3-8-3 Correction of Secular Changes

Within the area covered, works to construct steel towers for high voltage transmission lines and water ways under the Integrated Agricultural Development Project were under way, and also new villages were being systematically constructed. These were incorporated by means of plane table surveying. Some parts were surveyed with transits or electro distancers. Almost entire regions where vehicles could pass were confirmed.

3-8-4 Confirmation of Doubtful Matters at the Time of Compilation

Doubtful matters (roads, water ways, land classification items, housing, topography) on compilation manuscripts (duplicated maps) on which marks and comments were written at the time of compilation were locally confirmed and supplementarily surveyed.

3-8-5 Confirmation Concerning Administrative Boundaries Geographical Names and Annotations

Doubtful matters found at the time of compilation and/or preliminary photo-interpretation were discussed at BCGS. The counterpart reconfirmed and supplementarily surveyed on-site unclear points.

Special attention was paid to correct spelling of

proper nouns.

3-8-6 Arrangement

It was determined to arrange on-site all results of on-site supplementary survey and to develop complete drawings, leaving no questions.

3-9 Drawing

3-9-1 Outline

A rational drawing operation work flow chart was developed in accordance with the Map Symbols and Map Symbols rules agreed upon by Japan and the Philippines. On the basis of the flow chart, drawing operation was carried out.

3-9-2 Materials Used

1) Scribing Base
   Polyester base 500# coated with yellow shading coat. Its elasticity is very small.

2) Polyester base 500#
   Polyester base with high transparency and low elasticity was used.

3) Polyester base 300#
   Polyester base with high transparency, stable dimension and smooth surface was used.

4) Negative film
   Negative film with dimensional stability,

durability and excellent storability and which was suitable as original plate was used. (ligh-negative film, lith-positive film).

5) Peel coat
Peel coat with stable dimension, excellent shading characteristics and easy exfoliation was used.

6) Daylight peel coat
Daylight peel coat with stable dimension, excellent shading characteristics and easy exfoliation was used.

7) Sensitized paper
Used in interim data development operation.

8) Strip film
Characters were printed by photo-lettering machines in accordance with the Annotation Rules. Symbols were printed at 1:1 from symbol negative films.

3-9-3 Forming and Punching

Forming is an operation to transfer drawing lines onto a scribing base from a compiled manuscript. Specified punch hole were first made on the draft map and the scribing base. Using these holes, required sheets were reverse-image printed color by color by means of the diazo method.

After completion of forming, drawing lines were examined if they had been completely transferred. When there were unclear lines, the draft map was referred to determine if re-operation was necessary.

Holes were made on other bases, too, as preparation for actual operation.

3-9-4 Scribing

1) Black plate
Neat lines were correctly scribed, dimensions were examined and diagonal lines were confirmed to be within 0.2mm difference in comparison with calculated lines. Then, roads and planimetric features were scribed. In addition, the register marks to be used in printing were displayed on the top and bottom of each map.

2) Blue, brown, red plates
Each color plate was placed on the black plate, using the punched holes. After correctly scribing 2mm ticks and register marks on neat line corners, drawing lines of each color were indicated in accordance with the Map Symbols.

3) Scribing plate for daylight peel coat
This scribing plate is for a mask plate to indicate vegetation symbols and land crests. All border lines were scribed with 0.1mm solid lines to develop draft maps.

3-9-5 Mask Plate Development

Preparation and examination were made as follows prior to developing mask plates.
Studying symbols and type of land crests on the map and

density, it was decided whether to use peel coat or daylight peel coat. As data to develop mask plates, classification maps (model maps) were developed as to those maps with complex land classification.

1) Peel coat mask plate
A compiled draft map was placed upon a peel coat, using punched holes, and necessary parts were cut away with a cutting knife to exfoliate them. After completion of exfoliation, inspection was repeated using source maps and compiled draft maps for correction and addition. On completed sheets were indicated drawing number and types of symbols.

2) Daylight peel coat mask plate
The tying plate earlier developed was placed upon a daylight peel coat plate with punched holes. Required sheets were printed, and after development - water washing, etching and water washing drying-, required parts were exfoliated. Drawing lines outside the required area were erased with an opaque gent. After inspection and correction, drawing number and types of symbols were indicated to complete the operation.

3) Symbol plate
A mask plate was placed upon a symbol negative plate to be printed and to produce positives. The positives were fully inspected for symbols, etc. and were corrected using strip films with symbols printed on them in advance. From the completed symbol positive plates, negative for

photoengraving were produced.

3-9-6 Marginal Information Annotation Plate

1) Marginal information common items were indicated on a polyester base 500# to produce a marginal information negative. From the negative, duplication positives (72 plates) were produced to make them black annotation plates.

2) Strip film characters produced from the annotation source map of each plate in accordance with the Annotation Rules were correctly adhered at specified positions on the annotation plate.

3) As for blue and brown characters, separate plates were developed for individual colors.

4) After inspection and correction, annotation negative films were produced.

3-10 Printing

3-10-1 Outline

Using scribing plates, mask plates, annotation marginal information plates and symbol negative plates produced in drawing operation, photoengraving was performed, and printing correction plates were produced.
The correction prints were inspected by BCGS, and then final printing was done.

3-11 Orthophotomaps

3-11-1 Outline

Twelve orthophotomaps of four places (six orthophotomaps of Tuguegarao, four of Ilagan, one of Gonzaga, one of Port Irene) in the topographic mapping area were produced. (Attached Figure 12)

3-11-2 Specifications

(i) Scale
1:10,000

(ii) Photos used
1:30,000 f = 152.85mm

(iii) Projection
PTM (UTM coordinates indicated together).

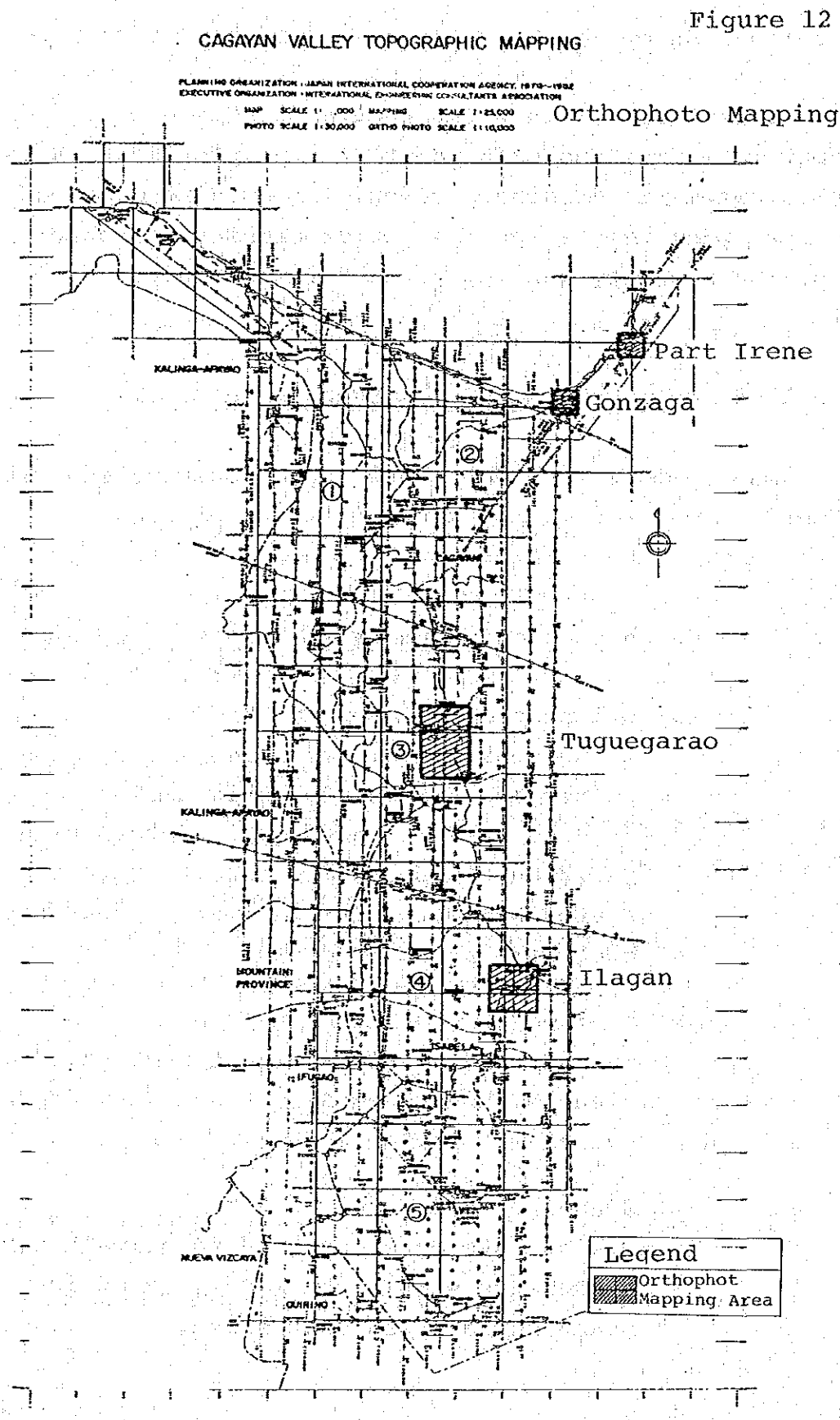
(iv) Neat lines
5Km x 5Km.

(v) Plotter
Topocart BE.
Stereo plotter A8.

3-11-3 Positive Films Used

As positive films for photo maps, films taken as part of this project, especially those with soft color tone, were used.

Figure 12


CAGAYAN VALLEY TOPOGRAPHIC MAPPING
Orthophoto Mapping
Part Irene
Gonzaga
Tuguegarao
Ilagan
KALINGA-APAYAO
MOUNTAIN PROVINCE
ISABELA
IFUGAO
NUEVA VIZCAYA
QUIRINO
Legend
Orthophot Mapping Area

3-11-4 Sheet for Orientation

Orientation sheets for section scanning were produced separately from those for contour line plotting. High speed automatic drawing devices were used to plot control points, pass points and tie points each by map sheet. Plotting accuracy was less than 0.2mm on maps.

3-11-5 Map Symbols and Map Symbols Rules

Map symbols were determined upon consultation with BCGS.

3-11-6 Cross Section Scanning and Photo Processing

(1) Orientation
Using control points, bench marks, pass points and tie points, orientation was performed. As will be used in determining positions in photo map mosaic operation as stated below, clear planimetric features, etc. were properly drawn.

(2) Slit Width
Taking into consideration topographic conditions within the model, the slit width was set at 4mm on the average.

(3) Scanning Rate
Taking into consideration relative height difference within the model, an optimum scanning rate was controlled.

3-11-7 Orthophoto Mosaic

The negative films with cross section scanning exposure completed were printed on polygra films (polyester films) after development. Mosaicing was done on the basis of internal neat lines and pass points to produce negative films.

3-11-8 Contour Line Plotting and Annotation

(1) Contour Line Plotting
In order to express topographic conditions in as detail as possible, 5-meter intermediate contour lines and 25-meter index contour lines were used. In topographic expression, 2.5-meter half interval contour lines were used whenever proper.

(2) Alignment and Annotation
As for compatibility of plotted contour line maps with photo maps, inspection and correction were done.
As for annotation, field reconnaissance survey photos and field annotation source maps for 1/25,000 topographic maps were used to carry out various annotating works. As for writing styles and character sizes, the new map symbols proposed by BCGS were used.

3-11-9 Drawing

From proofread contour line maps were made contour

line negatives by means of the scribing method. As for annotation, works to stick up various annotated items were performed to produce annotation map negatives.

3-11-10 Marginal Information Plate

On the basis of the marginal information plate samples presented by BCGS, marginal information plates were produced for each map sheet.
This time, PTM and UTM coordinates were indicated concurrently.

3-11-11 Printing of Orthophotomaps

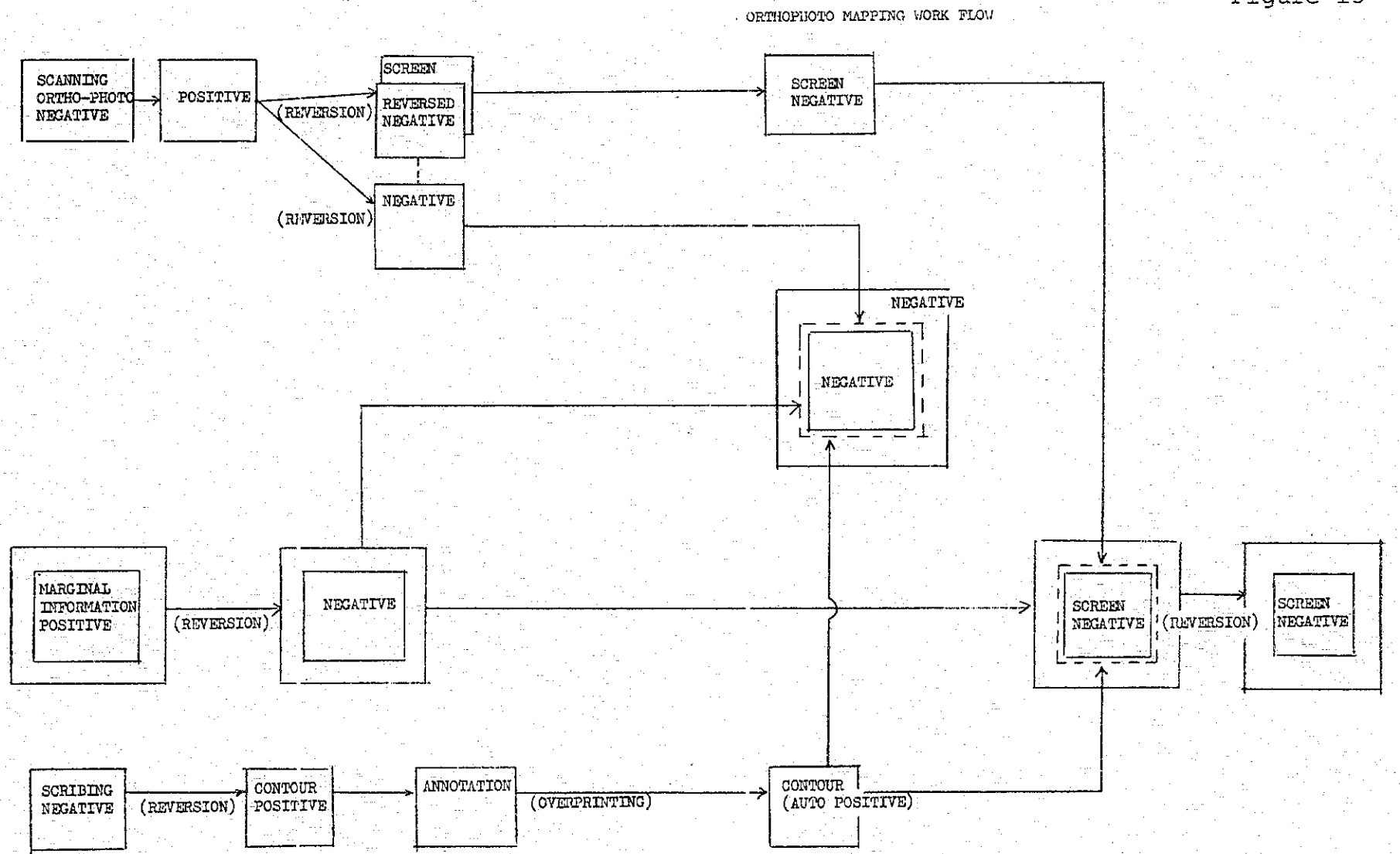
Marginal information plates, mosaic negative films and contour line and annotation plates (printed on clear bases) were placed on top of each other, and a vacuum printer was used for printing on photographic papers.

3-11-12 Positive Negative Film for Printing

Marginal information negative films, mosaic network negative films and contour line and annotation plates (printed on clear bases) were placed on top of each other, and a vacuum printer was used for printing on films.

The work flow for ortho photo map production is shown on Fig. 13.

Figure 13

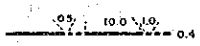
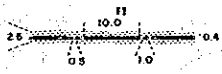

ORTHOPHOTO MAPPING WORK FLOW
SCANNING ORTHO-PHOTO NEGATIVE
POSITIVE
(REVERSION)
SCREEN
REVERSED NEGATIVE
SCREEN NEGATIVE
(REVERSION)
NEGATIVE
NEGATIVE
NEGATIVE
MARGINAL INFORMATION POSITIVE
(REVERSION)
NEGATIVE
SCREEN NEGATIVE
(REVERSION)
SCREEN NEGATIVE
SCRIBING NEGATIVE
(REVERSION)
CONTOUR POSITIVE
ANNOTATION
(OVERPRINTING)
CONTOUR (AUTO POSITIVE)

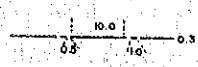
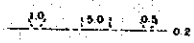
The Specification and Standard Rules for Application of 1/25,000 Map Symbols

3-12 Map Symbols and Their Applications

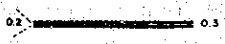
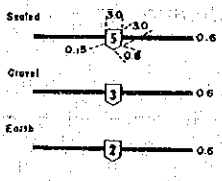
BCGS had tentative specification of map symbols and their application for 1/25,000 basic maps, but details were consulted between Japan and the Philippines to come to agreement as shown in the attached table.

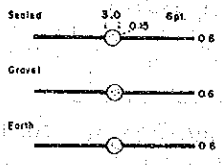
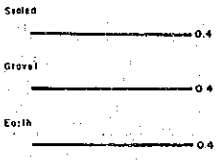
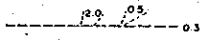
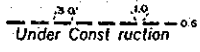
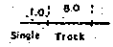
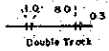
The table will be useful to show the history of basic map development, to help the Philippines in reading maps and as a foundation to develop basic map, map symbols application rules as a national project.

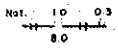
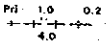
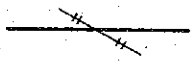
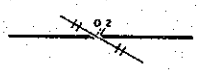
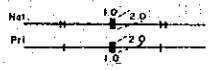
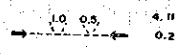
Item	Name	Symbol	Style and Symbol	Applications
Control point	Triangulation point		Black elevation value SB6006-6pt-c (black) (E16-25) (8Q)	Indicate a geodetic controls with a stone mark. Indicate elevation down to meter.
	Bench mark		Black elevation value SB6006-6pt-c (black) (E16-25) (8Q)	Indicate a bench mark with a stone mark. Indicate elevation down to meter.
	Spot elevation		Brown elevation value SB6006-6pt-c (brown) (E16-25) (8Q)	Indicate elevation down to meter.
Border	National boundary		Black	
	Regional boundary		Black annotation SBN6-9pt-c (black) (E08-25) (12Q) Red LT22	Indicate a regional name along the border.

Item	Name	Symbol	Style and Symbol	Application
Border	Provincial boundary		Black annotation SBN6-9pt-c (black) (E08-25) (12Q)	Indicate a provincial name and a special city name along the border.
	City or municipal boundary		Black annotation SBN6-9pt-c (black) (E08-25) (12Q)	Indicate a city name along the border.

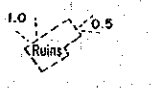
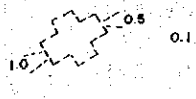
Remarks:
1. Each place name is indicated along the border with about 20-cm intervals.
2. An annotation may be omitted if it cannot be indicated due to too short border.
3. No border symbol shall be discontinued as a rule.
4. When a border is located in the middle of river or road, it shall be transferred to either side, and "Boundary is center of road" shall be indicated.

Item	Name	Symbol	Style and Symbol	Application
Road	Divided highway or expressway		Black	According to road surface conditions, roads are classified into paved roads, gravel roads and earth roads to be indicated by red, brown and black.
	National highway		Black (mark symbol) No. SB35-8pt-c (black) Annotation SBN6-6pt-c (black) (E08-25) (8Q) Red, brown, black	Paved roads ... red, gravel roads .. brown, earth roads ... black Indicate marks and numbers with black. Indicate routes with no route numbers as National Highway. Omit symbols within marks.

Item	Name	Symbol	Style and Symbol	Application
Road	Provincial road		Black (mark) number SBU45-6pt-c(black) Annotation SBN6-6pt-c (black) (E08-25) (8Q) Red, brown, black	Paved roads .... red, Gravel roads ... brown, Earth roads .... black Indicate marks and numbers with black. Indicate routes with no route numbers as Provincial Road. Omit symbols within marks.
	Barangay road		Red, brown, black	Indicate those roads more than 1.5-meter wide, excluding national and provincial roads. Paved roads .... red, Gravel roads ... brown, Earth roads .... black
	Trail		Black	Indicate roads less than 1.5-meter wide.
	Road under construction		Black annotation SBN6-6pt-c.L (black) (E08-25) (8Q)	More than 1.5cm long to be standard road length. Explanation annotation "Under Construction" to be indicated, 1/2 of character size away as a rule.
Rail way	National railway Single track		Black annotation SBN6-6pt-c (black) (E08-25) (8Q)	To be annotated when there is a name.
	National railway Double track		Black annotation SBN6-6pt-c (black) (E08-25) (8Q)	〃
	Private railway Single track		Black annotation SBN6-6pt-c (black) (E08-25) (8Q)	〃

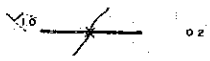
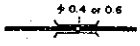
Item	Name		Symbol	Style and Symbol	Application
Rail way	Private railway Double track			Black annotation SBN6-6pt-c (black) (E08-25) (8Q)	"
	Railway under const-ruction National railway	Single track Double track		Black annotation SBN6-6pt-c (black) (E08-25) (8Q)	Indicate railways under construction. Indicate classification of single and double tracks. More than 1.5cm long to be standard on maps. Indicate explanation annotation "Under Construction".
	Railway under const-ruction Private railway	Single track Double track		Black annotation SBN6-6pt-c.L (black) (E08-25) (8Q)	"
	Level cross-ing				Indicate level crossing. Mutually indicate in compound.
	Overpass				Indicate crossing where a railway passes above a road. A road is discontinued and a 0.2mm white part is provided.
	Railway station			Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a railway station of a national or private railway. Annotate the name of a railway station when necessary.
Tunnel	Tunnel Road, railway	Symbol road Symbol railway		Black annotation SB6023-6pt-c.L (black) (E08-25) (9Q)	

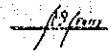
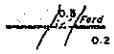
Item	Name	Symbol	Style and Symbol	Application
Building	Built-up area		Black Red D120-45-20	Major buildings to be indicated by the major building symbol.
	Building		Black	When adopting even when a building is 0.6mm x 0.5mm or less, to be indicated as 0.6mm x 0.5 mm. In this case, building pattern to be correctly indicated.
	Important building Minimum size		Black	Indicate the minimum size one of important buildings to be indicated. When indicating as an important building even minimum size, to be indicated as 0.8mm x 1.0 mm. When indicated as an important building, always indicate name or symbol.
	Church/ mission		Black annotation SB6023-tpt-c.L (black) (E08-22) (9Q)	Indicate a famous one or a big one. Annotate name when it is especially important.
	Mosque/ minaret		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a famous one or a big one. Annotate name when it is especially important.
	Hospital		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q) Symbol character SB6023-6pt-c (black) (E08-22) (9Q)	Indicate a famous one or a big one. Annotate name when it is especially an important one.
	School		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	"

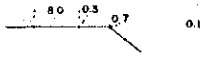
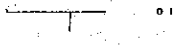
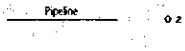
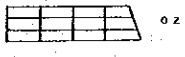
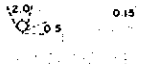
Item	Name	Symbol	Style and Symbol	Application
Building	Police station	▪PS	Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q) Symbol character SB6023-6pt-c (black) (E08-22) (9Q)	Abbreviated character or annotation depending on surrounding conditions.
	Post office	▪PO	Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q) Symbol character SB6023-6pt-c (black) (E08-22) (9Q)	"
	Municipal building	▪MH	Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q) Symbol character SB6023-6pt-c (black) (E08-22) (9Q)	Abbreviated character or annotation depending on surrounding conditions.
	Provincial capitol	▪PG	Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q) Symbol character SB6023-6pt-c (black) (E08-22) (9Q)	"
	Ruins		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate by an indicating point when an object to be indicated is very small. Attach an explanation annotation.
	Antiquity		Annotation SB6023-6pt-c.L black (E08-22) (9Q)	"

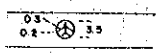
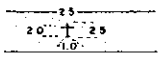
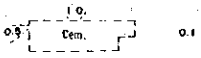
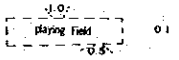
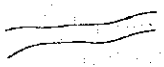
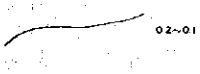
Remarks: 1. It is possible to indicate a building in real shape, it shall be indicated in real shape.

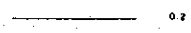
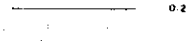
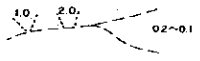
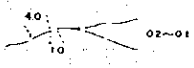
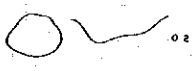
2. Names shall be attached to large buildings such as power station and plant.

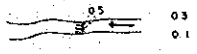
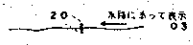
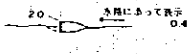
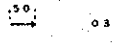
Item	Name	Symbol	Style and Symbol	Applications
Bridge	Bridge railway		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a bridge more than 40-meter long at scale. Big ones or famous ones to be annotated.
	Bridge road		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	"
	Small bridge Railway		Black	Indicate a bridge of 20-meter to 40-meter with a minimum size symbol.
	Small bridge road		Black	"
	Culvert/ small bridge		Black	Indicate a bridge of less than 20-meter long with a culvert symbol. Indicate a target in accordance with surrounding conditions, when indicating a culvert.
	Draw-bridge		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Names to be annotated when necessary.

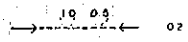
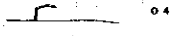
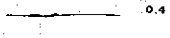
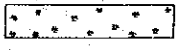
Item	Name	Symbol	Style and Symbol	Applications
Ferry	Ferry		Black annotation SB12-6pt-c.L (black) (E16-43) (9Q)	Indicate permanent ferry facilities to transport persons and vehicles. Indicate a ferry more than 75-meter long. An explanation annotation to be placed at a proper position in accordance with surrounding conditions.
	Ford		Black annotation SB12-6pt-c.L (black) (E16-43) (9Q)	Indicate a shallow ford where persons and vehicles could cross. Indicate one which is large or which has a public value. Indicate one with a crossing length of more than 75 meters. An explanation annotation to be placed at a proper place in accordance with surrounding conditions.
Small objects	Storage tank (other than water)		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate one which is big or can be a target. An explanation annotation to be attached.
	Chimney, tower, radio tower		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	"
	Windmill, windpump		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate one which can be a good target. Famous ones to be annotated.
	Mine		Black annotation SB6023-6pt-c.L (E08-22) (9Q)	Indicate present conditions when it is a big one. Famous ones to be annotate d

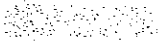
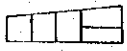
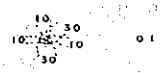
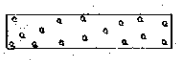
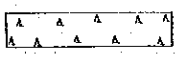
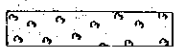
Item	Name	Symbol	Style and Symbol	Applications
Small objects	Cave		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate one designated by the local authority. Names to be annotated for famous or big ones.
	Power transmission line		Black	Indicate a high voltage power transmission line. A tower on turning point to be indicated at a real position with a symbol (0.7mm dot). The transmission line to be indicated with a symbol (0.3mm dot).
	Fence/ wall		Black	Indicate a permanent structure such as stone, brick or concrete. Indicate ones more than 2-meter high and more than 75-meter long which may be used as targets. Simple barricades like those for ranches not to be indicated.
	Pipeline, water pipeline		Black annotation SB6023-6pt-c.L (blue) water SB6023-6pt-c.L (black) (other than water) (E08-22) (9Q)	Indicate an object on the ground. Indicate one with a good target value, and an explanation annotation to be attached. A water pipeline to be blue-annotated.
	Salt-bed		Blue	Indicate a saltbed, and water ditches within a saltbed to be comprehensively indicated in accordance with conditions.
	Light-house		Red annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate all lighthouses. Ones with names to be annotated.

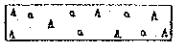
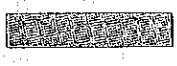
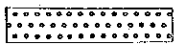
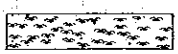
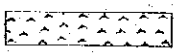
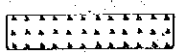
Item	Name	Symbol	Style and Symbol	Applications
Place	Airport, aerodrome		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate an airport with aviation facilities. A runway to be indicated with solid lines. Ones with names to be annotated.
	Airfield		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a small airfield with no aviation facilities. A runway to be indicated with solid lines. Ones with names to be annotated.
	Cemetery		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Famous ones to be annotated with names.
	Cleared area, park, playing field		Black annotation SB6023-6pt-c.L (black)	Ones with a good target value or big ones to be annotated with names or explanations.
Water area & similar ground object	River, stream (perennial) Double line		Blue Blue D120-45-30 annotations: 1.SBN6-12pt-c (blue) (15Q) 2.SBN6-10pt-c.L (E08-25) (14Q) (blue) 3.SBN6-8pt-c.L (blue) (E08-25) (14Q)	Indicate a river more than 0.3mm wide and more than 10mm long on a map with constant water flow. Major rivers to be annotated with names.
	River, stream (perennial) Single line		Blue Annotations: 1.SBN6-12pt-c (blue) (E08-25) (15Q) 2.SBN6-10pt-c.L (blue) (E08-25) (14Q) 3.SBN6-8pt-c.L (blue) (E08-25) (14Q)	Indicate a river less than 0.3mm wide and more than 10mm long on a map with constant water flow. Lines to be made thinner towards upstream. Famous ones to be annotated.

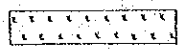
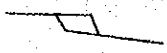
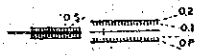
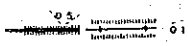
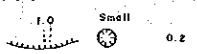
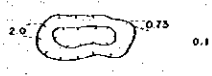
Item	Name	Symbol	Style and Symbol	Applications
Water area & similar ground object	Ditch		Blue Annotations: 1.SBN6-12pt-c (blue) (E08-25) (15Q)	Indicate a famous or big river with constant water flow.
			2.SBN6-10pt-c.L (blue) (E08-25) (14Q)	Indicate a famous or big river with constant flow.
			3.SBN6-8pt-c.L (blue) (E08-25) (11Q)	Ones with specific names to be annotated.
	Channel, canal		Blue Annotations: 1.SBN6-12pt-c (blue) (E08-25) (15Q)	Indicate an artificial water way more than 1.5-meter wide with constant water flow. Ones with specific names to be annotated.
			2.SBN6-10pt-c. L(blue) (E08-25) (14Q)	
			3.SBN6-8pt-c.L (blue) (E08-25) (11Q)	
	River, stream Inter-mittent		Blue	Indicate a river with constant water flow which is intermittent. Lines to be made thinner towards upstream.
	River, stream Indefi-nite		Blue	Indicate a part with traces of a river. Indicate a rough water way under forests. Lines to be made thinner towards upstream.
	Lake, pound, shore-line		Blue Blue D120-45-30 sea SBN6-12-24 pt-c(blue) (E08-25) (15-28Q)	Indicate a lake or pond whose single side being more than 1.0mm on a map when it is at a normal water level.
			Bay, lake, pond SBN6-12-24pt-c.L(blue) (E08-25) (15-28Q)	Indicate shorelines at the time of high tide. Note: This time, they are shown as photographed.

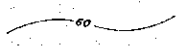
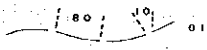
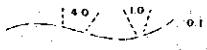
Item	Name	Symbol	Style and Symbol	Applications
Water area & similar ground object	Fall Double line stream		Blue	Indicate a fall with more than 5-meter relative height on a double line stream.
	Fall Single line stream		Blue	Indicate a fall with more than 5-meter relative height, and more than 2mm wide on a map, on a single line stream.
	Rapid		Blue	Indicate a part with a rapid water flow and with a relative height of 3 to 5 meters. Indicate a rapid flow more than 3mm wide on a map.
	Dam		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a dam more than 2mm wide on a map and more than 3-meter high. Big ones with names to be annotated.
	Weir		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a weir more than 2mm wide on a map. Big ones with specific names to be annotated with names.
	Spring		Blue simplified character SBN6-8-12pt-c(blue) (E08-25) (11-15Q)	Indicate a spring. Indicate a spring which can be a good target. The tail to be directed to the flow direction of a spring.
	Flow arrow		Blue	Indicate a water flow directions. Indicate an important river larger than a double line river.

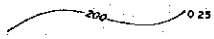
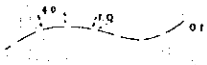
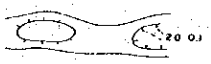
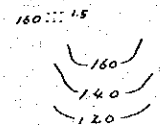
Item	Name	Symbol	Style and Symbol	Applications
Water area & similar ground object	Siphon		Blue annotation SB12-6pt-c.L (blue) (E16-43) (9Q)	Indicate one larger than 1cm on a map. Annotate as siphon.
	Pier, jetty		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a permanent pier. A pier less than 50 meters to be indicated by a symbol. Big piers or piers with names to be annotated.
	Break-water		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a permanent breakwater. A breakwater less than 50 meters to be indicated at scale. Big breakwaters or break-waters with names to be indicated by a symbol.
	Wharf		Black annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a permanent wharf. A wharf less than 50 meters to be indicated by a symbol. Big wharfs or wharfs with names to be an-notated.
	Well		Blue simplified character SBN6-8-12pt-c (blue) (E08-25) (11-15Q)	Indicate a well which is public used and which can be a good target.
	Swamp, marsh		Blue D120-75-20 blue P16	Indicate an area which is always wet and is filled with water during the rainy seasons. Indicate one larger than 5mm on a map.

Item	Name	Symbol	Style and Symbol	Applications
Water area & similar ground object	Tidal flat		Blue LT88	Indicate a sand or earth area which is under water during high tides and is exposed during low tides. Water edges to be indicated for the time of high tide.
	Reef		Blue P4	Indicate a reef including a coral reef.
	Fish pond		Blue, black blue D120-45-30 annotation SB6023-6pt-c.L (black) (E08-22) (9Q)	Indicate a fish raising pond. Indicate one larger than 5mm^2 on a map. Big ones to be annotated.
	Mud		Brown, black brown LT 934 annotation SB12-6pt-c.L (black) (E16-43) (9Q)	Indicate a muddy area in a tidal flat. Water edges to be indicate d for the time of high tide.
	Exposed wreck		Black	Indicate an exposed wreck which is famous and which can be used as a target.
Vegetation	Broad-leaf		Green D120-75-20 Blue P5	Indicate a broadleaf forest more than 2-meter high. Indicate one larger than 3mm^2 on a map.
	Conifer		Green D120-75-20 Blue P6	Indicate a conifer forest higher than 2 meters. Indicate one larger than 3mm^2 on a map.
	Bush, scrub		Green D120-75-20 Blue P7	Indicate a bush and scrub area higher than 2 meters. Indicate one larger than 3mm^2 on a map.

Item	Name	Symbol	Style and Symbol	Applications
Vegeta-tion	Mixed broadleaf & conifer		Green D120-75-20 blue P9	Indicate a mixed forest of broadleaf and conifer higher than 2 meters. Indicate one larger than 3mm^2 on a map.
	Mixed scrub & broadleaf		Green D120-75-20 blue P8	Indicate a mixed forest of scrub lower than 2 meters and broadleaf higher than 2 meters. Indicate one larger than 3mm^2 on a map.
	Mangrove		Green D120-75-20 blue D120-45-30	Indicate a mangrove forest. Indicate one larger than 3mm^2 on a map.
	Coconut		Green P17	Indicate a coconut forest. Indicate one larger than 3mm^2 on a map.
	Nipa		Blue D120-75-20 green P10	Indicate a nipa forest. Indicate one larger than 3mm^2 on a map.
	Tropical grass		Green P11	Indicate tropical grass and weeds. Indicate an area larger 3mm^2 on a map, excluding housing lands.
	Orchard		Green LT24	Indicate an area dedicated for fruit growing. Indicate one larger than 3mm^2 on a map.
	Rice field		Blue D120-45-10 green P14	Indicate dry, wet and sawmpy field. Include one where agricultural products are grown in some seasons. Indicate an area larger than 3mm^2 on a map.

Item	Name	Symbol	Style and Symbol	Applications
Vegetation	Cropland, agricultural land		Green P15	Indicate an area where vegetables are mainly grown or a pasture. Indicate one larger than $3mm^2$ on a map.
	Tree row		Green D120-45-50	Indicate a tree row along a road or an agricultural land. A net is overlapped on lines.
Topography or similar planimetric feature	Cutting		Black	Indicate a cutting more than 45° inclined, higher than 3 meters and longer than 3mm on a map. To be indicated with exaggeration when necessary for surrounding conditions.
	Embankment		Black	Indicate an embankment more than 45° inclined, higher than 3 meters and longer than 3mm on a map. To be indicated with exaggeration when necessary for surrounding conditions.
	Slope		Brown	Indicate a natural slope which cannot be shown by a curve.
	Quarry		Black	Indicate a quarry whose topography is directly shown. Indicate one which can be a good target.
	Depression		Brown	Indicate a natural depression. Indicate one by adding ticks on contour lines.
	Cliff		Brown	Indicate a cliff.

Item	Name	Symbol	Style and Symbol	Applications
Topography or similar planimetric feature	Lava flow		Brown LT935	Indicate an area with a lava flow. Indicate a big one. A flow line to be free-hand shown.
	Rockoutcrop area		Brown LT935	Indicate a rockoutcrop area as it is. Indicate a big one.
	Sand, dune		Brown LT88	Indicate a sand dune or sand hill. Indicate a relatively big one which can be a good target. Sand hill pattern to be free-han d indicated.
	Crater		Brown	Indicate a crater as it is.
Contour line, etc.	Intermediate contour line		Brown	Indicate standard contour lines with ten-meter intervals.
	Half interval contour line		Brown	Refer to contour lines with intervals one-half of standard contour line intervals. Used to indicate an area which cannot be sufficiently indicated with standard contour lines only.
	Quarter interval contour line		Brown	Refer to contour lines with intervals one-quarter of standard contour lines. Used to indicate an area which cannot be sufficiently indicated with standard and half interval lines only.

Item	Name	Symbol	Style and Symbol	Applications
Contour line, etc.	Approximate contour		Brown	Indicate contour lines of an area whose elevation and shape are approximate.
	Contour value		Brown SBN6-6pt-c(E08-25)(8Q)	Indicate a contour line height value. The head of a value to be on the higher part and on the upper part on a map.
	Index depth contour		Blue	Indicate isobathymetric lines with 100-meter intervals. Indicate the fifth standard contour line.
	Standard (intermediate) contour		Blue	Indicate isobathymetric lines with 20-meter intervals.
	Approximate depth contour		Blue	Isobathymetric lines when an isobathymetric position is approximate.
	Direction of slope		Blue	Indicate a direction of slope on a sea bottom. Indicate by adding ticks on isobathymetric lines.
	Depth contour value		Blue SBN6-6pt-c(E08-25)(8Q)	Indicate a depth value of an isobathymetric line. The head of a value to be on the deeper direction.
	Depth value		Blue SB6006-6pt-c(E08-25)(8Q)	Indicate the depth of a point. The depth of a point indicates the center of a value when it is a one digit value, the center of figures when it is a two-digit value and the center of the second figure when it is a three-digit value.

Item	Name	Symbol	Style and Symbol	Application
Line number	Line No.1	0.1mm	———	Indicate line thickness. An allowable range of drawing (0.10 - 0.11mm)
	Special line No.1	0.15	———	Indicate line thickness. An allowable range of drawing (0.14 - 0.16mm)
	Line No.2	0.2	———	Indicate line thickness. An allowable range of drawing(0.19 - 0.21mm)
	Special Line No.3	0.25	———	Indicate line thickness. An allowable range of drawing (0.24 - 0.26mm)
	Line No.3	0.3	———	Indicate line thickness. An allowable range of drawing (0.28 to 0.32mm)
	Line No.4	0.4	———	Indicate line thickness. An allowable range of drawing (0.38 - 0.42mm)
	Line No.6	0.6	———	Indicate line thickness. An allowable range of drawing (0.58 - 0.62mm)

4. CONCLUSION

4-1 Adjustment of Geodetic Controls

There are some geodetic controls established through triangulation in this district. In the project, some geodetic controls were newly established for aerialtriangulation. In newly establishing them, the following two methods were adopted.

(1) Satellite Doppler Method
In regions where it is difficult to establish geodetic controls through conventional triangulation or travers method owing to difficulty in access or poor visibility due to dense vegetation (carried out by BCGS).

(2) Precision Traversing Method
In regions excluding those under (1), second order geodetic controls are established.

As a result, the district has three different types of geodetic controls. These geodetic controls were adjusted to form a network of geodetic controls so that they may be used not only as orientation points for aerialtriangulation, but also as control points for various surveying in planning and engineering.

4-1-1 Problems Prior to Adjustment and Finding Solution

(Problems)

(1) As a result of surveying of the existing

conventional triangulation points, it was found that only three points, CHICO2, GAMMA and MASIPI2, are usable, and these points are concentrated on the north side of the center. It was therefore necessary to do the following to use them as given points in adjustment of the network.

i) Confirmation of existing geodetic controls.

ii) As project area is extend from the north to the south and the existing triangulation points are small in number and are concentrated in the north, the network is likely to rotate. Investigation to solve this problem is needed.

(2) Confirmation of accuracy of geodetic controls newly established through satellite Doppler geodesy.

(3) Confirmation of observation accuracy of geodetic controls newly established through precision traversing. Examination of adjustment methods to maintain this level of observation accuracy as much as possible.

(Examination and Solution of Problems)

(1)-i) Using the coordinate of the existing geodetic, CHICO2, GAMMA and MASIPI2, and the observed values observed through traversing survey, coordinate computation was performed as to between GAMMA and CHICO2, and GAMMA and MASIPI2 to obtain a closing ratio for each coordinate; 1/29,000 and 1/55,000. It was confirmed that the second order geodetic control accuracy of 1/75,000 is not satisfied in both cases.

(1)-ii) At the traversing points, Nos. 2, 15 and 36, an azimuth was observed using the Polaris to give azimuth when adjusting the network in order to prevent rotation.

(2) The satellite control point were connected with the geodetic survey network as much as possible to compute coordinate descrepancy to estimate accuracy. In fact, four points used both as satellite stations and traversing control stations and three points where observation was made to connect with the traversing network, a total of seven points were connected to the traversing network. The approximate accuracy was $\pm$ 5.65m in terms of mean square error, excluding one point.

(3) As for confirmation of accuracy of traversing, coordinate computation was performed with one 2nd order triangulation point, GAMMA, as to the coordinate to check accuracy through closing ratio. As for elevation, closing error of relative height was found with the bench marks, Nos. 2, 15 and 32, as given points in order to confirm accuracy. As a result, it was found that both coordinate and elevation were within the accuracy of 2nd order geodetic controls.

4-1-2 Adjustment of Traversing Network

As the 2nd order triangulation points which were initially planned to be used as given points in making network adjustment did not have satisfactory accuracy, consultation between Japan and the Philippines was held on

adjustment of a final geodetic control network. It was determined to perform the following computations to adopt an optimum result.

(1) With the astoronomical azimuthes observed at the station, JMR No. 5 (GAMMA)*, and at the three stations, Nos. 2, 15 and 36 as given points, JICA network adjustment are performed.

(2) The JICA net is connected to triangulation stations No. 9 (CHICO2), MASIPI2 and JMR No. 5 (GAMMA) and adjusted by least square method.

(3) The JICA net is connected to JMR No. 8 (CAPA), JMR No. 9 (GON) and JMR No. 16 (CAG) and then adjusted by least square method.

* JMR No. 5 (GAMMA) is a 2nd order triangulation point, and no satellite observation has not been performed.

4-1-3 Results of Adjustment and Evaluation of Results

(Results of Computation)

The results of computation under (1) through (3) of 4-1-2 indicate one direction mean square errors as follows:

(1) $\pm$ 1.43"

(2) $\pm$ 1.05

(3) $\pm$ 1.03

All of the above results satisfy the first order geodetic control accuracy of $\pm$ 1.5". Japan and the

Philippines consulted on the results to finally adopt (2).

From the calculation results of (1) through (3) of 4-1-2 above, the following evaluation may be made:

(1) The results of (1) through (3) of 4-1-2 show sufficient accuracy as given conditions in observations, and demonstrate that the adjustment of the JICA Traversing network was excellent. It is considered reasonable that the results of (2) showing a strong connection with the existing triangulation network and a small directional standard deviation.

(2) The geodetic controls established through satellite observation were computed by means of precise Ephemiris, and it was possible to roughly estimate the accuracy of all points by connecting some points to the precision traverse network. (Seven points were connected. The standard deviation in position was $\pm$ 5.65m. The points not connected are estimated to have roughly the same accuracy.) The results indicate that the points are sufficiently accurate as given conditions for aerialtriangulation. The computations under (3) of 4-1-2 demonstrated that the points could be used as given conditions for geodetic controls if sufficient intervals are taken between satellite stations.

The geodetic control adjustment method of different system (measurement method, accuracy) as used in this project may be satisfactorily applied in future projects in other regions.

4-2 Characteristics and Problems of Symbols

4-2-1 Characteristics of Symbols

The printed 1/25,000 topographic map is excellent both in cartographic appearance and use. This is due to application of the symbols established through consultation between Japan and the Philippines and also due to ideal color design for topographic map of medium scale.

The symbols employed in the project and those used in Japanese 1/25,000 topographic maps may be compared as shown below: in the project, one noticeable fact is that especially large number of printings (scribbing, masking, etc) were used in cartographic work.

	Japan	the Philippines
number of printing colors	3	5
number of sheets:		
vegetation	1	15
rock, sand, swamp, beach at ebb tide	1	5
notation characters (excluding numbers)	1	2
administration boundary	1	2
total	7	23 on an average
miscellaneous:		
line thickness	4	5
depth contour line	none	yes
description notation	almost none	some

4-2-2 Future Problems

(1) The map symbols and the map symbols application standards have almost established specifications of 1/25,000 topographic maps which the Philippines intends to develop. It is desirable to improve map symbols and map symbols application standards by adding new ground object symbols and modifying map symbols application standards in accordance with distribution of ground objects.

(2) The map symbols contain a considerable number of descriptive notations.
(ruins, ferry, ford, oil, tower, cem, mud, tunnel, etc.)
In order to develop a complete set of map symbols, it is desirable to symbolize common noun descriptions as much as possible.

(3) The map symbols make cartographic work and technics (separation, registration, inspection, etc.) complex to increase both work and cost, while they have the characteristics discussed under 4-2-1. These negative aspects could be a considerable burden when modifying topographic maps or developing topographic maps with these map symbols in other regions.

From the standpoint of promoting development of 1/25,000 topographic maps in the future, it may be possible to consider practical map symbols with less number of printings as a tentative measure.

4-3 Problems in Mapping Operation

To systematically carry out projects to develop 1/25,000 topographic maps from now on, it is desirable to do the following from the standpoint of improvement of operation efficiency, standardization of operation and securing of topographic map quality, etc.

4-3-1 As for the process up to compilation of topographic maps:

(1) To establish uniform symbols (abbreviations) for compilation to correspond the formal map symbols.

(2) To establish standards for compilation operation (selection of things to be shown, generalization and dislocation, etc.)

(3) As for geographic name and administration boundary shown on topographic maps, the government agencies concerned establish uniformity to develop reliable materials.

4-3-2 As for the process of reproduction there are especially a large number of plates in cartographic work. Therefore,

(1) In order to secure registration in cartographic work, a considerable investigation is made as to selection of materials to be used (polyester base).

(2) Quality control is done by multicolor proofreading printing to carefully inspect and proofread errors

of things shown, omissions, relationship between sheets, matching of neighboring sheets.

(3) As done in the project, composite negative films are produced for each color from scribing and masking results, and plates are made from these negative films.

(4) In reproduction operation, cares are taken as to changes of temperature and humidity in stores in order to prevent dismatching in printing color by color due to expansion or contraction of papers.

5. UTILIZATION OF RESULTS AND PROPOSAL

5-1 Utilization of 1/25,000 Topographic Maps

5-1-1 Utilization of 1/25,000 Topographic Maps

In the Philippines, it is planned to develop topographic maps of 1/25,000 of about 100,000Km^2 area covering river basins which have high developmental potential and which are equivalent of one-third of the entire national land area, in addition to revision of 1/50,000 topographic maps covering the entire national land area. As a starting operation, this project was carried out to develop the first map to be used as a model.

1/25,000 topographic maps are not only essential in investigation and examination of various development plans as highly accurate and most detailed multipurpose topographic maps but also used as administrative maps for research, education, sightseeing or leisure and basic maps to compile 1/50,000 topographic maps. Therefore, 1/25,000 topographic maps can be used in extensive applications.

5-1-2 Problems of Issuing 1/25,000 Topographic Maps

Of the above-mentioned applications of 1/25,000 topographic maps, line-only topographic maps suitable for writing things are more useful than multi-color tint in applications in the field of investigation, planning, research and education. From such standpoint of view, it may be probable to duplicate in some way line-only maps.

5-2 Utilization of 1/10,000 Ortho-photo Maps

Ortho-photo maps may be used as basic data of larger scale map in various development projects in regions. At the same time, they may play a role of work rules and model maps when developing ortho-photo maps of other regions in the future.

5-3 Utilization of Interim Results

In addition to the above-mentioned final results, various interim results could be effectively used in various ways. Some representative usages are introduced below:

5-3-1 Aerialphotographing

1/30,000 aerialphotographs covering the entire area could be used in various applications, including aerial-photographing (mapping, ortho-photo map, mosaic) down to the scale of 1/5,000 and photo interpretation in various specialized fields.

5-3-2 Results Obtained from Geodetic Control

A geodetic control network has been developed to cover the entire area with uniform coordinates and accuracy. Future detailed geodetic control survey based on the geodetic control network thus developed may be useful in developing large scale topographic maps and in various

public work projects. A table of geodetic control, point description and description of monuments are attached as samples.

5-3-3 Results of Control Station Pricking

Results of control point pricking operation will be useful in utilization of geodetic control or maintenance and management of geodetic control. Part of the statement of pricked points is attached as a sample.

5-3-4 Results of Supplementary Levelling

In addition to the existing levelling routes, a supplementary levelling network was established. This may be useful in future development of large scale maps and also in various public work projects. A table of geodetic controls, point description and description of monuments are attached as samples. Also, results of bench mark pricking operation will be useful in utilization of bench marks. Results of pricking are expressed on aerial photos (contact photos and double-enlarged photos.

5-3-5 Results of Aerialtriangulation

Aerialtriangulation was carried out over the entire region covered in the project. It is therefore possible to additionally develop topographic maps and ortho-photo maps of regions not covered in the project.

5-3-6 Records of Technical Management

The records of technical management may be used not only in systematic and proper management of future works but also in measurement works in other fields.

APPENDIX – I

Data List of Geodetic Controls

P.T.M. Projection (Ⅲ)

Name of Station	Latitude	Longitude	N	E	H
	° ′ ″	° ′ ″	m	m	m
No. 1	18 24 31.4805	121 26 50.8347	2 036 056.93	547 275.95	34.455
No. 1−1	18 19 15.9519	121 22 40.4465	2 026 339.89	539 947.44	65.36
No. 2	18 20 56.3222	121 38 31.5964	2 029 503.83	567 866.38	1.400
No. 2E	18 20 58.07.03	121 38 32.8197	2 029 557.70	567 902.11	12.590
No. 3	18 17 39.4601	121 49 19.8846	2 023 527.88	586 927.78	5.079
No. 4	18 13 19.7420	121 48 21.3430	2 015 535.27	585 243.59	59.135
No. 4−1	18 14 42.5722	121 51 56.6331	2 018 110.74	591 557.31	44.94
No. 5	18 17 30.1972	121 35 29.1172	2 023 148.62	562 529.36	43.89
No. 6	18 12 52.9641	121 24 33.1100	2 014 572.89	543 282.04	77.862
No. 7	18 09 30.3897	121 32 17.2648	2 008 380.37	556 938.10	116.54
No. 8	18 07 08.3196	121 41 49.7968	2 004 069.15	573 782.51	103.415
No. 9 (CHICO-2)	17 58 12.6154	121 34 59.3248	1 987 558.16	561 767.09	178.69
No. 9−1	17 53 47.7871	121 35 48.2536	1 979 421.25	563 232.84	125.59
No. 10	17 56 19.4678	121 40 26.5158	1 984 112.26	571 406.77	207.17
No. 11	17 48 17.0165	121 37 05.4919	1 969 259.98	565 540.02	22.195
No. 12 (JMR No.7)	17 47 27.6544	121 45 12.0831	1 967 794.90	579 876.69	74.268

Data List of Geodetic Controls

P.T.M. Projection (Ⅲ)

Name of Station	Latitude	Longitude	N	E	H
	° ′ ″	° ′ ″	m	m	m
No. 13	17 48 41.6413	121 30 25.5370	1 969 981.62	553 759.15	122.00
No. 14	17 43 54.3275	121 25 26.2415	1 961 127.31	544 965.18	118.94
No. 15	17 39 30.5350	121 45 29.4429	1 953 129.02	580 447.09	75.948
No. 16	17 37 00.0938	121 33 16.3901	1 948 429.15	558 854.14	119.61
No. 17	17 36 28.4164	121 27 48.6037	1 947 429.38	549 193.10	323.98
No. 18	17 31 51.3769	121 26 23.2743	1 938 906.98	546 697.14	135.370
No. 19	17 30 29.9383	121 39 59.9958	1 936 473.49	570 795.06	181.456
No. 20	17 28 43.4620	121 44 53.7314	1 933 232.39	579 472.91	60.481
No. 21	17 28 25.2942	121 33 06.2866	1 932 602.77	558 602.22	402.73
No. 22	17 25 24.3048	121 49 17.2322	1 927 141.84	587 273.70	92.00
No. 22−1	17 27 05.4754	121 39 25.7686	1 930 184.50	569 807.05	128.674
No. 23	17 24 00.2304	121 27 12.5610	1 924 427.12	548 185.24	264.37
No. 24	17 21 08.7437	121 34 30.3730	1 919 190.18	561 123.43	222.391
No. 25	17 18 06.1279	121 45 03.8459	1 913 640.87	579 848.10	30.848
No. 26	17 16 00.7691	121 52 15.7822	1 909 840.79	592 621.91	145.92
No. 27	17 12 26.7637	121 35 56.3264	1 903 152.01	563 710.93	57.369

Data List of Geodetic Controls

P.T.M. Projection (Ⅲ)

Name of Station	Latitude	Longitude	N	E	H
	° ′ ″	° ′ ″	m	m	m
No. 28	17 11 30.0442	121 41 52.8363	1 901 443.68	574 251.07	122.028
No. 29	17 06 54.1028	121 46 30.6753	1 892 992.15	582 495.11	63.12
No. 30	17 07 18.9451	121 53 09.5861	1 893 806.16	594 284.56	116.73
No. 31	17 06 35.7199	121 33 57.7553	1 892 350.39	560 238.98	100.447
No. 31−1	17 03 54.7042	121 34 52.9852	1 887 405.61	561 886.46	90.82
No. 32	17 01 59.8448	121 51 10.6706	1 883 980.89	590 812.07	81.070
No. 32−1	16 59 56.9341	121 50 56.8335	1 880 200.70	590 419.21	80.82
No. 33	16 59 53.2991	121 43 04.1697	1 880 033.05	576 437.86	47.77
No. 34 (JMR. 3)	16 59 06.6157	121 33 53.2615	1 878 544.70	560 146.03	156.971
No. 35	16 52 30.4385	121 51 16.2713	1 866 477.51	591 053.85	97.511
No. 36	16 52 13.3732	121 38 25.3004	1 865 866.51	568 234.83	72.783
No. 36−1	16 53 31.2089	121 41 53.6859	1 868 280.07	574 394.63	64.386
No. 37	16 52 09.9709	121 45 26.3092	1 865 806.03	580 697.28	63.192
No. 37−1	16 49 51.2729	121 46 24.1469	1 861 549.07	582 426.01	75.45
No. 38	16 49 23.2748	121 29 10.2932	1 860 591.03	551 819.59	156.514
No. 39	16 46 29.8707	121 42 56.5962	1 855 334.91	576 303.45	65.922

Data List of Geodetic Controls

P.T.M. Projection (Ⅲ)

Name of Station	Latitude	Longitude	N	E	H
	° ′ ″	° ′ ″	m	m	m
No. 40	16 45 00.5934	121 35 46.4705	1 852 548.53	563 573.50	75.485
No. 41	16 43 33.9010	121 27 38.3621	1 849 845.33	549 122.72	115.093
No. 42	16 39 10.6668	121 37 28.6288	1 841 801.47	566 632.99	106.976
No. 43	16 36 11.5899	121 29 51.2381	1 836 258.95	553 092.62	180.598
No. 44	16 34 16.2258	121 41 31.2961	1 832 774.34	573 855.42	130.749
No. 45	16 31 16.9208	121 36 47.1237	1 827 235.42	565 447.53	153.888
JMR. 1	16 29 06.7581	121 29 53.4266	1 823 200.69	553 189.82	424.50
JMR. 5 (GAMMA)	17 42 01.4833	121 37 18.7714	1 957 716.61	565 969.32	193.43
JMR. 9 (GON)	18 14 54.3858	122 00 07.3018	2 018 547.53	605 970.80	164.43
JMR. 16 (TUGUE GARAO)	17 37 08.9333	121 43 30.5817	1 948 762.10	576 960.34	42.12
MASIPI −2	17 24 31.6073	121 50 43.9228	1 925 532.94	589 839.41	190.88
J 8−1	18 20 23.0404	121 22 57.2443	2 028 403.42	540 436.36	10.36

Data List of Geodetic Controls (J.M.R.)

P.T.M. Projection (Ⅲ)

Name of Station	Latitude	Longitude	N	E	H
	° ′ ″	° ′ ″	m	m	m
JMR. 2					
JMR. 4					
JMR. 6					
JMR. 8 (CAPA)					
JMR.10 (PALA)					
JMR.11					
JMR.12 (CASI)					
JMR.13 (SMAC)					
JMR.14 (DIBA)					

Data List of Levelling (B.M.)

Name of Station	Elevation	Remarks	Name of Station	Elevation	Remarks
BM. No. 1	m 6.484		BM. No. 11	m 55.625	
2	19.239		12	216.017	
3	13.121		13	122.814	
4	80.105		14	58.570	
5	26.363		15	121.980	
6	31.534		16	57.913	
7	35.504		17	70.242	
8	61.009		18	71.650	
9	53.807		19	86.492	
10	87.446		20	103.053	

TRIG. INDEX CARD III

Name of Station	No. of Station	Order	Projection
	No.15	2	P.T.M.

Location CAGAYAN — Map Ref. ILAGAN 2506 1/250,000

Abstract No. — T. C. No. — Comps. No.

Latitude & Longitude	Co-Ordinnate	Scale Factor
Lat. = 17 39 30.5350	N = 1 953 129.02	1.000 030
Long. = 121 45 29.4429	E = 580 447.09	
Conv. = − 0 13 48.00	H = 75.948	

To Station	Azimuth	Distance	Remarks
20	182° 48′ 07″.04	19 919.88	
JMR.No.16	218 36 19 .11	5 588.00	
JMR.No.5	287 34 55 .81	15 186.98	
12	357 46 24 .75	14 676.54	
	.	.	
	.	.	
	.	.	
	.	.	

TRIG INDEX CARD III

Name of Station	No. of Station	Order	Projection
CAG '72	JMR.No.16	2	P.T.M.

Location CAGAYAN — Map Ref. ILAGAN 2506 1/250,000

Abstract No. — T. C. No. — Comps. No.

Latitude & Longitude	Co-Ordinnate	Scale Factor
Lat. = 17 37 08.9333	N = 1 948 762.10	1.000 023
Long. = 121 43 30.5817	E = 576 960.34	
Conv. = − 0 13 10.23	H = ~~42.10~~ 42.12	

To Station	Azimuth	Distance	Remarks
15	38 36′ 20″.86	5 588.00	
19	206 38 33 .22	13 748.23	
	.	.	
	.	.	
	.	.	
	.	.	
	.	.	
	.	.	

FINAL RESULT TABLE FOR (3rd) ORDER LEVELING

ROUTE (7) | From CY - 37 | To BM.No.5

Station	Distance	Elevation	Remarks
CY - 37		14.584 ✓	
7F - 3(P)	4.890 ✓	15.148 ✓	
7F - 7(P)	4.037 ✓	16.636 ✓	
7F -11(P)	3.904 ✓	18.861 ✓	
7F -14 (P)	3.798 ✓	22.013 ✓	
7F -17(P)	3.860 ✓	37.633 ✓	
7F - 21(P)	3.822 ✓	22.415 ✓	
7F -25(P)	4.299 ✓	27.047 ✓	
BM.No.5	2.350 ✓	26.363 ✓	

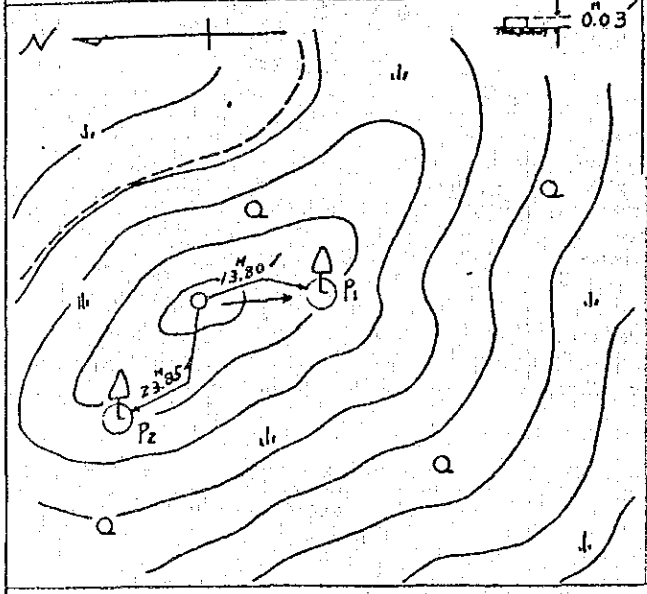
DESCRIPTION OF CONTROL POINT

37

Station No.		Operated by	Y. Katamine
		Checked by	C. Misawa
No 32		Date	Apr 11'80

Zone No.	Coordinates of Station		
	N	E	H
Main Point	+ 1 883 980·89	+ 590 812·07	81·07
Pricking Point P_1	+ 1 883 968·58	+ 590 818·30	80·42
Supplementary Point	--	-- T.H	82·62

Sketch-map of Station and Neighborhood



Photograph of Station

C4A No. 49 ~~NORTH~~ EAST C4A No. 50

STATION RECORD SHEET.

Station: No. 3

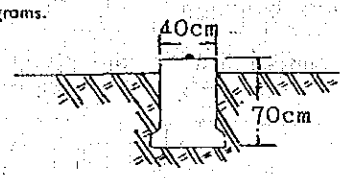
For Office Use 5

Latitude 18 17 39.4601
Longitude 121 49 19.8846
E. 586 927.78
N. 2 023 527.88
Elevation 5.079
Located on photo no. Run. Film.
Record prepared by. T. MASUDA Date. Mar 30, 1980
Station established by. T. MASUDA Date. Mar 30, 1980

Revisited by.	Date.	Remarks.

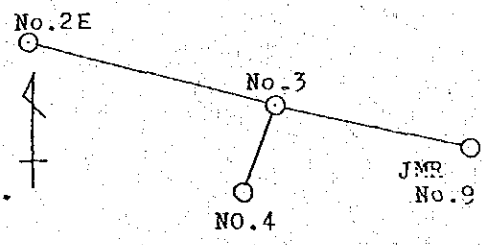
Description of Mark.
The station mark is a cross cut rod 30mm. in diameter embedded at the center of a square concrete monument 40 x 40 x 70 cm. protruding above the surface of the ground about 10.0 cm. The station is inscribed △ No. 3 BCGS 1980.

Diagrams.

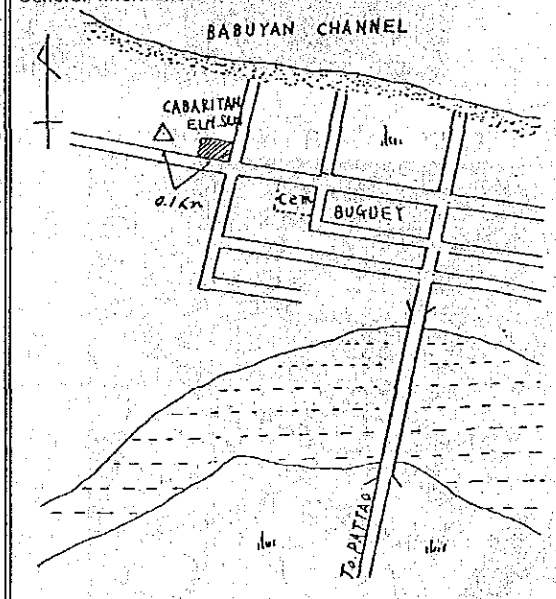


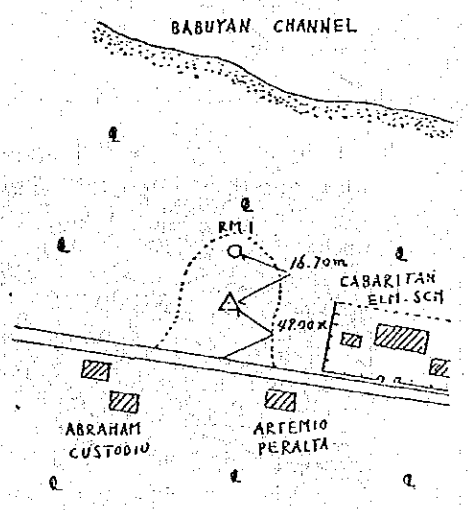
Location and Access.
The station is in Centro, Buguey, Cagayan. It is on the lot of Natalio V. Mendoza, a resident of the same place. It is approximately 120.0 m. west of Cabaritan Elementary School. A 23.0 meters steel tower was built over the station to avoid coconut plantations obstruction and to see the visibility of other stations.

To reach the station proceed to Centro, Buguey, Cagayan where the station is located. It is on the northern side of the road and about 400.0 m. NW of a cemetery.



General Information.





STATION RECORD SHEET.

Station :

BM. No. 7

For Office Use '7

Latitude

Longitude

E.

N. Elevation 35.504 ✓

Located on photo no. Run. Film.

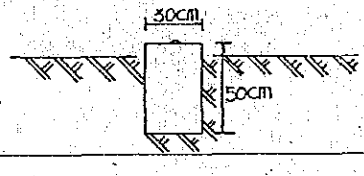
Record prepared by. S. TOMINAGA Date. 8.JAN'81

Station established by. S. TOMINAGA Date. 8.JAN'81

Revisited by. Date. Remarks.

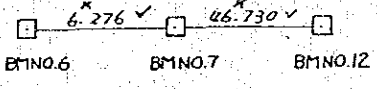
Description of Mark.

Diagrams.

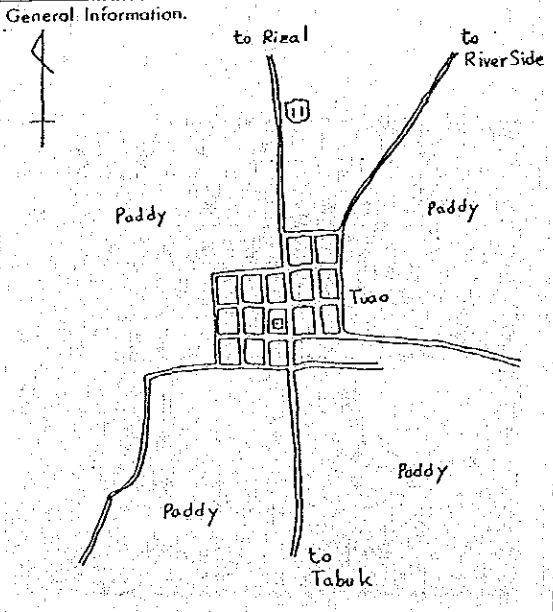


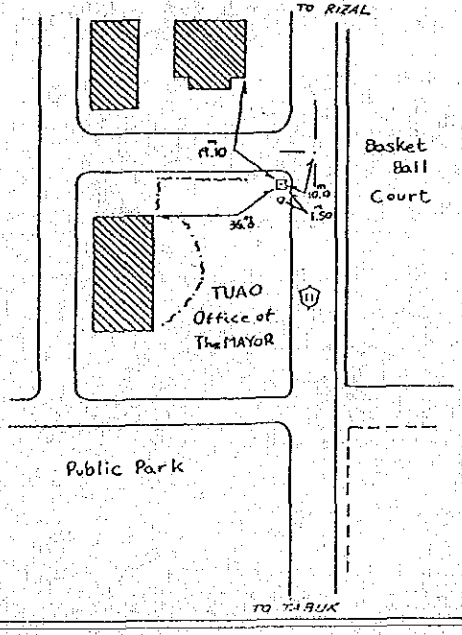
Location and Access.

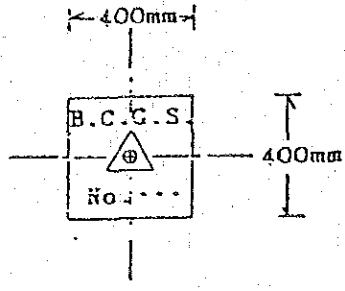
The station is in the town proper of Tuao, Cagayan. It is on the NE corner of the municipal building lot and is 1.50 m N of post with name: PNB, 10.00 m SW of the center of road junction, 36.00 m ENE of the NE corner of the Office of the Mayor's building and 19.10 m SE of the SE corner of Court of First Instance Building.



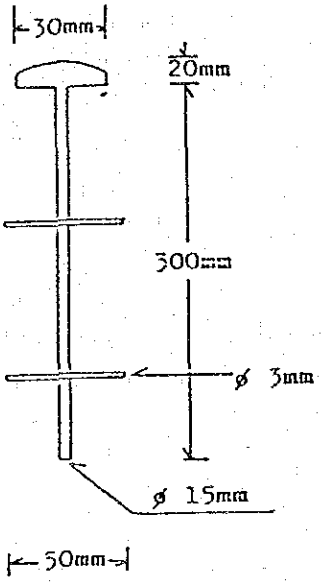
General Information.

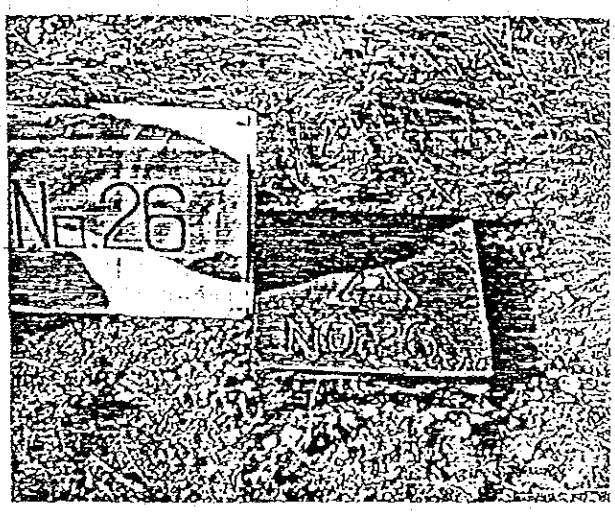


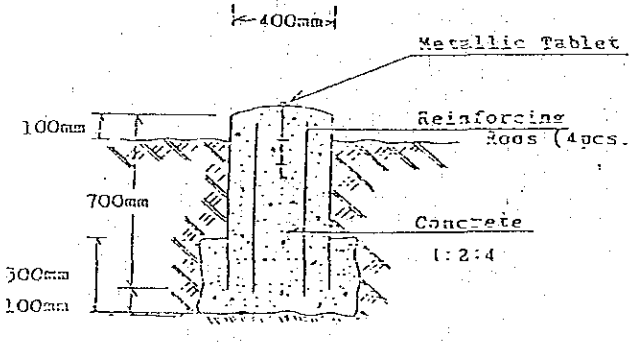


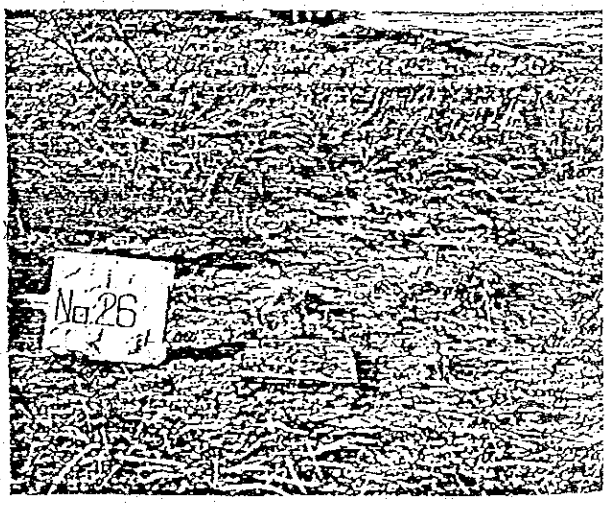

400mm
B.C.G.S
No.
400mm

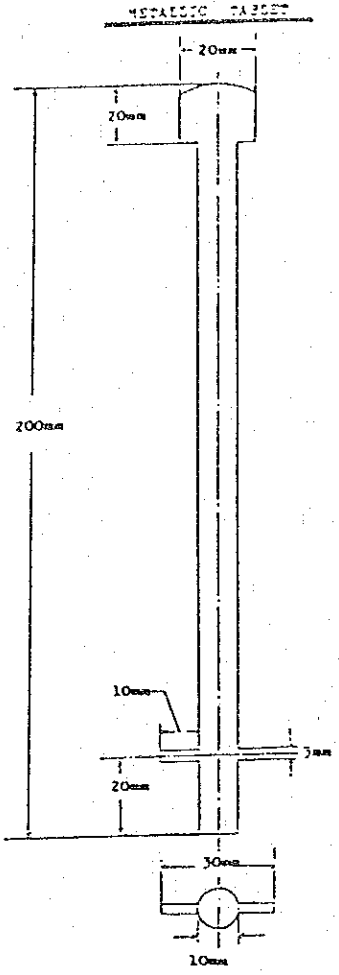

No.26


30mm
20mm
300mm
ø 3mm
ø 15mm
30mm

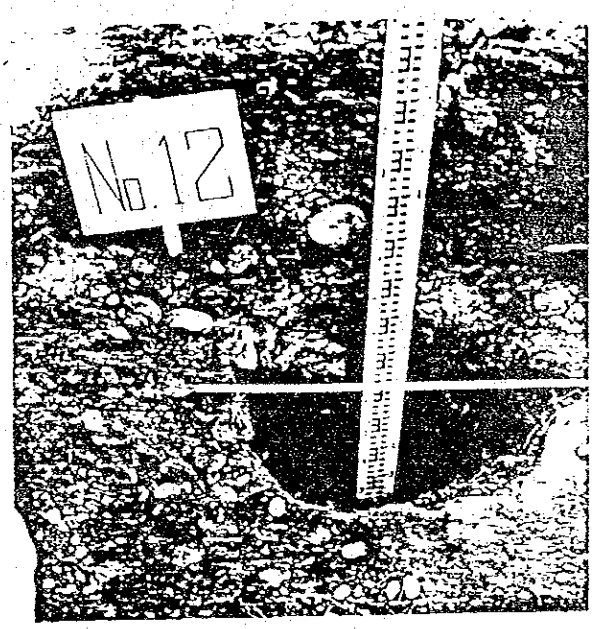

No.26
No.26


400mm
Metallic Tablet
100mm
Reinforcing
Rods (4pcs.
700mm
Concrete
1:2:4
300mm
100mm

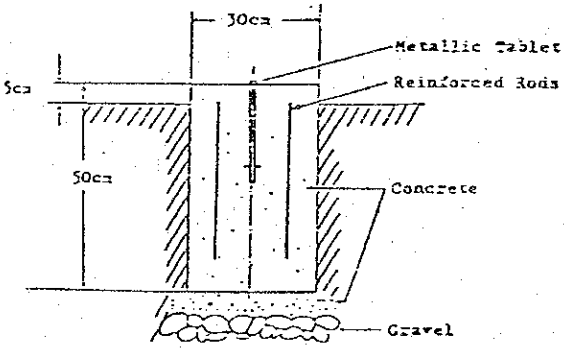

No.26

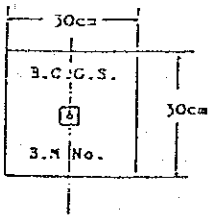

METALLIC TARGET
20mm
20mm
200mm
10mm
3mm
20mm
30mm
10mm

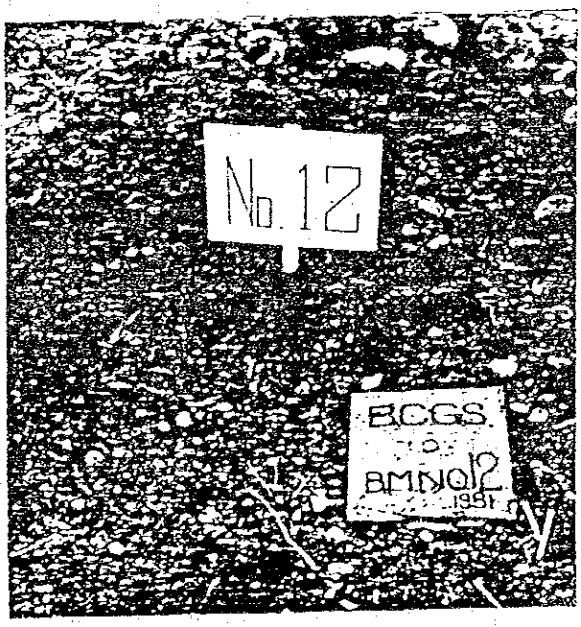

No.12


No.12

BENCH MARK


30cm
Metallic Tablet
Reinforced Rods
5cm
50cm
Concrete
Gravel


30cm
B.C.G.S.
6
B.M No.
30cm


No.12
B.C.G.S.
B.M No.12
1981

APPENDIX – II

IMPLEMENTING ARRANGEMENT OF THE TECHNICAL COOPERATION BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY AND THE BUREAU OF COST AND GEODETIC SURVEY FOR THE TOPOGRAPHIC MAPPING SURVEY OF THE CAGAYAN VALLEY

AGREED BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
BUREAU OF COAST AND GEODETIC SURVEY
DATED: 21ST FEBRUARY 1979

FOR JAPAN INTERNATIONAL COOPERATION AGENCY:

Takeshi Hirai

TAKESHI HIRAI
Head, Planning Coordination Division, Planning Department
Geographical Survey Institute
Ministry of Construction

FOR THE BUREAU OF COAST AND GEODETIC SURVEY:

ANTONIO P. VENTURA,
Commodore, BCGS
Director

IMPLEMENTING ARRANGEMENT ON THE TECHNICAL COOPERATION BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY AND THE BUREAU OF COST AND GEODETIC SURVEY FOR THE TOPOGRAPHIC MAPPING PROJECT OF THE CAGAYAN VALLEY

I. INTRODUCTION

In response to the request of the Government of the Republic of the Philippines, the Government of Japan dispatched a survey team to the Philippines in January 1978 for the purpose of the preliminary study of a Mapping Project (hereinafter (to be) referred to as the "Mapping Project") to prepare topographic maps and orthophotomaps of the Cagayan Valley, located in the northern part of Luzon Island of the Philippines, Which are prerequisites for the planning of various development projects in the areas.

Based on the report of the above survey team, the Government of Japan decided to undertake the Mapping Project in accordance with laws and regulations in force in Japan with regard to technical assistance programs, and the diplomatic notes on the Mapping Project which were exchanged between the Governments of Japan and the Republic of the Philippines up to February 1979.

II. MANAGEMENT AND ADMINISTRATION OF THE MAPPING PROJECT

1. The Japan International Cooperation Agency (hereinafter (to be) referred to as JICA), the official agency responsible for the implementation of technical

cooperation programs of the Government of Japan, will carry out the work necessary for the Mapping Project.

2. The Bureau of Coast and Geodetic Survey (hereinafter (to be) referred to as BCGS) shall act as counterpart to the Japanese survey teams and also as coordinating body to other concerned governmental and nongovernmental organizations, for the smooth implementation fo the Mapping Project.

3. The BCGS shall assign counterparts consisting of a Project Coordinator and the necessary technical men who shall jointly manage the execution of the Mapping Project with the representatives of JICA.

4. A report will be presented to the Government of the Republic of the Philippines by JICA every fiscal year (from April to March).

III. IMPLEMENTATION OF THE PROJECT

The present document sets forth the Implementing Arrangement agreed between JICA and BCGS for the Mapping Project.

1. The JICA shall provide technical cooperation to the BCGS for the implementation of the Topographic Mapping Project of the Cagayan Valley, covering an area approximately 11,000 km^2.

2. The Mapping Project shall be implemented in accordance with the Work Plan, which is given in detail in the Scope of Work, which forms a part of this

Implementing Arrangement, in close coordination with other development projects in the Cagayan Valley and other projects for economic and technical cooperation in the region.

3. The Mapping Project shall be undertaken in accordance with the Time Schedule which was formulated on the basis of the Work Plan referred to in III-2 above.

4. Technical Details shall be in accordance with those agreed upon by JICA and BCGS, as shown in APPENDIX V.

5. During the execution of the Mapping Project, changes can be made in the text of the Scope of Work by mutual agreement considered useful by JICA and BCGS in facilitating the work to be performed.

IV. DISPATCH OF JAPANESE MAPPING SURVEY TEAMS

The JICA shall, at its own expense, dispatch Japanese mapping survey teams in accordance with the schedule mutually agreed upon by JICA and BCGS.

V. PROVISION OF MACHINERY, EQUIPMENT, AND OTHER MATERIALS

The JICA shall, at its own expense, provide such machineries, equipment, and other materials, as listed in APPENDIX IV, necessary for the implementation of the Mapping Project.

VI. ON-THE-JOB TRAINING OF PHILIPPINE COUNTERPARTS IN JAPAN

The JICA shall, at its own expense, receive BCGS personnel connected with the Mapping Project for technical training or observation, as trainees in special subjects like aerial triangulation, stereoplotting and map compilation, in Japan in accordance with the normal procedures under the Colombo Plan Technical Cooperation Scheme.

VII. MEASURES TO BE TAKEN BY THE BCGS

1. The BCGS shall, at its own expense, provide the following:
   a. Additional primary geodetic control points to be established by JMR Doppler Survey Set, and the recovery/re-establishment of 1st order leveling bench marks.
      Results of above-mentioned surveys will be submitted to the Japanese Survey Team not later than June 30, 1980.
   b. Available data and information related to the Mapping Project.
   c. Counterparts consisting of a Project Coodinator and technical men as found necessary.
   d. Suitable office room in the BCGS office in Manila.
2. The BCGS shall make the necessary arrangements for the following:
   a. Suitable office space with appurtenant facilities, storage facilities and garage in the Project Area.

The cost of rental shall be chargeable against JICA funds alloted for the Mapping Project.

b. Secure flight permission for aerial photography related to the Mapping Project.

c. Secure permission for the use of radio communication facilities, including transceivers and electromagnetic distance-measuring instruments.

d. Secure permission for entry into private properties and restricted areas and the felling of trees when necessary.

e. Hiring of laborers as needed, but wages shall be chargeable against JICA funds allotted for the Mapping Project.

f. Availability of medical facilities when needed, but medical expenses shall be chareable against JICA funds allotted for the Mapping Project.

VIII. SECURITY ARRANGEMENTS

1. The following security arrangement will be taken in the implementation of the Mapping Project.

a. The Government of Japan, will submit to the Government of the Republic of the Philippines all materials acquired in the Philippines for the implementation of the Mapping Project, including those enumerated in the APPENDIX III and all products thereof. The Government of Japan, wishes to receive two copies of 1/25,000 Topographic

Maps from the Government of the Republic of the Philippines, one copy to be kept in the Ministry of Foreign Affairs of Japan and the other bo be kept in JICA, as the record of the said Project. The copy thus received by the Ministry of Foreign Affairs will be treated as confidential.

The standing orders of the JICA provide that all products of the surveys conducted by the JICA shall be kept confidential. The contract between the JICA and private contractor for the Mapping Project prohibits the latter from revealing any confidential knowledge acquired through implementation of the Mapping Project.

b. The Government of Japan will take necessary measures for JICA to accept two security officers. The two security officers will be responsible at all times for the processing, handling, reproduction, safekeeping and final disposition of all aerial photographs and reproducible mapping materials in accordance with relevant laws and regulations of the Philippines.

c. The JICA shall submit detailed background information on the aerial survey group and all its personnel who shall be working on the Mapping Project in the Philippines and the key personnel who shall be working on each stage of the work in Japan, to the Ministry of National Defense, through

the Ministry of Foreign Affairs, Republic of the Philippines, for purposes of accrediation/ clearance prior to the start of the Mapping Project.

2. The Government of the Philippines, shall take the following necessary measures:

   a. To ensure the safety of the survey teams while working in dangerous or critical areas, the BCGS shall arrange with proper authorities for necessary security details.

   b. To issue proper ID cards or Credentials to Japanese personnel who shall be working on the Mapping Project.

   c. To effect the smooth transfer of data and materials, including aerial photographic films from the Philippines to Japan or vice versa, for the purpose of executing the Mapping Project.

3. Provisions for the reception by the JICA of Philippine security officers as JICA trainees:

   The JICA shall receive two security officers, who shall have basic knowledge of photogrammetry, to Japan as JICA trainees, who at the same time will have custody of the aerial negatives or diapositives during the work to be undertaken in Japan and will jointly supervise, with their Japanese counterparts, the actual compilation work to be done thereon.

Note: This Implementing Arrangement shall come into force on the date of the exchange of Diplomatic Notes between the Government of Japan and the Government of the Republic of the Philippines.

SCOPE OF WORK AND REQUIREMENTS FOR THE
AERIAL PHOTOGRAPHY OF CAGAYAN VALLEY, PHILIPPINES

1. SCOPE OF WORK:

Aerial photography shall be carried out by the CONTRACTOR for the photographic mapping project of the Cagayan Valley, of which the survey and mapping have been entrusted to the International Engineering Consultants Association (IECA) by Japan International Cooperation Agency (JICA)

2. AREA:

The area to be photographed is outlined on attached Flight Map marked as Encl. 1, and covers approximately 15,000 sq. km.

3. COMMENCEMENT OF THE WORK:

All arrangement for the personnel of high-skill, materials, facilities and/or equipment necessary for this work shall be prepared quickly by the CONTRACTOR so that the flying can be commenced from the Tuguegarao Airport or Cauayan Airport, within fifteen (15) days after receipt of the notice of commencement from the International Engineering Consultants Association (IECA). IECA will make every effort to give the CONTRACTOR preliminary notice to start mobilization as far in advance of the notice of commencement as possible. CONTRACTOR should, afterwards, stand-by on site so as to fly when IECA requires.

The whole work, shall be completed within ninety (90) calendar days after receipt of the notice to start the work.

4. REPRESENTATIVE OF IECA ON SITE:

IECA will dispatch its personnel in the Philippines as its reproesentative in order to supervise and check the photo-flights of the CONTRACTOR.

Detail indication and minor modification of the specification as set forth below, within the extent of not affecting contract amount as mutually agreed by both parties will be ordered on site by the IECA representative.

5. EQUIPMENT TO BE UTILIZED:

5.1 Aircraft

The survey aircraft to be used in the performance of the contract work shall have a Civil Aeronautics Administration airworthiness certificate. It shall be equipped with all the essential navigational and photographic instruments. It must have the requisite photographic cruising speed and operating range, a high rate of climb, good stability while in flight, good field of view for visual navigation and a service ceiling at full load equal to or higher than the highest altitude required for the project. The design of the aircraft shall be such that there shall be an unobstructed field of view for the total image area of the camera, shielded from exhaust gases, oil and turbulence of airflow caused by propellers.

No window of glass, plastic or other materials shall be interposed between the camera and the ground to be photographed.

5.2 Aerial Camera

Aerial camera to be used for the photography shall be a modern aerial survey camera such as ZEISS RMK A15/23, or WILD RC-8, RC-10 type with wide angle lens (6 inches focal length), which has a calibration report indicating it has been tested within two years.

The calibration report should include:

a) The maker's serial number of the camera and the serial number of the lens.

b) The coordinates of the principal point with reference to the fiducial marks.

c) The radial distortions of the image, with reference to the principal point as origin.

d) The calibrated focal length at which these distortions apply.

e) The certificate as by whom and when the camera was calibrated.

5.3 All equipment and copies of the last calibration certificate of the above equipment should be agreed on and submitted to IECA before commencement of the work.

5.4 Laboratory

The contractor's laboratory shall be spacious enough

to meet the expected operational requirements and shall be adequately equipped and staffed with sufficient qualified personnel to facilitate high quality production in such a volume as the contract may require.

6. PERSONNEL TO BE EMPLOYED:

CONTRACTOR should employ or hire skilled and welltrained personnel for this kind of work, and submit to IECA their experience previously for the acceptance of IECA.

IECA shall have the right to reject and direct the replacement of CONTRACTOR's personnel who is judged "unqualified" by IECA for the execution of the work.

7. SPECIFICATION:

7.1 Flight Plan

The flight plan is attached as Encl. 1 and was prepared was prepared on a topographical map of the area at scale 1:250,000. The flight plan shows the lines to be flown and the required coverage beyond the boundaries of the area to be mapped. The directions of the flight lines are shown as such on the flight plan. Flight line No. C1-C15 are planned to fly over the center of the Philippines standard medium scale in Zone III. Easting of the flight lines are 612,500m - (n x 5,000m).

where: N = No. of the flight line

Therefore the spacing between adjacent flight lines are exactly 5,000 meters.

Flight of the north-east and north-west shore line area (line No. C16-C19) and control flight (line No. BC1-BC5) are not followed in this condition.

7.2 Photo Scale and Altitude

The aerial photography shall be taken at average scale of 1/30,000.

Flying altitudes for each lines are shown on the list of flight line marked as Encl. 2.

7.3 Aerial Films

a) The aerial film to be used shall be with a fine grain freshly coated emulsion and the base shall have minimum differential distortion.

b) Negatives shall be clear and sharp in details and of uniform density. They shall be free from clouds, smoke, haze, light streaks, shadows, tears, scratches and other blemishes.

c) To ensure dimensional stability, the film shall not be stretched or otherwise deformed in any way. Special care shall be exercised to ensure proper development and thorough fixing and washing of all films; and to avoid rolling of film tightly on drums during processing and drying. About one meter at each end of a roll shall remain unexposed.

7.4 Flying Requirements

a) The photography will be undertaken so as to provide complete stereoscopic coverage over the specified area.

b) The area will be covered with straight strips of photographs having overlap of about 60 ± 7 percent.

The sidelap (overlap of parallel strips of photography) shall average 27.5 percent. In no case shall the sidelap be less than 10 percent on the area to be mapped. In the event of considerable variations in ground level, a reasonable increase in the specified overlaps will be accepted.

c) Crab shall not exceed 10° or be such that stereoscopic gaps in the photography result from it.

d) Tip and tilt should not exceed 4°

e) The centers of the first one and the last one photograph shall fall outside the required area boundary.

f) Exposure of photography shaould be so that even in the shadows caused by topographic relief, satisfactory identification of details is possible.

g) Where breaks in a flight strip are necessary the minimum overlap between segments of the strip shall be at least three (3) exposures.

Any segment of a flight strip resulting from necessary breaks shall consist of no fewer than eight (8) exposures.

h) Reasonable effort will be made to obtain cloud free photographs and five percent of clouds appearing in each photograph may be considered as tolerable.

In no case, however, shall clouds fall on control points and principal points.

i) All flight strips shall be centered as close as possible over flight lines plotted. No flight strip or segment of a flight strip shall depart from its plotted position on the flight map by more than forty (40) percent of the specified mean side lap distance. Failure of any flight strip or section thereof to meet these requirements may be a cause for rejection.

j) Attention of the CONTRACTOR is directed to all existing regulations concerning restrictions and procedures on photography of classified installations and/or reproducing, publishing or selling pho photographs of such installations. The CONTRACTOR shall meet the Ministry of National Defense security requirements before taking photographs of classified areas or installations.

k) A flight report has to be delivered for each film c containing the following information (see Encl. 3):

1) The name of the contract
2) The name of contractor
3) The number of the film
4) The time of the first and last exposure for each run
5) The date exposed
6) The serial number of the camera, magazine and the lens

7) The calibrated focal length given in the calibration report

8) Lens aperture, filter, shutter speed

9) Type of film

10) Aircraft number

11) Height above sea level

12) Weather conditions, etc.

7.5 Indexing and numbering of films shall conform to the specifications of the Bureau of Coast and Geodetic Survey (BCGS), the Philippines. Each film and each aerial negative shall be marked clearly of the block type lettering approximately one sixth (1/6) inch high and positioned so that each group will not be less than 1/8" or more than 1/4" from the related image edge of the negatives.

a) Filmmarkings - Each negative roll shall be numbered consecutively starting with No. 001. Each end of each roll shall be clearly marked with:

1. Contract Number or Project Designation:

CAGAYAN VALLEY

2. The name of the island: LUZON

3. Roll Number.

4. Dates on which exposed, together with relevant negative numbers.

5. Serial number of camera optical unit and the principal distance as shown in the calibration certificate.

6. Corrected height (not indicated height) above mean sea level at which exposed, together with relevant negative numbers. When a roll is exposed at more than one height, all heights should be shown against the relevant numbers; e.g.:

011-075 flown at 25,000 ft above m.s.l.

076-110 flown at 24,000 ft above m.s.l.

111-200 flown at 19,000 ft above m.s.l.

b) Negative Numbering

Negative numbering will be instructed later.

7.6 Contact Prints

a) Contact prints from the negatives of the aerial photography shall be made on double weight semi-matte standard commercial grade photographic paper and shall be trimmed with a margin of approximately one-fourth (1/4) inch outside of the photographic image including the space necessary to show the registering instrument clearly.

b) Special care shall be exercised to ensure the proper development and the thoroughly fixing of contact prints. All prints shall be clean and free from stains, blemishes, uneven spots, light fog, and finger marks, and shall be thoroughly washed to completely eliminate the hypo or any other chemicals which would impair their permanency.

7.7 Photo Index

A photo coverage index of the project shall be prepared to check for overlaps and placement of flight strips against the approved flight plan. The coverage index shall be a line index which shall be prepared on the master reproducible 1:250,000 flight plan sheet. The master sheet will be supplied to CONTRACTOR by the representative of IECA.

8. PROCESSING AND INSPECTION:

8.1 The CONTRACTOR shall process aerial films and make contact prints immediately after the every photographic flight are completed in order to make preliminary inspection of the result and instruct re-flight if it is needed.

8.2 Quality Control Sheet, to be used for record of the result (see Encl. 4) will be inspected by the representative of IECA.

8.3 The CONTRACTOR shall follow any reasonable instructions or technical advices given by the representative of IECA.

9. FINAL MATERIALS TO BE DELIVERED:

9.1 Negatives, Prints and Reports

The following photographic materials and reports shall be delivered or supplied by the Contractor:

a) All original aerial negatives exposed during the aerial photography under this contract.
The films are to be on metal spools in metal containers properly labelled. The labels shall be one of durable materials and contain the following information:

Contract Number or Project Designation

Name of Contractor

Date Exposed

Roll Number

Numbers of First and Last Negatives

b) One contact print from every negative of the photography for evaluation.

c) One contact print from every negative of all accepted photography.

d) One set of line index in reproducible materials.

e) All reports required by the specifications.

9.2 Shipment of photographic materials.

All films shall be thoroughly cleaned, placed on spools and original metal containers, and sealed with emulsion facing the core of the roll and the outside edge secured to prevent unrolling. Contact prints shall be arranged and bound by flight strip and shall be identified by flight strip number, and relevant roll and negative numbers. Photo index negatives and prints shall be delivered in flat position.