2.11 Creation of Ortho-Photo Images

The results of spatial triangulation, 100m-grid DTMs and SPOT images were used to create the ortho-photo images.

(1) Creation of ortho-image per scene

Supresoft orthographic photo imaging software was used to create ortho-photo images. The resolution was 10 m, the same as that of SPOT images. As satellite ortho-images are created from either left or right images, the higher quality images with clear patterns were carefully selected.

(2) Connection of scenes

The ortho-images generated for each scene were integrated to make one ortho-image file.

(3) Filing of each map sheet

An ortho-image was cut out of the generated ortho-image file to fully cover each map sheet in a square extent and stored in a file.

(4) Printing in CD-ROM

Each ortho-photo image file for each map sheet was printed and stored in a CD-ROM.

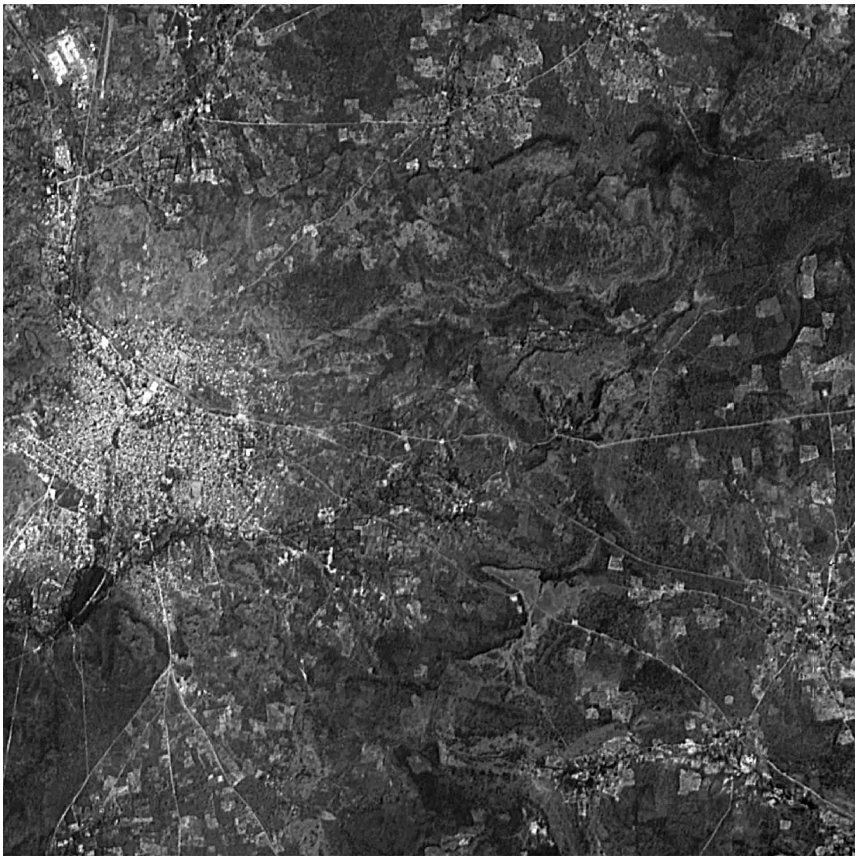

Fig. 2.11.1 Ortho-photo (Kita City)

2.12 Digital Mapping

The digital mapping for 2 map sheets in Mali and for 46 map sheets in Japan was carried out in the following steps:

(1) Acquisition of planimetric features

1) Production of base maps for data acquisition

A polyester-based overlay was put on each ortho-photo image per map sheet and the information including the roads, railways, rivers, small objects and administrative boundaries that were obtained in photo interpretation and field identification was transcribed and developed on the overlay. The base map was generated on the basis of it.

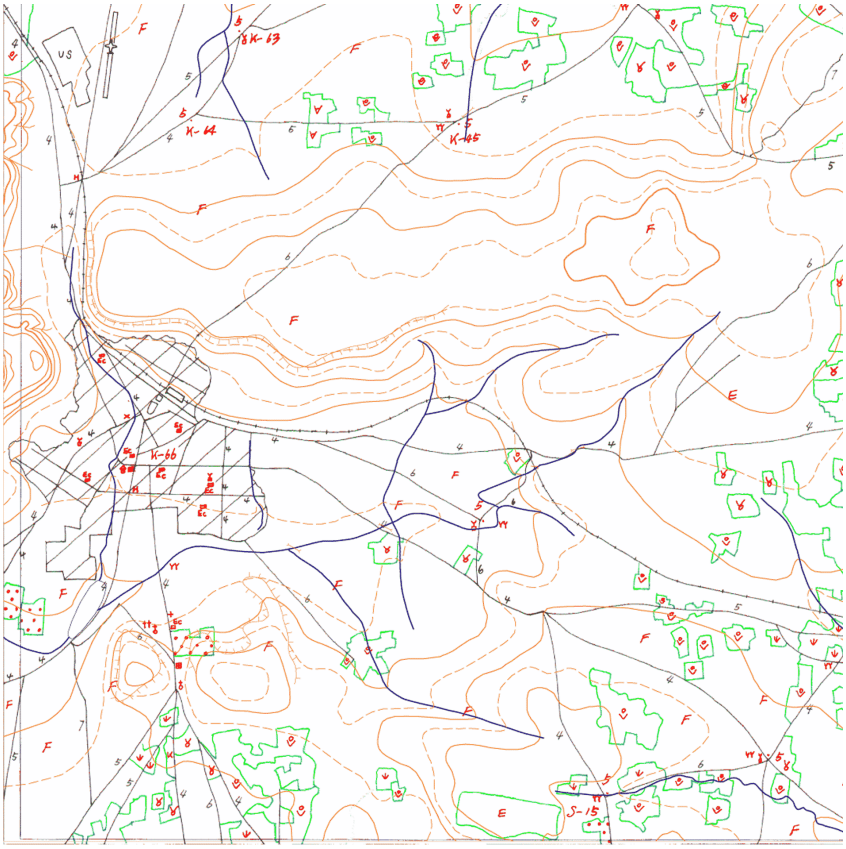

Fig. 2.12.1 Basic map for measuring

2) Acquisition of planimetric data

The base map was A/D-converted with a scanner and the ortho-photo image and the base map data were displayed on the computer monitor. The positions of the data on the base map were adjusted to coincide with the horizontal positions of the planimetric features to obtain the vector data of the planimetric data. The cracks running along the geological structure within the study area, which were defined as tectonic lines, were acquired as planimetric feature data that did not affect the contour lines. In the data acquisition, a digital compilation system was used. The acquired data was recorded as digital mapping data.

The order of data acquisition was as follows:

① Rivers (categorized into single-line rivers, dual-line rivers, wadi and falls)
② Railways
③ Roads (categorized by rank in accordance with the symbol specifications)
④ Artificial structures (such as airfields, railway stations and ground control points)
⑤ Small objects (such as steel towers)
⑥ Vegetation (categorized into cultivated land and grassland based on the results of field identification)
⑦ Boundaries of protected zones/geological lines
⑧ Annotations

(2) Creation of topographic data

The 20m main contour lines and the 100m index contour lines were generated from the DTM file using contour generation software. To enhance the contour accuracy, the special topographic lines (break lines such as cliff lines, ridge lines and valley lines) and single points were measured on the 3-dimensional models based on the satellite images. In the case of discrepancies between these measured points and the contour lines, the 3-dimensional topographic models were displayed on the digital plotter to correct such discrepancies through interpretation of topographic features. In the case the contour line was separated about 5 cm or more on the map in a flat terrain, supplementary contour lines were added. In the case the forms of some topographic features were deemed to be special, their special forms were added as they are. The acquired data was stored in a contour data file per map sheet.

The data of the 2 map sheets to be processed in Mali was sent to Mali after the data adjoining process was carried out. Then, the same work was conducted in Mali.

Fig. 2.12.2 Digital plotter

(3) Doubtful points and quality control

After the end of digital mapping, the digital mapping data was outputted for checking and correction. The final edition was inspected and the result of inspection was filled in the quality control sheet.

The doubtful and unclear points found in the inspection were indicated on the output maps and arranged as the field completion material.

2.13 Digital Compilation

Digital mapping data including planimetric features and contour lines were displayed on the digital compilation system monitor to correct any discrepancies and correct the contour line data. The digital mapping data file was then created.

In the digital compilation process, the following tasks were carried out:

① Checking of the consistency of road categories on each map sheet
② Addition of display positions and names of villages and checking of spelling of village names
③ Checking and processing of categories of single-line rivers and wadi
④ Checking of data acquired on public facilities (including schools, hospitals, mosques and graveyards)
⑤ Checking of data acquired on government and public offices (such as police and military facilities)

The results of digital compilation were outputted by plotter and inspected, and the final edition was further inspected and the quality control sheet was made up.

Fig. 2.13.1 Digital compilation system

2.14 Field Completion Survey

The doubtful, unclear points and secular changes that were found in digital plotting and compilation were verified through field completion survey.

Discrepancies in the materials were settled through discussions with the counterpart agency.

The secular change data on newly constructed roads, electric transmission lines and substations, and public facilities was made available from the related agencies that controlled the information and

materials on the data. In addition, these secular changes were verified and surveyed in the field.

The annotations such as names of villages, rivers and mountains were verified on the formal names and spellings in the field survey.

The results of the field completion survey were arranged, checked and inspected on the digital compilation maps and the inspected results were entered on the quality control sheet in an effort to improve the accuracy of the map contents.

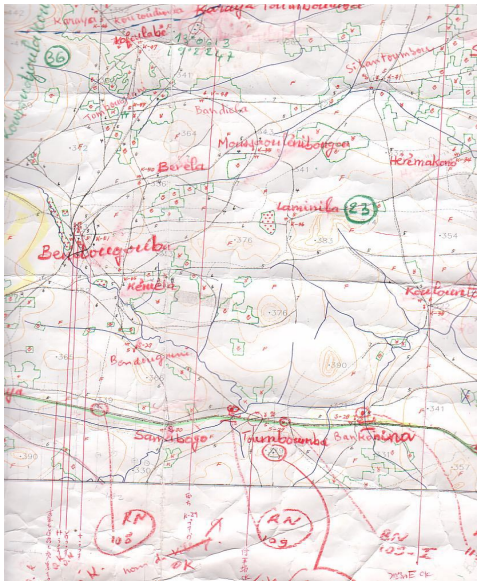

Fig. 2.14.1 Field completion map

2.15 Structuralization and Compilation Based on Field Completion

Based on the results of field completion survey, additions and corrections were made to the topographic mapping data and the compilation for adjoining the map sheets was carried out. In addition, the structures, points, lines and polygons defined in the symbol specifications were compiled and structuralized to complete the topographic mapping (structuralized) data required for producing the topographic maps. In particular, structuralization (to define the upper and lower relation of data for representing points, lines and polygons) for producing the reproduction film for printed maps was carried out to check and correct the order of priority for determining which of the duplicated data were to be represented.

The items to be structuralized were determined considering the plotter outputs and printing as follows:

Point data: Ground control point, independent house and its symbol, annotations, point-like planimetric features, single point of elevation, vegetation symbol and target objects.

Line data: Single-line road, single-line river, railway, electric transmission line, contour line, special topographic lines such as cliff, and geological lineament

Polygon data: Vegetation field (including plantations), dual-line road, dual-line river, lake and swamp, protected districts (for animals and plants, national parks), generalized representation of built-up area, and sandy area

2.16 Production of Printing Films and Printing of Topographic Maps

The topographic mapping data were divided into 4 colors, yellow, magenta, cyan and black, to produce the EPS files for the reproduction film. After color separation, each color block was output for checking and inspection. Overprint processing was carried out and the topographic mapping data was rechecked. The data was then printed out and the final EPS data was produced.

Color-separated printing film was produced on the basis of EPS data. The film was checked and corrected to complete the final printing film.

Using this printing film, 500 copies of each of the 48 map sheets for the Kita area were printed.

2.17 Production of Topographic Map Data Files

The structuralized topographic map data files were stored in a CD-ROM.

The overview of the created data is as follows:

Road length:	18,773 km
River length:	4,732 km
Public facilities	
Schools:	115
Hospitals:	1