computation are as follows:

Spheroid : Clerke 1866

Coordinate at origin: N 0 m

E 500,000 m

Scale factor : 0.99995

Coordinate system : PTM III

Adjustment computation of coordinates was designed as follows:

a) Computation by free-net solution method

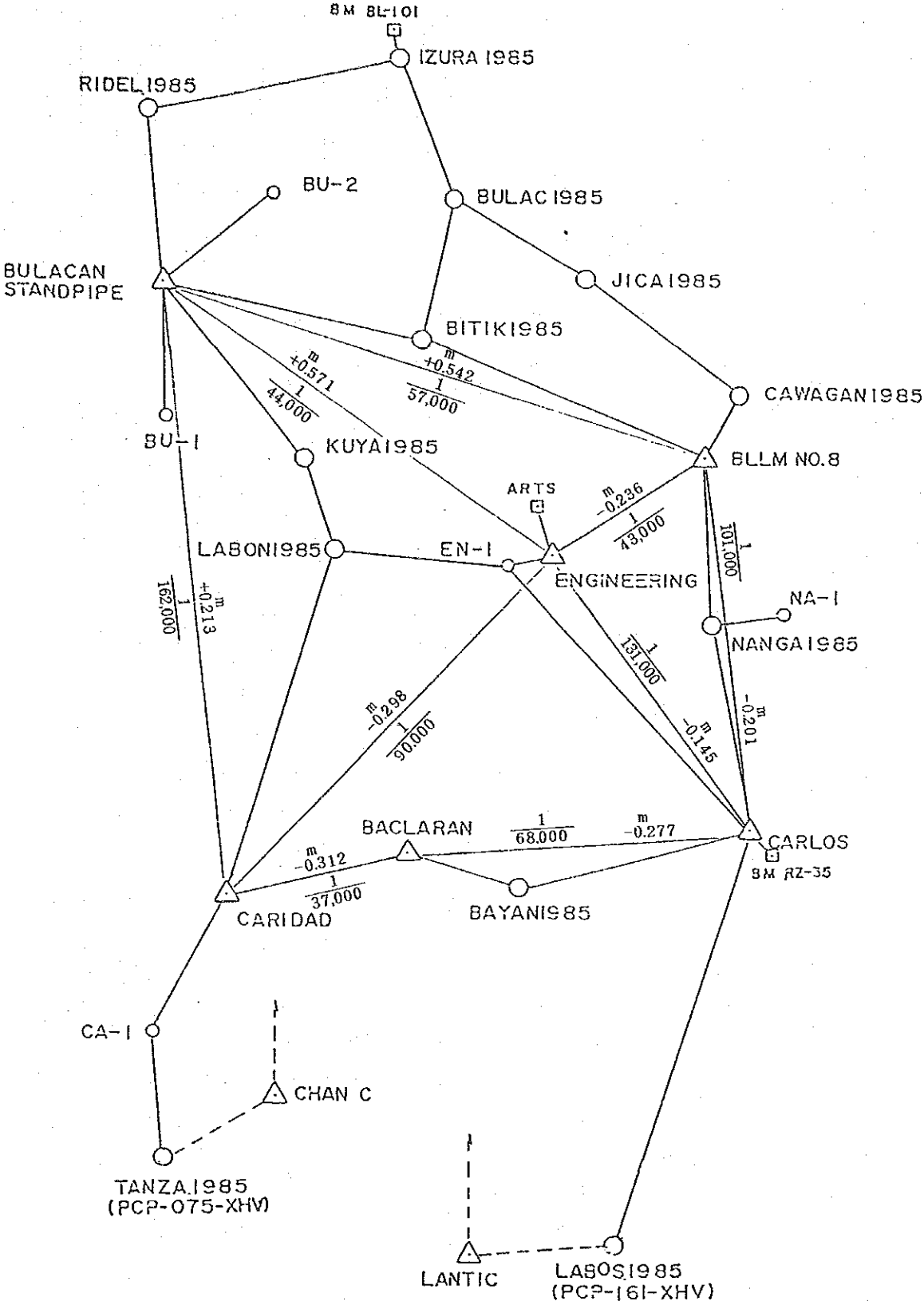
The computation was carried out to check displacement of the existing triangulation points. Description of displacement is shown in Table-2.

b) Final results were developed by simultaneous elevation and adjustment computation of coordinates of traversing net, using 6 existing triangulation points as given points, because it was proven that the accuracy of those existing triangulation points were mostly same in accordance with the results of trials such as computation by free-net solution method fixing coordinates of 6 existing triangulation points, fixing 4 existing triangulation points, etc.

Table-1 Comparison between Results of Free-net Solution Method (fixing 6 existing points as given points) and Results of BCGS

Name of Point		X	△x 1−2	Y	△y 1−2	Vector
		m	m	m	m	m
BULACAN STANDPIPE	1 Mean value (Free-net)	1636,060.367	+0.295	486,910.008	−0.390	0.489 307°
	2 BCGS	1636,060,072		486,910.398		
BLLM NO. 8	1 Mean value (Free-net)	1625,662.143	−0.277	516,452.683	−0.022	0.278 185°
	2 BCGS	1525,662.420		516,452,705		
ENGINEERING	1 Mean value (Free-net)	1620,956.003	−0.057	507,366.293	+0.129	0.141 114°
	2 BCGS	1620,956.060		507,366.164		
BACLARAN	1 Mean value (Free-net)	1605,657,166	+0.012	499,499.947	+0.089	0.090 82°
	2 BCGS	1605,657.154		499,499.858		
CARIDAD	1 Mean value (Free-net)	1601,412.484	+0.118	488,604.836	+0.381	0.399 73°
	2 BCGS	1601,412.366		488,604.455		
CARLOS	1 Mean value (Free-net)	1605,341.470	−0.092	518,365.560	−0.187	0.208 244°
	2 BCGS	1605,341.562		518,365.747		

Fig.-3 Comparison of Distances Measured by BCGS and JICA Survey Team



2) Elevation computation

Final results of the elevations of existing triangulation points (no elevation) and newly established ground control points were obtained by simultaneous elevation and adjustment computation of traversing net, using elevations of existing triangulation points, IZURA 1985, ENGINEERING, and CARLOS, whose values of elevations were determined from existing bench marks.

4-2-7 Inspection

All newly established ground control points were inspected in the field by check of observation sheets, computation of distance correction, rough computation of traversing net, preparation of draft description of control points, etc.

Several trials of adjustment and precise computation of coordinates in traversing net, elevation computation as well as preparation & inspection of final result table and record of station descriptions were conducted in Japan.

4-3 Pricking

4-3-1 Outline

Existing triangulation points, newly established ground control points and vertical control points were pricked on aerial photographs in order to be used for aerial triangulation and stereo plotting.

4-3-2 Photo reproduction

4-time enlargements used for pricking of new ground control points were reproduced by BCGS after selection of points and monumentation.

4-3-3 Pricking of ground control points

Newly established ground control points were pricked eccentrically at clear points of aerial photographs taking aerial triangulation and stereo plotting into account. Eccentric elements were observed. 4-time enlargements were used for indication of pricked points. Description sheet of ground control points were compiled.

4-3-4 Pricking of vertical control points

It was planned to prick vertical control points homogeneously in the project area. Pricking was carried out according to existing final result tables and description of vertical control points using 2-time enlargements.

Elevations of pricked points were determined by obtaining relating heights resulted by minor-order leveling and plane table surveying after those points were transferred eccentrically to center of road, flats, etc. for easier orientation in the course of aerial triangulation and stereo plotting. Description sheets of points were also prepared.

4-4 Field Identification (contoured map)

4-4-1 Outline

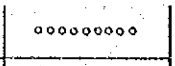
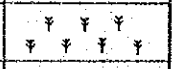
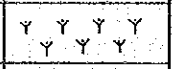
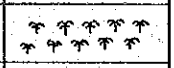
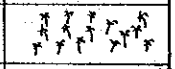
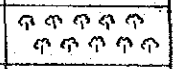
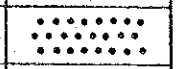
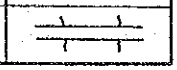
Field identification was carried out on the basis of map symbols (draft) and symbol specifications (draft) prescribed in the I/A, covering roads, rivers, buildings, structures, vegetation, annotations, names, etc., necessary for 1:10,000 scale contoured mapping, and they were expressed on the photograph.

Requests were made by BCGS during technical meetings held during the survey period for changes in or additions to the symbol specifications. Those of a small item were effected according to the views held by BCGS. However, those of a large item were left pending.

4-4-2 Examination of symbol specifications

Below is a list of those additional map symbols requested by BCGS during technical meetings.

Division	Name	Symbol
New Addition	ALLEY	
	SPORTS CENTER	
	GAS STATION	
	BUS TERMINAL	
	AERO BEACON	
	SLIPWAY	
	ROPEWAY	

	TREES LINED ROAD	
	SUGARCANE	
	PINEAPPLE	
	BANANA	
	COCONUT	
	MANGO	
	OTHER PLANTATION	
Deletion	Not use bridge symbol	

Below is a list of the changes in specifications requested by BCGS but were left pending as matters which required further consideration because they involved major changes.

(1) Indication of road surface classification

(2) Indication of plantations in six categories

(3) Changes in generalization for congested areas

(4) Changes in color design for contoured map printing

4-4-3 Preliminary photo-interpretation

In order to efficiently conduct field identification, preliminary photo-interpretation was carried out in Japan before commencing field identification. City guide maps, tourist maps, etc., obtained in Manila were used to mark public buildings, parks, public facilities, historic sites, etc. on the photograph to study survey routes and for job allocation for the survey group.

4-4-4 BCGS's field survey

As it turned out to be difficult to collect the material necessary for mapping requested by the Japanese side, BCGS conducted a field survey by organizing its own survey group to collect and supply data.

4-4-5 Field identification

Field identification was carried out by six survey groups, each consisting of two team members, one counterpart and assistants. Based on the results of preliminary photo-interpretation, field identification was carried out in accordance with symbol specifications with regard to unidentified features, road widths, function symbols and names of main buildings, small landmarks, vegetation, etc., covering the entire area. Views of counterparts were taken into consideration in adopting function symbols, annotations, etc. When there was no space for names, annotations, etc. on the photograph, a list of annotations was prepared.

In order to unify the contents of the survey, key for interpretation was prepared to unify the expression of features, etc.

Below is a list of main items for identification.

- o Roads : Grades, structures of sidewalks, separate zone, etc., widths
- o Railways : Single track, double track, siding, crossing with road
- o Buildings : Classification of independent or generalization in accordance with the map symbol specifications, and selection of annotations and symbols for buildings
- o Specified areas and small landmarks: Names, areas and positions
- o Rivers : Major rivers, routes and structures of main drainage canals
- o Vegetation: Those not clearly identified by aerial photograph, vegetation boundaries
- o Topography: Depressions, cliffs, rocks, banks, cuttings, etc., which are difficult to identify

4-4-6 Compilation

In view of the complexity presented by planimetric features and facilities in the project area, they were marked on the photograph in the order of importance to avoid omissions. Efforts were made to complete the compilation on the same day.

As for annotations, since there was no space on the photograph, they were numbered and a list of annotations, names, etc., was compiled. Function symbols were shown in accordance with the specifications for those buildings, structures, etc., for which map symbols had been prescribed.

Since the aerial photograph was taken in 1982, the number of changes after aerial photography was more than it had been anticipated. Although they were examined as much as possible during the field survey and were marked on the photograph, it was decided to survey and mark newly built motorways, large channels, housing areas, etc., during field completion survey.

4-4-7 Compilation in Japan

As for compilation work after returning to Japan, annotation overlays were prepared and supplementary plotting conducted on the photograph. In addition, examination and confirmation of the survey photographs were carried out. Although inking had been completed during the survey for important items, photo interpretation, matching, verification with land use maps, etc., were carried out in more detail. Verification of the annotation overlay with the annotation list of place names and survey photographs was also carried out.

The survey photographs of BCGS and those of the Japanese side were compared for confirmation.

4-4-8 Survey items to be surveyed by BCGS

As a result of technical meetings with BCGS upon the completion of the field survey, it was decided that the following items be surveyed by BCGS by May 1986.

(1) Effective clearances of overpaths, grade separations, bridges, tunnels, etc.

(2) Administrative and geographical names, administrative boundaries.

(3) Names of roads, rivers, bridges, railways, railway stations.

(4) Wrecks, sewerage outfalls, reefs, light houses

(5) Depth curves of Manila Bay and estuaries

(6) Edit of annotations, names and function symbols

(7) Expression of defense facilities

Also,

(1) Survey of road surface classification

(2) Survey of plantations in six categories

For BCGS to carry out these operations, it was decided for the Japanese side to sent plotting sheets (positives) to BCGS at an early date with instructions and to obtain a confirmation of the completion of operations.

4-5 Field Identification (land use map)

4-5-1 Outline

In conducting field identification for land use map, the specifications (draft) prepared by the Japanese side based on the land use classification prescribed in the I/A were discussed with BCGS. Based on the results of discussions, the present land use was surveyed and classified before plotting on the photograph.

The survey was conducted in coordination with field identification for contoured mapping.

4-5-2 Study of map specifications

As in the case of contoured mapping, BCGS proposed changes in classification and applications after commencing the work. After discussions, some of the changes proposed were accepted and put into effect. The standards for a minimum size of expression were also discussed and confirmed by both Japanese and Philippine sides.

(1) Buildings, etc.: 3 × 3 mm on map
To be classified by site including buildings and facilities. However, those areas such as mixed commercial areas not meeting the standards are to be generalized as a 1.5 mm strip.

(2) Vegetation, etc.: 5 × 5 mm on map
Vegetation and water sphere of 5 mm or more on map are to be expressed.

4-5-3 Field identification

Field identification for land use was conducted in parallel with that for contoured mapping, taking the results of preliminary photo-

interpretation conducted for contoured mapping into consideration. As the survey covered the built-up section of the Manila metropolitan area, a detailed land use classification had to be employed. Field identification was carried out by carrying the classification key prepared on the basis of the map specifications.

While virtually no problem was encountered in residential areas, identification of the use of buildings of two stories or more in commercial-residential areas and in industry-residential areas proved to be difficult as almost all the buildings in these areas were being used for multiple purposes. It was also difficult to ascertain the condition of those areas enclosed by fence, wall, etc. These areas were surveyed by means of interviewing conducted by counterparts.

4-5-4 Compilation

Compilation was carried out as in the case of field identification for contoured mapping. In particular, attention was paid to confirm commercial-residential areas and industry-residential areas. Temporary housing areas surveyed by BCGS were transferred and adjustment was made with contoured mapping with regard to boundaries.

Below is a list of changes made in classification as a result of discussions with BCGS.

Item	Classification at the time of survey	Final classification
Temporary housing	Temporary housing	Residential
Hotel/Motel	Commercial	Commercial
Theater/Cinema	"	Park & recreation
Exhibition hall	"	Education & culture
Billiards/casino/cockpit	"	Park & recreation
TV-radio station	Public & official	Business (Private sector only)
Telephone exchange	"	Business
Sports center		Park & recreation

Item	Classification at the time of survey	Final classification
Memorial park	Park & recreation	Religious/cemetry
Abattoir	Supply/treatment	Transportation/ distribution
Dumping	Open space	Supply/treatment
Gasoline station	Commercial	Transportation/ distribution
Agricultural warehouse	Transportation/ distribution	Agro-industrial
Animal food factory	Industry	"
Pasture/ranch	Crop land	Grass land
Plantation	Plantation	Categorized in 6 items

As these changes were proposed by BCGS when the survey was halfway through, it is necessary to survey motels, TV-radio stations, agricultural warehouses, animal food plants, etc. once again when supplementary identification is carried out. Also, it was requested just before the completion of the field work to add commercial-business areas to the classification. Although these requests were made because BCGS took map users' views (mainly government agencies) into account, it was decided to effect necessary modifications at the time of field completion as changes during the field work would disrupt the compilation of survey items.

4-5-5 Compilation in Japan

Although survey items were indicated on the photograph at survey sites by means of approximate annotation, they were checked with the results of field identification for contoured mapping by confirming them on the photograph. As for changes after aerial photographs, they were matched to the results of field identification for contoured mapping.

4-6 Results of Field Work

4-6-1 Ground control point survey

(1) Computation of coordinates were executed by free-net solution method, since it was impossible to collect detailed data on the accuracy of existing triangulation points in the project area. Furthermore, accuracy and instruments were subject to second-order horizontal control point survey to check specified accuracy of third-order horizontal control point survey.

In order to inspect accuracy, several trials were carried out such as the computation using 4 of 6 triangulation points as fixed points, the computation using 5 of the 6 points as fixed points and the computation using all of the 6 points as fixed points.

Results are shown in the following table:

Table of Comparison in Vector between BCGS and JICA Survey Team

Name of points	4 points fixed	5 points fixed	6 points fixed
BULACAN	0.592	* 0.432	* 0.489
BLLMNOS	* 0.167	0.372	* 0.278
ENGINEERING	* 0.085	* 0.199	* 0.141
BACLARAN	* 0.153	* 0.074	* 0.090
CARIDAD	0.474	* 0.355	* 0.399
CARLOS	* 0.142	* 0.292	* 0.208

* : fixed point
vector: ΔS

In accordance with the above results, the existing triangulation points were presumed to have about 20 cm to 30 cm of error. However, simultaneous adjustment computation was executed, because of deficiency of data to judge quality of each existing triangulation point.

It is concluded that the accuracy of the existing triangulation points and newly established ground control points are sufficient for conducting aerial triangulation and stereo plotting.

(2) In case using newly observed value for computation, elevation computation makes same good result on difference of the closure as computation

of coordinates does. On the other hand, in case 3 points of existing bench mark are used as given points, the difference of the closure still does not exceed the allowance of specified accuracy but become worse than the results from computation with no existing data.
Especially regarding the routes relating to existing BL-101, approximate 50 cm of discrepancy occur.
Four (4) points of 6 existing triangulation points did not have elevation value. However, elevation computation was executed with existing 3 bench marks, since those points have to obtain elevation value. Difference of the closure is within the allowance of specified accuracy. Therefore, those points are concluded to be enough as picture points.

Table of Accuracy on Rough Computation

Route No.	Length (km)	Direction angle		Coordinates		Coordinates		Elevations	
		Difference of closure (km)	Allowance (km)	Difference of closure (m)	Allowance	Ratio of cloure (thousand)	Allowance (thousand)	Ratio of closure (m)	Allowance (m)
1	58.560	+0.7	±7.8	0.132		1/443.	1/25.	+0.02	±0.81
2	47.771	+2.1	±7.8	0.143		1/334.	"	-0.01	±0.69
3	71.957	-6.7	±9.2	0.294		1/244.	"	-0.01	±0.89
4	53.125	-5.2	±7.8	0.301		1/176.	"	-0.07	±0.80
5	83.068	-1.5	±8.5	0.228		1/364.	"	-0.73	±1.08

(3) New ground control points established by BCGS

BCGS conducted establishment of 2 new ground control points (LABOS 1985, TANZA 1985) in parallel with JICA survey team. As, fortunately, those points were able to join the traversing net developed by JICA team, they were tied to the traversing net by open traversing method and used in the computation of net adjustment. The results surveyed by JICA team were compared with BCGS' results.

4-6-2 Leveling

BCGS re-surveyed and revised approximate 300 km of existing leveling route. JICA team received and verified the revised leveling data and conducted pricking. Relation between the tidal station at PIER 15 of MANILA PORT and the original point of leveling route was checked to ascertain the relation between elevation value of mean sea level of Manila Bay and elevation values of existing bench marks. In addition, the relation between

the mean sea level and the bench mark at the tidal station was explained by BCGS. JICA team confirmed that there was no problem on the elevation values in the project area according to BCGS' explanation, result of checked elevation data, etc.

4-6-3 Field identification

(1) Identification was started at central part of the National Capital Region then spread successively into suburban area.

1) When the identification was commenced, rainy season had been over already. However, it was still raining intermittently every day. It was recognized, therefore that the best way for complexing entire field work within scheduled duration was to survey the significant area initially.

2) It was important for field staff to get familiar with the symbols consisting of a lot of items and its application immediately before starting field work. It was recognized that it would be difficult to control and manage the operation if the work were initiated around the vast area at beginning.

3) The survey of 1:10,000 urban base mapping in Metro Manila is the first oversea project. Urban structure and formation of Metro Manila are different from the cities' in Japan.
It was required to commence survey from urbanized area in order to unify all staff's understanding on expression of congested features to be identified such as urban facilities, names, width of streets, etc.

4) Since raining was decreased in later part of survey period, weather had made terrible conditioned roads better. Therefore, the field work in hilly and mountaineous area was expedited to raise time for completion survey in congested area. Labor paid in urbanized area was as 2.5 to 3 times much as in hilly or mountaineous area having few objects to be identified.

(2) Additions and changes of symbols and application on contoured map were requested by BCGS through technical meetings with JICA team. As for acceptable items, field identification was proceeded taking the requests of BCGS into account.

As those changes of specifications in the intermediate stage of the field work some problems such as re-surveying of completed area, liability of wrong drawing, etc. were occured.

(3) In connection with survey on changes after aerial photography, BCGS requested JICA team to conduct detailed correction. Changes on small structure and topographic feature were corrected easily on the aerial photographs. However, it was difficult to draw large scale changes. As for elevated railways (Light Rail Transit), center line, building of station and other related structures were drawn on the aerial photographs to enable plotting them.

Correction on large changes were concluded to be involved in field completion survey, since extra time and ground survey were required for correction. Large scale changes were such like Manila-Cavite Coastal Road, Marcos Highway, canals, sub-division, etc. Number of changes was not so small as it was estimated to be.

(4) JICA team explained BCGS to pay attention to the following items regarding changes and additions of map symbols and its application through technical meetings:

1) Map symbols are replacement of annotations,
2) Map symbols are simple to be drawn,
3) Map symbols classify objects clearly,
4) And those map symbols are quite suitable to contoured map of Metro Manila and very beautiful.

(5) BCGS requested JICA team to draw names and annotations as much as possible abreast map symbols. Those names and annotations were surveyed during field identification collaborated by BCGS counterparts. JICA team suggested that it was necessary, however, to edit those data, because they were too many as well as congested to be drawn on maps.

(6) Through discussions on symbols and application for land use map, JICA team showed in detail and clearly how land and buildings should be classified in contoured map and suggested that it would be important to develop the maps from which land use situations could be recognized visually. From those standpoints, field identification for land use mapping was conducted.

5. Work in Japan

5-1 Aerial Triangulation

5-1-1 Outline

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

(1) Specifications

Photo scale	:	1:32,000
Number of courses	:	10 courses
Number of models	:	123 models
Control points	:	28 points (horizontal), 116 points (vertical)
Adjustment computation	:	Bundle adjustment method with self-calibration

(2) Main instruments

Pricking device	:	PUG-III IV (Wild)
Coordinate measuring device	:	STECOMETER (Zeiss Jena)
Computer	:	ACOS 350 (NEC)

5-1-2 Point selection and observation

(1) Point transfer

A precision point transfer device was used for selection of points on contact prints obtaining stereoscopic visions to prick and mark their coordinates on diapositives.

(2) Pass points

Except water sphere, pass points were selected in principle one point at each end of line crossing near principal points almost in perpendicular to the base line and either one point each amid a half of line as well as the other half. Position of points were selected on place in flat as much as possible and in good stereoscopic vision on 3 pieces of contact print in a row. Marking was then conducted on diapositives by circling in red.

(3) Tie points

More than one tie point must be selected per model in the area overlapped with an adjacent course and available for measurement in clear.

(4) Point Transfer

According to description sheets of ground control points, pricked 2-time enlargements of bench marks, vicinity map of bench marks, etc., a precision transfer device was used to transfer pricking points to diapositives stereoscopically.

(5) Photo coordinates observation

Coordinates were measured by numbering control points, pass points, tie points, etc. for inputting them into the computer.

(6) A stereocomparactor was used to measure index marks, pass points, tie points and control points existing in each model twice independently. If discrepancy exceeded 0.02 mm, measurement was repeated once more and the average of the three values was adopted.

As a result of computation, if the indicators showed a residual error of 0.03 mm or more, in case relative orientation showed a residual error of 0.03 mm or more in y-parallax on the positive film, or the difference between pass points in adjacent models was 0.5 or more both on a plane and in height, that model was measured once more.

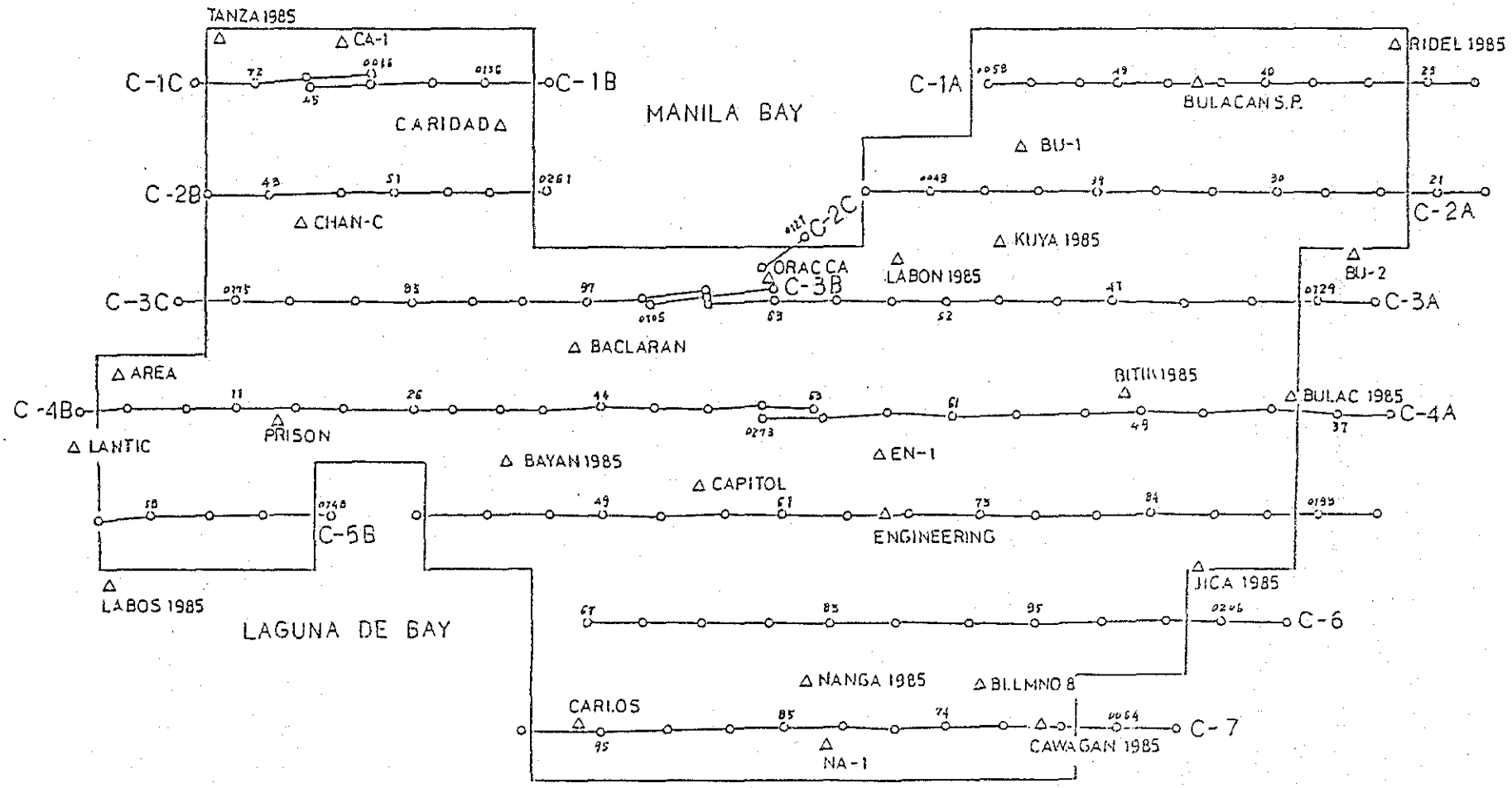
5-1-3 Computation

Simultaneous adjustment computation on coordinates and elevation was carried out, forming entire project area into one block. The program for block adjustment was based on the bundle adjustment method with self-calibration.

Index map of aerial triangulation is shown in Fig.-4. The accuracy of aerial triangulation is shown in the following table:

Number of Courses	Number of Models	Number of Control Points		Residual of Control Points (Horizontal)		Residual of Control Points (Vertical)	
		Horizontal	Vertical	Mean square error	Maximum value	Mean square error	Maximum value
10 Courses	123 Models	28 Points	116 Points	0.78 m	1.99 m	0.68 m	2.94 m

Fig.-4 Index Map of Aerial Triangulation



5-2 Stereo Plotting

5-2-1 Outline

Based on the aerial triangulation results, ground control points survey results, leveling results, etc., in accordance with specifications required items for topographic maps were plotted by stereo plotter.

5-2-2 Specifications

Mapping scale	:	1:10,000
Coverage	:	1,500 km^2
Contour line	:	Intermediate contour 4 m Index contour 20 m Auxiliary contour 2 m (Except mountainous area, 2 m auxiliary contour shall be plotted)
Plotting instruments	:	Autograph A-7, Stereoplotter A-8, Metrograph, Aviolyt BC1
Projection	:	UTM
Sheet lines	:	EW 3' × NS 3'
Plotting sheet	:	Polyester base #500
Plotting	:	High-speed automatic plotting machine
Accuracy	:	Horizontal A class (according to JICA specifications for overseas surveying) Vertical B class (according to JICA specifications for overseas surveying)

5-2-3 Stereo plotting

(1) Plotting of control points, etc.

A high-speed automatic plotter was used for plotting sheet lines, grid lines, longitude and latitude lines, triangulation points, new points, pass points, tie points and bench marks on plotting base with a plotting error of less than 0.2mm on map.

(2) Orientation

Six pass points were employed for relative orientation with a residual vertical parallax of not exceeding 0.02 mm on diapositives.

Pass points, tie points, pricked control points, pricked leveling points were used for absolute orientation with less than 0.3 mm of horizontal tolerable discrepancy and less than 1.0 m of vertical tolerable discrepancy.

Results of absolute orientation were entered in record sheet of orientation.

(3) Plotting

1) Based on field identification results, machine plotting was executed in order to draw roads, rivers and railway, building, vegetation and contour lines in those order.

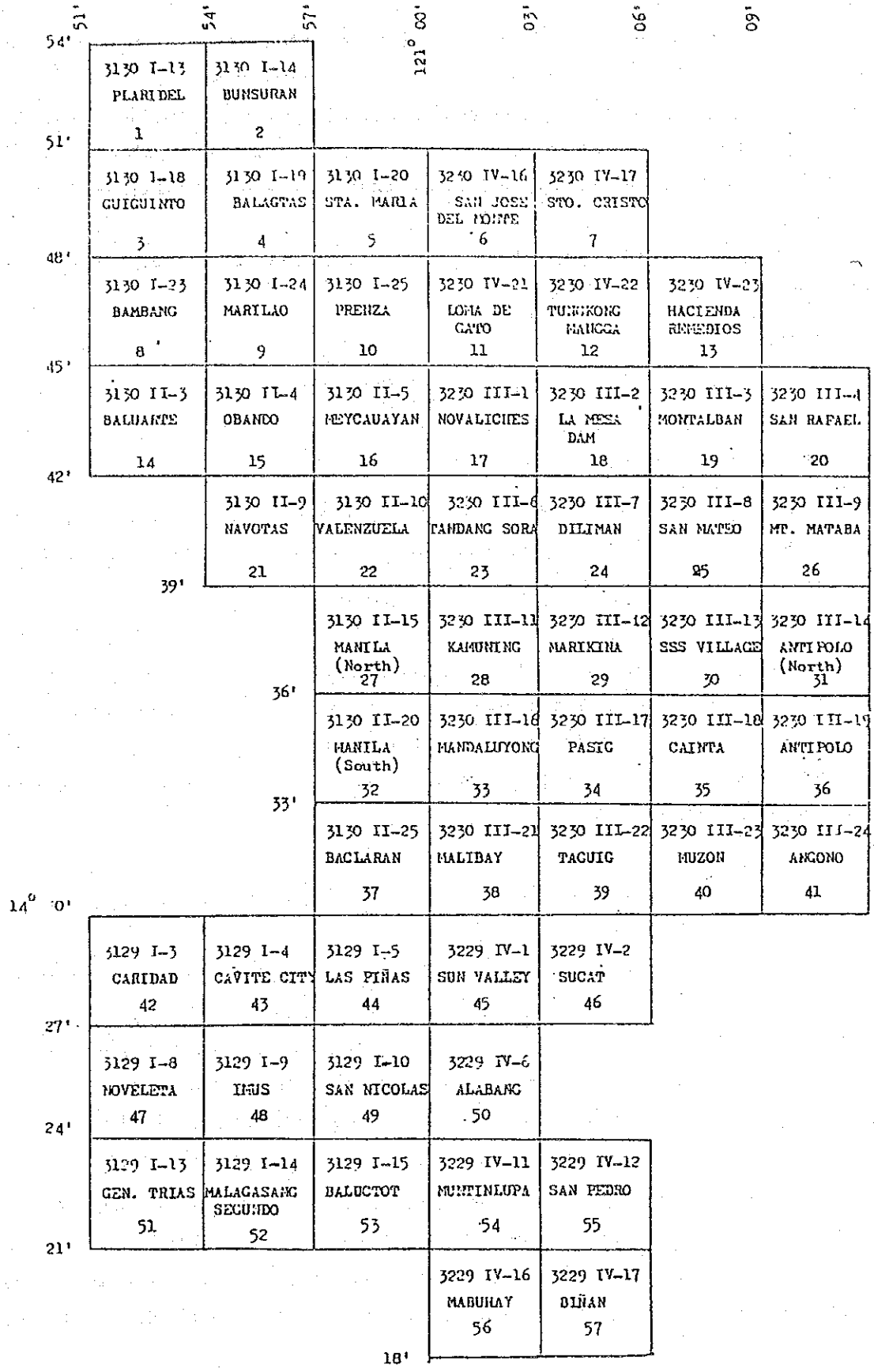
2) The project area was urbanized and congested. As crowded symbolization were predicted, attention was paid to plotting so as not to make unclear plotted lines.
Sheet names & number index of contoured map are given in Fig.-5.

3) Plotting was conducted in accordance with map symbols and application specified in I/A drafted after discussions and agreed to modify between Japan and the Philippines.
Abbreviations were used to indicate some of the generalized congested areas and plantations.

4) Color scheme for plotting
Black : roads shown to scale, railways, buildings, contour lines (index contours)
Red : symbolized roads, indicated points, plotting with critical points, fence, small objects, revetment
Green : vegetation boundaries, park, roads, distorted surface area
Orange: contour lines (intermediate contours)
Purple: coastal lines, rivers, lakes, marine ponds, salt beds, fish pens

5) Regarding to difinition on generalization, model maps of coverage of 70% and plotted sample maps were used to make a distinction between congested areas (separate buildings and partitions expressed) and generalized areas for plotting. When it was found difficult to

Fig.-5 Sheet Name & Number Index of Contoured Map



express congested areas, plotting was carried out separately as much as possible even for small houses, and the scenes were taken into consideration when expressing them either as congested areas or as generalized areas during compilation.

6) Temporary housing areas were plotted based on field identification data supplied by BCGS. Those which could be classified as temporary housing areas not covered by BCGS surveys were plotted separately from temporary housing areas treated as generalized areas. It is therefore necessary to confirm those areas during field completion survey.

7) Only photo-interpreted fishpens were plotted.

8) Spot heights were measured twice independently and the average value obtained was adopted. The measuring unit was 0.1 m. The measuring density for spot height was approximately 5 cm on map, including control points. The positions were pricked on control point data sheets and stereoplotted sheets and measured values were recorded on control point data maps. Spot heights were selected in accordance with the following principals:
   - o Major mountaintops
   - o Main forks
   - o Valley mouths and confluences
   - o Main critical points of slope
   - o Points representing feature
   - o Bottom of depression
   - o Other points indispensable for expressing topography, large lakes, etc.

9) Contour lines were plotted by paying attention so as to maintain elevation accuracy and not to deform expression of topography.

10) Plotting was carried out so as to adjoin all plotting sheets.

11) Some instruction were given to machine operators regarding to specifications for detail plotting based on a unified work manual on specifications, procedure for detail plotting, etc., so that unity and homogenety could be maintained among the operators.

12) Since the intermediate contour interval was 4 m on the mountain areas in the east and north, space between contour lines got narrow.

6. Views on the Second Year Work

The second year work are scheduled to include a field completion for contoured map and a field identification for land condition map in the Philippines and compilation, drafting, printing, etc., in Japan.

During field completion survey, it is necessary to solve the problems encountered during plotting and compilation as well as to confirm the items to be expressed. In the field completion survey, in particular, it is necessary to check the changes after aerial photography which are extensive in area and which require some surveying for confirming and expressing them.

As regards the scheduled field identification for land condition map, it is necessary to formulate clearly work specifications, etc., based on the standards for preparing land condition map as described in the I/A and to discuss with BCGS on land condition map specifications before commencing the field work.

In addition, since some changes were agreed upon on the condition that field surveying data be supplied by BCGS according to the proposals expressed by BCGS, it is necessary to give appropriate advice to BCGS and to confirm the progress of such work.

Especially, cooperation of BCGS is important in order to smoothly carry out the work scheduled for the second year.

7. Impression of the First Year Work

(1) The Metro Manila region is bisected by the Pasig River into the north and south sections which greatly differ in urban structure. While the shopping streets, the students' quarter and densely populated area are mainly found in the north, the south accommodates a cluster of modern high-rise buildings, hotels and government buildings. Concentrations of densely built temporary housing are seen all over the metropolitan region. Inundated roads and traffic congestion caused by such inundation were seen on several occasions. It was thus able to ascertain such local condition and strongly felt the need for preparing the proposed maps which could provide the basis of urban redevelopment planning.

(2) In mapping, results of aerial photography covering the project area greatly affect the results and the process of mapping work. In the present case, however, it was able to use aerial photographs already taken, making it possible to carry out all the work smoothly. However, these photographs were taken in 1982 and rather old, causing a problem in conducting survey of changes in planimetric features.

(3) In ground control point survey, the point selection and formation of traverse point networks presented problems because of the loss of existing points planned on traverse lines, interfered intervisibility, prohibition of entry into the proposed sites for new points. These problems were overcome by making use of high-rise buildings, long-distance range finders and precision transits and the proposed ground control point survey was completed.

Although there were some problems about the accuracy of existing points, the required accuracy was obtained for the present traverse point network by calculating coordinates with six triangulation points, known points, as given points. Also, judging from the results of aerial triangulation, the accuracy of control points in 1:10,000 aerial triangulation could be maintained for the existing points pricked. However, both the existing points and the present traverse point network are expected to contain an error of about 20 cm. Therefore, it is considered to be questionable to use them as precise ground control points.

(4) Many of the existing bench marks have been lost due to road improvement or extension work. It will therefore be necessary to improve the leveling network by installing permanent monuments and annually conducting precise surveying. It will also be necessary to formulate measures for ground subsidence by accurately ascertaining the condition of subsidence in the metropolitan region.

(5) As for contoured maps, field identification was carried out after studying the map symbols prescribed under the I/A, clarifying their definitions and formulating map symbol specifications. During the discussions to confirm the specifications for map symbol application, BCGS proposed changes on the following items: 7 names of symbols, 5 symbols, 7 additional symbols and 1 deletion. Although it was the survey team's basis to conform to the map symbols prescribed under the I/A, in view of the fact that the request came from the Philippine government agencies, the main map users, the survey team tried to meet the request when it was possible on the condition that cooperation be provided by BCGS. Apart from map symbols, changes were also proposed for other specifications. Those concerning the classification of road surface, the six-category classification of plantations, the method for indicating concentrated congested housing areas and the color design for printing were treated as pending and it was decided to implement them subject to the approval of the Japanese Government.

(6) As for aerial triangulation, it was conducted with the existing triangulation points and newly established control points (10 by the Japanese party and 2 by BCGS) as picture points. The results of adjustment computation after the aerial triangulation adequately satisfied the residual limit for ground control points.

As regards the control points, those in the central and northern sections were obtained by closed traversing and their accuracy was confirmed. As for the two points in the south handled by BCGS, since open traversing was conducted using existing control points, there was some concern as to their accuracy. However, they adequately satisfied the accuracy required in aerial triangulation and the results obtained were adequate for mapping at 1:10,000 by using all the control points pricked.

(7) The plotting sheets for contoured map are the results of the present field work and domestic work. The 1:10,000 draft sheets did not undergo the selection of items to be expressed. Following Team's return to Japan, technical study meeting were held on many occasions for preparations of the work. The contents of discussions at these meetings were instructed to plotting work so that they could be incorporated.

Densely inhabited urban areas were classified into four categories of indication: permanent building, independent building & houses (densely located independent houses), congested (generalized) housing area and temporary housing area. Plotting was conducted with caution so that the views of built-up areas would not assume an unnatural tone because of this classification.

The mountain and foothill areas have few tall trees and form grass land with shrubs, making it easy to measure and plott contour lines.

(8) Finally, Team's sincere thanks are hereby expressed to the BCGS, the Japanese Embassy in the Philippines, the JICA Manila Office and the Geographical Survey Institute, Ministry of Construction, for the warm cooperation they have given during the field work. It would be grateful if they would continue to provide to the Team with cooperation in the future work.

Appendeces

1. Outline of the Survey Schedule

2. Specifications and Symbols for Metro Manila Contour Map 1:10,000

3. Minutes of Meetings with BCGS

(1) Minutes at the commencement of the field work (July 1985)

1) Minutes for changes of site of land condition map (request by BCGS)
2) Minutes for plan of operation

(2) Minutes at the completion of the field work (October 1985)

1) Minutes for change of site of land condition map (approval by JICA)
2) Minutes for the field work and following work

(3) References

1) Application of the contoured map symbols
2) Definition, application and applicable landmarks of symbols for land use map (draft)
3) Specifications of planimetric map (draft)

4. I/A and related Minutes of Meetings

1. Outline of the Survey Schedule

2. Specifications and Symbols for Metro Manila Contour Map 1:10,000

1. Outline of the Survey Schedule

1985 July 18 : Team Leader Takasaki, Deputy Team Leader Motojima, Coordinator Kimura, Chief Surveyor Furukawa and Team Member Okuizumi arrive in Manila. Courtesy calls on the Japanese Embassy and JICA Office. Briefing.

19 : Courtesy call on BCGS. Briefing.

20 : Headquarters set up in Quezon for the Survey Team.

22 : Supervisors Tadao Dohi (Head of Planning Div., Topographic Dept., GSI, Ministry of Construction) and Yoshikazu Yamada (JICA) arrive in Manila for meeting with BCGS and supervisory work.

23 - 27 : Meetings with BCGS on work plans, contents, etc. Minutes concluded.

25 : Team Member Kosuge and ten others (Field Identification Group) arrive in Manila.

28 : Team Leader Takasaki and Supervisors return to Japan.

29 : Field Identification Group commences work (contoured and land use maps).

July 29 -
August 8 : Technical meetings with BCGS on specifications for contoured map, planimetric map, land use map, etc.

13 : Chief Surveyor Koyama arrives in Manila. Preparations commences for control point work.

21 : Team Member Iba and five others (Control Point Survey Group) arrive in Manila.

26 : Control Point Survey Group commences work.

September 10
- October 5 : Technical meetings with BCGS on detail specifications for contoured map, planimetric map and land use map as well as map symbols.

6 : Team Leader Takasaki and Supervisors Dohi and Yamada arrive in Manila.

7 - 12 : Meetings with BCGS on the survey work in general.
Minutes concluded.

8 : Field work completed.

1985 October 12 : Chief Surveyor Koyama and 18 others return to Japan.

13 : Team Leader Takasaki and Supervisors Dohi and Yamada return to Japan.

14 - 18 : 4 members of the Headquarters hold technical meetings with BCGS. Remaining matters settled.

17 : Headquarters close.

19 : Deputy Team Leader Motojima and three others of the Headquarters return to Japan.

2. Specifications and Sumbols for Metro Manila Contour Map 1:10,000

SPECIFICATIONS AND SYMBOLS FOR METRO MANILA CONTOUR MAP 1:10,000

CONTROL POINTS

- Horizontal Control Station
- Vertical Control Station (identifiable)
- Spot Height
- Direct Leveling Point

BOUNDARIES

- Regional Boundary
- Provincial Boundary
- City or Municipal Boundary

ROADS

- Divided Highway/Expressway
- National/Provincial Road
- City/Municipal Road
- Trail/Alley
- Road Under Construction
- Side Walk
- Grade Separation
- Crossing
- Pedestrian Overpass
- Pedestrian Underpass
- Toll Gate
- Route Marker National/Provincial

RAILWAY FEATURES

- National Railway (Single Track, Double Track)
- Private Railway
- Under Construction
- Level Crossing
- Overpass
- Underpass
- Railway Station
- Light Rail Transit Crossing
- Turnplate

BUILDINGS

- Prominent Building
- Independent Buildings & House
- Congested Housing Area (More Than 30% Roof Coverage)
- Ruins
- Temporary Housing Areas
- Building Minimum

PUBLIC BUILDING (Symbol)

- Government Building
- Police Station
- Fire Station
- Post Office
- Water Supply & Sewerage
- School
- Hospital
- Church/Mission
- Mosque
- Embassy
- Health Center
- Temple
- Power Plant and Sub - Station
- Bank
- Hotel/Motel
- Market & Prominent Store
- Factory and Works
- Helipad
- Theater and Cinema (Prominent)
- Airport/Airfield
- Sports Center

MISCELLANEOUS LANDMARK FEATURES

- Storage Tank
- Tower, Radio Tower, TV, Stack/Flagpole, Telephone
- Power Transmission Line
- Lighthouse
- Cave
- Mine
- Water Tank/ Stand Pipe
- Monument
- Wall/Fence
- Antiquity
- Parks
- Windpump
- Gas Station
- Bus Terminal
- Aero Beacon
- Slipway
- Memorial Park, Cemetery
- Fort
- Rope Way
- Military

WATER and ASSOCIATED FEATURES

- Pier - Jetty
- Breakwater
- Wharf/Revetment
- River/Stream (Single Line, Double Line)
- Intermittent
- Indefinite
- Flow Arrow
- Falls (Double Line, Single Line)
- Channel/Causeway
- Flood Gate
- Dam
- Weir
- Lake/Pond Shoreline
- Ditch
- Swamp/Marsh
- Tidal Flat
- Reef/Coral
- Mud
- Pipeline/Water Pipeline
- Siphon
- Rock Awash
- Wreck
- Sewerage Outfall
- Marine Pond
- Fishpen
- Salt Bed
- Ferry/Ford

VEGETATION

- Broadleaf
- Bushes/Scrub
- Mixed Scrub & Broadleaf
- Rice Fields
- Cropland Agricultural Land
- Mangrove
- Nipa
- Tropical Grass
- Trees Lined Road
- Bamboo
- Sugarcane
- Pineapple
- Banana
- Coconut
- Mango
- Other Plantation

RELIEF and ASSOCIATED FEATURES

- Cutting
- Embankment
- Slopes
- Quarry
- Depression
- Cliff
- Rockcourtrop Area
- Sand/Dunes

CONTOURS

- Index Contour
- Intermediate Contour
- Auxiliary Contour
- Contour Values

DEPTH CURVES

- Depth Curve

LINE SIZES

3. Minutes of Meetings with BCGS

3. Minutes of Meetings with BCGS

(1) Minutes at the commencement of the field work (July 1985)

1) Minutes for changes of site of land condition map (request by BCGS)

SUMMARY OF DISCUSSION

ON ADMINISTRATIVE ISSUES ON THE ESTABLISHMENT OF GRAPHIC INFORMATION BASE PROJECT OF THE NATIONAL CAPITAL REGION IN THE REPUBLIC OF THE PHILIPPINES.

July 26, 1985

Commodore ANTONIO P. VENTURA
Director
B C G S

Mr. YOSHIKAZU YAMADA
Japan International
Cooperation Agency

TADAO DOHI
Member
Advisory Committee for
Mapping Project

Change of site of land condition map.

Philippine side made a strong request that the land condition maps covering sheet no. 20, 26, 31, 36 and 41 be change to map sheets no. 21, 22, 24, 29 & 34.

JICA Survey Team is not in a position to reply on that. Therefore, Mr. Yamada, a staff of JICA, will take it back to Japan and convey it to the authorities concerned for further consideration.

The reason for the new request made by the Philippine side are as follows:

> The original coverage of the land condition map was selected on a mountainous area, thinking that erosion and cause of flooding emanates from these places. It was not realized until lately that the need for land condition map is more on low lying areas which are prone or susceptible to natural calamities like floods, earthquakes, etc. The calamities have drained so much on the economy of the country not to mention the lost of lives and property. As per advise of the Preliminary Survey Team, the budget of the land condition map is very limited and would be impossible to cover the entire project area, the new request for change of site which will give maximum benefit would place first priority to the areas which are on low land and where flood is a common occurrence. Moreover, during the months of June and July of this year, the low lying areas, covered by the proposed new map sheets, have been hit by one of the worst flood that have occurred in the country, prompting all government agencies such as the Ministry of Public Works and Highways, the Metro Manila Commission, etc. to concentrate more in the redevelopment of these places. In line with this priority a request for changing the site for the proposed land condition map is also made a necessity.

II. BCGS Counterpart Schedule

In regards to the BCGS Counterpart to be sent for the indoor work of the first year survey of this project to be carried out in Japan, BCGS proposed the following schedule of the remaining 3 counterparts:

Course	Tentative Schedule
Aerial Triangulation	October 15 - December 22, 1985
Stereoplotting	November 23, 1985 - Feb. 28, 1986
Stereoplotting	January 10, 1985 - March 23, 1986

Mr. Yamada will also take the above proposed schedule to Japan and convey it to proper department in JICA.

山田

LIST OF ATTENDANTS

BUREAU OF COAST AND GEODETIC SURVEY

1. Commodore Antonio P. Ventura
   Director
2. Commander Renato B. Feir
   Chief
   Planning Division
3. Commander Jose Galo P. Isada, Jr.
   Chief
   Operations Division
4. Mr. Ponciano C. Ciceron
   Chief
   Coastal Mapping and Special
5. Mr. Gavino C. Angeles, Jr.
   Chief
   Chart and Map Production Division
6. Mr. Conrado Santos
   Chief
   Physical Science Division

JICA ADVISORY COMMITTEE

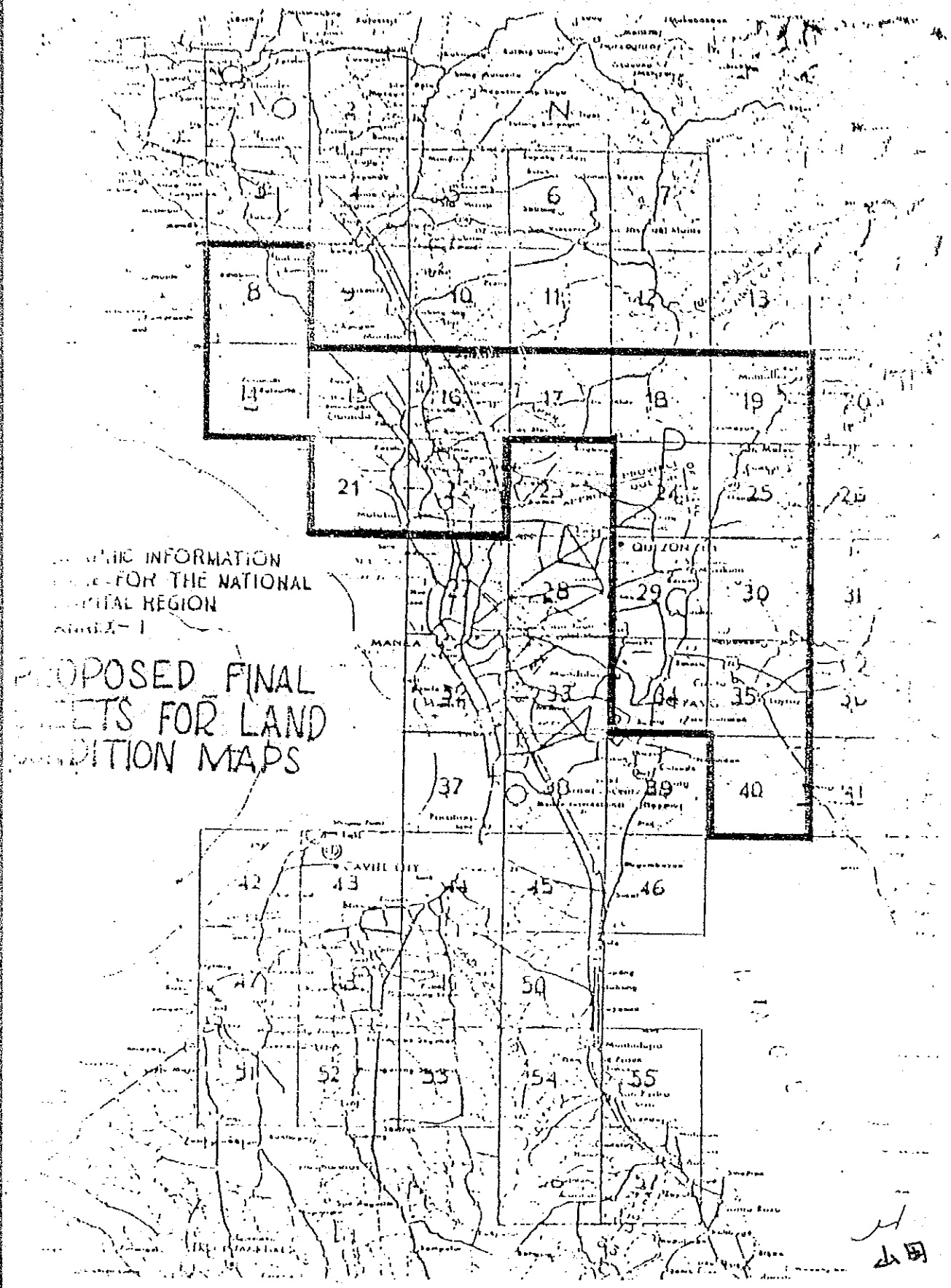
1. Mr. Tadao Dohi
   Technical Advisor
2. Mr. Yoshikazu Yamada
   Advisor

JICA MANILA OFFICE

1. Mr. Yuji Okazaki

JICA SURVEY TEAM

1. Mr. Masayoshi Takasaki
   Leader
2. Mr. Kenzo Motojima
   Deputy Leader
3. Mr. Hiroshi Kimura
   Coordinator


...PHIC INFORMATION
...FOR THE NATIONAL
...ITAL REGION
...ET X-1
PROPOSED FINAL
...ETS FOR LAND
...PTION MAPS
QUEZON
MANILA
PASAY
CAVITE CITY