6.6 Photo-interpretation and Field Verification

The objective of this survey was to verify a secular change of geographic features, and to precisely provide the present updates to the compilation of digital mapping. Field survey was carried out based on aerial photographs (B & W) at the 1:40,000 scale (hereinafter referred to as "the contact print") taken in July 2000, and existing topographic maps at the 1:50,000 scale (hereinafter referred to as "the existing topographic map"). The work started in the middle of July 2001 and completed by the end of October 2001 on schedule. All the work was done by SCLC counterparts under the supervision of JICA Study Team. Basically, this work included photo interpretation, field verification and pricking for carrying out photogrammetric procedure as precisely as possible.

6.6.1 Photo-interpretation

(1) Summary of Photo Interpretation implemented in the First-Year

To grasp status of secular changes on the existing topographic maps, SCLC's counterparts implemented preliminary photo interpretation in the First-Year before commencing field verification. This process was essential to detect the secular change features to be revised for the National Digital Mapping in Azerbaijan. This work was initiated from comparing the existing topographic maps with the contact prints. The results were delineated to each contact print corresponding to area detected on the existing map.

(2) Photo Interpretation in the Second-Year

The purpose of photo interpretation processes was not only to facilitate recognizing features located at an inaccessible site but also to support an optimal inferring about topographic features. Photo interpretation was effectively implemented using a different feature with the specific elements, such as tone, patterns, size and shape shown on the contact prints. For roads, water bodies and vegetation, the recognizable changed features were readily interpreted because of their characteristics of features. On the other hand, unclear features like any buried pipelines were fairly hard to interpret, but they were inferred by recognizing of specific elements, such as a light-toned linear streak reflected from the ground surface due to the backfill. To ensure the results, they were identified at field verification finally. The results interpreted were represented to the contact prints correctly. As the basic equipment for viewing images, stereoscope and pocket-type lens stereoscope were used.

6.6.2 Field verification

First, several symbol's annotations used in field verification processes were abbreviated to facilitate in representing the annotations on a contact print.

Abbreviated symbols are shown in Table 6.3.

Table 6.3 The list of abbreviation of symbols for field verification

Code	Full annotation	New abbreviated annotation	Code	Old annotation	New abbreviated annotation
20	Разрушенные Кварталы	Разв. кв.	47	Бензоколонки	АЗС
24-4	Поселок и дерево (или парк)	Пос. дер.	175-1, 175-1	Водопроводы	В
67	Метереологические ст.	Мет. ст.	146	Водопроводы	В
69 (a) 69 (b)	Мечети (Large/small)	Меч.	149	Железобет. Лотки на опорах	жб. лот. на оп.
	Школы (Large/small)	Шк.	150	Акведуки	Акв.
	Больницы(Large/small)	Бол.	137-3 137-4	Водопады и пороги	Вдп. пор.
			152-1 152-2	Сухие канавы	Сух.
38-a. 37-a	Заводы, фабрики и мельницы (Large/small)	З-д, ф-ка, мел.	74-2a	Дерево	дер. М, Х, С
38-b 37-b	Заводы, фабрики и мельницы (Large/small)	З-д, ф-ка, мел.	48	Гидроэлектростанции	ГЭС, ГРЭС, ТЭЦ
51 (a)	Трансформаторные	Тр.	74-2b 74-2a	Дерево	дер. М, Х, С
51 (b)	Преобразовательные	Пр.			
51 (c)	Электроподстанчии	Эл. подс.			

Then field verification was carried out using abbreviated annotation mainly in the area delineated based on the map symbol specification. The results of photo interpretation were also identified to ensure the identity of each item. In addition, all administrative and geographical names were surveyed in order to improve old ones that should be changed from Russian to Azeri Latin to be suitable for use in Azerbaijan's digital mapping systems. It was represented in Russian and Azeri Latin on the contact prints. This work was performed by 8 groups of SCLC counterparts. The following items were verified in the field and the results were correctly represented on the contact prints using four kinds of technical pens (black, red, blue and green). Verified topographic features are shown in Table 6.4.

Table 6.4 The list of Field verification features

Layer name	Feature name
Infrastructures	Electric transmission lines, pipelines, walls and boundary for a lot of space and so on
Roads	Highways, motorways(paved and unpaved), trail and foot path, bridge and so on
Buildings and Others structures	Houses, building and residential district, suburban settlement estates with lots of trees, factory, oil well, gas well, petrol station, school, mosque, church and cemeteries and so on
Hydrographic and its structures	Rivers, canals, intermittent river, permanent river, aqueduct, dams, dike, and so on
Railway	Railway, station, trestle bridge and railway with embankment and so on
Vegetation	Rice, cane and reed, grass, swamps, vineyards, forest and so on

To check the consistency of the above results, the supervisor carried out field checks. This process not only enriched the field surveyor's experience but also confirmed the reliability of the interpreted results.

The results obtained in field checks are as follows:

① Roads, water bodies, vegetation and small objects were correctly verified due to their characteristic shape.

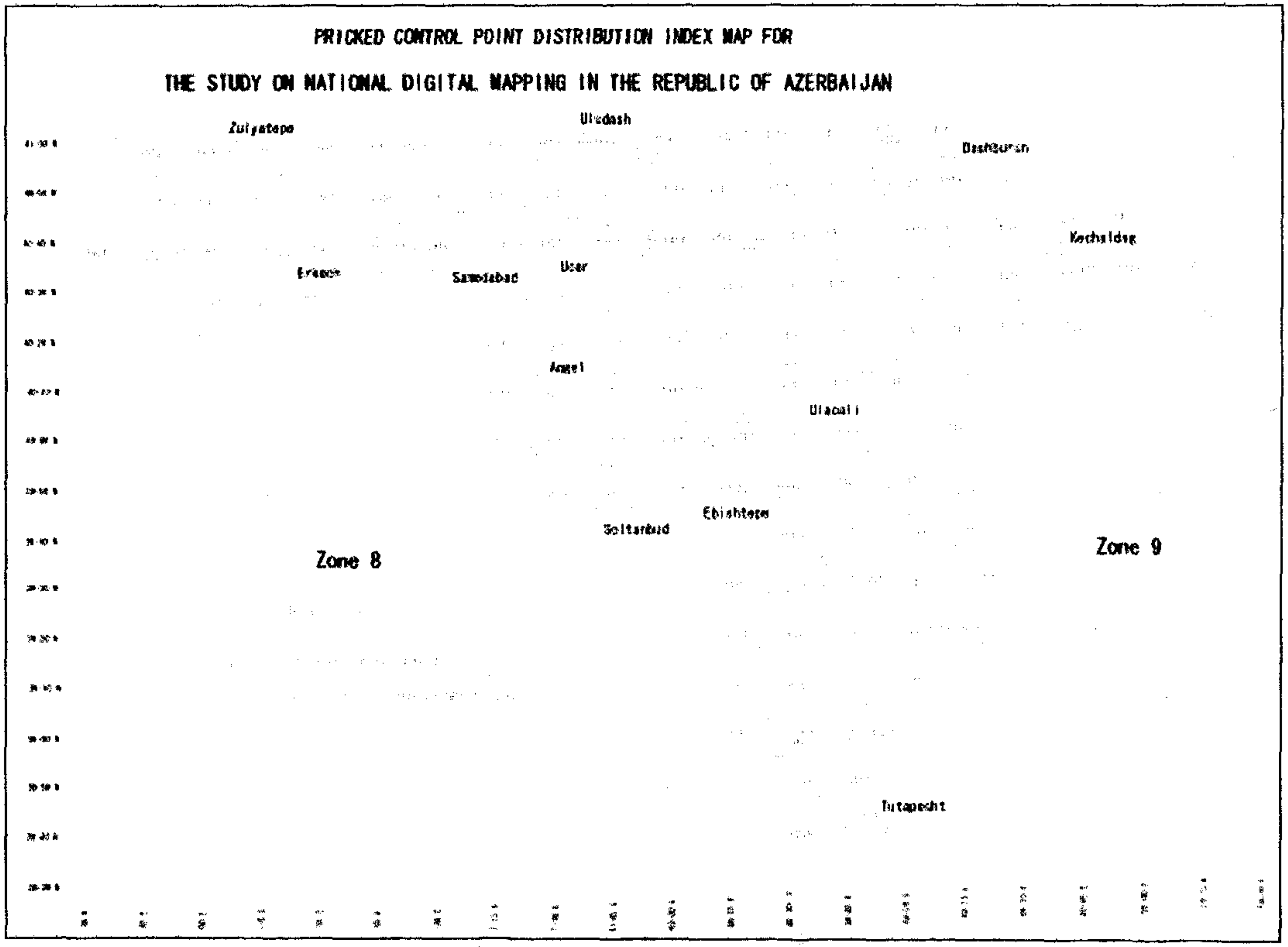
② Linear features, such as transmission lines and pipelines tended to be incompletely verified due to their fuzzy lines shown on the contact prints.

From above results, the supervisor advised SCLC counterparts that in identifying the indistinctive linear feature, other related maps/information should be collected. As a result of field check process field verification technique of the SCLC counterparts became more accurate. Inspected results were listed on a checklist (see Annex 6). This list also gave SCLC counterparts a common basis of quality management for field verification process. The total number of contact prints used in field verification was approximately 1,500 photos.

6.6.3 Pricking of control points

To achieve an absolute orientation of the projected models in stereoscopic plotting procedure, ground control points pricking was implemented. First, identifiable ground control points were (triangulation points and traverse points) selected taking account of their locations on the existing maps, as one point per map sheet basically. Then, they were pricked to be consistent with corresponding positions on the contact prints by SCLC counterparts during field verification. To confirm the reliability of the results obtained, the supervisor carried out an inspection. The inspections revealed that some ground control points tended to be mistakenly pricked due to lack of field surveyor's skill of stereoscopic viewing. Therefore, the supervisor gave SCLC's counterparts a basic technology in which an accurate pricking becomes possible by combination of existing map and stereoscopic viewing of the terrain with the help of stereoscope. After the instruction, the counterparts' skill was eventually improved. As the basic equipment for viewing images, stereoscope and pocket-type lens stereoscope were used. The total number of ground control points used for pricking was 135 points. Distribution of pricked ground control points is shown in Figure 6.5..

Figure 6.5 Index Chart for Pricked Control Point



6.7 Stereo Plotting

6.7.1 Stereo plotting 1

(1) Control point survey and aerial triangulation for digital plotting

The control points used for aerial triangulation were selected from the existing points. Based on the pricked control points, aerial triangulation was carried out for use in the digital plotting of secular changes to be performed by the calculations of aerial triangulation from photo coordinates to geodetic coordinates of tie points. 6 or more tie points were also selected within each model.

(2) Revised plotting of secular changes

Before carrying out the digital plotting of secular changes, the contact prints containing the survey details as the results of the field verification and the existing 1/50,000-scale topographic maps used for the field survey were additionally interpreted and rearranged for preparation of the digital plotting process. The digital plotting to revise the secular changes that amounted for about 25% of the study area was performed in the following two methods:

- Revised plotting of secular changes by orthophotos prepared based on the results of aerial triangulation.
- Digital plotting of secular changes by a digital plotter based on the results of aerial triangulation.

1) Digital plotting of secular changes using orthophotos

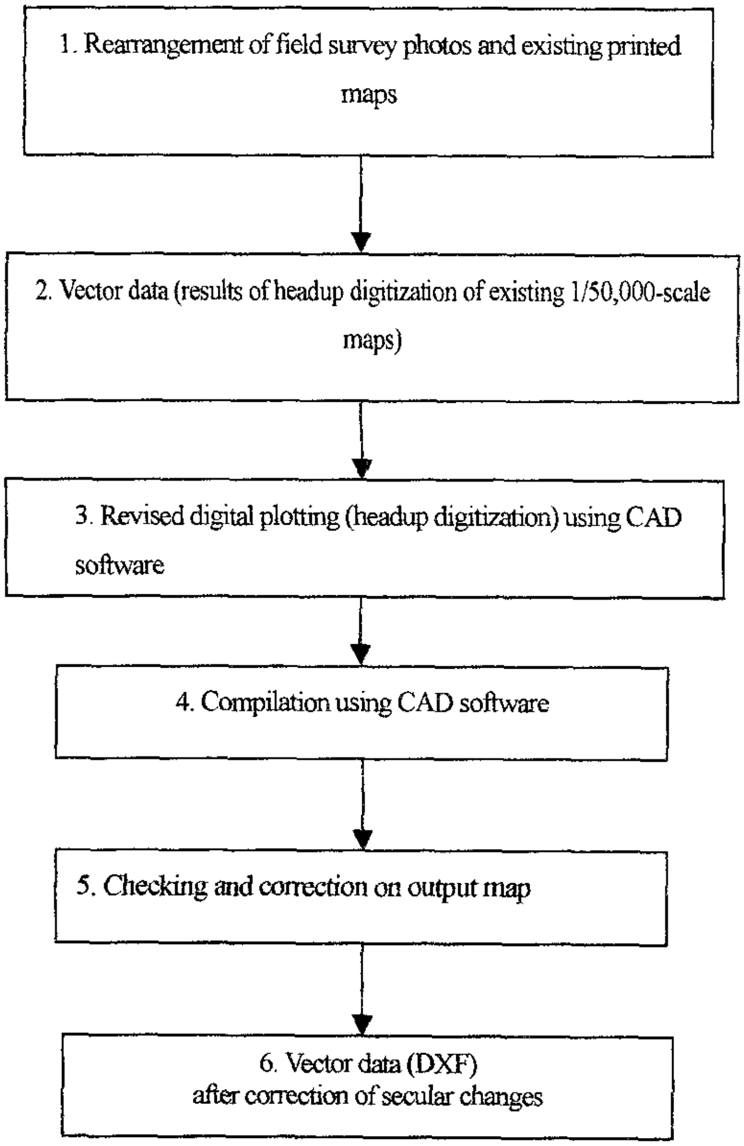
The DEM to prepare orthophotos using the results of aerial triangulation was set to 100m pitches. The orthophotos were prepared in the unit of about 10 map sheets and an ortho-image per map sheet was cut out for digital plotting of secular changes. As the ortho-images were used as the background in the digital plotting of secular changes, the resolution of 2.5m per pixel was used.

The revised plotting of secular changes of the vector data (digital data of planimetric features) on the background ortho-image was performed in the headup digitization method using the CAD system software to overlay the digital data of planimetric features in an existing map on the ortho-image appearing on the computer display.

The revised plotting was performed only for the secular changes edited and designated in ink on the field survey photos (contact prints).

The workflow of digital plotting of secular changes using ortho-images is shown below.

Figure 6.6 Workflow of Diigital Plotting



The following map sheets of vector data were revised:

Map sheets No.;

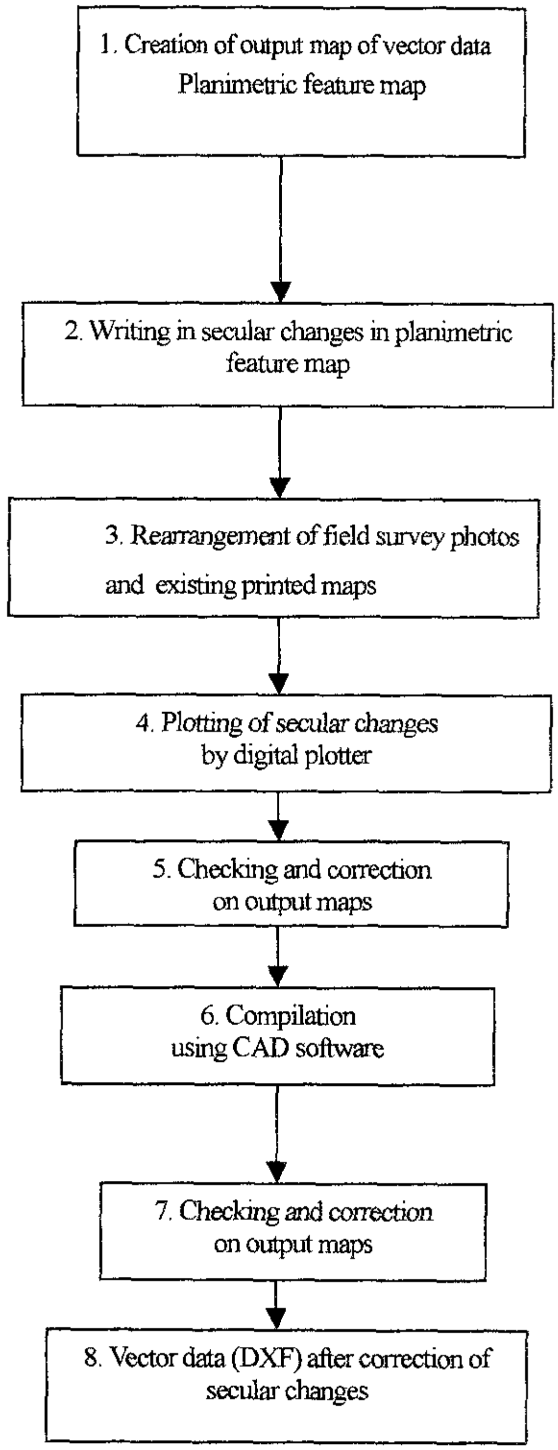
0216, 0217, 0315, 0316, 0317, 0415, 0416, 0417, 0515, 0516, 0517, 0518, 0615, 0616, 0617, 0618, 0619, 0715, 0716, 0717, 0718, 0719, 0815, 0816, 0817, 0818, 0819, 0912, 0913, 0914, 0915, 0916, 0917, 0918, 0919, 1011, 1012, 1013, 1014, 1015, 1016, 1111, 1112, 1113, 1211, 1212, 1213, 1306, 1307, 1311, 1312, 1313, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1505, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613 (80 map sheets in total).

2) Revised plotting of secular changes using digital plotter

Before digital plotting, the vector data as the result of headup digitization of the existing 1/50,000-scale maps (digital data of planimetric features in the existing maps) was outputted and the secular changes were marked in the same maps. (The lost planimetric features were marked with X.)

For the digital plotting of secular changes using a digital photogrammetric plotter based on the results of aerial triangulation, the planimetric features were marked in ink on the contact prints in the field verification and corrected through photo interpretation. A planimetric feature with a secular change was displayed on the stereo image and digitally plotted referring to the digital data of the planimetric feature displayed on another window. The plotted data of secular changes was outputted as the output maps, in which plotting faults and losses were checked and corrected. The digital data of planimetric features in the existing maps was combined with that of secular changes using the CAD system software and compiled in the unit of each map sheet. In the compilation process, the lines in the joint area between the solid models on the aerial photos in the digital plotting were corrected for their continuity (the lines forming a polygon is completely enclosed.). The workflow of digital plotting of secular change using digital plotters is shown below.

Figure 6.7 Workflow of Digital plotting by Stereo plotter



The following map sheets of vector data were revised:

Map sheets No.;

1017, 1018, 1019, 1114, 1115, 1116, 1117, 1118, 1119, 1214, 1215, 1216, 1217, 1218, 1219, 220, 1221, 1223, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1514, 1515, 1516, 1517, 1518, 1519, 1520, 1614, 1615, 1616, 1617, 1618, 1619 (50 map sheets in total).

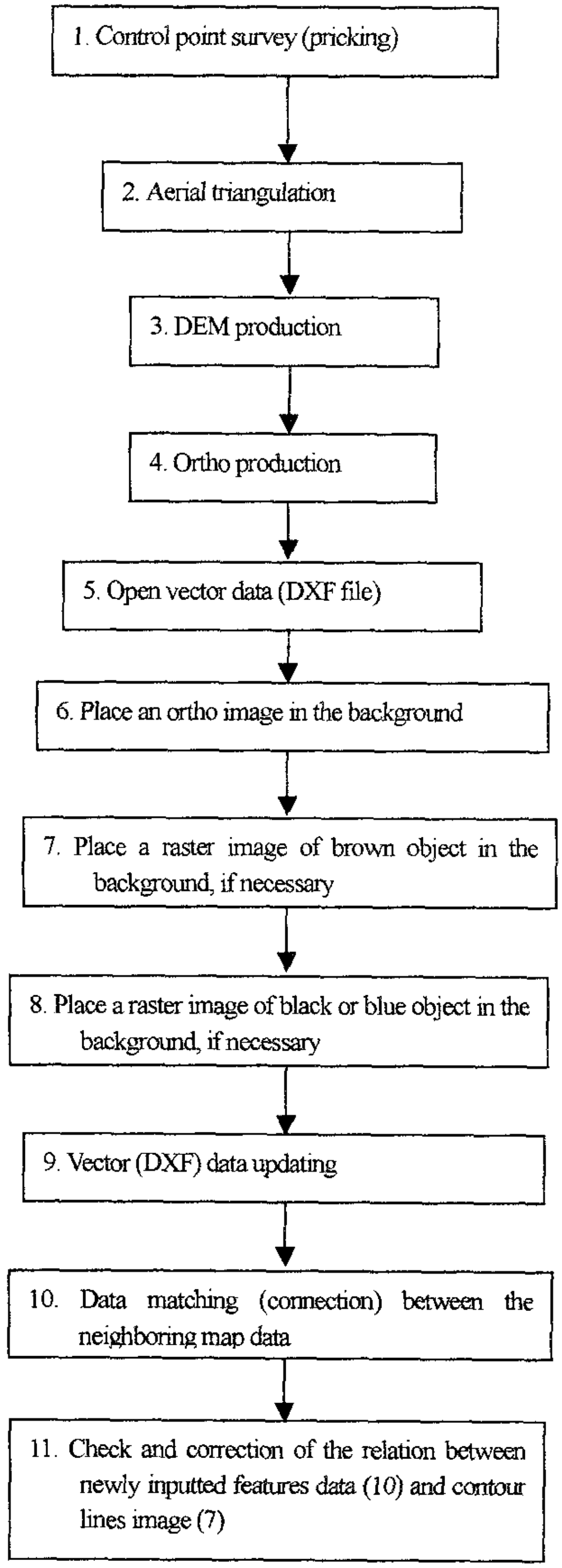
6.7.2 Stereo plotting 2

Before vector data updating of secular changes of 35 digital map sheets covering approx. 12,000 km^2, pricking of 100 ground control points, aerial triangulation of 643 models, preparation of DEM and orthophoto were carried out.

The plotting of secular changes in Azerbaijan was executed by using ortho-photo images and computer digitizing, which saved the insufficiency of digital mapping instruments and the working duration.

As for the planimetric features of the secular changes, the plotting, digitizing, accuracy using ortho-photo images is equivalent with the stereo plotting by digital plotters.

Figure 6.8 Workflow of Digital plotting using Ortho photo



(1) Preparation of orthophotos

The preparation of the orthophotos covering 35 sheets was conducted by selecting the following 5 blocks starting from Block 1 to Block 5:

Block 1 (Area C_1)

Strip NO.	Photo No.			Number of model
Run 1	2130	-	2128	2
Run 2	2124	-	2116	8
Run 3	2102	-	2115	13
Run 3	2099	-	2083	16
Run 4	1965	-	1984	19
Run 5	1963	-	1941	22
Run 7-1	3383	-	3377	6
Run 7-2	1515	-	1533	18
Run 8-1	3365	-	3370	5
Run 8-2	1509	-	1491	18
Run 9	1440	-	1465	25
Run 10	1437	-	1412	25
Run 11	3424	-	3404	20
Run 12	3363	-	3345	18
Run 13	3299	-	3312	13
Run 14	3297	-	3283	14
Run 15	2699	-	2710	11
Run 16	2695	-	2686	9
Run 17	2654	-	2660	6
Run 18	2649	-	2644	5
Total	272 models (not including photo No. 3382)			

Total photo number of Area C 292 photos

Control point 38 points

1/50,000 map; 18 sheets (No. 1714, 1715, 1716, 1717, 1718, 1814, 1815, 1816, 1817, 1818, 1915, 1916, 1917, 1918, 2016, 2017, 2116, 2117)

Block 2 (Area C_2)

Strip NO.	Photo No.			Number of model
Run 1	2205	-	2216	11
Run 2	2198	-	2187	11
Run 3	2162	-	2180	18
Run 4	2160	-	2138	22
Run 5	2487	-	2512	25
Run 18	2652	-	2644	8
Run 19	2595	-	2605	10
Run 20	2593	-	2580	13
Run 21	2518	-	2531	13
Total				131 models

Total photo number of Area DE	92 photos
AreaC	48 photos
Control point	14 points
1/50,000 map;	5 sheets (No. 1709,1710,1711,1712, 1713,1809,1810)

Block 3 (Area B)

Strip NO.	Photo No.			Number of model
Run 1	2238	-	2217	21
Run 2	2239	-	2258	19
Run 3	2281	-	2259	22
Run 4	2283	-	2304	21
Run 5	2325	-	2304	21
Run 6	2331	-	2335	4
Total				108 models

Total photo number of Area DE	114 photos
Control point	20 points
1/50,000 map;	8 sheets (No. 1809,1810,1909,1910,2008,2009,2107,2108)

Block 4 (Area A)

Strip NO.	Photo No.			Number of model
Run 1	2438	-	2421	17
Run 2	2399	-	2419	20
Run 3	2397	-	2378	19
Run 4	2377	-	2369	8
Run 5	2361	-	2368	7
Run 6	2359	-	2357	2
Total				73 models

Total photo number of Area DE 79 photos

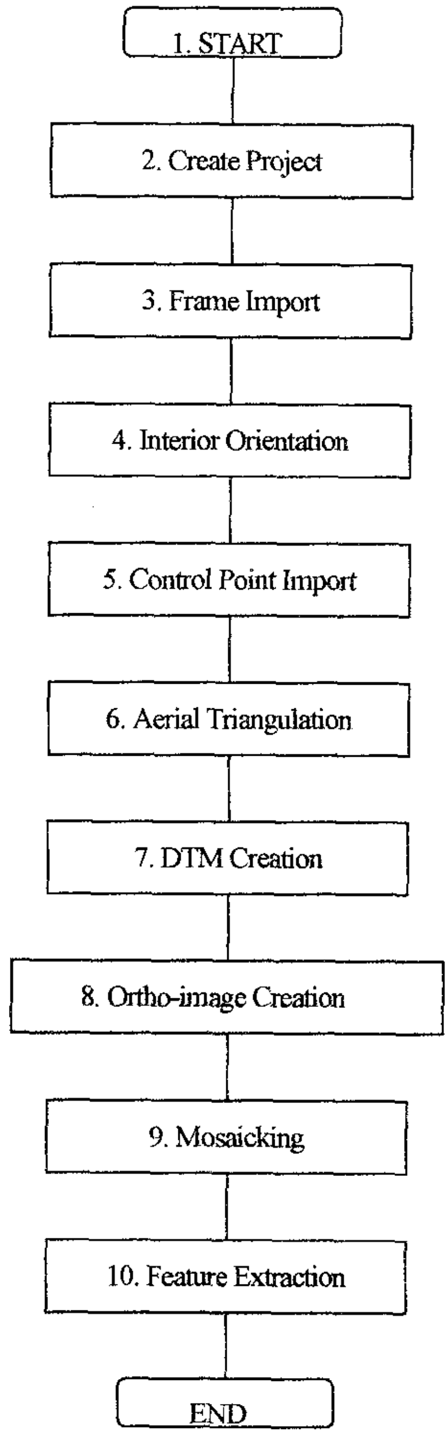
Control point 19 points

1/50,000 map; 4 sheets (No. 1704,1705,1706,1803)

(2) Digital Method of Feature Extraction

Main preparation job steps for feature extraction are triangulation, DTM generation and ortho-image generation. In this Study, SOCET SET software (Softcopy Exploitation Tool Set) was used for the preparation jobs and AutoCAD software was used for feature extraction. The typical workflow is shown on Figure 6.9.

Figure 6.9 Feature Extraction Workflow



Typical Workflow

a. Create Project

When using **SOCET SET**, first of all a ***project*** must be created. The project seems as a container for all the data for a set of images you are going to work with. The followings were specified creating the project:

Coordinate system

Datum

Disk directories

Project name

b. Frame Import

Frame Import/Edit reads digitized frame camera images into SOCET SET. SOCET SET supported types are the followings:

Sun, USGS DOQ, Helava, TIFF, VITEC, Targa, COT, DGN, NITF, Plain Raster

The digital image in this Study was TIFF format.

c. Interior Orientation

Interior Orientation creates a transformation from film space to digitized image space. The units in film space are millimeters; the units in digitized image space are pixels. This transformation is a key part of the Frame sensor models. RMS Error of the transformation must be less than one pixel in general and the result of the Study satisfied this criterion.

d. Ground Point Import

ASCII Ground Point Import reads ground point data in an ASCII format into the internal Ground Point File Format. Each ground point contains a point ID along with an (X, Y, Z) coordinate.

e. Triangulation

Triangulation **registers** images to the ground and to other images. Triangulation is known by other names such as image registration, geo-positioning, orientation or resection. The job sequence is usually the followings:

① Setup

② GCP (Ground Control Point) measurement

③ Automatic Point Measurement

④ Interactive Point Measurement

⑤ Blunder Detect and Solve
⑥ Simultaneous Solve
⑦ Verify

In this Study, **ORIMA** (ORIentation MAnagement software) was used for the triangulation and it's quality control. A part of the result list and its strip diagrams are shown below.

*** CAP Combined Adjustment Program *** Rel. 6.00 (C) L. Hinsken 1988-2001

Maximum number of iterations: 31 Number of Control Points: 12

Number of Terrain Points: 1686 Number of Images: 74

Number of Cameras: 1

Adjusted geodetic observations

Mean terrain height: 49.6

Control points

Point ID		Coordinates	SD.Post	SD.Prio	Resid.
F909	X	9293030.9844	1.0420	9.7220	-3.9596
	Y	4611984.9357	1.0206	10.2600	5.1437
	Z	168.8638	1.0611	1.9920	1.0678
F1938	X	9305272.3133	0.4452	9.7270	-0.9887
	Y	4597733.4822	0.3842	10.2600	0.0422
	Z	206.3836	0.9476	1.9960	1.5836
F929	X	9308991.8241	0.3845	9.7290	1.5841
	Y	4599161.5424	0.3435	10.2600	-7.3586
	Z	130.4632	0.7448	1.9890	-2.7228
F931	X	9315613.1700	0.4682	9.7310	-2.6510
	Y	4602708.7308	0.4207	10.2600	-3.9852
	Z	16.6472	0.6490	1.9730	-2.4618
F9919	X	9285644.0053	1.1265	9.7200	2.3023
	Y	4602419.1264	1.0126	10.2600	8.4624
	Z	432.3775	1.2452	2.0180	2.6415
F69934	X	9302232.6618	0.4232	9.7270	-3.1302
	Y	4590275.9006	0.5799	10.2500	2.3636
	Z	329.7453	0.9299	2.0130	-6.8637
F29915	X	9294030.2561	0.6771	9.7230	-0.5829
	Y	4603561.6996	0.6149	10.2600	3.3336
	Z	283.9285	0.6953	2.0040	1.4435
F69939	X	9299325.9642	0.4250	9.7260	-2.1928
	Y	4592956.8888	0.4855	10.2500	3.2368
	Z	338.5963	0.8995	2.0130	-2.8067
F699161	X	9290919.9776	0.8666	9.7220	1.2636
	Y	4605796.7525	0.8084	10.2600	3.9145
	Z	261.5567	0.8279	2.0050	-0.8383

F699142	X	9287072.1404	1.0807	9.7210	1.2594
	Y	4605142.1355	0.9818	10.2600	6.5685
	Z	337.2730	1.1374	2.0120	3.1540
F912	X	9297145.1733	1.1099	9.7230	6.6773
	Y	4616608.9542	1.1236	10.2600	-1.2868
	Z	73.8112	1.1282	1.9790	-6.0798
F910	X	9305313.5912	1.1238	9.7260	1.9442
	Y	4618933.8556	1.0805	10.2600	-5.3364
	Z	-13.8959	1.2502	1.9620	0.9681

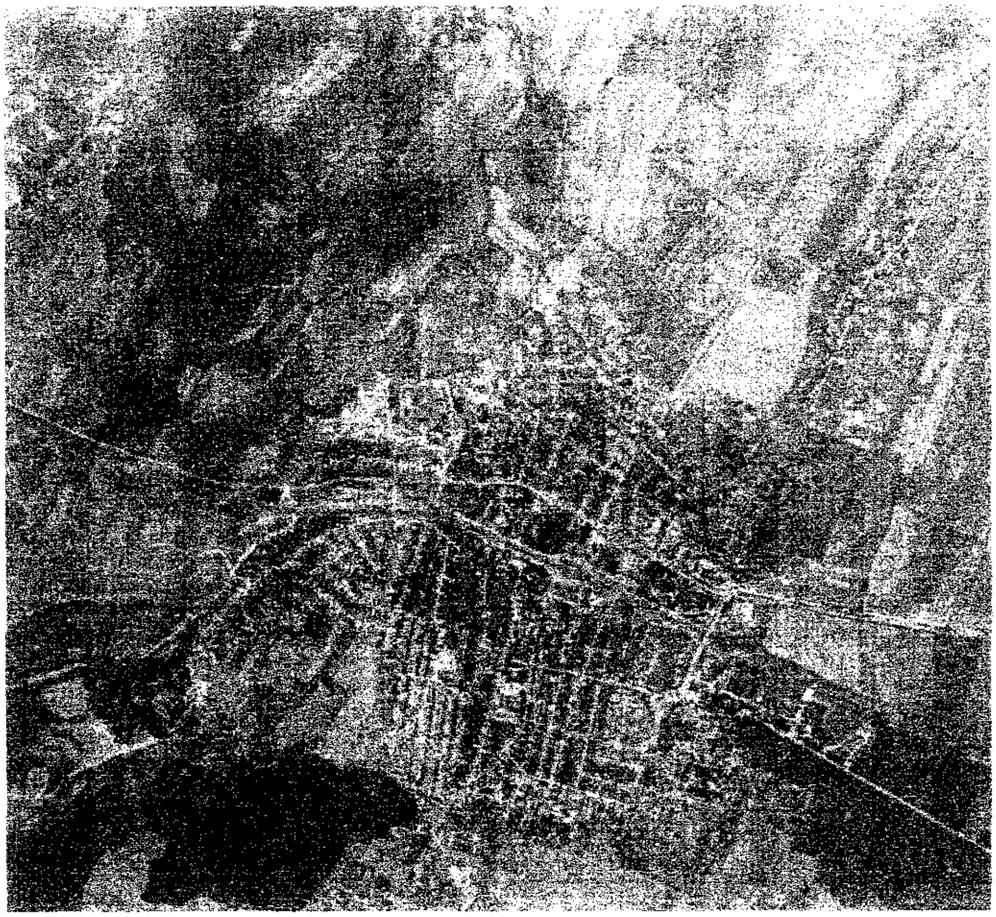
(3) DTM Creation

Digital Terrain Model (DTM) has two data formats in SOCET SET: Grid and TIN. Grid is a two dimensional array of elevation data points. TIN (Triangulated Irregular Network) stores critical points and breaklines that model the terrain without redundant data. DTM is automatically created from stereo image pairs. In the Study Grid format DTMs were created and a grid interval was 100 meters. The result of DTM was checked comparing with the existing maps and edited if necessary.

(4) Ortho-image Creation and Mosaicking

In case of SOCET SET software, ***Mosaic*** is a single function for the generation of ortho-corrected and mosaicked images. Its typical inputs include triangulated images, a DTM. A ground sample distance in the Study was 5 meters. The example of ortho-image made in this Study and the existing map are shown Figure 6.10.

Figure 6.10 Ortho-image and the existing map



(5) Feature Extraction

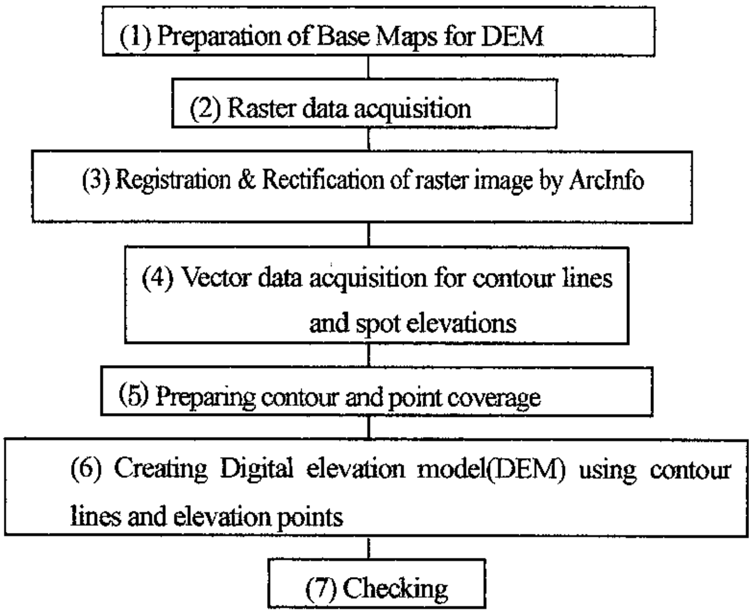
Feature Extraction stores a database of three-dimensional point, poly-line and polygon objects that together represent three-dimensional features in imagery. Features include rivers, roads, buildings, ridgelines, lakes, etc. In the Study AutoCAD MAP 2000 and Autodesk MAP 5 were used to extract features against the ortho-images on the computer screen.

6.8 DEM Production

The Digital Elevation Model (DEM) is the same with the Digital Terrain Model (DTM) which is created in SOCET SET for the aid of plotting. DEMs in the Grid format were created separating from the purpose of the plotting, for the whole map sheets covering the Study area with 50m grid intervals. For this purpose, the contour lines of 10m in the plain area and those of 50m in the mountainous areas were vectorized from their existing maps.

The workflow of DEM production using contour lines and elevation points in ArcInfo software is shown below.

Figure 6.11 Workflow of DEM Creation



(1) Preparation of Base Maps for DEM

By using the brown positives film bases, the preparation of base maps for DEM was carried out to scratch out the confidential items by the SCLC.

(2) Raster data acquisition

Raster data acquisition work for DEM production was done using scanner with black and white, 300 dpi resolution.

(3) Registration & Rectification of raster image

Because scanned raster image has some distortions caused by scanning, normalization of the image shall be performed by REGISTER and RECTIFY commands of Arc/Info.

(4) Vector data acquisition for contour lines and spot elevations

Contour lines were digitized using the above raster data images in the background by data inputting soft of VecEdit Three dimensional coordinates values of spot elevations were acquired on Vector data acquisition 2 using elevation values of black plates.

Both 8 and 9 zones shall be adjusted against each other by analog method.

(5) Preparing contour and point coverage

Conversion of contour lines and elevation points from DXF to Arc/Info coverage was carried out by DXFArc command in Arc/Info program.

(6) Creating Digital elevation model (DEM) using contour lines and elevation points

In Arc/Info, there are many commands and hence ways of creating DEM. Here, by inputting contour and SPOT height as Arc/Info coverage, DEM creation using "**TOPOGRID**" command is explained. The "**TOPOGRID**" command is executed at **ARC:** prompt. So, after getting both data as Arc/Info coverage, open "ArcInfo Workstation" in "Arc/Info" program. It will display Arc prompt (**ARC:**).

Specifications:

- Vectorized contour lines shall be prepared for 10m contour intervals (intermediate contour) for flat areas or 50m contour intervals (index contour) for mountainous areas.
- Where adjacent index contour lines intervals are more than approximately 5cm on the 1/50,000 scale maps is specified as flat areas and intermediate contour lines shall be inputted. In case, where the contour lines are broken due to the 5cm criteria, the length of contour line to be inputted should not be shorter than 5cm. However, in cases, where the same contour line is crossing two or more neighboring sheets, the total length of all line sections should be considered.
- DEM shall be created by more than 2 blocks. (Zone 8 and 9)
- DEM shall be generated from the vectorized contour lines in ARC/INFO GRID format, and converted into ASCII codes.
- Cell Size is specified by 50m X 50m.

(7) Checking

DEM image data checking by using coverage data in the background was performed by ArcView.

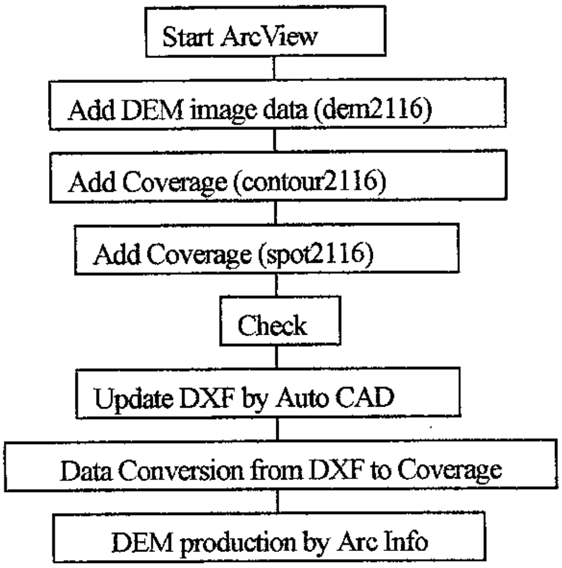
Following items were checked:

a. Inputting mistake (minus elevation value become plus).

b. Elevation value missing (elevation value became zero).

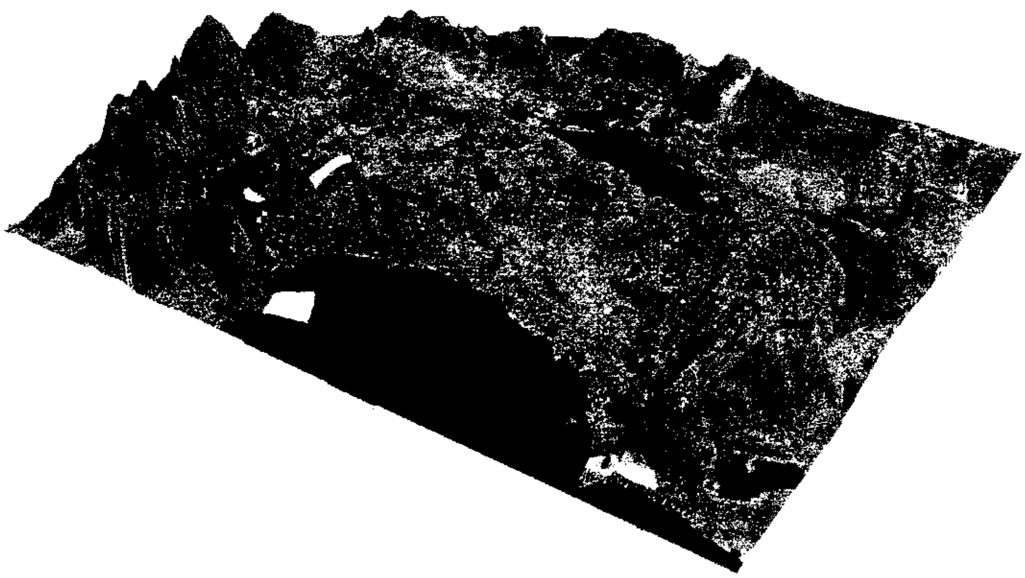
c. Visual quality control by using existing printed maps.

Figure 6.12 Workflow for Checking



DEM production work on this Study was comprised of DEM production 1 in Japan and DEM production 2 in Azerbaijan.
The DEM production 2 for the OJT area of approximately 12,000 km^2 was undertaken in a similar way to the DEM production 1 work in Japan.
Without changing the drawing soft used for Vector data acquisition for contour lines and spot elevations from VecEdit to AutoCAD, the three dimensional digital data on contour lines and elevation points were created in the Vector data revision 2. The work on OJT area was executed by counterpart team under the supervision of JICA study team.

Figure 6.13 Digital Elevation Model (Sheet No.1321)



6.9 Revision of the Vector Data

Vector data acquired at "Vector data acquisition of existing maps" were revised in computer using the data obtained at "Stereo-plotting" for the secular change areas as final vector data.
In case of inconsistency of the raster data of contour lines and vectorized planimetric features of the secular change data, the contour lines was plotted newly and revised the raster contour data was revised partially.
These revision of the vector data was implemented as "Raster data revision 1" for 48,000km^2 in Japan, and as "Raster data revision 2" for 12,000km^2 in Azerbaijan.

Updating of secular changes was carried out by using the ortho-photo images mainly and work on some portion was implemented by digital plotters directly as "Stereo plotting 1".

The digital DXF file format data acquired on vector data acquisition were updated using ortho images in the background by drawing software. Field verified photographs and the existing printed maps were also used for the updating. Work methods of the updating were followed with the digitizing of the existing topographic maps, however the images of the background were ortho-photos instead of scanning images of the printed maps in case of the digitizing of the existing maps.

topographic maps, however the images of the background were ortho-photos instead of scanning images of the printed maps in case of the digitizing of the existing maps.

Meanwhile, the updating of the vector data was conducted basing on the code numbers per map symbols and their applicable rules like the digitizing of the existing maps.

(1) Existing data and materials used:

① Ortho-image data of 1/40,000-scale aerial photos, TIFF format

② Normalized raster data of 1/50,000-scale printed maps, TIFF format

③ Vector data of the existing maps, DXF format (CD)

④ Corner coordinate data of 1/50,000 printed maps (floppy)

⑤ Field verification photos (contact photos)

⑥ 1/50,000-scale printed maps used in field verification

⑦ A4-size field verification photos orientation chart

⑧ A4-size index chart of existing 1/50,000 map sheets

⑨ Coordinates table of national triangulation points and traverse points

(2) Personal involved with the work in Azerbaijan

The updating of DXF data was conducted by the following 6 members using 6 computers:

Station 1: Mr. Selim Mustafayev

Station 2: Mr. Sadradin Nurkhametov

Station 3: Mr. Vladimir Roztopira

Station 4: Mr. Vladislav Roztopira

Station 5: Mr. Alovsat Guliyev

Station 6: Mr. Gasim Suleymanov

(3) Work specification

- The following specifications were specially considered in addition to the specifications for digitizing of the existing topographic maps on raster images scanned:
  The updating parts of orhto images on the computer display shall be of the same scales as that of the field verified photographs.
- As the results of the supplemental survey, check and updating of DXF data were thoroughly conducted in consideration that not only symbolized data used by Illustrator but also updating DXF data shall be corrected.
- The plane features and contours were relatively corrected by brown raster images in the background including the features such as contour lines and cliffs. (Cartography of the

mountainous areas was referred to the printed topographic maps.)

- The depth contours, their values (Code No. 7112) and spot depth (Code No. 7319) were not shown on the maps.
- The reversed side of the contact prints was also carefully checked because of using the side by field verification.
- The disappeared features marked by X symbol on the photographs and printed maps were neglected.
- The use of the same kinds of liner features was checked between the adjoining sheets.
- The proper tie between the adjoining sheets was checked.
- For those schools, hospitals, generating stations, substations, deserted houses, parking areas, docks and periodically used buildings which needs explanatory notes, only objects were inputted on DXF data. Explanatory notes shall be inputted at the time of symbolization.
- The types of roads were identified by red encircled numbers shown on the field verified photographs.
- Linear features were shown by the continuous lines and their edges were completely connected by points for the network structure.

(4) Deliverables

① Updated vector (DXF) data

② Color output maps from updated DXF data

③ Reports on supplemental verification surveys

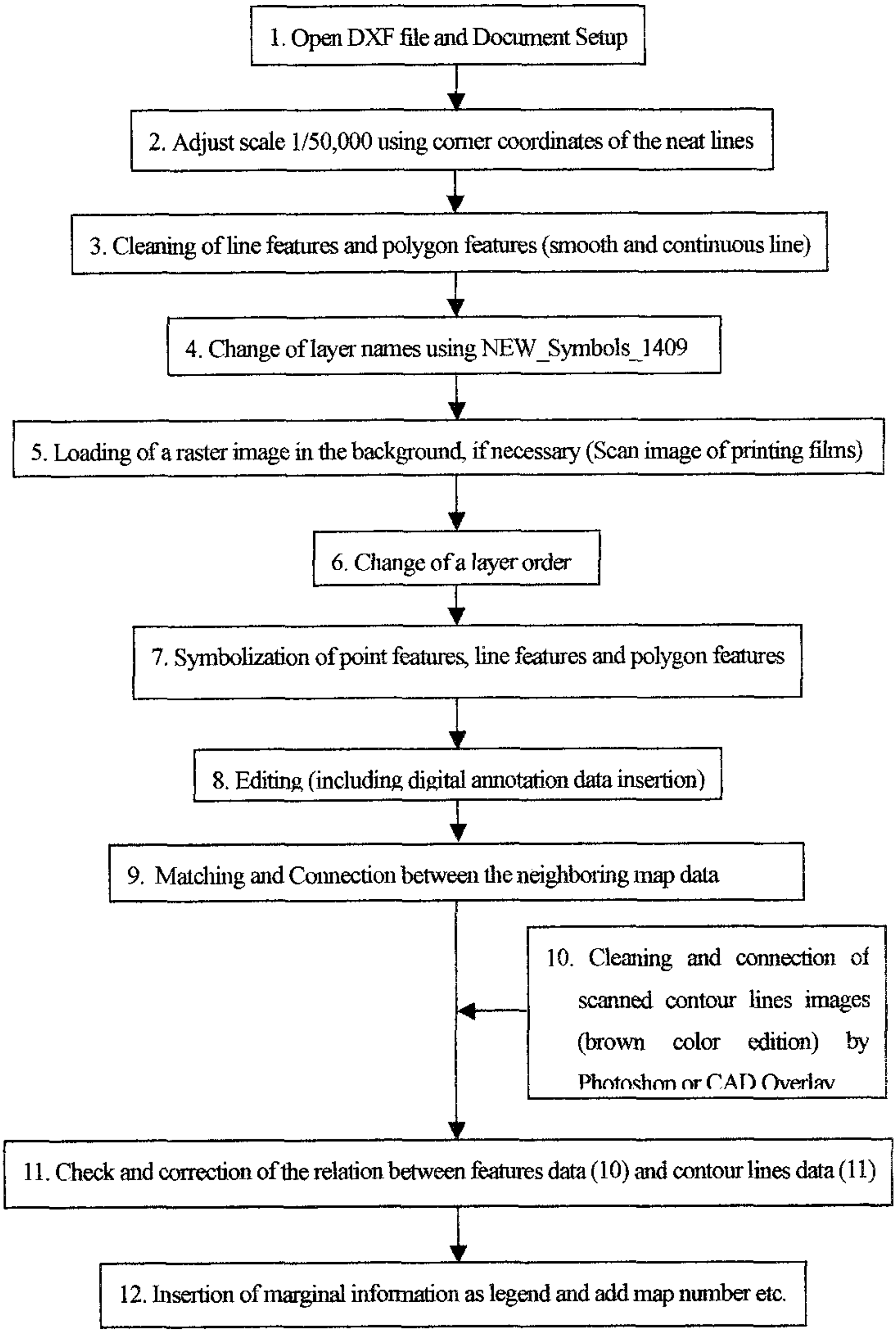
④ Accuracy control tables to be prepared by Study team

6.10 Revision of the Raster Data

Works for Revision of the raster data works on this Study is comprised of "Revision of the raster data 1" in Japan and "Revision of the raster data 2" in Azerbaijan.
Based on the final vector data revised, DXF data were compiled as raster map data using Adobe Illustrator V.8 software. After that DXF data were converted to "AI" format, raster data in Adobe Illustrator, all coded data were symbolized according to the Map Symbols Specifications. Then, the compilation of necessary replacement as the scaled map was implemented on computer displays

During the symbolization, the scale of the updated vector data (in DXF format) inserted in Illustrator was adjusted to the scale of 1/50,000 by the corner coordinates on the neat lines. Then, the linear features were smoothed as continuous lines and symbolized in accordance with the prescribed map symbols (New Symbols) in the order of point, line and polygon. The map compilation work was carried out the procedure as shown in the flowchart.

Figure 6.14 Workflow of Raster data revision



(1) Materials used for map compilation

The vector data (DXF format) in which the secular changes were updated and the following materials were used as references.

① Scanned image of the brown color edition film for the 1/50,000 scale maps, Tiff format

② Ortho-image data of 1/40,000-scale aerial photos, TIFF format

③ Normalized raster data of positive films for black and blue colors for 1/50,000-scale printed maps , TIFF format

④ Geo-coordinated color scanned image of 1/50,000-scale printed maps (3 maps), Tiff format

⑤ Corner coordinate data of 1/50,000-scale printed maps, text file

⑥ Field verification photos (contact photos)

⑦ 1/50,000-scale printed maps used in field verification

⑧ A4-size field verification photo orientation map

⑨ A4-size index chart of 1/50,000 scale map sheets

⑩ Coordinates table of national triangulation points and traverse points

⑪ Digital symbol data of the Illustrator format for point features

Because there is not the brown color edition for the existing map sheets 1803, 2107, 2116, the terrain data like contour lines, spot heights, cliffs, etc. that are described in brown color on this existing map shall be symbolized by using the scanned image of this existing map.

(2) Personnel involved with the work in Azerbaijan

The map compilation using Illustrator in Azerbaijan was made by formation consisting a group of 6 engineers using 6 personal computers.

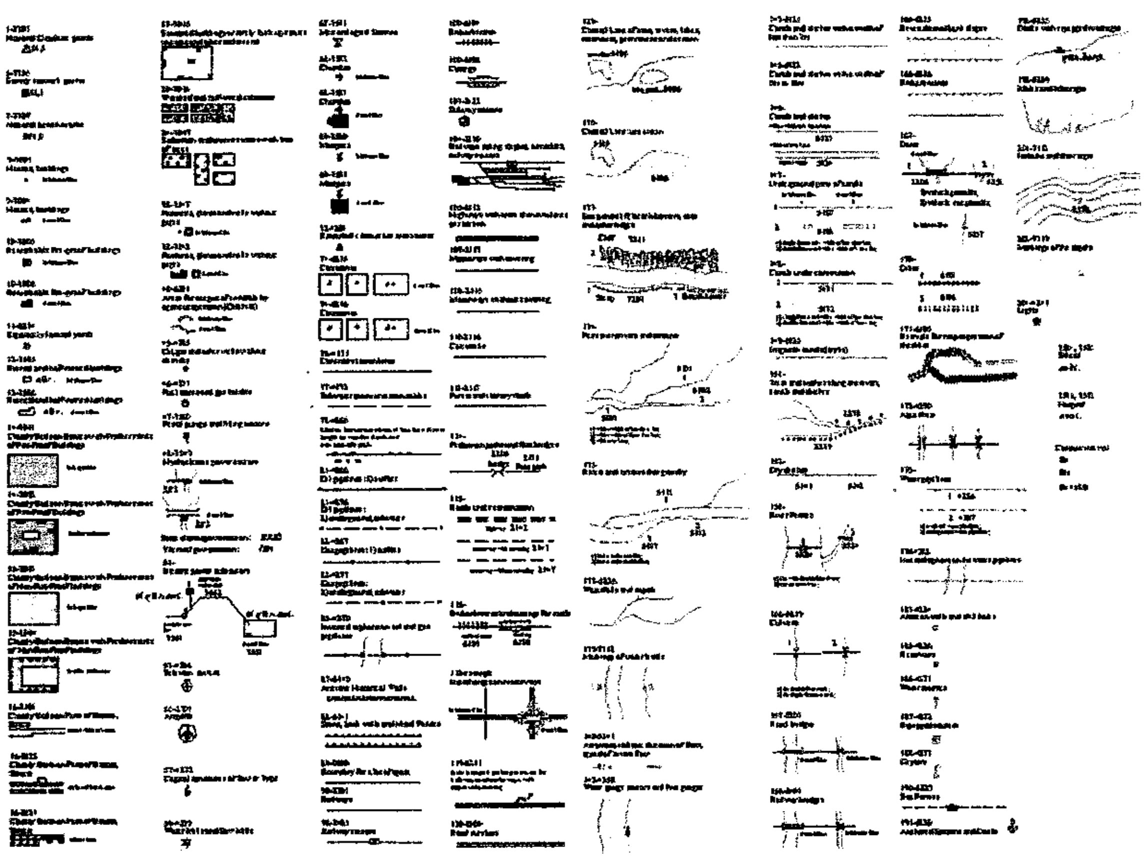
Station 1: Mr. Latif Guseynov
Station 2: Mr. Emil Bayranov
Station 3: Mr. Yusif Akhadi
Station 4: Ms. Sakina Ibragimova
Station 5: Ms. Samira Abbasova
Station 6: Ms. Aygun Nagiyeva
Station 7: Mrs. Zamira Beybutova

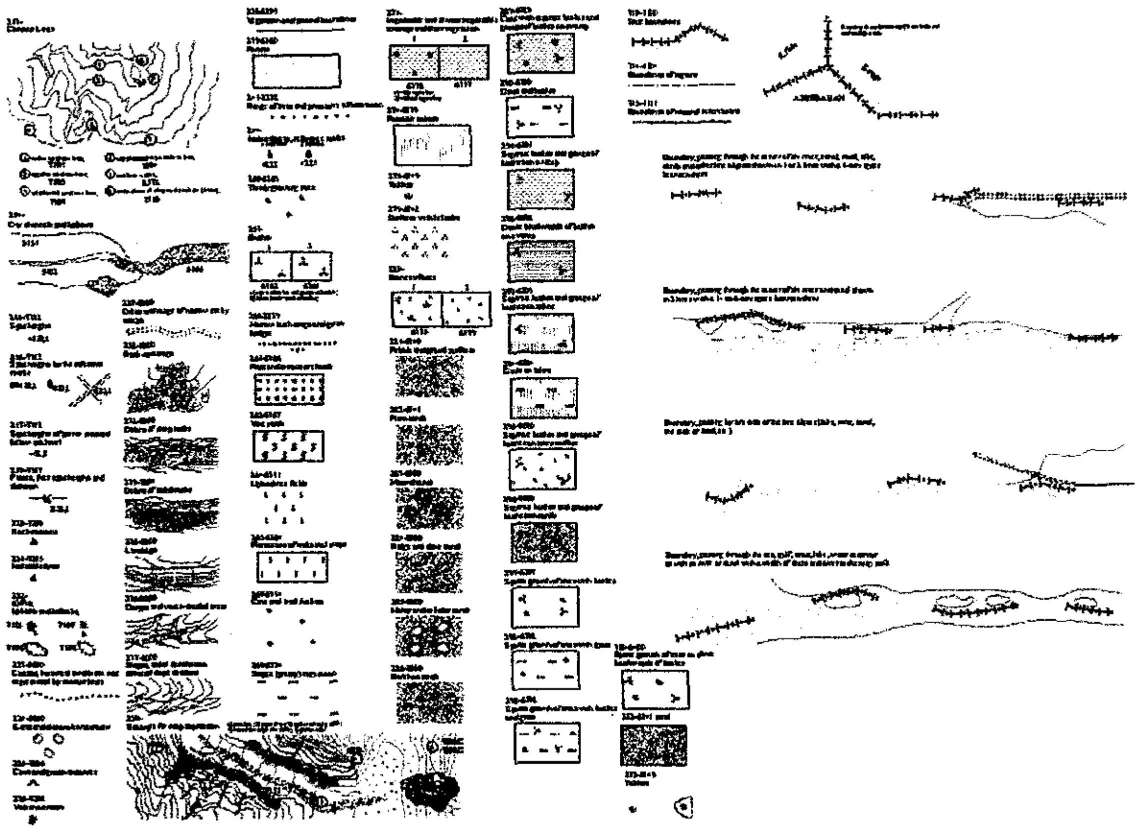
(3) Special considerations

Quality control was performed under special consideration for the following points that may cause work errors:

- Horizontal and vertical scale of character (text) shall be 100%.
- The map scale was adjusted accurately to 1/50,000.
- Checking and correction have been made to confirm that the linear features were drawn as

- The order of layers was designed in consideration of checking and correction after completion of the work.
- Symbolization was made in the order of point, line and polygon as shown in the NEW_Symbols below.





- For a symbol consisting of a line and a polygon, the line and polygon were symbolized in different layers in consideration of correction after checking the symbol.
- A symbol consisting of a pattern was arranged in reference to an existing printed map.
- Point buildings of the size of 0.5mmX0.5mm on the map were rotated at an angle of their actual disposition (e.g. roadside buildings are displaced at the same angle as roads are). Besides, symbols of separate Yards with Houses symbols were rotated.
- A road passing through a city area was defined differently from the general roads.
- Concerning roads in town areas, road segments in the town areas shall be described as the street type, bold black line. As for the roads (Code Nos. 2112, 2113, 2144 and 2143) which go through the build-up areas (Code Nos. 3011, 3012, 3013, 3014, 3015, 3016 and 3017) on the maps, the road just for going through the build-up areas should be changed to the road symbols shown by the double black lines (Code Nos. 2101, 2121 and 2122). The roads which go through the build-up areas are specified as the roads both sides of which are build-up areas, however even if their one side is the build-up area, the road in such a situation should be changed to the above mentioned road symbols.
- The omissions of a transmission line and a communication line in a road section passing through a city area were defined.

- The representations of a transmission line (Code No. 4265), a communication line (Code Nos. 4131 and 4132), and a pipeline (Code Nos. 4266, 4267, 4276, 7277, 4286 and 4287) were omitted only in the crowded orange/yellow built-up area (4 types available: Code Nos. 3011, 3012, 3013 and 3014). The transmission line, communication line or pipeline in the intersection of linear features such as roads were not omitted but represented.
- The elevation value was standardized as a value down to one place of decimal, and the decimal point was not represented as a point but as a comma. The font size was 6.5 pt.
- As a building in a built-up area could not be represented, it was represented as an ornament.
- If two features symbolized overlapped with each other, one feature was relocated. In case it was inevitable that two buildings in a city area overlapped even if one was relocated, one building was cleared.
- If a feature of the same color as an annotation overlapped with the annotation, the annotation was preferentially relocated to avoid overlapping and to reduce masking. The masking was made for the following symbols:
  i. Frame mask of Neatline
  ii. Mask for mapping boundary
  iii. Mask to contour line for contour value, slop, cliff symbols
  iv. Blue mask to hydro polygon features.
- The masking of the data of a feature stretching across the border of two adjacent map sheets was carefully checked and corrected.
- In creating digital annotations, the annotation specifications were established to standardize the font type, size and color.
- The colors of fonts and features were used in accordance with the following specifications. Annotation and linear features shall be symbolized with the true colors based on the **CMYK** color specifications listed below. Polygon features are provided with their own set of color specifications.

  True colors (Spot Color) of symbols were created for Illustrator as follows:

Item	Color				Remarks
	C	M	Y	K	C: Cyan; M: Magenta; Y: Yellow; B: Black
Az Orange	0	45	100	0	**100%**: Built-up area (3011, 3012), Parking area (6211), Road (2112, 2113, 2142, 2143) **50%**: National boundary (1100)
Az Blue	100	0	0	0	**100%**: Reservoir (4226), Water level (7318), Hydro objects & annotation (6235, 4224, 4271, 4272, 4273, 4286, 4287, 4288, 5101-5132, 5107, 5108, 6337,

					6338, 6339, 5209, 5215, 5216, 5226, 5241, 8151, 8152, 8153, 8154, 8173, 8175), Contour (7101G, 7102G,) **30%**: Hydro polygon (5102-5106, 5112-5116, 5122-5124, 5132, 5108)
Az Yellow	5	20	95	0	Built-up area (3013, 3014)
Az Green	30	0	60	0	**100%**: Built-up area (3017), Vegetation (6360, 6366), Cemetery (6216) **50%**: Vegetation (6361, 6364, 6367)
Az Brown	50	85	100	0	Contour (7101, 7102, 7103, 7104, 7110, 7105, 7106, 7107, 7108, 8176), Cliff (7211, 7204, 7203), Quarries (6231), Stream (5141, 5142, 5151, 5152, 5155, 5156), Sand & Gravel (6348, 6349, 6335, 6339, 6340, 6341)
Black	0	0	0	100	Others

- Overprint setting for black, brown, blue 100% objects and annotation data should be on.
- Overprint setting for Orange line of national boundary (1100), Hydro polygon (5102-5106, 5112-5116, 5122-5124, 5132, 5108) and Vegetation polygon (6361, 6364, 6367) objects should be off.
- Final Illustrator data should be created by the Illustrator version 8.

(4) Revision of the raster data for existing contour plates scanned

The raster contour images used for final printed maps were improved in respect to the following items by using Adobe Photoshop or CAD Overlay software:

- Elimination of the speckles more than 0.3mm and dust images appeared on the output
- Elimination of brown colored roads symbols appeared on the brown contour plates/
- Linear connection of broken contour lines more than 1mm on the maps, which should be shown by continues lines
- Correction of inconvenient contour lines and brown features such as sand and small topographic symbols located at the following secular changed areas or items;
  - Secular changed areas such as large-scale land improvement area, moved areas of the riverbed and channels
  - Correction of contours followed by the changes of lakes and marsh in the scale
  - Elimination of sand symbols following the retreat of Caspian shoreline
  - Gapped areas of planimetric features caused by secular changes
  - Adjustment of contour matching between adjacent sheets

There were some big gaps in contour matching between adjacent sheets because some existing maps were based on the contour plates of old version

(5) Deliverables

① Symbolized Illustrator data

② Color output maps from symbolized digital data

③ Reports for supplemental verification surveys

④ Accuracy control tables to be prepared by Study team

The Revision of raster data 2 for the OJT area of approximately 12,000 km^2 was undertaken in a similar way to the Revision of raster data 1 work in Japan. The work on OJT area was executed by counterpart team under the supervision of JICA study team.

The lay out of marginal information representation for the printed maps including the legend was consulted with SCLC several times and agreed finally by Azerbaijan side finally.

6.11 Supplemental Field Verification

Generally, procedure for improving the accuracy of planimetric features consists of (1) inspection, (2) supplemental field survey, (3) data arrangement and (4) quality control. Especially, the inspection process was important act in finding errors before starting field survey. Based on the found errors supplemental field survey was carried out to clarify indefinite features. In addition, it was done to verify additional annotations and important updated geographic features in a fieldwork, as well.

6.11.1 Preparation of topographic manuscripts

Three kinds of topographic manuscripts (hereinafter referred to as "output") were prepared in advance to facilitate extracting the necessary items to be revised at the field or office by SCLC counterparts. First output was used for the annotations checking, second one was used for the extraction of questionable items and the field survey, and third one was used for the arrangement of features as a final manuscript.

6.11.2 Inspection of errors and omissions in Japan

The Study Team conducted beforehand an inspection of data errors and omissions in Japan. It was done based on outputs compiled in plotting 1 and 2 by visual inspection to find major errors. In this inspection, some inconsistency items were revealed. Details were shown in the checklist. (see Table 6.5)

Then, inspection was done based on the following policies:

- Consistency of annotations (their position, correctness of administrative and geographic name)
- Right and wrong in representing unidentifiable features (power lines and pipelines, etc.)
- Consistency of symbolized small features such as schools, churches, public facilities and so on located in the big city
- Right and wrong on displacement between linear features (between road, canal and road railway, etc.)
- Consistency of symbolized build-up area classified by seven types
- Right and wrong in representing vegetation (symbols and its boundaries)
- Consistency of symbolized road passing through in the big city
- Edge matching

Table 6.5 Checklist for Output

No	Item for checking
1	Digital annotation data should be updated based on the above-mentioned annotation checking.
2	Some annotations in digital data were inputted not complete, namely baseline was shorter than text (number of characters). So, in this view it is impossible to see all names on screen.
3	Edge matching
4	Carefully check missing features, which were not seen on the contact prints (e.g. all annotations, some power lines, pipelines etc.).
5	Only principal school symbols should be indicated in the first copy of output map and/or if enough time input it in digital annotation data. *In case if some school changed its original location (as was shown on the existing topomaps)* this should be updated and indicated the same way as above.
6	Only principal mosque and hospital symbols should be indicated in the first copy of output map and/or if enough time input it in digital annotation data. In case if some mosque and hospital changed its original location (as was shown on the existing topomaps) this should be updated and indicated the same way as above.
7	Check "KaM" annotation, since so many of them were indicated on the contact prints. Reduce their number.
8	In many cases on the contact prints there were indicated vegetation dotted boundary lines dividing the same vegetation species although the same ones should have been indicated within the common boundary. Therefore, in some not all cases the dividing boundary line should be deleted.
9	There are 7 types of built-up area, but not all types were indicated on the contact prints. So, it is necessary to check these types once again.
10	Some annotations are not existing, but on the annotation overlay there were some old but not existing annotations. They should be checked and deleted.
11	Roads # 2101, 2121, 2122 should be indicated inside of city area, but # 2115, 2116, 2117, 2147, 2131 should be indicated outside of city.
12	For map sheets # 0216, 0315,0415, 0515, 0615, 0715, 0815, 0914, 0913, 0912, 1011, 1111, 1211, 1306, 1307, 1404, 1405, 1505, 1605 some areas on which were not covered by aerial photography (boundary areas) SCLC should create updated DXF data for these areas by using the images data prepared by JICA *Study* team. *Another layer number shall be used* during data inputting of DXF (for example: original code number plus "N")
13	Power lines (smaller than 35kv) and pipelines (except for trunk lines) should not be inputted as passing through built-up areas (it means they are not seen in the built-up area).
14	In *some cases there were not put map sheet names.* These map sheet names should be inputted in the digital annotation data.
15	In cases when some main roads and railways etc. are divided by a neat line the nearest city name and the distance should be indicated as part of marginal design.
16	In some map sheets there are the same village names shown in different locations. An original correct village name only should be indicated.
17	In some map sheets (for example #1112, 1509, 1311, 1213, 1307 etc.) there were no any administrative names indicated although there are any villages are shown.
18	In some cases there are villages with the names but without any schools.
19	In case of map sheet #1111 (contact print #3465) it is not clear which kind of feature is indicated if it is a building or a tank.
20	In case of map sheet #1409 (contact print #13-3178) there are clouds so that it is impossible to update digital data. SCLC should update.
21	Location of the village name should be on the right side of the village as first priority. Check carefully location of all annotations.
22	Elevation value of points (triangulation point, traversing point, photogrammetric point) shall be one decimal meter and font size of all elevation points shall be 6.5 pt.
23	During preparation of annotation data SCLC should prepare data on the bordering countries as part of marginal design (for example, Azerbaijan and Iran annotation should be given as part of marginal design).

6.11.3 Selection

In accordance with the following rules, which are being used in SCLC, the representation of schools, mosques, churches, public facilities, etc. located in the big cities were selected.

① Schools, mosques, churches and towers and so on located at dense build-up areas (3011, 3012, 3013, and 3014) in big cities on 1/50,000-scale maps are represented without detail building showing, as long as they are not conspicuous and/or isolated ones.

② Only conspicuous and/or isolated buildings are represented on final mapping (1/50,000 scale maps) by using either abbreviated words or symbols on the background of two kinds orange color.

6.11.4 Extraction of the items to be revised

All necessary items listed above were extracted by comparing outputs (using first and second output) with the original source information. (Aerial photos and existing maps) The work was performed by SCLC counterparts, composed of ten (10) specialists, under the supervision of JICA Study Team member.

The extracted items were classified into two categories, namely, indiscernible items and recognizable ones. The formers were verified in the field, and the latter were clarified during the office work using information collected finally.

In particular, reviewing annotations was carefully done by SCLC counterparts in consideration of their correctness of locations and names. Then, imperfect place-name was extracted through this process.

6.11.5 Transcription into output

(1) Planimetric features

The indiscernible items and questionable ones were transferred into second output for supplemental field survey correctly. On the other hand, recognizable items, such as an easy symbol's retouching which are not necessary to recognize in the field, were correctly transferred into third output directly so that their corrections could clearly be understood by Japanese operators.

(2) Annotations

Extracted and revised annotations were transferred into the first output so that full-length annotations could be represented in their precise positions.

6.11.6 Field verification

The supplemental field survey was done based on extracted items by SCLC counterparts. In obtaining the positions of some indiscernible features a handheld GPS was used in the field. Other questionable and unidentifiable features which could not be recognized on aerial photos were verified again in the field. The results were put into the third output.

6.11.7 Updating

Updating of areas in short supply of aerial photos, covering 19 map sheets (0216, 0315, 0414, 0515, 0615, 0715, 0815, 0914, 0913, 0912, 1011, 1111, 1211, 1306, 1307, 1404, 1405, 1505 and 1605), was correctly surveyed earlier this year by SCLC counterparts using GPS. (see Figure 6.15-1) The compilation of updates was carried out using the images prepared by JICA Study team as a background. The results were converted to DXF data format.

6.11.8 Data arrangement

In consideration of the easy-to-understand planimetric revision manner, the verified features to be reflected to the final raster data were represented into third output (see Figure 6.15-2) using simple indication and corresponding codes, which were adopted as map symbols for 1/50,000 topographic map in the territory of Azerbaijan.

Two types of annotation approved by SCLC, administrative and geographical, were correctly posted into annotation overlay in Azeri Latin.

6.11.9 Quality control

The quality control was carried out comparing the outputs, photos and existing maps as to the following topics. Extracted items were filled up on the checklist. (see Figure 6.15-3)

(1) Linear features consistency

After inspecting the linear features, it was found that unidentifiable linear features such as buried pipelines, water pipelines, communication lines, electric power lines, etc. were such vague features on photos that their positions tended to be mistakenly represented in the plotting. However, in doing edge matching those lines were fairly connected respectively although they became one of the causes for discrepancies in the matching. In accordance with SCLC's final decision some communication lines were deleted due to the fact of their discontinuity.

(2) Roads and Railways expression

Roads were readily characterized, but their surface and types tended to be mistakenly plotted in some outputs because of indistinct surface tone on the photos. Expression of Sidetracks branched off from the trunk line was wrong.

(3) Small features expression

After inspecting the small features, it was found that large scale schools, bridges and public facilities, etc. were readily plotted in cities due to their well-defined shape, but small scale schools, culverts, etc. located in the vegetation or fields were not correctly plotted due to their uncertain outlines and dark background. Finally, according to their existence necessary features were chosen by SCLC counterparts.

(4) Vegetation expression

On vegetation representing, it was found that some steppe symbols lacked due to the difficulty of their identification.

(5) Displacement consistency

In mapping to produce small-scale maps (1/50,000) appropriate solutions for displacement problems are indispensable to keep the planimetric appearance. Therefore, using displacement rules adopted by SCLC, displacement problems were checked and solved all over outputs. (130 outputs)

The following items were checked for displacement mistakes:

- Roads and canals with hachure
- Between different road types
- Both roads and railways with hachure
- Line features overlaid on roads

(6) Edge matching

Edge matching was executed as follows:

- Mismatches of linear features between adjacent map sheets
- Mismatches of polygons between adjacent map sheets
- Mismatches of symbols between adjacent map sheets

Figure 6.15-1. Check-plot

Output for Data arrangement

Sheet No. 1420

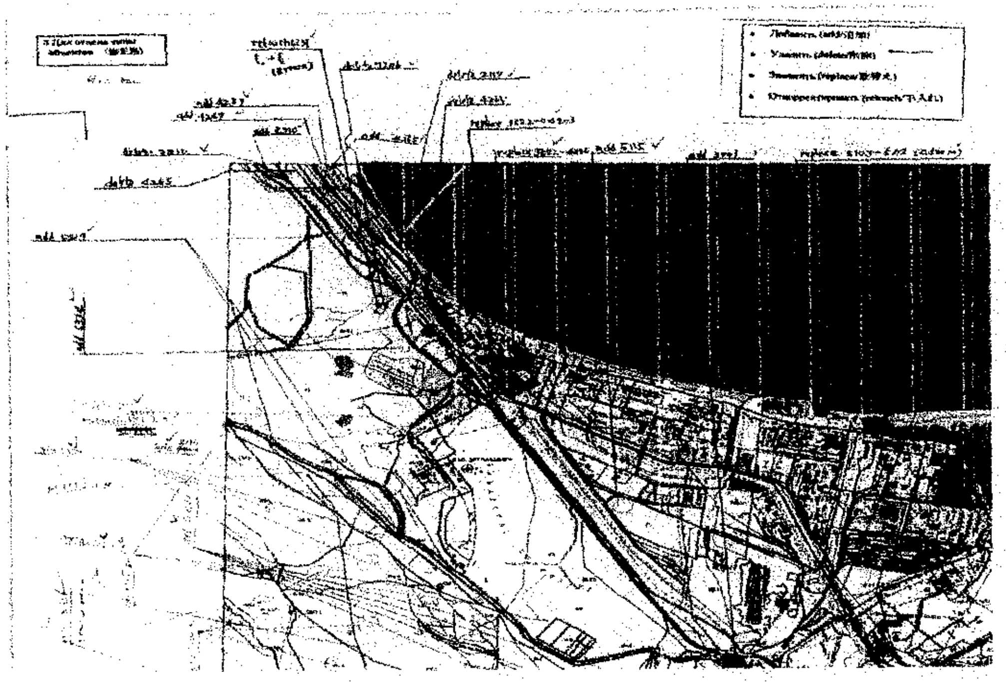


Figure 6.15-2. Index map

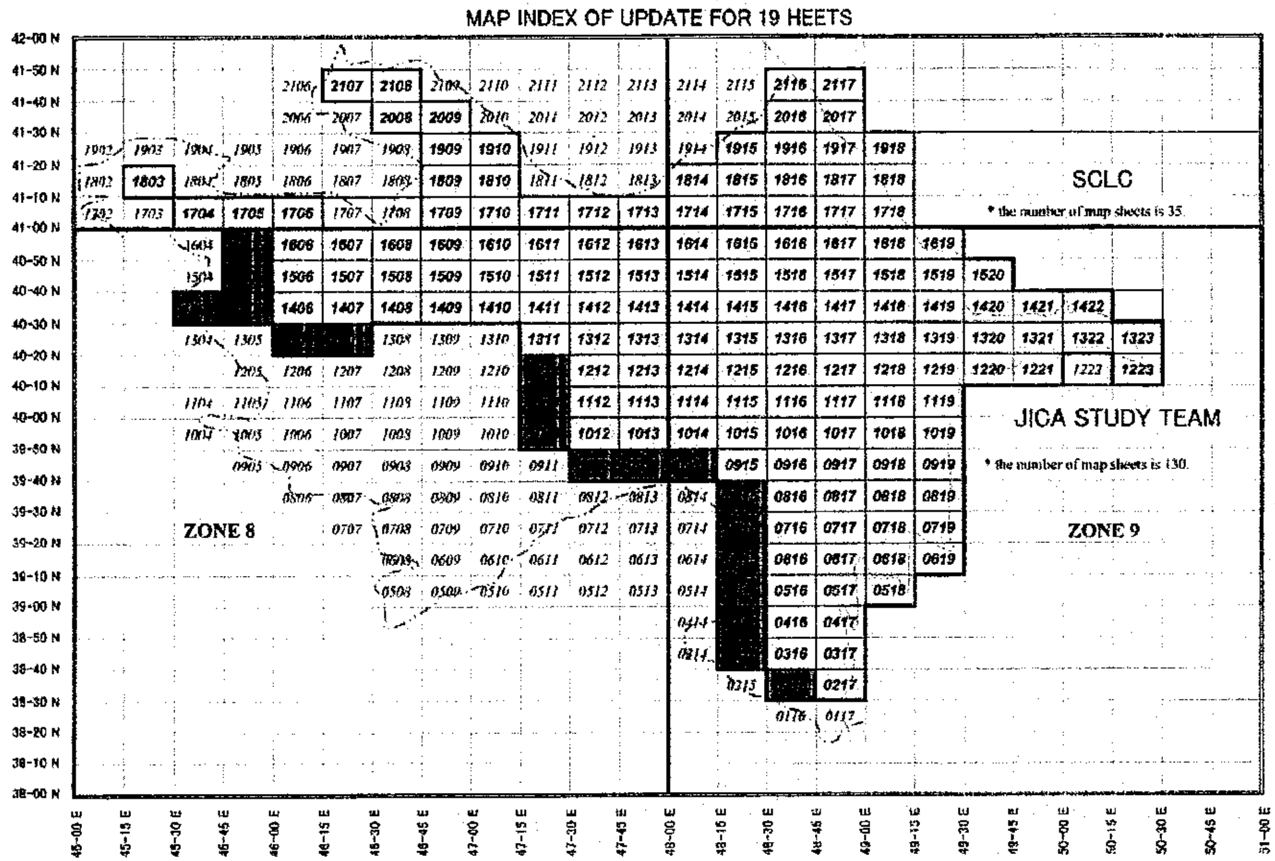


Figure 6.15-3. Check list 1

ПРОВЕРОЧНЫЙ ЛИСТ РЕЗУЛЬТАТОВ ВЫВОДА

№ ЛИСТА 1420 Проверено K. Usuda Дата 2002(?) 9 / 22

Группа	Наименование	Код	Пропуск	[illegible]
Почтовые(?)	[illegible]			
	[illegible]			
[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]		
Здания и прочие сооружения / Здания в застроенной области	[illegible]	3001		
	[illegible]	3004		
	[illegible]	3005		
	[illegible]	3006		
	[illegible]	3011		
	[illegible]	3012		
	[illegible]	3013		
	[illegible]	3014		
	[illegible]	3015	3	
	[illegible]	3016		
	[illegible]	3017		/
	[illegible]	3520		
	[illegible]	3521		
	[illegible]	3522		4
	[illegible]	3523		
	[illegible]	3524		
	[illegible]	3525		
	[illegible]	3531		
	[illegible]	3532		
Здания и прочие сооружения / Прочие сооружения	[illegible]	3547		
	[illegible]	3548		
	[illegible]	3549		
	[illegible]	3551		
	[illegible]	3552		
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	[illegible]	4214		/
	[illegible]	6215M		
	[illegible]	6215X		
	[illegible]	6215Q		
	[illegible]	6216M		
	[illegible]	6216X		
	[illegible]	6216Q		
	[illegible]	2301(?)		
	[illegible]	6211		/
	[illegible]	4212		
Железные дороги	[illegible]	2301		/
	[illegible]	2401		
	[illegible]	2301W		/
	[illegible]	6108W		
	[illegible]	2310		2
	[illegible]	2421		
	[illegible]	3412(?)		

Группа	Наименование	Код	Пропуск	[illegible]
Гидрография	[illegible]	4286		
	[illegible]	4287	4	
	[illegible]	4288		
	[illegible]	5101		/
	[illegible]	5102		
	[illegible]	5103		3
	[illegible]	5105	/	
	[illegible]	5106		
	[illegible]	5111		2
	[illegible]	5112		/
	[illegible]	5113		
	[illegible]	5115		/
	[illegible]	5116		
	[illegible]	5121		2
	[illegible]	5122		
	[illegible]	5123		
	[illegible]	5124		
	[illegible]	5133(?)		
	[illegible]	5131		
	[illegible]	5132		
	[illegible]	4290		
	[illegible]	5105(?)		
	[illegible]	5108		
	[illegible]	5210	2	
	[illegible]	6105		
	[illegible]	4224(?)		
	[illegible]	4222		
	[illegible]	4271		
	[illegible]	4272		
Малые объекты	[illegible]	3560		
	[illegible]	4224		
	[illegible]	4225		
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	[illegible]	4276		
	[illegible]	4267	/	/
	[illegible]	4277		
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Дороги	[illegible]	2112		2
	[illegible]	2113		5
	[illegible]	2115		4
	[illegible]	2116	2	5
	[illegible]	2117	4	6
	[illegible]	2101		
	[illegible]	2122		
	[illegible]	2121	/	

Группа	Наименование	Код	Пропуск	[illegible]
Дороги	[illegible]	2131		2
	[illegible]	2203	/	2
	[illegible]	2235		
	[illegible]	2206		
	[illegible]	6151		
	[illegible]	6108		
	[illegible]	5221		
	[illegible]	5222		
	[illegible]	5223		
Топография	[illegible]	6215		
	[illegible]	0900		
	[illegible]	7101G		
	[illegible]	7102G		
	[illegible]	2112		
	[illegible]	1100		
	[illegible]	1114		
	[illegible]	1111		
Растительность(?)	[illegible]	6301	/	
	[illegible]	6311		
	[illegible]	6314		
	[illegible]	6334	5	
	[illegible]	6337		
	[illegible]	6318		
	[illegible]	6319		/
	[illegible]	6350		
	[illegible]	6351		
	[illegible]	6352		/
	[illegible]	6363		
	[illegible]	6364		
	[illegible]	6366	2	/
	[illegible]	6367		
	[illegible]	6308(?)		
	[illegible]	2238		
	[illegible]	2210		
Картография и др.	[illegible]	4203		
	[illegible]	4221		
	[illegible]	4222		
	[illegible]	4237		
	[illegible]	4241		
	[illegible]	4252		
	[illegible]	5209		
	[illegible]	5215		
	[illegible]	5216		
	[illegible]	5225(?)		
	[illegible]	5225		
	[illegible]	5226		
	[illegible]	5241		
	[illegible]	5258	/	
	[illegible]	5257		
	[illegible]	6101Y		

Группа	Наименование	Код	Пропуск	[illegible]
Картография и др.	[illegible]	6102Z		
	[illegible]	6140		
	[illegible]	6741		
	[illegible]	7206		/
	[illegible]	7208		
	[illegible]	7209		
	[illegible]	7215		
	[illegible]	6211		/
	[illegible]	5141		
	[illegible]	5142		
	[illegible]	5148		
	[illegible]	6149		
	[illegible]	7203		
	[illegible]	0000		
	[illegible]	5151		
	[illegible]	5152		
	[illegible]	5153		
	[illegible]	7105		
	[illegible]	7106		
	[illegible]	7107		
	[illegible]	7108		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	7211		
	[illegible]	5156		
	[illegible]	7204		
	[illegible]	1,6235		
	[illegible]	2,6239		
	[illegible]	6340		
	[illegible]	6341		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
Сводка по рамке	(1520) ✓ / (1419) ✓ [1420] (1421) ✓ / (1320) ✓			

Figure 6.15-3. Check list 2

CHECKLIST FOR CORRECTION IN OUTPUT

Sheet No. 1420 Checked by K. Usuda Date 2002. 8. 22

		Item	Code	Omission	Misdescription
Annotation		[illegible]			
		Geographical name			
Control points		[illegible]	[illegible]		
		[illegible]	[illegible]		
Buildings and Other Structures	Buildings and Built-up Area	[illegible]	3001		
			3004		
		[illegible]	3005		
			3006		
		[illegible]	3011		
			3012		
		[illegible]	3013		
			3014		
		[illegible]	3015	3	
		[illegible]	3016		
		[illegible]	3017		/
		[illegible]	3520		
			3521		
		[illegible]	3522		4
			3523		
		[illegible]	3524		
			3525		
		[illegible]	3531		
			3532		
	Other structures	[illegible]	3547		
			3548		
			3549		
		[illegible]	3551		
			3552		
			3553		
		[illegible]	3585		
			3586		
		[illegible]	4226		
		[illegible]	4216		/
		[illegible]	6214		/
		[illegible]	6213M		
			6215X		
			6215Q		
			6216M		
			6216X		
			6216Q		
		[illegible]	2701		
		[illegible]	6211		/
		[illegible]	4232		
Railways		[illegible]	2301		/
		[illegible]	2401		
		[illegible]	2301W		/
		[illegible]	6108W		
		[illegible]	2310		2
		[illegible]	2421		
		[illegible]	2432		

	Item	Code	Omission	Misdescription
Hydrography	[illegible]	4286		
		4287	4	
	[illegible]	4288		
	[illegible]	5101		/
		5102		
		5103		3
	[illegible]	5105	/	
		5106		
	[illegible]	5111		2
		5112		/
		5113		
	[illegible]	5115		/
		5116		
	[illegible]	5121		2
	[illegible]	5122		
	[illegible]	5123		
	[illegible]	5124		
	[illegible]	5215		
	[illegible]	5131		
		5132		
	[illegible]	4290		
	[illegible]	5107		
		5108		
	[illegible]	5219	2	
	[illegible]	6105		
	[illegible]	4224		
	[illegible]	4272		
	[illegible]	4273		
	[illegible]	4271		
Small objects	[illegible]	3560		
	[illegible]	4224		
	[illegible]	4225		
	[illegible]	4231		
Infrastructure	[illegible]	4131		
	[illegible]	4132		
	[illegible]	4266		
	[illegible]	4276		
	[illegible]	4267	/	/
	[illegible]	4277		
	[illegible]	4270		
	[illegible]	4265	2	
Roads	[illegible]	2112		2
	[illegible]	2113		5
	[illegible]	2115		4
	[illegible]	2116	2	5
	[illegible]	2117	4	6
	[illegible]	2191		
	[illegible]	2132		
		2121	/	

	Item	Code	Omission	Misdescription
Roads	[illegible]	2131		7
	[illegible]	2203	/	2
	[illegible]	2205		
	[illegible]	2206		
	[illegible]	6101		
	[illegible]	6108		
	[illegible]	5221		
	[illegible]	5222		
		5223		
Topography	[illegible]	6235		
	[illegible]	0000		
	[illegible]	7101G		
		7102G		
	[illegible]	7112		
	[illegible]	1109		
	[illegible]	1104		
	[illegible]	1111		
Vegetation	[illegible]	6301	/	
	[illegible]	6311		
	[illegible]	6314		
	[illegible]	6334	5	
	[illegible]	6337		
	[illegible]	6378		
	[illegible]	6339		/
	[illegible]	6360		
	[illegible]	6361		
	[illegible]	6362		/
	[illegible]	6363		
	[illegible]	6364		
	[illegible]	6366	2	/
	[illegible]	6367		
	[illegible]	6500B		
	[illegible]	2218		
	[illegible]	2239		
Cartography and Other	[illegible]	4233		
	[illegible]	4221		
		4222		
	[illegible]	4239		
	[illegible]	4213		
	[illegible]	4252		
	[illegible]	5209		
	[illegible]	5215		
	[illegible]	5216		
	[illegible]	3220		
	[illegible]	5225		
	[illegible]	5228		
	[illegible]	5241		
	[illegible]	5251	/	
	[illegible]	5257		
	[illegible]	6101Y		

	Item	Code	Omission	Misdescription
Cartography and Other	[illegible]	6102Z		
	[illegible]	6140		
	[illegible]	6141		
	[illegible]	7206		/
	[illegible]	7208		
	[illegible]	7209		
	[illegible]	7215		
	[illegible]	6131		/
	[illegible]	5141		
		5142		
	[illegible]	6348		
	[illegible]	6349		
	[illegible]	7203		
	[illegible]	0005		
	[illegible]	5151		
		5152		
		5155		
	[illegible]	7105		
	[illegible]	7106		
	[illegible]	7107		
	[illegible]	7108		
	[illegible]	0008		
	[illegible]	0008		
	[illegible]	0000		
	[illegible]	0009		
	[illegible]	0008		
	[illegible]	0008		
	[illegible]	7211		
	[illegible]	5156		
	[illegible]	7104		
	[illegible]	1 6235		
		2 6239		
	[illegible]	6310		
	[illegible]	6311		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
	[illegible]	0000		
Edge Matching				

Edge Matching:

	(1520)	
(1419)	1420	(1421)
	(1320)	

6.12 Revision of the Digital Map Data

All vector data were revised in computer using the results obtained at the supplemental field verification surveys for the Study area as final vector data.

In case of inconsistency between the raster data of contour lines and vectorized planimetric features, the contour lines were newly plotted and the raster data were partially revised.

Based on the final vector data revised, the revised data were reflected in the digital map data to be used for map printing.

6.13 Film Preparation for Printing Plate-making

6.13.1 Raster and Vector data Integration and Adjustment

The scanned raster data of existing contour lines, which are brown color plates, were integrated into new digital map data compiled by Illustrator, and there was adjusted some inconsistency between the planimetric features and contour lines. In this occasion, the adjustment was performed only on the portions of relatively prominent discrepancy found. Because of the term as more than 10 years passed since the existing original films were produced and respectively stored, they experienced sufficient deformation resulted in some partial irregular expansion and contraction. As a result of that deformation, it was almost impossible to match perfectly the contour lines with the new digital planimetric features.

The marginal information such as legend, adjacent sheet information and proper sheet names, etc. was designed at the accurate positions agreed by SCLC in A2 format size. Only main new map symbols were represented in the legend as part of the marginal information.

On the OJT area of approximately 12,000 km^2, the work of Raster and vector data integration and adjustment 2 was undertaken using the same method as for the Raster and the vector data integration and adjustment 1 in Japan. The work on the OJT area was executed by counterpart team under the supervision of JICA study team

6.13.2 Pre-outputting and Inspection

After the integration of raster data of contour lines with annotation data and vector data for the printing maps, the pre-outputting sheets were produced using ink-jet printers by setting up actual colors for inspection prior to the film-making.

The inspection items were as follows:

- Inappropriate features' duplication such as overlapping between black color annotation and black color features

- The fails of color screen on polygon area
- Omission of features by the fails of layer order

The work on the OJT area was executed by counterpart team under the supervision of JICA study team.

6.13.3 Film preparation

The films for printing plate-makings based on color separation were produced by high-resolution laser image printer – Image Setter. For this purpose, #300-thick transparent polyester films were used as film materials to keep the images stable.

Six pairs of films produced for each map sheet were inspected finally making an accurate duplication by means of four crop marks in each outputted film on light tables, and the same inspection items 6.13.2 and the condition of the overprint by superimposing separate colors was checked and confirmed.

On the OJT area of approximately 12,000 km^2 (35 map sheets), the make-up films for printing the map data prepared in the compilation process were prepared in the same method as film preparation for plate-making in Japan. The work on the OJT area was executed by counterpart team under the supervision of JICA study team

6.14 CD-ROM Production

All final digital data with the results were generated as "Metadata" and stored on CD-ROM as item of final deliverables.

Metadata are follows:

-Inventory of existing data

-Quality of the data for a specified purpose

-Information of source data used for data creation

-Spatial location of the data

-Data structures (definitions of the names and data items, available data format)

-Access to data creator

-Information of the data distribution

A sample of metadata is given below. This metadata is written by html format.

road_lin

Metadata also available as

Metadata:

- Identification_Information
- Spatial_Data_Organization_Information
- Spatial_Reference_Information
- Entity_and_Attribute_Information
- Distribution_Information
- Metadata_Reference_Information

Identification_Information:

Citation:

Citation_Information:

Originator:

The name of an organization or individual that developed the data set. REQUIRED.

Publication_Date:

The date when the data set is published or otherwise made available for release. REQUIRED

Title: road_lin

Geospatial_Data_Presentation_Form: vector digital data

Description:

Abstract: A brief narrative summary of the data set. REQUIRED.

Purpose:

A summary of the intentions with which the data set was developed. REQUIRED.

Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date:

The year (and optionally month, or month and day) for which the data set corresponds to the ground. REQUIRED.

Currentness_Reference:

The basis on which the time period of content information is determined. REQUIRED.

Status:

Progress: The state of the data set. REQUIRED.

Maintenance_and_Update_Frequency:

The frequency with which changes and additions are made to the data set after the initial data set is completed. REQUIRED.

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: 49.750145

East_Bounding_Coordinate: 50.000530

North_Bounding_Coordinate: 40.502341

South_Bounding_Coordinate: 40.332262

Keywords:

Theme:

Theme_Keyword_Thesaurus:

Reference to a formally registered thesaurus or a similar authoritative source of theme keywords. REQUIRED.

Theme_Keyword:

Common-use word or phrase used to describe the subject of the data set. REQUIRED.

Access_Constraints:

Restrictions and legal prerequisites for accessing the data set. REQUIRED.

Use_Constraints:

Restrictions and legal prerequisites for using the data set after access is granted. REQUIRED.

Native_Data_Set_Environment:

Windows NT Version 5.0 (Build 2195) Service Pack 3; ESRI ArcInfo 8.1.0.415

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Vector

Point_and_Vector_Object_Information:

SDTS_Terms_Description:

SDTS_Point_and_Vector_Object_Type: Complete chain

Point_and_Vector_Object_Count: 6537

SDTS_Terms_Description:

SDTS_Point_and_Vector_Object_Type: Point

Point_and_Vector_Object_Count: 4

Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Planar:

Map_Projection:

Map_Projection_Name: Transverse Mercator

Transverse_Mercator:

Scale_Factor_at_Central_Meridian: 1.000000

Longitude_of_Central_Meridian: 51.000000

False_Easting: 9500000.000000

False_Northing: 0.000000

Planar_Coordinate_Information:

Planar_Coordinate_Encoding_Method: coordinate pair

Coordinate_Representation:

Abscissa_Resolution: 0.000032

Ordinate_Resolution: 0.000032

Planar_Distance_Units: meters

Geodetic_Model:

Horizontal_Datum_Name: D_Krasovsky_1940

Ellipsoid_Name: Krasovsky_1940

Semi-major_Axis: 6378245.000000

Denominator_of_Flattening_Ratio: 298.300000

Entity_and_Attribute_Information:

Detailed_Description:

Entity_Type:

Entity_Type_Label: road_lin.aat

Attribute:

Attribute_Label: FID

Attribute:

Attribute_Label: SHAPE

Attribute:

Attribute_Label: FNODE#

Attribute:

Attribute_Label: TNODE#

Attribute:

Attribute_Label: LPOLY#

Attribute:

Attribute_Label: RPOLY#

Attribute:

Attribute_Label: LENGTH

Attribute:

Attribute_Label: ROAD_LIN#

Attribute:

Attribute_Label: ROAD_LIN-ID

Attribute:

Attribute_Label: CODE

Attribute:

Attribute_Label: BD_CODE

Attribute:

Attribute_Label: ATTRB

Attribute:

Attribute_Label: $ID

Attribute:

Attribute_Label: $FROMNODE

Attribute:

Attribute_Label: $TONODE

Attribute:

Attribute_Label: $LEFTPOLYGON

Attribute:

Attribute_Label: $RIGHTPOLYGON

Distribution_Information:

Standard_Order_Process:

Digital_Form:

Digital_Transfer_Information:

Format_Name: ARC

File_Decompression_Technique: No compression applied

Transfer_Size: 0.920

Digital_Transfer_Option:

Online_Option:

Computer_Contact_Information:

Network_Address:

Network_Resource_Name: \\LUPO\E$\kakiuchi\azerbaijan\1321\road_lin

Access_Instructions: Local area network

Metadata_Reference_Information:

Metadata_Date: 20021128

Metadata_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization:

The organization responsible for the metadata information. REQUIRED.

Contact_Person: The person responsible for the metadata information. REQUIRED.

Contact_Address:

Address_Type:

The mailing and/or physical address for the organization or individual. REQUIRED.

City: The city of the address. REQUIRED.

State_or_Province: The state or province of the address. REQUIRED.

Postal_Code: The ZIP or other postal code of the address. REQUIRED.

Contact_Voice_Telephone:

The telephone number by which individuals can speak to the organization or individual. REQUIRED.

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

Metadata_Time_Convention: local time

Metadata_Extensions:

Online Linkage: <http://www.esri.com/metadata/esriprof80.html>

Profile_Name: ESRI Metadata Profile

Generated by mp version 2.4.38 on Thu Nov 28 14:05:05 2002

6.15 Transfer of Technology

The cooperative work with the counterparts in Azerbaijan was carried out through the process of new digital maps generation by means of latest technology.

The following technical items were transferred to the staffs of SCLC as listed.

Technical Item	Counterpart	Year
① GPS Survey	Mr. Gorhma Kerimov Mr. Namaz Asadov Mr. Valeh Agabalayev Mr. Alam Kerimov	2001
② Image Scanning & Digitizing	Mr. Latif Guseynov Mr. Yusif Akhadi Mr. Emil Bayramov*	2001
③ Digital Photogrammetry	Mr. Alovsat Guliyev Ms. Shakhla Suvorova Ms. Gulnara Mamedova	2002
④ Revision of Vector data	Mr. Latif Guseynov Mr. Emil Bayranov Mr. Yusif Akhadi Ms. Sakina Ibragimora Ms. Samira Abbasova Ms. Aygun Nagiyeva Ms. Zamira Beybutova	2002
⑤ Revision of Raster data	Mr. Latif Guseynov Mr. Emil Bayranov Mr. Yusif Akhadi Ms. Sakina Ibragimova Ms. Samira Abbasova Ms. Aygun Nagiyeva Ms. Zamira Beybutova	2002
⑥ Out-put and Inspection	Mr. Latif Guseynov Mr. Yusif Akhadi Ms. Sakina Ibragimova Ms. Samira Abbasova Ms. Aygun Nagiyeva Ms. Zamira Beybutova Ms. Aygun Veliyeva	2003
⑦ Preparation of the Plate making	Mr. Agil Ahmadov Ms. Shakhla Suvorova Ms. Elmira Jafarova Ms. Adilya Mamedova Ms. Malek Guliyeva Ms. Gulnara Mamedova	2003

P.S. *mark is a retired person

The detailed contents of technical transfer to SCLC were as follows:

6.15.1 GPS Survey

Geodetic coordinates on the observation spots were determined by receiving and analyzing the geodetic data provided by the satellites, and computing the differential values between Azerbaijani National Coordinates and WGS 84.

The technical items concerning the selection, using the GPS operational manuals prepared by the Study Team transferred observation and analysis of the control points.

6.15.2 Acquisition of Raster and Vector Data

Digitizing was carried out for the scanning raster data on the existing topographic maps at a scale of 1/50,000. The digitizing works were conducted through raster image generation by scanning the topographic maps, distortion correction of scanning images and acquisition of vector data on the planimetric features by employing draw computer software.

Acquisition of the vector data on the scanning images of the background on the computer was conducted by means of tracing the points, lines and polygons of the images in accordance with the operational manuals.

The digitizing of the existing topographic maps was transferred by using the operational manuals, feature catalogues and identification cards prepared by the Study Team.

6.15.3 Digital Photogrammetry

The staff of SCLC conducted orthophoto production in order to revise the vector data by means of digital photogrammetry using DPW (Digital Photogrammetry Workstation) following the procedures of photo control points survey through pricking of the existing control points, aerial triangulation, DEM production and orthophoto production in accordance with the operational manuals prepared by the Study Team.

6.15.4 Revision of Vector Data

The staff of SCLC conducted the revision of vector data by employing computer draw software, Auto CAD. The revision of vector data was carried out through tracing the points, lines and polygons of the features having secular changes on the orthophoto images of the background on the computer. The classification of points, lines and polygons was based on the code classification of map symbols and the operational manuals prepared by the Study Team.

6.15.5 Revision of Raster Data

The staff of SCLC conducted the symbolization of vector data updated secular changes by employing the computer software for drawing and compilation, Adobe Illustrator.

The manuals for symbolization, map symbols and specifications were prepared on the agreement between SCLC and the Study Team.

6.15.6 Output and Inspection

Digital data which has been symbolized by Illustrator was outputted by plotters, and these outputs were inspected with the eye, and corrected by staff of SCLC in accordance with map symbols and specifications. The Study Team has prepared the accuracy control checklists in order that the staff of SCLC conducted the inspection for such as missing and duplication of the features, data consequence, unity of formats and accuracy of positions.

6.15.7 Preparation of Films for Printing Plates

Digital data for printing symbolized by Illustrator was inputted into high resolution lazar plotter for printing, Image Setter, classified in colors and set for resolution degrees in order to produce the printing film positives in 6 special colors.

The staff of SCLC prepared the printing film positives in accordance with the specifications and manuals prepared by the Study Team.

6.16 Equipment for the Study in Azerbaijan

The specifications of the equipment for OJT were prepared after verifying their equipment and status of operation. An equipment list and specifications was prepared referring to the basic policy of that to be applied their recent mapping techniques. A set of the equipment was a model which SCLC can manage its maintenance. The Team examined possibility of the local procurement of the equipment and the cost.

As the results, Japanese side purchased the following equipment and software necessary for the technology transfer to the Azerbaijan side, which were installed at State Aerogeodesy Corporation / SCLC.

① GPS receivers

② Digital photogrammetry workstation

③ Image setter for out-put film making

④ Scanner

⑤ Stereo plotter

⑥ PCs and related software for map digitizing, compilation and data analysis

These detail specifications and their volume were descried in following Tables.

List of GIS equipment installed at State Aerogeodesy Cooperation / SCLC

At the end of August 2001

Items	Remarks	Quantity
1. Desktop Computer		
① Dell / Optiplex GX110MT CPU: PentiumIII 933Mhz HDD; 20Gb FDD: 3.5" 1.44Mb CD-ROM: OS: Windows 98 Monitor: Dell 19" Mouse / Keyboard	For map digitizing & compilation	1 set
② Power Macintosh CPU: 450Mhz HDD; 20Gb FDD: 3.5" CD-ROM: OS: Mac. Monitor: 19" Mouse / Keyboard	For map digitizing & compilation	1 set
2. Soft-ware		
① Autodesk Aout-CAD MAP 2000	Draw, Map(GIS)	1 license
② Autodesk, CAD-Overlay 2000	Draw support	1 lic.
③ Raster to Vector 4	Data change to Vector	2 lic
④ Adobe Illustrator V8.0 for Macintosh	Draw	2 lic.
⑤ Adobe Photo-shop V5.5 for Macintosh	Draw	2 lic.
⑥ Free Hand V9.0 for Macintosh	Draw	2 lic.
⑦ Ms Office 2000 Pro.	Office	1 lic
⑧ Windows 2000 Professional	OS	1 lic

At the end of March 2002

Items	Remarks	Quantity
1.Digital Photogrammetric Workstation **Leica DPW770**		
① DELL Precision Workstation 530MT CPU: Dual Intel Xeon 1.5Ghz Chipset; 860i 400Mhz system bus optimized for RDRAM Memory: 1GB RDRAM (8 RIMM Slots) AGP: Pro 4x VGA/DVI 36Gb SCSI U160/M 10,000RPM 73Gb SCSI U160/M 10,000RPM CD-ROM: x48 Drive Internal: LTO Tape Device Integrated 3 Com 10/100Mb Eathernet controller with WuOL Z-Screen Kit; Polarizing bezel to fit over 21" monitor enabling 3D viewing. TopoMouse: NT Flexible and programmable Buttons	Hardware for DPW	1 set

Items	Remarks	Quantity
OS: Windows 2000 Pro. Monitor: 2 x 21" DELL FD TRINITRON Z-Screen Kit TopoMouse Dell Keybord External: HP DLT 40 Tape Device		
② Software		
CORE SOCET SET lic.-NT		1 license
APM lic.-NT		1 lic.
ATE lic.-NT		1 lic.
TRUE ORTH lic.-NT		1 lic.
ORTH-MOSAIC lic.-NT		1 lic.
PRO600 lic.-NT		1 lic.
MicroStation Geographics "J" lic.		1 lic.
ORIMA/SOCET-TE/GPS lic.-NT		1 lic.
2. Leica GPS System 500		
① Reference Station SR530 dual frequency receiver AT501 antenna GEB121, NiMh, 6V/3.6Ah battery GKL122 Pro Charger x 4 Hard Container for GPS receiver Tribrack GDF112 BASIC Antenna cable (2.8m) Technical documentation PCMCIA-ATA flash card Tripod GTS05 Satellite 2AsxE radio modem, Tranceiver Housing for Satellite radio modem GAIFLEX radio antenna, fits, 2.8m cable TR500 terminal Large battery GEB71, NiCd, 12V7Ah Base with 5/8 inch screw Telescopic tow with 5/8 inch screw Arc 3cm long screw 2.8m antenna cable, 1.6m extension cable 1.8m connect cable	For Control Points Survey	1 set
② Rover Station SR530 dual frequency receiver AT502 antenna Hard Container for GPS receiver PCMCIA-ATA flash card Tripod GTS05 Satellite 2AsxE radio modem, Tranceiver Housing for Satellite radio modem Technical documentation GAIFLEX radio antenna, fit, 2.8m cable Grip with circular bubble Bottom section aluminum pole x 2		1 set

Items	Remarks	Quantity
Mini-pack for GPS receiver		
TR500 terminal		
Base with 5/8 inch screw		
Telescopic tow with 5/8 inch screw		
Arc 3cm long screw		
1.2m antenna cable, 1.6m extension cable		
1.8m connect cable		
Card reader		
Data transfer cable		
③ Software		
SK-Pro lic., & protection key		1 license
Datum & Map transformation		1 lic.
Design and adjustment		1 lic.
GIS/CAD output		1 lic.
RINEX import		1 lic.
3. GPS mobile System Leica	For field survey	
Reference & Rover station		2 sets
GS50 single frequency GPS receiver		
At501 antenna & 1.2m antenna cable		
TR500 terminal & 1.8m connect cable		
Hand strap with belt crip		
GEB121 batteries,NiMh, 6V/3.6Ah x 2		
Hard container for GS50 receiver		
Tripod GST05		
Tribrach GDF112 Basic		
GRT146 Carrier		
Minipack holds, GPS receiver and modems		
PCMCIA Ataflash card		
Telescopic rod with 5/8 inch screw		
User manuals		
Getting started with GS50		
Card reader for flash and SRAM PCMCIA		
Data transfer cable, 2.8m Lemo		
4. Total Station Leica TC1100	For geodetic survey	2 sets
with laser plummet, 1control panel user manual and container		
User manual TPS1100, English/Russian		1 pc.
Field Manuals TPS1100 System, English		1 pc.
Field Manuals TPS1100 applications, English		1 pc.
CD-ROM TPR Series Surveying		1 pc.
Container		1 pc.
GEB121 battery, NiMh, 6V/3.6Ah		1 pc.
Charger GK122 Pro, European Version		2 pcs.
PCMCIA flash card		1 pc.
Data transfer cable Lemo 0/RS232		1 pc.
Alminum tripod GST05L		1 pc.
Circular Prism GPR1		1 pc.
Single prism holder		1 pc.

Items	Remarks	Quantity
Target plat GZT4 Dawn string bag for GPH1 Reflector pole GSL11, extends to 2.15m Card Reader for flash and SRAM / PCMCIA		
5. Laptop Computer		
Dell / Latitude C610 CPU: Intel Pentium III / 1.0 GHz Memory: 128Mb 100Mhz SDRAM Hard Drive: 20Gb FDD: 3.5" 1.44Mb, removable 8 x DVD Drive ATI RADEON-TM graphics 16Mb AC97 audio Integrated Mini-PCI 56K Modem Display: 14.1" XGA and SXGA OS: Windows 98		2 sets
6. Others		
① MICROFLEX CE5320		1 set
② DAPCE5320 / SurvCE		1 license
7. Surver		
Dell / PowerEdge 2500 PE2500 Server Tower Option CPU: Pentium III 933MHz Memory: 512Mb 133MHz SDRAM HDD: 4x18Gb SCSI CD-ROM: 10/24x EIDE FDD: 3.5" 1.44Mb 6-Drive (1x6) Hot Plug Backplane PE2500 PERC3/Di 125Mb RAID, U160 SCSI, Dual Channel Non Redundant Power Supply (1x550W PSU) Terminator Card Intel PRO/100 + 10/100 PCI Ethernet NIC OS: MS Win 2000 Server, 5 CALs, English Monitor, 15" E551 Value Monitor 2 Botton IntelliMouse Keyboard Slimline		1 set
8. Workstation		
① Dell / Optiplex GX 240SMT CPU: Pentium V 1.6Ghz, cash L2 256Kb FSB 400MHz, Intel 845 chipset Memory: 256Mb up to 1Gb, PC133, SDRAM Two gold plate DIMM slots AHA 2940 SCSI Controller HDD: 9Gb SCSI		2 sets

Items	Remarks	Quantity
CD-ROM: 48x		
FDD: 3.5" 1.44Mb		
I/O Ports: 4 USB, 2 serial, 1 parallel, 2 PS/2		
Video M.: 16Mb 4xAGP ATI Rage Ultra128		
Audio: Integrated AC97 with SoftSynthesizer		
Integrated 3Com Etherlink 10/100 PCI		
Dell Keyboard and Mouse		
OS: MS Windows 2000 Pro		
Monitor: Dell 21" FD Trinitron		
② Dell / Optiplex GX 240SMT		1 set
HDD: 16Gb SCSI		
- the others same with ① -		
9. Desktop computer		
Dell / Optiplex GX 240SMT		1 set
CPU: Intel Pentium V 1.5Ghz, cash L2 256Kb		
FSB 400MHz, Intel 845 chipset		
Memory: 256Mb up to 1Gb, PC133, SDRAM		
Two gold plate DIMM slots		
HDD: 20Gb EIDE Uitra ATA/100 20, 7200RPM		
CD-ROM: 48x		
FDD: 3.5" 1.44Mb		
I/O Ports: 4 USB, 2 serial, 1 parallel, 2 PS/2		
Video M.: 16Mb 4xAGP ATI Rage Ultra128		
Audio: Integrated AC97 with SoftSynthesizer		
Integrated 3Com Etherlink 10/100 PCI		
Dell Keyboard and Mouse		
OS: MS Windows 2000 Pro		
Monitor: Dell 17" Value monitor		
10. Flatbed Scanner		
Epson Expression 1640XL Pro.		1 set
11. Color inkjet plotter		
HP DJ1055CM Plus		1 set
A0 format,		
Resolution; 600 x 600 dpi color, 1200 dpi b/w		
Memory; 128Mb HDD; 7.5Gb		
Adobe Postscript		
Buit-in HP Jet network card, cartridges		
12. Accessories		
① UPS Inform 1200		1 pc
② UPS Inform 2000		1 pc
③ CD writer/re-write HP		1 pc
④ External ZIP Drive IOMEGA		1 pc
⑤ Internal ZIP Drive IOMEGA		1 pc

Items	Remarks	Quantity
⑥ ZIP Disk IOMEGA		1 pc
⑦ Network Items CISCO WS-1548-DS		1 pc
13. Image Setter	For film output	
① DOLEV 4Press Pro Extreme; Produces hight quality films Image area: 743mm x 580mm Dolev4Press, Turbo Screening Automatic FAF for Brisque Brisque extreme Hope EG-750 film processor and bridge		1 set
② IBM 43P Tiger2 station PPC RISC SPU 604 375MHz, 256Mb RAM 9Gb system disk, 18Gb user disk, 18Mb VRAM 10/100 Ethernet card Modem The Brisque contains Ethershare licenses for six users IBM keyboard & mouse 17" Trinitron monitor		1 set
③ Chemicals and films Film: 660mm x 61m x 1 roll Film Developer: 2 cans x 10litters (1:3) Film Fixer: 2cans x 10litters (1:3)		1 set
④ Cost of installation & 6 months warranty		1 set
14. Scanner Vidar Truscann Titan II Pro A0 format, Optical resolution 400dpi, Scaled resolution up to 1600dpi Accuracy: ±0.10%±1pixel Document width: up to 42 inches Scan thickness: up to 3mm Data capture: 36bit color Warranty: 24 months	For raster data Generation	1 set
15. Software	For GIS & CAD	
① ArcGIS ArcView 8.1 (including Russian version)		1 license
② ArcGIS ArcEditor 8.1 (including Russ. Version)		1 lic.
③ ArcGIS ArcInfo 8.1 (including Russian Version)		1 lic.
④ ArcGIS Spatial Analyst 8.1		1 lic.
⑤ ArcGIS 3D Analyst 8.1		1 lic.
⑥ ArcPress for ArcGIS 8.1		1 lic.
⑦ AutoCAD Map R3		1 lic.
⑧ Autodesk CAD Overlay		1 lic

7 FINAL RESULTS FOR THE STUDY

The final results delivered to State Committee for Land and Cartography of Azerbaijan were as following table.

Final results

(1)	Report	
1)	Inception Report	English and Russian 20 copies each
2)	Progress Report 1	-ditto-
3)	Progress Report 2	-ditto-
4)	Draft final report	
	main report	English / Russian 20 copies each
	Summary	-ditto-
5)	Final Report	
	Main report	English / Russian 20 copies each
	Summary	-ditto-
(2)	Final products	
1)	Aerial Photos	
	Negative film	1 set
	Contact Photos	3 sets
	Digital Image Data	5 sets
	Photo Index	1 set
2)	Digital map data	
	Raster data	5 sets
	Vector data	5 sets
	DEM	5 sets
3)	1/50,000 Topographical map	
	Plate-making film	1 set
	Digital image data	5 sets
4)	Meta-data CD-ROM	1 set

8 FUTURE UTILIZATION OF THE STUDY RESULTS

8.1 Raster data & Vector data of the Study

Two types of digital map data, raster data and vector data, were generated in the course of this Study. In addition, the DEM (digital elevation model) data , which is generated from vector data of contour lines and point heights data, were produced.

The vector data of these digital maps are composed of point, line and area data classified in each layer attached code number. The data are coordinated to the national coordinate system as to be applied to the source geographical data for succeeding GIS project.
The raster data of this Study were prepared exclusively for the color printing maps by DTP, Desktop Publishing, system. Therefore, this raster data of the digital maps have different composition from normal raster model and are not used for GIS as they are.
In general, normal raster data use regularly spaced grid cells in specific sequence. An element of the grid cell is called a pixel (picture cell). and coordinated normal raster data would be used for GIS as they are generally.

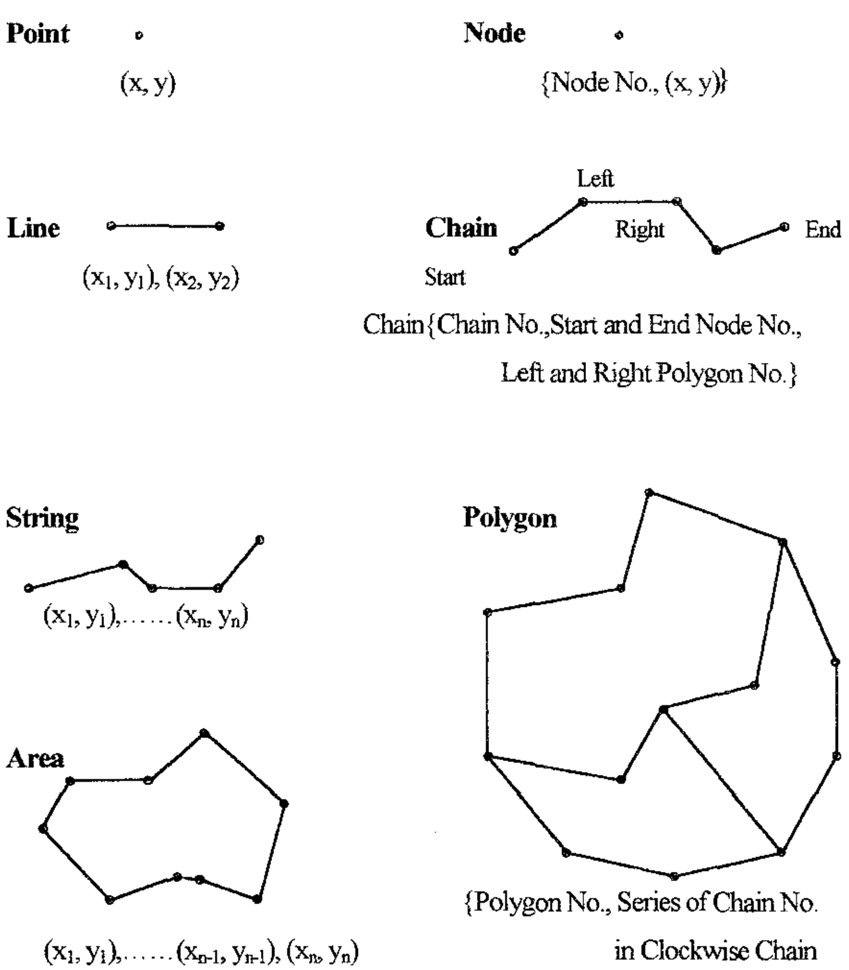
The raster data of new digital maps will be prepared easily from the films for revised printing plates as the occasion on demand using computers. The vector data and the DEM data produced in this Study will be used for succeeding GIS project in Azerbaijan.
However, the vector data of new digital maps are classified into point objects such as symbolic houses, line objects such as roads and areas object such as vegetation lands, which are represented geometrically by point, line and area respectively. For spatial analysis in GIS, only geometry with the position, shape and size in a coordinate system is not enough but the topology is also required. Topology refers to the relationships or connectivity between spatial objects.
The geometry of a point is given by two dimensional coordinates (x, y), while line, string and area are given by a series of point coordinates, as shown in Figure 8-1. The topology, however, defines additional structure as follows (see Figure 8-1 b).

Node: an intersect of more than two lines or strings, or start and end point of a string with node number

Chain: a line or a string with chain number, start and end node number, left and right neighbored polygons

Polygon: an area with polygon number, series of chains that form the area in clockwise order.

Figure 8.1 Geometry and Topology



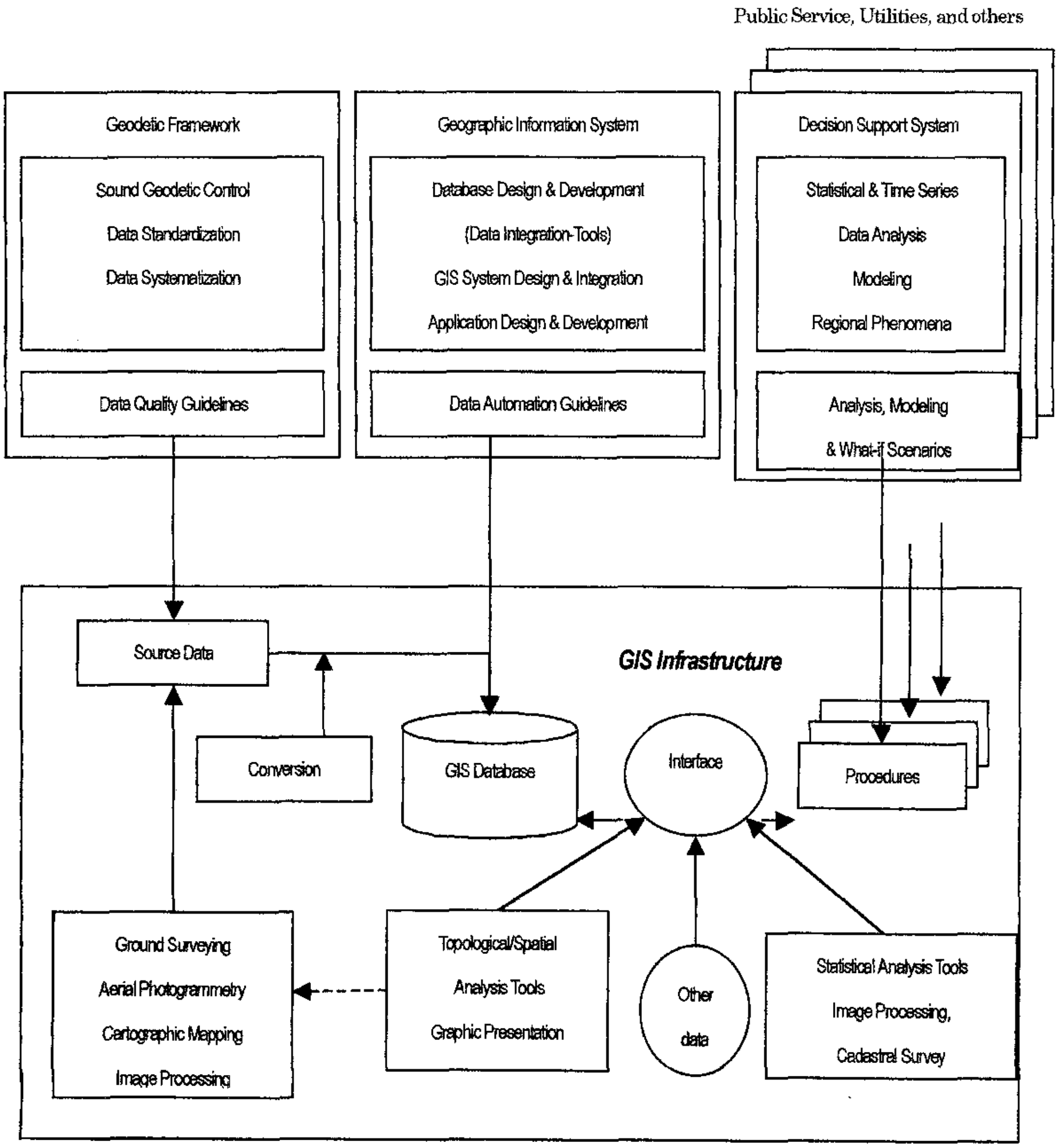
(a) Geometry (b) Topology

The vector data prepared in this Study is two-dimensional geometric data in DXF format. Therefore, it is necessary to convert these data for GIS usage to ArcInfo coverage, Arc/Info layer classification, by ArcInfo GIS software to generate the above mentioned topology.

8.2 Conception of Geographic Information System

GIS stands for Geographical Information System and it is a multi-disciplinary technology, which includes representation of the real world and computer & information technology. GIS represents the real world similar to the way maps represent on paper, and it is capable of utilizing computer information technology to conduct various analyses.

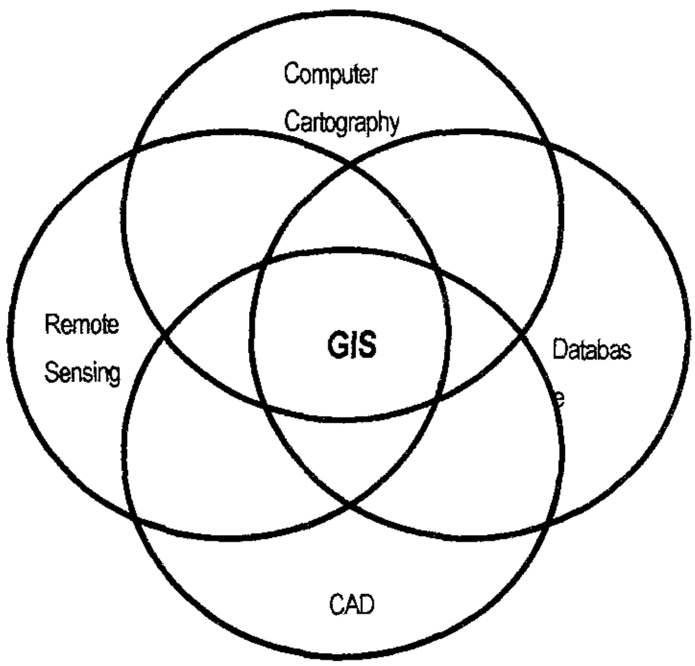
Figure 8.2 GIS as Multi-disciplinary Technology



Defining GIS is a difficult task, because it has multi-disciplinary nature comprising the components; such as, multi-disciplinary technologies, and multi-institutional professions. People with different experience in different profession might have different definition of GIS. An operational definition of GIS is that it is a tool for managing and analyzing spatial information using a computer system. It is a system which is designed to handle information regarding spatial locations. Two major functions of GIS in government organizations are planning/policy support and/or facility management. In database terminology, they may be called decision support system and data processing functions.

GIS has a function of integrating source data from different fields. Basic categories of data sources are computer cartography, remote sensing, computer-aided design, and database. The inter-linkages of source data, which is also considered as an independent sub-system, makes definitions and applications of GIS more complex.

Figure 8.3 Source Data and Overlaps



As shown in above diagram, the source data come from computer cartography, remote sensing, database, and CAD. What should be prepared for the future GIS will be the source data from the computer cartography category. In the first stage of development, existing maps may be digitized to be processed to prepare base maps. Field data and statistical data are used as attribute data, which can be linked to the spatial data.

Raw data are generally classified into raster and vector data. Common file formats of vector data are DLG, DXF, DXX and NTF. Raster data such as scanned photographs and maps may be stored in TIFF and GIF. The raw data are further processed. All the data needs to be transformed to a common coordinate system. The raw vector data are processed to have topological structures that identify nodes, chains, polygons and their relations. Image or raster data can be processed to classify land uses, identify features, and produce elevation models. The processed data are stored in database, usually in a logical data model of relational database. The processed data are ready to be searched and analyzed. Types of data retrieval are by location, classification, or attribute. Patterns or routes or interactions may be searched as well. Analysis of modeling and simulation of physical and social phenomena may be conducted with appropriate non-spatial data added to the system. Output is for communication and visualization. They are in forms of thematic maps or reports.

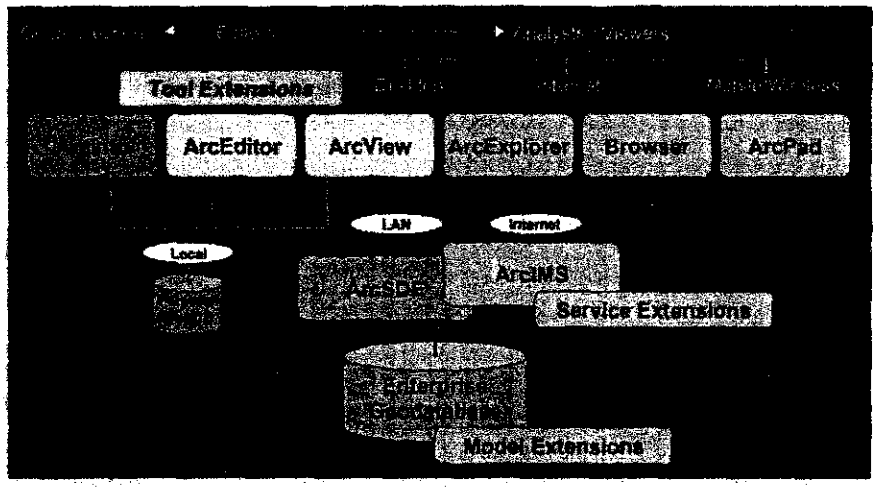
8.3 GIS Software

Major GIS software packages are as follows:
ArcGIS / Environmental Systems Research Institute, Inc.
GeoMedia / Intergraph Corporation
MapInfo / MapInfo Corporation
Autodesk Map, Autodesk GIS Design Server / Autodesk Inc.

In the Study, ArcGIS and Autodesk Map were selected. Details of these software packages are given below.

ArcGIS:
ArcGIS is a scalable system of software for geographic data creation, management, integration, analysis, and dissemination for every organization, from an individual to a globally distributed network of people. Users can deploy multiple ArcGIS clients (ArcView, ArcEditor, ArcInfo) seats and ArcGIS servers (ArcSDE and ArcIMS) to meet their needs for scalable GIS solutions. (See Figure 8.4)

Figure 8.4 Composition of ArcGIS

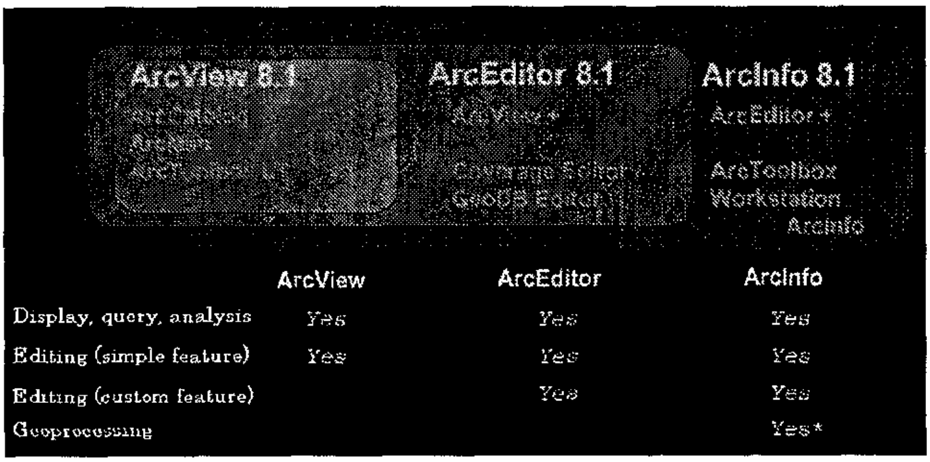


ArcView is the world's most popular desktop GIS and mapping software, with more than 500,000 copies in use worldwide. ArcView provides data visualization, query, analysis, and integration capabilities along with the ability to create and edit geographic data.

ArcEditor includes all the functionality of ArcView and adds the power to edit features in a multi-user geodatabase. Additional functionality includes support for multi-user editing, versioning, custom feature classes, feature-linked annotation, dimensioning, and rasters in a multi-user geodatabase. ArcEditor allows you to create and edit vector data formats including shapefiles, personal geodatabases, and multi-user geodatabases.

Within the ArcGIS software family, ArcInfo is the most comprehensive GIS available. It includes all the functionality of ArcView and ArcEditor and adds the advanced geoprocessing and data conversion capabilities that make ArcInfo the de facto standard for GIS. ArcInfo is the complete GIS data creation, update, query, mapping, and analysis system. (See Figure 8-5)

Figure 8-5 Comparison of the Function



	ArcView	ArcEditor	ArcInfo
Display, query, analysis	Yes	Yes	Yes
Editing (simple feature)	Yes	Yes	Yes
Editing (custom feature)		Yes	Yes
Geoprocessing			Yes*

ArcView, ArcEditor and ArcInfo consists of three desktop applications: ArcMap, ArcCatalog, and ArcToolbox. The differences among ArcView, ArcEditor and ArcInfo depend on limitation of each function.ArcMap provides data display, query, and analysis. ArcCatalog provides geographic and tabular data management, creation, and organization. ArcToolbox provides basic data conversion. Using these three applications together, you can perform any GIS task, simple to advanced, including mapping, data management, geographic analysis, data editing, and geoprocessing.

Autodesk Map:

Autodesk Map is the premier solution for creating, maintaining, analyzing, and producing mapping information in a CAD environment. Autodesk Map is used to digitize, maintain, analyze, and plot your own maps. Main functions of Autodesk Map are as follows:

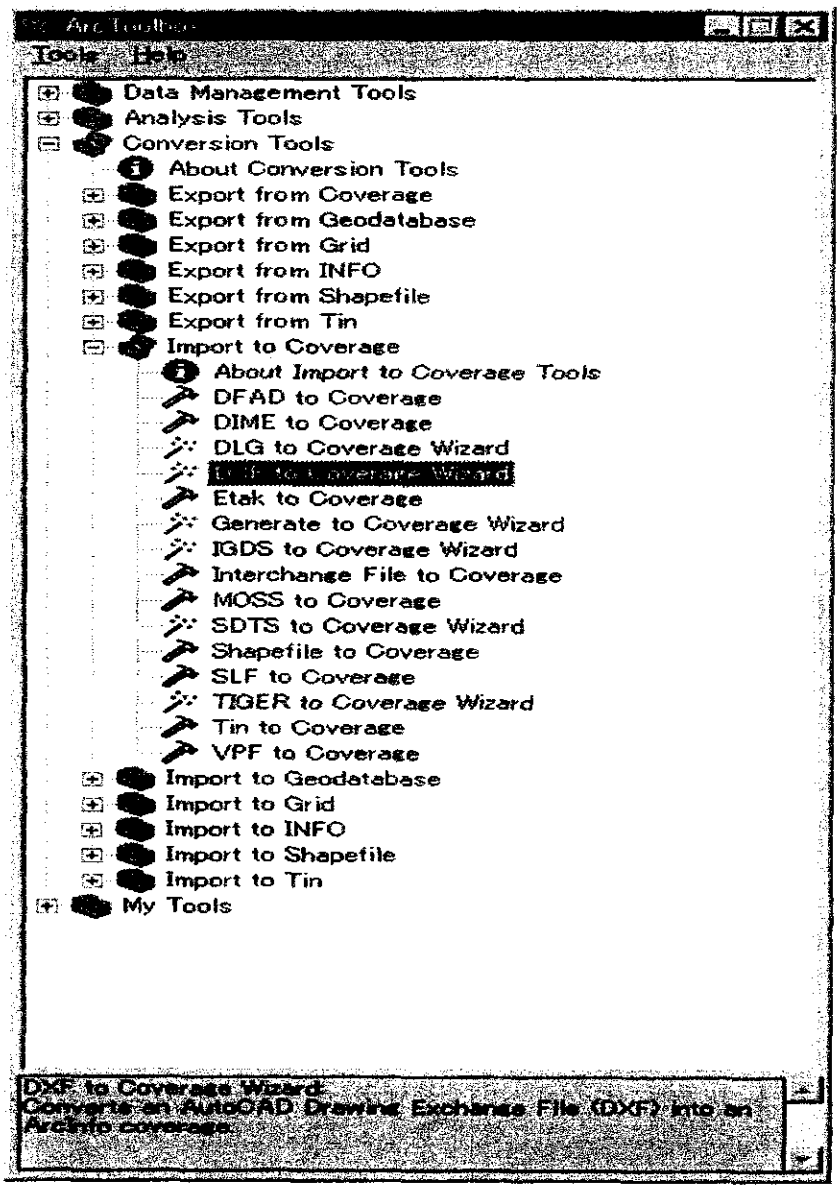
- Linking maps to associated databases
- Adding data to maps and making them more intelligent
- Cleaning up maps
- Building node, network, and polygon topologies for analysis
- Producing thematic maps with legends
- Working with existing map data in other coordinate systems and file formats
- Importing map data from other CAD and GIS systems
- Exporting data to other formats
- Plotting maps and map books easily and efficiently

8.4 Conversion to ArcInfo Coverage

The methods to create the Arc/Info coverage from imported DXF format data in Arc/Info software are as follows:

Step I:

Open **Arc Toolbox** module of **ArcInfo**. It can be done in two ways. One by left clicking of **start icon** and selecting **the program**, then **ArcGIS,** and then selecting **Arc Toolbox** and clicking it once. Another, if **Arc toolbox** icon is present on the desktop, it can be run **by clicking it twice**. This will display the window as shown below:

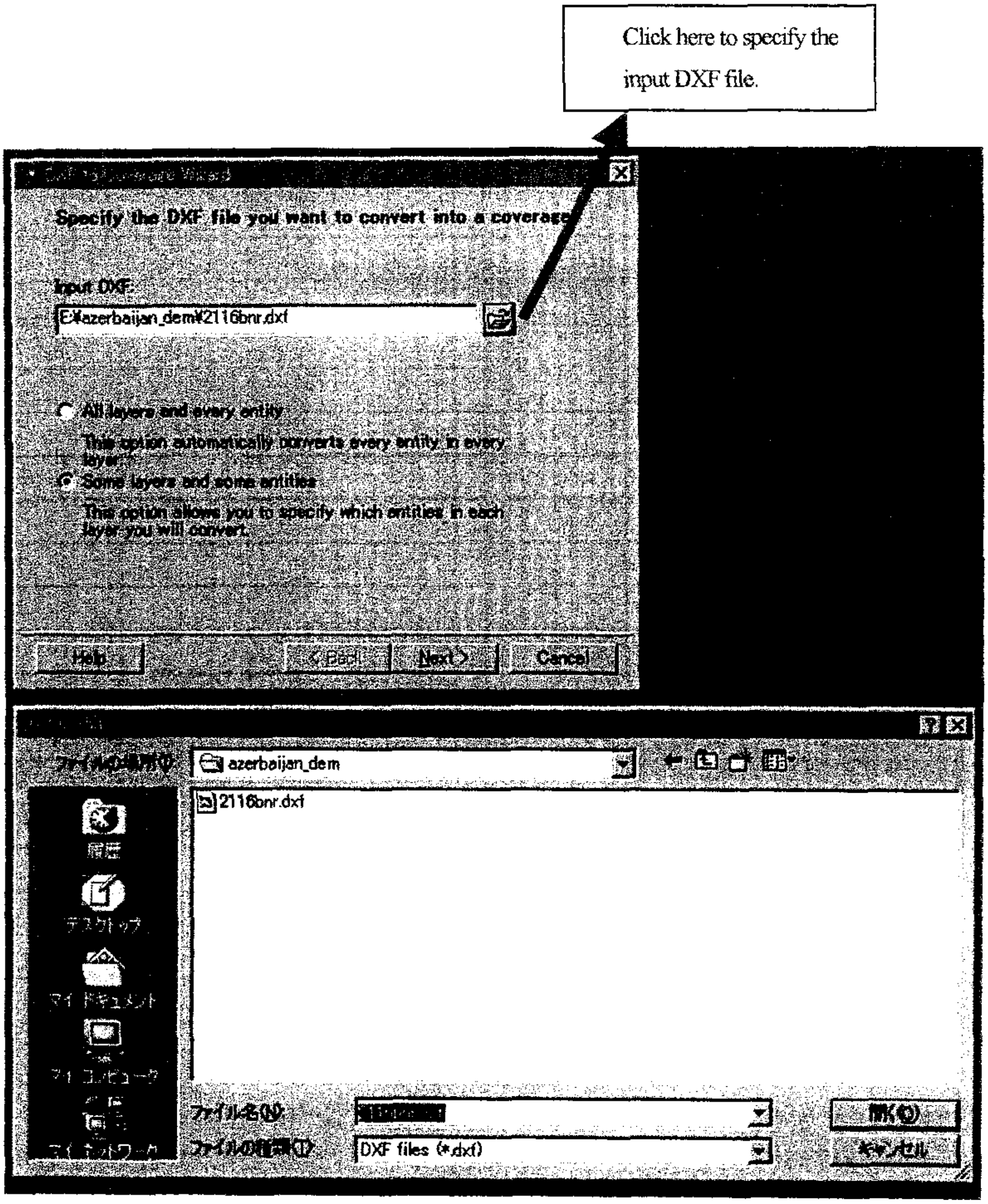


As marked in the above window, select "**the DXF to Coverage Wizard**".

Step 2:

The selection of **the DXF to Coverage Wizard**, will display the following window.

Then, specify the DXF file you want to convert into **a Coverage**.



If you do not need to convert all layers present in DXF file, check the option called "**Some layers and some entities**" from the above window. Then press "**Next**".