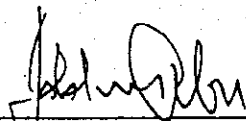


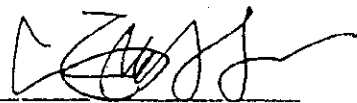
5-4 第2年次現地作業終了時の協議議事録

MINUTES OF MEETINGS
AT
THE END OF THE SECOND YEAR'S FIELD SURVEY WORKS
FOR
THE TOPOGRAPHIC MAPPING
OF
SOUTHERN PART OF THE REPUBLIC OF GHANA
BETWEEN
SURVEY DEPARTMENT OF GHANA
AND
JICA STUDY TEAM

ACCRA GHANA, 20th JANUARY 1997



NA AL-HAJI IDDRISU ABU
DIRECTOR OF SURVEYS
SURVEY DEPARTMENT OF
GHANA
MINISTRY OF LANDS AND
FORESTRY



TOKIHIKO KAMINISHI
LEADER
JICA STUDY TEAM

SURVEY DEPARTMENT OF GHANA(SDG) and JICA Study Team(Team) had a series of meetings at the end of the second year's field works for the "TOPOGRAPHIC MAPPING OF SOUTHERN PART OF THE REPUBLIC OF GHANA" from January 16th to 20th 1997.

At the meetings the following items were confirmed by both sides.

1. The Team reported briefly the progress of the second year's field work for the Study, and presented the "Progress Report of the second year for Topographic Mapping of southern part of the republic of Ghana" prepared by the Team (appendix-1), SDG accepted the report.
2. The Team received datum for topographic mapping from SDG and agreed on it.(appendix-2)
3. SDG and Team agreed on Symbols for 1:50,000 Topographic Map and their application rules.(appendix-3)

ATTENDANTS:

1) SDG Side

Mr. J. Dotse	Asst. Director	Great Accra Region
Mr. Marcus Tabil	Examiner	Examination Section
Mr. K. N. Arku-Lawson	Chief Cartographer	Cartographic Section
Mr. I. Andoh-Kesson	Chief Photogrammetrist	Photogrammetric Section
Mr. E. R. Tetteh	Chief Lithographer	Lithographic section

2) Team Side

Mr. Tokihiko KAMINISHI	Team Leader
Mr. Koichi MIKI	Deputy Leader
Mr. Kozo OKUMURA	Mapping Planner
Mr. Hitoshi YOSHIDA	Chief Surveyor
Mr. Makoto TUJIMOTO	Surveyor

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PROGRESS REPORT
OF
THE FIELD WORK OF THE SECOND YEAR
FOR
TOPOGRAPHIC MAPPING OF SOUTHERN PART
OF
THE REPUBLIC OF GHANA

JANUARY, 1997

STUDY TEAM
OF
TOPOGRAPHIC MAPPING OF SOUTHERN PART
OF
THE REPUBLIC OF GHANA

JAPAN INTERNATIONAL COOPERATION AGENCY

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1. INTRODUCTION

The topographic mapping of the southern part of the Republic of Ghana started in January 1996, in a five-year plan, as a technical cooperation program of JICA.

In compliance with the Scope of Work agreed upon between the Survey Department of Ghana and JICA on the 17th March, 1995, the JICA Study Team arrived in Accra separately on 27th September, and 4th October 1996, to execute the second year's field work.

Meanwhile Ghana counterparts from the Survey Department of Ghana joined the work from time to time.

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

2. OBJECTIVE OF THE STUDY

The objective of the Study are : (1) To prepare 1/50,000 topographic map covering an area of approximately 25,500Km² in the southern part of the Republic of Ghana, (2) To Transfer technology to the counterparts personnel of SDG through the implementation of the work, and (3) To promote the friendship between Ghana and Japan through the implementation of the Study.

The second year work of the Study is consisting of the aerial photography II, ground control point survey II, leveling, pricking, and office work such as computation of the survey results.

2-1. Period of Survey Work

Field work	
Aerial photography II	3 rd October, 1996 ~ 12 th December, 1996
Ground control point survey II	3 rd October, 1996 ~ 24 th January, 1997
Leveling	---- ditto----
Pricking	---- ditto----

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2-2. Formation of the Study Team

Leader	Mr. Tokihiko KAMINISHI	26 th Sep.'96 ~ 15 th Oct.'96
"	"	14 th Jan.'97 ~ 24 th Jan.'97
Deputy Leader	Mr. Koichi MIKI	26 th Sep.'96 ~ 24 th Jan.'97
Mapping Planner	Mr. Kozo OKUMURA	26 th Sep.'96 ~ 24 th Jan.'97
Chief Surveyor	Mr. Hitoshi YOSHIDA	26 th Sep.'96 ~ 24 th Jan.'97
Photographer	Mr. Shun TAKAGI	10 th Oct.'96 ~ 12 th Dec.'96
Mechanical Engineer	Mr. Shinpei ISHIWATA	26 th Sep.'96 ~ 24 th Jan.'97
Surveyor	Mr. Shigeo ONO	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Masahiko OHASHI	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Michio SATOJI	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Tsuyoshi YAMAZAKI	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Koichi WAKISAKA	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Kozo ASANO	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Makoto TSUJIMOTO	26 th Sep.'96 ~ 24 th Jan.'97
Surveyor	Mr. Masaru TERADA	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Tomohiro MURAKAMI	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Kensuke KIMURA	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Yuichi TABIKAWA	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Masaya TOKITA	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Kazutomo NAKANISHI	3 rd Oct.'96 ~ 24 th Jan.'97
Surveyor	Mr. Kuniaki NOGUCHI	3 rd Oct.'96 ~ 24 th Jan.'97
Coordinator	Mr. Hideaki SAKAI	26 th Sep.'96 ~ 15 th Oct.'96

2-3. Amount of the Survey Work (Plan and Results)

Progress in the second year are as follows;

ITEM	ORIGINAL PLAN	RESULTS
Aerial photography II : Scale	approx. 1/60,000	approx. 1/60,000
Flight length	2,800km	346 km
Coverage	approx. 20,400km ²	approx. 2,550km ²
Photo No.	approx. 563 photos	74 photos
Ground control point survey II	approx. 34 points	34 points
Leveling	approx. 1,080 km	1,230 km
Pricking GPS point	approx. 74 points	35 points
New leveling point	approx. 1,080 km	580 km
SDG Existing BM		102 points

2-4. Counterparts of SDG

Headquarters;

Na Al-haji Iddirisu Abu	Director of Surveys	Headquarters
Mr. J. Dotse	Asst. Director	Great Accra Region
Mr. R. Brimah	Asst. Director	Headquarters
Mr. J.A. Abossey	Staff. Surveyor	Headquarters
Mr. Marcus Tabil	Examiner	Examination Section
Mr. K.N.Arku-Lawson	Chief Cartographer	Cartographic Section
Mr. I. Andoh-Kesson	Chief Photogrammetrist	Photogrammetric Section
Mr. J.C. Acquah	Senior Engineer	Great Accra Region
Mr. E.R. Tetteh	Chief Lithographer	Lithographic section

Field Work

Mr. E. K. Nkebi	Regional Surveyor	Central Region
Mr. E. Djokoto	Regional Surveyor	Western Region
Mr. P.E. Attah	Survey Technician	Central Region
Mr. E. Abbah	Technical officer I	Central Region
Mr. D. Kumasenu	Technical officer I	Central Region
Mr.H.Mustaphad	Technical officer II	Central Region
Mr. G.K. Arhin	Technical officer II	Central Region
Mr. A. Gatsi	Technical officer I	Central Region
Mr. A. Abrefa	Technical officer I	Central Region
Mr. K. Sapong	Technical officer II	Central Region
Mr. B.Gustau	Survey Technician	Western Region
Mr. B.Adoey	Technical officer I	Western Region
Mr. A. Robert	Technical officer II	Western Region
Mr. A. Godwin	Technical officer II	Western Region
Mr. A. Daniel	Survey Technician	Western Region
Mr. E. Paul	Technical officer I	Western Region
Mr. S. Francis	Technical officer I	Western Region

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3. FIELD WORK

3-1. Aerial Photography II

Aerial photography was started after the rainy season. The team contracted with Aircraft Operation Company(PTY) Ltd. (A.O.C.South Africa) same condition as first year's for all aerial photography.

(1) Base for Aerial photography

KOTOKA International Airport was used for the base aerial photography.

(2) Aircraft and Camera

Details of aircraft and camera are as follows;

Aircraft	: Gates Learjet 24 No.24-165
Camera	: Zeiss RMK-A 8.5/23
Lens Number	: No.132014 f=85.54mm
Navigation Equipment	: GPS Navigation, Trimble 2000

(3) Photographic work

Test flight was made on 10th October 1996 and full scale aerial photography was commenced from 11th October 1996.

(4) Materials of aerial film

Panchromatic film was used for aerial photography, and details are as follows;

Film type : AGFA AVIOPOT PAN 200 PEI & DOUBLE X

3-2. Photo processing

(1) Development

The instruments and materials to be used were as follows;

Developer	: ILFORD OQ UNIVERSAL
Paper	: AGFA RAPSTONE P2-2
Film development	: ZEISS REWIND S/No.111079
Contact printer	: ZEISS KG-30
Drier	: ZEISS TG 24 S/No.20209

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(2) Printing and inspection

After printing and inspection of the aerial photos, re-flight was made, in case of necessity.

Items to be inspected were as follows;

1. Over-lap and side-lap
2. Cloud, Cloud shadow and uneven development
3. Deviation of flight course
4. Halation, smoke of field fire, etc.

(3) Film annotation

The form of film annotation and numbering on each frame of aerial photography should be same as first study.

(4) Amount of work

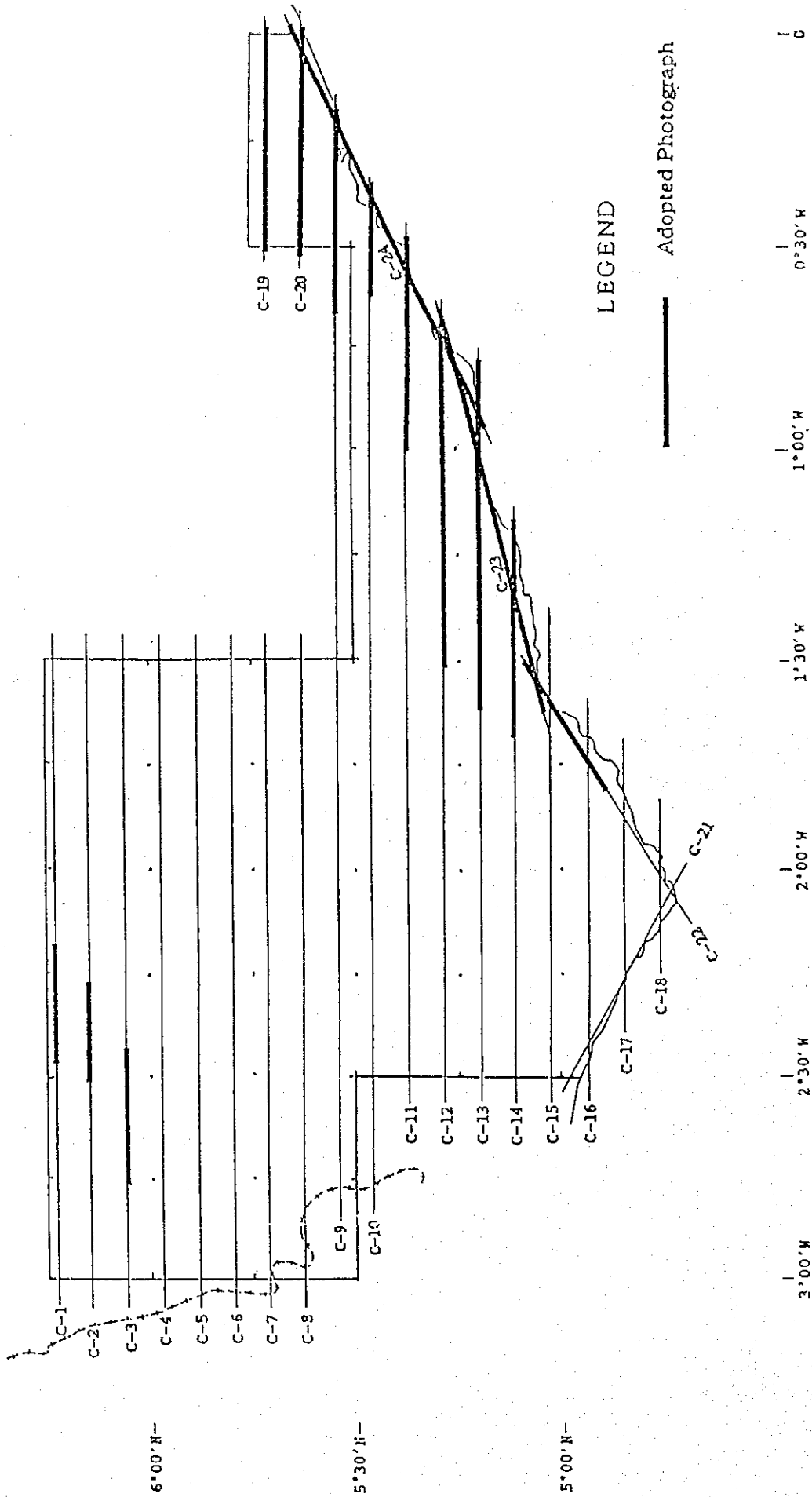
Film roll : 5rolls
Available photographs : 74 photos (13%)
Flight lines/length : 7/346 Km (12%)

Number of photographs in this study is shown as follows; , and total coverage shown in Figure- 1.

List of available aerial photos;

RUN No.	FRAME No.	PHOTO No.
C-1	639 ~ 645	7
C-2	652 ~ 657	6
C-3	697 ~ 704	8
C-9	384 ~ 396	13
C-14	227 ~ 237	11
C-22	205 ~ 213	9
C-24	184 ~ 203	20
	TOTAL	74

Fig. 1 PHOTO INDEX (Phase 1 & 2)



3-3. Ground Control Point Survey II

Ground control point survey was executed by satellite geodesy applying Global Positioning System(GPS). Four Trimble 4000SSE instruments of dual frequency model were used for the simultaneous observation at the control points.

(1) Observation

Observation was made at four or three points simultaneously. Due to the limitation of passing hours of satellites it was made over two hours, over five satellites were observed.

(2) Observation scheme

The network consisting of 24 observation groups as shown in Fig-2 .

(3) Results

The coordinate closures of each group were computed by approximate computation in the field to check the reliability of the observation. The results are tentatively as shown in table-1, where dx, dy and dz stand for the coordinate closure of the geodetic coordinate system of ellipsoid WGS-84 to which GPS is referred.

3-4. Leveling

(1) Leveling Routes

Leveling, carried out for about 1,230km (91 routes) covering the Study Area were set up as shown in Fig-3, and result table .

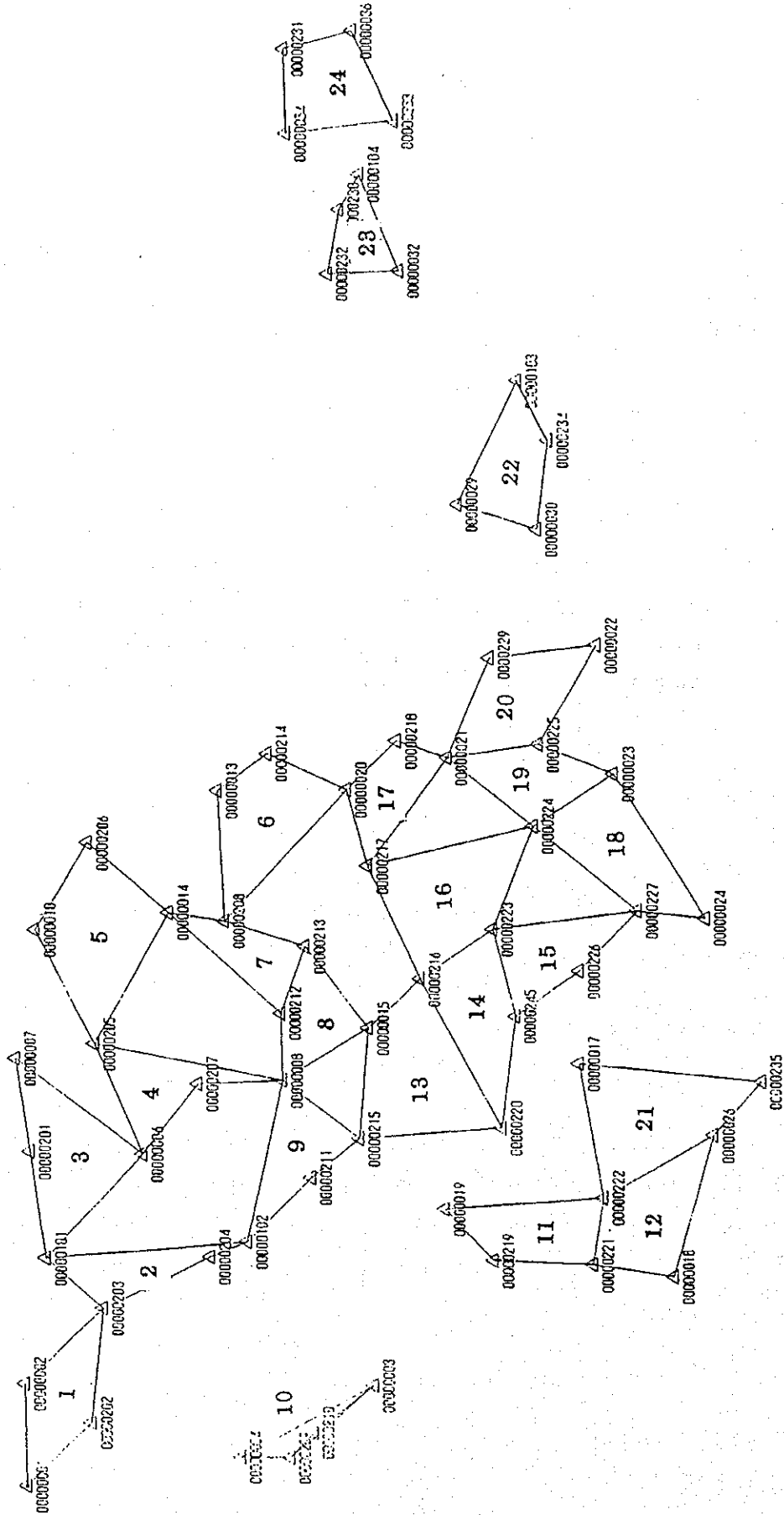
(2) Measurements

Existing bench marks were used for starting, ending and checking;

Check measurements were carried out with satisfactory results (See table-2). The nominal value of existing bench mark will be adopted as given.

The observation was made by closures or double observations with bar-code level and bar-code staff.

Fig - 2. GPS Observation Group



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Table-1. (GPS observation result)

Group No.	Station combination for baseline		Computed Slope Distance(m)	Accuracy (m)
1	1	2	23,113.440	TD= 92,806.745
	2	203	23,845.312	dx = +0.012
	203	202	25,620.504	dy = -0.007
	202	1	20,227.488	dz = +0.001
				Ratio=0.144ppm
2	203	101	16,161.700	TD= 94,874.639
	101	102	43,774.179	dx = +0.013
	102	204	8,896.978	dy = -0.007
	204	203	26,041.783	dz = +0.007
				Ratio=0.172ppm
3	101	201	23,761.421	TD= 109,461.531
	201	7	20,524.753	dx = -0.006
	7	6	33,980.923	dy = -0.001
	6	101	31,194.434	dz = +0.001
				Ratio=0.053ppm
4	6	205	26,022.469	TD= 105,678.680
	205	8	41,530.304	dx = -0.001
	8	207	18,619.409	dy = -0.02
	207	6	19,506.499	dz = 0.001
				Ratio=0.021ppm
5	205	10	28,142.008	TD= 106,454.911
	10	206	22,079.494	dx = +0.002
	206	14	22,876.969	dy = -0.001
	14	205	33,356.440	dz = -0.000
				Ratio=0.023ppm
6	208	13	28,224.646	TD= 100,086.206
	13	214	13,598.048	dx = +0.001
	214	20	19,090.226	dy = -0.001
	20	208	39,173.286	dz = -0.001
				Ratio=0.020ppm
7	14	208	12,279.276	TD= 79,549.148
	208	213	18,524.618	dx = +0.007
	213	212	15,775.784	dy = -0.002
	212	14	32,969.470	dz = -0.004
				Ratio=0.102ppm
8	212	213	15,775.784	TD= 75,496.679
	213	15	22,703.528	dx = +0.015
	15	8	22,090.909	dy = -0.020
	8	212	14,926.458	dz = +0.010
				Ratio=0.355ppm
9	102	8	36,158.321	TD= 90,800.643
	8	215	21,046.750	dx = -0.005
	215	211	13,641.462	dy = -0.001
	211	102	19,954.111	dz = +0.001
				Ratio=0.052ppm
10	209	4	10,843.096	TD= 69,045.366
	4	3	33,460.337	dx = -0.007
	3	210	17,045.525	dy = +0.004
	210	209	7,696.407	dz = -0.002
				Ratio=0.118ppm

Group No.	Station combination for baseline		Computed Slope Distance(m)	Accuracy (m)
11	219	19	15,545.705	TD= 86,271.911
	19	222	34,296.738	dx = -0.026
	222	221	15,009.392	dy = +0.017
	221	219	21,420.076	dz = +0.000
				Ratio=0.359ppm
12	221	222	15,009.392	TD= 92,412.094
	222	26	27,609.600	dx = +0.003
	26	18	32,279.158	dy = -0.012
	18	221	17,513.944	dz = -0.008
				Ratio=0.155ppm
13	15	216	15,690.607	TD= 108,257.976
	216	220	37,241.843	dx = -0.009
	220	215	30,970.201	dy = -0.006
	215	15	24,355.324	dz = -0.001
				Ratio=0.096ppm
14	220	216	37,241.843	TD= 101,220.363
	216	223	19,422.494	dx = -0.015
	223	245	19,741.506	dy = +0.014
	245	220	24,814.520	dz = +0.007
				Ratio=0.214ppm
15	223	227	31,326.789	TD= 86,239.838
	227	226	18,319.993	dx = -0.043
	226	245	16,851.550	dy = +0.001
	245	223	19,741.506	dz = +0.009
				Ratio=0.113ppm
16	217	224	37,040.750	TD= 107,424.341
	224	223	24,045.178	dx = -0.003
	223	216	19,422.494	dy = -0.001
	216	217	26,915.919	dz = -0.003
				Ratio=0.044ppm
17	217	20	17,134.092	TD= 73,116.173
	20	218	15,139.772	dx = +0.001
	218	21	11,619.305	dy = +0.001
	21	217	29,223.003	dz = -0.000
				Ratio=0.017ppm
18	224	23	20,637.564	TD= 100,969.858
	23	24	36,848.911	dx = -0.002
	24	227	14,865.093	dy = +0.002
	227	224	28,618.290	dz = +0.001
				Ratio=0.023ppm
19	21	225	20,087.100	TD= 81,665.078
	225	23	17,167.803	dx = -0.042
	23	224	20,637.564	dy = +0.031
	224	21	23,772.610	dz = +0.009
				Ratio=0.039ppm
20	21	229	23,524.833	TD= 91,672.292
	229	22	23,185.185	dx = -0.002
	22	225	24,875.174	dy = +0.001
	225	21	20,087.100	dz = +0.001
				Ratio=0.022ppm

Group No.	Station combination for baseline		Computed Slope Distance(m)	Accuracy (m)
21	222	17	29,603.515	TD= 112,497.205
	17	235	39,588.283	dx = 0.004
	235	26	15,695.807	dy = 0.000
	26	222	27,609.600	dz = -0.001
				Ratio=0.039ppm
22	29	103	29,990.404	TD= 82,254.219
	103	234	14,538.416	dx = -0.001
	234	30	19,714.790	dy = -0.000
	30	29	18,010.610	dz = +0.000
				Ratio=0.015ppm
23	104	32	22,713.169	TD= 61,245.116
	32	232	15,418.601	dx = +0.000
	232	230	14,383.851	dy = +0.000
	230	104	8,729.495	dz = +0.000
				Ratio=0.007ppm
24	34	231	18,472.580	TD= 78,820.321
	231	36	15,470.086	dx = +0.000
	36	233	21,465.757	dy = +0.001
	233	34	23,411.898	dz = -0.001
				Ratio=0.015ppm

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Fig.3 INDEX MAP FOR LEVELING

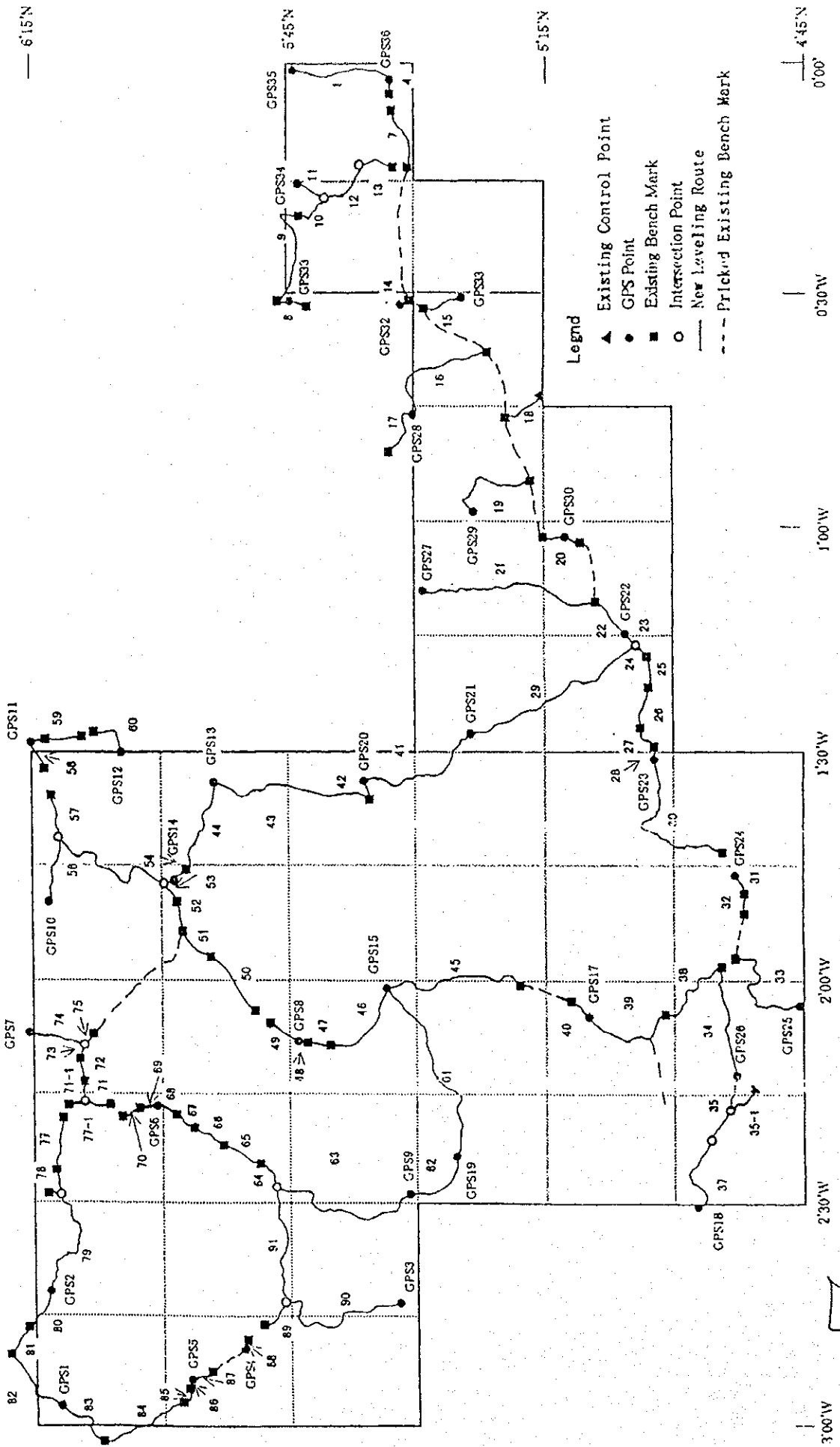


Table-2. Check measurement results

BM No. From ~ To	Distance (km)	Closures Error(m)	Tolerance(m)
PL 7/325 ~ 7/324	0.388	0.003	0.031
PL 7/324 ~ 7/322	0.796	0.006	0.044
PS 9/ 2 ~ 9/ 4	1.906	0.020	0.069
PS 9/33 ~ 9/32	0.632	0.004	0.039
PS 9/35 ~ 9/34	1.770	0.001	0.066
PS 9/45 ~ 9/52	1.778	0.027	0.066
PS 9/65 ~ 9/ 64	1.818	0.008	0.067
PS 3/45 ~ 3/44	0.800	0.007	0.044
L 12/18 ~ 12/12	4.732	0.004	0.108
L 12/33 ~ 12/35	1.580	0.052	0.062
PS 4/10 ~ 4/ 9	1.652	0.003	0.064
PS 4/ 2 ~ 4/ 1	1.586	0.003	0.062
PS 2/A3 ~ 2/113	1.074	0.009	0.051
PL 25/106 ~ 25/105	1.160	0.035	0.053
PL 25/107 ~ 25/108	1.644	0.009	0.064
PL 25/114 ~ 25/115	1.470	0.016	0.060
PS 1/A2 ~ 1/A3	5.926	0.004	0.121
PS 1/A5 ~ 1/124	2.524	0.004	0.079
PL 17/A26 ~ 17/103	1.678	0.009	0.064
PL 18/A5 ~ 18/A6	9.118	0.000	0.150

(3) Results

Results for the respective route sections are as follows;

Route No.	B.M; From ~ To	Dist. (km)	Closure (m)	Tolerance (m)	Remarks
1,4	PL 7/ 325 ~ GPS.35	20.606	0.130	0.226	double
7	PL 7/ 322 ~ PS 9/2	22.134	0.045	0.235	closed
8	PL 1/ 19 ~ 1/ 17	5.338	0.006	0.115	closed
9	PL 1/ 17 ~ 1/ 6	29.504	0.004	0.271	closed
10,12,13	PL 1/ 6 ~ PS 9/ 4	25.960	0.013	0.254	closed
11	1002 ~ GPS.34	7.042	0.013	0.132	double

14	PS 9/32~ GPS.32	0.590	0.001	0.038	double
15	PS 9/34 ~ GPS.33	10.445	0.017	0.161	double
16,17	PL 1/29 ~ PS 9/45	36.810	0.094	0.303	closed
18	PS 9/52 ~ GCS.102	10.618	0.010	0.162	closed
19	PS 9/65 ~ GPS.29	22.038	0.041	0.234	double
20	PS 9/77 ~ PS 9/80	3.798	0.009	0.097	closed
21	PL 25/A16B ~ GPS.27	38.424	0.186	0.309	closed
22,23,24	PL 25/A16B-SGW20/60/3	14.030	0.013	0.187	closed
25	SGW20/60/3~FBM.5	7.956	0.046	0.141	closed
26	FBM.5 ~ CFP.3141	11.728	0.024	0.171	closed
27	CFP.3141 ~ PL 1/55	7.710	0.016	0.138	closed
28,30	PL 1/55 ~ FBM.5A	40.458	0.027	0.318	closed
29,41,42	2301 ~ PS 3/45	77.136	0.054	0.439	closed
31,32	L 12/12 ~ GPS.24	7.147	0.022	0.133	double
33	L 12/33 ~ GPS.25	26.097	0.243	0.255	double
34,35,-1	L 12/35 ~ L12/84	38.912	0.065	0.311	closed
35,37	3501 ~ GPS.18	30.425	0.035	0.275	double
38	L 12/35 ~ PS 4/25	20.574	0.090	0.226	closed
39,40	PS 4/25 ~ PS 4/10	22.210	0.040	0.235	closed
43,44	PS 3/45 ~ FBM.7	72.836	0.175	0.426	closed
45,46	PS 4/1 ~ PS 2/106	55.018	0.353	0.370	closed
47	PS 2/106 ~ PS 2/A2	6.540	0.011	0.127	closed
48,49	PS 2/A2 ~ PS 2/A3	6.350	0.007	0.125	closed
50	PS 2/113 ~ PS 2/A5	18.450	0.018	0.214	closed
51	PS 2/A5 ~ PL 17/A33	9.702	0.020	0.155	closed
52	PL 17/A34 ~ PL 17/A33	7.618	0.027	0.138	closed
53,54	PL 17/A34 ~ FBM.7	7.608	0.017	0.137	closed
55,57	5301 ~ PL 25/105	49.358	0.158	0.351	closed
56	5600 ~ GPS.10	16.795	0.047	0.204	double
58,59	PL 25/108 ~ PL 25/114	15.030	0.020	0.193	closed
60	PL 25/115 ~ GPS12	7.720	0.019	0.138	double
61,62,63	4601 ~ 9111	104.862	0.130	0.512	double
64	9111 ~ PS 1/101	9.114	0.016	0.150	closed
65	PS 1/101 ~ PS 1/108	12.184	0.055	0.174	closed
66	PS 1/108 ~ PS 1/A2	7.462	0.047	0.136	closed

67	PS 1/A2 ~ PS 1/A3	5.926	0.004	0.121	closed
68,69,70	PS 1/A3 ~ PS 1/A5	16.748	0.003	0.204	closed
71,77-1	PS 1/124 ~ PL 17/A26	8.156	0.124	0.142	closed
71-1	7111 ~ PL 17/A27	4.608	0.045	0.107	closed
72,73,75	PL 17/A27 ~ PL 17/114	11.946	0.039	0.172	closed
74	7301 ~ GPS.7	15.813	0.010	0.198	double
77	PL 17/A23 ~ PL 17/103	21.930	0.049	0.234	closed
78	PL 17/A22 ~ PL 17/A23	6.370	0.034	0.126	closed
79,80	PL 18/A6 ~ 7801	46.138	0.014	0.339	closed
81	PL 18/A5 ~ PL 18/A6	9.118	0.000	0.150	closed
82	GPS.1 ~ PL 18/A5	18.528	0.016	0.215	closed
83	PL 18/A14 ~ GPS.1	20.074	0.016	0.224	closed
84	PL 18/65 ~ PL 18/A14	14.454	0.017	0.190	closed
85	PL 18/A16 ~ PL 18/65	1.466	0.016	0.060	closed
86	GPS.5 ~ PL 18/A16	0.308	0.016	0.027	closed
87	PL 18/A17 ~ GPS.5	7.100	0.016	0.133	closed
88	PL 18/A19 ~ GPS.4	0.409	0.001	0.031	double
89	PL 18/82 ~ 9000	5.654	0.017	0.118	closed
90	9000 ~ GPS.3	32.727	0.084	0.286	double
91	9000 ~ 9111	40.152	0.016	0.316	closed

3-5. Pricking

Pricking of the horizontal and vertical control for aerial triangulation was conducted using the aerial photos.

(1) Control points

Original plan of points to be pricked were 74 points, however we pricked 35 new GPS points on the aerial photo.

Elements of eccentricity for pricking were conducted using GPS and observation of Sun.

(2) Existing bench marks and spot heights

Pricking of existing bench marks and spot heights was conducted on the aerial photos along the leveling route.

Spot heights were computed from leveling observation results. Points were pricked at every 4 to 5 km interval.

The above progress report covered the period from 26th September, 1996 to 14th January, 1997.

DATUM FOR THE TOPOGRAPHIC MAPPING OF
THE SOUTHERN PART OF GHANA

1. REFERENCE ELLIPSOID

SPHEROID : Clarke 1880
Semi axis major (a) : 6,378,249.145 m
Flattening (f) : 1/ 293.465

2. GRID SYSTEM

PROJECTION : Ghana Modified Transverse Mercator
Meridian of Origin : 1° 00' West of Greenwich
Latitude of Origin : 4° 40' North
False Coords at Origin : 300,000m Easting, Nil-Northing
Scale Factor at Origin : 0.99975

3. UNIT OF MEASUREMENT

UNIT : meter

4. CONVERT VALUE FOR FOOT TO METER





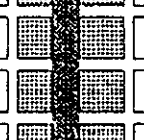
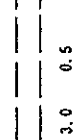
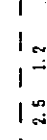
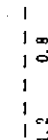
1 meter = 3.28084558 feet



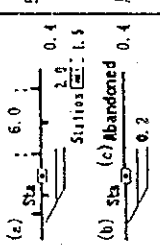
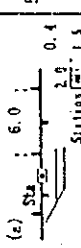
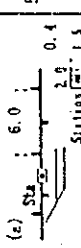
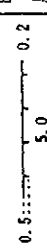
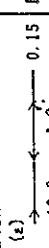

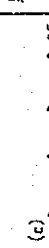
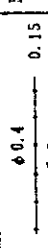

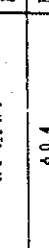
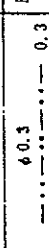
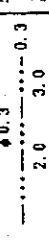

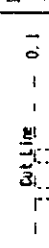
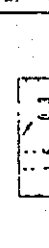
SYMBOLS AND THEIR APPLICATION RULES
FOR
THE TOPOGRAPHIC MAPPING OF THE SOUTHERN PART
OF
THE REPUBLIC OF GHANA



SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

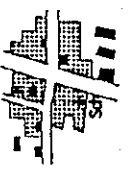
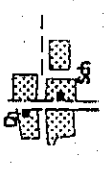


CLASS NO 分類	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 説明記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
1	Motorway (dual carriage): 自動車道 (片側2車線以上)		 1.2 0.25 0.08	black red-sc green 100% 黒 赤線 100%				*Apply symbol to four lanes or more with central reserve. *中央分断帯を持つ片側2車線 (計4車線) 以上の道路に適用する *ロータリーに適用する
2	Roads: Class 1 Motorable throughout the year 1級道路: 通年自動車通行可		 0.8 0.2 0.15	black red-sc green 100% 黒 赤線 100%				*Apply symbol to paved road. *Route No. shall be indicated on both ends of each map sheet. *SDC shall provide route No. *隣接道路に適用する *路線番号を道路付近に表示する *SDCが道路番号を提供する
3	Roads: Class 2 Motorable, occasionally closed 2級道路: 時により通行不可		 0.6 0.15 0.15	black red-sc green 50% 黒 赤線 50%				*Apply symbol to unpaved road (maintained). *Route No. shall be indicated on both ends of each map sheet. *SDC shall provide route No. *隣接道路であるが、維持管理されている道路に適用する *路線番号を道路付近に表示する *SDCが道路番号を提供する
4	Roads: Class 3 Motorable in dry seasons only 3級道路: 自動車道 (乾期のみに通行可)		 0.6 0.15 0.15	black 黒				*Apply symbol to unpaved road (not maintained). *SDC shall provide route No. *隣接道路で維持管理もされていない道路に適用する *SDCが道路番号を提供する
4	Street & main roads passing through the city and town. 街路及び真鍮道路		 0.4 0.1 0.4	black 黒				*Apply symbol to street in the city and town. *A Street: width less than 20m shall be plotted as 0.4m. The actual scale shall be plotted for a street width more than 20m. *Main roads through the city and town shall be indicated as No. 1 or No. 2. *市街地内の道路に適用する *街路の幅小幅は0.4mとするが、道幅20m以上の場合は拡大して表示する *No.1とNo.2の真鍮道路は記号道路で表示する
5	Road under construction 建設中道路		 0.6 0.15 0.15	black 黒				
6	Tracks and Major Footpaths 小道及び主要な歩道		 0.3 0.1 0.1	black 黒				
7	Other Footpaths (踏み分け道) その他の歩道		 0.15 0.1 0.1	black 黒				

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOR 色	INTERPRETATION 説明記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
8		Railway (Standard gauge): (a) double line (b) single line (c) Discontinued railway 鉄道 (標準軌道): (a) 複線 (b) 単線 (c) 廃線		(a)  (b)  (c) 	Black 黒				(c) Discontinued railway shall be annotated as "Abandoned" shall not apply annotation to temporary closed railway) (c) 廃線は Abandoned と注記をする (運行中止中の路線には Abandoned の注記はしない)
10		Cable ways, Conveyor belt 索道, ベルトコンベア			Black 黒				(a) Apply symbol to 1 or 2 line running parallel with each other. (b) Apply symbol to 3 line running parallel with each other. (c) Apply symbol to 4 line running parallel with each other.
11		Power transmission line 送電線		(a)  (b)  (c) 	Black 黒				(a) 1本、又は 2本の送電線が平行の場合に適用する (b) 3本の送電線が平行の場合に適用する (c) 4本の送電線が平行の場合に適用する (送電線相互の間隔は考慮しない)
12		Telephone line 電話線			Black 黒				* SDG shall draw International border on the map (as manuscript) * Red screen shall be put in the Green side. * 現地情報時に測量局が図案集図に表示する * 所点はガニ子図例に表示する
13		Boundary: International 境界: 国界			Black Red-screen 黒、赤線				* SDG shall draw boundary on the map (as manuscript) if necessary.
14		Boundary: Regional 境界: 区域界			Black 黒				* SDG shall draw boundary on the map (as manuscript). * Annotation shall be put in the center of its area.
15		Boundary: District (Local council) 境界: 区立公団、保護林、并 系区域その他指定界			Black 黒				* 現地情報時に測量局が図案集図に表示する * 中等位置に区立公団、保護林等の注記をする
16		Boundary: City, Municipal or town 境界: 市区域その他指定界			Black 黒				* Annotation shall fit along the lines.
17		Boundary: National park Forest Reserve Hunting area Other boundaries 境界: 国立公園、保護林、并 系区域その他指定界			Green screen 緑線				* SDG shall draw boundary on the map (as manuscript). * Annotation shall be put in the center of its area.
19		Cut line 伏閉線 (防火線)			Black 黒				* 適宜の位置に注記する
21		Fence Concrete or block wall 柵 コンクリート又はブロック柵			Black 黒				* Apply symbol to fence or wall which is more than 50cm long. * 長さか50cm以上の柵及び壁に適用する

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

note:A.A. (Abbreviated Annotation)

CLASS 分類	CLASS NO	NAME 名 称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現置記号	PLOTTING 図化記号	COMPIIATION 編集記号	APPLICATION RULES 適用規定
	2 2	City, Town 市街			black screen 黒の網 ? X				* If there is any prominent building in the congested (generalized) area, it shall be indicated (protted) as such. * 総置地域内に記号等を表示すべき建物等がある場合、当該建物が独立建物で表示できる場合は建物を表示し、その建物が小さい場合は+で真位置を表示する
	2 3	Village 村落			black screen 黒の網 ? X				*ditto. * 総置地域内に記号等を表示すべき建物がある場合は、上記に準ずる
	2 4	(a)Compound & Huts (b)Prominent Building (a)小屋 (村本部の建物) (b)零落な建物		(a) $\phi 0.6$ (b) 	black 黒				(a)Apply symbol to soil/mud house etc. (b)Apply symbol to Concrete and block house etc. (a) 土壁等の建物の適用する (b) コンクリート及びブロック建築の建物の適用する
	2 5	Market 市場		Mkt	black 黒				*big market shall be indicated with building. If building can't be drawn, A.A. shall be indicated on the center. * 大規模なものを表示し、独立建物を表示できない場合はその地域の中等位置に表示する
	2 6	(a)Hospital, (b)Clinic (a)病院, (b)産院		(a) + Hosp (b) + Clin	black 黒				(a)If building can be drawn, cross symbol shan't be indicated. (b)Apply A.A. also to the prominent clinic. (a) 独立建物が表示できる場合は+を表示しない (b) 若きものを表示する
	2 7	(a)Hotel, (b)School (c)Police Station (d)Court House (e)Barrier (a)ホテル, (b)学校 (c)警察署 (d)裁判所 (e)検問所		(a) H + Sch (c) + PS + Ct H (e) Barrier	black 黒				(a)Apply A.A. to the prominent hotel only. (b)University, polytechnic, college, institute etc shall be indicated with building and its full name shall be annotated in principle (b)...(d)If building can be drawn, cross symbol shan't be indicated. (e) Barrier shall be annotated as "Barrier". (a) 著名なホテルに適用する (b) 総合大学、技術大学、短期大学、研究所等は建物を表示し原則として注記する (b)...(d)独立建物が表示できる場合は+を表示しない (e) 検問所は"Barrier"と注記する
	27-1	(a)Military Station (b)Barracks (a)軍施設 (b)兵舎		(a) MS (b) Bks	black 黒				(a)Apply A.A. also to the big chapel. (a)(b)If building can be drawn, cross symbol shan't be indicated. (c)Actual position shall be center of base line.Syabo direction shall be set at right angle to the road. (e) 大きいChapel (礼拝堂)は教堂の記号を適用する (a) 独立建物が表示できる場合は+を表示しない (c) 真位置(下辺中央)に表示し、道筋に対し直角に表示する(記号の向きは不定)
	2 8	(a)Church, (b)Mission (c)Temple (a)教会, (b)伝道水戸 (c)寺院		(a) + Ch (b) + M (c)  1:5	black 黒				

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOR 色	INTERPRETATION 説明記号	PLOTTING 図化記号	COMPLICATION 複雑記号	APPLICATIONS RULES 適用規定
	29	Silos サイロ		<p>60.8 ○ ○</p>	black 黒				
	31	Mosque イスラム教寺院		<p>1.0 ○ 1.2 ○</p>	black 黒				*Actual position shall be bottom of black circle. *Symbol direction shall be set at right angle to the road. *真位置 (円の下点) に表示し、道に対して直角に表す
	32	Cemetery 墓		<p>1.0 ○ 1.2 ○</p>	black 黒				*Large one: Indicate limits with black solid line. *Small one: Indicate its position by cross symbol. *大規模な墓は厚を黒実線で表示して中央に表示し、小規模な場合は真位置を+で示す
	33	(a) Post Office (b) Telecommunication office (c) Post & Telecommunication office (a) 郵便局 (b) 電信局 (c) 郵便・電信局		<p>(a) P (b) T (c) P-T</p>	black 黒				(a).. (c) Indicate its position by cross symbol, if building can't be drawn. * Shall apply (c) to common use of post & telecommunication. * 独立建物を表示出来ない場合は+で真位置を表示する * 郵便局と電信局を兼ねている場合は(a)を適用する
	34	Electricity substation 変電所		<p>2.0 2.0</p>	black 黒				
	35	Sports ground 競技場		<p>2.5 3.5</p>	black 黒				*Very big one shall be drawn to actual size.
	37	Shed 集荷場		<p>+ Shed</p>	black 黒				*この記号より大きい場合は実形で表示する *shall apply annotation to storage/guard for Cocoa Coffee, etc. *ココア、コーヒー等農産物の集荷場、貯蔵所に適用する
	38	(a) Light house (b) Navigation Beacon (a) 灯台 (b) 航路標識		<p>(a) 1.3 (b) 1.5</p>	black 黒				
	39	(a) Fort, (b) Castle (c) Palace (a) 砦 (b) 城 (c) 宮殿		<p>(a) 1.0 (b) 1.0</p>	black 黒				* shall not apply (a) & (b) to present use. (c) Very big palace shall be annotated with full name. (a) (b) 現在は別の目的で使用されている場合でも、これを適用する (c) 大きい場合は注記する
	40	Tower 高塔		<p>1.0 1.0</p>	black 黒				*shall apply symbol to clock tower etc. *時計台のような高塔に適用する
	41	(a) Ruin, (b) Ancient wall (c) Ancient site (a) 遺跡 (b) 城跡 (c) 史跡		<p>(a) 0.5 (b) 0.6</p>	black 黒				

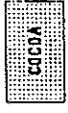

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

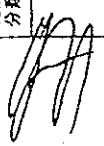
CLASS NO 分類	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 説明記号	PLOTTING 図化記号	COMPILATION 編纂記号	APPLICATION RULES 適用規定
53	Ebankran: 堤防		1.0:-----+++++ 0.1 0.5	brown 茶				
54	Mine Dump スリ捨場		miniaux jengih 0.522	brown 茶				
55	Sand or Mud 砂地又は泥地	内陸と沿岸の砂(67)を区 分するか?		brown 茶				
56	Dunes 砂丘			brown 茶				
57	Quarry 採石場			black 黒				
60	Water courses: (a) Indefinite stream (b), (c) Rapids (d), (e) Waterfall 河川: (a) 不徒河川 (b) (c) 急流, (d) (e) 滝			blue Rapide water- fall black 青, 黒				
61	(a) Areas liable to flood (b) Marsh or Swamp (a) 浸水し易い地域 (b) 沼地又は低湿地	浸水し易い地域の積算方 法?		blue 青				
62	Trench, Gutter 溝, 用水路(灌溉, 排水用)		0.2	Blue 青				
63	(a) Lake, (b) Pond, (c) Dam (e) 湖, (b) 池, (c) ダム			blue bl. scr. 青, 青網				
63	Salt Ponds 塩田			black 黒				*Salt ponds shall be indicated with check embankment and shall be annotated as "Salt Ponds". *塩田はせき止め用堤防を表示し, Salt Pondsと注記する
64	Waterhole, Well, Spring (Borehole) 小池, 井戸, 泉(試掘穴)		φ 1.2 ○	blue 青				
64	Water tower 給水塔		φ 1.2 screen 100% ⊕	blue 青網				

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 説明記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
	6 5	Water pipe 送水管			blue 青				
	6 6	(a) Bridge, (b) Footbridge, (c) Culvert, (d) Ford (e) Ferry (a) 橋, (b) 徒歩橋 (c) カルバート, (d) 渡渉所 (e) フェリー			black 黒				(a) shall apply symbol also to train bridge. (b) shall apply symbol to footbridge and bridge upon double lines river on the map. (Excluding small bridge on the single line river on the map) (a) 鉄道橋にも適用する (b) 原則として、2条河川には表示するものとし、歩道橋にも適用する(1条河川には表示しない)
	6 7	Coastline (Sand or Mud) 海岸線 (砂又は泥地)			own 茶				
	67-1	Flat Rock(a) Boulder Rock(b) 平らな岩石海岸 岩塊の海岸			Black 黒				
	6 8	Thick Forest 樹木の多い森林			Green 100% 緑 100%				Light points shall not be indicated.
	6 9	Light Forest 疎林			Green- screen 7% 緑網点 7%				
	7 1	Savannah 草原		Non-symbol					* 緑網点は表示しない

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 説明記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
	72	Plantation 農園			Green Green- screen 緑 緑実線 緑網点 7%				* Indicate limits with green solid line, and anno- tate product's name in the center. * 外周を緑の実線で表示し、ココア、ゴム等の種類を中 央に在記する
	77	Cultivation 耕種		 2.5	black 黒				* Limits shall not be indicated. (Put the symbol in the area suitable) * 境界は表示しない (範囲内に記号を適宜表示する)

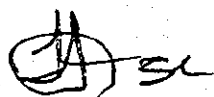



5-5 第3年次現地作業開始時の協議議事録

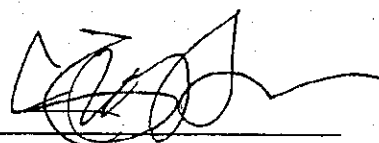
MINUTES OF MEETINGS
FOR
THE TOPOGRAPHIC MAPPING
OF
SOUTHERN PART OF THE REPUBLIC OF GHANA
BETWEEN
SURVEY DEPARTMENT OF GHANA
AND
JICA STUDY TEAM

ACCRA GHANA, 7th OCTOBER 1997

for



NA AL-HAJI IDDRISU ABU
DIRECTOR OF SURVEYS
SURVEY DEPARTMENT OF
GHANA
MINISTRY OF LANDS AND
FORESTRY



TOKIHIRO KAMINISHI
LEADER
JICA STUDY TEAM

The JICA Study Team headed by Team Leader Mr. Tokihiko KAMINISHI visited the Republic of Ghana from 29th September, 1997 to carry out the third year programme for the Study on Topographic Mapping of Southern Part of Ghana.

Prior to the commencement of the third phase survey work, a series of meetings were held from 1st to 7th October, 1997 and the following items have been confirmed and agreed by Survey Department of Ghana (SDG) and JICA Study Team.

1. Twenty (20) copies of Second Year Reports were submitted to SDG by JICA Team.
2. Twenty (20) copies of Third Year Plan of Operation were submitted to SDG by JICA Team. The Third Year Plan of Operation was discussed and accepted by both sides.
3. Both sides agreed that the recommendation for improvement of management and operation systems and maintenance system of control points and maps should be made by JICA Team in the final report.
4. SDG requested that digital data of final maps should be added and delivered to SDG at the final stage and JICA Team took note for conveying this request to JICA Head Office of Tokyo.

LIST OF ATTENDANTS

1. Ghanaian Side (SDG)

Na Al-haji Iddrisu Abu	Director of Surveys	Headquarters
Mr. J. Dotse	Asst. Director	Great Accra Region
Mr. Marcus Tabil	Examiner	Examinations Section
Mr. K.N.Arku-Lawson	Chief Cartographer	Cartographic Section
Mr. I. Andoh-kesson	Chief Photogrammetrist	Photogrammetric Sec.
Mr. E.R. Tetteh	Chief Lithographer	Lithographic Section
Mr. Jones Ofori Boadu	Assistant Staff Surveyor	Great Accra Region
Mr. Jerry Awambigo	Senior Survey Technician	Great Accra Region
Mr. Nii Quarshie Quartey	Senior Survey Technician	Great Accra Region

2. Japanese Side (JICA Study Team)

Mr. Tokihiko KAMINISHI	Team Leader
Mr. Kouichi MIKI	Deputy Team Leader
Mr. Kozo OKUMURA	Mapping Planner
Mr. Hitoshi YOSHIDA	Chief Surveyor
Mr. Hideaki SAKAI	Coordinator



ATTACHMENT

PLAN OF OPERATION
FOR
TOPOGRAPHIC MAPPING OF SOUTHERN PART
OF
THE REPUBLIC OF GHANA

(THIRD YEAR)

SEPTEMBER, 1997

JAPAN INTERNATIONAL COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Republic of Ghana (hereinafter referred to as Ghana), the Government of Japan (hereinafter referred to as Japan) has decided to conduct the topographic maps of southern part of the Republic of Ghana (hereinafter referred to as the Study) in accordance with the relevant laws and regulation in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as JICA), the official agency responsible for the implementation of the technical cooperation programs of Japan, will undertake the Study in close cooperation with the authorities concerned in Ghana.

Survey Department of Ghana (hereinafter referred to as SDG) shall acts the counterpart agency to the JICA Study team and also as the coordinator in relation to other governmental and nongovernmental organizations concerned of Ghana for the smooth implementation of the Study.

The Plan of Operation (P/O) for the Third Year's Study is proposed with the tentative schedule for succeeding years as shown in Fig. 1, and the flowchart for the production of topographic map is as shown in Fig. 2.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to prepare the 1/50,000 topographic maps covering an area of approximately 25,500 square kilometers (see attached map) and to transfer technology to the counterparts personnel of Ghana.

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 Southern Part of the Republic of Ghana" agreed between SDG and JICA on 17th March 1995. It covers :
Aerial photography, Ground control point survey, Leveling, Pricking,
Field verification, Aerial triangulation, Stereo plotting & Compilation,
Field completion, Drafting and Printing.

The work volumes and standards for respective work items are shown in Table 1 and Table 2.

Table 1. Work volume of the Study

ITEM	VOLUME	REMARK
1. Aerial photography (scale 1/60,000)	approx. 25,500 km ²	See Fig.3 progress.
2. Ground control point survey (GPS)	74 points	Completed.
3. Leveling	1,230 km	Completed.
4. Pricking GPS point	74 points	35 points finished.
Leveling point	1,230 km	approx. 580km finished.
Existing BMs	102 points	Completed.
5. Field verification	approx. 25,500 km ²	3rd year's work.
6. Aerial triangulation	approx. 680 models	-ditto-.
7. Stereo plotting	approx. 25,500 km ²	-ditto-. S=1/50,000
8. Compilation	approx. 25,500 km ²	4th year's work.
9. Field completion	approx. 25,500 km ²	-ditto-.
10. Drafting	approx. 25,500 km ²	4th & 5th year's work.
11. Printing	40 sheets	-ditto-. 1,000 copies each.

Table 2. Standard of the Study

Reference ellipsoid :	Clarke 1880
Map projection :	Ghana Modified Transverse Mercator
Datum of height :	M. S. L. (Based on the existing BMs)
Map scale :	1/50,000
Neat line :	15' x 15'
Contour interval :	10meters (Mountainous area 20meters)
Map style & application rule :	One adopted by SDG
Ground control point survey :	1/100,000 (Relative accuracy)
Leveling :	5cm /s (s : km)
Number of colors :	5 colors

IV. GENERAL UNDERTAKINGS

The Study shall be conducted in close cooperation between the two countries of Ghana and Japan. Responsibilities of each side set forth in S/W are summarized as follows :

1. Ghana side :

-Necessary arrangement to ensure the entry, exit and stay of the team members as well as personnel of an aerial photography company contracted by the Team for the Study together with related materials and equipment to bring in and out of Ghana.

-Assistance to facilitate issuance of permit necessary for implementation of the Study.

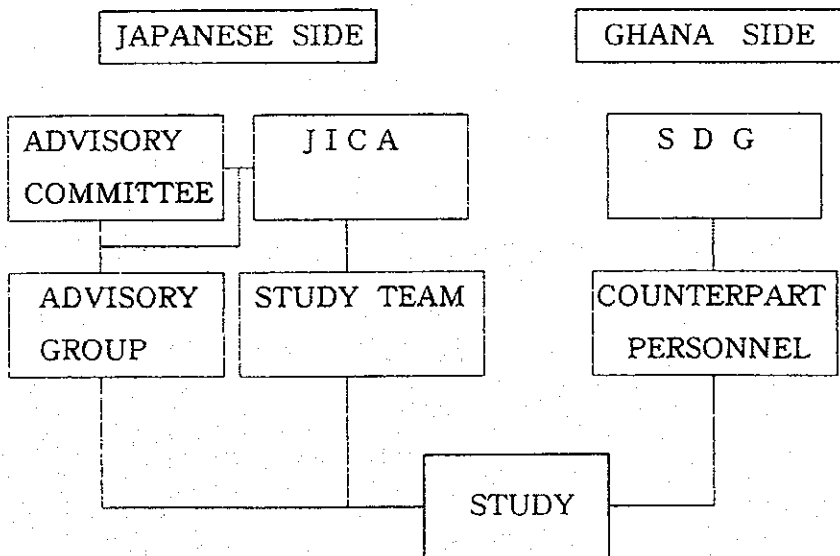
2. Japanese side :

-Implementation of the Study in Ghana and Japan.

-Technology transfer through the execution of the Study.

3. Organization :

Parties involved in this Study shall be organized as follows ;



V. STUDY SCHEDULE

The Study shall be planned five years from January,1996 to June,1999 as shown in Fig.1. The flowchart for the production of topographic map is as shown in Fig. 2.

VI. REPORT AND FINAL PRODUCTS

An annual report shall be prepared by Study team at the beginning of field survey stage II, III and IV. The report on the final year (fiscal) shall cover all of the activities in this Study.

The final products to be delivered to the Government of Ghana are as follows ;

- (1) Aerial photo original negatives ----- 1 set
- (2) Aerial triangulation diapositives----- 1 set
- (3) Contact prints (including aerial triangulation photos)----- 2 sets
- (4) Photo index map ----- 1 set
- (5) GPS control points descriptions & results ----- 1 set
- (6) Vertical control (leveling) results ----- 1 set
- (7) Pricked & field verified aerial photographs (enlarged) ----- 1 set
- (8) Aerial triangulation results ----- 1 set
- (9) Color separation scribed sheets ----- 1 set each
- (10) Color separation combined negatives or positives ----- 1 set each
- (11) 1/50,000 topographic maps -----1,000 copies each

VII. PROGRESS OF SECOND YEAR WORK

The progress and details of second year work are described in Report II.

VIII. PLAN OF OPERATION FOR THIRD YEAR WORK

The field work and the laboratory work in Japan for the third year (aerial photography III, pricking II, field verification, aerial triangulation and stereo plotting) shall be carried out for a period from September,1997 to March, 1998.

The members of the Study team and their assignment for the third year's field work are as shown in Table 3.

1. Preliminary Work in Japan

Prior to the start of the work as above, chief engineer together with other responsible engineers shall be prepared a detailed plan and equipment for each work process so as to facilitate the field work.

2. Preliminary Work in Ghana

Upon arrival in Ghana, the Study Team shall start preparing for field operations. Team Leader and his staff shall discuss administrative matters same as previous year's work with SDG.

3. Aerial Photography III

Aerial photography shall be carried out continuously based on the previous year's progress. One Japanese engineer is assigned to Ghana to supervise the operations and check the results.

3-1 Specifications for aerial photography

Main specifications for the aerial photography shall be as follows (work volume includes previous year's);

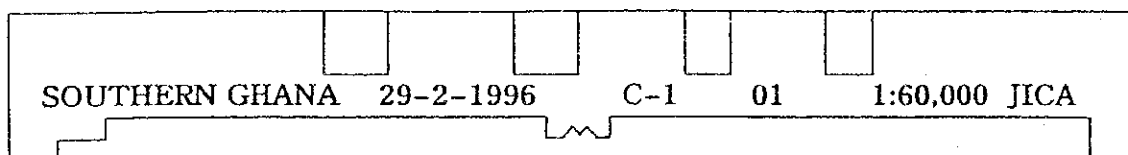
- Camera : Super wide angle camera
- Photo scale : approx. 1/60,000
- Coverage : approx. 25,500Km²
- Flight course : 24 courses
- Flight length : approx. 3,500km
- Film : Panchromatic film
- Forward overlap: 60 ± 5%
- Lateral overlap: 30 ± 10%
- Crab : Less than 10 degree
- Tip & tilt : Less than 5 degree
- Cloud coverage: Amount of cloud shall not exceed approx. 3% in successive 5 photos. However, important areas for orientation and cartography shall not be covered with clouds.

3-2 Implementation of photography

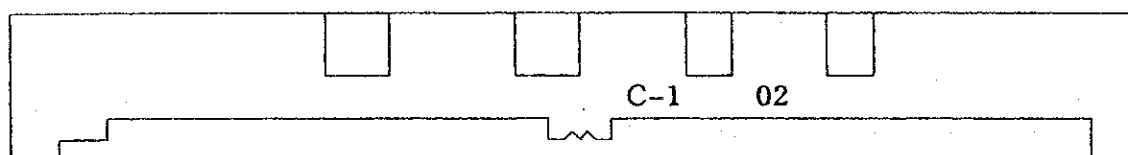
- Base air port : The flight plan shall be made with Accra Airport as the base.
- Test flight : Test flight and test photographing shall be made over the site before launching the scheduled operations.
- Checking : Supervisor for aerial photography inspects developed photos to ensure sidelaps, overlaps and other specified items. If the results do not fulfill the specifications, the aerial photography company shall re-fly the same portions.

- Film editing : Course numbers and photo numbers, etc. shall be annotated on the negatives as follows ;

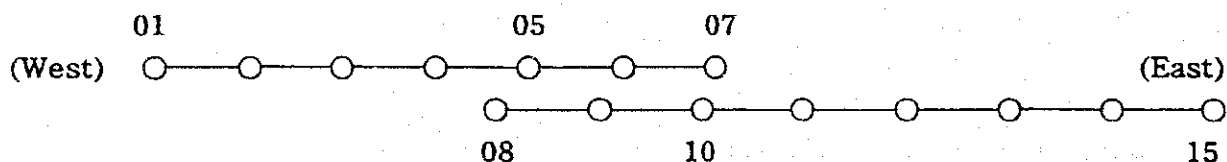
(1) Both end photographs in each strip



(2) Other inside photographs



- Index map : The photo index map shall be prepared on the existing 1/500,000 topographic map by assigning principal points of photos as follows;



4. Pricking II

Pricking work shall be performed for GPS points and new leveling points using enlarged photos same as previous work for aerial triangulation control.

4-1 Work volume

Pricking work volume are as follows ;

Horizontal & vertical control	39 points (GPS & Existing control)
Vertical control points	650 km (leveling points)

4-2 Implementation

- Horizontal and vertical control points shall be carefully pricked on the enlarged aerial photos in the field.
- Eccentric points for horizontal control shall be selected and pricked at clear points on the aerial photos, and the eccentric elements shall be measured using EDM, theodolite, plane-table, etc..
- Pricking of new leveling points shall be done at intervals of 3~4 km for the succeeding aerial triangulation and stereo plotting orientation.

5. Field Verification

In compliance with the map symbol's specification, necessary items to indicate on the map shall be collected and identified in the field using aerial photos.

Map symbols and application rules shall be used as agreed to by SDG (see Attachment).

The results shall be inscribed on the two times enlarged aerial photographs for succeeding plotting and compilation works.

5-1 Planning and preparation

Prior to the survey, preliminary study for photo interpretation shall be made to the best possible extent fully utilizing aerial photos and other available materials.

Administrative boundaries and place names, etc. necessary for annotation on the map shall be based on the information to be supplied by SDG.

5-2 Implementation

Following items shall be investigated and/or confirmed in the field.

- Confirmation of the results of pre-interpretation.
- Keys for photo-interpretation of topography and geographical features.
- Items difficult to interpret on the aerial photographs.
- Items necessary for the application of map symbols, such as road, railways, rivers, buildings, specified area, vegetation, etc..
- Collection of materials at local administrative offices.

6. Aerial Triangulation

Based on the ground control point survey data and the scale of 1/60,000 aerial photos, coordinates of pass points and tie points necessary for stereo plotting orientation shall be determined by aerial triangulation.

Pass points and tie points shall be selected at such locations that are adequate for photogrammetric orientation and accurate determination of coordinates on the photographs.

Pass points, tie points and control points as pricked on the diapositives using pricking device shall be measured by stereo comparater or equivalent, and adjustment computation shall be performed using block adjustment program.

Orientation elements of each model on the stereo plotting machine shall also be computed.

The tolerance (discrepancy) for pass points, tie points, and also limits of residuals of ground controls as used for adjustment shall be less than JICA procedural rules.

Layout of control points are as shown on Fig. 4.

7. Stereo Plotting

Based on the results of aerial triangulation and field verification, all items to be indicated on the scale of 1/50,000 topographic maps shall be measured from scale 1/60,000 aerial photos and delineated at 1/50,000 by plotting machine to produce restitution manuscript.

Detailed terrain features and vegetation shall be carefully measured, and also contour lines shall be drawn every 10 meters (mountainous area 20 meters).

Main specifications for stereo plotting are as follows ;

- Stable polyester sheet shall be used for plotting materials.
- Neat lines, grid lines and control points for plotting orientation shall be plotted on the polyester sheet using an automatic coordinategraph.
- Neat lines shall be 15' (longitude) x 15' (latitude)
- Map projection shall be Ghana modified transverse mercator.
- After the absolute orientation of horizontal, the discrepancy between the plotted points and their model points shall not exceed the values specified in the JICA specifications.
- For the absolute orientation of height, vertical controls pricked on the photos shall be used as much as possible for the sake of accuracy of height in the map.
- Stereo plotting shall be executed in accordance with the map symbols and their application rules in the order of linear elements, such as roads, rivers, buildings, vegetation and contour lines.
- Contour lines shall be drawn every 10 meters (20 meters for mountainous area).
- Care must be taken of the representation of micro topography, like hills, plains, forests, seasonal rivers, cultivated lands , etc..
- Density of spot height on the map shall be discussed with SDG.

IX. TENTATIVE WORK PLAN FOR SUCCESSIVE WORK

Following is the work plan covering successive work. It is tentative at this time because it is subject to change depending on the progress of a preceding process or due to unexpected reasons (see Fig.1).

1. Compilation

On the basis of the plotted manuscript, compilation shall be carried out using the results of field verification with the symbols and specifications as agreed between the Study team and SDG.

Main specifications for compilation are as follows;

- For the compilation work, stable synthesized polyester sheet shall be used and the specifications shall be same as the stereo plotting.
- Care must be taken to keep the density of drawn lines uniform and avoid error or omission during compilation work following the rules for map representation.
- If any doubtful point arises during compilation, it shall be noted to clarify it at the time of field completion.
- On the basis of plotted sheet, control point data sheet and materials collected in the field, various kind of data sheets shall be prepared as follows;

- * Compiled manuscript.
- * Annotation data sheet.
- * Road information sheet.
- * Vegetation data sheet.
- * Water information data sheet.
- * Forest information data sheet.
- * Marginal information data sheet.

2. Field Completion

Field completion shall be carried out on the items which are unidentified in the process of plotting and compilation. Also important changes that have happened in the meantime, if any, shall be incorporated and modified.

At the time of the field completion, test printed sample sheet shall be prepared for discussion with SDG to finalize the colors and other matters.

3. Drafting

Based on the original manuscripts, scribing shall be carried out on the stable polyester base for five color separation plates. Map style and symbols shall be those adopted by SDG.

The original maps shall consist of scribed sheets, masking sheets, annotation sheets and marginal information sheets.

Annotation shall be in English (Latin alphabet). Every map sheet to be product in this survey work shall have the following annotation printed at the lower margin the following ;

“This map was prepared jointly by Japan International Cooperation Agency (JICA) under the Japanese Government Technical Cooperation Programme and Ministry of Land and Forestry, Survey Department of the Government of Ghana”

4. Printing

Printing plates shall be prepared by photo lithography using 1/50,000 scribing negatives. Color applied for printing shall be five, and 1,000 final copies shall be printed for each map sheet.

Specification of printing paper to be used shall be determined through talks with SDG.

5. Recommendations

Recommendations for improvement of management and operation systems and maintenance system of control points and maps shall be provided.

6. Work Flow

The flow of the entire work is schematically shown on the Fig. 2.

TABLE 3. MEMBERS OF STUDY TEAM AND THEIR ASSIGNMENT IN THE THIRD YEAR

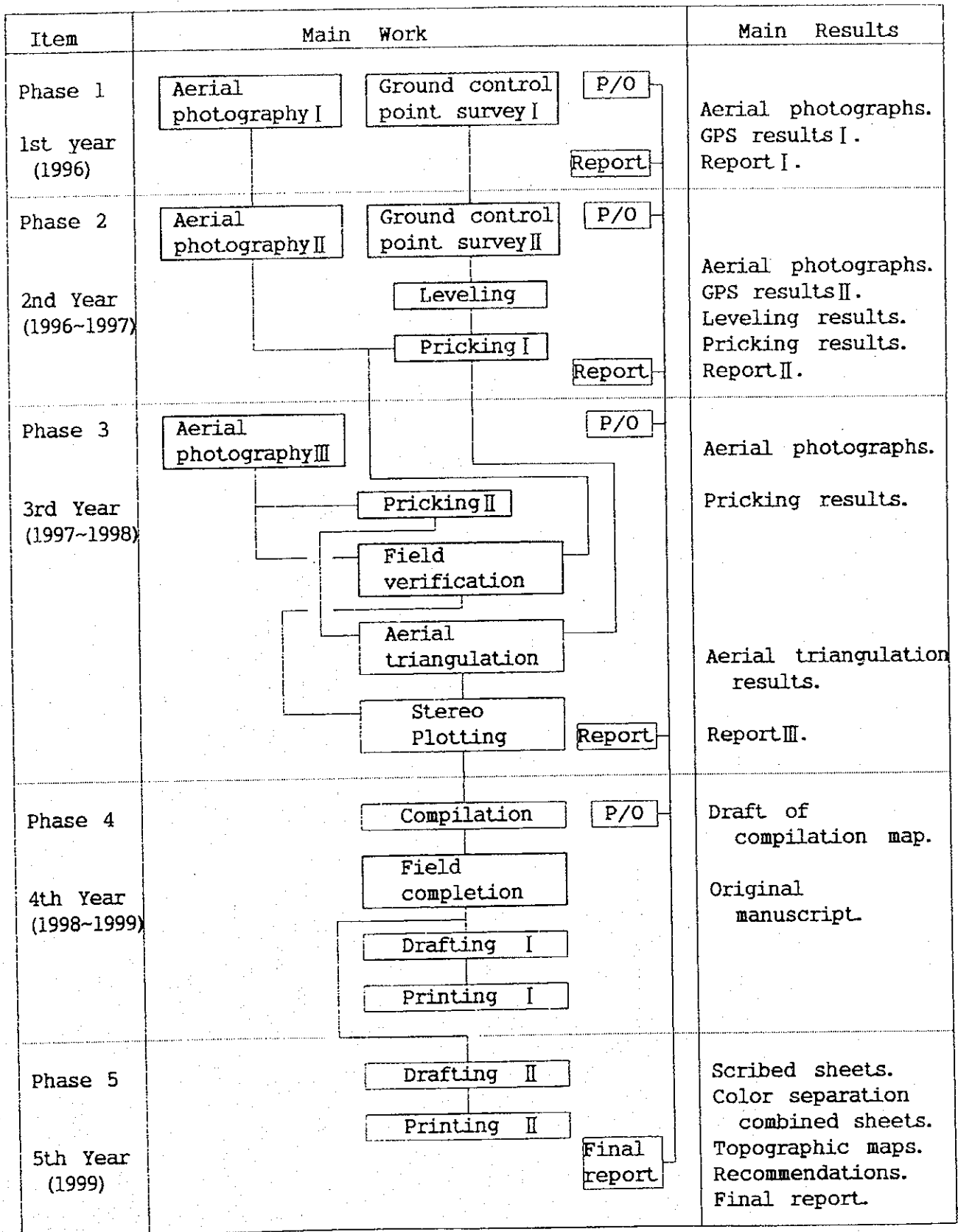
NAME	ASSIGNMENT	DURATION	CONTENTS
Tokihiko KAMINISHI	LEADER	28 th Sep.'97 ~ 9 th Oct.'97 25 th Nov.'97 ~ 4 th Dec.'97 1 st Mar.'98 ~ 16 th Mar.'98	1. Total Management 2. General Discussion
Koichi MIKI	SUBLEADER	28 th Sep.'97 ~ 12 th Nov.'97 6 th Jan.'98 ~ 16 th Mar.'98	1. Sub Management 2. General Discussion 3. Assistance of Leader 4. General Supervision
Kozo OKUMURA	MAPPING PLANNER	28 th Sep.'97 ~ 12 th Nov.'97 6 th Jan.'98 ~ 16 th Mar.'98	1. Fundamental Map Planning 2. General Coordination 3. Reporting
Hitoshi YOSHIDA	CHIEF SURVEYOR	28 th Sep.'97 ~ 12 th Nov.'97 6 th Jan.'98 ~ 16 th Mar.'98	1. Planning of Implementation 2. Supervision of Works 3. Coordination of Works 4. Quality Checking
Daikichi NAKAJIMA	PHOTOGRAPHER	6 th Oct.'97 ~ 4 th Dec.'97	1. Inspecting of Photograph & Photo Process
Shinpei ISHIWATA	MECHANICAL ENGINEER	28 th Sep.'97 ~ 12 th Nov.'97 6 th Jan.'98 ~ 16 th Mar.'98	1. Management of Vehicle 2. Maintenance of Vehicle
Masahiko OHASHI	SURVEYOR	28 th Sep.'97 ~ 12 th Nov.'97	1. Field Verification 2. Pricking
Kouzou ASANO		6 th Jan.'98 ~ 16 th Mar.'98	
Tuyoshi YAMASAKI		'	
Michio SATOJI		'	
Masaru TERADA		'	
Kensuke KIMURA		'	
Sanenori OHNAKA		6 th Jan.'98 ~ 16 th Mar.'98	
Tsuyosi NEMOTO		'	
Hideaki SAKAI	COORDINATOR	28 th Sep.'97 ~ 12 th Oct.'97 2 nd Mar.'98 ~ 16 th Mar.'98	1. Coordination

FIGURE 1 TENTATIVE WORKING SCHEDULE

YEAR ITEMS MONTH	1ST YEAR 1996			2ND YEAR 1996 - 1997			3RD YEAR 1997 - 1998			4TH YEAR 1998 - 1999			5TH YEAR 1999											
	2	3		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	
GROUND CONTROL SURVEY																								
AERIAL PHOTOGRAPHY																								
LEVELLING SURVEY																								
PRICKING SURVEY																								
AERIAL TRIANGULATION																								
FIELD IDENTIFICATION																								
PLOTTING																								
COMPILATION																								
FIELD COMPLETION																								
DRAFTING																								
MAP-REPRODUCTION																								
REPORT																								
INSPECTION																								
DELIVERY OF GOODS																								

LEGEND — PREPARATION  FIELD SURVEY  WORK IN JAPAN

Fig. 2 Flowchart for Production of Topographic Map



Remarks: Field works in Ghana. Works in Japan.

Fig. 3 PHOTO INDEX MAP

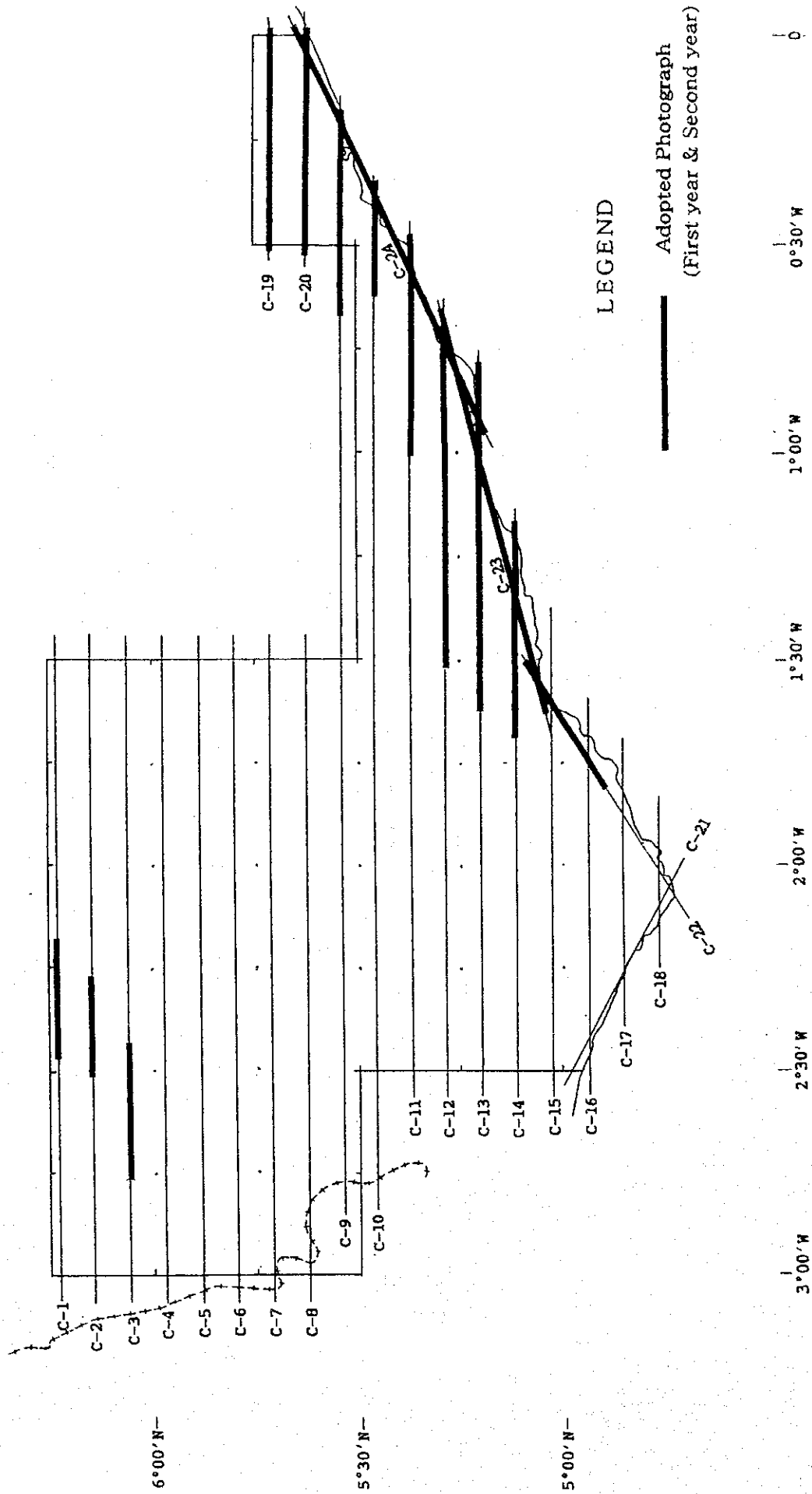


Fig. 4 Aerial Triangulation Control Points

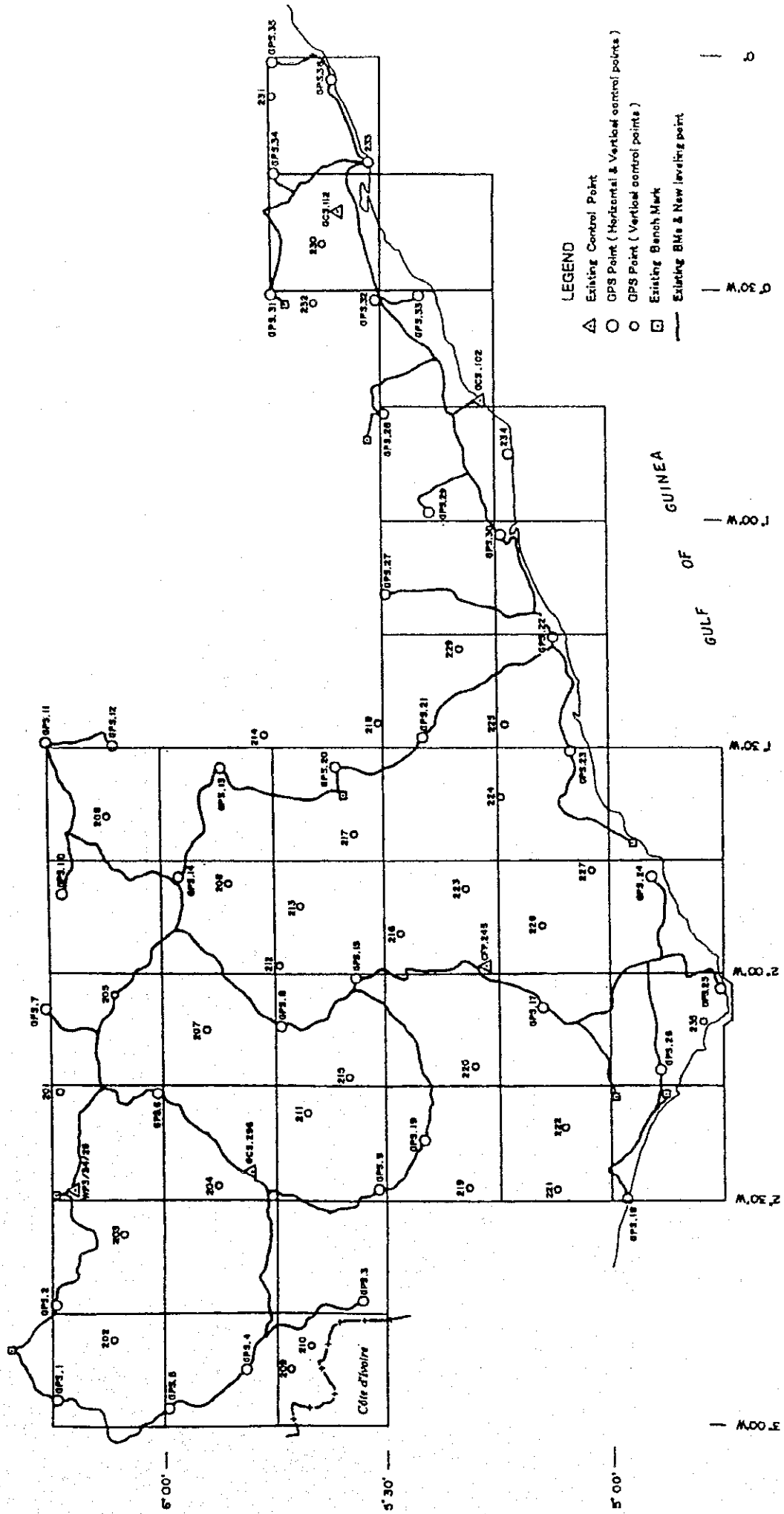
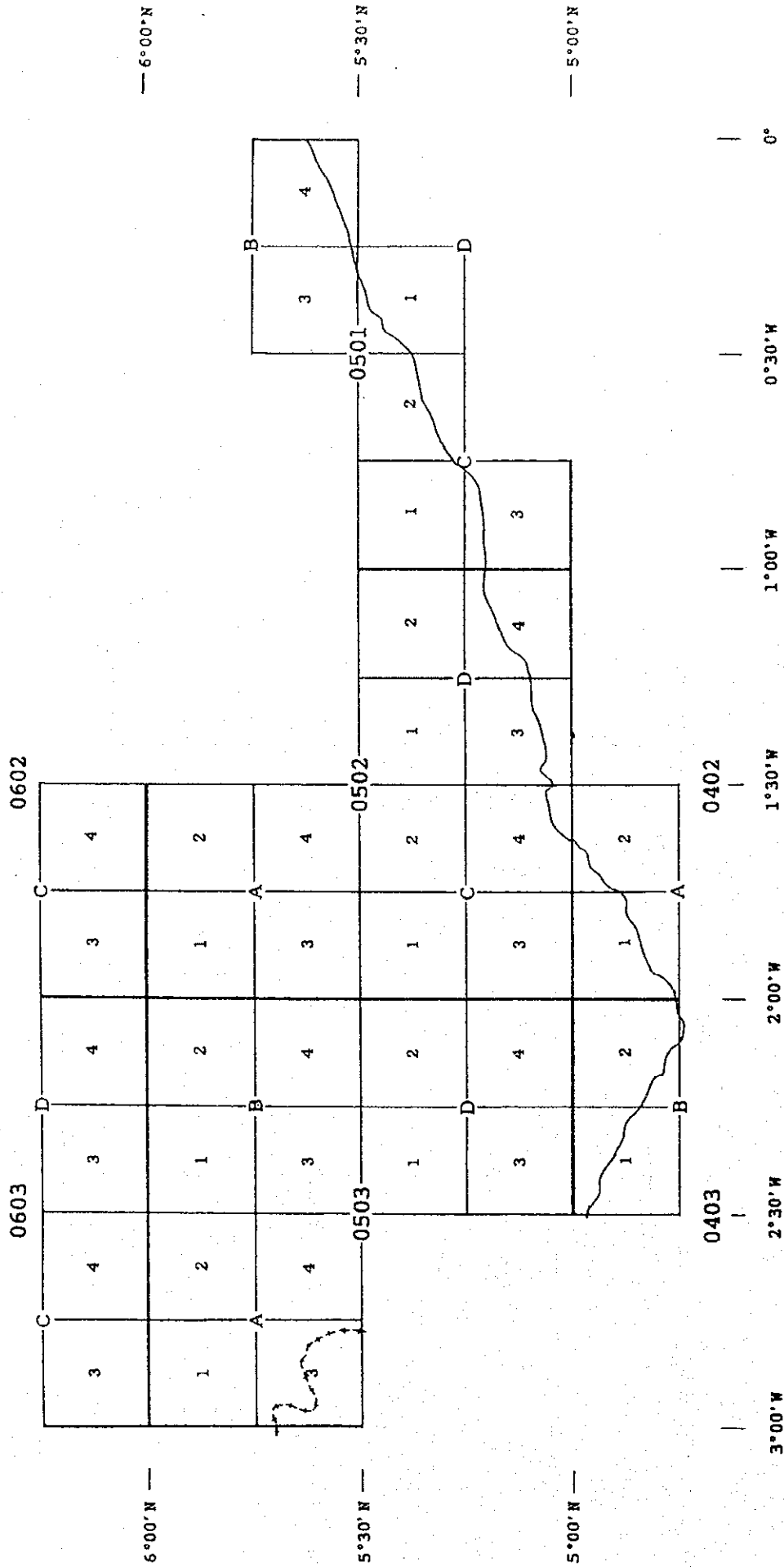


Fig. 5 SHEET INDEX MAP



ATTACHMENT

MAP SYMBOLS AND APPLICATION RULES


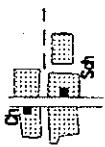



- REVISED -

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現調記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
8		Railway (Standard gauge): (a) double line (b) single line (c) Discontinued railway 鉄道 (標準軌道): (a) 複線 (b) 単線 (c) 廃線		(a) (b) (c)	Black 黒				(c) Discontinued railway shall be annotated as "Abandoned" (shall not apply annotation to temporary closed railway) (c) 廃線は Abandoned と注記を要する (運行休止中の路線には Abandoned の注記はしない)
10		Cable ways, Conveyer belt 索道, ベルトコンベア			Black 黒				
11		Power transmission line 送電線		(a) (b) (c)	Black 黒				(a) Apply symbol to 1 or 2 line running parallel with each other. (b) Apply symbol to 3 line running parallel with each other. (c) Apply symbol to 4 line running parallel with each other. (a) 1本、又は2本の送電線が平行の場合に適用する (b) 3本の送電線が平行の場合に適用する (c) 4本の送電線が平行の場合に適用する (送電線相互の間隔は考慮しない)
12		Telephone line 電話線			Black 黒				
13		Boundary: International 境界: 国界			Black Red-screen 黒 赤網				* SDG shall draw international border on the map (manuscript) * Red screen shall be put in the Ghana side. * 現地補測時に測量局が境界線図に表示する * 網点はガーナ側に表示する
14		Boundary: Regional 境界: 区域界			Black 黒				* SDG shall draw boundary on the map (manuscript) if necessary.
15		Boundary: District (Local council) 境界: 区界			Black 黒				
16		Boundary: City, Municipal or town 境界: 市界, 自治体界, 町界			Black 黒				* 現地補測時に測量局が境界線図に表示する
17		Boundary: National park, Forest Reserve, Hunting area, Other boundaries 境界: 国立公園, 自然保護区, 狩猟区, その他特定境界			Green screen 緑網				* SDG shall draw boundary on the map (manuscript). * Annotation shall be put in the center of its area. * 現地補測時に測量局が境界線図に表示する * 中等位置に国立公園, 保護区等の注記を要する
19		Cut line 伐開線 (防火線)			Black 黒				* Annotation shall fittingly be put along the lines. * 適宜の位置に注記する
21		Fence Concrete or block wall 塙 コンクリート塙			Black 黒				* Apply symbol to fence or wall which is more than 500m long. * 長さが500m以上の塙及び塙に適用する

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

note:A.A. (Abbreviated Annotation)

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現地記号	PLOTTING 図化記号	COMPILATION 編纂記号	APPLICATION RULES 適用規定
	2 2	City, Town 市街			black screen 7%				* If there is any prominent building in the congested (generalized) area, it shall be indicated (protted) as such. * 総構地帯内に記号等を表示すべき建物がある場合、当該建物が独立建物を表示できる場合は建物を表示し、その建物が小さい場合は+で真位置を表示する
	2 3	Village 村落			black screen 9%				*ditto. * 総構地帯内に記号等を表示すべき建物がある場合は、上記に準ずる
	2 4	(a) Compound & Huts (b) Prominent Building (a) 小屋 (村本部の建物) (b) 著名な建物		(a)  (b) 	black 黒				(a) Apply symbol to soil/mud house etc. (b) Apply symbol to Concrete and block house etc. (a) 土壁等の建物の適用する (b) コンクリート及びブロック建築の建物の適用する
	2 5	Market 市場		Mkt	black 黒				*Big market shall be indicated with building. If building can't be drawn, A.A. shall be indicated on the center. * 大規模なものを表示し、独立建物を表示できない場合はその地域の中等位置に表示する
	2 6	(a) Hospital, (b) Clinic (a) 病院, (b) 医院		(a) + Hosp (b) + Clin	black 黒				(a) If building can be drawn, cross symbol shan't be indicated. (b) Apply A.A. also to the prominent clinic. (a) 独立建物が表示できる場合は+を表示しない (b) 著名なものを表示する
	2 7	(a) Hotel, (b) School (c) Police Station (d) Court House (e) Barrier (a) 料亭 (b) 学校 (c) 警察署 (d) 裁判所 (e) 検問所		(a) H + Sch (b) + PS + Ct H (c) + Hosp + Clin (d) + Hosp + Ct H (e) Barrier	black 黒				(a) Apply A.A. to the prominent hotel only. (b) University, polytechnic, college, institute etc shall be indicated with building and its full name shall be annotated in principle. (b) .. (d) If building can be drawn, cross symbol shan't be indicated. (e) Barrier shall be annotated as "Barrier". (a) 著名なホテルに適用する (b) 総合大学、技術大学、専科大学、研究所等は建物を表示し、原則として注記する (b) .. (d) 独立建物が表示できる場合は+を表示しない (e) 検問所は "Barrier" と注記する
	27-1	Military Station Barracks (a) 軍施設 (b) 兵舎		(a) HS (b) Bks	black 黒				(a) Apply A.A. also to the big chapel. (a) (b) If building can be drawn, cross symbol shan't be indicated. (c) Actual position shall be center of base line. Symbol direction shall be set at right angle to the road. (a) 大きいChapel (礼拝堂) は教会の記号を適用する (a) (b) 独立建物が表示できる場合は+を表示しない (c) 聖地(聖子下宿中央)を表示し、道路に対し直角に表示する (記号の向きは不定)
	2 8	(a) Church, (b) Mission (c) Temple (a) 教会, (b) 伝道本部 (c) 寺院		(a) + Ch (b) + M (c)  1.5	black 黒				(a) Apply A.A. also to the big chapel. (a) (b) If building can be drawn, cross symbol shan't be indicated. (c) Actual position shall be center of base line. Symbol direction shall be set at right angle to the road. (a) 大きいChapel (礼拝堂) は教会の記号を適用する (a) (b) 独立建物が表示できる場合は+を表示しない (c) 聖地(聖子下宿中央)を表示し、道路に対し直角に表示する (記号の向きは不定)

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現物記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
	29	Silos サイロ			black 黒				
	31	Mosque イスラム教寺院			black 黒				*Actual position shall be bottom of black circle. Symbol direction shall be set at right angle to the road. * 墓位置 (記号の向きは不定)
	32	Cemetery 墓			black 黒				*Large one: indicate limits with black solid line. *Small one: indicate its position by cross symbol. * 大規模な墓は黒を基線として表示し、小規模な場合は真位置を示す
	33	(a) Post Office (b) Telecommunication office (c) Post & Telecommunication office (a) 郵便局 (b) 電話局 (c) 郵便・電話局			black 黒				(a) .. (c) Indicate its position by cross symbol, if building can't be drawn. * Shall apply (c) to common use of post & telecommunication. * 郵便局と電話局を兼ねている場合は(c)を適用する
	34	Electricity substation 変電所			black 黒				
	36	Sports ground 競技場			black 黒				*Very big one shall be drawn to actual size.
	37	Shed 集荷場			black 黒				*この記号より大きい場合は実形で表示する
	38	(a) Light house (b) Navigation beacon (a) 灯台 (b) 航路標識			black 黒				*shall apply annotation to storage/yard for Cocoa Coffee, etc. * ココア, コーヒー等農産物の集荷場、貯蔵所に適用する
	39	(a) Fort, (b) Castle (c) Palace (a) 砦 (b) 城 (c) 宮殿			black 黒				* shall not apply (a) & (b) to present use. (c) Very big palace shall be annotated with full name. (a) (b) 現物は別の目的で使用されている場合でも、これを適用する (c) 大きい場合は注記する
	40	Tower 高塔			black 黒				*shall apply symbol to clock tower etc. * 時計台のような高塔に適用する
	41	(a) Ruin, (b) Ancient wall (c) Ancient site (a) 遺跡 (b) 城壁 (c) 史跡			black 黒				

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現視記号	PLOTTING 図化記号	COMPILED 編集記号	APPLICATION RULES 適用規定
	4 2	(a) Jetty, (b) Quay (c) Wharf (a) 防波堤, (b) 埠頭 (c) 浮橋		(a) 0.3 (b) 0.6 (c) 1.8 	black 黒				
	4 3	Radio transmission station ラジオ送信所		2.0 1.3 	black 黒				*shall apply symbol also to TV/telecommunication tower etc. *テレビ送信塔, マイクロウェーブ, 無線中継塔等にも適用する
	4 4	Mine 鉱山		2.0 2.0 	black 黒				
	4 6	(a) Aerodrome, (b) Airstrip (a) 小型空港, (b) 滑走路		(a) 3.5 (b)	black 黒				*International airport shall be annotated with full name. *国際空港はフルネームを注記し、記号は表示しない
	4 7	Geodetic point 測地基準点		CGS-1Z 1.2 1.3 	black 黒				*shall indicate symbol with the name and number. (no elevation) *New GPS points shall not be indicated. *三角点には標高を表示せず、点名、点番号を表示する
	4 8	(a) Spot Height (b) Photo Principal Points (a) 標高点 (b) 写真主点		(a) 8.5 1.3 4.0 (b) C-25 15 	black 黒				(b) Line number shall be indicated on both ends of each map sheet. (b) 写真主点のコーン番号, 写真番号は各コーンの両端の主点のみに表示する
	4 9	Bench mark 水準点		2.0 FM 	black 黒				*shall indicate fundamental bench mark only. (no elevation and no damaged bench mark) *基準水準点のみ表示し、標高は表示しない (敬称点は表示しない)
	5 0	(a) Contour line (b) Index contour (a) 等高線 (b) 計画線		100 250 200 	brown 茶				
	5 1	(a) Depression (b) Basin, shallow Depression (a) 凹地 (b) 浅い凹地		(a) minimum length 0.5 (b)	brown 茶				
	5 2	Rocky areas: (a) Outcrop Rock (b) Steep slopes (c) Cliffs 岩石地帯: (a) 露岩 (b) 斜面 (c) 断崖		(a) (b) (c)	black 黒				
	5 3	Embankment 堤防		1.0 0.5 	brown 茶				
	5 4	Mine Dump スリ捨て場		minimum length 0.5mm 	brown 茶				


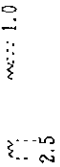
SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現地記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
	5 5	Sand or Mud 砂地又は泥地	内陸と海岸の砂(67)を区 分するか?		brown 茶				
	5 6	Dunes 砂丘			brown 茶				
	5 7	Quarry 採石場			black 黒				
	6 0	Water courses: (a) Indefinite stream (b) Rapids (c) Waterfall 河川: (a) 不定河川 (d) (e) 滝 (b) (c) 急流			blue Rapide water- fall black 青, 黒				
	6 1	(a) Area liable to flood (b) Marsh or Swamp (a) 浸水し易い地帯 (b) 沼地又は低湿地	浸水し易い地域の調査方 法		blue 青				
	6 2	Trench, Gutter 溝, 用水路(灌溉, 排水用)			Blue 青				
	6 3	(a) Lake, (b) Pond, (c) Dam (a) 湖, (b) 池, (c) ダム			blue bl. scr 青, 黒 黒				*Salt ponds shall be indicated with check embankment and shall be annotated as "Salt Ponds".
	6 3	Salt Ponds 塩田			black 黒				*塩田はせき止め用堤防を表示し、Salt Pondsと注記する
	6 4	Waterhole, Well, Spring (Borehole) 小池, 井戸, 泉 (或は掘穴)			blue 青				
	6 4	Water tower 給水塔			blue screen 青網				

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名 称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現物記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
	6 5	Water pipe 送水管			blue 青				
	6 6	(a) Bridge, (b) Footbridge (c) Culvert, (d) Ford (e) Ferry (a) 橋, (b) 徒歩橋 (c) カルバート, (d) 徒歩所 (e) フェリー			black 黒				(e) shall apply symbol also to train bridge. (b) shall apply symbol to footbridge and bridge upon double lines river on the map. (Excluding small bridge on the single line river on the map) (a) 鉄道橋にも適用する (b) 原則として、2線河川には表示するものとし、歩道橋にも適用する(1線河川には表示しない)
	6 7	Coastline (Sand or mud) 海岸線 (砂文母泥地)			own 茶				
	67-1	Flat Rock (a) Boulder Rock (b) 平らな岩石海岸 岩塊の海岸			Black 黒				
	6 8	Thick Forest (樹木の多い森林)			Green 100% 緑 100%				*Limits shall not be indicated.
	6 9	Light Forest (樹木の少ない森林)			Green- screen % 緑網点 %				
	7 1	Savannah 草原		Non-symbol					*境界は表示しない

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO	NAME 名称	SYMBOL 記号	ENLARGED 拡大図	COLOUR 色	INTERPRETATION 現調記号	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 適用規定
	72	Plantation (農園)			Green screen 緑色網点 7% 緑網点 7%				* Indicate limits with green solid line, and annotate product's name in the center. * 外周を緑の垂線で表示し、コア、ゴム等の種類を中央に注記する
	77	Cultivation (耕地)			black 黒				* Limits shall not be indicated. (Put the symbol in the area suitable) * 植生界は表示しない (範圍内に記号を適宜表示する)

ATTACHMENT

PROGRESS REPORT

OF

THE FIELD WORK OF THE THIRD YEAR (FIRST STAGE)

FOR

TOPOGRAPHIC MAPPING OF SOUTHERN PART

OF

THE REPUBLIC OF GHANA

7th NOVEMBER, 1997

STUDY TEAM

OF

TOPOGRAPHIC MAPPING OF SOUTHERN PART

OF

THE REPUBLIC OF GHANA

JAPAN INTERNATIONAL COOPERATION AGENCY

1. INTRODUCTION

The topographic mapping of the southern part of the Republic of Ghana started in January, 1996, in a five years plan, as a technical cooperation program of JICA.

In compliance with the Scope of Work agreed between the Survey Department of Ghana and JICA on 17th March, 1995, the JICA Study Team arrived in Accra on 29th September, 1997, for implementation of the first stage of third year's field work. After consultation with the SDG, the team set up the field headquarters in Accra for the aerial photography III and a part of field verification work.

Meanwhile Ghana counterparts from the SDG joined the work from time to time.

In accomplishing the field work of first stage of the third year, hereinafter, the summary of the progress of the work is reported.

2. OUT LINE OF THE THIRD YEAR WORK (First Stage)

2-1 Objective

The objective of the Study are : (1) To prepare 1/50,000 topographic map covering an area of approximately 25,500 km² in the southern part of the Republic of Ghana, (2) To transfer technology to the counterparts personnel of SDG through the implementation of the work, and (3) To promote the friendship between Ghana and Japan through the implementation of the Study.

The first stage of third year's work is consisting of the aerial photography III, field verification (in part) and office work.

2-2 Period of Survey Work

Field work

(Aerial photography III)	6 th October,'97	~	6 th December,'97
(Field verification)	28 th September,'97	~	12 th November,'97

2-3 Formation of the Study Team

Leader	Mr. Tokihiko KAMINISHI	28 th Sep.'97	~	9 th Oct.'97
Deputy Leader	Mr. Koichi MIKI	28 th Sep.'97	~	12 th Nov.'97
Mapping Planner	Mr. Kozo OKUMURA		,	
Chief Surveyor	Mr. Hitoshi YOSHIDA		,	

Photographer	Mr. Daikichi NAKAJIMA	6 th Oct.'97	~	4 th Dec.'97
Mechanical Engr.	Mr. Shinpei ISHIWATA	28 th Sep.'97	~	12 th Nov.'97
Surveyor	Mr. Masahiko OHASHI		'	
'	Mr. Kouzou ASANO		'	
'	Mr. Tuyoshi YAMASAKI		'	
'	Mr. Michio SATOJI		'	
'	Mr. Masaru TERADA		'	
'	Mr. Kensuke KIMURA		'	
Coordinator	Mr. Hideaki SAKAI	28 th Sep.'97	~	10 th Oct.'97

2-4 Amount of the Survey Work (Plan and Results)

Progress, until 6thNov.'97, are as follows.

ITEM	ORIGINAL PLAN	RESULTS
Aerial photography III		
Scale	approx. 1/60,000	approx. 1/60,000
Flight length	approx. 2,454 km	approx. 177 km
Photo No.	approx. 490 photos	40 photos
Field verification (in part)	approx. 4,270 km ²	approx. 4,270 km ²

2-5 Counterparts of SDG

Headquarters ;

Na Al-haji Iddirisu	Abu	Director of Surveys	Headquarters
Mr. J. Dotse		Asst. Director	Great Accra Region
Mr. Marcus Tabil		Examiner	Examination Section
Mr. K.N.Arku-Lawson		Chief Cartographer	Cartographic Section
Mr. I.Andoh-Kesson		Chief Photogrammetrist	Photogrammetric Sec.
Mr. E.R. Tetteh		Chief Lithographer	Lithographic Section

Field Work ;

Mr. J. Ofori-Boadu		Asst. Staff Surveyor	Great Accra Region
Mr. Jerry Awambigo		Senior Survey Technician	'
Mr. Nii Q. Quartey		'	'

3. FIELD WORK

3-1 Aerial Photography III

Aerial photography was started again after the rainy season. The team contracted with Aircraft Operating Company(Pty) Ltd.(A.O.C., South Africa) same condition as first and second year's for all aerial photography. Unfortunately due to the bad weather condition, until now, little progress was made in aerial photography.

(1) Base for aerial photography

KOTOKA International Airport was used for the base for aerial photography.

(2) Aircraft and Camera

Details of aircraft and camera are as follows :

Aircraft	: CESSNA 404, ZS-KUZ
Aerial Camera	: WILD RC-10, Sag II 2067 Super wide angle lens cone
Navigation equipment	: Garmin 100 GPS

(3) Photographic work

Test flight was made on 10th October, '97 and full scale aerial photography was commenced from 11th October, '97.

(4) Materials of aerial film

Panchromatic film was used for aerial photography, and details are as follows.

Film type : AGFA AVIPHOT PAN 200 PEI & KODAK DOUBLE X

3-2 Photo Processing

(1) Development

The instruments and materials to be used were as follows ;

Developer	: ILFORD PQ UNIVERSAL
Paper	: ILFORD Gr2+3 44M
Film development	: ZEISS REWIND No.111079
Contact printer	: ZEISS KG-30
Drier	: ZEISS TG-24 No.20209

(2) Printing and inspection

After printing and inspection of the aerial photos, reflight was made, in case of necessity.

Items to be inspected were as follows ;

- ① Forward overlap & lateral overlap
- ② Cloud, cloud shadow, and uneven development
- ③ Deviation of flight course
- ④ Halation, Haze, and smoke of field fire, etc.

(3) Film annotation

The form of film annotation and numbering on each frame of aerial photos shall be same as previous study.

(4) Amount of work (until 6th November '97)

Film roll : 1 roll

Available photographs : 40 photos

The list of photographs in this period is shown as follows, and coverage is shown in Fig. 1.

Run No.	Frame No.	Available Photos	Photo No.
C-09	0013 ~ 0023	non	—
'	4847 ~ 4857	4849 ~ 4857	supplementation
C-10	0001 ~ 0011	non	—
'	4859 ~ 4881	4866 ~ 4871	6 photos
C-11	4842 ~ 4843	non	—
'	5061 ~ 5071	5062 ~ 5067	6 photos
C-15	5036 ~ 5060	5051 ~ 5059	9 photos
C-17	5017 ~ 5028	5017 ~ 5021	5 photos
C-18	4883 ~ 4888	4883 ~ 4887	5 photos
C-21	4982 ~ 4994	non	—
'	5030 ~ 5034	non	—
C-22	4890 ~ 4900	4890 ~ 4898	9 photos
'	4971 ~ 4980	4971 ~ 4976	supplementation

3-3 Field verification

Field verification (first stage ; Accra ~ Cape coast) was started by the team

members and SDG counterparts on 2nd of October 1997 in compliance with the map symbols and their application rules.

Confirmation and investigation of various expressions and names specified by map symbols were conducted. The survey results were described on two times enlarged aerial photographs to be used as data for succeeding stereo plotting and compilation work.

(1) Discussion with SDG for Map Symbols

Survey work was started based on the map symbols and their application rules agreed between SDG and JICA study team on 20th Jan.'97. At the meantime of survey work, amendment/modification for map symbols and application rules were discussed continuously between SDG and JICA .

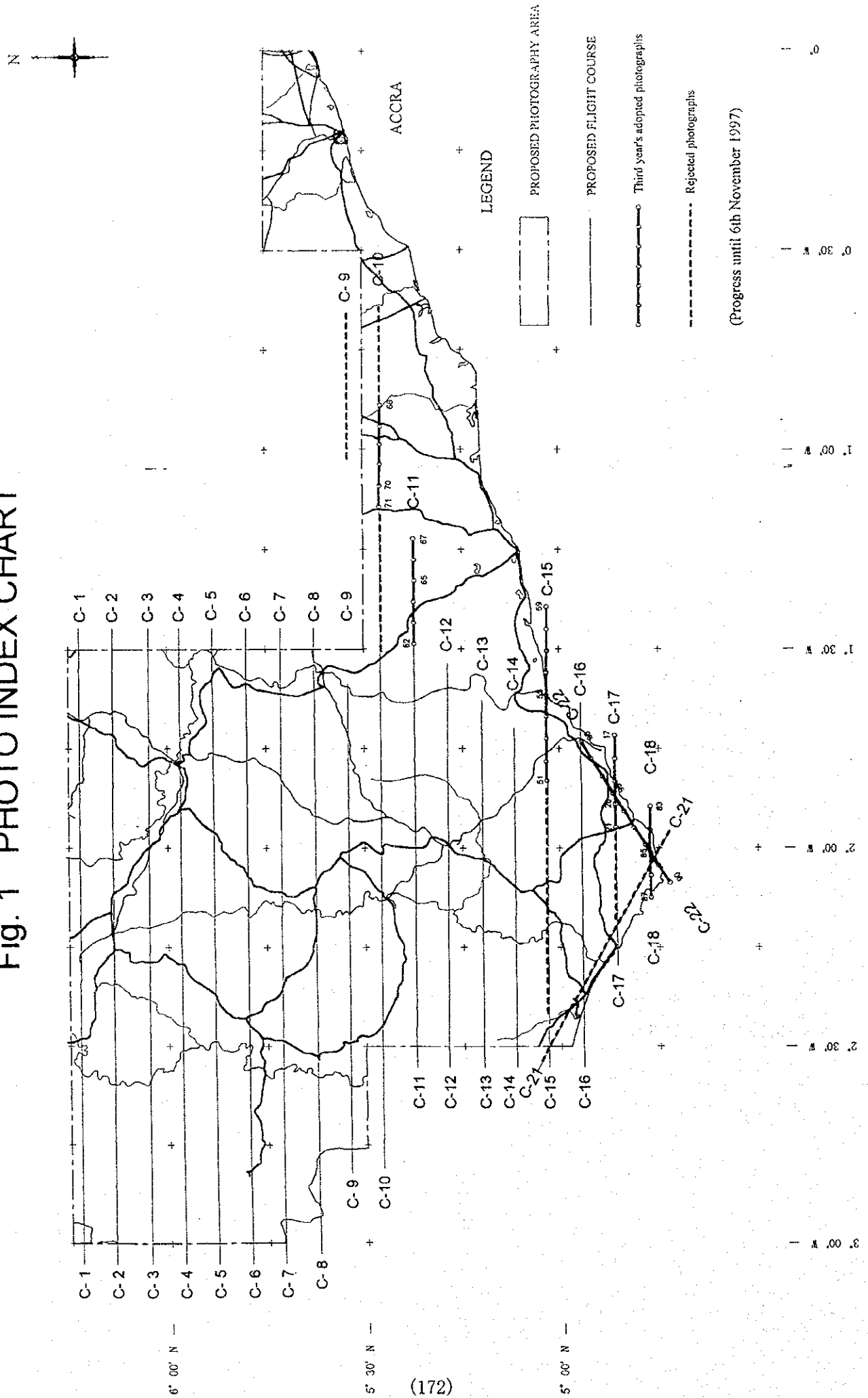
(2) Implementation

Main items verified in the field are as follows, and the results were indicated on the enlarged aerial photographs.

- ① Classification of roads and their attributes.
- ② Public buildings and structures.
- ③ Linear structures (railway, power transmission line, etc.).
- ④ Key for photo-interpretation of vegetation and topographic features.
- ⑤ Collection of toponomy and designation of ground features (village, mountain, river, etc.).
- ⑥ Other necessary items for map representation in accordance with the map symbols and their application rules.

The above progress report covered the period from 28th September, 1997 to 6th November, 1997.

Fig. 1 PHOTO INDEX CHART



ATTACHMENT

(ADDENDUM)

PLAN OF OPERATION

FOR

TOPOGRAPHIC MAPPING OF SOUTHERN PART

OF

THE REPUBLIC OF GHANA

(THIRD YEAR)

FEBRUARY, 1998

JAPAN INTERNATIONAL COOPERATION AGENCY

I. INTRODUCTION

Based on the progress of third year's aerial photography and the additional request from Survey Department of Ghana (SDG) for the digital mapping works, the Japan International Cooperation Agency (JICA) sent a Mission to Ghana in the middle of December 1997, to discuss its feasibility with SDG. And subsequently on December 18th, 1997, the Minutes of Meeting was agreed to between the two governments.

In compliance with the Minutes of Meeting, the survey procedure and time schedule shall be changed and the Plan of Operation (P/O) for the third year's latter work is proposed as follows.

II. DETAILS OF THE THIRD YEAR'S LATTER WORK

1. Additional Ground Control Point Survey

Based on the aerial photography progress and the aerial triangulation's new amount, four (4) additional horizontal control points shall be surveyed to keep aerial triangulation accuracy.

Observation shall be made simultaneously via plural units of GPS equipment to form an observation network connected to Phase 1 and 2 new control points. Observation, computation, allowable errors, etc., shall be the same as in Phase 1 & 2 work procedure.

2. Pricking (continuation)

Control point pricking necessary for the third year's new photographed and aerial triangulation area shall be performed using enlarged photos in the same manner as previous work procedure. Additional pricking work volumes are as follows;

Horizontal & vertical control 20 points (GPS & Existing control)

Vertical control points 230 km (leveling points)

3. Field Verification (West zone)

In compliance with the map symbol's specifications, necessary items to indicate on the map shall be collected and identified in the field under the same specifications as for the former part of work (East zone). The work volume

shall be 6,830 km², and the total volume including the former part of work shall be 11,100 km² (20 sheets).

4. Aerial Triangulation

Based on the ground control point survey data and the scale of 1/60,000 aerial photos, coordinates of pass points and tie points necessary for stereo plotting orientation shall be determined by aerial triangulation.

Pass points and tie points shall be selected at such locations that are adequate for photogrammetric orientation and accurate determination of coordinates on the photographs.

Pass points, tie points and control points as pricked on the diapositives using pricking device shall be measured by stereo comparater or equivalent, and adjustment computation shall be performed using the block adjustment program.

Orientation elements of each model on the stereo plotting machine shall also be computed.

The tolerance (discrepancy) for pass points, tie points, and also limits of residuals of ground controls as used for adjustment shall be less than the JICA procedural rules.

Aerial triangulation work volumes are as follows;

- East zone 147 models
- West zone 176 models. Total 323 models (for 20 sheets mapping)

5. Digital Stereo Mapping

Based on the results of aerial triangulation and field verification, all items to be indicated on the scale of 1/50,000 topographic maps shall be digitized using 1/60,000 scale aerial photos and analytical stereo plotters.

Detailed terrain features and vegetation shall be carefully measured, and contour lines shall be measured every 10 meters. Main specifications for digital stereo measurement are as follows ;

- Neat lines shall be 15' (longitude) x 15' (latitude)
- Map projection shall be Ghana modified transverse mercator.
- After the absolute orientation of horizontal, the discrepancy between aerial triangulation pass point's coordinates and their model coordinates shall not exceed values as specified in the JICA specifications.
- For the absolute orientation of height, vertical controls pricked on the

photos shall be used as much as possible for the sake of accuracy of height in the map.

- Digital stereo measurement shall be executed basically in accordance with the SDG's map symbols and their application rules in the order of linear elements, such as roads, rivers, buildings, vegetation and contour lines.
- Contour lines shall be measured every 10 meters.
- Care must be taken of the representation of micro topography, like hills, plains, forests, seasonal rivers, cultivated lands, etc..
- Density of spot heights on the map shall be 5 ~ 7 cm on the map.

6. Topological Data Structure

Based on the Ghana Environmental Resource Management Project (GERMP) code table and SDG's map symbols & application rules, JICA study team produced tentative new code as attached. These new code application rules shall be discussed with SDG and JICA study team to finalize. (See Appendix)

7. SPOT Image Production

The existing SPOT images shall be prepared for the succeeding updating work for the area 1/60,000 scale aerial photographs did not fully cover. (approx. 14,400 km², 20 sheets).

Printing photo scale shall be 1/30,000 ~ 1/40,000 , or an appropriate the field verification work and so on.

8. Time Schedule

The field survey of third year's latter part of work and members are as shown in Table-1, and the time schedule including subsequent 4th and 5th fiscal year's work are as shown in Fig.-1.

TABLE 1. MEMBERS OF STUDY TEAM AND THEIR ASSIGNMENT IN THE THIRD YEAR (LATTER)

NAME	ASSIGNMENT	DURATION	CONTENTS
Tokihiko KAMINISHI	LEADER	3 rd Mar.'98 ~ 18 th Mar.'98	1. Total Management 2. General Discussion
Koichi MIKI	SUBLEADER	1 st Feb.'98 ~ 18 th Mar.'98	1. Sub Management 2. General Discussion 3. General Supervision
Kozo OKUMURA	MAPPING PLANNER	1 st Feb.'98 ~ 18 th Mar.'98	1. Fundamental Map Planning 2. General Coordination 3. Reporting
Hitoshi YOSHIDA	CHIEF SURVEYOR	1 st Feb.'98 ~ 18 th Mar.'98	1. Planning of Implementation 2. Supervision of Works 3. Quality Checking
Fujio ITO	D/M PLANNER	1 st Feb.'98 ~ 15 th Feb.'98	1. Digital Mapping Data Discussion & Design
Shinpei ISHIWATA	MECHANICAL ENGINEER	1 st Feb.'98 ~ 18 th Mar.'98	1. Management of Vehicle 2. Maintenance of Vehicle
Masahiko OHASHI	SURVEYOR	1 st Feb.'98 ~ 18 th Mar.'98	1. Ground Control Survey (GPS) 2. Pricking 3. Field Verification
Kouzou ASANO	"	"	
Tuyoshi YAMASAKI	"	"	
Michio SATOJI	"	"	
Minori OHNAKA	"	"	
Masaru TERADA	"	"	
Takesi NEMOTO	"	"	
Masaaki MIZUOCHI	"	"	
Hideaki SAKAI	COORDINATOR	4 th Mar.'98 ~ 18 th Mar.'98	1. Coordination

Fig. 1 REVISED TENTATIVE WORKING SCHEDULE

YEAR MONTH	1ST YEAR 1996			2ND YEAR 1996 - 1997			3RD YEAR 1997 - 1998			4TH YEAR 1998 - 1999			5TH YEAR 1999 - 2000																	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
GROUND CONTROL SURVEY																														
AERIAL PHOTOGRAPHY																														
LEVELING SURVEY																														
CHUCKING SURVEY																														
AERIAL TRIANGULATION																														
FIELD VERIFICATION																														
SPOT IMAGE PRODUCTION																														
SPOT IMAGE PRE INTERPRETATION																														
ADDITIONAL PHOTOGRAPHY																														
STEREO PLOTTING																														
EXISTING MAP/DATA REVISION																														
DIGITAL COMPILATION																														
FIELD COMPLETION																														
DATA REVISION																														
ORIGINAL MAP OUT PUT																														
MAP PRINTING																														
REPORT																														
INSPECTION																														
DELIVERY OF GOODS																														

LEGEND
 ----- PREPARATION
 ▨ FIELD SURVEY
 ▩ WORK IN JAPAN

Fig. 2 PHOTO INDEX CHART

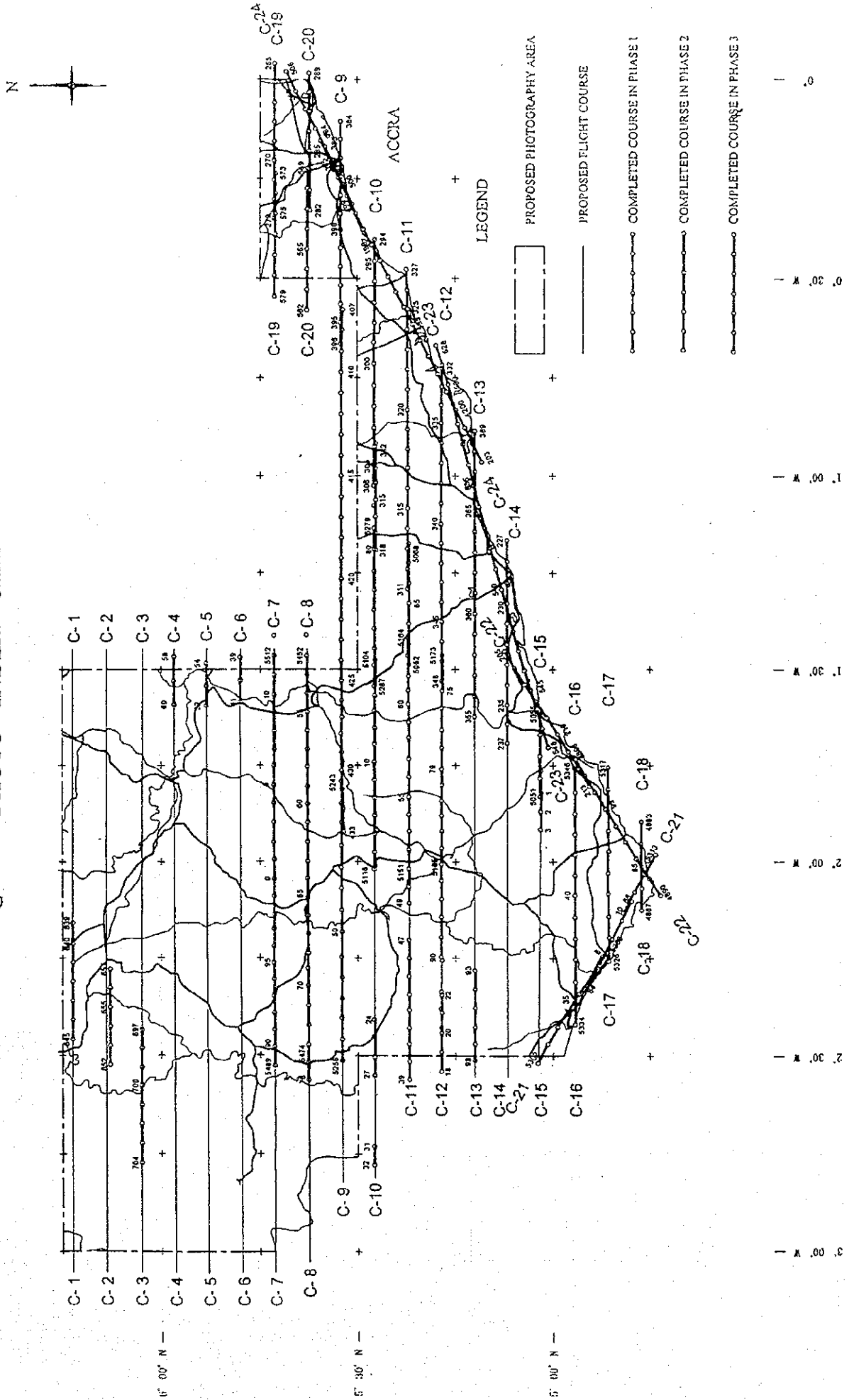
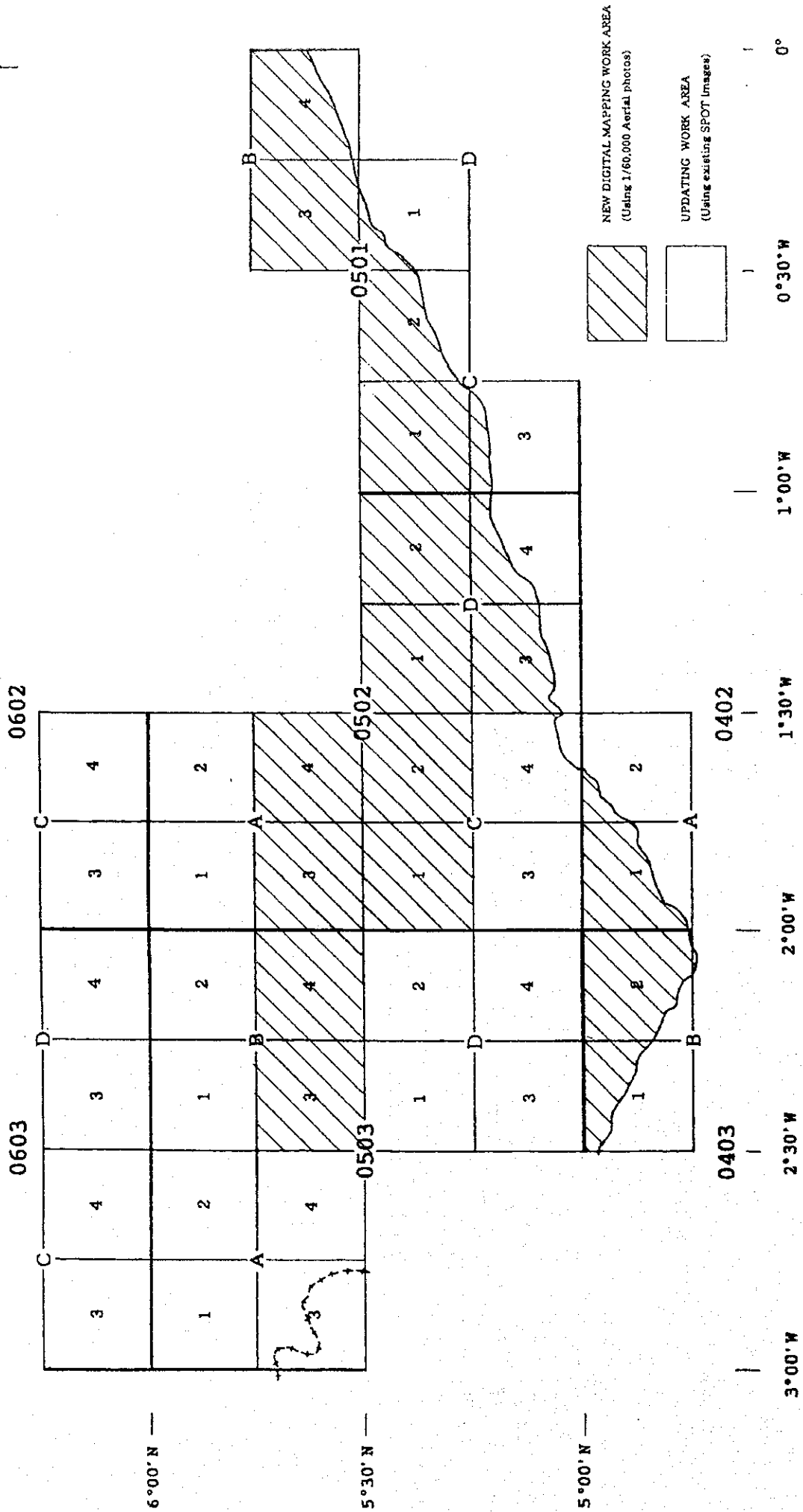


Fig. 3 TOPOGRAPHIC MAPPING AREA



APPENDIX

CODE TABLE FOR THE TOPOGRAPHIC MAPPING OF
SOUTHERN PART OF THE REPUBLIC OF GHANA

-DRAFT-

GHANA

(new code X1XX)

Layer	Feature	Code	Name	名称	No of Symbol	Attributes	Remarks
01 Cult-poly	Line	2006	City, Town	市街	22		
01 Cult-poly	Centroid	2051	City, Town	市街	22		old code-2006,2051
01 Cult-poly	Line	2121	Village	村落	23		
01 Cult-poly	Centroid	2122	Village	村落	23		
01 Cult-poly	Centroid	3101	Mine Dump (Mineral Working Centroid?)	ズリ捨て場	54		
01 Cult-poly	Line	3102	Mine Dump (Mineral Working Area?)	ズリ捨て場	54		
01 Cult-poly	Line	3007	Quarry(Line)	採石場	57		Line→Poly
01 Cult-poly	Centroid	3103	Quarry(Centroid)	採石場	57		
02 Cultural	Point	1001	Waterhole,Well, Spring (Borehaole)	小池、井戸、泉(試掘穴)	64		
02 Cultural	Point	1028	Water tower (works)	給水塔	64		
02 Cultural	Line	3104	Embankment	堤防	53		
02 Cultural	Point	2001	Navigation beacon	航路標識	38(b)		
02 Cultural	Point	2003	Compound & Huts	小屋	24(a)		Symbol(small circle)
02 Cultural	Point	2004	Prominent Building	著名な建物	24(b)		Symbol(small square)
02 Cultural	Point	2008	Church	教会	28(a)		
02 Cultural	Point	2009	Court House	裁判所	27(d)		
02 Cultural	Point	2012	Hospital	病院	26(a)		
02 Cultural	Point	2015	Market	市場	25		
02 Cultural	Point	2016	Barracks	兵舎	27-1(b)		
02 Cultural	Point	2019	Mosque	イスラム寺院	31		
02 Cultural	Point	2020	Police Station	警察署	27(c)		
02 Cultural	Point	2021	Post Office	郵便局	33(a)		
02 Cultural	Point	2022	Station	鉄道駅	8		
02 Cultural	Point	2024	Hotel	ホテル	27(a)		
02 Cultural	Point	2025	School	学校	27(b)		
02 Cultural	Point	2037	Clinic	医院	26(b)		
02 Cultural	Point	2043	Cemetery	墓	32		
02 Cultural	Point	2101	Barrier	検問所	27(e)		
02 Cultural	Point	2102	Military Station	軍施設	27-1(a)		
02 Cultural	Point	2103	Mission	伝道本部	28(b)		
02 Cultural	Point	2104	Temple	寺院	28(c)		

02 Cultural	Point	2105	Silo	サイロ	29		
02 Cultural	Point	2106	Telecommunication Office	電話局	33(b)		
02 Cultural	Point	2107	Post & Telecommunication Office	郵便・電話局	33(c)		
02 Cultural	Point	2108	Electric substation	変電所	34		
02 Cultural	Point	2109	Sports ground	競技場	36	(Angle)	
02 Cultural	Point	2110	Shed	集荷場	37		
02 Cultural	Point	2111	Light House	灯台	38(a)		
02 Cultural	Point	2112	Fort	砦	39(a)		
02 Cultural	Point	2113	Castle	城	39(b)		
02 Cultural	Point	2114	Palace	宮殿	39(c)		
02 Cultural	Point	2115	Tower	高塔	40		
02 Cultural	Point	2116	Ruin	遺跡	41(a)		
02 Cultural	Point	2117	Ancient site	史跡	41(c)		
02 Cultural	Point	2118	Radio transmission station	ラジオ送信所	43		
02 Cultural	Point	2119	Aerodrome	小型空港	46(a)		
02 Cultural	Point	2120	Aerodrome	国際空港	46(a)	Name	
02 Cultural	Line	3002	Cut line	伐開線	19		
02 Cultural	Point	3004	Mine	鉱山	44		
02 Cultural	Line	3105	Cable ways, Conveyor belt	索道、ベルトコンベヤー	10		
02 Cultural	Line	3106	Fence , Concrete or block wall	柵、塀	21		
02 Cultural	Line	3107	Ancient wall	城壁	41(b)		
02 Cultural	Line	3108	Jetty	防波堤	42(a)		
02 Cultural	Line	3109	Quay	埠頭	42(b)		
02 Cultural	Line	3110	Wharf	浮き棧橋	42(c)		
02 Cultural	Line	3111	Sports ground (to Scale)	競技場	36		
02 Cultural	Line	3112	Airstep	滑走路	46(b)		
02 Cultural	Point	7002	Photo Principal Points	写真主点	48(b)	Course & No	
03 Forest	Line	4006	Boundary : Forest Reserve	保護林	17		
03 Forest	Centroid	4021	Boundary : Forest Reserve	保護林	17		
04 Hydrog-Poly	Line	1006	Area liable to flood	浸水しやすい地域	61(a)		
04 Hydrog-Poly	Centroid	1007	Area liable to flood	浸水しやすい地域	61(a)		
04 Hydrog-Poly	Centroid	1009	Lake (Centroid)	湖	63(a)		
04 Hydrog-Poly	Line	1010	Marsh or Swamp	沼地又は低湿地	61(b)		
04 Hydrog-Poly	Centroid	1011	Marsh or Swamp (Centroid)	沼地又は低湿地	61(b)		
04 Hydrog-Poly	Line	1014	Sand or Mud (Flats)	砂地又は泥地	55		
04 Hydrog-Poly	Centroid	1015	Sand or Mud (Centroid)	砂地又は泥地	55		

04 Hydrog-Poly	Line	1016	Lake (Shoreline)	湖	63(a)		
04 Hydrog-Poly	Line	1023	Water courses(Line)	2条河川	60		
04 Hydrog-Poly	Line	1042	Pond	池	63(b)		
04 Hydrog-Poly	Centroid	1101	Dunes (Centroid)	砂丘	56		
04 Hydrog-Poly	Line	1102	Dunes (Area)	砂丘	56		Line→Poly
04 Hydrog-Poly	Centroid	1103	Water courses(centroid)	2条河川	60		
04 Hydrog-Poly	Centroid	1104	Pond(Centroid)	池	63(b)		
04 Hydrog-Poly	Line	2034	Salt Ponds	塩田	63'		
04 Hydrog-Poly	Centroid	2044	Salt Ponds (Centroid)	塩田	63'		
05 Hydrographic	Line	1018	Coastline	海岸線	67		
05 Hydrographic	Line	1024	Water courses(indefinite streams)	不定河川	60(a)		
05 Hydrographic	Line	1105	Trench,Gutter	溝、用水路	62		
05 Hydrographic	Line	1106	Dam	ダム	63(c)		
06 Hypsographic	Line	8001	Approximate Index Contour	不確定等高線	50(a)	elevation	
06 Hypsographic	Line	8002	Approximate Intermediate Contour	不確定計曲線	50(b)	elevation	
06 Hypsographic	Line	8004	Depression index Contour	凹地	51(a)	elevation(direction)	
06 Hypsographic	Line	8005	Depression intermediate contour	凹地計曲線	51(a)	elevation(direction)	
06 Hypsographic	Line	8006	Index contour	計曲線	50(b)	elevation	
06 Hypsographic	Line	8007	Contour line	等高線	50(a)	elevation	
06 Hypsographic	Point	8008	Spot Height	標高点	48(a)	elevation	
06 Hypsographic	Point	8101	Geodetic point (Triangle)	三角点	47	elevation,Name,No	
06 Hypsographic	Point	8102	Geodetic point	測地基準点	47	elevation	
06 Hypsographic	Point	8103	Bench mark	基準水準点	49	elevation	
06 Hypsographic	Line	8104	Basin,shallow Depression	浅い凹地	51(b)	elevation(direction)	
07 Landform	line	1012	Water courses Rapids	急流(1条)	60(b)		
07 Landform	line	1021	Waterfall	滝	60(d)		
07 Landform	line	3001	Cliffs	断崖	52(c)	(direction)	
07 Landform	line	3113	Steep slopes	斜面	52(b)	(direction)	
08 Landform-Poly	Line	1003	BoulderRock	岩塊の海岸	67-1(b)		Line(1003)→POLY
08 Landform-Poly	Line	1004	Flat Rock	岩石海岸	67-1(a)		Line(1004)→POLY
08 Landform-Poly	line	1013	Water courses Rapids to Scale	急流	60(c)		line(1013)→Poly
08 Landform-Poly	line	3008	Outcrop Rock(outline)	露岩	52(a)		Line→Poly
08 Landform-Poly	Centroid	3114	Thick Forest(Centroid)	樹木の多い森林	68		
08 Landform-Poly	Line	3115	Thick Forest(area)	樹木の多い森林	68		

08 Landform-Poly	Centroid	3116	Outcrop Rock(Centroid)	露岩		52(a)		
08 Landform-Poly	Centroid	3117	Water courses Rapids to Scale (Centroid)	急流		60(c)		
08 Landform-Poly	Centroid	3118	Flat Rock (Centroid)	岩石海岸		67-1(a)		
08 Landform-Poly	Centroid	3119	BoulderRock(Centroid)	岩塊の海岸		67-1(b)		
08 Neat Line	Line	4007	Boundary : International	国境		13		Poly→Line
08 Neat Line	Line	4101	Boundary : Regional			14		
08 Neat Line	Line	4102	Boundary : District			15		
08 Neat Line	Line	4103	Boundary : City,Municipal or town			16		
09 Transport	Line	5001	Ford	徒歩所		66(d)		
09 Transport	Line	5002	Ferry	フェリー		66(e)		
09 Transport	Point	2002	Bridge	橋		66(a)		
09 Transport	Point	5102	Footbridges	徒歩橋		66(b)		
09 Transport	Point	2039	Culvert	カルバート		66(c)		
09 Transport	Line	5104	Railway (double line)	鉄道(複線)		8(a)		Standard guage
09 Transport	Line	5007	Roads : Class 1	1級道路		2		Motorable throughout the year
09 Transport	Line	5008	Roads : Class 2	2級道路		3		Motorable,occasionally closed
09 Transport	Line	5009	Roads : Class 3	3級道路		4		Motorable in dry seasons
09 Transport	Line	5012	Tracks and Major Footpaths	小道及び主要な歩		6		
09 Transport	Line	5105	Motorway	自動車道		1		centerline of dual carriage
09 Transport	Line	5106	Street & main roads	街路及び貫通道路		4'		passing through the city and towns
09 Transport	Line	5107	Road under construction	建設中道路		5		
09 Transport	Line	5108	Other Footpaths	その他の歩道(踏み分け道)		7		
09 Transport	Line	5109	Railway (single line)	鉄道(単線)		8(b)		Standard guage
09 Transport	Line	5110	Railway (Discontinued)	鉄道(廃線)		8(c)		Standard guage
09 Transport	Point	5111	Rotary	円形交差点				Symbol
10 Utility	Line	6101	Water pipe	送水管		65		
10 Utility	Line	6001	Telephone line	電話線		12		
10 Utility	Line	6003	Power transmission line	送電線(a)		11(a)		1 or 2 line running parallel
10 Utility	Line	6102	Power transmission line	送電線(b)		11(b)		3 line running parallel
10 Utility	Line	6103	Power transmission line	送電線(c)		11(c)		4 line running parallel
11 Veg-Poly	Centroid	9101	Light Forest(Centroid)	疎林		69		
11 Veg-Poly	Line	9102	Vegetation boundary	植生界				
11 Veg-Poly	Centroid	9103	Savannah(Centroid)	草原		70		

11 Veg-Poly	Centroid	9105	Plantation (Centroid)	農園	72	
11 Veg-Poly	Centroid	9107	Cultivation(Centroid)	耕地	77	
12 Boundary-Poly	Centroid	9109	Boundary : National Park	国立公園	17	
12 Boundary-Poly	Centroid	9110	Boundary : Hunting area	狩猟区域	17	
12 Boundary-Poly	Centroid	9111	Boundary : Other	その他特定界	17	
12 Boundary-Poly	Line	9112	Boundary : National Park	国立公園	17	重複？
12 Boundary-Poly	Line	9113	Boundary : Hunting area	狩猟区域	17	重複？
12 Boundary-Poly	Line	9115	Boundary : Other	その他特定界	17	重複？
13 Build-Poly	Line	2005	Prominent Building	著名な建物	24(b)	to scale
13 Build-Poly	Centroid	2050	Prominent Building	著名な建物	24(b)	to scale

Only In Existing DB

Layer	Feature	Code	Name	名称	No of Symbol	Attributes	Remarks
		1002	Boulder Area	転石			
		1005	Flat Rock Area	平石			
		1008	Island Centroid	島			
		1017	Shoreline Virtual Segment				
		1019	Coastline Virtual Segment				
		1025	Watercourse Virtual				
		1027	Reservoir	貯水池			
		2002	Bridge	橋			Point
		2033	Wireless Station	無線局			
		2036	Health Point				
		2039	Culvert Symbol	カルバート			Point
		2040	Tank Symbol	タンク			
		2041	Dry Dock	乾船渠			
		2042	Pipeline	パイプライン			
		3005	Mineral Working Centroid	鉱物採掘場			Mine Dump Centroid?
		3006	Mineral Working Area	鉱物採掘場			Mine Dump Area?
		3009	Sand Bar	砂州			
		3010	Sand/Mud Outline	砂地・泥地			
		3012	Feature Outline (Misc.)	地物外郭線			
		3015	Gravel Pit Centroid	砂利坑			
		3016	Gravel Pit Outline	砂利坑			
		4002	Boundary Pillar	境界杭			
		4008	Mile Post	マイル標			
		4012	Survey Pillar	測量杭			
		4016	Trig Station				
		4022	International Centroid	国境中心点			
		5003	Level Crossing	高架部			
		5005	Railway L.G.				
		5006	Railway U/C				
		5010	Siding	引込線			
		6002	Telegraph V/S	受信所			
		7001	Neatline	図郭線			

Coverage

