



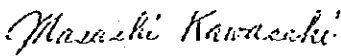
2-2 現地作業終了時の協議議事録(1998年2月26日)

MINUTES OF MEETINGS
ON
PROGRESS REPORT
OF
THE FIRST YEAR'S FIELD WORK
FOR
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA

NAIROBI, 26th Feb. 1988


MR. A. K. HJUKI
For Director of Surveys


MR. SHO SAITO
Leader,
JICA Study Team


MR. M. KAWASAKI
JICA Advisor

1. Date and time: 23rd Feb. 1988 14:30 - 15:00
23rd Feb. 1988 15:30 - 17:00
2. Place: 14:30 - 15:00 Survey Headquarters,
Nairobi
15:30 - 17:00 Survey Field Head-
quarters, Ruaraka
3. Attendants: Attachments - 1, 2
4. The JICA Study Team (hereinafter referred to as the "Team") briefly reported the progress of the first year's field work for the Topographic Mapping of South Kenya, submitting the "Progress Report of the First Year's Field Work for the Topographic Mapping of South Kenya in the Republic of Kenya" prepared by the Team. (Attachment - 3)
5. The Survey of Kenya (hereinafter referred to as "SK") appreciated the report and raised requests to continue the aerial photography and re-establish missing geodetic control points and bench marks, because they realize that those points are necessary not only for the mapping, but also for the planning and implementation of development projects in the captioned area which are the reasons for the request of the mapping.
The team took note of the request.
6. In preparation for the second year's field work, the Team requested the provision of counterparts and arrangement for permission letter to enter National Parks, Reserves or limited areas when necessary.
SK took note of the request and requested, for earlier arrangement, to inform them of the schedule of the Team as early as possible when fixed.
The Team replied to do their best to inform SK of necessary information beforehand, including the date of arrival, period, team members, etc. through JICA.
7. The Team requested SK to keep a part of contact prints of the aerial photographs taken this time for the sake of security and SK accepted the request.

Attendants of Meeting
(14:30 - 15:00, 23rd Feb. 1988)

1. Government of Kenya

Mr. Absaloms	Ag. Director of Surveys
Mr. Njuki	Assistant Director of Surveys, Mapping
Mr. Wainaina	Superintending Surveyor, Mapping

2. Government of Japan

(1) JICA Kenya Office

Mr. Kaiho	Assistant Resident Representative
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(2) JICA Advisors

Mr. Kawasaki	Head, Inspection Div., Topo. Dept., Geographical Survey Institute
Mr. Izaki	Staff, Planning Div., Social Development Cooperation Dept., JICA

(3) JICA Study Team

Mr. Saito	Leader
Dr. Huraoka	Deputy Leader
Mr. Yoshida	Mapping Planner

Attachment - 2

Attendants of Meeting
(15:30 - 17:00, 23rd Feb. 1988)

1. Government of Kenya

Mr. Njuki	Assistant Director of Surveys, Mapping
Mr. Wainaina	Superintending Surveyor, Mapping
Mr. Kibore	Chief Photogrammetrist
Mr. Ndunda	Chief Cartographer
Mr. Chabeda	Chief Lithographer

2. Government of Japan

(1) JICA Kenya Office

Mr. Kaiho	Assistant Resident Representative
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(2) JICA Advisors

Mr. Kawasaki	Head, Inspection Div., Topo. Dept., Geographical Survey Institute
Mr. Izaki	Staff, Planning Div., Social Development Cooperation Dept., JICA

(3) JICA Study Team

Mr. Saito	Leader
Dr. Muraoka	Deputy Leader
Mr. Yoshida	Mapping Planner
Mr. Kyakuno	Chief Surveyor

PROGRESS REPORT
OF
THE FIRST YEAR'S FIELD WORK
FOR
THE TOPOGRAPHIC MAPPING OF SOUTH KENYA
IN
THE REPUBLIC OF KENYA

--- February, 1988 ---

STUDY TEAM
OF
THE TOPOGRAPHIC MAPPING OF SOUTH KENYA
IN
THE REPUBLIC OF KENYA

JAPAN INTERNATIONAL COOPERATION AGENCY

I. INTRODUCTION

The topographic mapping of South Kenya started in October, 1987, in four-year term study, as a technical cooperation program of JICA.

In compliance with the Scope of Work agreed between the Ministry of Lands and Settlement and JICA on 19th March, 1987, the JICA Study Team, composed of 18 members, arrived in Nairobi on 3rd December, 1987 and stayed in Mombasa from 14th December, 1987, to 18th February, 1988. Meanwhile, Kenyan counterparts joined the work from time to time.

In accomplishing the first year's field work, hereinafter, the summary of the progress of the work is reported.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to prepare the 1/50,000 topographic map covering an area of approximately 29,800 km² in South Kenya from east of Long. 37° 45' to the coast and from south of Lat. 3° to the Kenyan territory of the Tanzanian border. Main items of the Study are as follows:

1. Aerial photography: approximately 29,800 km²
2. 1/50,000 topographic mapping: approximately 29,800 km².

III. SCOPE OF WORK FOR THE CAPTIONED PERIOD

The scope of work for the first year covers

1. Aerial photography

Two missions of aerial photography shall be carried out.

a. 1/40,000 aerial photography covering the existing and proposed leveling routes in single strip courses for approximately 740 and 760 Lkm respectively,

b. 1/60,000 aerial photography covering the whole project area of approximately 29,600 km² (or 4,000 Lkm).

2. Aerial signal

Aerial signals shall be established on 40 existing geodetic control points.

3. Pricking of existing bench marks

Pricking on the aerial photographs shall be carried out of bench marks along existing 1st and 2nd order leveling routes extending approximately 700 km.

4. Leveling

Minor order leveling shall be carried out along the proposed leveling routes extending approximately 720 km.

IV. AERIAL PHOTOGRAPHY

Two missions of aerial photography were carried out by contracting with Photomap Co. Ltd.

1. Mission 1:

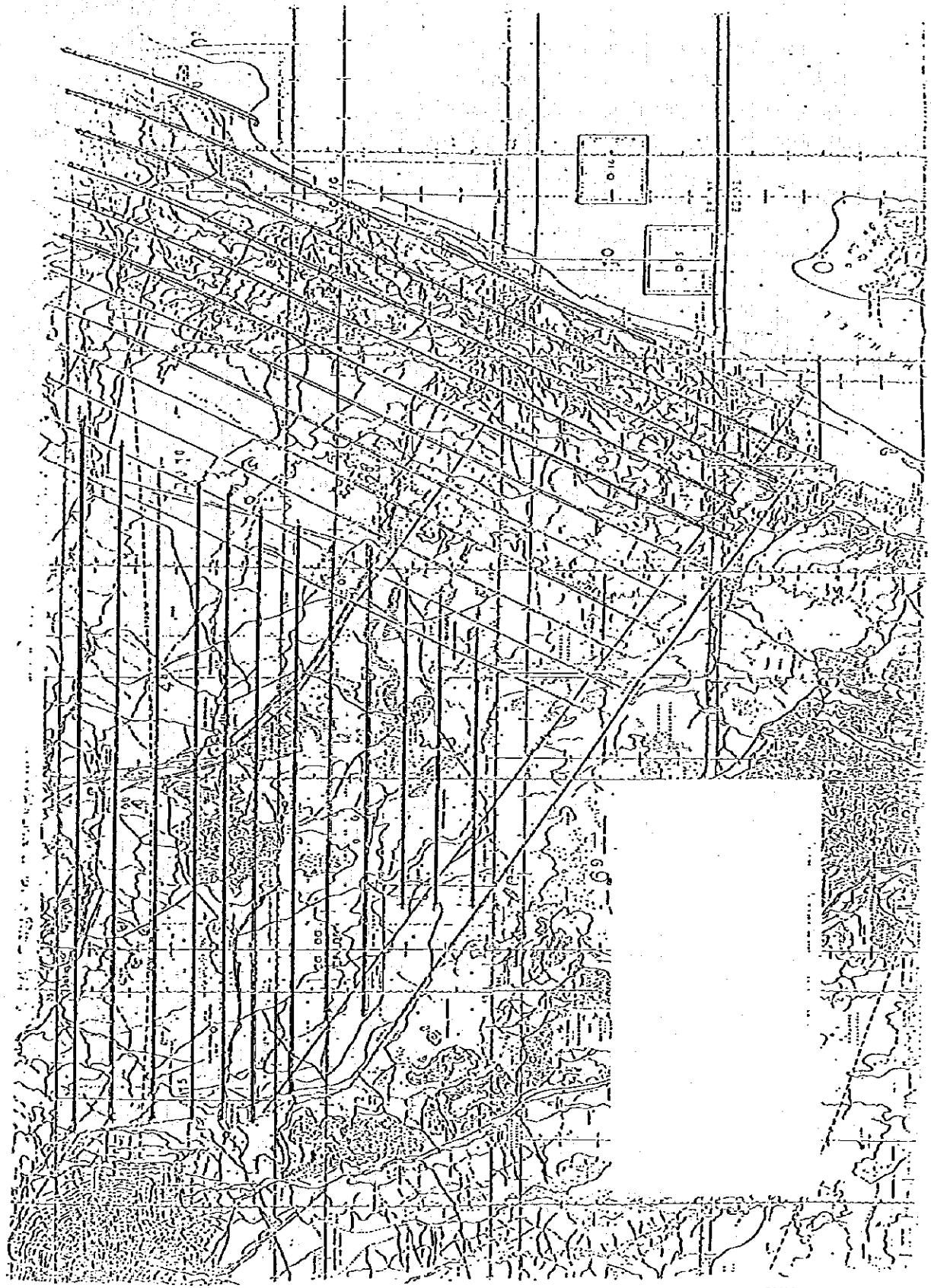
Aerial photography was carried out along existing and proposed leveling routes totaling approximately 1,500 Lkm with single strip courses as follows:

- a. Period: November, 1987,
- b. Camera : Super-wide angle camera,
- c. Photographic scale: Approximately 1/40,000 in general. However, due to unfavorable weather conditions, photographic scale varied from 1/8,000 to 1/40,000.
- d. Flight course map: Map showing flight courses is shown in Fig. 1.

2. Mission 2.

Aerial photography was carried out to cover the whole project area totaling approximately 4,000 Lkm. Due to unfavorable weather conditions, however, about 70% was covered during the period.

- a. Period: December, 1987 - February, 1988,
- b. Photographic scale: Approximately 1/60,000
- c. Camera: Super-wide angle camera,
- d. Flight course map: Map showing flight courses is shown in Fig. 2.



V. AERIAL SIGNAL

Aerial signals were to set up on 40 existing geodetic control points as shown in Fig. 3. Among those, however, for 5 missing points, aerial signals were set up in their neighbourhood. Missing points are:

1935 2, 190S 2, 196ST 4, 199ST 2 and 199ST 1.

An example of aerial signals is shown in Fig. 4.

The conditions of the monuments of the signalized geodetic control points are tabulated in Tab. 1 and summarized as follows:

Normal	22
Felled down	3
Destroyed	10
Missing	5

Among 35 existing geodetic control points, the distribution of points which are not vertically controlled is shown in Fig. 5 and summarized as follows:

	Total	No vertical control
1st order triangulation point	10	4
2nd " "	19	9
1st " traverse point	2	1
2nd " "	4	3
Total	35	17.

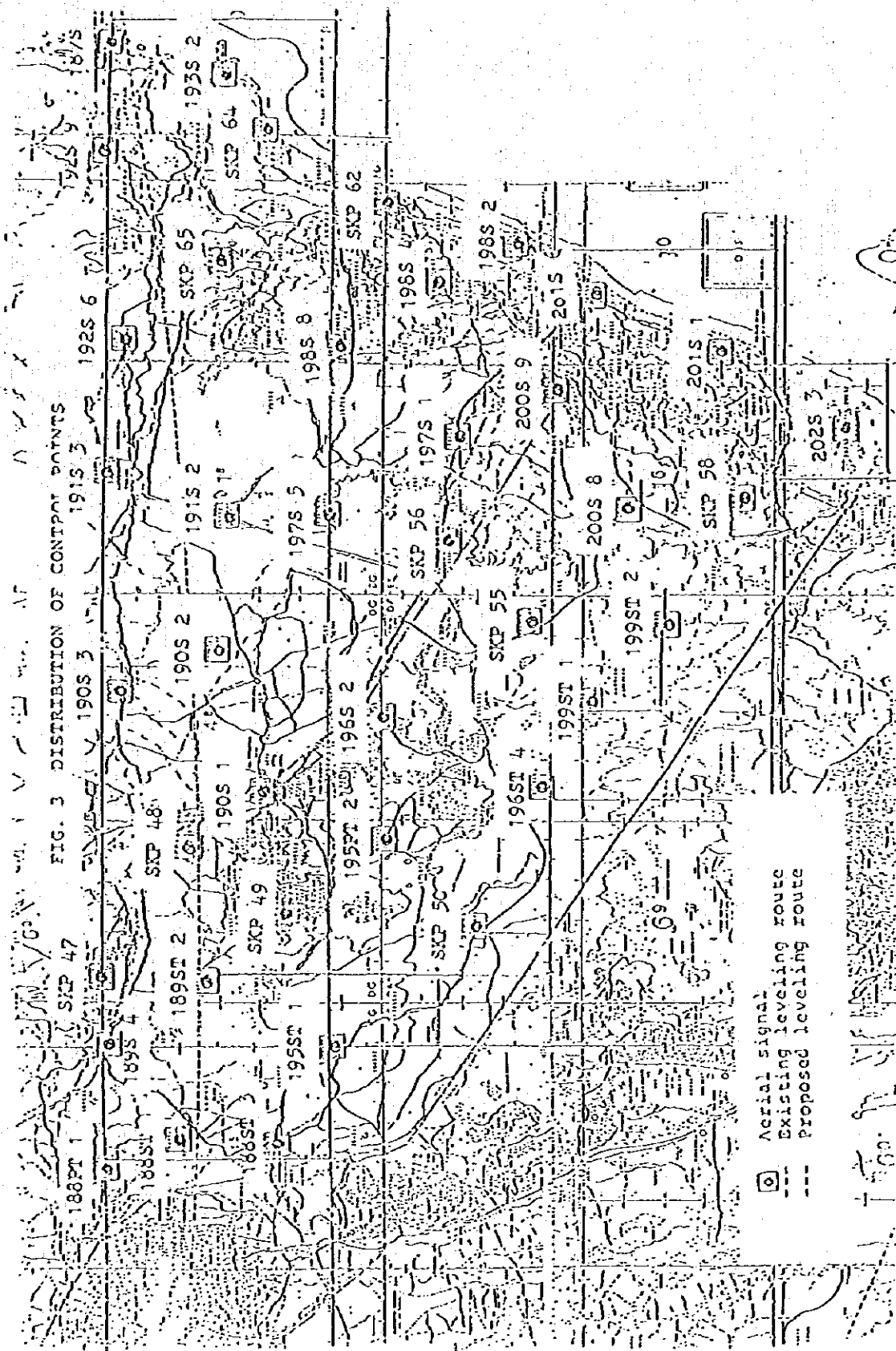


FIG. 3 DISTRIBUTION OF CONTROL POINTS

Tab. 1. Conditions of geodetic control points

Point number	Conditions of monument			Missing	Vertical control
	Normal	Felled down	Destroyed		
SKP 47	*				*
SKP 48	*				*
SKP 49	*				*
SKP 50	*				*
SKP 55	*				*
SKP 56	*				*
SKP 58			*		*
SKP 62	*				*
SKP 64	*				*
SKP 65	*				*
187S	*				*
189S		*			*
190S		*			*
190s	2			*	*
190s	3	*			*
191s	2	*			*
191s	3	*			*
192s	6	*			*
192s	9		*		*
193s	2			*	*
196s	2			*	*
197s	1			*	*
197s	5	*			*
198s	2	*			*
198s	4		*		*
198s	8		*		*
200s	7	*			*
200s	8	*			*
201s	1	*			*
201s	6	*			*
202s	3				*
188rT	1		*		*
195rT	2	*			*
188sT	1	*			*
188sT	3		*		*
195sT	1	*			*
196sT	4			*	*
199sT	1			*	*
199sT	2			*	*
189sT	2	*			*
40	22	3	10	5	18



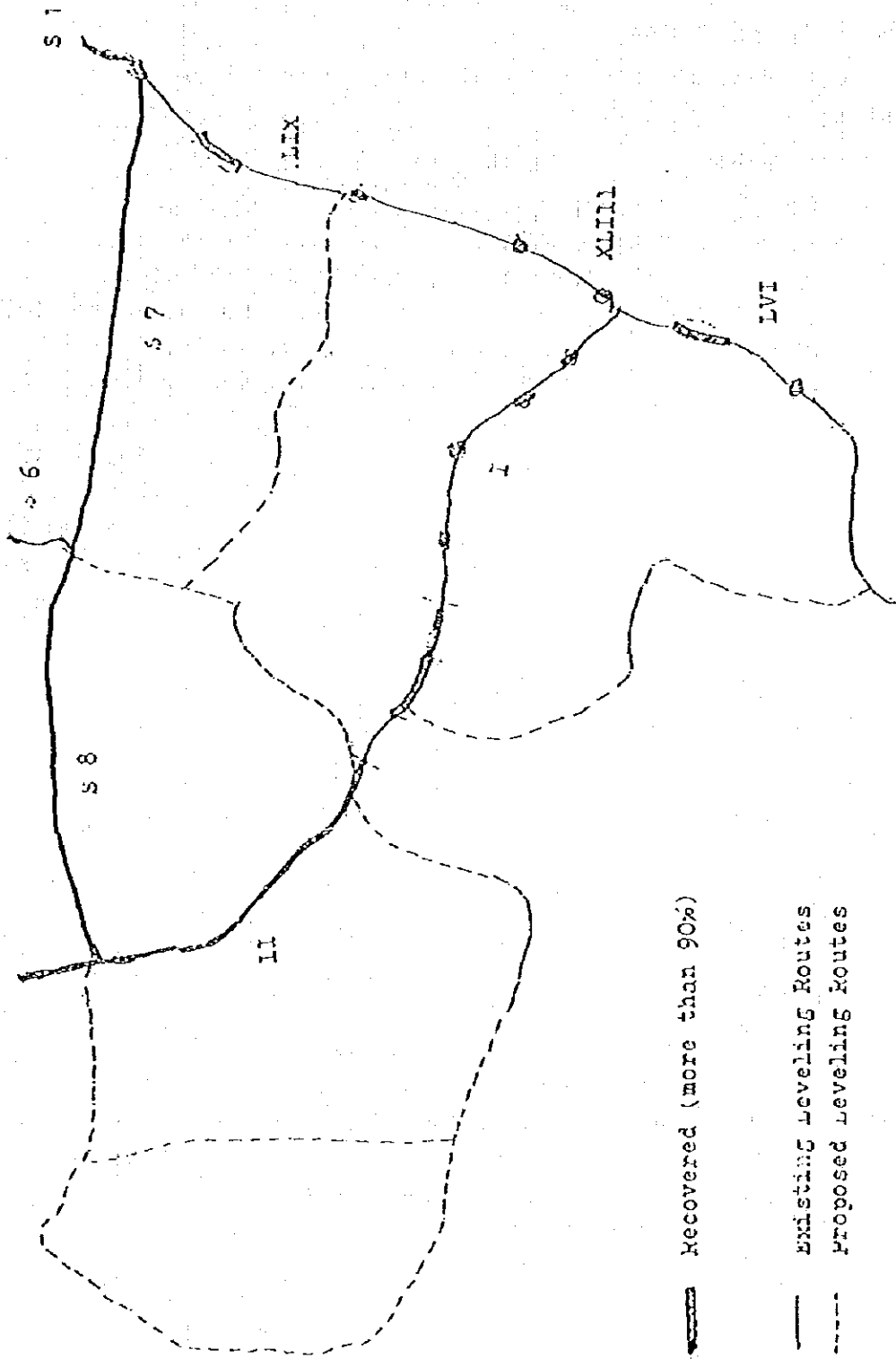
VI. PRICKING OF EXISTING BENCH MARKS

Pricking on aerial photographs of bench marks was carried out along existing leveling routes. However, some of the bench marks were missing. The conditions of the bench marks are summarized as follows:

Line	From - To	Recovered	Missing	Total
I	Voi - Hoabasa	35	83	118
II	II/78 - II/117	28	10	38
XLIII	XLIII/8 - Baburi	1	8	9
LVI	N - LVI/65	4	62	66
LIX	Madruai - LIX/82	13	67	80
S1	S1/1 - S1/7	6	1	7
S6	S6/21 - S6/26	6	0	6
S7	S7/1 - S/FBM 1	27	5	32
S8	S8/1 - S8/27	27	0	27

The distribution is shown in Fig. 5.

Fig. 5 Status of existing bench marks



VII. LEVELING

1. Leveling Routes

8 routes for minor order levelings were set up as shown in Fig. 6 and as follows:

Route number	Bench marks	Length
R1	J-1, R1-1,, R1-16, S8/3	32.1 km
R2	I-21, R2-1,, R2-34, J-1	69.9
R3	LIX-49, R3-1,, R3-27, R-3, R3-28,, R3-53, J-1	109.3
R4	Fixed point, R4-1,, R4-64, I-38	135.8
R5	II-91, R5-1,, R5-21, J-2	45.2
R6	J-2, R6-1,, R6-40, R-6, R6-41,, R6-81, J-3	161.6
R7	J-2, R7-1,, R7-19, R-7, R7-20,, R7-37, J-3	81.0
R8	I-21, R8-1,, R8-45, J-3	96.3
Total	357. (New Marks)	731.2 km

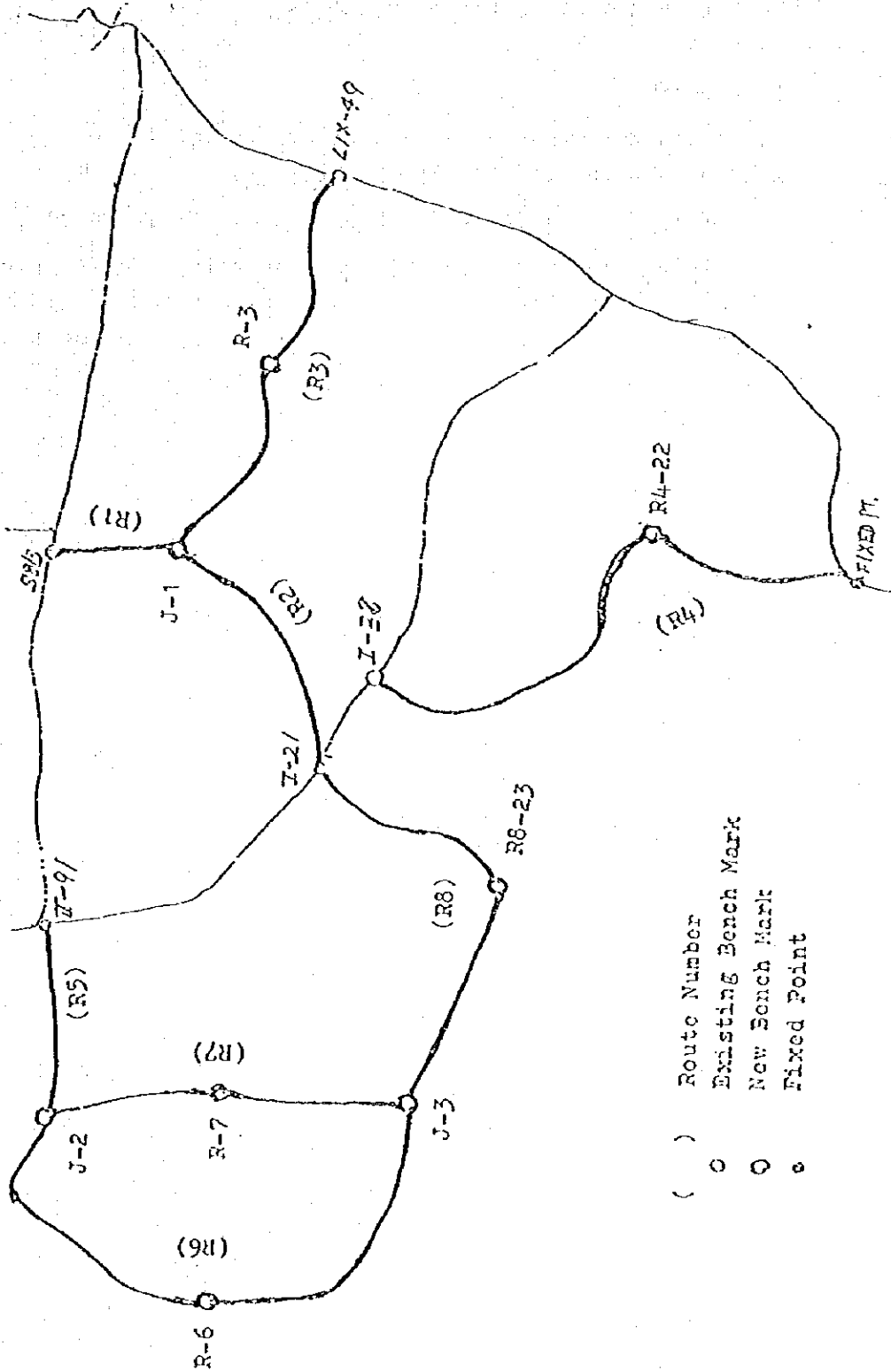
2. Measurement

Following existing bench marks were used for starting, ending and reference points for checking:

Given point	Reference point for checking
I-21	I-18
I-38	I-37
II-91	II-90
LIX-49	---
S8/3	S8/2

Check measurement was carried out with satisfactory results. The nominal values of BHs I-21, I-38, II-91 and S8/3 will be adopted as given. However, for LIX-49, it was not able to carry out check measurement, because of missing of neighbouring bench marks. It will be regarded as given point for the time being.

FIG. 6. Distribution of Leveling Routes



At the starting point of the route R4 near Lunga-Lunga, no existing bench marks were found. Closure was not estimated.

3. Marking

Permanent monuments were set up at the following 8 points as shown in Fig. 6:

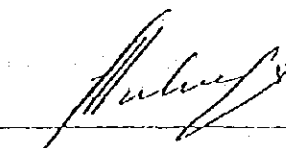
J-1, J-2, J-3, R-3, R4-22, R-6, R-7, R8-23.

At some points, marking was done using stable ground features. For other points, temporary marking was done by setting up small wooden stick with a nail on the top.


2-3 現地作業開始時の協議議事録(1998年8月9日)

MINUTES OF MEETINGS
ON
THE SECOND YEAR WORK
FOR
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA

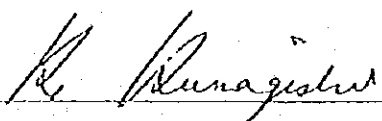
NAIROBI 9TH AUGUST, 1988



MR. E. M. GIKINYA
FOR: DIRECTOR OF SURVEYS



MR. SHO SAITO
LEADER
J I C A STUDY TEAM



MR. K. KUMAGISHI
RESIDENT REPRESENTATIVE
J I C A KENYA OFFICE

MINUTES OF MEETINGS ON THE START OF THE SECOND YEAR WORK
TOPOGRAPHIC MAPPING OF SOUTH KENYA

Dates: The meetings were held on Thursday 28th July, Friday 29th July, Monday 1st August and Tuesday 2nd August, 1988.

Present:

Survey of Kenya:

W. J. Absaloms	Ag. Director of Surveys
E. M. Gikinya	Ag. Assistant Director of Surveys, Mapping
O. M. Wainaina	Superintending Surveyor Mapping
F. Ito	JICA Expert Attached to Survey of Kenya
P. Ndunda	Chief Cartographer
J. Kibore	Chief Photogrammetrist
D. Chabeda	Chief Lithographer
C. Kimele	Oi/C 1:50,000 Topo Drawing Office

JICA Kenya Office

Ryuji Matsunaga	Assistant Resident Representative, JICA Kenya Office
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JICA Study Team

S. Saito	Leader
K. Muraoka	Deputy Leader
M. Yoshida	Mapping Planner
Y. Kyakuno	Chief Surveyor
T. Hidaka	Chief Surveyor
M. Nakai	Surveyor
K. Miyakawa	Surveyor

1. Report to the Director of Surveys:

The JICA Study Team (hereinafter referred to as the "Team") held the first meeting with the Ag. Director of Surveys in his office on 28th July, 1988. The Team reported briefly on the progress of work and presented the Ag. Director with copies of the report on what had been accomplished during the first year. The Team also presented him with a copy of the plan of operations during the just beginning 2nd year work. - See Attachment

SS.

R/c

E.M.G.

2. Review of first year work

The team made a brief review of the first year's work during the rest of the meetings with the Survey of Kenya (SK) at the Survey Field Headquarters.

3. Plan of Operations for the Second Year (Phase II)

The Team presented copies of the plan of operations for the second year (Phase II) to the Survey of Kenya (SK). The whole of Phase II would involve Aerial Photography, Levelling, Geodetic Control Point Survey, Field Verification, Aerial Triangulation, Stereo Plotting and Compilation. However, Plotting and Compilation will be continued to the third year. It was expected that all the work would be completed by the end of the fourth year during March, 1991.

After a detailed discussion the plan of operations for the second year was adopted. The map symbols and annotations contained in the plan of operations for the first year were reviewed in detail.

4. Counterparts

It was agreed that Survey of Kenya would provide the following:-

- (a) At least 1 counterpart for geodetic control point survey party.
- (b) 3 counterparts for the field verification parties.

5. Materials to be provided by Survey of Kenya (SK)

- (a) Composite copies on stable material for all the maps at the edges of the mapping area. The Team will provide the material to SK for printing.
- (b) Pricked diapositives, contact prints, photo index and aerial triangulation results for the old JICA maps in the North of the mapping area. This should cover 2 strips along the southern edge of the old JICA mapping area.
- (c) Photographs of the old JICA levelling bench marks.
- (d) Copies of the field revision data on the old maps within the mapping area where available.

6. Data to be provided by Survey of Kenya (SK)

- (a) Details for the location of water pipelines, powerlines and telephone lines.
- (b) Information on road classifications

S.S.

E.M.G.

[Handwritten signature]

- (c) Administrative and Cadastral boundaries. Survey of Kenya will mark the boundaries and send back to the Team. SK will also do a final checking on the boundaries before printing.
- (d) SK will supply up-to-date symbols for some of the items which were not concluded like different water features, built-up areas etc., Survey of Kenya will also provide material for coral and cliffs symbols to be reproduced by the Team. A complete set of all the standard symbols and annotations were also to be provided to the Team.
- (e) Survey of Kenya will also provide a list of coordinates, heights and descriptions for all the triangulation and traverse points to be shown on the maps. Survey of Kenya will also clarify the heights to be used in instances where two heights exist at a station or benchmark.

7. Administration

The Survey of Kenya will assist in obtaining permission to enter the National Parks and other restricted areas. Letters should also be sent to the Local Administration introducing the Team. The Mombasa Provincial Survey Office will also assist as during the first year. The Team provided Survey of Kenya with a list of vehicles that would be used during the field survey to enable SK obtain duty passes for the national parks.

8. Map symbols and their application

- (a) Following were discussed and confirmed.
 - (1) Embankments, hedges, walls and similar features shall be shown, if they are longer than one centimetre on the map.
 - (2) Underground water pipe line shall be shown, except when it lies under the road.
 - (3) Oil pipe line shall not be shown.
 - (4) Telephone, telegraph and power lines are shown only for main lines.
 - (5) Road cuts and fills shall be at least 250 m long and 5 m high to be shown.
 - (6) For viaduct, the symbol is used only when it has intermediate pillars. Otherwise, the same symbol as the bridge shall be used.
 - (7) Buildings shall be shown as square, or round dot symbols according to their shapes.
 - (8) Annotation "Airfield (earth)" shall be included in "Grass."

S.A.
R.K.
E.M.G.

- (9) The symbol for cemetery shall not be used, but a annotation "Cem" shall be used.
 - (10) Rivers shall be shown, if they measure at least one centimetre on the map for the Coastal and plains, but at least five milimetres in hilly areas.
 - (11) For plantation not stated in the application rules the first letter of the plant name shall be shown.
 - (12) For registered land the boundary and land reference number shall be shown.
 - (13) Photo-number at the principal point of the aerial photograph shall be noted in three figures, for example, 001 .
 - (14) Bench marks shall be shown only when confirmed in the field.
- (b) Concerning the application of the annotation "Pan", discussions shall be made with counterparts in the field.
 - (c) Concerning generalization of built-up areas further discussions shall be necessary.
 - (d) SK requested sub-district, boundaries to be shown. The Team took note of the request.
 - (e) In connection with the item 6 (d), the Team proposed to modify symbols of features, like long reefs or cliffs, which cannot be shown by zipatone and not suitable to work out by scribing method. However, both parties did not reach to agreement. Further discussion shall be necessary.

9. Training

SK requested to have one person trained on photo-processing. The Team took note of the request.

A.S.

E.M.G.

K.K.

Attachment

PLAN OF OPERATIONS
FOR THE
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA
IN THE
REPUBLIC OF KENYA

--- 2nd Year ---

July, 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

PLAN OF OPERATIONS
FOR THE
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA
IN THE
REPUBLIC OF KENYA

I. INTRODUCTION

In response to the request of the Government of the Republic of Kenya (hereinafter referred to as "Kenya"), the Government of Japan (hereinafter referred to as "Japan") decided to conduct the Topographic Mapping of South Kenya in Kenya (hereinafter referred to as the "Study").

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of Japan, will undertake the Study, in close cooperation with the authorities concerned of Kenya. Survey of Kenya, Ministry of Lands and Settlement, (hereinafter referred to as "SK") shall act as counterpart agency to the Japanese study team (hereinafter referred to as the "Team") and also as coordinating body in relation to other governmental and non-governmental organizations concerned of Kenya for the smooth implementation of the Study.

Table 1 Volume of the Study

Item	Volume	Remark
Aerial photography	approx. 29,800km ²	scale 1/60,000 (whole project area)
Leveling	approx. 920km	minor order leveling (including pricking)
Geodetic control Point Survey	9 points	satellite geodecy
Aerial signal	40 points	
Pricking	approx. 500km	existing bench marks
Field verification	approx. 26,800km ²	
Aerial triangulation	approx. 725 models	
Plotting and Compilation	approx. 29,800km ²	
Field completion	approx. 29,800km ²	
Drafting	approx. 29,800km ²	
Printing	43 sheets	in 6 colours 1,000 copies each

IV. WORK PLAN

The entire work shall be carried out under a four-year programme starting from October, 1987, and accomplishing in March, 1991. It shall consist of the following four phases in accordance with the time schedule shown in Fig. 2.

1. Phase I (First Year, 1987): Aerial Signal, Aerial Photography,
Pricking and Leveling

1 - 1. Aerial Signal

To secure the proposed map accuracy, the accuracy of horizontal control point shall be not more than

$$0.07 \text{ mm} \times 1/\text{plotting scale} (= 0.07 \text{ mm} \times 50,000 = 3.5 \text{ m}).$$

For horizontal control of photographs for aerial triangulation, 40 points of existing 1st and 2nd order triangulation and traverse points shall be used. The distribution plan is shown in Fig. 3. Aerial signals shall be set up on these proposed photo-control points.

1 - 2. Aerial Photography

Black and white panchromatic aerial photography shall be carried out in dry season with a super-wide angle camera ($f = 8.8$ cm) in two missions.

1 - 2 - 1. Mission I.

For pricking of existing bench marks and along proposed leveling routes, aerial photography shall be carried out in a form of strip courses for approximately 1,500 line km along these leveling routes at a scale of 1/40,000. This mission is done for the efficiency of the time schedule.

1 - 2 - 2. Mission II.

For mapping, the proposed mapping area of approximately $29,800 \text{ km}^2$ shall be flown at a scale of 1/60,000 as shown in Fig.

4.

1 - 3. Pricking.

For vertical control of aerial photographs for aerial triangulation and mapping, existing bench marks shall be pricked (approximately 500 km). Pricking of proposed leveling routes (approximately 920 km) shall also be done for the same purpose at the time of leveling work. Twice enlargement of 1/40,000 aerial photograph shall be used in the field and later pricked points shall be transferred onto the 1/60,000 aerial photograph when necessary.

1 - 4. Leveling.

To secure the proposed map accuracy, the accuracy of vertical control points shall be not more than

$$0.07 \times \text{contour interval} (= 0.07 \times 20 \text{ m} = 1.4 \text{ m}).$$

For vertical control of photographs for aerial triangulation and mapping, existing 1st and 2nd order bench marks shall be used. The distribution of existing bench marks, however, is not sufficient for aerial triangulation and mapping. Consequently, minor order leveling shall be carried out to supplement existing bench marks. Minor order leveling of the accuracy of $5 \text{ cm} \times \sqrt{S}$ (Where S is the route length in km.) shall be carried out for approximately 920 km along main roads or national park boundaries where leveling work is found feasible, starting from and closing to existing bench marks. (Fig. 5)

Marking shall be done by utilizing conspicuous ground features or setting up marks every 2 km in average.

Pricking shall be done on aerial photographs for the vertical control for aerial triangulation and mapping on the above points and at knick points of topography along leveling routes at the time of leveling work.

Prior to the execution, reconnaissance shall be carried out for proposed leveling routes to allocate marks and for existing bench marks to find out if it is necessary to recover them in order to use them as given points for the minor order leveling.

2. Phase II (Second Year, 1988). Aerial Photography, Leveling,
Geodetic Control Point Survey,
Field Verification, Aerial Tri-
angulation, Stereo Plotting and
Compilation

In view of the results and progress of the Phase I's study, work plan for this Phase shall be modified from the original.

2 - 1. Aerial Photography

Of the aerial photography covering the project area of about 29,800 Km² at a scale of 1:60,000, about 3,000 Km² which were not successful in the first year's flight shall be flown (Fig. 4)

2 - 2. Leveling

It was found that among existing leveling routes, almost all bench works were destroyed or lost along the route along coast. Minor order leveling shall be executed along this route for about 200 Km² to establish photo control points (Fig. 5).

2 - 3. Geodetic Control Point Survey.

Of the existing geodetic control points, three dimensional measurement for 5 missing points and height measurement for 4 points shall be executed by satellite geodesy.

2 - 4. Field Verification

Prior to field survey for verification of aerial photographs, reconnaissance study (photo-interpretation) shall be carried out using aerial photographs and reference data collected beforehand.

In compliance with the map style and its application rule, selection of items to express on the map and topographic information related to classification of ground features shall be verified and objects which are hard or impossible to interpret on the aerial photograph shall be clarified in the field. The key for photo-interpretation needed for mapping shall be prepared. Geographical and administrative names shall be collected by SK.

2 - 5. Aerial Triangulation.

To obtain coordinates of pass points and tie points, aerial triangulation shall be carried out by analytical method using 1/60,000 aerial photographs, comparators and electronic computers. Approximately 725 models shall be adjusted by block adjustment method.

The residual of the ground control points after adjustment and discrepancy at tie and pass points between adjacent models shall be not more than

1.4 per mil of the flight height

$$= 5,400 \text{ m} \times 1.4 \text{ per mil} = 7.6 \text{ m}$$

for both planimetry and altitude.

2 - 6. Stereo Plotting and Compilation

Stereo plotting shall be carried out by 1/60,000 aerial photograph and stereo plotting machine at the scale of 1/50,000 using the results of aerial triangulation and those obtained by field verification. Intermediate contour shall be plotted at 20 m intervals. 10 m of supplementary half interval contour shall be plotted for flat area, if necessary. The photogrammetric spot height shall be plotted every 5 cm in principle, taking the topography and distribution of control points into consideration.

Results shall be compiled in the format of the sheet lines of 15' x 15'. Along the northern boundary of the Study area lie the area mapped by JICA in the eastern part and that by Canada in the western part. Along the southern boundary to Tanzanian territory, the Ordnance Survey, United Kingdom, is executing mapping. The connection of maps among these maps shall be taken into consideration. Necessary data for the connection, such as pricked diapositives, results of aerial triangulation, copies of original manuscript of maps, etc., shall be obtained through SK. The discrepancy of connection to existing maps shall be adjusted in principle. If it is found difficult to tie, however, the treatment shall be discussed with SK.

This work shall be continued to Phase III.

3. Phase III (Third Year, 1989): Stereo Plotting and Compilation
(continued) and Field Completion

3 - 1. Stereo Plotting and Compilation (continued)

A part of the stereo plotting and compilation works shall be continued to this phase.

3 - 2. Field Completion

Topography, ground features, vegetation, etc., which cannot be properly identified on the aerial photographs during plotting and compilation works, shall be verified in the field and inscribed on the copies of the compiled manuscript printed on the synthesized polyester sheets. Administrative and geographical names and administrative boundaries etc. shall be verified, confirmed and indicated on the paper copy of the compiled manuscript by SK.

4. Phase IV (Fourth Year, 1990). Drafting and Printing

4 - 1. Drafting

Based on the field completed compiled manuscript (original manuscript), negative scribing and preparation of masks and sheets for marginal information for printing plate making shall be carried out on stable polyester bases for 6 colour separation. Map style and symbols shall be discussed with SK. These sheets shall be composed so that one colour may be in one sheet for the sake of printing plate making (preparation of composite negative). A composite positive shall also be prepared consisting mainly of linear elements for the maintenance (revision) of maps.

4 - 2. Printing.

Making of printing plate shall be carried out using 1/50,000 composite negatives by photo-lithography.

Printing shall be carried out in 6 colours by the offset printing machine. Number of copies to be printed shall be 1,000 for each map. Specifications and size of printing paper shall be decided after discussion with SK.

5. Work Schedule.

Work schedule is shown in Fig. 2.

V. PLAN OF OPERATIONS FOR PHASE II (SECOND YEAR, 1988)

The study for Phase II comprises field survey and laboratory work: The field survey consists of aerial photography, leveling, geodetic control point survey and field verification. The period shall be from 25th July, 1988 to 27th October, 1988 (95 days).

The work volume is as follows:

Aerial photography	: scale 1:60,000, 14 coarses, 780Lkm.
Leveling	: about 200 bn along coast line
Geodetic control point survey	: 9 points by satellite geodesy 5 points ... new points 4 points ... height measurement
Field verification	: 26,800 Km ²
Plotting	: 1:50,000, 11,475 Km ² (15 sheets)
Compilation	: 1:50,000, 11,475 Km ² (15 sheets)

1. Preparations in the office

1 - 1. Planning of field survey

Chief engineer and engineers in charge of respective items of field survey shall prepare detailed plan for the efficiency of work.

1 - 2. Preparation of equipment and material

Followings shall be executed :

- a. Preparation of the survey equipment and material necessary for field survey.

- b. Pre-arrangement of necessary procedures for export and import of equipment and material out of Japan to Kenya.
- c. Request of obtain licence of using radio.

1 - 3. Reconnaissance by aerial photograph

Proir to proceeding into the field, reconnaissance study shall be carried out in Japan to prepare materials which need field verification.

- a. Thorough study of collected materials and pointing out of doubtful points,
- b. Execution of photo-interpretation and picking up of keys necessary to verify,
- c. Study of aerial photographs to point out points difficult to interpret and confirmation of the Study area,
- d. Preparation of double enlargement of 1/60,000 aerial photographs which shall be used for field verification.

2. Field Survey

Field survey shall be carried out during 25th July, 1988, and 27th October, 1988 (95 days). During the period, team leader, deputy leader, mapping planner, 2 chief engineers, mechanic and 12 members consisting of 5 parties, - totaling to 18 member shall be dispatched for about 3 months and one member for the inspection of aerial photographs for about 1 month to the field.

2 - 1. Preparation

Before arrival of the main team to Kenya, team leader, deputy leader and other 6 staffs shall arrive in Nairobi to prepare for their reception. The main duties are as follows. Of those, the items especially indebted to the cooperation of SK are:

- a. To discuss plan and execution of operations with SK, Concerning field verification, stereo-plotting and compilation, items to discuss with SK and to be confirmed are as follows:
 - i. Map style and its application rule,
 - ii. Administrative names and boundaries,
 - iii. Data concerning names of following items:
 - public building, church, mosque, road, railway,
 - mountain, river, park, etc.,
 - iv. Representation of military facilities,
 - v. Name and/or number of each map sheet,
 - vi. Marginal information and legend.
- b. To secure permission for the flight for the aerial photography and use of airports (Malindi and/or Tsavo),
- c. To secure licence for the use of communication facilities. The team is equipped with 7 JRC 10 W Portable HF SCB Radiotelephones JSB-20 with frequencies of 4055 and 6098 KHz.
- d. To provide rangers, watchmen, laborers and drivers,
- e. To arrange to study and/or copy materials related to the Study, such as existing aerial photographs, survey results and descriptions of points and place names kept by SK, for reviewing survey plan,

- f. To announce to authorities concerned,
- g. To ask SK to prepare tie-strips for tying adjoining existing maps,
- h. To ask SK to assign counterpart personnel,
- i. To ask SK to obtain credentials or identification cards to the Team members,
- j. To ask SK to issue permit to enter into private properties and national parks to execute survey work when necessary.

Besides the aboves, followings shall be dealt with chiefly by the Team:

- k. To prepare to establish headquarters and sub-camps in the field.
- l. To receive shipped equipments, machinery and other materials,
- m. To purchase equipments, machinery and other materials in Nairobi,
- n. To hire vehicles,
- o. To contract with local private aerial survey firm for aerial photography.

2 - 2. Aerial Photography

Aerial photography shall be carried out by contracting with a local private aerial survey firm. The air base for the work shall be in Malindi and/or Tsavo and final products shall be prepared in Nairobi. For the contract, supervision of the work

ψ and ω : not more than 5 degrees

k. Cloud coverage: Amount of cloud shall not exceed 3 % in successive 5 photographs. However, important areas for orientation and cartography shall not be covered with clouds.

l. Number of models: approximately 128

m. Number of photographs: approximately 142

n. Film: black and white panchromatic

o. Printing paper: Kodak RC paper or equivalent

p. Results:

original negative	1 set
contact print	2 sets
index map	2 sets
flight record	1 set

Exposed original negatives being taken out to Japan, extra copy of contact prints shall be prepared and left in Kenya for security.

2 - 3. Leveling

2 - 3 - 1. Planning and point selection

In Phase I, although all existing bench marks were investigated to prick them on the aerial photographs, it was not able to find points except along the routes shown in thick lines in Fig. 5.

Minor order leveling shall be executed along the routes along coast for about 200 Km to establish height control of photographs.

2 - 3 - 2. Observation

Observation shall be made by double observation starting from an existing bench mark and closing to another existing one. Otherwise, routes shall close to themselves. Prior to observation, check observation shall be made for at least two neighboring existing bench marks, on one of which the minor order leveling is based. When the result of check observation is coincident with the nominal value within the accuracy of the check observation, the nominal value of the bench mark shall be adopted as given value. Otherwise check observation shall be extended to reach within the tolerable closure and newly observed value shall be taken as given.

Observed marks shall be pricked on the double enlargement of 1/40,000 aerial photographs at the time of observation and later they shall be transferred on to the 1/60,000 aerial photographs as in the case of pricking of existing bench marks.

Kilindini Harbor, Mombasa, and Kirifi Creek shall be crossed over by trigonometric crossrivers leveling method.

Accuracy of observation:	$50 \text{ mm} \times \sqrt{S}$, where S is the route length in km.
Instrument to be used:	Autolevel
Staff:	wooden folding staff
Staff stand:	
Theodolite:	Wild T2
Distance meter :	electro-optical distance meter

2 - 4. Geodetic Control Point Survey

2 - 4 - 1. Outline

Of 40 signalized geodetic control points, geodetic control survey shall be executed for 5 missing points and 4 points whose height is unknown.

2 - 4 - 2. Method of observation

The survey is executed by satellite geodisy, applying Global Positioning System (GPS). Three Trimble 4000SX instruments shall be used. Measurement is executed geometrically. For high accuracy, simultaneous observation shall be made at two points (interference). Measured value is the coordinate difference of the two points on the reference ellipsoid. Consequently, by executing observation at three points, from the closure of a triangle, it is possible to check the accuracy of the observation. Choosing one known point, the co-ordinates of other points can be obtained. Measured height, however, being that on the basis of the reference ellipsoid, in order to make it for leveling data, it is necessary to convert it to the height on the basis of geoid. The height of a point from geoid is calculated by putting unknown point between two known points (leveled points) and adjusting the observed results by interpolation.

2 - 4 - 3. Observation

Observation is made by classifying the points into following two groups and shall start from a given point and close to another given point.

a. Planimetry and height

Planimetry and height shall be obtained for the following 5 points:

190S2, 193S2, 196ST4, 199ST1 and 199ST2.

b. Height

Height shall be obtained for the following 4 points:

188PT, SKP49, 195PT2 and 202S3.

2 - 4 - 4. Accuracy required

Accuracy for photo control points is required as follows:

Planimetry : 0.07 mm/map scale (=3.5m)

Height : 0.07 x contour interval (=1.4m).

2 - 4 - 5. Monumentation

Monumentation shall be executed, when necessary. Style of the monument shall be decided after consulting SK.

2 - 4 - 6. Computation and adjustment

From the observed data, following computation shall be executed:

- a. Coordinate difference or relative height between two points
- b. Coordinates or Height of a point
- c. Geoditic coordinates (Transformation of the computed values obtained in WGS-84 system to the values in New Arc 1960 system)

2 - 5. Field Verification.

Using aerial photographs, the keys for photo-interpretation needed for plotting and cartography shall be prepared by verifying them in the field.

Based on the application rule of the map style, necessary items to represent on the map shall also be collected and verified in the field. Close cooperation of the SK counterparts is cordially requested.

The area for field verification of aerial photographs will be confined to that where aerial photographs were taken in Phase I, ground feature or topography in the remaining area are thought not complex. The field verification for the latter area will be executed by using compiled manuscript at the occasion of field completion in Phase III.

2 - 5 - 1. Items of field verification.

In compliance with the map style and its application rule, followings shall be investigated and confirmed in the field:

- a. Result of reconnaissance study,
- b. Key for photo-interpretation,
- c. Items difficult to interpret on the photograph,
- d. Following items to represent on the map:
 - road, railway, building, control point, specified area, river, vegetation, topography, etc.,
- e. Names necessary for annotation.

2 - 5 - 2. Adjustment.

Results of field verification shall be adjusted on the double enlargement of 1/60,000 aerial photographs.

2 - 5 - 3. Tying

It is necessary to investigate carefully tying among aerial photographs and between mapping area and existing maps. On account of changes in ground features, if it is impossible to tie, the treatment shall be discussed with SK.

3. Laboratory Work.

3 - 1. Aerial triangulation.

Aerial triangulation is carried out as follows:

- a. Using pricked diapositives of 1/60,000 aerial photograph on which aerial signals are photographed, coordinates of pass points, control points, etc necessary for plotting are measured by stereo-comparator.
- b. Adding the results of ground control point survey, adjustment computation is executed.
- c. Coordinates of pass points and orientation elements of aerial photographs are calculated.

3 - 1 - 1. Method.

Aerial triangulation is done analytically by the block adjustment method by means of independent models. PAT-M43 program shall be used.

3 - 1 - 2. Area covered.

The area for aerial triangulation covers the whole area of 1/50,000 topographic mapping.

3 - 1 - 3. Distribution and number of control points.

Distribution of horizontal control points is shown in Fig. 3. Their number shall be 40. Vertical control points shall be selected among pricked bench marks and spot heights. (Fig. 4)

3 - 1 - 4. Selection of pass points.

Pass points shall be selected so that their position shall be appropriate for orientation of aerial photographs and that it shall be correctly measurable on the photograph.

3 - 1 - 5. Adjustment computation.

- a. The residuals of ground control points and discrepancies of pass points and tie points between adjacent models after adjustment shall be less than 1.4 per mil of the flight height for both planimetry and altitude.
- b. When adjustment computation is made by dividing into blocks, the discrepancy of tie points between adjacent blocks shall be less than 1.5 per mil of the flight height for both planimetry and altitude.

3 - 2. Stereo Plotting (Restitution).

Using the results of aerial triangulation and field verification, necessary items for representing on the map shall be measured and plotted by stereo plotting machine and plotted manuscript of the topographic map shall be prepared.

Map index is shown in Fig. 1, where plotting area in Phase II is surrounded by shaded lines. The work for remaining part will be continued to Phase III.

3 - 2 - 1. Material.

For restitution, stable polyester sheet shall be used.

3 - 2 - 2. Neat lines.

Neat lines shall be 15' x 15'.

3 - 2 - 3. Plotting.

Neat lines, control points and grid lines are plotted using automatic coordinategraph. The maximum discrepancy shall not exceed 0.2 mm on the map.

3 - 2 - 4. Orientation.

- a. After absolute orientation of the photographs, the discrepancy between the plotted points and their model points shall be not more than 0.3 mm on the map.
- b. For orientation of height, pricked leveling points shall be used as many as possible for the sake of accuracy of height.

3 - 2 - 5. Restitution.

- a. Restitution shall be executed in accordance with the map style and its application rule in the order of linear elements, like roads, rivers, railways, etc., buildings, vegetation and contour lines.
- b. If necessary, planimetry and contour lines can be restituted on separate sheets.

c. Intermediate contour shall be 20 m and half interval contour lines of 10 m shall be supplemented according to topography. Care must be taken for the representation of micro topography, the project area being rich in various types of ground features and topography like hill, plain, forest, wadi, cultivated land, etc.

3 - 2 - 6. Measurement of spot height.

- a. Spot height shall be measured photogrammetrically at distinct knick points of topography.
- b. Spot height shall be distributed taking the topography into consideration.

3 - 2 - 7. Tying

Map tying shall be made between

- a. existing 1/50,000 topographic map along the northern edge of the project area,
- b. 1/50,000 topographic map being worked by the Ordnance Survey along the western and southern borders to Tanzania.

Connection shall be made in principle. However, if is found difficult to tie, the treatment shall be discussed with SK.

4 - 3. Compilation.

- a. On the basis of the plotted manuscript, compilation shall be carried out using the results of field verification and materials collected. The sheets in the area

surround by shaded lines in Fig. 1 shall be compiled in Phase II. The remaining sheets will be worked out in Phase III.

- b. If any doubtful point arises during compilation, it shall be noted to clarify at the time of field completion.
- c. Annotation items shall be compiled on a separate sheet using plotted manuscript and data obtained by field verification.

VI. REPORT

The progress report of Phase II shall be prepared.

VII ORGANIZATION OF THE TEAM

Organization of the Team is as follows:

Duty	Member	Number for a party	Number of parties	Total
Leader	Japanese engineer			1
Deputy-leader	"			1
Mapping planner	"			1
Chief-engineer	"			1
Mechanic	"			1
Geodetic control point survey	"	4	1	4
	counterpart			1
	laborer	18	1	18
Inspection of Aerial photography	Japanese engineer			1
Leveling	"	2	1	2
	laborer	6	1	6
Field verification	Chief-engineer (Japanese engineer)			1
	Japanese engineer	2	3	6
	counterpart	1	3	3
	laborer	4	3	12

VIII WORK SCHEDULE

VIII WORK SCHEDULE

The work for Phase II (2nd year) starts on 25th July, 1988, and shall continue to March, 1989. Detailed work schedule is shown in Fig. 6.

IX. FINAL PRODUCTS AND MATERIALS

Final products and materials of Phase II, (2nd year) are as follows:

1. Geodetic control survey
 - a. Note of eccentric calculation 1 set
 - b. Observed data 1 set
 - c. Computation notes 1 set
 - d. Final results 1 set
 - e. Others 1 set

2. Aerial Photography
 - a. Negative film 1 set
 - b. Contact print 2 sets
 - c. Photo index 2 sets
 - d. Others 1 set

3. Leveling

- a. Observation note 1 set
- b. Final result 1 set
- c. Route map 1 set
- d. Pricked Photograph 1 set
- e. Point description 1 set
- f. Others 1 set

4. Field verification

- g. Photograph with verified data 1 set
- h. Others 1 set

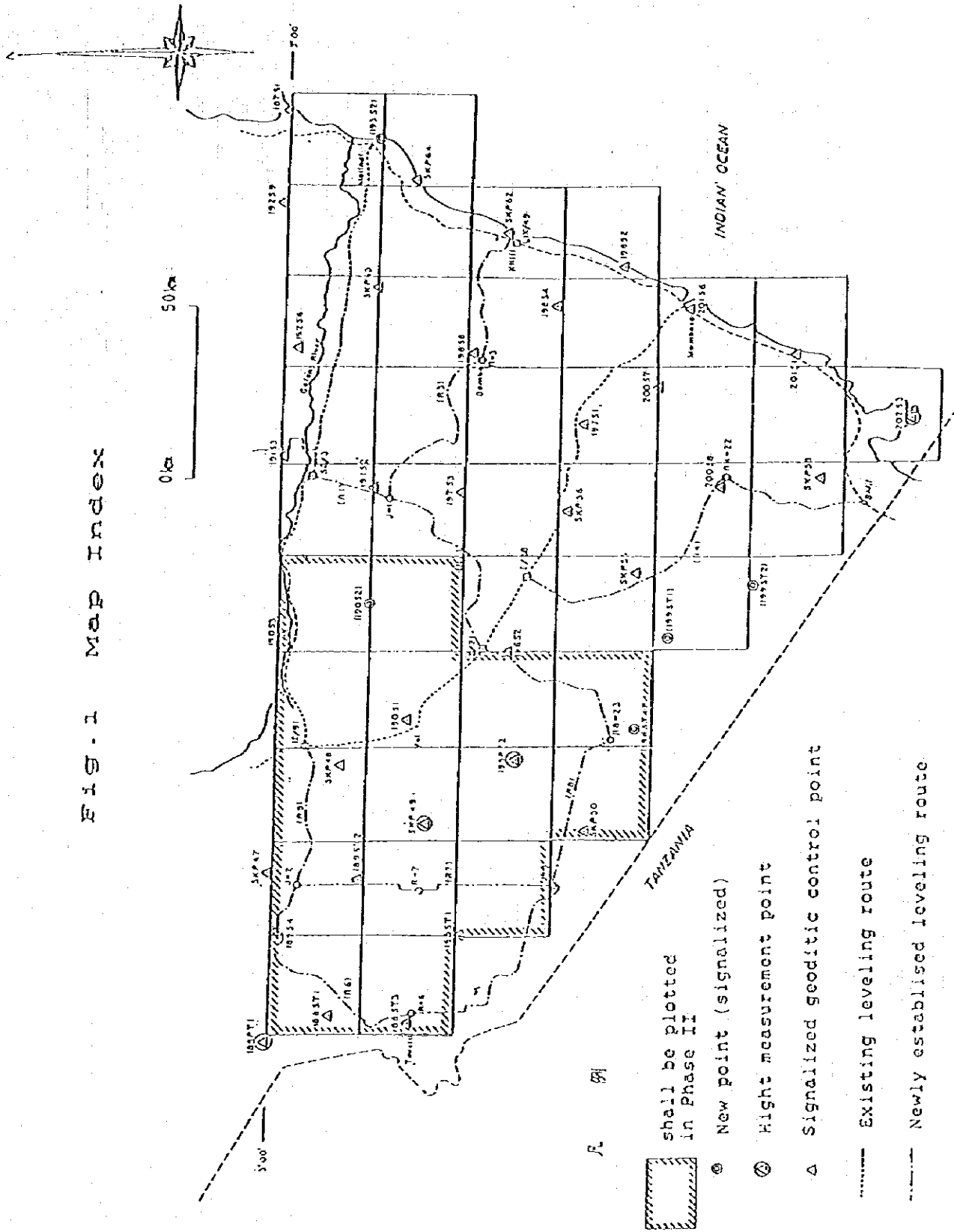
5. Aerial triangulation

- a. Final result 1 set
- b. Index map 1 set
- c. Pricked dispositive 1 set
- d. Pricked contact print 1 set
- e. Computation sheet 1 set
- f. Table for accuracy check 1 set
- g. Others 1 set

6. Stereo plotting and compilation

- | | |
|---|-------|
| a. Plotted original | 1 set |
| b. Map showing control point distribution | 1 set |
| c. Record of orientation | 1 set |
| d. Compiled original | 1 set |
| e. Annotation data | 1 set |
| f. Vegetation data | 1 set |
| g. Road data | 1 set |
| h. Marginal information data | 1 set |
| j. Others | 1 set |

FIG. 1 Map Index



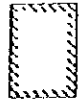





-  shall be plotted in Phase II
-  New point (signalized)
-  Height measurement point
-  Signalized geodetic control point
-  Existing leveling route
-  Newly established leveling route

Fig. 2 WORK SCHEDULE

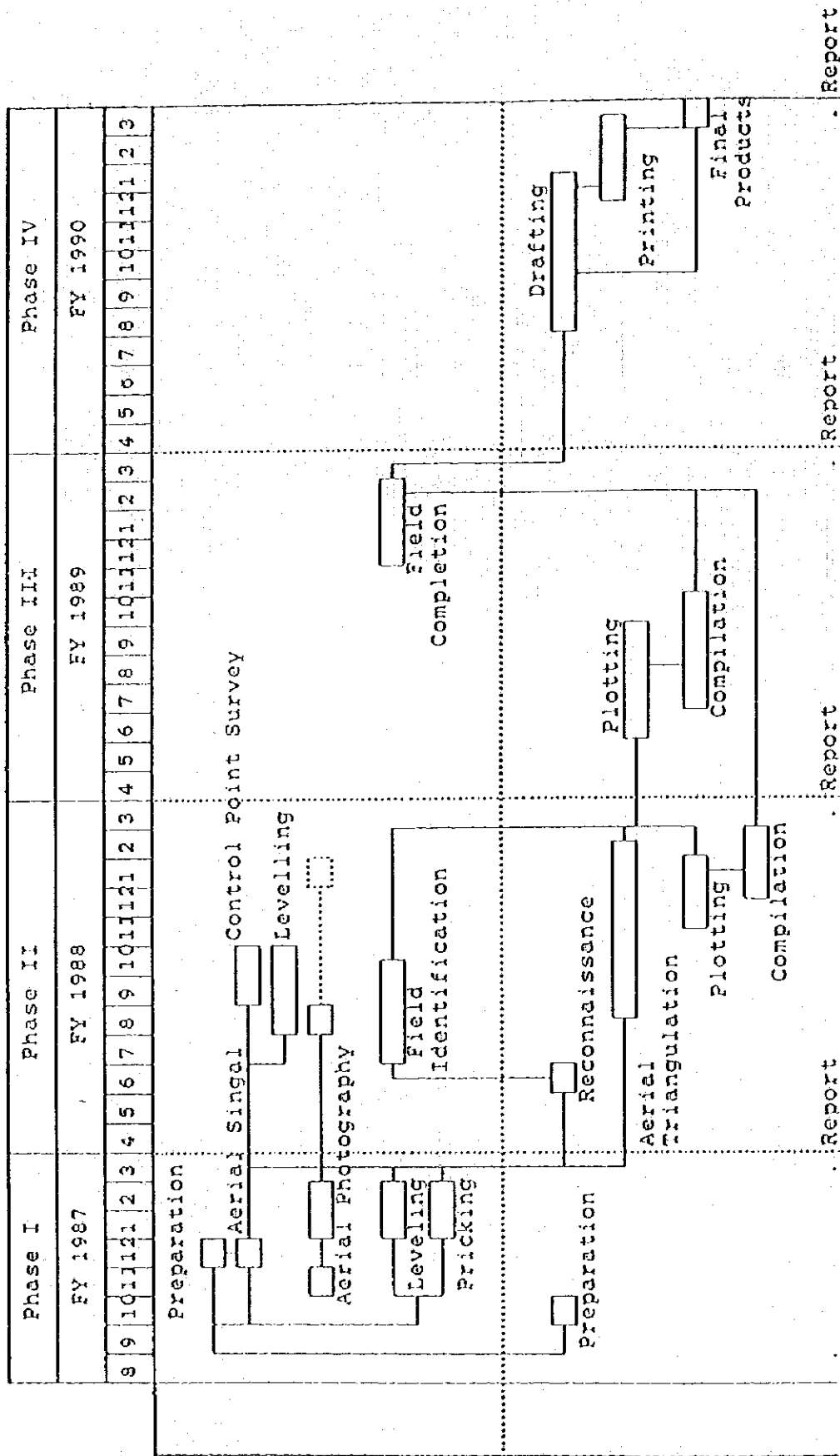
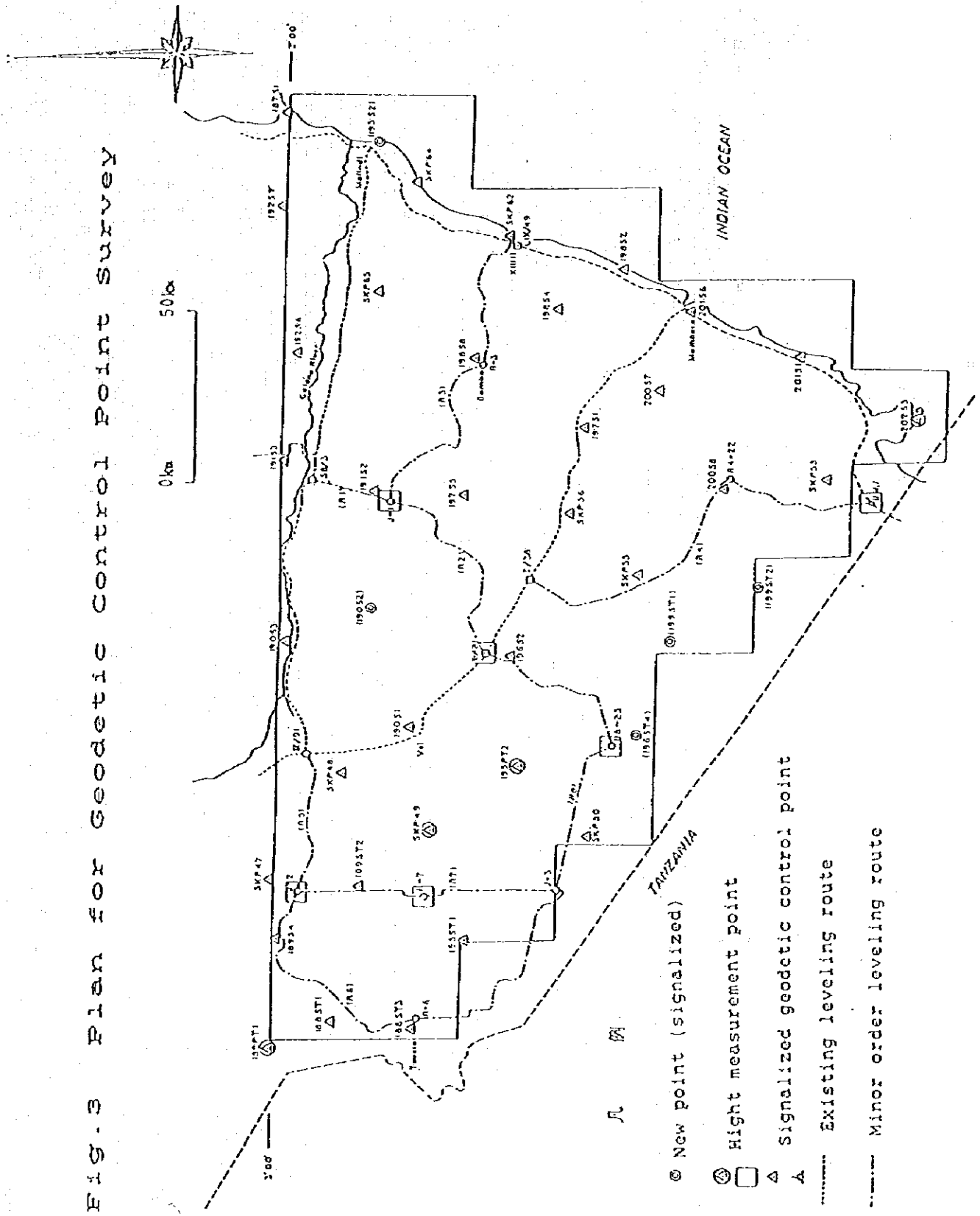


FIG. 3 Plan for Geodetic Control Point Survey



⊗ New point (signaled)

⊙ High measurement point

△ Signaled geodetic control point

----- Existing leveling route

..... Minor order leveling route

FIG. 4 Plan for Aerial Photography

Photo scale : 1:60,000 0km 50km

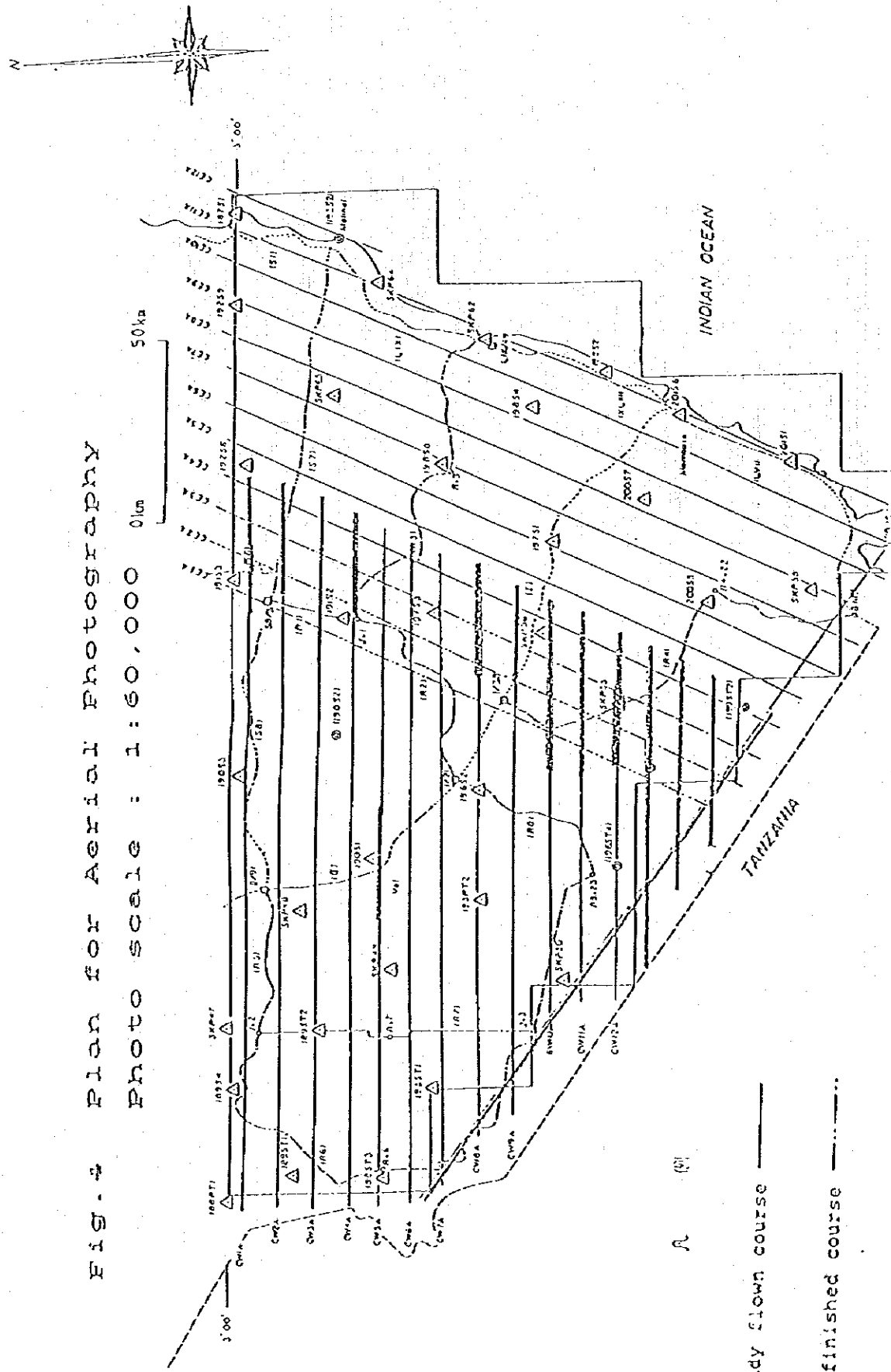


FIG. 5 Plan for Leveling

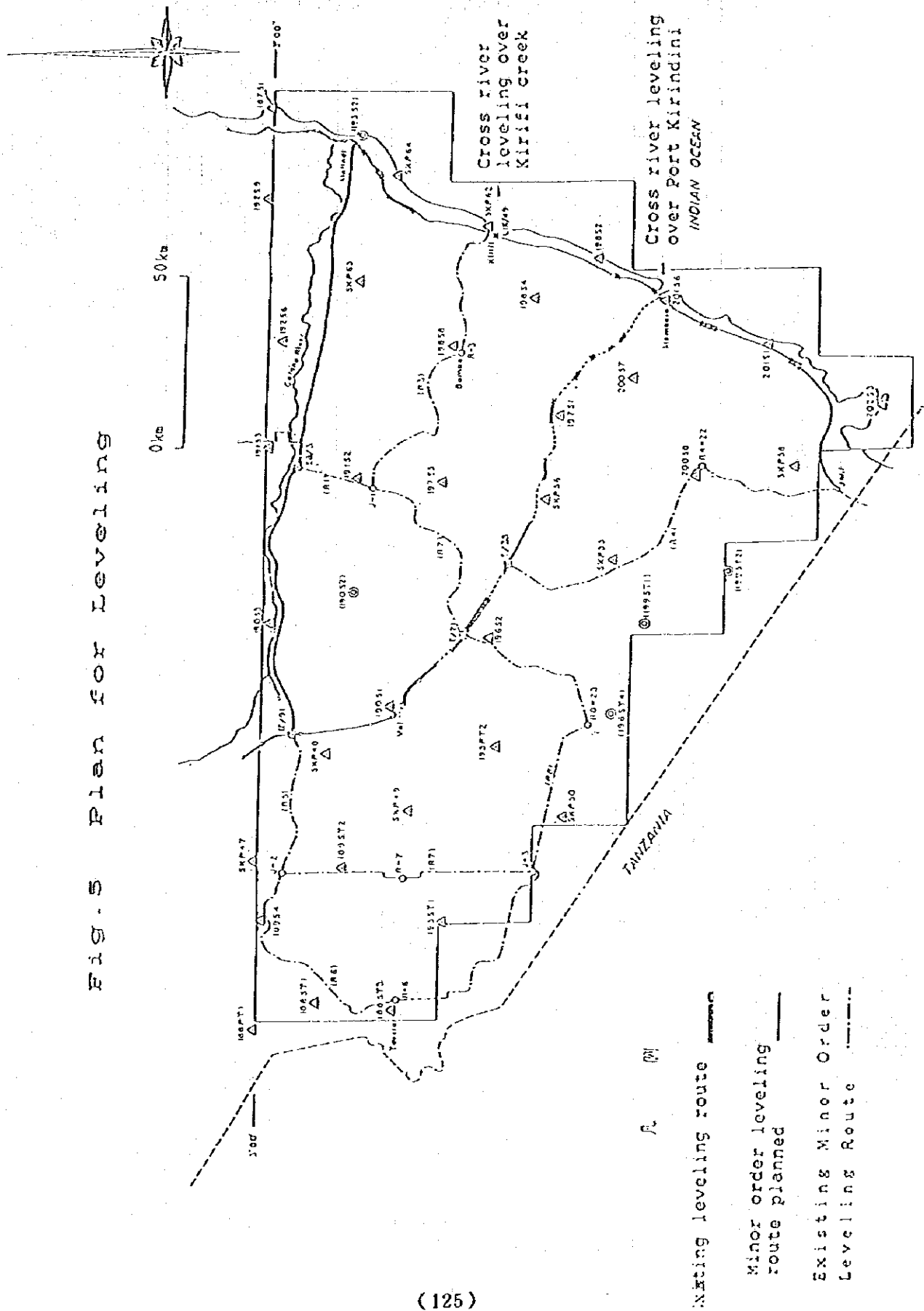


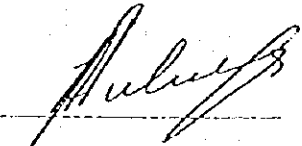
FIG. 6 WORK SCHEDULE FOR PHASE II

Item	Date	7	8	9	10	11	12	1	2	3
Field work	Mob. demob.		7/11 - 7/10		7/10 - 7/17					
	Aerial Photography		7/10 - 7/10					7/10 - 7/14		
	Control Point Survey		7/12		7/14					
	Leveling		7/13			7/17				
	Field Verification		7/15			7/15				
Lab. work	Aerial Triangulation									
	Plotting									
	Compilation									

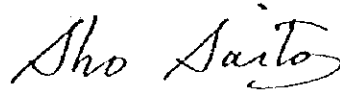
2-4 現地作業終了時の協議議事録(1998年10月21日)

MINUTES OF MEETINGS
AT THE END OF
THE SECOND YEAR'S FIELD WORK
OF
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA

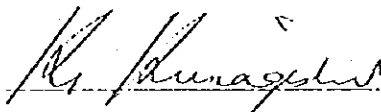
NAIROBI 21ST OCTOBER, 1998



MR. E. M. GIKINYA
FOR: DIRECTOR OF SURVEYS



MR. SHO SAITO
LEADER
JICA STUDY TEAM



MR. K. KUMAGISHI
RESIDENT REPRESENTATIVE
JICA KENYA OFFICE

MINUTES OF MEETINGS AT THE END OF THE SECOND YEAR'S FIELD
WORK OF TOPOGRAPHIC MAPPING OF SOUTH KENYA

Dates: The meetings were held on Wednesday 12th October,
Thursday 13th October, Monday 17th October and
Tuesday 19th October, 1968.

Present:

Survey of Kenya:

A. K. Huki	Deputy Director of Surveys
B. M. Gikinya	Asst. Assistant Director of Surveys, Mapping
O. M. Mainaina	Superintending Surveyor, Mapping
P. Ndenda	Chief Cartographer
J. Kibere	Chief Photogrammetrist
S. Chabeda	Chief Lithographer
P. D. Amiani	O/C Technical Section
C. Kimele	O/C 1:50,000 Topo Drawing Office
F. Ito	JICA Expert Attached to Survey of Kenya

JICA Study Team

S. Saito	Leader
K. Murakami	Deputy Leader
M. Yoshida	Mapping Planner
Y. Kyokuno	Chief Surveyor
T. Hidaka	Chief Surveyor
M. Nakai	Surveyor

1. Review of the Minutes of Former Meetings

The Minutes of Meetings on the Start of the Second Year Work signed on 9th August were reviewed. The items to be noted are:

- (a) Concerning item 5-(a), a set of tie strips were provided by Survey of Kenya (hereinafter referred to as SK).
- (b) Concerning item 5-(b), pricked diapositives, contact prints and aerial triangulation results for the old JICA maps necessary for tying were lent to the JICA Study Team (hereinafter referred to as the "Team") and photo index was provided by SK. The contact prints of the Canadian project area were also lent to the Team.
- (c) Concerning item 5-(c), description of bench marks was provided.
- (d) Concerning item 5-(d), copies of field revision data were provided.

L.M.G.

S.A.

- (f) Concerning items 6-(a) and 6-(b), data for water pipelines and powerlines were provided. However, data for telephone lines and information on road classification were not available to the team. They requested to SK to check the result and supplement the compiled manuscript, if necessary.
- (g) Concerning item 6-(c), SK will mark the boundaries on a sheet to be provided by the Team.
- (h) Concerning 6-(d), SK prepared positive films of symbols and elevations, including coral and cliffs symbols.
- (i) Concerning item 6-(e), for the height of existing bench marks, nominal values given on the description of point were used and when they were not available, those on the final resultant table were used by the team. SK agreed to the treatment.
- (j) In connection with item 3-(a)-(B), aviation facilities shall be classified as follows:
 - Airfield - runway with permanent building,
 - Airstrip - runway
 - Airport - Mombasa and Malindi.
- (k) Concerning item 8-(b), discussions did not reach to conclusion. Reference shall be to the old maps.
- (l) Concerning item 8-(c), generalization shall be classified into two categories: permanent buildings and others.
- (m) Concerning item 8-(d), SK requested to prepare maps showing sub-district boundaries as overprint using the seventh colour for the half part of the number of copies to be printed. SK will prepare necessary data. The Team took note of the request.

E.M.G.
S.S.

2. Materials provided by SK

Besides the materials described in para. 1, following were also provided by SK:

- (a) Copy of a booklet showing map symbols, application rule of lines and annotation, etc.
- (b) Transparency of marginal information plate for black.
- (c) Sample sheet of legend.
- (d) Magnetic information.

E.M.G.

S.S.

3. Reporting

The Team reported briefly the progress of the second year's field work for the Study, presenting the "Progress Report of the Second Year's Field Work for the Topographic Mapping of South Kenya in the Republic of Kenya" prepared by the Team. (Attachment) SK appreciated the report.

4. Compiled manuscript

SK requested that the form of compiled manuscript to be provided by the Team shall be:

- (a) Contour sheet.
- (b) Composite of planimetry with annotation sheet.

they shall be printed on stable material in mirror image.

The Team proposed to add following sheets:

- (c) Overprint of vegetation boundary in colour on (b).
- (d) Overprint of double line roads in colour on (b).
- (e) Overprint of water systems in colour on (b).

5. Future work

The Team explained the tentatively planned future works as follows:

- (a) Second year (November 1988 - March 1989)

In accordance with the "Plan of operation for the Topographic Mapping of South Kenya in the Republic of Kenya -2nd Year-", the Team explained remaining works for this year, adding that in January - February, 1989, aerial photography is planned again for the remaining area.

- (b) Third year (April 1989 - March 1990)

In accordance with the tentative plan of operations described in the "Plan of Operations for the Topographic Mapping of South Kenya in the Republic of Kenya -1st Year-", the Team explained the schedule, in which in view of the modification in the second year's work schedule, more works will be needed to field completion than originally planned. Consequently, more number of counterparts will be required for field work. SK took note of the request.

E.M.G.
S.S.

6. Repair of aerial signals

The Team requested to repair some of the aerial signals in the area to be flown in January-February, 1989. The description of aerial signals shall be provided by the Team. SK took note of the request.

E.M.G.

S.S.

Attachment

PROGRESS REPORT
OF
THE SECOND YEAR'S FIELD WORK
FOR
THE TOPOGRAPHIC MAPPING OF SOUTH KENYA
IN
THE REPUBLIC OF KENYA
--- October, 1968 ---

STUDY TEAM
OF
THE TOPOGRAPHIC MAPPING OF SOUTH KENYA
IN
THE REPUBLIC OF KENYA
JAPAN INTERNATIONAL COOPERATION AGENCY

d. Field verification

Items needed for map representation on the aerial photographs and other materials shall be verified in the field.

2. Office work

Following works shall be carried out in Japan.

a. Aerial triangulation

Using field surveyed data, aerial triangulation shall be executed in preparation for plotting.

b. Plotting and compilation

Using the result of aerial triangulation and field verified materials, stereo-plotting and then compilation shall be executed to prepare the manuscript of the 1/50,000 topographic map. The work shall be continued to the third year.

IV. AERIAL PHOTOGRAPHY

Due to unfavorable weather conditions, no aerial photograph was taken during this period (July-Oct., 1988). Another flight is planned in Jan.-Feb., 1989.

Repairs of aerial signals were done for 9 points in the planned area and identification of aerial signals for 4 points on the aerial photographs taken in the last period.

V. GEODETIC CONTROL SURVEY

Geodetic control survey was executed by satellite geodesy, applying GPS. Three Trimble 4500SX instruments were used by making simultaneous observation at three points.

1. Observation

Observation was made at every three points simultaneously. Due to the limitation of the passing hours of satellites it was made from 09:00 to 11:00 local time (2 hours). 3 - 5 satellites were observed. (Nos 3, 6, 9, 12 and 13).

Observation was not successful on SKP 49. In its neighbourhood, there is a transmitting station with a power plant. Observation was made on a hill about 1 km apart from the point and the eccentricity measurement was made.

2. Unknown points

The planned points to obtain the planimetry and/or height are as follows:

158PT1, SKP49, 190S2, 193S2, 195PT2,
196ST4, 199ST1, 199ST2 and 202S3.

- a. 190S2, 196ST4, 199ST1 and 199ST2 were not found. Monumentation was done at places different from their supposed position. To distinguish newly established monuments from the original ones, numbering was applied by adding suffix N to the original number:

190S2N, 196ST4N, 199ST1N and 199ST2N.

- b. The monuments of 188PT1 and 193S2 were missing and monuments were buried at the same hole as the originals. The monument of 203S2 was also missing. New monument was buried at the intersection of diagonals of a quadrangle formed of four reference marks.
- c. Geodetic control point R2 was newly established close to BM R2-16, in reference to which the height was measured by direct leveling.

3. Given points

Following points were adopted as given points for computation.

- a. For planimetry

188PT1, 191S2, 192S6, SKP49, 195PT2,
197S1, 198S8, SKP52, 200S8, 202S3.

- b. For height

J-2, J-3, R-6, 196ST4, R-2, R9-47A, SKP62,
193S2.

For the above points, measurement was done on the spot. Their planimetry can be computed at the same time.

Close to the bench marks I/21 and BM-1, temporary marks were set up exclusively for height control. Their height was measured by direct leveling. They are designated as I/21T and BM-1T to distinguish them from I/21 and BM-1.

4. Observation scheme

Combining unknown points with the known points, observation was made following the scheme shown in the following table and Fig. 1.

Group	Points
1.	188PT1 J-2 R-6
2	SKP49 J-3 R-6
3	195PT2 196ST4N J-3
4	199S2N I/21T J-2

5	191S2	R-2	190S2N
6	I/2IT	199ST1N	196ST1N
7	200S8	199ST2N	199ST1N
8	200S8	202S3	BM-1T
9	202S3	SKP62	197S1
10	197S1	I/2IT	R-2
11	192S6	190S8	R-2
12	SKP62	192S6	193S2N
13	197S1	R9-47A	BM-1T

4. Results

The coordinate closures of each triangle were computed by approximate computation in the field to check the reliability of the observation. The result is tentatively as follows, where groups 9 and 11 are excluded.

	Range	Mean
Side length	21 km - 96 km	50 km
Closure(absolute value)		
dX	1.0 cm - 25.8 cm	9.5 cm
dY	3.0 cm - 56.3 cm	31.1 cm
dH	0.0 cm - 29.9 cm	14.2 cm
Mean error of side length	0.0 cm - 7.2 cm	1.1 cm

where dX, dY and dH stand for coordinate closures in X, Y and H directions on WGS-84 ellipsoid to which GPS is referred.

VI. FIELD VERIFICATION

By using twice enlargement of 1/60,000 aerial photographs, field verification was carried out.

Main items worked out are:

1. Classification of roads and identification of their attributes.
2. Identification of public buildings.
3. Collection of key for photo-interpretation of vegetation.
4. Verification of telephone lines, power lines, water pipe lines.
5. Verification of other ground features.

LEVELLING

Minor order leveling (tolerance 50 mm /S, where S is the route length) was carried out (for about 240 km from Junga-Lunga to Malindi along coastal main road (A14 and B5), dividing it into two routes:

Route number	Bench marks	Length
R 9	BM-1, R9-1,.....R9-25, LVI/30	50.9 km
	LVI/30, R9-25,.....R9-41, LVI/10	32.8 km
	LVI/8, R9-42,.....R9-48, FBM	14.0 km
R10	FBM, R10-1,.....R10-10, LIX/77	21.0 km
	LIX/77, R10-11,.....R10-34, LIX/49	42.6 km
	LIX/49, R10-35,.....R10-56, S7-6	66.9 km
Total		227.2 km

The routes are shown in Fig. 2.

Besides, check measurement among existing bench marks totaling 5.1 km (1.-a.) and measurement to give height for geodetic control points totaling 12.8 km (3.-a.) were executed.

The total length of leveling is 245.1 km.

The observation was made by double observations with automatic level Nikon AS, metal staves and staff stands.

1. Reference bench marks

There are some first order bench marks scattered along the routes (Fig. 2). Leveling was carried out passing through all these bench marks. When the closure among them was within the tolerance, the nominal values were accepted as given and they were regarded as starting and ending points:

- a. Check measurement of the spans among LVI/8, LVI/9 and LVI/10 and between S7-5 and S7-6 were consistent one another. (Total length is 5.1 km) - LVI/8, LVI/10 and S7-5 were adopted as given points.
- b. LIX/49, LIX/77, FBM and LVI/30 are isolated, but viewing from the result of leveling, their nominal values were taken as given. (Table in paragraph 3.)
- c. Between R10-51 and R10-56 there are 10 existing bench marks. The check measurement among them, however, did not come within the tolerance. Consequently, they were regarded as unknown points and gave them new value.

2. Results

Closures between given points are,

Route number	Bench marks	Closure	Tolerance	S
R4+R9	1/38 - LVI/30	80 mm	683 mm	186.7 km
R9	LVI/30 - LVI/10	27 mm	286 mm	32.8 km
	LVI/8 - FBM	15 mm	137 mm	14.0 km
R10	FBM - LIX/49	7 mm	399 mm	53.5 km
	(FBM - LIX/77	68 mm	229 mm	21.0 km)
	(LIX/77 - LIX/49	51 mm	326 mm	42.6 km)
	LIX/49 - S7-6	27 mm	405 mm	55.9 km

Route R4 between 1/38 and BM-1) was measured during Dec., 1987. - Feb., 1988.

3. Height control of geodetic control points

Some geodetic control points and bench marks were used for height control in geodetic control survey.

- a. The height of 193S2, SKP62 and 196ST4N was measured by direct leveling starting from R10-55, LIX/49 and R8-23, respectively. Closure of double measurements is as follows:

Route	Closure	Tolerance	S
R10-55 - 193S2	3 mm	115 mm	5.3 km
LIX/49 - SKP62	3 mm	52 mm	1.1 km
R8-23 - 196ST4N	11 mm	126 mm	6.4 km

Total 12.8 km

- b. 1/21T, R-2 and BM-1T were used for height control in geodetic control survey. Their height was measured by direct leveling in reference to the nearest bench marks 1/21, R2-16 and BM-1, respectively.

4. Cross-sea leveling

To cross over the Kilindini Harbour and Kilifi Creek, cross-sea leveling was executed at Likoni and Kilifi, respectively

Trigonometric leveling was applied by using two theodolites Wild T2 and an electro distance meter Wild D1-4. Cross-sea distances are 540 m and 470 m for Likoni and Kilifi, respectively. Observation triangle is shown schematically in Fig. 3, where

	LIKONI	KILIFI
D	540 m	470 m
A	R9-48	R10-34
B	R9-47A	R10-33A
C	R9-47B	R10-33B
Vertical closure	2 mm	4 mm

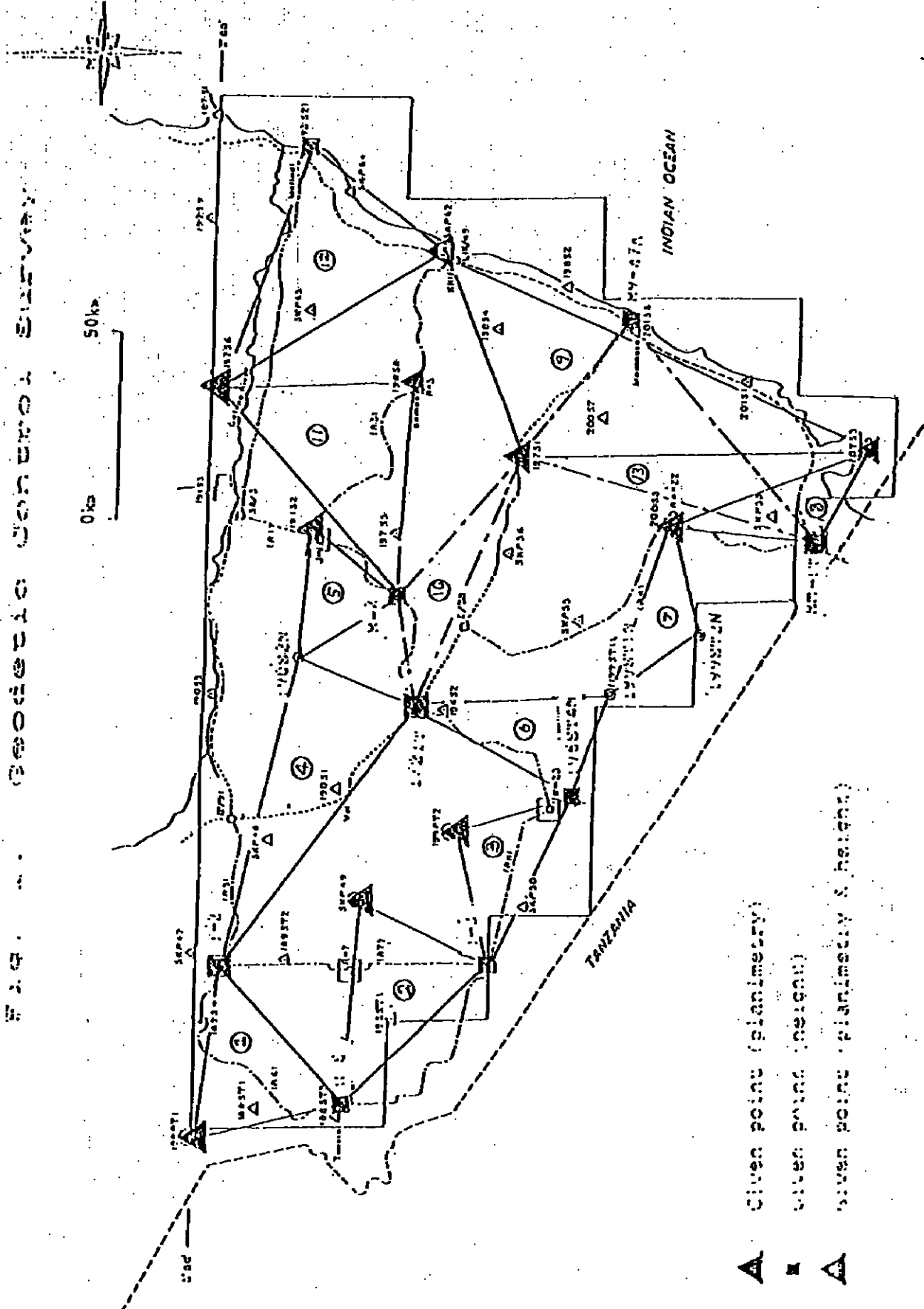
The distance between A and B is approximately 10 m for both cases. Their relative height was measured by direct leveling. The observation was checked by comparing two measurements AB and AC. The closure in the above table stand for the discrepancy between these two measurements.

5. Monumentation

Approximately every 2 km, marks were set up. The types are classified as follows:

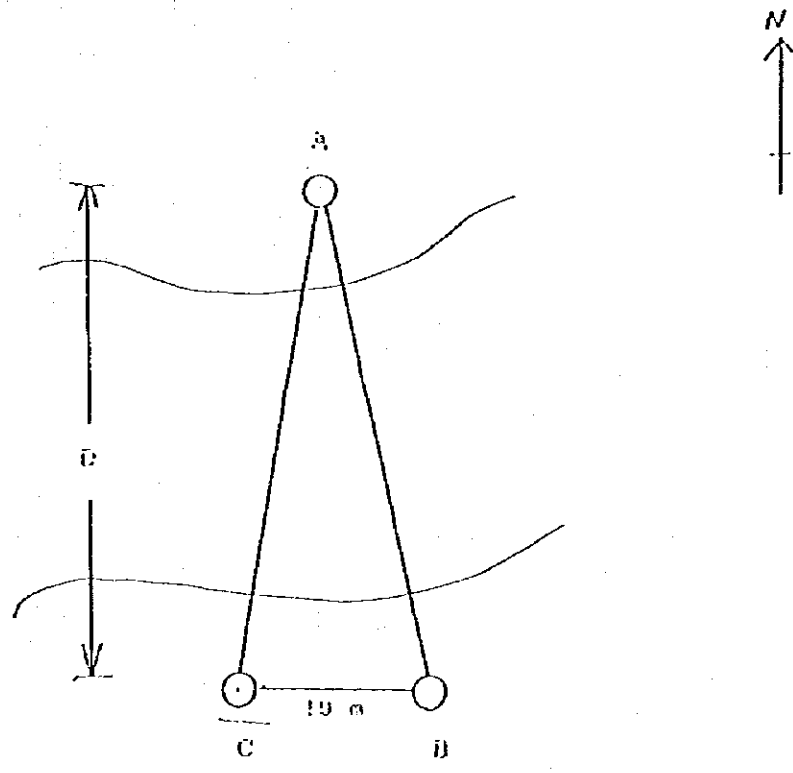
	Number
1. Rivet driven on the paved road	69
2. Rivet driven on stable ground feature	14
3. Rivet driven onto the side of the monument of the tertiary traverse point	15
4. Permanent monument (including 6 for cross-sea leveling)	13
Total	111

Fig. 1. Geodetic Control Survey.



- ▲ Given points (planimetry)
- Given points (height)
- △ Given points (planimetry & height)

Fig. 3. Cross Sea Leveling



2-5 現地作業開始時の協議議事録

2-5-1 1990年1月11日付

MINUTES OF THE MEETING ON TOPOGRAPHIC MAPPING SOUTH OF LATITUDE 3° SOUTH HELD BETWEEN JICA STUDY TEAM (JST) AND SURVEY OF KENYA STAFF IN THE OFFICE OF THE ASSISTANT DIRECTOR (MAPPING) ON 11TH JANUARY, 1990

PRESENT

Mr. J.R.R. Aganyo	-	Asst. Director (Mapping) - Chairman
Mr. Albert Odhiambo	-	Supt. Mapping
Mr. Joseph Kibore	-	Principal Photogrammetric Asst.
Mr. Joshua Ogutu	-	Chief Cartographic Assistant
Mr. Muia	-	Ag. Principal Photolithographic Asst.
Dr. Kazuo Muraoka	-	Deputy Leader
Mr. Mitsuo Yoshida	-	Mapping Planner
Mr. Tadashi Hidaka	-	Chief Surveyor
Mr. Michimasa Nakai	-	JICA Expert
Mr. Akifusa Itabashi	-	JICA Expert
Mr. Kombo Mwero	-	Officer-in-Charge, Technical-Secretary

The meeting started at 14.30 hours as per schedule. The Chairman welcomed the JST staff and a formal introduction conducted.

Soon after the introduction, the Deputy Leader expressed appreciation for the warm welcome accorded to his team and proceeded to briefly outline the work to be done in phase III as per the project document (attachment). He informed the members that the team's exercise was to cover all aspects of field data acquisition.

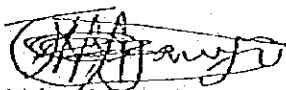
Furthermore the Deputy Leader outlined the necessary procedure to be followed in tackling phase III; phase IV is to be concluded in Japan. Most of the subject deliberated upon base from the project document with specific attention on various issues including:

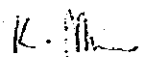
1. Hatched areas on page 29 (fig.3) of the project document will require field verification on the ground.
2. Survey of Kenya was requested through the Chairman to provide counterparts for every party which will be deployed for verification purposes.
3. As for supporting staff, it was agreed that JST get assistance from the Provincial Surveyor, Coast Province, as has been done before.
4. Proper identification and relevant entry permit to prohibited areas were necessary for all staff participating in the exercise including JST staff. SK was therefore requested to prepare identification cards and seek the necessary entry permission from the relevant departments particularly the one in charge of National Parks.


It was agreed that a follow-up meeting be held on 12th January, 1990.

In addition, the Deputy Leader pointed out that the remaining crew was due on 16th January, 1990. The Leader was, however expected here (Kenya) on 24th February, 1990.

Refreshment were served and the meeting closed at 15.40 hrs.


.....
MR. J. R. R. ACANYO
For: SURVEY OF KENYA TEAM


.....
Kombo Mwero
SECRETARY


.....
DR. K. MURAOKA
For: JICA STUDY TEAM

Date: 23 Jan 1990
(142)

PLAN OF OPERATIONS
FOR THE
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA
IN THE
REPUBLIC OF KENYA

--- 3rd Year ---

September, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

PLAN OF OPERATIONS
FOR THE
TOPOGRAPHIC MAPPING
OF
SOUTH KENYA
IN THE
REPUBLIC OF KENYA

I. INTRODUCTION

In response to the request of the Government of the Republic of Kenya (hereinafter referred to as "Kenya"), the Government of Japan (hereinafter referred to as "Japan") decided to conduct the Topographic Mapping of South Kenya in Kenya (hereinafter referred to as the "Study").

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of Japan, will undertake the Study, in close cooperation with the authorities concerned of Kenya. Survey of Kenya, Ministry of Lands and Housing, (hereinafter referred to as "SK") shall act as counterpart agency to the Japanese study team (hereinafter referred to as the "Team") and also as coordinating body in relation to other governmental and non-governmental organizations concerned of Kenya for the smooth implementation of the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to prepare the 1/50,000 topographic map covering an area of approximately 29,800Km² in South Kenya from east of Long. 37 45' E to the coast and south of Lat. 3 s to the Kenyan territory of the Tanzanian border as shown in Fig. 1. Main Items of the Study are as follows:

1. Aerial photography approximately 29,800Km²
2. 1/50,000 topographic mapping approximately 29,800Km²
43 sheets.

III. SCOPE OF WORK

The scope of work to achieve the captioned objective is stated in a document entitled "Scope of Work for Topographic Mapping of South Kenya in the Republic of Kenya" agreed upon between the Ministry of Lands and Housing and the Japan International Cooperation Agency issued on 19th March, 1987, in Nairobi, Kenya (hereinafter referred to as "S/W").

The study started in 1987. In view of the results and progress of the first year's study, coverage of the scope of work shall be modified as follows:

Aerial Photography, Leveling, Geodetic Control Point Survey, Aerial Signal and Pricking, Field Verification, Stereo Plotting, Field Completion, Drafting and Printing.

The Volume of the Study is tabulated in Table 1.

Table 1 Volume of the Study

Item		
Aerial photography	approx. 29,800Km ²	scale 1/60,000 (whole project area)
Leveling	approx. 976Km	minor order leveling (including pricking)
Geodetic control Point Survey	10 points	satellite geodecy
Aerial signal	40 points	
Pricking	approx. 500Km	existing bench marks
Field verification	approx. 29,800Km ²	
Aerial triangulation	approx. 757 models	
Plotting and Compilation	approx. 29,800Km ²	
Field completion	approx. 29,800Km ²	
Drafting	approx. 29,800Km ²	
Printing	43 sheets	1,000 copies each
	— in 6 colours	500 copies each
	in 7 colours	500 copies each

IV. WORK PLAN

The entire work shall be carried out under a four-year programme starting from October, 1987, and accomplishing in March, 1991. It shall consist of the following four phases in accordance with the time schedule shown in Fig. 2.

1. Phase I (First Year, 1987): Aerial Signal, Aerial Photography,
Pricking and Leveling

1 - 1. Aerial Signal

To secure the proposed map accuracy, the accuracy of horizontal control point shall be not more than

0.07 mm X 1/plotting scale (= 0.07 mm X 50,000 = 3.5m).

For horizontal control of photographs for aerial triangulation, 40 points of existing 1st and 2nd order triangulation and traverse points shall be used. The distribution plan is shown in Fig. 1. Aerial signals shall be set up on these proposed photo-control points.

1 - 2. Aerial Photography

Black and White panchromatic aerial photography shall be carried out in dry season with a super-wide angle camera (f=8.8cm) in two missions.

1 - 2 - 1. Mission I

For pricking of existing bench marks and along proposed leveling routes, aerial photography shall be carried out in a form of strip courses for approximately 1,500 line Km along these leveling routes at a scale of 1/40,000. This mission is done for the efficiency of the time schedule.

1 - 2 - 2. Mission II

For mapping, the proposed mapping area of approximately 29,800Km² shall be flown at a scale of 1/60,000.

1 - 3. Pricking.

For vertical control of aerial photographs for aerial triangulation and mapping, existing bench marks shall be pricked (approximately 500Km). Pricking of proposed leveling routes (approximately 976Km) shall also be done for the same purpose at the time of leveling work. Twice enlargement of 1/40,000 aerial photograph shall be used in the field and later pricked points shall be transferred onto the 1/60,000 aerial photograph when necessary.

1 - 4. Leveling.

To secure the proposed map accuracy, the accuracy of vertical control points shall be not more than

$$0.07 \times \text{contour interval} (= 0.07 \times 20\text{m} = 1.4\text{m}).$$

For vertical control of photographs for aerial triangulation and mapping, existing 1st and 2nd order bench marks shall be used. The distribution of existing bench marks, however, is not sufficient for aerial triangulation and mapping. Consequently, minor order leveling shall be carried out to supplement existing bench marks. Minor order leveling of the accuracy of $5\text{cm} \times \sqrt{S}$ (Where S is the route length in Km.) shall be carried out for approximately 976Km along main roads or national park boundaries where leveling work is found feasible, starting from and closing to existing bench marks. (Fig. 1)

Marking shall be done by utilizing conspicuous ground features or setting up marks every 2Km in average.

Pricking shall be done on aerial photographs for the vertical control for aerial triangulation and mapping on the above points and at knick points of topography along leveling routes at the time of leveling work.

Prior to the execution, reconnaissance shall be carried out for proposed leveling routes to allocate marks and for existing bench marks to find out if it is necessary to recover them in order to use them as given for the minor order leveling.

2. Phase II (Second Year, 1988). Aerial Photography, Leveling,
Geodetic Control Point Survey,
Field Verification, Aerial Tri-
angulation, Stereo Plotting and
Compilation

In view of the results and progress of the Phase I's study, work plan for this Phase shall be modified from the original.

2 - 1. Aerial Photography

Of the aerial photography covering the project areas of about 29,800Km² at a scale of 1:60,000, about 3,000Km² which were not successful in the first year's flight shall be flown (Fig. 3)

2 - 2. Leveling

It was found that among existing leveling routes, almost all bench works were destroyed or lost along the route along coast. Minor order leveling shall be executed along this route for about 250Km² to establish photo control points.

2 - 3. Geodetic Control Point Survey.

Of the existing geodetic control points, three dimensional measurement for 5 missing points and height measurement for 4 points shall be executed by satellite geodesy. One extra point shall be newly established by satellite geodesy for the sake of aerial triangulation.

2 - 4. Field Verification

Prior to field survey for verification of aerial photographs, reconnaissance study (photo-interpretation) shall be carried out using aerial photographs and reference data collected.

In compliance with the map style and its application rule, selection of items to express on the map and topographic information related to classification of ground features shall be verified and objects which are hard or impossible to interpret on the aerial photograph shall be clarified in the field. The key to photo-interpretation needed for mapping shall be prepared. Geographical and administrative names shall be collected by SK.

2 - 5. Aerial Triangulation.

To obtain coordinates of pass points and tie points, aerial triangulation shall be carried out by analytical method using 1/60,000 aerial photographs, comparators and electronic computers. Approximately 757 models shall be adjusted by block adjustment method.

The residual of the ground control points after adjustment and discrepancy at tie and pass points between adjacent models shall be not more than

1.4 per mil of the flight height

$$= 5,400\text{m} \times 1.4 \text{ per mil} = 7.6\text{m}$$

for both planimetry and altitude.

2 - 6. Stereo Plotting and Compilation

Stereo plotting shall be carried out by 1/60,000 aerial photograph and stereo plotting machine at the scale of 1/50,000 using the results of aerial triangulation and those obtained by field verification. Intermediate contour shall be plotted at 20m intervals. 10m of supplementary half interval contour shall be plotted for flat area, if necessary. The photogrammetric spot height shall be plotted taking the topography and distribution of ground features and control points into consideration.

Results shall be compiled in the format of the sheet lines of 15' X 15'. Along the northern boundary of the Study area lie the area mapped by JICA in the eastern part and that by Canada in the western part. Along the southern boundary to Tanzanian territory, the Ordnance Survey, United Kingdom, is executing mapping. The connection of maps among these maps shall be taken into consideration. Necessary data for the connection, such as pricked diapositives, results of aerial triangulation, copies of original manuscript of maps, etc., shall be obtained through SK. The discrepancy of connection to existing maps shall be adjusted in principle. If it is found difficult to tie, however, the treatment shall be discussed with SK.

This work shall be continued to Phase III.

3. Phase III (Third Year, 1989): Stereo Plotting and Compilation
(continued) and Field Completion
(Including Field Verification)

3 - 1. Stereo Plotting and Compilation (continued)

A part of the stereo plotting and compilation works shall be continued to this phase.

For the areas covered by aerial photography in Phase II and not verified in the field, plotting and compilation shall be done without field verified data. For such areas, field verification shall be executed at the time of field completion. The areas are shown in Fig. 3.

3 - 2. Field Completion

Topography, ground features, vegetation, etc., which cannot be properly identified on the aerial photographs during plotting and compilation works, shall be verified in the field and inscribed on the copies of the compiled manuscript printed on the synthesized polyester sheets. Administrative and geographical names and administrative boundaries etc. shall be verified, confirmed and indicated on the paper copy of the compiled manuscript by SK.

4. Phase IV (Fourth Year, 1990). Drafting and Printing

4 - 1. Drafting

Based on the field completed compiled manuscript (original manuscript), negative scribing and preparation of masks and sheets for marginal information for printing plate making shall be carried out on stable polyester bases for 6 and/or 7 colour separation. Map style and symbols shall be discussed with SK. These sheets shall be composed so that one colour may be in one sheet for the sake of printing plate making (preparation of composite negative). A composite positive shall also be prepared consisting mainly of linear elements for the maintenance (revision) of maps.

4 - 2. Printing.

Making of printing plate shall be carried out using 1/50,000 composite negatives by photo-lithography.

Printing shall be carried out in 6 and/or colours by the offset printing machine. Number of copies to be printed shall be 1,000 for each map. Specifications and size of printing paper shall be decided after discussion with SK.

5. Work Schedule.

Work schedule is shown in Fig. 2.

V. PLAN OF OPERATIONS FOR PHASE III (THIRD YEAR, 1989)

The study for Phase III comprises laboratory work and field survey: The field survey consists of the field completion for the whole area and field verification for a part of the field which was not field verified. The period of the field works shall be from 8th January, 1990 to 8th March, 1990 (60 days).

The work is as shown in Fig. 2 and the volume is as follows:

Field completion	:	29,800 Km ²
Field verification	:	3,000 Km ²
Plotting	:	1:50,000, 18,325 Km ² (15 sheets)
Compilation	:	1:50,000, 18,325 Km ² (15 sheets)

1. Preparations in the office

1 - 1. Planning

Chief engineer and engineers in charge of respective items shall prepare detailed plan for the efficiency of work.

1 - 2. Preparation of equipment and material for field survey

Followings shall be executed :

- a. Preparation of the survey equipment and material necessary for field survey.
- b. Pre-arrangement of necessary procedures for export and import of equipment and material out of Japan to Kenya.

1 - 3. Preparation of sample of printed sheet of map.

In order to help discussions of the matter concerning drawing and printing of the map with SK, a sample of printed sheet of map shall be prepared in advance.

2. Laboratory Work

Plotting and compilation are the continuation from Phase II and shall be completed in this Phase.

2 - 1. Plotting (Restitution)

Using the results of aerial triangulation and field verification, necessary items for representing on the map shall be measured and plotted by stereo plotting machine and plotted manuscript of the topographic map shall be prepared.

For the areas not verified in the field, the blotting (and compilation) must be carried out by the diducation from the photo-interpretation in surrounding areas. At the time of field completion the result of photo-interpretation must be checked with great care for this areas.

Specifications for plotting are as follows:

Plotting scale : 1:50,000

Area : 18,325Km² (shown in Fig. 1)

Number of sheets : 28 sheets

Projection : UTM

Plotting machine : not less than 2nd class.

Map index is shown in Fig. 1, where area plotted in Phase II is surrounded by shaded lines. The work for this Phase is for the remaining part.

2 - 1 - 1. Material.

For restitution, stable polyester sheet shall be used.

2 - 1 - 2. Neat lines.

Neat lines shall be 15' X 15'.

2 - 1 - 3. Plotting.

Near lines, control points, grid lines and pass points and tie points obtained from aerial triangulation are plotted using automatic coordinategraph. The maximum discrepancy shall not exceed 0.2 mm on the map.

2 - 1 - 4. Orientation.

- a. After absolute orientation of the photographs, the discrepancy between the plotted points and their model points shall be not more than 0.3 mm on the map.
- b. For orientation of height, pricked leveling points shall be used as many as possible for the sake of accuracy of height.

2 - 1 - 5. Restitution

- a. Restitution shall be executed in accordance with the map style and its application rule in the order of linear elements, like roads, rivers, railways, etc., buildings, vegetation and contour lines.

b. Planimetry and contour lines are restituted on separate sheets.

c. Items are classified by different colours on the plotted manuscript as follows:

Black : double line road, railway, building, linear object, vegetation symbol.

Red : trail, designating point, enclosure, small object, covering

Green : vegetation boundary, path in garden

blown : contour

violet: shore line, river, lake, fish-firm, salt-field, water-plant

d. Intermediate contour shall be 20 m and half interval contour lines of 10 m shall be supplemented according to topography. Care must be taken for the representation of micro topography, the project area being rich in various types of ground features and topography like hill, plain, forest, wadi, cultivated land, etc.

2 - 1 - 6. Measurement of spot height.

a. Spot height shall be measured photogrammetrically at mountaintop, saddle, intersection of roads, distinct knick points of topography etc.

b. Spot height shall be distributed taking the topography into consideration.

2 - 1 - 7. Tying

Map tying shall be made among adjustment sheets and also to existing maps such as;

- a. existing 1/50,000 topographic map along the northern edge of the project area,
- b. 1/50,000 topographic map being worked by the Ordnance Survey along the western and southern borders to Tanzania.

Connection to existing sheets shall be made in principle. However, if it is found difficult to tie, the treatment shall be discussed with SK.

3 - 2. Compilation.

- a. On the basis of the plotted manuscript, compilation shall be carried out using the results of field verification and materials collected. The work area and volume are the same for those of plotting and shown in Fig. 1.
- b. If any doubtful point arises during compilation, it shall be noted to clarify at the time of field completion.
- c. Planimetry and topography (contour) are compiled on the same sheet. Annotation items shall be compiled on a separate sheet using plotted manuscript and data obtained by field verification.
- d. Details of compiled items are as follows:
 - . roads are shown by symbolised roads and name and number are inscribed, when applicable. Breadth of roads in town shall be 0.4 mm on the map.
 - . Railway is shown by center line of track both for single and double-tracks.

- . Generalization of town is followed after the application rule of map symbols.
- . Buildings represented by dots are thinned out according to circumstances.
- . As it is generally difficult to interpret gas and pipe line on the photograph, they shall be represented in reference to the data submitted by SK.
- . Value of agretic declivation shall be submitted by SK.
- . Oil lines shall not be represented on compiled manuscript.
- . Inscription of destination shall be done by SK.

e. Data sheets

. Roads

Roads are classified by different colours.

Red solid line : all weather paved surface roads

Green solid line : all weather soft surface roads

Yellow solid line: dry weather roads

. Vegetation

For vegetation such as, forest, bamboo, bush etc.

needed to prepare mask, data sheet is prepared by

classifying them by different colours.

forest : green

bush : blue

bamboo : yellow

plantation: brown

2. Field Survey (Field completion)

Field Survey shall be carried out during 8th January 1990, and 8th March, 1990 (60 days). During the period, team leader, deputy leader, mapping planner, chief engineer, mechanic and 8 members consisting of 4 parties, - totaling to 13 member shall be dispatched for about 2 months to the field.

Field Survey for this Phase shall be devoted mainly to field completion to clarify important items to be represented on the map - topography, ground features and place names - and doubtful points arisen in plotting and compilation.

For verification and inscription of names and administrative boundaries, close cooperation of SK counterparts is cordially requested. Important change of ground features after aerial photography shall be supplemented in the field.

2 - 1. Preparation

Following materials shall be prepared before entering into the field.

a. Preparation of copies		for each sheet
Compiled manuscript	polyester sheet	1
	paper	3
	SSP	2
Anotation sheet	polyester sheet	1
	paper	2
Composite of compiled manuscript and anotation sheet	polyester sheet	1
	SSP	2

Data sheet for road	paper	2
"	vegetation	" 2
"	water system	" 2

b. Preparation of material

- . Items to clarify for the areas plotted and compiled with only photo-interpretation (without field verification)
- . Doubtful points arisen during plotting and compilation.
- . Materials to discuss the specifications of final products with SK.

c. Shipment of materials for the technical transfer in printing.

2 - 2. Discussion with SK

2 - 2 - 1. Preparation

Before arrival of the main team to Kenya, deputy leader and other 3 staffs shall arrive in Nairobi to prepare for their reception. The main duties are as follows. Of those, there are many items to be indebted to the cooperation of SK.

a. To discuss plan and execution of operations with SK concerning field completion. Items to discuss and to be confirmed are as follows:

- i. Map style and its application rule, compiled manuscript and tying to the existing map,
- ii. Administrative names, place names and destination names,

- iii. Data concerning names of following items:
 - public building, church, mosque, road, railway,
 - mountain, river, park, etc.,
 - iv. Administrative, cadastral and national park boundaries,
 - v. Name and/or number of each map sheet,
 - vi. Marginal information and legend.
- b. To provide rangers, watchmen, laborers and drivers,
 - c. To announce to authorities concerned,
 - d. To ask SK to assign counterpart personnel,
 - e. To ask SK to obtain credentials or identification cards to the Team members,
 - f. To ask SK to issue permit to enter into private properties and national parks to execute survey work when necessary.

2 - 2 - 2. Provision of Materials for Printing.

In accordance with the request of the SK, JICA will provide with following materials:

Printing paper	50,000 sheets
Printing plate	280 sheets
(P.S.plate, positive type)	
Printing ink	200 Kg
Blanket	4 rolls
Chemicals etc.	

JST shall explain the materials and their use.

2 - 2 - 3. Discussion on the plan of operations for Phase IV.

As this is the last occasion to meet each other, the matters concerning drafting and printing shall be discussed based on the "Draft Plan of Operations for Phase IV" attached to this document.

2 - 3. Preparatory works in Kenya.

Besides the aboves, followings shall be dealt with chiefly by the Team:

- a. To prepare to establish headquarters and sub-camps in the field.
- b. To receive shipped equipments, machinery and other materials,
- c. To purchase equipments, machinery and other materials in Nairobi,
- d. To hire vehicles,

2 - 4. Field completion

- a. Confirmation of doubtful points arisen while in plotting and compilation

Doubtful points shall be verified in the field.

For important points, surveying shall be executed by using plain tables, when necessary.

- b. Supplementary study of the area of which aerial photographs were not verified in the field.

Important ground features, such as roads, public establishments, etc., shall be confirmed in the field and supplementary surveying shall be executed, when necessary.

c. Confirmation of annotations

Annotations which cannot be verified in the office by SK shall be verified in the field with SK counterparts.

d. Revision of secular change

Secular change in ground features after taking aerial photographs will not be revised in principle. However, for the items considered important to revise, survey shall be executed after consulting with SK.

3. Preparation of original manuscript of map.

After returning to Japan, original manuscript of map shall be prepared by arranging compiled manuscript using field-verified data. Followings shall be arranged for drafting and printing.

- a. Field completed original (original manuscript of map)
- b. Results of supplementary surveying of changed part.
- c. Data for boundaries (administrative, cadastral etc.)
- d. Data for annotation (administrative, geographical, etc.)
- e. Data for road (classification, name, destination, etc.)
- f. Data submitted by SK (oil line, etc.)
- g. others

VI. REPORTING

The progress report of Phase III shall be prepared.

VII. ORGANIZATION OF THE TEAM.

Organization of the Team is as follows:

Duty	Member	Number for a party	Number of parties	Total
Leader	Japanese engineer			1
Deputy-leader	"			1
Mapping planner	"			1
Chief-engineer	"			1
Mechanic	"			1
	driver			1
	vehicle			1
Field	Japanese engineer	2	4	8
Completion	counterpart	1	4	4
	laborer	4	4	16
	driver			8
	vehicle(including 2 trucks)			8

VIII. WORK SCHEDULE

Work schedule is shown in Fig. 4.

IX. FINAL PRODUCTS AND MATERIALS

Final products and materials of Phase III (3rd year) are as follows:

1. Stereo plotting and compilation
 - a. Plotted original 28 sheets
 - b. Map showing control point distribution 28 sheets
 - c. Record of orientation 1 set
 - d. Annotation data 28 sheets
 - e. Vegetation data 28 sheets
 - f. Road data 28 sheets
 - g. Water system data 28 sheets
 - h. Marginal information data 28 sheets
 - i. Others 1 set

2. Field completion
 - a. Original manuscript of map (field completed manuscript)
43 sheets.
 - b. Copies of compiled manuscript on which boundaries,
place name, etc. are verified by SK.
 - c. Various data sheets revised by field completion
 - d. Aerial photographs with field-verified data.

FIG. 1 Map Index

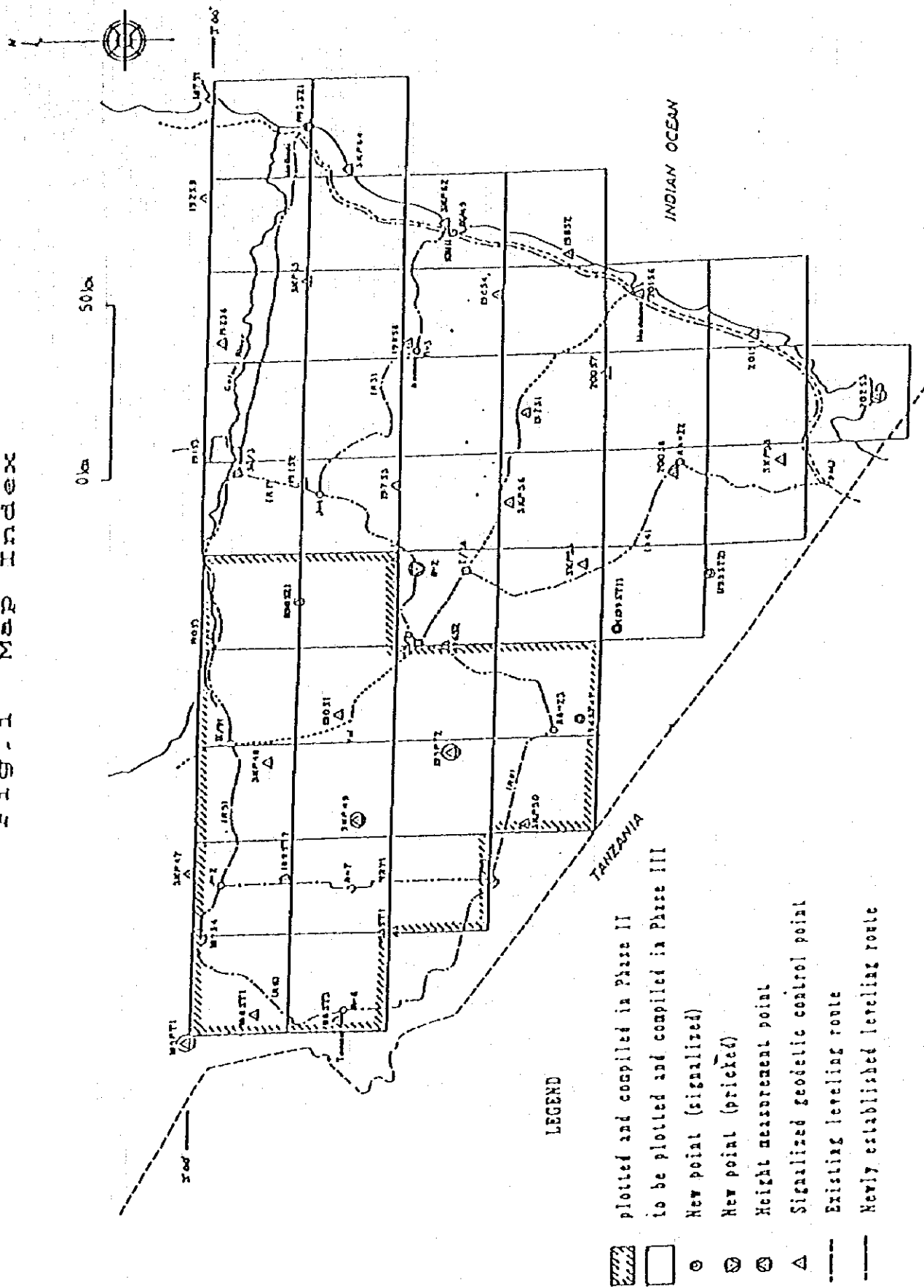
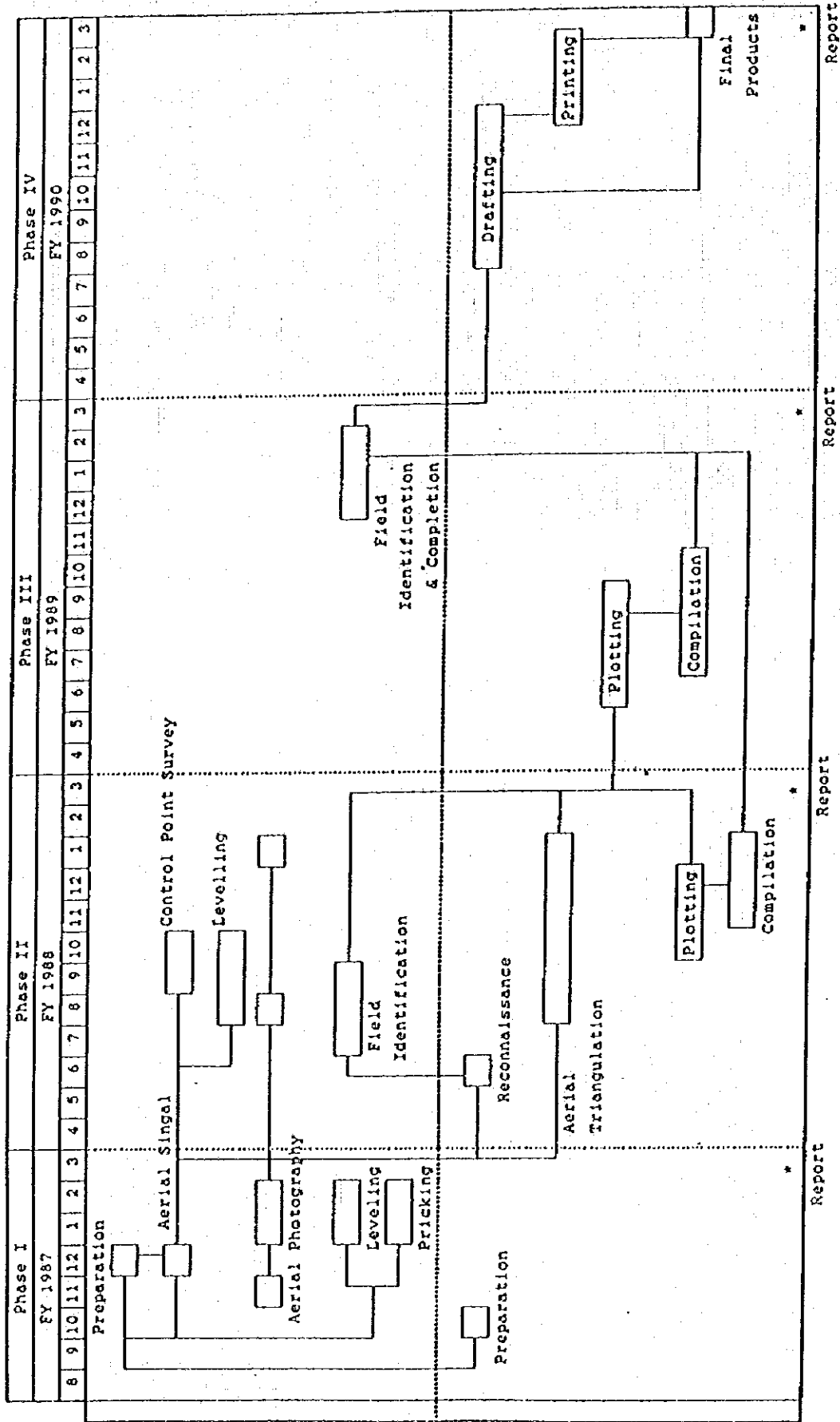
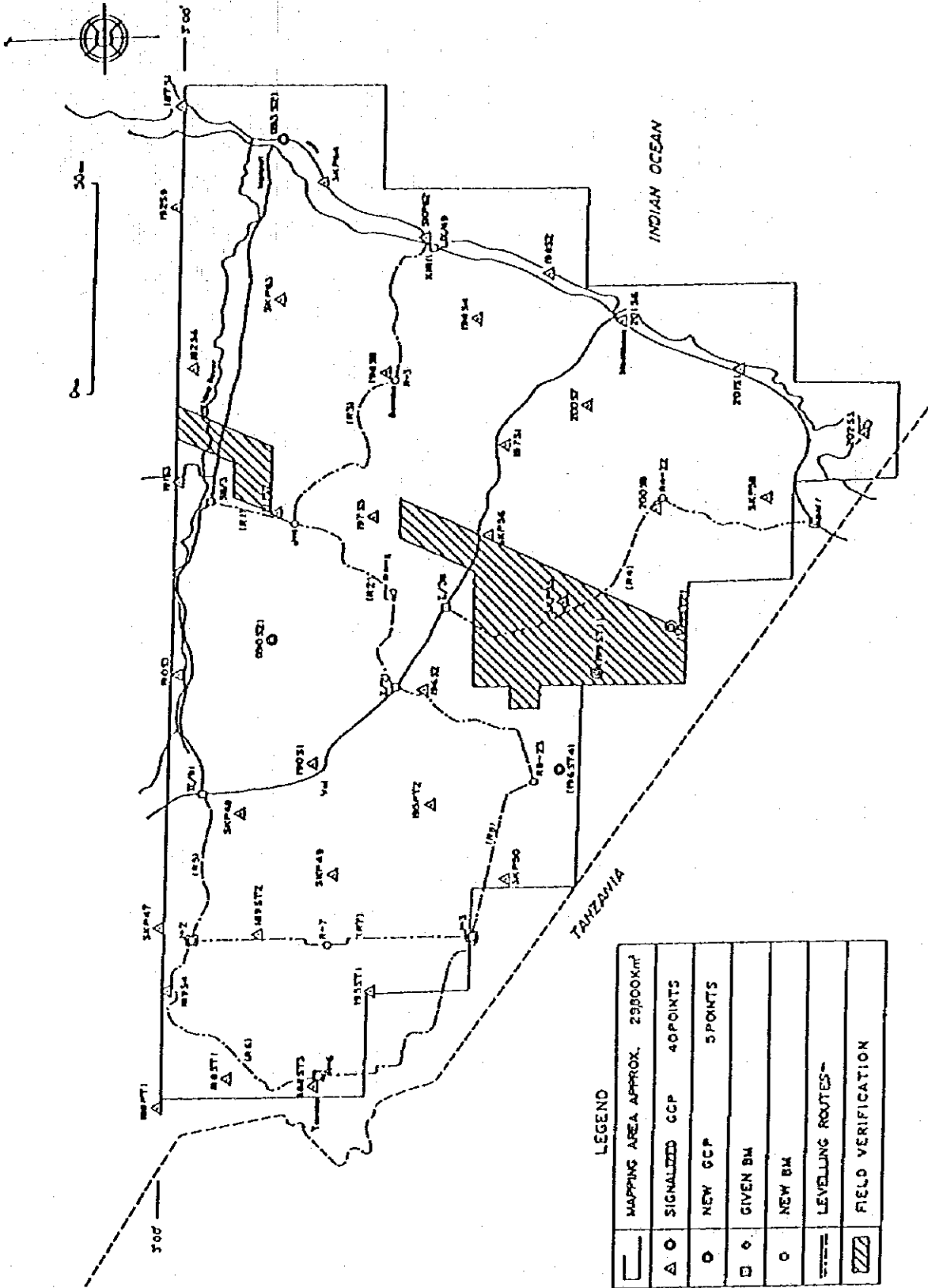


Fig. 2 WORK SCHEDULE



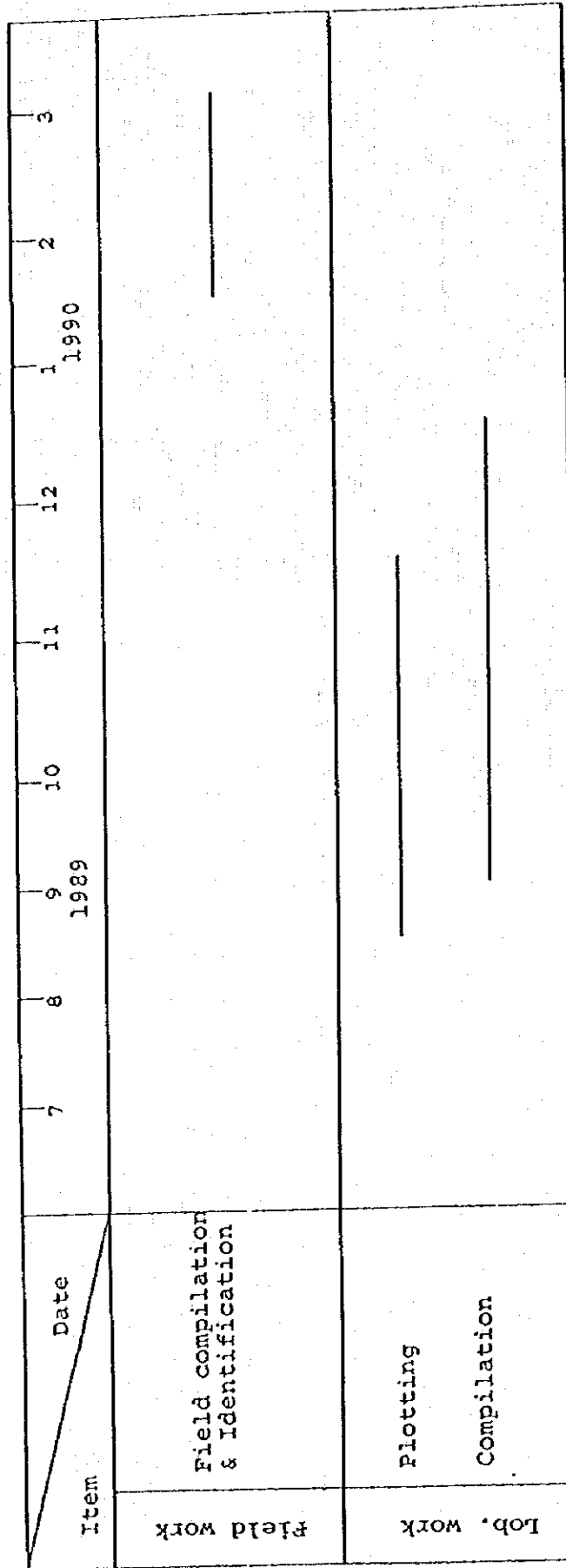


LEGEND

	MAPPING AREA APPROX. 29000km ²
	SIGNALIZED GCP 40POINTS
	NEW GCP 5POINTS
	GIVEN BM
	NEW BM
	LEVELLING ROUTES
	FIELD VERIFICATION

Fig. 3 AREAS FOR FIELD VERIFICATION

FIG. 4 Work Schedule for Phase III



DRAFT OF PLAN OF OPERATIONS
FOR PHASE IV

As this is the last time for us to meet and discuss the matters concerning the Study with SK, herein is tentatively set up the plan of operations for Phase IV as follows. It is, however, subject to modification according to the progress of the Study of Phase III and/or other conditions which may affect the progress of the Study.

1. Drafting

Using original manuscript, road classification data, annotation sheet, etc., final drafting shall be carried out by colour separation negative scribing method to be ready for making plates for printing. Negative scribed sheets, negative mask sheets and positive sheets for annotation and marginal information shall be prepared. Prodecures for drafting is shown in the annexed figure in which the produress for plate making and printing are included.

1 - 1. Map style

Map symbols shall be finally determined after discussion with SK in time for drafting. For this purpose JST shall submit a sample sheet of final printing.

1 - 2. material.

Stable synthesized polyester sheets shall be used for all cartographic works.

1 - 3. Composite negative.

Scribed sheets, mask sheets and annotation sheets shall be composed into one negative film so that one colour may be included on one sheet for the sake of plate making and printing.

1 - 4. Composite Positive

Composite positives shall be prepared composed of mainly linear elements to help map maintenance (revision).

1 - 5. Connection

Care shall be taken for connection of each sheet between adjacent ones.

2. Printing.

Printing shall be carried out by off-set printing machine in 6 and/or 7 colours:

The sheets for general use shall be printed in 6 colours and the sheets for administrative use shall be printed in 7 colours with over-print of sub-district boundary on the sheets for general use by 7th colour.

Before printing, proof shall be read and the approval of SK shall be obtained.

2 - 1. Plate making.

Printing plates shall be prepared by photo-lithography by using composite negatives.

2 - 2. Printing.

Printing shall be carried out by off-set printing machine in 6 and/or 7 colours. Number of copies shall be 1,000 for each sheet.

general sheet	6 colours	500 copies each
administrative sheet	7 colours	500 copies each

3. Work Schedule

Work schedule is shown in Fig. 2 of the main text.

4. Reporting

At the end of Phase IV, comprehensive report shall be prepared including the progress and the results of the Study.

5. Final Products and Materials

a. Drafting

a set of scribed original	43 sheets
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b. Printing

Printed map in 6 colour	43 sheets
	500 copies each
Printed map in 7 colour	43 sheets
	500 copies each

c. Report

Final report	20 copies
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2-5-2 1990年1月12日付

MINUTES OF THE FOLLOW-UP MEETING BETWEEN JICA STUDY TEAM (JST) & SURVEY OF KENYA (SK) STAFF, HELD IN THE ADM'S OFFICE ON 12TH JANUARY, 1990 (ac) 5

PRESENT

Mr. J. R. R. Aganyo	- Asst. Director Mapping - Chairman
Mr. Albert Odhiambo	- Supt. Mapping
Mr. Joseph Kibore	- Principal Photogrammetric Asst.
Mr. Joshua Ogutu	- Chief Cartographic Asst.
Mr. Paul Muia	- Ag. Principal Photolithographic Ass.
Dr. Kazuo Muraoka	- Deputy Leader
Mr. Mitsuo Yoshida	- Mapping Planner
Mr. Tadashi Hidaka	- Chief Surveyor
Mr. Michimasa Nakai	- JICA EXPERT
Mr. Akifusha Itabashi	- JICA EXPERT
Mr. Kombo Mweru	- Officer-In-Charge Technical - Secretary

This was a follow-up of the preceding meeting held on 11th January, 1990. The Chairman opened this session at 9 hrs and invited the Deputy Leader to continue with his presentation.

The Deputy Leader informed the meeting that the hatched area on page 26 (fig.1) of the project document had been fully completed during phase II and sample sheets would be available to relevant officers for ratification.

He said that field Survey for phase III shall be devoted mainly to field completion to clarify important items to be represented on the map - topography, ground feature and place names and doubtful points arising from plotting and compilation.

For verification and inscription of names administrative boundaries, close co-operation of SK counterparts is cordially requested. Important change of ground features after aerial photography shall be supplemented in the field.

The Deputy Leader further informed the meeting that various printing materials had been brought for the whole area to be covered viz.

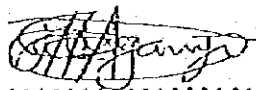
Compiled manuscripts, annotation sheets;
Composite manuscripts, data sheets for roads

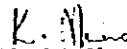
It was agreed that further discussion and consultation be held between JST and SK staff on cartographic and lithographic aspects of the project. JST admitted taking responsibility in camp establishment and maintenance while executing the programme.

The Deputy Leader also requested that SK provide cadastral boundary data by end of February 1990 so that inclusion of the same may be done in time.

A sample sheet for Voi was presented by the Deputy Leader and it was agreed that fill-ups and annotation corrections be done for each sheet that is already fairly done.

Next meeting was fixed for 17th February, 1990 at 9.30 hrs. Meeting closed at 10.29 hrs.


.....
MR. J. R. R. AGANYO


Kombo Mweru
SECRETARY


.....
DR. KAZUO MURAOKA

For: SURVEY OF KENYA TEAM

For: JICA STUDY TEAM

DATE: 23 Jan. 1990.

2-5-3 1990年1月17日付

MINUTES OF THE MEETING BETWEEN JICA STUDY TEAM (JST) AND SURVEY OF KENYA (SK) HELD IN THE ADM'S OFFICE ON 17TH JANUARY, 1990

PRESENT:

Mr. J. R. R. Aganyo	- ADM - Chairman	} JICA STUDY TEAM
Dr. Kazuo Muraoka	- Deputy Leader	
Mr. Mitsuo Yoshida	- Mapping Planner	
Mr. Tadashi Hidaka	- Chief Surveyor	
Mr. Hideo Ishibashi	- Surveyor	
Mr. Yoshihiro Azuma	- "	
Mr. Minoru Ohnaka	- "	
Mr. Yutaka Kokufu	- "	
Mr. Minoru Arai	- "	
Mr. Norio Goto	- "	
Mr. Makoto Tsujimoto	- "	
Mr. Koji Yanagimachi	- "	
Mr. Michinasa Nakai	- Japanese Expert	
Mr. Akifusa Itabashi	- "	

Mr. A. Odhianbo	- Supt. Mapping
Mr. D. A. Chabeda	- Principal Photolithographic Asst.
Mr. D. Kimando	- For Principal Photogrammetric Asst.
Mr. J. Ogutu	- Chief Cartographic Assistant
Mr. P. Muia	- Chief Photolithographic Asst.
Mr. C. A. Kinele	- Senior Cartographic Asst.
Mr. Kombo Mweru	- Officer-In-Charge, Technical (Secretary)

The meeting was held in the ADM'S Office and started at 9.30 hrs.

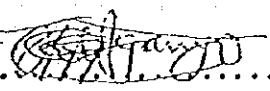
Opening the meeting, the Chairman welcomed all the participants particularly the Surveyors from Japan. Soon after the introduction from both sides the Deputy Leader (JST) announced that departure to the working area would be immediate and that the field staff... anticipate to complete data collection within a period of one month. During the same meeting the Deputy Leader issued six copies of the project report for phase II to the Chairman.


It was agreed that JST and SK experts meet in smaller groups and discuss technical details regarding the project.

Again the issue of SK counterparts was discussed and it was agreed that the officers selected be ready for field work. Action Mr. Ogutu.

The meeting ended at 10.00 a.m.


Kombo Mweru
SECRETARY


MR. J. R. R. AGANYO
For: SURVEY OF KENYA TEAM


DR. K. MURAOKA
For: JICA STUDY TEAM

DATE: ... 23th Jan. 1990.