

2. Technical Report

In this Study, 48 sheets of the 1/50,000-scale topographic maps covering the Kita area for which the future agricultural, industrial and mining developments are expected, and the mapping data to be usable for GIS were produced.

The work processes to obtain these products in this Study will be described below.

2.1 Work Plans

(1) Confirmation of survey specifications

The following survey specifications were confirmed before beginning the Study:

- Reference ellipsoid: CLARKE 1880
Semi-major axis: 6,378,249.145m; Flattering : 1/293.465
- Standard of position: Point 58
Latitude 13° 5' 40.629" N; Longitude 9° 30' 43.2326" W
- Standard of elevation (Origin at Dakar)
The elevation value of the existing benchmark was used.
- Map projection
UTM Zone 29
- Symbols

The symbols were determined through discussions based on the existing maps.

(2) Collected materials

The materials collected and used to implement this Study are as follows:

- 4 sheets of 1/200,000 topographic maps (Kita, Sirakoro and Bafing-Makana, Dinguiraye)
- Existing 1/50,000 topographic maps
- Existing 1/20,000 topographic maps (Bamako, Nord-est, Nord-ouest, Sud-est, Sud-ouest)
- Astronomic point table and description of control point
- 12th parallel survey material
- Symbol specifications
- Magnetic bearings
- 1/200,000-scale map sheet index maps
- Statistic data of population of Kita District
- Electric transmission line location map
- Road construction plan map

(3) Borrowed materials

- SPOT image data (20 scenes of stereo image data)

2.2 Discussions on Symbols and Marginal Information

The items to be included in the topographic maps and mapping data were determined through discussions with the counterparts in Mali. Basically, these items were determined on the conditions that they would have integrity with those in the existing 1/50,000 topographic maps and that they would be applicable to digital processing. In determining these items, the symbols (draft) were prepared by the Study Team, based on the existing materials and, incorporating the opinions of the counterparts of Mali, the sample symbol figures were depicted in accordance with the symbol specifications of Mali. Then, the final symbols for the topographic maps were determined. After that, the samples using the data actually acquired were produced with some corrections in color or character size. The marginal information (draft) was also prepared by the Study Team, based on the existing examples and finally determined through discussions with the counterparts of Mali. (See Attached Material 1)

Existing materials used

- Existing map: 1/50,000 KHOSSANTO
- Carte de France 1:50,000 Edition 1980

2.3 Acquisition of SPOT Images and Aerial Photography

The map data for the study area was basically acquired from the SPOT images. As it was difficult to acquire the detailed information from the SPOT image data with the resolution of 10m, the 1/50,000 aerial photographs were used as the materials for detailed interpretation.

(1) Satellite image photography

For the SPOT image photography, JICA made its direct instructions and purchased the necessary equipment, which was lent to the Study Team. The study area was covered with 20 models. The date of photography and the satellite used to photograph the images are as follows:

Table 2.3.1 Satellite image data

Model No.	Satellite	Pass-Row No.	Date	MODE	Angle (°)
1	1	35-324	28/11/98	P	26.5E
	4	35-324	26/10/98	M	19.6W
2	2	35-325	16/11/98	P	26.9E
	4	35-324	26/10/98	M	19.6W
3	2	35-326	16/11/98	P	26.9E
	4	34-326	17/12/98	M	19.9W
4	1	36-322	28/10/98	P	23.4E
	4	35-322	16/10/16	M	30.0W
5	1	36-323	28/10/98	P	23.4E
	4	35-323	16/10/98	M	30.0W
6	1	36-324	28/10/98	P	23.4E
	4	36-324	16/16/98	M	30.0W

Model No.	Satellite	Pass-Row No.	Date	MODE	Angle (°)
7	2	36-325	16/11/98	P	30.0W
	4	36-325	11/11/98	M	29.7W
8	2	36-326	16/11/98	P	30.0E
	4	36-326	11/11/98	M	30.0W
9	4	37-322	15/11/98	M	19.6E
	4	37-322	16/10/98	M	26.1W
10	4	37-323	15/11/98	M	19.6E
	4	37-323	16/10/98	M	26.2W
11	4	37-324	20/10/98	M	19.6E
	4	37-324	16/10/98	M	26.2W
12	2	37-325	11/11/98	P	26.5E
	4	37-325	11/11/98	M	26.5W
13	2	37-326	11/11/98	P	26.5E
	4	37-326	11/11/98	M	26.5W
14	4	38-322	15/10/98	M	15.8E
	4	37-322	06/11/98	M	30.0W
15	4	38-323	15/10/98	M	15.8E
	4	37-323	06/11/98	M	30.0W
16	4	38-324	15/10/15	M	15.8E
	4	38-324	06/11/98	M	30.0W
17	4	38-325	06/12/98	M	16.1E
	4	38-325	06/11/98	M	30.0W
18	4	38-326	06/12/98	M	16.1E
	4	38-326	06/11/98	M	30.0W
19	2	39-325	06/11/98	P	26.5E
	4	39-325	06/11/98	M	26.2W
20	2	38-326	06/11/98	P	26.5E
	4	39-326	06/11/98	M	26.2W

Note: The items denoted in the above table are as follows:
 Satellite “1” denotes SPOT No. 1, “2” SPOT No. 2, “3” SPOT No. 3.
 “Pass-Row No.” denotes a unique number to indicate the geographic location of the scene photographed from the SPOT satellite.
 “Date” denotes the date of photography expressed as day/month/year.
 “M” and “P” in MODE denote mono-band pan chromatic and pan chromatic respectively.
 “Angle” denotes the angle of inclination of the camera used.

The satellites SPOT No.1, No.2 and No.4 were used for photography. As the image format from SPOT No.4 was changed, the data collected from the different types of sensor on SPOT No. 1 and SPOT No.2 was combined as a stereo pair, resulting in some troubles in software operation.

There were some scenes of which 3-dimensional photography was not available due to the halation of clouds, shadows or water area that appeared in part of those scenes. Since these scenes would affect the subsequent processes including stereo matching, ortho-photo production and digital plotting, resulting in lower accuracy of photography, the defective positions in these scenes were recorded for later supplementary use of the existing materials such as the topographic maps and aerial photos.

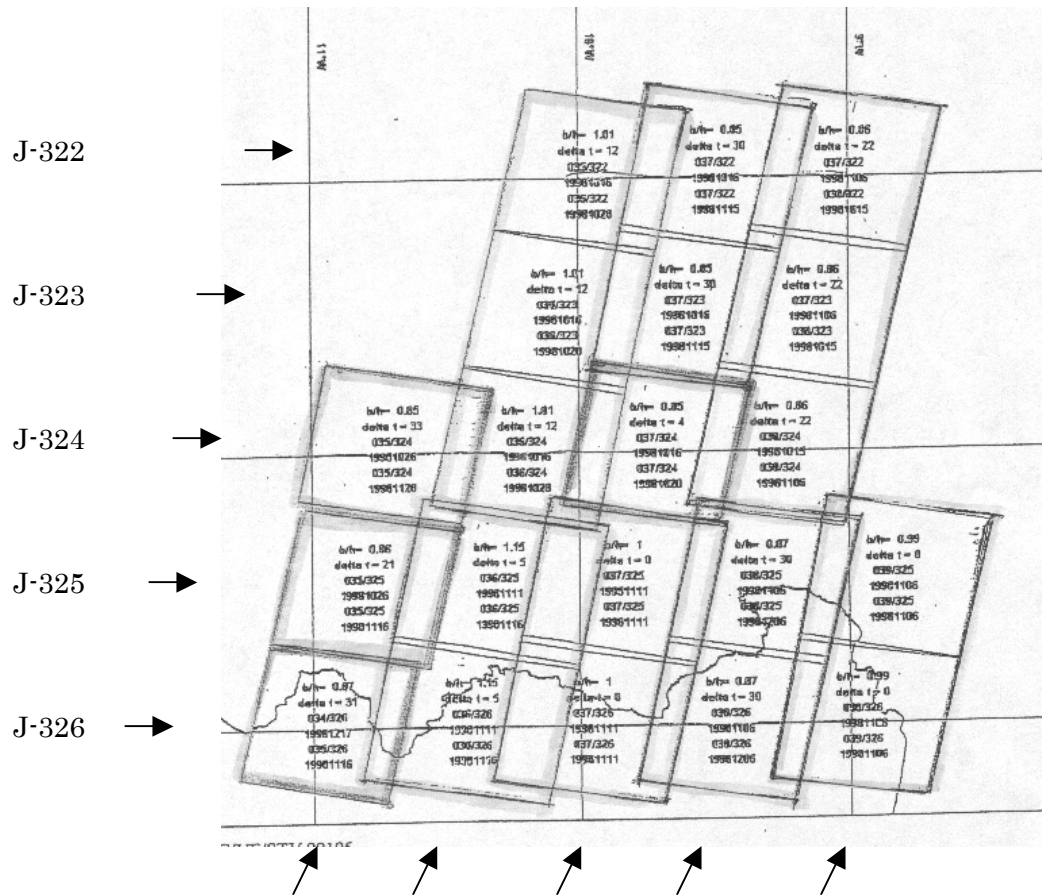


Fig. 2.3.1 Index map of SPOT image

(2) Aerial photography

There were the existing 1/50,000 aerial photos of a part of the study area that were taken in 1995 under Germany's assistance. These photos were photographed under the specifications: Overlap 50% and side-lap 0%. It was found that these photos could be used for this Study though some scenes include clouds partly. Thus, the usable ones were selected from these photos and it was decided to newly conduct the aerial photography of the lacking areas. Each photo was two times enlarged for use in photo interpretation.

Table 2.3.2 Specifications of camera used

Item	Existing photos	New photography
Type of camera	Zeiss RMK TOP15	Zeiss RMK TOP15
Photo size	230 x 230	230 x 230
Focal distance	154.401mm	154.401mm
Number of photography strips	44	22
Number of photos	596	334

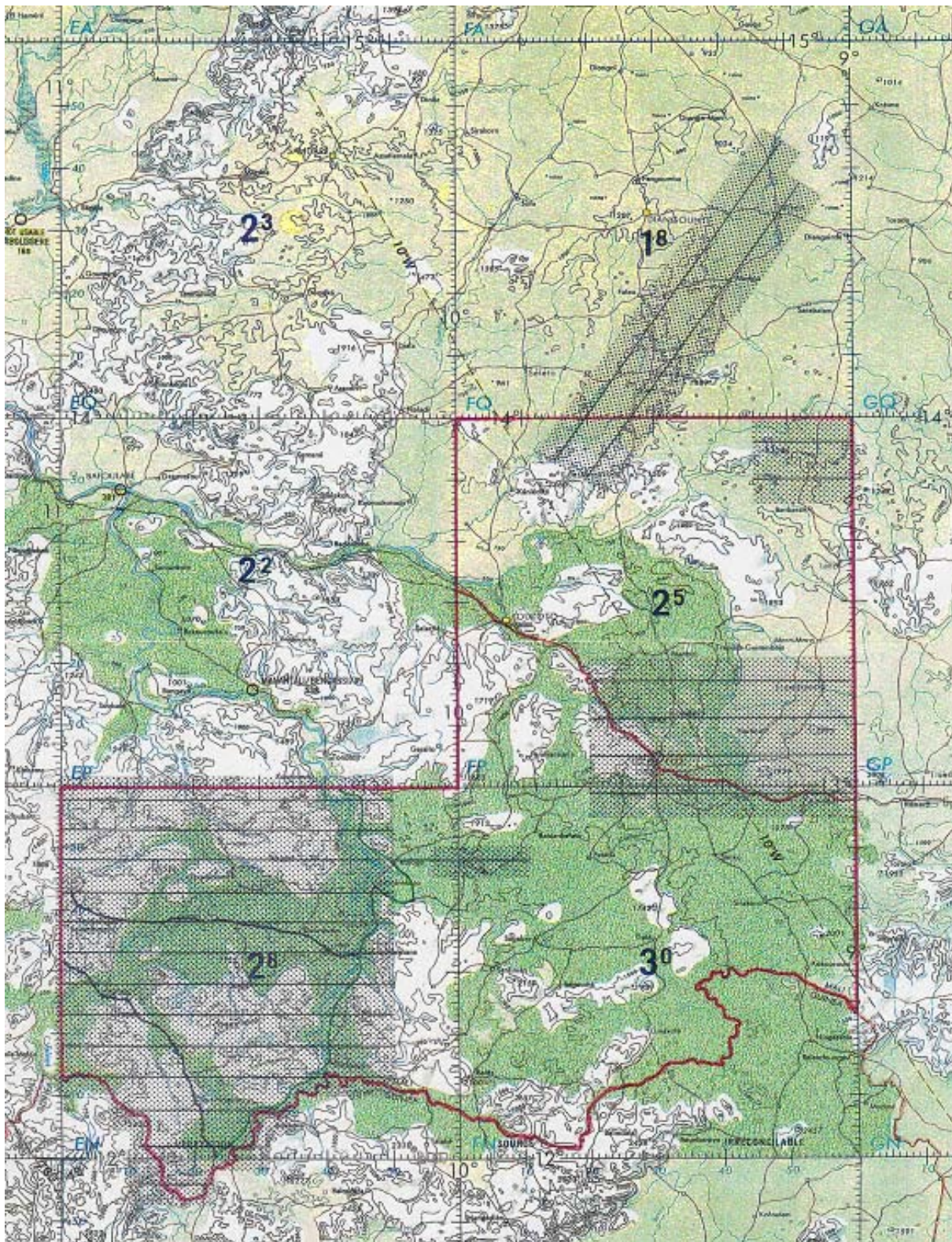


Fig. 2.3.2 Aerial photography area

2.4 Photo Interpretation

As the SPOT images had a low resolution of 10 m, making direct interpretation and depiction for digital plotting difficult, the items to be included in the maps were examined by photo interpretation based on new and existing aerial photos, and the field identification was carried out in advance to prepare the materials needed for digital plotting.

(1) Verification of study area

After verifying the plotting area, all the aerial photos covering the entire study area were arranged to verify the range of the field identification

(2) Verification of aerial photos covering each map sheet

As the study area was covered by the existing aerial photos and the new aerial photos taken in this Study, the aerial photos to cover each map sheet were selected for preparation for field identification.

(3) Creation of photo interpretation keys

In interpretation of the items to be acquired from the aerial photos and satellite images, the keys for photo interpretations were made to standardize the interpretation. The acquired items were classified and filled in cards to make the photo interpretation keys for representation of the positions and map symbols on the 1/200,000 topographic maps, formation of 3-dimensional images based on the 1/50,000 aerial photos and better understanding of the present conditions on the field photos.

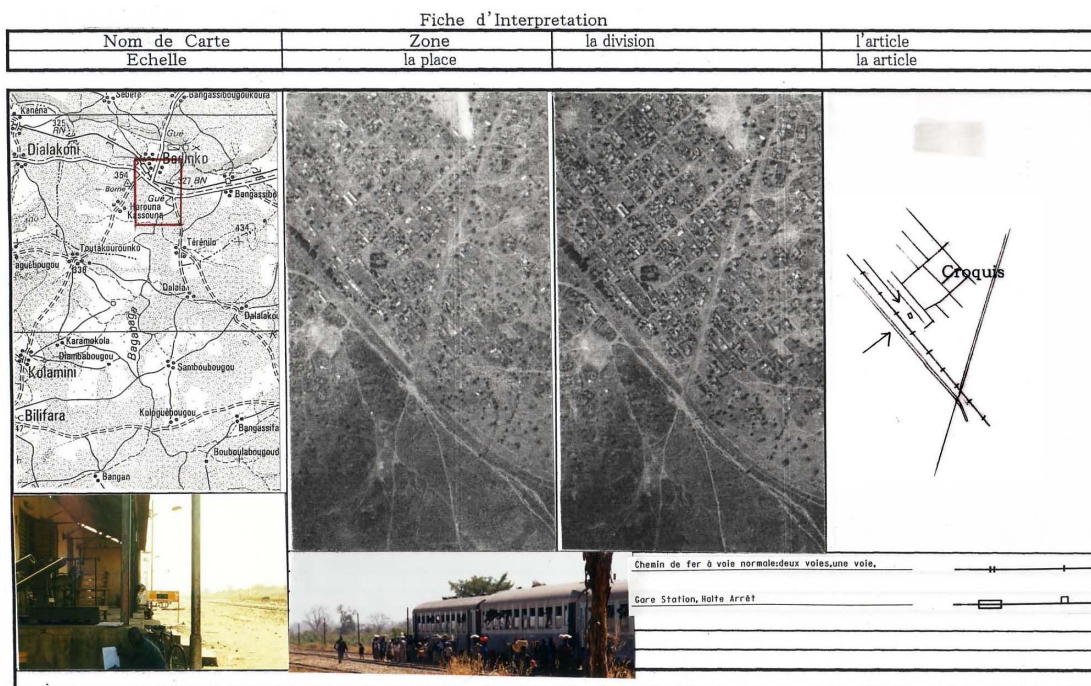


Fig. 2.4.1 Example of photo interpretation keys (railway and station)

(4) Photo interpretation

Photo interpretation was carried out by 3-dimensional observation with the counterparts from Mali using two times enlarged photos (scale 1/25,000) in accordance with the photo interpretation keys. Questions and uncertainties that arose during the photo interpretation were listed up and their location on the map and detailed content noted. This list was then used to prepare the material for field verification.

(5) Check and inspection

When photo interpretation was finished, the aerial photos were checked to make sure there had been no oversight or loss before the final edition was inspected, and the results of the check and inspection were compiled into a quality control sheet.



Fig. 2.4.2 Inspection of aerial photos

Table 2.4.1 Control sheet for aerial photos

Control sheets for new aerial photography						16.Nov.1998
Liste de controle des nouvelles photos aeriennes						
Numero zone	Numero photos	Total	Pas bon	Remarques	Observations	
File (1:200,000)						
343458-2223		22	2125,2134,2133	Nuage	Reprise	
353598-2683,2164-2181		24	2155,2164,2097	Nuage, 2097manque	Reprise	
363758-3766,2152-2161,2090-2092		22	Bon			
373300-3288,837-819		22		827,819	Exposition default	
383258-2365,840-854		23	Bon	2358 et 839(egalle)	Reprise	
383258-2365,840-854		23	Bon			
403252-2285,918-925		23	Bon			
421162-1197		23	Bon			
431303-1314,1307-1320		26	1307-1320	14photos	Exposition default	
441246-1268		23	Bon		11758-1268	
451218-1197		23	Bon		1200-1197	
 Sous total		254	Photos			
Sirakore(1:200,000)						
471136-758		23	Bon		747-750	
481724-730,710-723,797		27	Bon			
50323-251		18		252,253,232	Manque	
52312-320,321-332		21	Bon		333(Minque)	
53385-388,385-374		22	Bon			
54409-416,417-430		22	Bon			
55593-589		9	Bon			
56609-584		16	Bon			
58627-642		16	Bon			
63843-654,655-657		15	Bon			
66871-684		14	Bon			
69688-692		6	Bon			
 Sous total		208	Photos			
Bafing Makana(1:200,000)						
471133-1248,1231-1237,736-737		23	Bon	1232-1235	Reprise	
481731-735,1214-1230		22	Bon	1214-1229	Reprise	
50326-720,724-735		17	Bon	728-738	Reprise	
51300-304		5	Bon	300-304	Reprise	
52305-311		7	Bon	305-307	Reprise	
53401-368		6	Bon	401-400	Reprise	
54402-408		7	Bon	402-404	Reprise	
58617-610		8	Bon	617-614	Reprise	
59818-630		13	Bon	618-622	Reprise	
63658-688		9	Bon	668-682	Reprise	
68687-673		7	Bon	667-669	Reprise	
69693		1	Bon			
 Sous total		125	Photos			
Dinguiaye(1:200,000)						
 Sub total		0				
Diemna(1:200,000)						
274526-4540		15				
284098-4103,4734-4739		15				
293278-2902		15				
302553-2567		15				
312442-2418		15				
322968-2982		15				
332770-2784		15				
 Sous total		105				
Bamako oest(1:200,000)						
53588-584		5	Bon			
53572-370		4	Bon			
 Sous total		9	Photos			
 Grand total		596	Photos			
Area total pour la photographie aeriennes nouvelles						
Projet						
A	Bafing Makana + Dinguiaye	7,200	km ²			
B	Nita nord	400	km ²			
C	Sirakore	200	km ²			
D	Diemna	500	km ²			
E	Banlieue de Nita	2,200	km ²			
 Total		10,600	 km²			

