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1. Legends and their applicable specifications


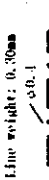

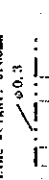

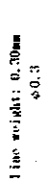
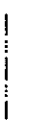

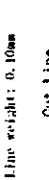

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS No. 分類	NAME 名称	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 現調記号	THEWAY LAYER 層	TEXTURE 質感	CODE	PLOTTING 図化記号 (letter shape) BLACK 赤色	COMPLICATION 編集記号 (Same as final product) 赤色	APPLICATION RULES 図式適用規定
1	MOTORWAY (dual carriageway) 自動車道：片側2車線以上	Line weight: 0.35, 0.60mm Width: 1.5mm 	BLACK RED Solid (fill) 赤：男 中央：女	RED (1) 赤色	Transport	Line	5070	BLACK (1) 赤色	BLACK 赤色	1. Apply symbol to four lanes or more with central reserve. 1. 中央分擔帯を持つ片側2車線(計4車線)以上の道路に適用する。
2	ROADS: class 1 Waterable throughout (the year) 1級道路：通年自動車 運行可能	Line weight: 0.30mm Width: 0.8mm NO. 106 	BLACK RED Solid (fill) 赤：男 中央：女	(Ditto) RED (2) 赤色	Transport	Line	5007	(Ditto) BLACK (2) 赤色	(Ditto) BLACK 赤色	1. Apply symbol to paved road. 2. Route No. shall be indicated on both ends of each map sheet. 3. SDG shall provide route No. 1. 舗装道路に適用する。 2. 道路番号を図部両端に表示する。
3	ROADS: class 2 Waterable occasionally (less than 1 year) 2級道路：自動車道 (時)：1年運行可能	Line weight: 0.15mm Width: 0.6mm NO. 80 	BLACK RED red screen 赤：男 赤調点：50%	(Ditto) RED (3) 赤色	Transport	Line	5008	(Ditto) RED (3) 赤色	(Ditto) BLACK 赤色	1. Apply symbol to unpaved road (maintained) 2. Route No. shall be indicated on both ends of each map sheet. 3. SDG shall provide route No. 1. 未舗装で維持管理されている道路に適用する。 2. 道路番号を図部両端に表示する。
4	ROADS: class 3 Waterable in dry seasons only 3級道路：自動車道 (乾期)：50%運行可能	Line weight: 0.15mm Width: 0.6mm 	BLACK Non color 赤：男 中：白抜	(Ditto) RED (4) 赤色	Transport	Line	5009	(Ditto) RED (4) 赤色	(Ditto) BLACK 赤色	1. Apply symbol to unpaved road (not maintained) 2. SDG shall provide route No. 1. 未舗装で維持管理されていない道路に適用する。
5	Street & main roads crossing through the city and town. 市街地及主要道路	Line weight: 0.10mm Width: 0.4mm 	BLACK Non color 赤：男 中：白抜	(Ditto) RED 赤色	Transport	Line	5080	(Ditto) RED 赤色	(Ditto) BLACK 赤色	1. Apply symbol to street in the city and town. 2. A street width less than 20m shall be plotted as 0.4mm. The actual scale shall be plotted for a street width more than 20m. 3. Main roads through the city and town shall be indicated as No. 1 or No. 2. 1. 市街地内の道路に適用する。 2. 道路幅員が20m未満の場合は0.4mmで表示する。 3. No. 1 or No. 2の主要道路は記号道路で表示する。
6	ROAD UNDER CONSTRUCTION 建設中道路	Line weight: 0.15mm Width: 0.5mm 3mm peak with 0.5mm gap 	BLACK Non color 鉄線：男 中：白抜	(Ditto) RED 赤色	Transport	Line	5011	(Ditto) RED 赤色	(Ditto) RED 赤色	
7	TRACKS and MAJOR FOOTPATHS 軌道及主要歩道	Line weight: 0.30mm 1.5mm peak with 1.5mm gap 	BLACK Non color 鉄線：男	(Ditto) RED 赤色	Transport	Line	5012	(Ditto) RED 赤色	(Ditto) BLACK 赤色	
8	OTHER FOOTPATHS その他歩道 (踏込分：1.0)	Line weight: 0.15mm 1.5mm peak with 0.8mm gap 	BLACK Non color 鉄線：男	(Ditto) RED 赤色	Transport	Line	5013	(Ditto) RED 赤色	(Ditto) BLACK 赤色	

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8	RAILWAY (Standard gauge) : double line 标准 (標準軌道) : 复线	Line weight: 0.40mm Sta 6.0	BLACK 黑色	(On the photographs) RBD — Sta — 黑色	Transport	Line	5004	(Actual slope) BLACK — Sta — 黑色	(Same as final BLACK product) — Sta — 黑色	
8 1 1 1	RAILWAY (Standard gauge) : single line 标准 (標準軌道) : 单线 侧线	Line weight: 0.40mm Sta 6.0	BLACK 黑色	(Ditto) RBD — Sta — 黑色	Transport Transport	Line Line	5005 5010	(Ditto) BLACK — Sta — 黑色	(Ditto) BLACK — Sta — 黑色	
8	RAILWAY : discontinued railway 标准 : 废线	Line weight: 0.40mm Abandoned	BLACK 黑色	(Ditto) RBD — Abandoned 黑色	Transport	Line	5015	(Ditto) BLACK — 黑色	(Ditto) BLACK — Abandoned 黑色	1. Discontinued railway shall be annotated as "Abandoned". (shall not apply annotation to temporary closed railway) 1. 废线は Abandoned と表記する。 (運行停止中の路線には Abandoned の表記はしない。)
8 3	RAILWAY : Station 駅	2.0mm Station 1.5mm	BLACK 黑色	— Sta — 黑色	Cultural	Point	2022	(Ditto) BLACK — Sta — 黑色	(Ditto) BLACK — Sta — 黑色	
10	CABLE RAYS CONVEYER BELT 索道、ベルトコンベヤ	Line weight: 0.30mm 5.0	BLACK 黑色	(Ditto) RBD — 黑色	Cultural	Line	3032	(Ditto) BLACK — 黑色	(Ditto) BLACK — 黑色	
11	POWER TRANSMISSION LINE 送電線	(a) 0.15 10.0 1.0 (b) 0.20 (c) 0.25	BLACK 黑色	(Ditto) RBD (a) — (b) — (c) — 黑色	Utility	Line	(a) 6003 (b) 6004 (c) 6005	(Ditto) BLACK — 黑色	(Ditto) BLACK (a) — (b) — (c) — 黑色	1. (a) Apply symbol to 1 or 2 line running parallel with each other. 2. (b) Apply symbol to 3 line running parallel with each other. 3. (c) Apply symbol to 4 line running parallel with each other. 1. (a) 本又は2本の送電線が平行の場合に適用する。 2. (b) 3本の送電線が平行の場合に適用する。 3. (c) 4本以上の送電線が平行に並んでいる場合に適用する。 (送電線組法の別開は考慮しない。)
1	TELEPHONE LINE 電話線	Line weight: 0.15mm 0.4 3.0	BLACK 黑色	(Ditto) RBD — 黑色	Utility	Line	6001	(Ditto) BLACK — 黑色	(Ditto) BLACK — 黑色	



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CLASS No. 分類	NAME 名称	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 現調記号	HEMATIC LAYER	FEATURE	CODE	PLOTTING 図化記号	COMPILATION 編集記号	APPLICATION RULES 図式適用規定
13	BOUNDARY: International 境界 : 国境	2.0  2.0 Screen width : 2.0mm 0.3 十字 1.0	BLACK Red screen 20x 十字 : 青色 枠線点線 : 赤	(On the photograph)	Cultural	Line	4007	(Actual shape)	(Same as final BLACK product)	1. SDC shall draw International border on the map (manuscript) 2. Red screen shall be put in the Ghana side. 1. 現地測量時に境界線が編集範囲に表示する。 2. 線画はカラー印刷に表示する。
14	BOUNDARY: Regional 境界 : 州境	Line weight: 0.30mm  0.3 3.0 1.5	BLACK 青色		Neat Line	Centroid	4022		(Ditto) BLACK  1.5 青色	1. SDC shall draw boundary on the map (manuscript) if necessary.
15	BOUNDARY: District 境界 : 郡境	Line weight: 0.30mm  0.3 2.5 2.0	BLACK 青色						(Ditto) BLACK  1.5 青色	1. 現地測量時に郡境界が編集範囲に表示する。
16	BOUNDARY: City, Municipality or town 境界 : 市町村境	Line weight: 0.30mm  0.3 2.0 3.0	BLACK 青色						(Ditto) BLACK  1.5 青色	
17	BOUNDARY: National park Forest Reserve Hunting area Other boundaries 境界 : 国立公園、保護林 狩猟区域、その他 特定界	 0.4	GREEN 1:100x 緑 100x		Forest	Line Centroid Line Line	4006 4021 9109 9110 9111	(Forest Reserve) (National Park) (Hunting Area) (Other)	(Ditto) GREEN 緑色	1. SDC shall draw boundary on the map (manuscript). 2. Annotation shall be put in the center of its area. 1. 現地測量時に保護林、狩猟区域、保護林等が編集範囲に表示する。 2. 中央位置に国立公園、保護林等が注記をする。
19	CUT LINE (圍体 (防火線))	Line weight: 0.10mm  1.0 1.0	BLACK 青色	(Ditto) RED & GREEN Cut Line 青色及び緑色	Cultural	Line	3002	(Ditto) GREEN & BLACK Cut Line 緑色及び黒色	(Ditto) GREEN & BLACK Cut Line 緑色及び黒色	1. Annotation shall fittingly be put along the lines. 1. 適宜の位置に注記する。
21	FENCE CONCRETE or BLOCK WALL 圍 : コンクリート又はブロック	Line weight: 0.15mm  1.5 0.3	BLACK 青色	(Ditto) RED 赤色	Cultural	Line	3033	(Ditto) RED 赤色	(Ditto) RED 赤色	1. Apply symbol to fence or wall which is more than 500m long. 1. 長さが 500m 以上の圍及び壁に適用する。






SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS NO. 分類	NAME 名	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 現調記号	THERMALIC LAYER	FEATURE	CODE	PLOTTING 図化記号	COMPIATION 編集記号	APPLICATION RULES 図式適用規定
22	CITY, TOWN 市街		BLACK Screen 黒色	(On the photographs)	Cult-Poly	Line Centroid	2006 2051	(Actual shape) BLACK 黒色	(Same as final product) BLACK 黒色	1. If there is any prominent building in the congested (generalized) area, it shall be indicated (protted) as such. 1. 群集建物内に起算線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+で現位置を表示する。
23	VILLAGE 村		BLACK Screen 黒色		Cult-Poly	Line Centroid	2006 2054	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	(Ditto) 同上
24	PROMINENT BUILDING 著名な建物		BLACK 黒色		Cult-Poly	Point Line Centroid	2004 2005 2050	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	1. Apply symbol to Concrete and block house etc. 1. コンクリート及びブロック建築の建物の建物の適用する。
24	COMPOUND & HUTS 小集 (村本部の建物)		BLACK 黒色		Cultural	Point	2003	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	1. Apply symbol to soil/mud house etc. 1. 土壁等の建物の適用する。
25	MARKET 市場		BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2015	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. Big market shall be indicated with building. If building can't be drawn, Abbreviated annotation shall be indicated on the center. 1. 大規模なものを表示し、独立建物を表示できない場合は中心地帯の中心位置に表示する。
26	HOSPITAL 病院		BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2012	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. If building can be drawn, cross symbol shall be indicated. 1. 独立建物が表示できる場合は+ を表示しない。
26	CLINIC 診療		BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2037	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. If building can be drawn, cross symbol shall be indicated. 2. Apply abbreviated annotation also to the prominent clinic. 1. 独立建物が表示できる場合は+ を表示しない。 2. 著名なものを表示する。
27	HOTEL ホテル		BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2024	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. Apply abbreviated annotation to the prominent hotel only. 1. 著名なホテルに適用する。
27	SCHOOL 学校		BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2025	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. University, polytechnic, college, institute etc. shall be indicated with building and its full name shall be annotated in principle. 2. If building can be drawn, cross symbol shall be indicated. 1. 総合大学、技術大学、専修大学、研究大学は建物を表示し、注記を付す。 2. 独立建物が表示できる場合は+ を表示しない。

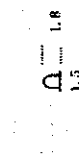

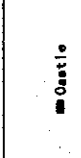
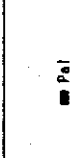
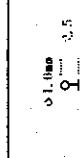
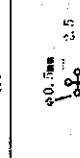
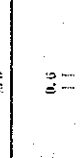
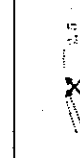
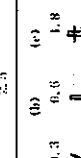
SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS No. 分類	NAME 名称	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 現測記号	THEMATIC LAYER 主題層	FEATURE 地物	CODE	PLOTTING (Actual shape) 図化記号	COMPILATION (Same as final product) 編集記号	APPLICATION RULES 図式適用規定
1	POLICE STATION 警察署	+PS ■ PS	BLACK 黒色	RED 赤色	Cultural	Point	2020	RED 赤色	BLACK 黒色 +PS ■ PS	1. If building can be drawn, cross symbol shall be indicated. 1. 独立建物が表示できる場合は+は表示しない。
2	COURT HOUSE 裁判所	+Ct H ■ Ct H	BLACK 黒色	RED 赤色	Cultural	Point	2009	RED 赤色	(Ditto) BLACK 黒色 +Ct H ■ Ct H	(Ditto)
3	BARRIER 柵間所	Barrier	BLACK 黒色	RED 赤色	Cultural	Point	2013	RED 赤色	(Ditto) BLACK 黒色 Barrier	1. Barrier shall be annotated as "Barrier". 1. 柵間所は"Barrier"と注記する。
4	MILITARY STATION 軍施設	MS	BLACK 黒色	RED 赤色	Cultural	Point	2061	RED 赤色	(Ditto) BLACK 黒色 MS	
5	BARRACKS 兵舎	Bks	BLACK 黒色	RED 赤色	Cultural	Point	2016	RED 赤色	(Ditto) BLACK 黒色 Bks	
6	CHURCH 教会	+Ch ■ Ch	BLACK 黒色	RED 赤色	Cultural	Point	2008	RED 赤色	(Ditto) BLACK 黒色 +Ch ■ Ch	1. Apply abbreviated annotation also to the big chapel. 2. If building can be drawn, cross symbol shall be indicated. 1. 大きいChapel (礼拝堂)は教会記号を適用する。 2. 独立建物が表示できる場合は+は表示しない。
7	MISSION 伝道本部	+M ■ M	BLACK 黒色	RED 赤色	Cultural	Point	2007	RED 赤色	(Ditto) BLACK 黒色 +M ■ M	1. If building can be drawn, cross symbol shall be indicated. 1. 独立建物が表示できる場合は+は表示しない。
8	TEMPLE 寺院	 Tm	BLACK 黒色	RED 赤色	Cultural	Point	2091	RED 赤色	(Ditto) BLACK 黒色 Tm	1. Actual position shall be center of base line. Symbol direction shall be set at right angle to the road. 1. 位置図(下辺中央)に基準し、道路に對し直角に表示する。 (祀奉方向は不定)
9	SILOS サイロ	 Sil	BLACK 黒色	RED 赤色	Cultural	Point	2017	RED 赤色	(Ditto) BLACK 黒色 Sil	

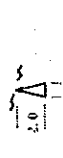
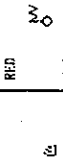
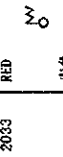
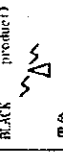
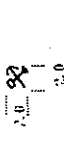
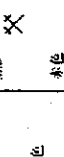
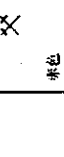
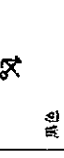
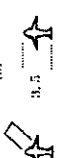
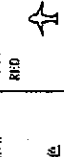
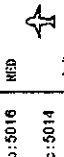
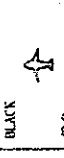

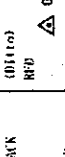
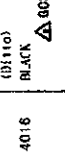
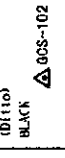
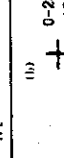
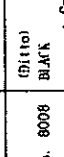
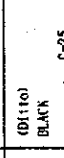

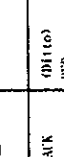
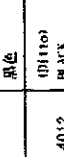
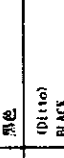
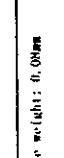
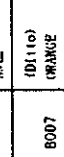
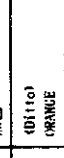
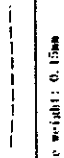
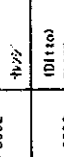
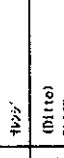
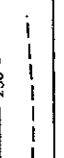
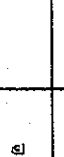
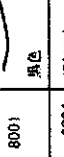

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS No. 分類	NAME 名称	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 見取記号 (in the photographs)	THEMATIC LAYER	FEATURE	CODE	PLOTTING 図化記号	COMPIATION 編集記号 (Same as final product)	APPLICATION RULES 図式適用規定
31	MOSQUE モスク	1.0  2.2 0.1, 2	BLACK 黒色	RED 赤色	Cultural	Point	2019	赤色 	BLACK 黒色	1. Actual position shall be bottom of black circle. Symbol direction shall be set at right angle to the road. 2. 实际位置(円の最下点)に標示し、道路に対して直角に標示する。 (配号の向きは不定)
32	CEMETERY 墓	+Cem	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2043	(Ditto) RED 赤色	(Ditto) BLACK & GREEN 黒及び緑色	1. Large one : Indicate limits with black solid line. 2. Small one : Indicate its position by cross symbol. 1. 大規模な場合は墓の境を黒い実線で標示し、中央に略注記を付す。 2. 小規模な場合は其位置を十字で示す。
33	POST OFFICE 郵便局	+P = P	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2021	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. Indicate its position by cross symbol, if building can't be drawn. 1. 独立建物を表示できない場合は十字で其位置を表示する。
33	TELECOMMUNICATION OFFICE 通信局	+T = T	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2083	(Ditto) RED 赤色	(Ditto) BLACK 黒色	(Ditto) 同上
33	POST & TELECOMMUNICATION OFFICE 郵便・通信局	+P.T = P.T	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2026	(Ditto) RED 赤色	(Ditto) BLACK 黒色	(Ditto) 同上
34	SUBSTATION 変電所	 2.0 2.0	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2018	(Ditto) RED 赤色	(Ditto) BLACK 黒色	
36	SPORTS GROUND 競技場	 2.5 3.5	BLACK 黒色	(Ditto) RED 赤色	Cultural	Line Point	3001 2023	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. Very big one shall be drawn to actual size. 1. この記号より大きい場合は実形で表示する。
37	SHED 電線場	+Shed	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2027	(Ditto) RED 赤色	(Ditto) BLACK 黒色	1. Shall apply annotation to storage / yard for Coca Coffee, etc. 1. コーヒー等の農産物の貯蔵場、貯蔵所に適用する。
38	LIGHT HOUSE 燈台	 2.5 1.3	BLACK 黒色	(Ditto) RED 赤色	Cultural	Point	2014	(Ditto) RED 赤色	(Ditto) BLACK 黒色	Bell are installed for safety sea navigation. Light house is for showing the location of land by sending light far away from its upper structure. Beacon is smaller than light house and only to indicate shoreline.

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS No. 分類	NAME 名	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 、現調記号 (on the photographs)	THEMATIC LAYER	FEATURE	CODE	PLOTTING 図化記号 (Actual shape)	COMPILED 編集記号 (Same as final product)	APPLICATION RULES 図式適用規定
28	NAVIGATION BEACON 航路浮標		BLACK 黒色	RED 赤色	Cultural	Point	2001	RED 赤色	BLACK 黒色	標台と航路浮標の区別は、いづれも海上航行のためのもので、左右は標台の位置を知らせるために遠くまで光を出す装置のあるものをいふ、航路浮標はこれより規模が小さく標台を知らせる程度である。
29	FORT 砦		BLACK 黒色	RED 赤色	Cultural	Point	2028	RED 赤色	BLACK 黒色	1. Shall not apply to present use. 1. 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。
30	CASTLE 城		BLACK 黒色	RED 赤色	Cultural	Point	2082	RED 赤色	BLACK 黒色	(Ditto) (Ditto)
30	PALACE 宮殿		BLACK 黒色	RED 赤色	Cultural	Point	2029	RED 赤色	BLACK 黒色	1. Very big palace shall annotate with full name. 1. 大きい場合は注記する。
40	TOWER 高塔		BLACK 黒色	RED 赤色	Cultural	Point	2030	RED 赤色	BLACK 黒色	1. Shall apply to clock tower etc. 1. 時計台のような高塔に適用する。
41	RUIN 遺跡		BLACK 黒色	RED 赤色	Cultural	Point	2035	RED 赤色	BLACK 黒色	
41	ANCIENT WALL 城壁		BLACK 黒色	RED 赤色	Cultural	Line	3034	RED 赤色	BLACK 黒色	
41	ANCIENT SITE 史跡		BLACK 黒色	RED 赤色	Cultural	Point	2053	RED 赤色	BLACK 黒色	
41	(a) JETTY (b) QUAY (c) WHARF (c) 防波堤 (b) 埠頭 (c) 荷役橋		BLACK 黒色	RED 赤色	Cultural	Line	a:3035 b:3036 c:3037	RED 赤色	BLACK 黒色	

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS No. 分類	NAME 名称	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 現調記号	THEMATIC LAYER	FEATURE	CODE	PLOTTING 図化記号	COMPILED 編集記号	APPLICATION RULES 図式適用規定
43	RADIO TRANSMISSION STATION ラジオ送信所		BLACK 黒色		Cultural	Point	2003			1. Shall apply symbol also to TV / Telecommunication tower etc. 1. テレビ送信塔、マイクローワーエーズ、無線中継塔等にも適用する。
44	WINE 酒		BLACK 黒色		Cultural	Point	3004			
46	AIRDROME AIRPORT RUNWAY 小型空港 滑走路		BLACK 黒色		Transport	Point Line	a: 2038 b: 5016 c: 5014			1. International airport shall be annotated with full name. 1. 国際空港はフルネームを注記し、記号は表示しない。
47	GEODEIC POINT 測地基準点		BLACK 黒色		Cultural	Point	4016			1. Shall indicate symbol with the name and number. (no elevation) 2. New GPS points shall not be indicated. 1. 三角点には標高を表示せず、点名、点番号を表示する。 2. GPS 点は表示しない。
48	SPOT HEIGHT PHOTO PRINCIPAL POINTS 標高点 写真主点		BLACK 黒色		a: Hypsographic b: Cultural	Point	a: 8008 b: 7002			1. (b) Line number shall be indicated on both ends of each map sheet. 1. (b) 写真主点のコース番号、写真番号は各コースの両端の主点のみに表示する。
49	BENCH MARK 水準点		BLACK 黒色		Cultural	Point	4012			1. Shall indicate fundamental bench mark only. (no elevation and no damaged bench mark) 1. 基準水準点のみ表示し、標高は表示しない。 (異常点は表示しない。)
49	CONTOUR LINE 等高線 (5m)		BROWN 茶色		Hypsographic	Line	8007			
50	INDEX CONTOUR (every fifth) 計曲線 (5m 毎)		BROWN 茶色		Hypsographic	Line	8006 8001			
51	DEPRESSION BASIN SHALLOW DEPRESSION 凹地		BROWN 茶色		Hypsographic	Line	a: 8004 (計曲線) a: 8005 (主線) b: 8050			

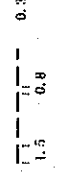
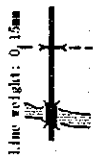
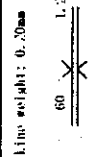

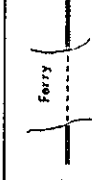


SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS. NO. 分類	NAME 名稱	SPECIFICATIONS 規格	COLOR 色	INTERPRETATION 現象記号	HEMATIN LAYER	FEATURE	CODE	PLOTTING (Actual shape)	CUMULATION (Same as final principle)	APPLICATION RULES 圖式適用規定
52	OUTCROP ROCK 露岩		BLACK 黑色	(On the photographs) RED 紅色 BLACK 黑色	Landform	Line Poly	3008 3118			
53	STEEP SLOPES 斜度 (陡)		BLACK 黑色	(Ditto) RED 紅色 BLACK 黑色	Landform	Line	3109			
54	CLIFFS 斷崖		BLACK 黑色	(Ditto) RED 紅色 BLACK 黑色	Landform	Line	3001			
55	EMBANKMENT 堤防 (堤)	Line weight: 0.1mm 	BROWN 茶色	(Ditto) RED 紅色 BLACK 黑色	Landform	Line	3013			
56	CUTTING 溝 (溝)		BROWN 茶色	(Ditto) RED 紅色 BLACK 黑色						
57	MINE MOUND 礦堆 (堆)		BROWN 茶色	(Ditto) RED 紅色 BLACK 黑色	Cult-Poly	Line Centroid	3005 3006			
58	SAND or MUD 砂地 (泥堆)		BROWN 茶色	(Ditto) RED 紅色 BLACK 黑色	Hydrographic	Line Centroid	1014 1015			
59	DUNES 砂丘		BROWN 茶色	RED 紅色 BLACK 黑色	Hydrographic	Line Centroid	3009 1015			
60	QUARRY 採石場		BLACK 黑色	(Ditto) RED 紅色 BLACK 黑色	Cultural	Line	3007			

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS NO. 分類	NAME 名 称	SPECIFICATIONS 仕 様	COLOR 色	INTERPRETATION 見 調 記 号 (to the photographs)	THERMAL LAYER	FEATURE	CODE	PLOTTING 圖 化 記 号 (Actual shape)	COMPILED 構 集 記 号 (Same as final product)	APPLICATION RULES 圖 式 通 用 規 定
60 1	RIVER : Double line 二条河川		BLUE 青色		Hydrographic	Line Centroid	1016 1009	 青色 (Ditto) PURPLE 紫色	(Same as final product) PURPLE product 紫色	
60 2	RIVER : Single line Indefinite stream 一条河川 (60-2-1) 不定河川 (60-2-2)		BLUE 青色		Hydrographic	Line Line	1023 1024	 青色 (Ditto) PURPLE 紫色	(Ditto) PURPLE 紫色	
60 3	WATERFALL : Single (60-3-1) Double (60-3-2) 滝		BLACK 灰色	(Ditto) BLUE 青色	Landform	Line Point	1022 (Scale) 1021	(Ditto) BLACK 黑色	(Ditto) BLACK 黑色	
60 4	RAPIDS : Single (60-4-1) Double (60-4-2) 急流、草瀬		BLACK 灰色	(Ditto) BLUE 青色	Landform	Line Point Centroid	1013 1012 3117	(Ditto) BLACK 黑色	(Ditto) BLACK 黑色	
61 1	AREA LIABLE TO FLOOD 浸水し易い地域		BLUE 青色	(Ditto) BLUE 青色	Hydrographic	Line Centroid	1006 1007	(Ditto) BLUE 青色	(Ditto) PURPLE 紫色	
61 2	MARSH or SWAMP 沼地又は湿地		BLUE 青色	(Ditto) BLUE 青色	Hydrographic	Line Centroid	1010 1011	(Ditto) BLUE 青色	(Ditto) PURPLE 紫色	
62 1	TRENCH, GUTTER 溝、用水路 (灌溉、排水)		BLUE 青色	(Ditto) BLUE 青色	Hydrographic	Line Line	1105	(Ditto) PURPLE 紫色	(Ditto) PURPLE 紫色	
63 1	(a) LAKE (b) POND (c) DAM (a) 湖 (b) 池 (c) ダム		BLUE 青色 Dark-BLACK	(Ditto) RED & BLUE 赤と青	Hydrographic	Line Centroid Point Line	a: 1016 b: 1042 a: 1009 b: 1104 c: 2010 c: 2011	(Ditto) BLUE 青色	(Ditto) PURPLE 紫色	
63 2	SALT PONDS 塩 田		BLACK 灰色	(Ditto) RED 赤色	Cult-Poly	Line Centroid	2034 2044	(Ditto) BLACK 黑色	(Ditto) BLACK 黑色	1. Salt ponds shall be indicated with check embankment and shall be annotated as "Salt Ponds". 1. 塩田は止まり用堤防を表示し、Salt Ponds と注記する。





















SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS No. 分類	NAME 名 称	SPECIFICATIONS 仕 作 探	COLOR 色	INTERPRETATION 現 象 記 号	THEMATIC LAYER	FEATURE	CODE	PLOTTING 図 化 記 号	COMPILATION 編 集 記 号	APPLICATION RULES 圖 式 通 用 規 定
64 1	WATER HOLE, WELL, SPRING (Borehole) 水池、井、穴、泉 (穴掘井)	○ 1.2mm	BLUE 青色	(On the photographs) BLUE 青色	Cultural	Point	1001	(Actual shape) BLUE 青色	(Same as final product) PURPLE 紫色	
64 2	WATER TOWER 塔水塔	● 1.2mm	BLUE Solid fill 青色	(Ditto) BLUE 青色	Cultural	Point	1028	(Ditto) BLUE 青色	(Ditto) PURPLE 紫色	
65	WATER PIPE 送水管		BLUE 青色	(Ditto) BLUE 青色	Utility	Line	2042	(Ditto) BLUE 青色	(Ditto) PURPLE 紫色	
66 1	BRIDGE (66-1-1) FOOTBRIDGE (66-1-2) 橋、徒歩橋	Line weight: 0.15mm 	BLACK 黒色	(Ditto) RED 赤色	Transport	Point	2002 5102	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	1. Shall apply symbol also to train bridge. 2. 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) 1. 鉄道橋にも適用する。(1) 単河川には表示しない。 2. 原則として、2条河川には表示するものとす、歩道橋にも適用する。
66 2	CULVERT カナルパイプ	Line weight: 0.20mm 	BLACK 黒色	(Ditto) RED 赤色	Transport	Point	2039	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	
66 3	FORD 徒歩橋		BLACK 黒色	(Ditto) RED 赤色	Transport	Line	5002	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	
66 4	FERRY フェリー		BLACK 黒色	(Ditto) RED 赤色	Transport	Line	5001	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	
67 1	COASTLINE (Sand or Shal) 海岸線 (砂・沙地記号)		BROWN 茶色	(Ditto) RED 赤色	Hydrographic	Line	1018 (海岸線)	(Ditto) BROWN 茶色	(Ditto) BROWN 茶色	
67 2	FLAT ROCK 平らな岩石海岸		BLACK 黒色	(Ditto) RED 赤色	Landform	Line Point Centroid	1004 1005 3118 Poly	(Ditto) BLACK 黒色	(Ditto) BLACK 黒色	

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO. 號	NAME 名稱	SPECIFICATIONS 規格	COLOR 顏色	INTERPRETATION 說明	LAYER 層	FEATURE 特徵	CODE 代碼	PLOTTING 繪圖	COMPILATION 編纂	APPLICATION RULES 圖式應用規定
	67	BOULDER ROCK 岩塊 (散石) 凸出狀		BLACK 黑色	(On the photographs) RED 紅色	Landform	Line Point Centroid	1003 1002 3119 Poly	(Actual shape) BLACK 	(Same as final BLACK product) 	

SYMBOLS FOR 1:50,000 TOPOGRAPHIC MAP OF GHANA

CLASS 分類	NO.	NAME 名称	SPECIFICATIONS 仕様	COLOR 色	INTERPRETATION 現調記号	HEMALIC LAYER	FEATURE	CODE	PLOTTING 図化記号	COMPIATION 編集記号	APPLICATION RULES 図式運用規定
68	68	THICK FOREST 樹木心多、森林	 2.0	GREEN 50% Symbol:- BLACK 30% 緑 50% 黒 30%	 (On the photograph) GREEN & RED 緑及び赤	Forest	Centroid	4025  GREEN & BLACK 緑及び黒	 (Same as final product) GREEN & BLACK 緑及び黒	1. Limits shall not indicate. 2. Dense forest with tall trees. 3. Minimum size to be shown 500m x 500m or equivalent. 1. 樹生界は表示しない。 2. 樹木の密度が高く、樹高が高くなっている時、3. 図上 500m x 500m 以上を表示。	
69	69	LIGHT FOREST 疎林	 2.0	GREEN Screen 緑 20%	 (Ditto) GREEN & RED 緑及び赤	Vegetation	Centroid	4023  ID (itto) GREEN & BLACK 緑及び黒	 (Ditto) GREEN & BLACK 緑及び黒	1. Limits shall not indicate. 2. Minimum size to be shown 500m x 500m or equivalent. 1. 樹生界は表示しない。 2. 図上 1.0cm x 1.0cm を標準とする。	
70	70	SAVANNAH 草原	Non-symbol	Non-color		Vegetation	Centroid	4024			1. Limits shall not indicate. 1. 樹生界は表示しない。
71	71	PLANTATION 農林	 2.0	GREEN GREEN- screen 20% 緑及び緑 緑 20%	 (Ditto) GREEN & RED 緑及び赤	Vegetation	Centroid	4030  ID (itto) GREEN & BLACK 緑及び黒	 (Ditto) GREEN & BLACK 緑及び黒	1. Indicate limits with green solid line and annotate product's name in the center. 2. Minimum size to be shown 500m x 500m or equivalent. 1. 外周を緑の実線で表示し、コア、ゴム等の標高を中央に注記する。 2. 図上 1.0cm x 1.0cm を標準とする。	
72	72	PALM TREES ヤシ	 2.0	BLACK 黒色	 (Ditto) 赤				 ID (itto) 黒	 ID (itto) 黒	1. 図上 1.0cm x 1.0cm を標準として記号 1 個配置する。
73	73	CULTIVATION 耕地	 2.5	BLACK 黒色	 (Ditto) GREEN & RED 緑及び赤	Vegetation	Centroid	4031  ID (itto) GREEN & BLACK 緑及び黒	 (Ditto) GREEN & BLACK 緑及び黒	1. Limits shall not indicate. (Put the symbol in the area suitably.) 1. 樹生界は表示しない。(範囲内に記号を適宜配置する)	

2. Code table

Thematic Layer	GIS Code NO.	Featuer type	Description	Catographic reference
Cult-poty	2005	Line	Building to Scale	24
Cult-poty	2006	Line	Built Up Area(village)	23,22
Cult-poty	2034	Line	Salt Pond	63
Cult-poty	2044	Centroid	Salt Pond	63
Cult-poty	2050	Centroid	Building	24
Cult-poty	2051	Centroid	Built Area(City and Town)	22
Cult-poty	3005	Line	Mineral Working Area(including Mine dump)	44
Cult-poty	3006	Centroid	Mineral Working Area(including Mine dump)	54
Cult-poty	3015	Centroid	Gravel pit centroid	
Cult-poty	3016	Line	Gravel pit outline	
Cult-poty	2054	Centroid	Village	23
Cultural	1001	Point	Borehold/Waterhold	64-1
Cultural	1028	Point	Water Works	64-2
Cultural	2001	Point	Beacon	38-1
Cultural	2003	Point	Building(Round)	24-2
Cultural	2004	Point	Building(Square)	24
Cultural	2007	Point	Mission	28-1
Cultural	2008	Point	Church	28
Cultural	2009	Point	Court House	27-3
Cultural	2010	Point	Dam Single	63(C)
Cultural	2012	Point	Hospital	26
Cultural	2013	Point	Barrier	27-4
Cultural	2014	Point	Light House	38

Cultural	2015	Point	Market	25
Cultural	2016	Point	Military Barracks	27-6
Cultural	2017	Point	Silo	29
Cultural	2018	Point	Electric Substation	34
Cultural	2019	Point	Mosque	31
Cultural	2020	Point	Police Station	27-2
Cultural	2021	Point	Post Office	33
Cultural	2022	Point	Railway Station	8-3
Cultural	2023	Point	Sports Ground(angle)	36
Cultural	2024	Point	Rest House,Hotel	27
Cultural	2025	Point	School	27-1
Cultural	2026	Point	Post & Telecommunication	33-2
Cultural	2027	Point	Shed	37
Cultural	2028	Point	Ford	39
Cultural	2029	Point	Palace	39-2
Cultural	2030	Point	Tower	40
Cultural	2033	Point	Radio Transmission Station,Wireless Station	43
Cultural	2035	Point	Ruin	41
Cultural	2036	Point	Health Post	
Cultural	2037	Point	Clinic	26-1
Cultural	2040	Point	Tank Symbol	
Cultural	2041	Line	Dry Doc	
Cultural	2043	Point	Cemetery	32
Cultural	2053	Point	Ancient Site	41-2
Cultural	2061	Point	Military Station	27-5

Cultural	2063	Point	Terecommunication Office	33-1
Cultural	2082	Point	Castel	39-1
Cultural	2091	Point	Temple	28-2
Cultural	3002	Line	Cutline	19
Cultural	3004	Point	Mineral Working(including Mine)	44
Cultural	3007	Line	Quay	57
Cultural	3012	Line	Feature Outline(Misc.)	
Cultural	3013	Line	Embankment	53
Cultural	3031	Line	Sports Ground(scale)	36
Cultural	3032	Line	Cable Ways,Conveyor Belt	10
Cultural	3033	Line	Fence,Concrete of Block Wall	21
Cultural	3034	Line	Ancient Wall	41-1
Cultural	3035	Line	Jetty	42(a)
Cultural	3036	Line	Quay	42(b)
Cultural	3037	Line	Whart	42(C)
Cultural	4002	Point	Boundary Pillar	
Cultural	4007	Line	International Boundary	
Cultural	4012	Point	Survey Pillar,Bench Mark	49
Cultural	4016	Point	Geodetic Point,Trig Station	47
Cultural	4016	Point	Trig Station	
Cultural	7002	Point	Photo Centre	48(b)
Forest	4006	Line	Forest Reserve Boundary	17
Forest	4021	Centroid	Forest Reserve	17
Forest	9109	Line	Boundary(National Park)	17

Forest	9110	Line	Boundary(Hunting Area)	17
Forest	9111	Line	Boundary(Other)	17
Hydrograohic	1006	Line	Flooded Land Area	61-1
Hydrograohic	1007	Centroid	Flooded Land	61-1
Hydrograohic	1008	Centroid	Island	
Hydrograohic	1009	Centroid	Lake,river	63-1(a),60-1
Hydrograohic	1010	Line	Marsh Area	61-2
Hydrograohic	1011	Centroid	marsh	61-2
Hydrograohic	1014	Line	Sand or Mub Flats	55
Hydrograohic	1015	Centroid	Sand/Mub Flats	55,56
Hydrograohic	1016	Line	Shoreline	60-1,63-1(a)
Hydrograohic	1017	Line	Shoreline Virtual Segment	
Hydrograohic	1018	Line	Coastline	67-1
Hydrograohic	1019	Line	Coastline Virtual Segment	
Hydrograohic	1023	Line	Watercourse	60-2-1
Hydrograohic	1024	Line	Watercourse Indefinite	60-2-2
Hydrograohic	1025	Line	Watercourse Virtual Segment	
Hydrograohic	1027	Line	Reservoir	63-1(a)
Hydrograohic	1042	Line	Pond	63-1(b)
Hydrograohic	1104	Centroid	Pond	63-1(b)
Hydrograohic	1105	Line	Trench Gutter	62
Hydrograohic	2011	Line	Dam to Scale	63-1(C)
Hydrograohic	3009	Line	Sand Bar,Dunes	56

Hydrograohic	3010	Line	Sand/Mub Outline	55
Hydrograohic	8001	Line	Approximate Index Contour	50-1
Hydrograohic	8002	Line	Approximate Intermadiate Contour	50
Hydrograohic	8004	Line	Depresion Index Coutour	51(a)
Hydrograohic	8005	Line	Depresion Intermadiate Coutour	51(a),50
Hydrograohic	8006	Line	Index Contour	50-1
Hydrograohic	8007	Line	Intermindeate Countour	50
Hydrograohic	8008	Point	Spot Height	48(a)
Hydrograohic	8050	Line	Basin Shallow Depression	51(b)
Landform	1002	Point	Boulder Area	67-3
Landform	1003	Line	Boulder Rock Area	67-3
Landform	1004	Line	Flat Rock Area	67-2
Landform	1005	Point	Flat Rock Area	67-2
Landform	1012	Point	Rapids Signal	60-4-1
Landform	1013	Line	Rapids to Scale	60-4-2
Landform	1021	Point	Water Fall Signal	60-3-1
Landform	1022	Line	Water Fall to Scale	60-3-2
Landform	3001	Line	Cliff Outline	52-2
Landform	3008	Line	Rock Outcrop	52
Landform	3109	Line	Steep Slope	52-1
Landform	3116	Centroid	Outcrop Rock	52
Landform	3117	Centroid	Water Cources Rapids to Scale	60-4-2
Landform	3118	Centroid	Flat Rock	67-2
Landform	3119	Centroid	Boulder Rock	67-3

Neat Line	4003	Line	Bondary Virtual Segment	
Neat Line	4022	Centroid	International Centroid	13
Neat Line	7001	Line	Neatline	
Transport	2002	Point	Bridge	66-1-1
Transport	2038	Point	Airport,Aerodrom	46(a)
Transport	2039	Point	Culvert	66-2
Transport	4008	Point	Mail Post	
Transport	5001	Line	Ferry	66-4
Transport	5002	Line	Ford	66-3
Transport	5003	Point	Level Crossing	
Transport	5004	Line	Railway(Double line)	8
Transport	5005	Line	Railway L.G.(Single line)	8-1
Transport	5007	Line	Road #1	2
Transport	5008	Line	Road #2	3
Transport	5009	Line	Road #3	4
Transport	5010	Line	Siding Railway	8-1-1
Transport	5011	Line	Road Under Construction	5
Transport	5012	Line	Track	6
Transport	5013	Line	Trail,other footpaths	7
Transport	5014	Line	Airstrip,Runway	46(C)
Transport	5015	Line	Railway(discontinued)	8-2
Transport	5016	Point	Airstrip	46(b)
Transport	5070	Line	Motorway	1
Transport	5080	Line	Street & Main Roads	4-1

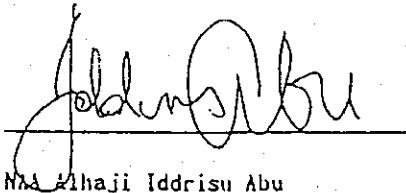
Transport	5102	Point	Foot, Bridges	66-1-2
Utility	2042	Line	Pipeline	65
Utility	6001	Line	Telegraph/Trephone	12
Utility	6002	Line	telegraph V/S	12
Utility	6003	Line	Transmission Line	11(a)
Utility	6004	Line	Power Transmission Line	11(b)
Utility	6005	Line	Power Transmission Line	11(C)
Vegetation	4023	Centroid	Light Forest	69
Vegetation	4024	Centroid	Sanannah	71
Vegetation	4030	Centroid	Plantation	73
Vegetation	4031	Centroid	Cultivation	77
Vegetation	4025	Centroid	Thick Forest	68

3. Scope of Work & Minutes of Meeting on Scope of Work

SCOPE OF WORK
FOR
TOPOGRAPHIC MAPPING
OF
SOUTHERN PART OF THE REPUBLIC OF GHANA
AGREED UPON BETWEEN
SURVEY DEPARTMENT OF GHANA,
MINISTRY OF LANDS AND FORESTRY
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

ACCRA, GHANA

17th March, 1995



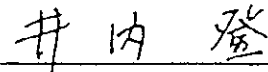
N/A Alhaji Iddrisu Abu

Leader

Director of Surveys

Survey Department of Ghana,

Ministry of Lands and Forestry



Mr. Noboru INOUCHI

Leader

Preparatory Study Team

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 Mapping of Southern Part of the Republic of Ghana (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations 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 programmes of JAPAN, will undertake the Study in close cooperation with the authorities concerned in GHANA.

Survey Department of Ghana, Ministry of Lands and Forestry (hereinafter referred to as "SDG"), the official agency responsible for survey and mapping in Ghana, shall act as an executing agency to the Japanese Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVE

The objective of the Study is to prepare the 1/50,000 Metric Topographic Map covering an area of approximately 25,000km² (25,000 square kilometers) shaded on an attached map (APPENDIX-1).

III. SCOPE OF WORK

In order to achieve the above mentioned objective, the Study will cover the following items (The technical details are shown in APPENDIX-2).

1. Aerial Photography

Aerial Photographs shall be taken at a scale of approximately 1/60,000.

Setting of airphoto signals shall be done, if necessary, prior to commencement of the aerial photography.

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2. Ground Control Point Survey

Although existing control points will be used for the topographic mapping, establishment of temporary control points shall be carried out, if necessary.

(1) Traversing and Satellite Geodesy

Supplementary map control points necessary for aerial triangulation and mapping work shall be established by traversing and/or satellite positioning.

(2) Leveling

Leveling shall be carried out to obtain vertical controls for aerial triangulation and mapping work starting from existing bench marks.

3. Pricking

Pricking of identified control points on the aerial photographs shall be done in the field.

4. Field Verification

The topographic map information related to land use, vegetation, etc. shall be verified in the field.

5. Aerial Triangulation

Aerial Triangulation shall be carried out by analytical block adjustment method.

6. Stereo Plotting

Stereo Plotting shall be carried out using stereo plotting instruments at the scale of 1/50,000.

7. Compilation

Compilation shall be carried out based on restitution manuscripts and field verification data.

8. Field Completion

Topographic features, vegetation, etc., which cannot be properly identified in the course of compilation shall be verified in the field and plotted on the compilation sheet. Administrative boundaries and geographical names shall be verified and indicated on the paper copy of the compilation sheet by SDG.

9. Drafting

Based on the compiled sheet, scribing shall be carried out on stable polyester base for several color separation plates. Map style and symbols shall be those adopted by SDG. And the contents of map shall comply with the standards

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of SDG.

10. Printing

Plate making shall be carried out using 1/50,000 scribed negatives, and printing shall be carried out by offset method.

11. Recommendations

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

IV. STUDY SCHEDULE

The whole work shall be conducted in accordance with the attached tentative schedule (APPENDIX-3).

V. REPORTS AND FINAL RESULT

Annual Reports shall be submitted to SDG by the Japanese Study Team (hereinafter referred to as "the Study Team") every Japanese fiscal year (from April to March). The materials mentioned in APPENDIX-4 shall also be submitted to SDG by the Study Team.

All maps produced under the Study shall bear 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 the Government of Ghana."

VI. UNDERTAKING OF GHANA

1. To facilitate smooth conduct of the Study, GHANA shall take necessary measures:
 - (1) to ensure the safety of the Study Team,
 - (2) to permit the members of the Study Team to enter, leave and sojourn in Ghana for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,
 - (3) to exempt the members of the Study Team from taxes, duties and other charges on equipment, machinery and other materials brought into Ghana for the conduct of the Study.

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- (4) to exempt the members of the JICA Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the JICA Study Team for their services in connection with the implementation of the Study,
 - (5) to provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced into Ghana from Japan in connection with the implementation of the Study,
 - (6) to secure permission for entry into private properties or restricted areas with Ghanaian counterpart for the conduct of the Study,
 - (7) to secure permission for the Study Team to take all data and documents (including maps, photographs) related to the Study out of Ghana to Japan, provided said documents shall remain the property of Government of Ghana except those paid for by the Study Team, and
 - (8) to provide medical services as needed. Its expenses will be chargeable on members of the Study Team.
2. GHANA shall bear claims, if any arises, against the members of the Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arises from gross negligence or willful misconduct on the part of the members of the Study Team.
3. To facilitate smooth conduct of the Study, SDG shall make necessary arrangements for the Study Team, in cooperation with other relevant organizations as follows;
- (1) to secure permission for flights for the aerial photography and the use of airports for the implementation of the Study upon written request,
 - (2) to assist to take permission for the use of communication facilities including transceivers which may be used in Japanese language, with allocated frequencies, and
 - (3) to assist hiring necessary number of laborers and watchmen in the project sites.



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4 SDG shall, at its own expense, provide the Study Team with the following in cooperation with other related organizations;

- (1) available data and information related to the Study upon request,
- (2) counterpart personnel (staff of SDG),
- (3) suitable office space with necessary equipment in Accra,
- (4) credentials or identification cards to the members of the Study Team,
- (5) administrative and technical support,
- (6) existing facilities and space of SDG for processing aerial photographs,
- (7) information on necessary administrative boundaries and geographical names to be shown on the maps. The correctness of such information is the responsibility of SDG.
- (8) cartographic specifications for 1/50,000.

VII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures;

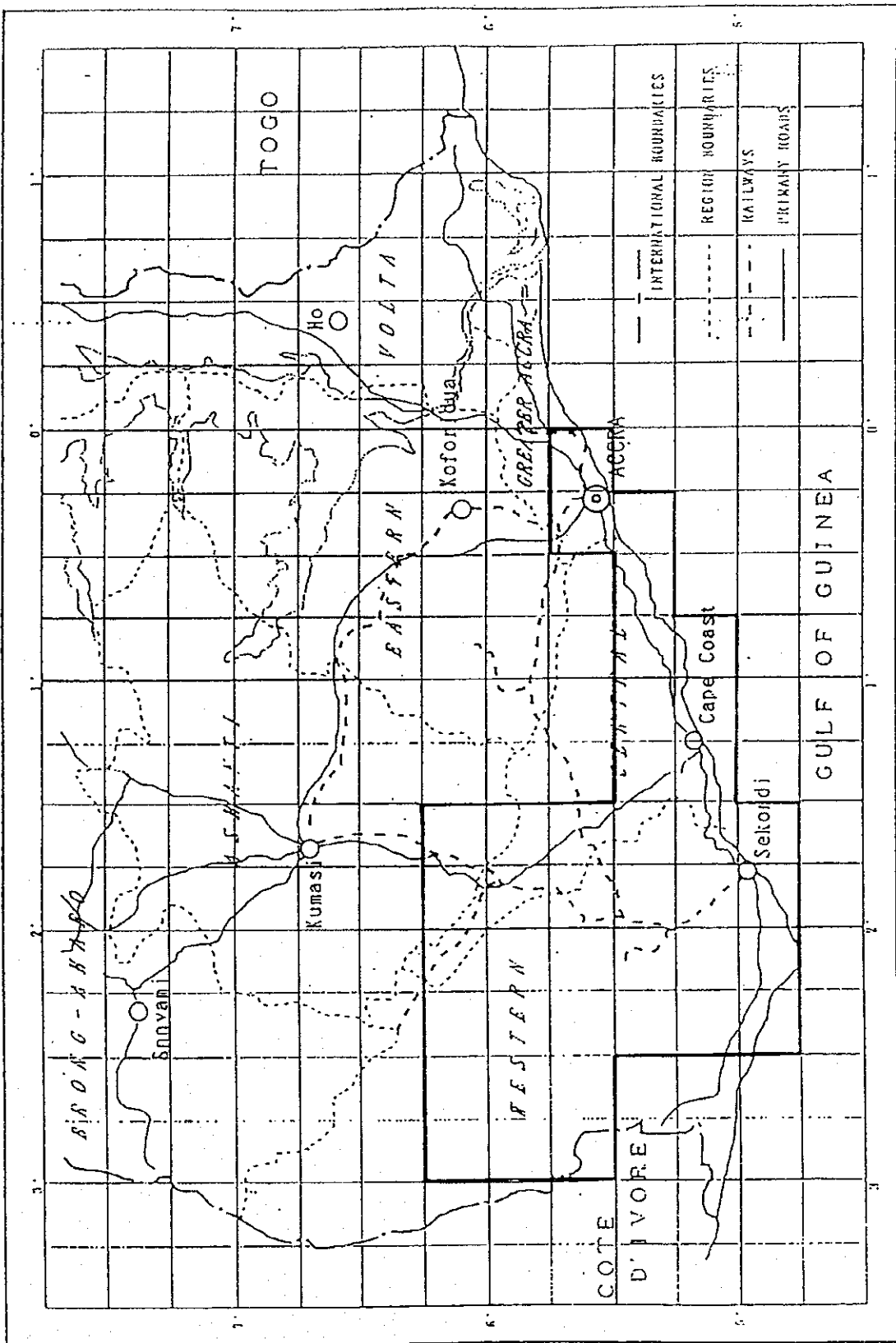
1. To dispatch, at its own expense, the Study Team to Ghana for Premarking, Aerial Photography, Ground Control Point Survey, Pricking, Field Verification and Field Completion with the use of local expertise as much as applicable with JICA's supervision,
2. To carry out Aerial Triangulation, Stereo Plotting, Compilation, Drafting and Printing in Japan at its own expense, and
3. To pursue technology transfer to Ghana counterpart personnel in the course of the Study.

VIII. CONSULTATION

JICA and SDG shall consult with each other in respect of any matter that may arise from or in connection with the Study.

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APPENDIX - I



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Principal Technical Specification

1. Aerial Photography: super-wide angle camera
2. Ground Control Point Survey: 10^{-4} (Relative Accuracy)
3. Leveling
 - (1) Limit of Difference of Reciprocal Observation
for Minor Order Leveling for Photo Control
 $5\text{cm} \sqrt{S}$, where S is expressed in km.
4. Mapping
 - (1) Projection: Ghana Modified Transvers Mercator Projection
 - (2) Sheet Line: $15' \times 15'$ in Latitude and Longitude
 - (3) Contour Interval: 10m
 - (4) Number of Colors: 5 colors

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TENTATIVE SCHEDULE

ITEM	MONTH	1	3	10	20	30	40	42
Signalization (premarking)								
Aerial Photography								
Ground Control Point Survey								
Pricking								
Aerial Triangulation								
Field Verification								
Stereo Plotting								
Compilation								
Field Completion								
Drafting								
Printing								

Note: Work in China Work in Japan

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FINAL RESULTS

1. Aerial Photography
 - (1) original negative-film (1set)
 - (2) contact positive prints (2sets)
 - (3) index map of aerial photographs

2. Ground Control Point Survey
 - (1) final result tables
 - (2) distribution and route diagram

3. Pricking
 - (1) description of Pricking

4. Aerial Triangulation
 - (1) final result tables
 - (2) diapositive films (1set)

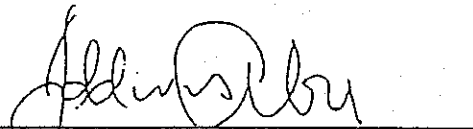
5. Topographic Mapping
 - (1) scribed sheets
 - (2) printed maps (1000 copies for each sheet)
 - (3) reproduceable sheets (1set)

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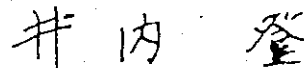
MINUTES OF MEETING
FOR
THE SCOPE OF WORK
FOR
TOPOGRAPHIC MAPPING
OF
SOUTHERN PART OF THE REPUBLIC OF GHANA
AGREED UPON BETWEEN
SURVEY DEPARTMENT OF GHANA,
MINISTRY OF LAND AND FORESTRY
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

ACCRA, GHANA

17th March, 1995



NAA Alhaji Iddrisu Abu
Leader
Director of Surveys
Survey Department of Ghana,
Ministry of Lands and Forestry



Mr. Noboru INOUCHI
Leader
Preparatory Study Team,
Japan International Cooperation Agency

The Preparatory Study Team (hereinafter referred to as "the Team"), for Topographic Mapping of Southern Part of the Republic of Ghana (hereinafter referred to as "the Study") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Noboru INOUCHI visited the Republic of Ghana from March 12 to March 31, 1995, and had a series of discussions with the Ghana side, represented by Survey Department of Ghana, Ministry of Lands and Forestry (hereinafter referred to as "SDG"). List of Participants is shown in Attachment.

As a result of the said discussions, both sides came to an agreement on the SCOPE OF WORK (hereinafter referred to as "S/W") of the Study, and signed it on March 17, 1995.

This document summarizes major items discussed between both sides and is meant to supplement the S/W for the smooth conduct of the Study.

1. Mapping Area

Both sides agreed that the mapping area should be approximately 25,000km² (shown in appendix-1 of S/W).

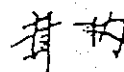
2. Scale of Aerial Photography

The scale of aerial photography 1/60,000 is finally agreed upon.

3. Flight Permission

SDG shall obtain flight permission for aerial photography from the Government of Ghana upon written request. And on the national border of Cote d'Ivoire, SDG will obtain the permission from the Government of Cote d'Ivoire. Both shall be obtained prior to commencement of the Study.

In case the flight permission by Cote d'Ivoire is not available, the area



approximately 10km inside along the national border shall be basically excluded for aerial photography.

4. Radio Frequency

SDG shall assist the Japanese Study Team to take permission for the use of radio frequency from Frequency Board.

5. Contour Interval

Due to the eager and strong request of Ghana side, contour interval will be 10m. However in mountainous and/or steep area, contour interval will be 20m.

6. Necessary Vehicles

SDG strongly requested necessary vehicles for the Study because the Government of Ghana cannot arrange those vehicles. The Team promised to convey that request to JICA.

7. Counterpart Training

SDG strongly requested to send participants to the counterpart training in Japan. The Team promised to convey that request to JICA and related organizations.

8. Retainment of Maps

SDG agreed that Japanese sides can retain some sets of printed maps which will be produced as a result of the Study as long as they are not given to third parties without approval of Government of Ghana represented by SDG.

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PARTICIPANT LIST

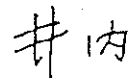
GHANA SIDE

NAME	POSITION
NAA ALHAJI IDDRISU ABU	Leader, Director of Surveys
Dr. George J.W. Zarzycki	Advisor Land Administration and Information Systems, Ghana Urban II Project
Mr. E.S.SAI	Acting Deputy Director
Mr. J.DOTSE	Principal Staff Surveyor/Regional Surveyor
Mr. J.T.ODAMETAY	World Bank Project Unit /Principal Survey and Cartographic School
Mr. R.TETTEH	Chief Lithographer
Mr. ANDOH KESSON	Officer-in-charge Photogrammetric Section
Mr. JOHN AYER	World Bank Project Unit
Mr. ARKU LAWSON	Chief Cartographer
Mr. J.ESSIEN	Assistant Chief Cartographer
Mr. JONES OFORI BOADU	Assistant Examiner
Mr. W.K.OPOKU	World Bank Project Unit
Mr. E.A.LOMO	Assistant Chief Lithographer
Mr. MARCUS A. TABIL	Examiner and computing

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JAPAN SIDE

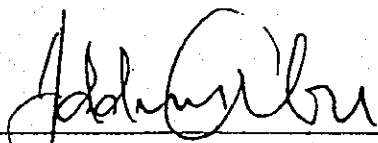
NAME	POSITION
Mr. INOUCHI, Noboru	Leader of the mission Director, Geodetic Department, Geographical Survey Institute (GSI), Ministry of Construction (MOC)
Mr. TSUJI, Hiromichi	Survey planning Research Geodesist, Geodetic Department, GSI, MOC
Mr. TAKITA, Yoshimi	Cost Estimate Topographic Division, Topographic Department, GSI, MOC
Mr. MAGOME, Hiroshi	Photogrammetry Director, Japanese Association of Surveyors
Mr. TANIKAWA, Toshiaki	Control Point Survey Chief, Japanese Association of Surveyors
Ms. KUDO, Mikako	Study Planning First Development Study Division, Social Development Study Department, Japan International Cooperation Agency (JICA)
Mr. KAI, Toshiharu	Deputy Director JICA Ghana Office

4. Minutes of Meeting

MINUTES OF MEETING
FOR
TOPOGRAPHIC MAPPING
OF
SOUTHERN PART OF THE REPUBLIC OF GHANA
AGREED UPON
BETWEEN
SURVEY DEPARTMENT OF GHANA,
MINISTRY OF LANDS AND FORESTRY
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

ACCRA, GHANA
December 18th, 1997


NAA Alhaji Iddirisu Abu
Director of Surveys
Survey Department of Ghana
Ministry of Lands and Forestry

宇根 寛
Mr. Hiroshi UNE
Leader
Advisory Committee,
Japan International Cooperation Agency

The advisory Committee (hereinafter referred to as "the Committee") for Topographic Mapping of Southern Part of the Republic of Ghana (hereinafter referred to as "the Study") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Hiroshi UNE visited the Republic of Ghana from 14th of December to 19th of December, 1997, and had a series of discussions with the Ghana side, represented by the Survey Department of Ghana, Ministry of Lands and Forestry (hereinafter referred to as "SDG") headed by NAA Alhaji Iddirisu Abu. The list of participants is shown in Appendix-1.

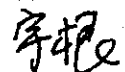
The Study, a five-year plan, started in January, 1996, as a technical cooperation program of JICA in compliance with the Scope of Work agreed upon between SDG and JICA on 17th of March, 1995.

In October 1997, the SDG requested that the digital data be added to the final products and delivered to the SDG. Furthermore, little progress was made in the aerial photography on account of unexpected unseasonable weather even though the study team extended the schedule and tried four times.

As a result of the said discussions, both sides came to share a common understanding on the changes of the process of the Study.

Main items discussed by both sides are as follows:

1. The SDG and the Committee agreed that the digital topographic data of the study area will be added to the final products and delivered to SDG. The data will be installed into CD-ROMs. The format of the data will be designed so as to be comparable with the existing digital topographic data produced by SDG under the Ghana Environmental Resources Management Project. (hereinafter referred to as "existing digital data"). 10 copies of CD-ROMs which contain digital topographic data for all the study area shall be supplied as final products. Digital plate making method will be applied instead of manual scribing, and the scribed sheets shall be deleted from the list of the final products to be submitted. The plates for reproducing paper maps will be delivered to the SDG after finishing the Study.
2. The Committee and the SDG agreed that Japanese side can retain some sets of CD-ROMs which will be produced as a result of the Study as long as they are not given to third parties without approval of the Government of Ghana represented by SDG.
3. The Committee explained the state of aerial photo-shooting. The work of aerial photograph shooting did not progress as much as it was planned. Even if it is continued, the work will not be completed within a reasonable timeframe. Therefore, the Committee proposed that the work of 1:60,000 aerial photo-shooting will be limited to the work done up to the end of the year 1997 and terminated. The SDG accepted the proposal.
4. The Committee proposed that the new digital mapping work for 20 sheets (as shown in Appendix 2) will be conducted to produce topographic maps with a scale of 1:50,000 using newly taken photographs. The SDG accepted the proposal.
5. The Committee proposed an updating work be conducted for the area where aerial photographs were not fully taken to conduct a new digital mapping. In this work, ground features will be updated to produce revised topographic data with a scale of 1:50,000 from existing digital data, using



available satellite images. Field verification shall be done more intensively than the new digital mapping work. Other possible materials such as existing aerial photos provided by the SDG may be used. Adding to it, a large scale aerial photo shooting will be conducted for the limited area where planimetric change is great. The SDG accepted the proposal.

6. The SDG and the Committee agreed that all the digital data that will come from both the new digital mapping work and the updating work will be structured topologically. The structure will be harmonized with the structure of existing digital data.

7. The SDG requested that the contour interval of the new mapping is applied to the updating work.

8. The SDG requested for technology transfer on operation and maintenance of the digital topographic data. The Committee accepted the request.



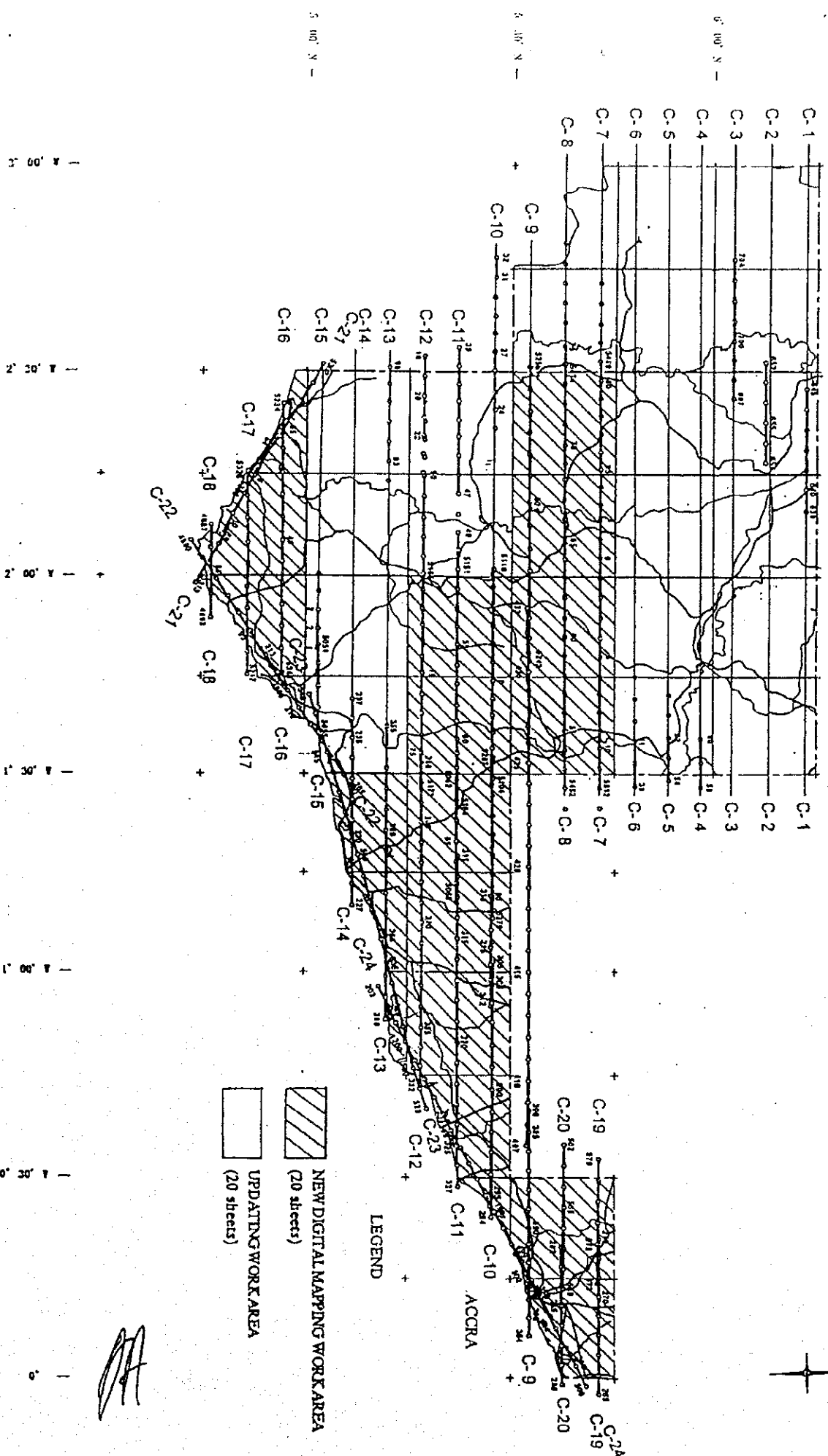
**PARTICIPANTS FROM GHANA SIDE
(SURVEY DEPARTMENT OF GHANA)**

<u>NAME</u>	<u>POSITION/SECTION</u>
1. Naa Alhaji Iddirisu Abu	Director of Surveys
2. E. S. Sai	Ag. Deputy Director of Surveys
3. J. Dotse	Coordinator, Mapping Project
4. R. Brimah	Assistant Director
5. J.A. Abbosey	Headquarters Staff
6. E.R. Tetteh	Chief Lithographer
7. Marcus A. Tabil	Examiner
8. S. Oppong-Antwi	Digital Mapping Unit
9. E. Addo-Tawiah	Digital Mapping Unit.
10. Kofi N. Arku-Lawson	Chief Cartographer
11. I. Andoh-Kesson	Photogrammetrist
12. E.A. Quaye	Headquarters staff (In-charge of Cadastral Survey)
13. J.C. Acquaaah	Geodesy Unit (G.P.S)
14. K. D. Ewusi-Ampah	Headquarters staff (Accountant)
15. Jones Ofori-Boadu	Data Examiner
16. John Ayer	Officer-in-charge of training
Ian K. Isaacs	Terra Surveys (Observer).

**PARTICIPANTS FROM JAPANESE SIDE
(JICA)**

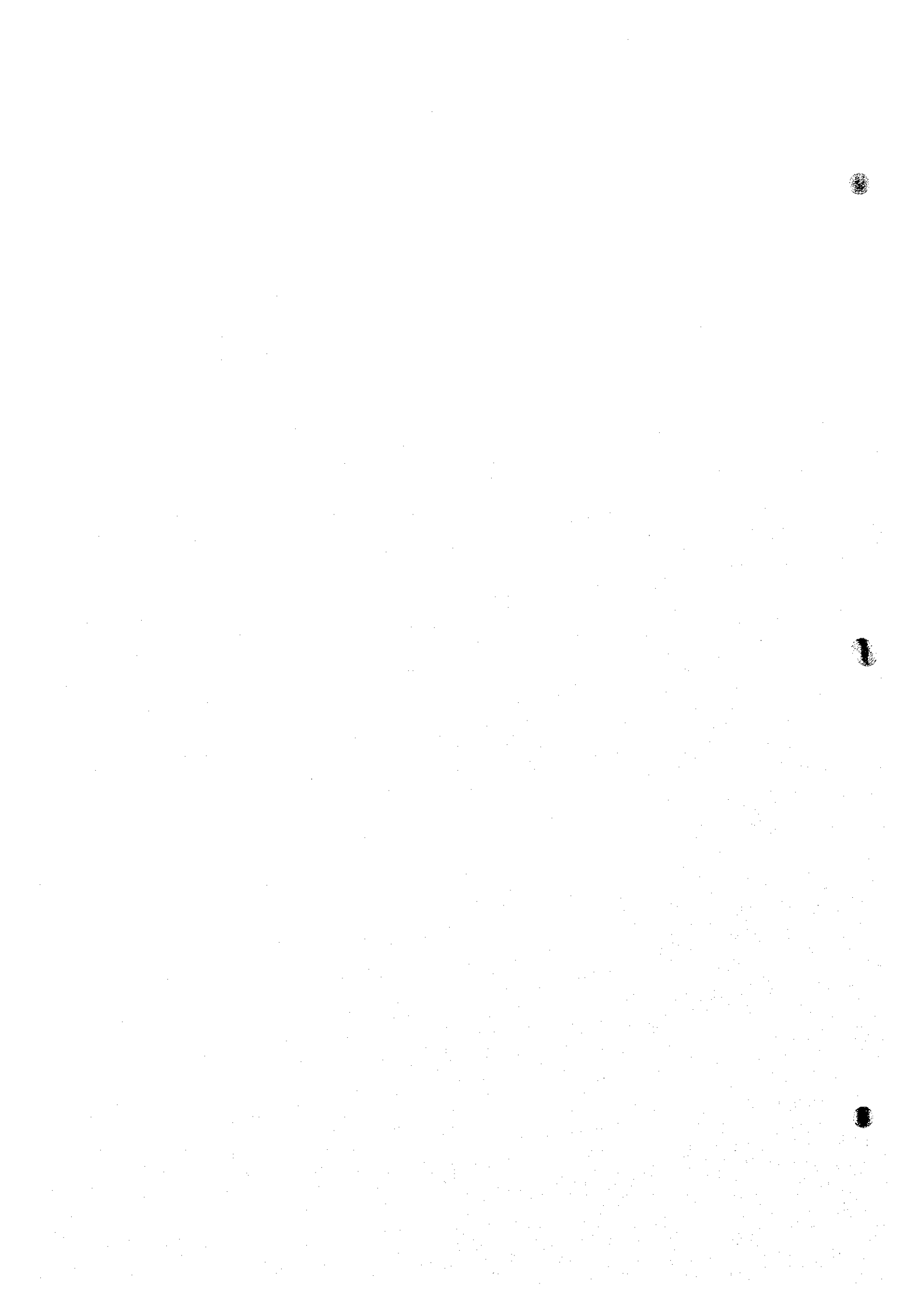
1. Hiroshi UNE	Team Leader, Head of International Affairs office, Geographical Survey Institute, Ministry of Construction, Japan
2. Hozumi KATSUTA	Study Planning, Development Specialist, JICA
3. Tokihiko KAMINISHI	Consultant Team Leader, (Infrastructure Development Institute, Japan)
4. Christopher NUOYEL	Programme Officer, JICA/Ghana Office

TOPOGRAPHIC MAPPING CHART



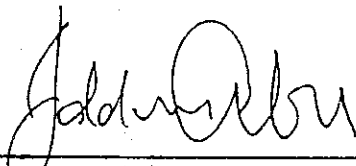
5. The Minutes of the meetings with the Survey Department of Ghana

5-1 Minutes of meeting at the start-up of the 1st year field work (Feb. 9, 1996)

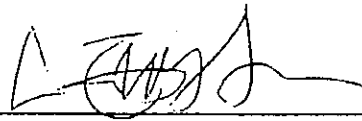


MINUTES OF MEETINGS
FOR
THE STUDY ON TOPOGRAPHIC MAPPING
OF
SOUTHERN PART OF THE REPUBLIC OF GHANA
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
SURVEY DEPARTMENT OF GHANA

ON
FEBRUARY 9, 1996
ACCRA, GHANA



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



TOKIHIKO KAMINISHI
LEADER
JICA STUDY TEAM

The JICA Study Team headed by Mr. Tokihiko KAMINISHI visited the Republic of Ghana from 30th January, 1996 to carry out the first year work for the Study on Topographic Mapping of Southern Part of the Republic of Ghana.

Prior to the commencement of the first phase survey work, a series of meetings were held from 1st to 9th February, 1996 and following items have been confirmed and agreed by Survey Department of Ghana (SDG) and JICA Study Team.

1. The Plan of Operation proposed by JICA Study Team was discussed and agreed as appendix.
2. Study Team received the Geodetic Data to be applied in the Study area from SDG.
3. SDG requested to Study Team that the following annotation should be printed at the lower margin of every map;

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

Study Team took note this request and confirmed to convey this request Tokyo JICA Head Office.



LIST OF ATTENDANTS

GHANAIAN SIDE

(SDG)

1. Na Al-haji I. Abu	Director of Surveys	Headquarters
2. R. Brimah	Asst. Director	Headquarters
3. J. Dofse	Asst. Director	Greater Accra Region
4. J. Abbosy	Staff Surveyor	Headquarters
5. E. A. Quaye	Asst. Chief Cartographer	Headquarters
6. J. T. Odametey	Asst. Staff Surveyor	Headquarters
7. H. A. Kuffo	Asst. Staff Surveyor	Headquarters
8. J. C. Acquah	Technician Engineer	Greater Accra Region
9. Andoh Kessey	Technician Engineer	Photogrammetric Section
10. E. R. Tetteh	Chief Lithographer	Lithographic Section
11. J. Ofori Boadu	Asst. Staff Surveyor	Examination Section
12. K. Wemegah	Technician Engineer	Examination Section
13. Marcus Tabil	Asst. Staff Surveyor	Examination Section
14. Arku Lawson	Asst. Staff Surveyor	Cartographic Section
15. C. R. K. Anyaah	Snr. Technician Engineer	Examination Section

JAPANESE SIDE

(JICA Study Team)

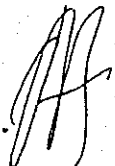
1. Tokihiko KAMINISHI	Leader
2. Koichi MIKI	Deputy Leader
3. Kozo OKUMURA	Mapping Planner
4. Yutaka KYAKUNO	Chief Surveyor
5. Hideaki SAKAI	Coordinator

(Advisory Committee Team)

1. Yoshimi TAKITA	Technical Staff, Geographical Survey Institute
2. Toshihisa HASEGAWA	Staff, JICA Headquarters

(Ghana Office, JICA)

1. Toshiharu KAI	JICA Deputy Resident Representative
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ATTACHMENT

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

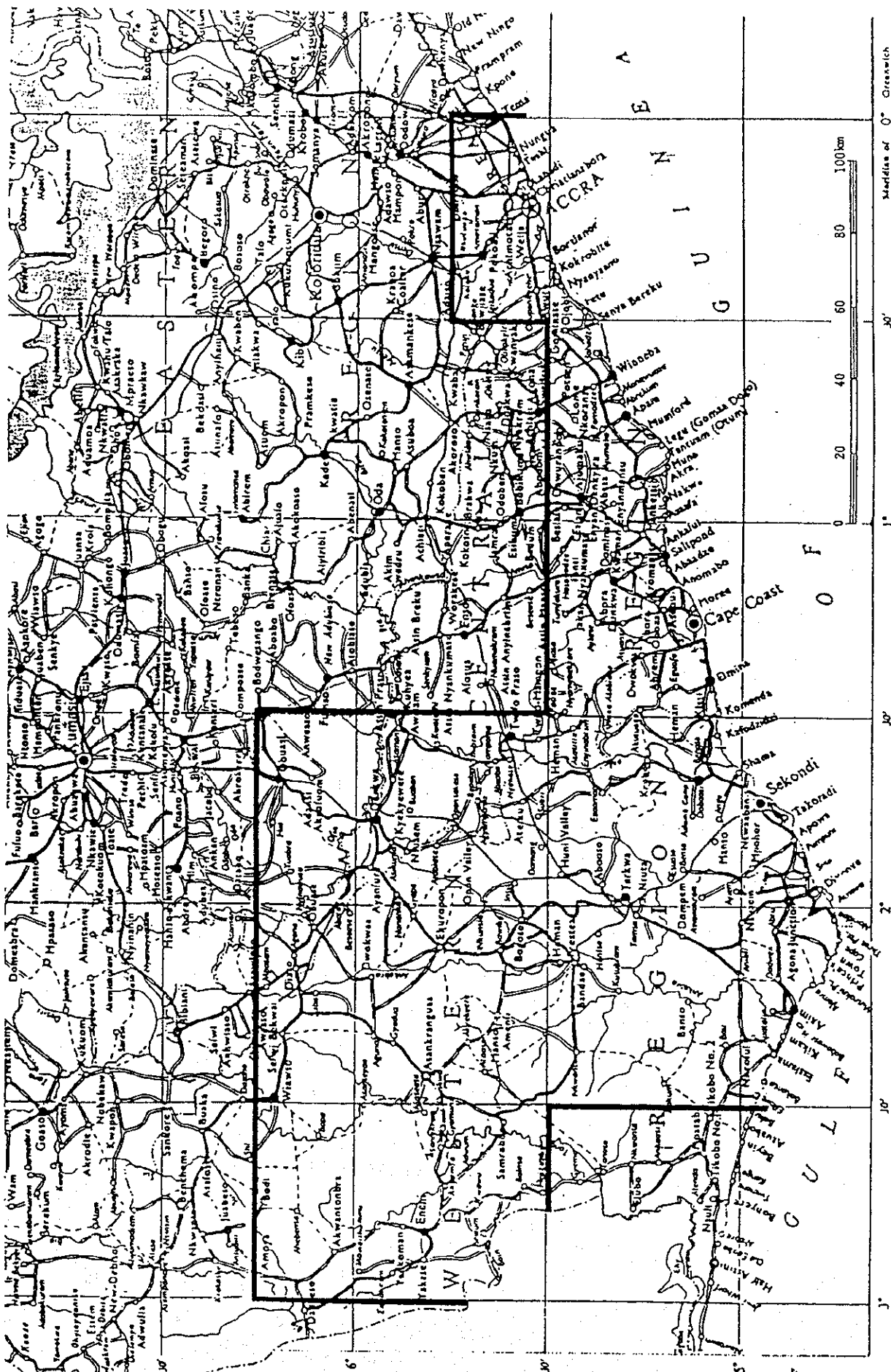
JANUARY, 1996

JAPAN INTERNATIONAL COOPERATION AGENCY

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TOPOGRAPHIC MAPPING AREA



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ATTACHMENT: Scope of Work & Minutes of Meeting

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 Mapping of Southern Part 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 programme 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 act as the counterpart agency to the JICA Study Team (hereinafter referred to as the Team) and also as the coordinator in relation to other governmental and non-governmental organizations concerned of Ghana for the smooth implementation of the Study.

The Study shall be executed under four years plan, and the Plan of Operation (P/O) for the first year's study is proposed with tentative schedule for succeeding years.

II. OBJECTIVE OF THE STUDY

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

III. OUTLINE OF THE STUDY

In order to achieve the above mentioned objective, the Study will cover the following items in accordance with the Scope of Work (S/W), minutes of meetings (M/M), JICA procedural rules for overseas surveying (base mapping).

1. Aerial Photography

Panchromatic vertical aerial photographs shall be taken at a scale of

1/60,000 covering the entire study area using super-wide angle camera.

2. Ground Control Point Survey

Control points for aerial triangulation shall be executed by Satellite Geodesy, applying Global Positioning System (GPS) for horizontal and vertical control. Additionally, vertical control points for aerial triangulation shall be increased by direct leveling of minor order using leveling instrument in principle.

3. Pricking

Pricking of above horizontal and vertical control points (including existing BMs) shall be performed on the enlarged aerial photos.

4. Aerial Triangulation

Aerial triangulation shall be performed based on the ground control points survey data. Adjustment computation shall be made analytically by the block adjustment method.

5. Field verification

The topographic features, land use, vegetation and other information necessary for terrain representation shall be identified in the field. Place names to be adopted shall be confirmed on site referring to the information provided by SDG. Cooperation of SDG is sought for collection and recording of geographic and administrative names that are necessary for topographic map.

6. Stereo-plotting

Stereo-plotting shall be carried out at a scale of 1/50,000 by stereo plotting machine with contour interval 10m (mountainous area 20m).

7. Compilation

Compilation shall be carried out based on the restitution manuscript and field verification data. Map symbols and specifications shall be used in accordance with pre-agreed between the Study team and SDG.

8. Field Completion

Topographic features, vegetation, etc., which cannot be properly identified in the course of compilation shall be verified in the field and plotted on the compilation sheet (To complete the original manuscript). Administrative boundaries and geographical names shall be verified and indicated on the paper copy of the compilation sheet by SDG.

Additionally, subsequent drafting and map-reproduction treatment shall be discussed and agreed between the Study Team and SDG.

9. Drafting

Based on the original manuscripts, scribing shall be carried out on stable polyester base for several color separation plates. Map style and symbols shall be those adopted by SDG. And the contents of map shall comply with the standards of SDG.

10. 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 sheet.

11. Recommendations

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

Work volumes and standards for respective work items are shown in Tab.1 and Tab.2.

Tab. 1 Work volume of the Study

ITEM	VOLUME	REMARK
1. Aerial photography	approx. 25,500 Km ²	Scale 1/60,000 (super-wide)
2. Ground control survey	approx. 74 points	GPS survey method(including existing control points).
3. Leveling	approx. 1,080 Km	Minor order leveling.
4. Pricking		
GPS point	approx. 74 points	40 points for horizontal & vertical, 34 points for vertical control.
New leveling point	approx. 1,080 Km	approx. 270 points
5. Aerial triangulation	approx. 680 models	
6. Field verification	approx. 25,500 Km ²	
7. Stereo-plotting	approx. 25,500 Km ²	Scale 1/50,000 (40 sheets)
8. Compilation	approx. 25,500 Km ²	Scale 1/50,000 (40 sheets)
9. Field completion	approx. 25,500 Km ²	
10. Drafting	approx. 25,500 Km ²	Scale 1/50,000 (40 sheets)
11. Printing	40 sheets	1,000 copies each

Tab. 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. 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 (as attached) are summarized as follows ;

1. Ghana side :

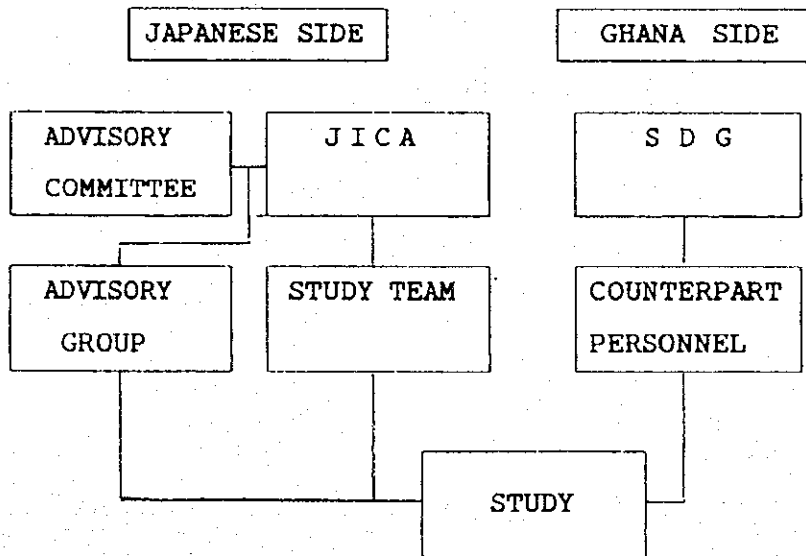
- Necessary arrangement to ensure the entry, exit and stay of the Team members as well as personnel of an aerial photography company contracted by the Team for the Study together with related materials and equipment to bring in and out of Ghana.
- Assistance to facilitate issuance of permit necessary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

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VI. REPORT AND FINAL PRODUCTS

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) 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 and annotated aerial photographs ----- 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. DETAILED WORK PLAN FOR FIRST YEAR (PHASE 1)

The field work for the first year (aerial photography, ground control survey I) shall be carried out for a period from January, 1996 to March 1996. The members of the Study team and their assignment in the first year 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 equipments for each work process so as to facilitate the field work.

2. Preliminary Work in Ghana

Upon arrival in Ghana, while Study Team shall start preparing for field operations. Team Leader and his staff shall meet with SDG to discuss following administrative matters.

- (1) Explanation of P/O.
- (2) To secure permissions to take aerial photographs.
- (3) Security of Survey Team Members. Issuance of ID card/pass permits.
- (4) Notifying relevant government agencies and request for assistance by the military, if necessary.
- (5) Appointment of SDG counterparts for each survey team activity.
- (6) Permission to take out the original negative films and other related materials from Ghana to Japan and also back into the Ghana.
- (7) Office space & photo-processing facilities of SDG for Study Team.
- (8) Permits for entering public/private land for cutting trees as necessitated by the survey work.
- (9) Assistance in hiring vehicles and drivers.
- (10) Assistance in setting sub-camps.
- (11) Supply of survey data of existing control points.
- (12) Other items relevant to S/W.

3. Aerial Photography

Aerial photography shall be contracted out to a foreign aerial photography company. 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;

- 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 3% in successive 5 photograph. 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 inspect developed photos to ensure sidelaps, overlaps and see the specifications are followed. If the results do not fulfill the specifications, the aerial photography company shall be carried out to re-fly same portions.
- Film editing : Course numbers and photo numbers (starting from west) shall be annotated on negatives. In details, the annotations shall be finalized after discussion with SDG.
- Index map : The index map is prepared on the existing 1/500,000 topographic map by assigning principal points of photos.

4. Ground Control Point Survey I

In order to ensure the planimetric relative accuracy (1/100,000) for the horizontal control point survey as agreed to in S/W, horizontal control point survey shall be conducted by satellite geodesy using GPS units. Observation shall be made simultaneously via plural units of GPS equipment to form an observation network connected to existing control points. The results shall be computed by network adjustment in Japan. Check observation shall be made over a distance between known points to ensure the accuracy. It shall be so planned as to receive signals from more than four different satellites. The elevation of Phase-1 GPS control points shall be determined by direct or indirect leveling method using leveling instrument or EDM/theodolite on Phase-2.

4-1 Observation plan

New control points shall be set up in the study area to maintain the accuracy required for subsequent aerial triangulation.

GPS observation (newly set up) : approx. 36 points

GPS observation (existing control point): approx. 4 points

If the location of a new point happens to have no access even by vehicle, it may be moved to an easier location.

4-2 Observation

In GPS observation, attention shall be paid as follows ;

- Antenna shall be set up higher than any obstacles (metal object in particular) in the surroundings, and overhead clearance of 80 degree or more of zenith angle must be ensured.
- Observation shall be made more than four GPS satellites in different orbits.
- Signals shall be received from satellites as they are at 15 degree or higher.
- Observation shall be made in static mode at a horizontal control points.

4-3 Computation & accuracy

Computations are made of satellite observation data as obtained above;

- To obtain vectors of base lines between points.
- To calculate coordinates of observation points based on WGS-84. Then closure errors are calculated for simultaneous observation points to examine the quality of observation. Closure errors of vector shall be kept to less than 5 ppm.
- From tentative computation results, to perform geodetic network adjustment computations and make conversion to the relevant geodetic system.
- Strict inspection shall be performed at every work process to maintain required accuracy.

VI. TENTATIVE WORK PLAN FOR SUCCESSIVE WORK (PHASE 2~5)

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. Ground Control Point Survey II

Additional ground control points (approx. 34 points) shall be increased in this stage for vertical control for aerial triangulation. It shall be done same as Phase-I specification, but the height shall be computed by interpolation method by referring to the geoidal slope of the study area based on the difference between Phase-I GPS results/leveling.

2. Leveling

Bench marks are applied for vertical control, but existing bench marks as distributed in the study area are do not satisfy the required specifications for aerial triangulation, so that minor order leveling shall be carried out to set up additional vertical control for aerial triangulation.

The survey shall be made by direct leveling in principle but for areas where access is difficult, indirect leveling may be applied using EDM/theodolite.

(1) Observation

- The leveling shall be start at an existing bench mark and to close other existing one. Also bench marks to be applied are selected after check surveying in relation to neighboring existing bench mark.
- For routes with no closure route, double-run (back & fore) observation shall be executed.
- Vertical control points for aerial triangulation shall be set up about 3 to 4 Km intervals at location where pricking is possible on photos.

(2) Accuracy

- Allowable error for both closure and double-run shall be within $5\text{cm}/s$ ($s=\text{Km}$).

3. Pricking

Pricking shall be performed for above mentioned GPS points, existing BMs and new leveling points using two times enlarged photos. Eccentric points for horizontal control shall be selected and pricked at clearly identifiable points on the aerial photos, and the eccentric elements shall be measured using EDM, theodolite etc.

Pricking of new leveling points shall be done at the same time of observations, if possible.

4. Map Symbols Consultation

To facilitate the Third year field work (field identification), SDG shall be consulted on the following items;

- (1) Map symbols and their application rule.
- (2) Collection of materials related to above.

5. Aerial Triangulation

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

Pass-points, tie-points and control points as pricked on the diapositives are measured using stereocomparator or equivalent for their coordinates.

Adjustment computation shall be performed using block adjustment program based on the independent models. Orientation elements on the plotter are also computed.

Control points and model layout are as shown on Fig.4. The tolerance (discrepancy) for pass-points, tie-points, and also the limits of residuals of ground controls as used for adjustment shall be less than JICA procedural rules.

6. Field Verification

Field verification shall be conducted using 2-times enlarged aerial photos. Map symbols and application criteria shall be set as agreed to by SDG.

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

other available materials. In the field, key for photo interpretation of land-use/vegetation, for example shall be collected and confirmed.

Roads linking, scattering villages and communities shall be identified, and items for map representation are selected.

Administrative boundaries and place names shall be based on informations to be supplied by SDG.

7. Stereo-plotting

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

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

8. Compilation

Restitution maps shall be compiled according to the field identification findings and made into compilation manuscripts with the symbols and specifications as agreed between the Study team and SDG.

Sheet size of the compiled topographic maps shall be 15' x 15' and number of the map sheets shall be 40 sheets.

9. 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.

10. Drafting

Based on the final manuscripts, original drafting maps shall be prepared for making 5-color printing plates. For drafting, color separation negative scribing method shall be applied.

The original drafting maps shall consist of scribed sheets, masking sheets, annotation/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 the Government of Ghana."

11. Printing

Printing plates shall be made from the original draft maps by photolithography. Printing shall be done in five colors by an offset printing machine. 1,002 copies shall be printed for each map sheet, of which 2 copies each shall be kept in Japan. Specification of printing paper to be used shall be determined through talks with SDG.

12. Work Flow

The flow of the entire work is schematically shown on the Fig. 1.

TABLE. 3 MEMBERS OF STUDY TEAM AND THEIR ASSIGNMENT IN THE FIRST YEAR (PHASE 1)

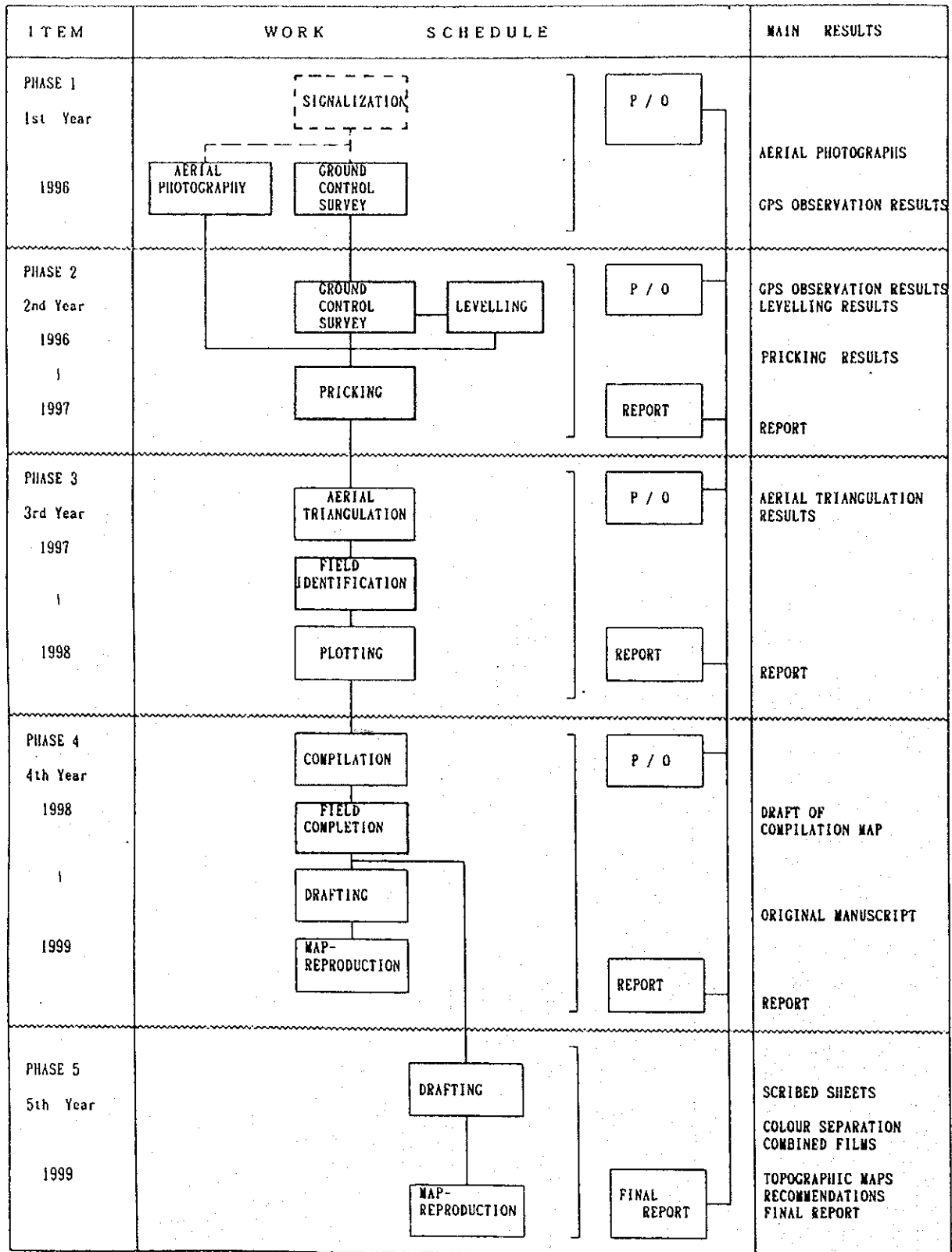
NAME	ASSIGNMENT	DURATION	CONTENTS
Tokihiko KAMINISHI	LEADER	29th Jan--17th Feb, 1996 8th Mar--25th Mar, 1996	1. TOTAL MANAGEMENT 2. GENERAL DISCUSSION
Koichi MIKI	SUBLEADER	29th Jan--25th Mar, 1996	1. SUB MANAGEMENT 2. GENERAL DISCUSSION 3. ASSISTANCE OF LEADER 4. GENERAL SUPERVISION
Kouzou OKUMURA	MAPPING PLANNER	29th Jan--25th Mar, 1996	1. FUNDAMENTAL MAP PLANNING 2. GENERAL COORDINATION 3. REPORTING
Yutaka KYAKUNO	CHIEF SURVEYOR	29th Jan--25th Mar, 1996	1. PLANNING OF IMPLEMENTATION 2. SUPERVISION OF WORKS 3. COORDINATION OF WORKS 4. QUALITY CHECKING
Shinpei ISHIWATA	MECHANICAL ENGINEER	29th Jan--25th Mar, 1996	1. MANAGEMENT OF VEHICLE 2. MAINTENANCE OF VEHICLE
Yutaka KOKUFU	PHOTOGRAPHER	19th Feb--25th Mar, 1996	1. INSPECTING OF PHOTOGRAPH AND PHOTO PROCESS
Masahiko OIASHI Yasuo GOTO Seiichi FUKUTOMI Tuyoshi YAMASAKI Kouichi WAKISAKA Makoto TSUJIMOTO Masaru TERADA Sadao MATSUMOTO Tomohiro MURAKAMI Kensuke KIMURA Yuichi TABIKAWA Kazutomo NAKANISHI Kouji FUKAZAWA Kouzou YAMAYA	SURVEYOR	29th Jan--25th Mar, 1996	1. G. P. S. OBSERVATION 2. G. P. S. ANALYZING
Hideaki SAKAI	COORDINATOR	29th Jan--17th Feb, 1996 16th Mar--25th Mar, 1996	1. Coordination

TENTATIVE WORKING SCHEDULE

YEAR YEAR	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	
ITEMS	MONTH																							
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 [grid pattern] FIELD SURVEY [rectangle] WORK IN JAPAN [triangle]

FIGURE 2. FLOWCHART FOR THE PRODUCTION OF TOPOGRAPHIC MAPS



Remarks: 1. Field works in Uganda 2. Works in Japan

Fig. 3 FLIGHT COURSE

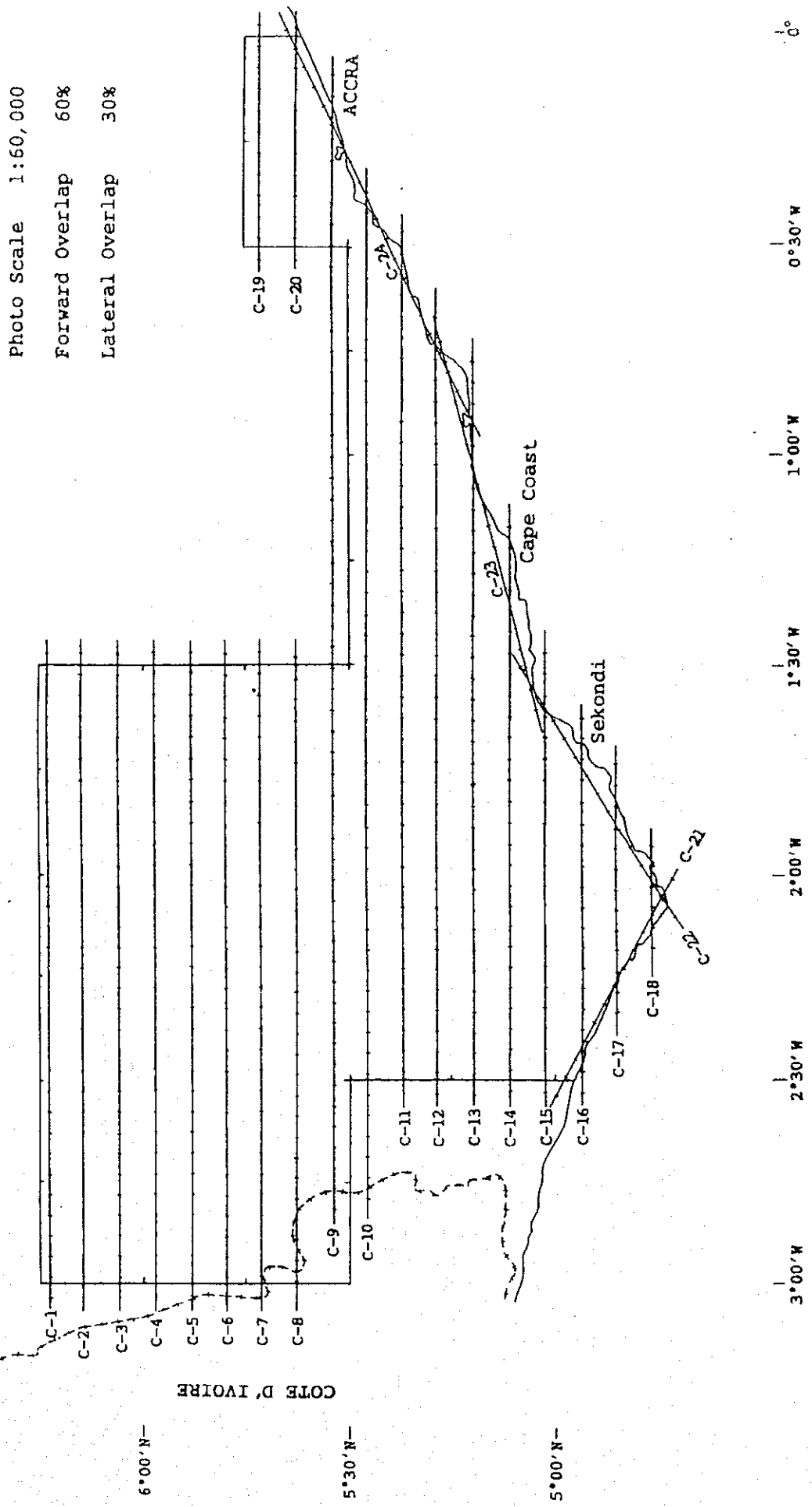


Fig. 4 GROUND CONTROL INDEX (DRAFT)

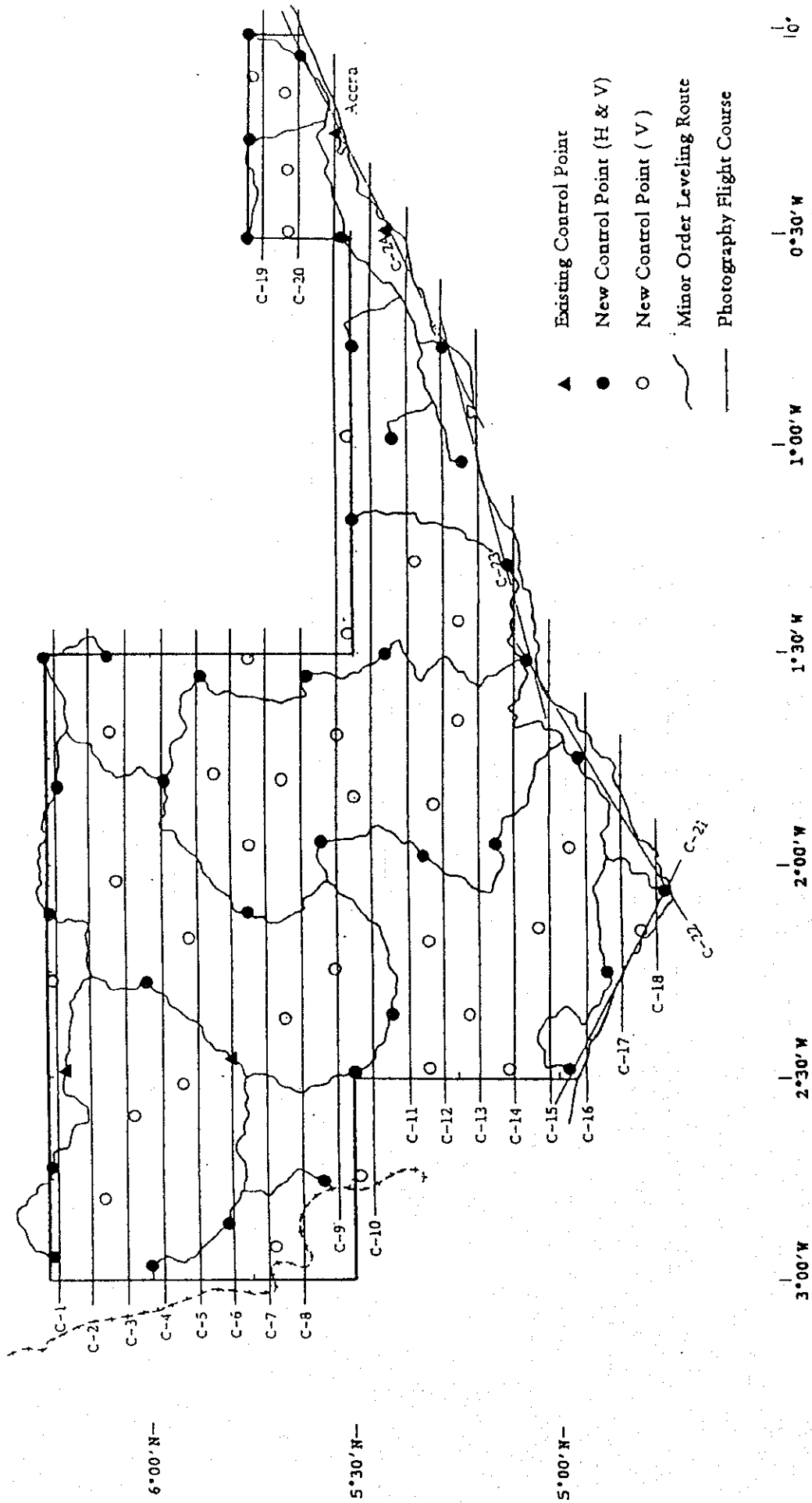
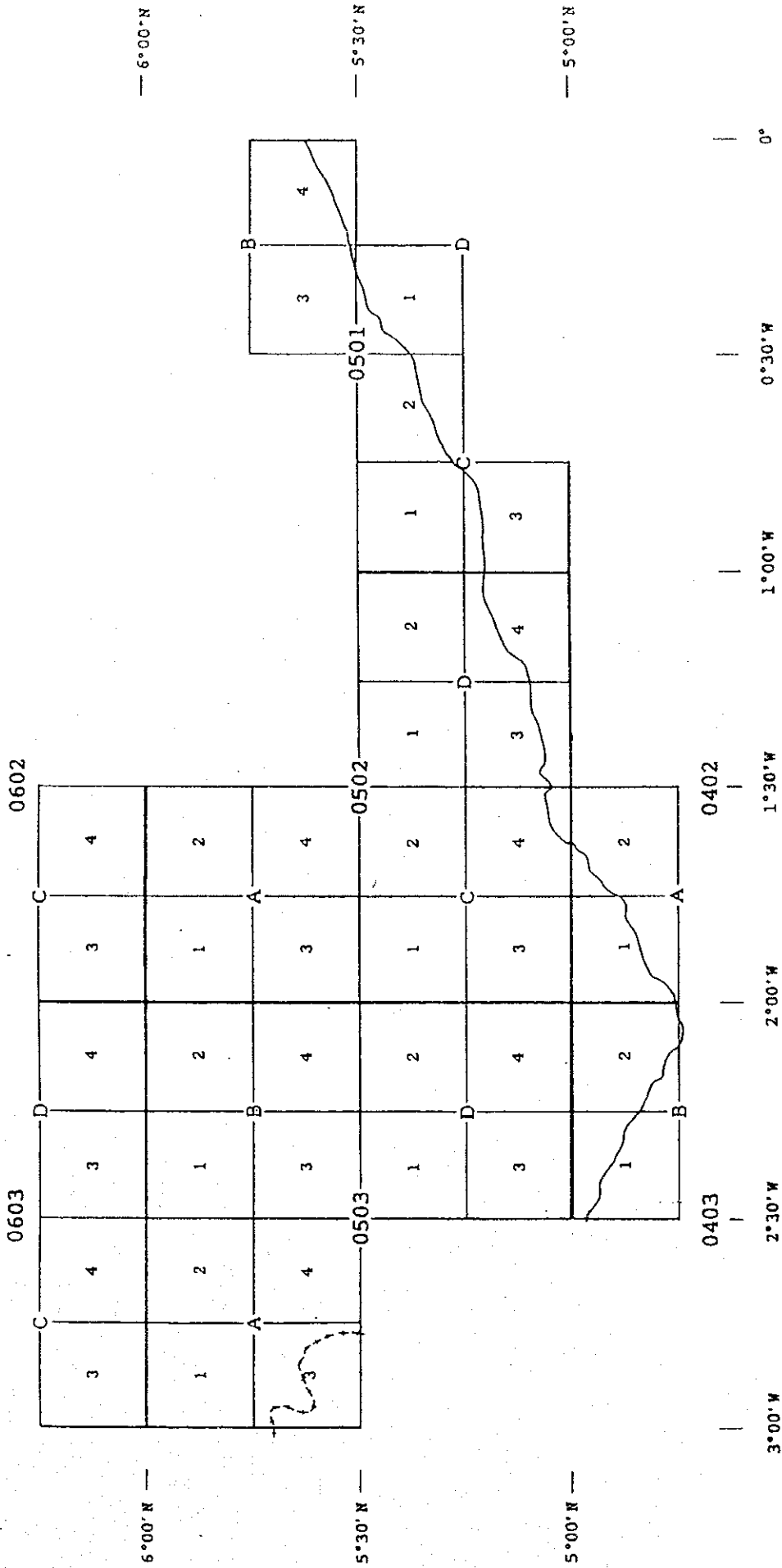


Fig. 5 SHEET INDEX MAP



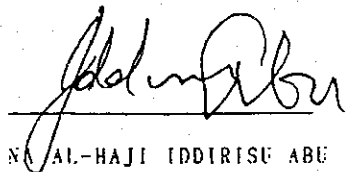
Handwritten signature

Handwritten mark

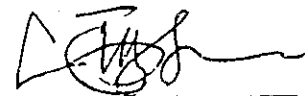
5-2 Minutes of meeting at the end of the 1st year field work (Mar. 21, 1996)

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

ACCRA GHANA, 21ST MARCH 1996



N. AL-HAJI IDDIRISU ABO
DIRECTOR OF SURVEYS
SURVEY DEPARTMENT OF GHANA
MINISTRY OF LANDS AND FORESTRY



MR. TOKIHIRO KAMINISHI
TEAM LEADER
JICA STUDY TEAM

SURVEY DEPARTMENT OF GHANA (SDG) and JICA STUDY TEAM (Team) had a series of meetings at the end of the first year's field works for the TOPOGRAPHIC MAPPING OF SOUTHERN PART OF THE REPUBLIC OF GHANA from March 19th to 21st 1996.

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

1. The Team submitted 'Progress Report of the First Year's Field Work for the Topographic Mapping of the Southern Part of the Republic of Ghana (Appendix) in which the progress of the field work is briefly described.

SDG was informed on the progress of the work and results at the meeting, and SDG accepted the Progress Report.

Concerning the form of annotation and numbering on each frame of the aerial photograph, the engineers in charge of both sides especially agreed as shown in the progress report.

2. The Team requested to take the maps and surveyed materials such as processed negative films, contact prints and survey results out of Republic of Ghana to Japan. SDG had no objection to the request.

3. The aerial photography work has not been completed on account of the unseasonable weather. SDG has strongly requested the Team to complete all the rest of aerial photography work in the next phase. Team promised to convey the request of SDG to Tokyo JICA Head Office.

ATTENDANTS:

1) SDG side

Na Al-haji Iddirisu Abu	Director of Surveys.	Survey Dept. (Headquarters)
Mr. R. Brimah	Asst. Director of Survey Dept.	Survey Dept. (Headquarters)
Mr. J. Dotse	Asst. Director of Survey Dept.	Survey Dept. (Greater Accra Region)
Mr. J. Abbosey	Staff surveyor	Survey Dept. (Headquarters)
Dr. G. Zarzycki	Adviser	Survey Dept. (Headquarters)

2) The Team Side

Mr. Tokihiko KAMINISHI	Team Leader
Mr. Koichi MIKI	Deputy Leader
Mr. Kozo OKUMURA	Mapping Planner
Mr. Yutaka KYAKUNO	Chief Surveyor
Mr. Makoto TSUJIMOTO	Surveyor
Mr. Hideaki SAKAI	Coordinator

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

March, 1996

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 (hereinafter referred to as the "Study") started in January 1996, in a five-year plan, as a technical cooperation program of the Japan International Cooperation Agency (hereinafter referred to as the "JICA").

In compliance with the Scope of Work agreed between the Survey Department of GHANA (hereinafter referred to as the "SDG") and JICA on 17th March 1995, the JICA study team (hereinafter referred to as the "Team") arrived in Accra on 30th January 1996, for the field work of the first year. After consultation with the SDG, the Team set up the field headquarters in Accra for Ground control point survey and Aerial photography from 31st January 1996, to 22nd March 1996.

The SDG counterparts personnel worked with the JICA Team.

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

2. OUTLINE OF THE FIRST YEAR WORK

2-1 Objective

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 first year work of the study is to carry out the field survey including aerial photography, ground control point survey (phase 1), and office work such as computation of the survey results.

2-2 Period of Survey Work

Field work

(Ground control point survey) 31 January, 1996~22 March, 1996

(Aerial photography) 21 February, 1996~22 March, 1996

2-3 Formation of the Study Team

Leader Mr. Tokihiko KAMINISHI 31 Jan. '96~14 Feb. '96

Leader	Mr. Tokihiko KAMINISHI	10 Mar. '96~22 Mar. '96
Deputy Leader	Mr. Koichi MIKI	31 Jan. '96~22 Mar. '96
Mapping Planner	Mr. Kozo OKUMURA	"
Chief Surveyor	Mr. Yutaka KYAKUNO	"
Mechanical Engr.	Mr. Shinpei ISHIWATA	"
Photographer	Mr. Yutaka KOKUFU	21 Feb. '96~22 Mar. '96
Surveyor	Mr. Masahiko OHASHI	31 Jan. '96~22 Mar. '96
"	Mr. Yasuo GOTO	"
"	Mr. Seiichi FUKUTOMI	"
"	Mr. Tsuyosi YAMAZAKI	"
"	Mr. Koichi WAKISAKA	"
"	Mr. Makoto TSUJIMOTO	"
"	Mr. Masaru TERADA	"
"	Mr. Sadao MATSUMOTO	"
"	Mr. Tomohiro MURAKAMI	"
"	Mr. Kensuke KIMURA	"
"	Mr. Yuichi TABIKAWA	"
"	Mr. Kazutomo NAKANISHI	"
"	Mr. Koji FUKAZAWA	"
"	Mr. Kozo YAMAYA	"
Coordinator	Mr. Hideaki SAKAI	31 Jan. '96~14 Feb. '96
"	"	18 Mar. '96~22 Mar. '96

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

Progress in the first year are as follows

Item		Original Plan	Results
Ground control point survey (GPS)		10 points	10 points
Aerial Photography	Scale	Approx. 1/60,000	Approx. 1/60,000
	Flight line	24 lines	8 lines
	Flight length	Approx. 3,500km	475km
	Coverage	Approx. 25,500 km ²	3,350km ²
	Photo No.	Approx. 705 photos	108 photos

2-5 Counterparts of SDG

Na Al-haji Iddirisu Abu	Director of Surveys.	Survey Dept. (Headquarters)
Mr. R. Brimah	Asst. Director of Survey Dept.	Survey Dept. (Headquarters)
Mr. J. Dotse	Asst. Director of Survey Dept.	Survey Dept. (Greater Accra Region)
Mr. J. Abbosey	Staff surveyor	Survey Dept. (Headquarters)
Mr. E. R. Tetteh	Chief Lithographer	Survey Dept. (Lithographic Section)
Mr. Marcus Tabil	Asst. Staff Surveyor	Survey Dept. (Examination Section)
Mr. Jones Ofori-Boadu	Asst. Staff Surveyor	Survey Dept.
Mr. John Quist	"	"
Mr. John C. Acquaaah	Senior Survey Technician	"
Mr. Kofi Wemegah	"	"
Mr. Quarshie Quartey	"	"
Mr. Jeremiah Awabigo	"	"
Mr. C.R.K. Anyah	"	"

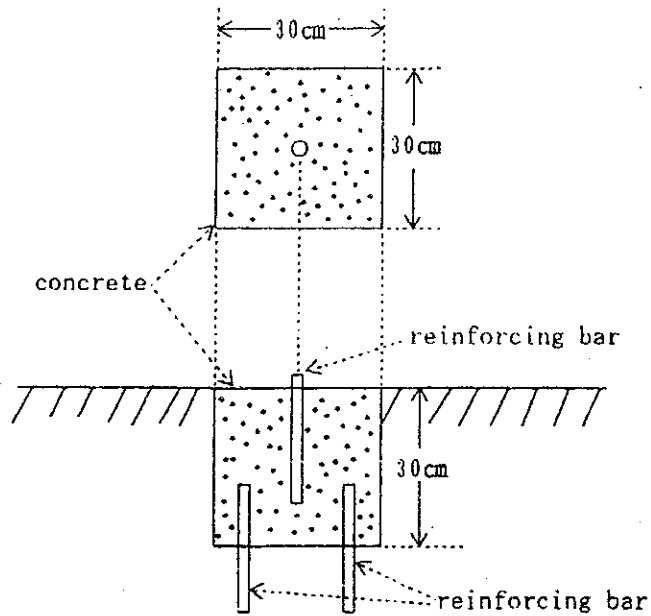
3. FIELD WORK

3-1 Ground control point survey

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

(1) Placement and Monumentation

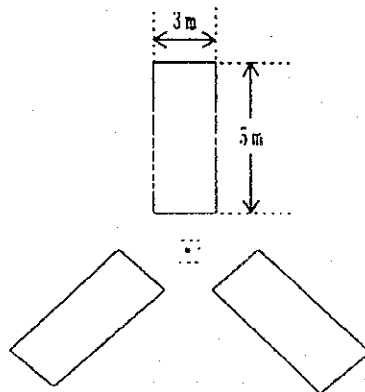
Control points selection was done in the field based on the original plan using portable GPS units and existing 1/50,000 topographic map. Each point was selected for easier location for succeeding pricking work for the aerial triangulation. The newly set up control points were monumented as follows.



(2) Signalization

In case of difficult pricking for aerial triangulation, pre-marking was done at the existing control point.

Dimension of pre-marking were as follows.



(3) Observation

GPS observation was done at six or seven points simultaneously. To take account of obtaining the height accuracy, five or six satellites were observed two hours and the elevation angle of satellites was adopted more than 15 degrees.

SA

(4) Given points

Following points should be adopted as given points for computation.

CFP 245, GCS 102, GCS 112, GCS 296, W3/34/28

(5) Observation scheme

The network consisting of 11 observation group including 5 known points is shown in Fig.-1.

(6) Results

The coordinate closures of each group were calculated to check the reliability of the observation in the field. The result is tentatively obtained as shown in the Table-1.

Where dx, dy, and dz stand for the coordinate closures of the geocentric coordinate system of ellipsoid WGS-84 to which GPS is referred.

There are 19 base lines measured twice on different days, and these data were repeatedly checked and confirmed. (Table-2)

3-2 Aerial Photography.

(1) Base for aerial photography

Kotoka Airport was used for the base for the aerial photography.

(2) Aircraft and Camera

The team contracted with Aircraft Operation Company (Pty) Ltd. (AOC, South Africa) for all aerial photography.

Details of aircraft and camera are as follows:

Aircraft	: Gates Learjet 24 No. 24-165
Camera type	: Zeiss RMK-A 8.5/23
Lens number	: No. 132019 F=85.54mm
Navigation equipment	: GPS Navigation, Trimble 2000

(3) Photographic work

Test flights were made on February 28th and 29th, 1996 and full-scale aerial photography was commenced from March 1st, 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

3-3 Photo processing

(1) Development

The instruments and materials to be used were as follows:

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

Forward overlap & Lateral overlap
Deviation of flight course
Cloud, Cloud shadow, Uneven development, Halation, Haze, Smoke of fieldfire

(3) Film annotation

The form of film annotation and numbering on each frame of the aerial photograph agreed by engineers in charge of both sides are as follows.

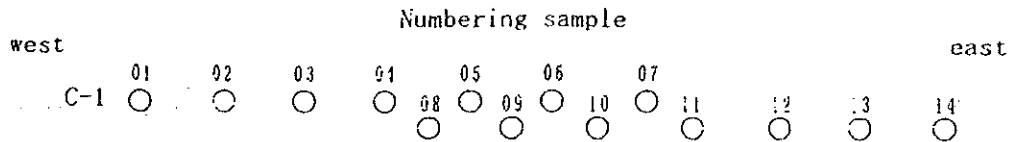
Film annotation : First frame and end frame

altitude meter level/focal length time contractor's name

SOUTHERN GHANA	29-2-1996	C-1	01	1:60,000	JICA
----------------	-----------	-----	----	----------	------

Film annotation : Middle frame

		C-1	02		
--	--	-----	----	--	--



The above film annotation was prepared, based upon the following specification :

FILM ANNOTATION

- Start or End (as appropriate)
- Contact Number and/or designation (if any)
- Film Number
- Date of Photography
- Effective negative numbers and run numbers
- Approximate scale(s) of photography
- Calibrated focal length of the lens unit
- Contractor's name

(4) Amount of work

Film roll	3 rolls
Flight lines/length	8/475km (13%)
Photographs	108 photos (15%)

Number of photographs in First study is shown in Table-3.

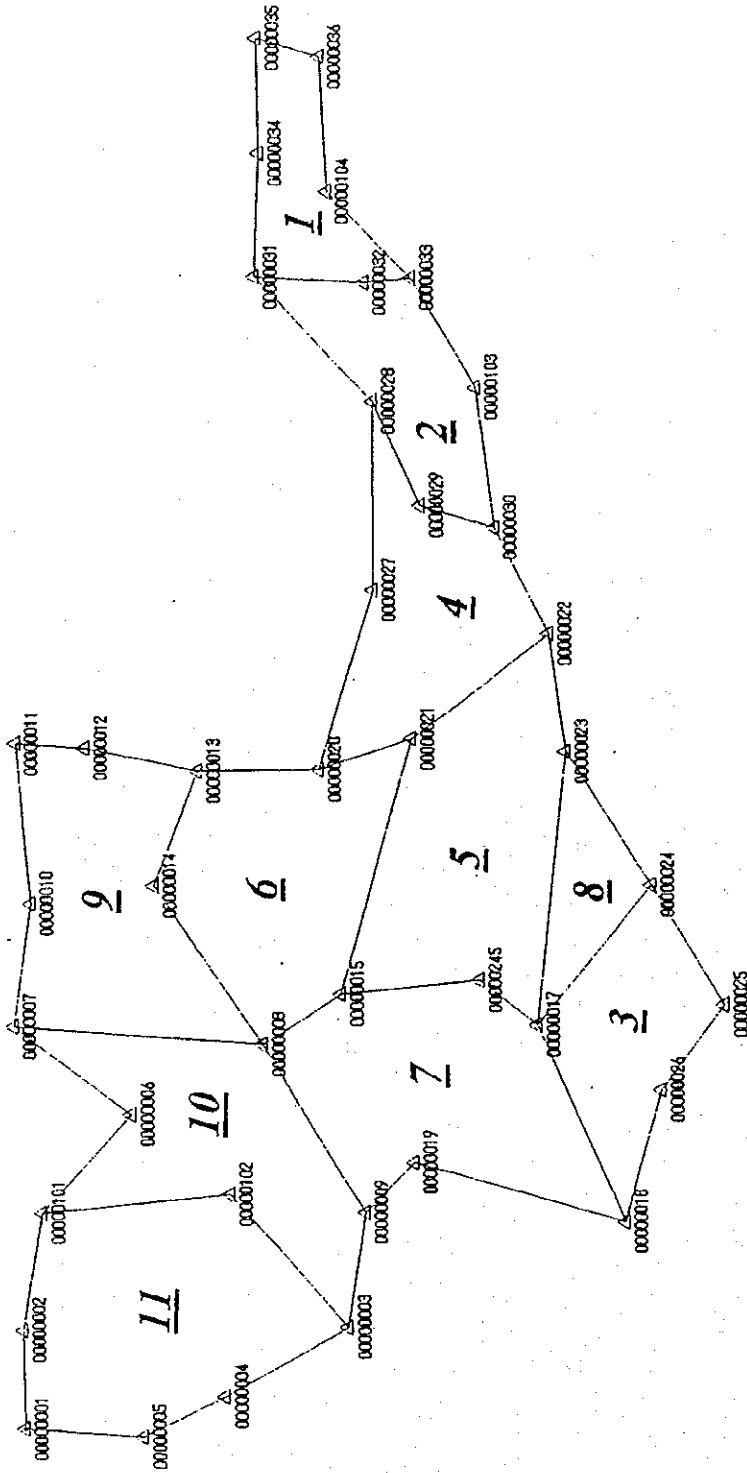
The above progress report covered the period from 27th February to 17th March, 1996.

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GPS OBSERVATION GROUP

Fig - 1



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5000m

Table - 1 (1/2)

SUMMARY OF BASELINE COMPUTATION

Observation Group	Station combination for Baseline		Computed Slope Distance	Accuracy	
	From	To			
1	34	35	26,600.185 m	Total Dist. = 166,603.102 m dx = 0.011 m dy = -0.007 m dz = 0.004 m Ratio = 0.0782 ppm	
	35	36	15,512.779 m		
	36	104	31,177.790 m		
	104	33	28,028.344 m		
	33	32	11,068.947 m		
	32	31	25,809.307 m		
2	31	32	25,809.304 m	Total Dist. = 183,334.081 m dx = -0.018 m dy = -0.019 m dz = 0.002 m Ratio = 0.1429 ppm	
	32	33	11,068.958 m		
	33	103	29,255.876 m		
	103	30	32,792.588 m		
	30	29	18,010.622 m		
	29	28	26,505.573 m		
	28	31	39,891.160 m		
3	17	24	42,266.566 m	Total Dist. = 182,170.103 m dx = -0.004 m dy = 0.003 m dz = -0.004 m Ratio = 0.0567 ppm	
	24	25	32,369.921 m		
	25	26	24,612.179 m		
	26	18	32,279.166 m		
	18	17	50,642.271 m		
4	27	28	44,017.974 m	Total Dist. = 224,501.634 m dx = -0.002 m dy = 0.001 m dz = -0.005 m Ratio = 0.0232 ppm	
	28	29	26,505.606 m		
	29	30	18,010.645 m		
	30	22	28,176.363 m		
	22	21	40,510.183 m		
	21	20	22,923.419 m		
	20	27	44,357.443 m		
5	21	22	40,510.152 m	Total Dist. = 243,342.822 m dx = 0.017 m dy = -0.020 m dz = 0.006 m Ratio = 0.1103 ppm	
	22	23	28,127.394 m		
	23	17	63,772.488 m		
	17	245	17,072.295 m		
	245	15	32,270.384 m		
	15	21	61,590.110 m		
6	14	13	28,514.502 m	Total Dist. = 208,046.851 m dx = 0.004 m dy = 0.000 m dz = 0.001 m Ratio = 0.0232 ppm	
	13	20	28,382.440 m		
	20	21	22,923.411 m		
	21	15	61,590.050 m		
	15	8	22,090.889 m		
	8	14	44,545.559 m		
7	9	8	46,201.235 m	Total Dist. = 236,040.313 m dx = -0.010 m dy = 0.000 m dz = 0.001 m Ratio = 0.0420 ppm	
	8	15	22,090.894 m		
	15	245	32,270.329 m		
	245	17	17,072.287 m		
	17	18	50,642.249 m		
	18	19	51,350.558 m		
	19	9	16,412.763 m		

Table - 1 (2/2)

SUMMARY OF BASELINE COMPUTATION

Observation Group	Station combination for Baseline		Computed Slope Distance	Accuracy
	From	To		
8				Total Dist.= 142,887.825 m dx = 0.001 m dy = -0.001 m dz = 0.005 m Ratio = 0.0367 ppm
	17	23	26,600.185 m	
	23	24	15,512.779 m	
	24	17	31,177.790 m	
9	10	11	37,328.922 m	Total Dist.= 240,028.781 m dx = 0.059 m dy = -0.002 m dz = 0.009 m Ratio = 0.2502 ppm
	11	12	16,235.007 m	
	12	13	26,701.445 m	
	13	14	28,514.543 m	
	14	8	44,545.587 m	
	8	7	57,832.287 m	
	7	10	28,870.991 m	
10	6	7	33,980.954 m	Total Dist.= 282,511.415 m dx = -0.029 m dy = 0.052 m dz = 0.000 m Ratio = 0.2113 ppm
	7	8	57,832.295 m	
	8	9	46,201.298 m	
	9	3	27,689.071 m	
	3	102	41,839.133 m	
	102	101	43,774.176 m	
	101	6	31,194.489 m	
11	1	2	44,017.974 m	Total Dist.= 218,988.078 m dx = 0.002 m dy = 0.000 m dz = 0.002 m Ratio = 0.0127 ppm
	2	101	26,505.606 m	
	101	102	18,010.645 m	
	102	3	28,176.363 m	
	3	4	40,510.183 m	
	4	5	22,923.419 m	
	5	1	44,357.443 m	

Table - 2

SUMMARY OF REDUNDANT BASELINE

STATION No.		Slope Distance	Component Difference		
From	To		Delta X	Delta Y	Delta Z
3	102	41,839.133 m .075 m	-0.004 m	0.043 m	0.039 m
7	8	57,832.287 m .295 m	-0.114 m	-0.021 m	-0.002 m
8	9	46,201.235 m .298 m	-0.009 m	0.065 m	0.014 m
8	14	44,545.559 m .587 m	0.065 m	-0.03 m	-0.004 m
8	15	22,090.889 m .894 m	0.051 m	0.004 m	0.015 m
13	14	28,514.502 m .543 m	-0.043 m	0.043 m	-0.009 m
15	21	61,590.110 m .050 m	-0.085 m	0.057 m	-0.038 m
15	245	32,270.384 m .329 m	-0.011 m	0.031 m	-0.054 m
17	18	50,642.271 m .249 m	-0.043 m	-0.02 m	-0.011 m
17	23	63,772.488 m .405 m	0.039 m	0.079 m	-0.021 m
17	24	42,266.566 m .530 m	-0.062 m	0.029 m	-0.029 m
17	245	17,072.295 m .287 m	0.021 m	0.016 m	-0.001 m
20	21	22,923.419 m .411 m	0.05 m	0.007 m	-0.002 m
21	22	40,510.183 m .152 m	-0.043 m	0.032 m	-0.02 m
28	29	26,505.573 m .606 m	0.032 m	0.032 m	0.011 m
29	30	18,010.622 m .645 m	-0.029 m	0.005 m	0.021 m
31	32	25,809.307 m .304 m	-0.025 m	0 m	-0.005 m
32	33	11,068.947 m .958 m	0.068 m	-0.013 m	0.017 m
101	102	43,774.176 m .133 m	0.074 m	0.023 m	-0.034 m

APPENDIX 4

SECTION III

TECHNICAL SPECIFICATIONS

3.1 GENERAL

The Specifications mentioned hereunder have been designed in order that the Contractor shall carry out the aerial photography for the Topographic Mapping of Southern Part of the Republic of Ghana.

3.2 SCOPE OF WORK

The Work shall be executed in Ghana in accordance with the terms, conditions and requirements of this Contract and Specifications and under the supervision of the Engineer. The Work shall be aerial photographing at a scale of 1:60,000 for 3,500 line kilometers (24 courses, approx. 25,500 km²).

The Work includes the following items.

- (1) Mobilization and Demobilization,
- (2) Aerial photographing, and
- (3) Photo processing and preparation of each one set of rush prints and the final contact prints with annotation.

3.3 FLIGHT PLAN

The flight plan is attached as Fig. 1

The flight plan shows the runs to be flown and the required coverage beyond the boundaries of the area of photogrammetry and cartography works.

The direction of the flight runs are shown as such on the flight plan.

3.4 WORK PERIOD

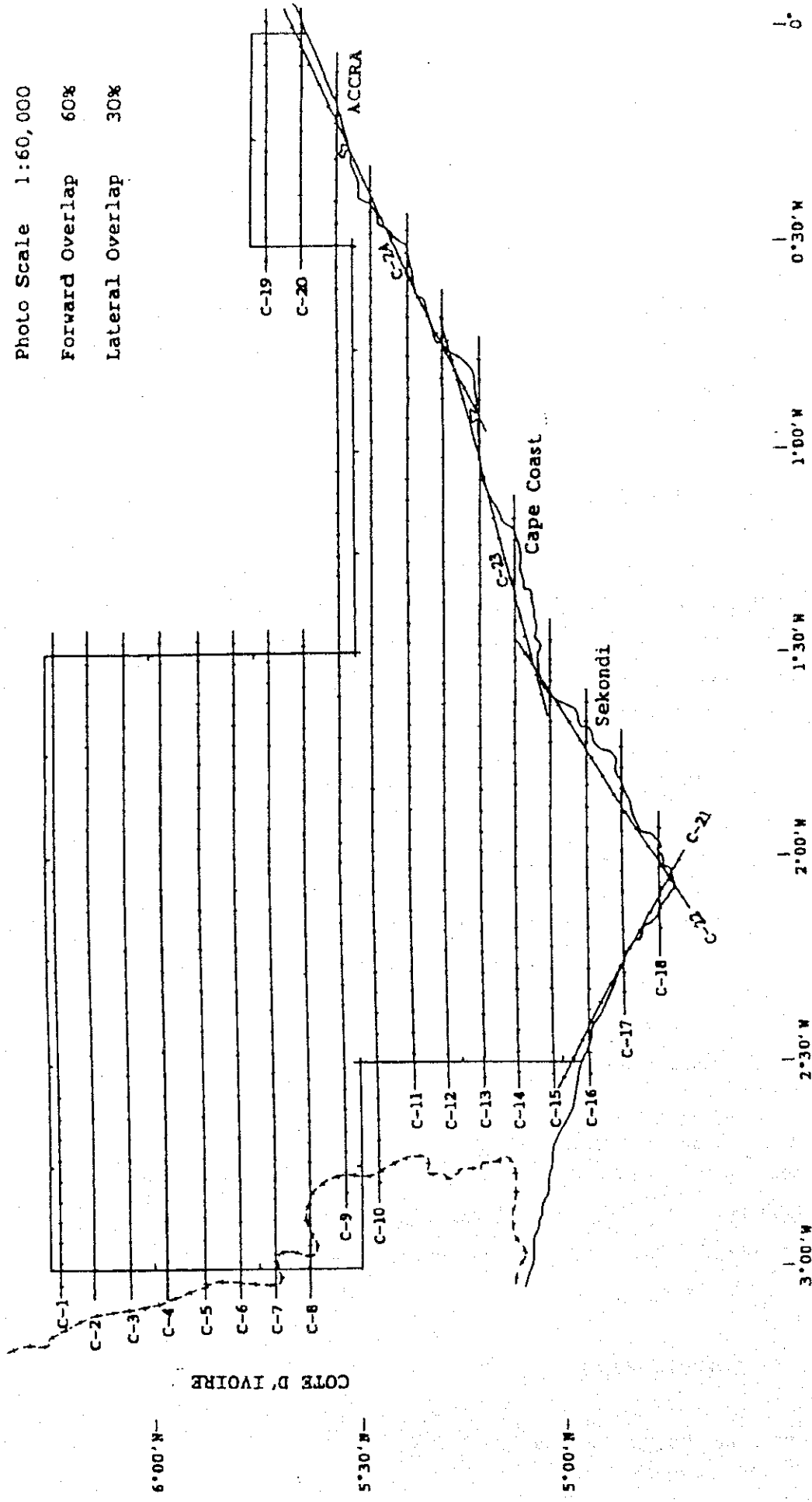
The Work shall be completed by 22 March 1996.

FLIGHT COURSE

Photo Scale 1:60,000

Forward Overlap 60%

Lateral Overlap 30%



6°00'N

5°30'N

5°00'N

3°00'W 2°30'W 2°00'W 1°30'W 1°00'W 0°30'W 0°

COTE D'IVOIRE

3.5 EQUIPMENT TO BE USED

(1) Aircraft

A Lear Jet 24 or equivalent jet plane, capable of the altitude flying specified in Clause 3.6 hereunder, shall be used.

(2) Aerial Camera

A Zeiss RMK-A or equivalent aerial survey camera with a super-wide angle lens cone (89 mm) shall be used.

The Contractor shall submit the calibration report for the lens tested within the past five (5) years to the Engineer. The calibration report shall contain:

- (a) camera number and lens number;
- (b) position of the principal point relative to fiducial marks (in 0.001 mm);
- (c) calibrated focal length (in 0.01 mm);
- (d) radial distortion; and
- (e) observer's name and report number.

(3) Navigation Instruments

Aircraft shall be equipped with proper navigation aids, such as onboard GPS navigation system which are essential for accurate navigation.

(4) Film

Kodak double X Panchromatic Aerographic type 2405 distortion free film or Agfa film of the same quality shall be used for aerial photography.

(5) Printing Paper

Ilford 24M paper, Kentmere or Kodak resin coated paper or equivalent shall be used for the reproduction of prints

(6) Photo processing Instruments

Photo processing instruments for film development and rush prints production shall be equipped by the Contractor in Accra.

3.6 REQUIREMENTS OF PHOTOGRAPHIC FLIGHT

- (1) Aerial photographing shall be performed for 3,500 line kilometers (24 courses, approx. 25,500 km²).
- (2) Photo Scale, Altitude and Flight Direction
The aerial photography shall be taken at a scale of 1:60,000.
Flight altitude shall be 5,400 meters \pm 5 percent above Mean Sea Level.
Flight directions shall be east/west and tie flight runs as shown in Fig. 1
Flight runs shall not be broken due to changes in terrain elevation.
- (3) Flight Course
The discrepancy of flight course shall be within 800 meters from the course on the Flight Plan.
- (4) Tolerable Shifting Error
The proposed mapping area shall not be missed on stereoscopic models due to shifting error.
- (5) Overlaps
Forward overlaps between successive exposures in each run shall be a standard between 55 and 65 percent, and lateral overlap between adjacent runs shall be a standard between 20 and 40 percent, except where specified otherwise.
- (6) Crab
Crab shall not exceed 10 degrees when measured between the base line and a line parallel to the frame of the negative nor be such that stereoscopic gaps in the photograph result from it.
- (7) Tip and Tilt
Tip and Tilt shall not exceed 3 degrees.
- (8) Haze, Mist, and Smoke
Photography shall only be flown when haze, mist or smoke, etc. does not substantially impair the tone reproduction of the negatives.

(9) Tolerable Volume of Cloud and Haze

Although cloud free photographs shall be required, in the case of unfavorable weather conditions, the tolerable volume of cloud shall not exceed three (3) percent of the successive five (5) photographs.

However, on the effective stereoscopic photographs, the important points and/or areas for orientation and cartography shall not be covered with the clouds.

(10) Dividing of Strip

If a designated run is divided into two or more runs for any reason, the overlap for the runs shall consist of at least three (3) photographs.

(11) Altitude of the Sun

Photographic flight shall be carried out only when the altitude of the sun is 30 degrees or more.

(12) Another Requirements

(a) Two (2) extra photographs shall be taken to cover outside area before the designated flight run starts and after it ends in order not to miss some of the required area, and

(b) Approximately one meter at both ends of the roll of film shall be left unexposed.

3.7 PHOTOGRAPHIC PROCESSING

(1) The film shall be developed to ensure homogeneous tone and clear contrast in the negatives.

(2) Fixing shall be done with sufficient time to thoroughly remove unexposed emulsion.

(3) Washing shall also be done with sufficient time to thoroughly remove any remaining fixing solution.

(4) Drying shall be carefully done for avoiding film distortion to be caused by rapid heating, etc.

3.8 NEGATIVE NUMBERING

The following annotations shall be recorded on each frame of negative film by the Contractor in accordance with the instruction by the Engineer.

- (1) Name of job
- (2) Date of photography
- (3) Scale of photography
- (4) Run number
- (5) Serial number of camera and lens
- (6) Flight altitude
- (7) Photo number

3.9 FLIGHT LINE INDEX

A line index shall be prepared for all flight lines and photo centers on the existing map at a scale of 1:500,000.

3.10 FINAL PRODUCTS AND MATERIALS TO BE DELIVERED

The following materials shall be delivered to the JICA Study Team in Accra, Ghana. The Contractor shall submit to the JICA Study Team a delivery note or a list showing contents and quantity at each delivery.

- (1) One (1) set of original photo negatives
- (2) One (1) set of contact points with annotation
(Another one (1) set of rush prints is also produced by the Contractor and used by the Engineer for checking)
- (3) One (1) set of original flight line index