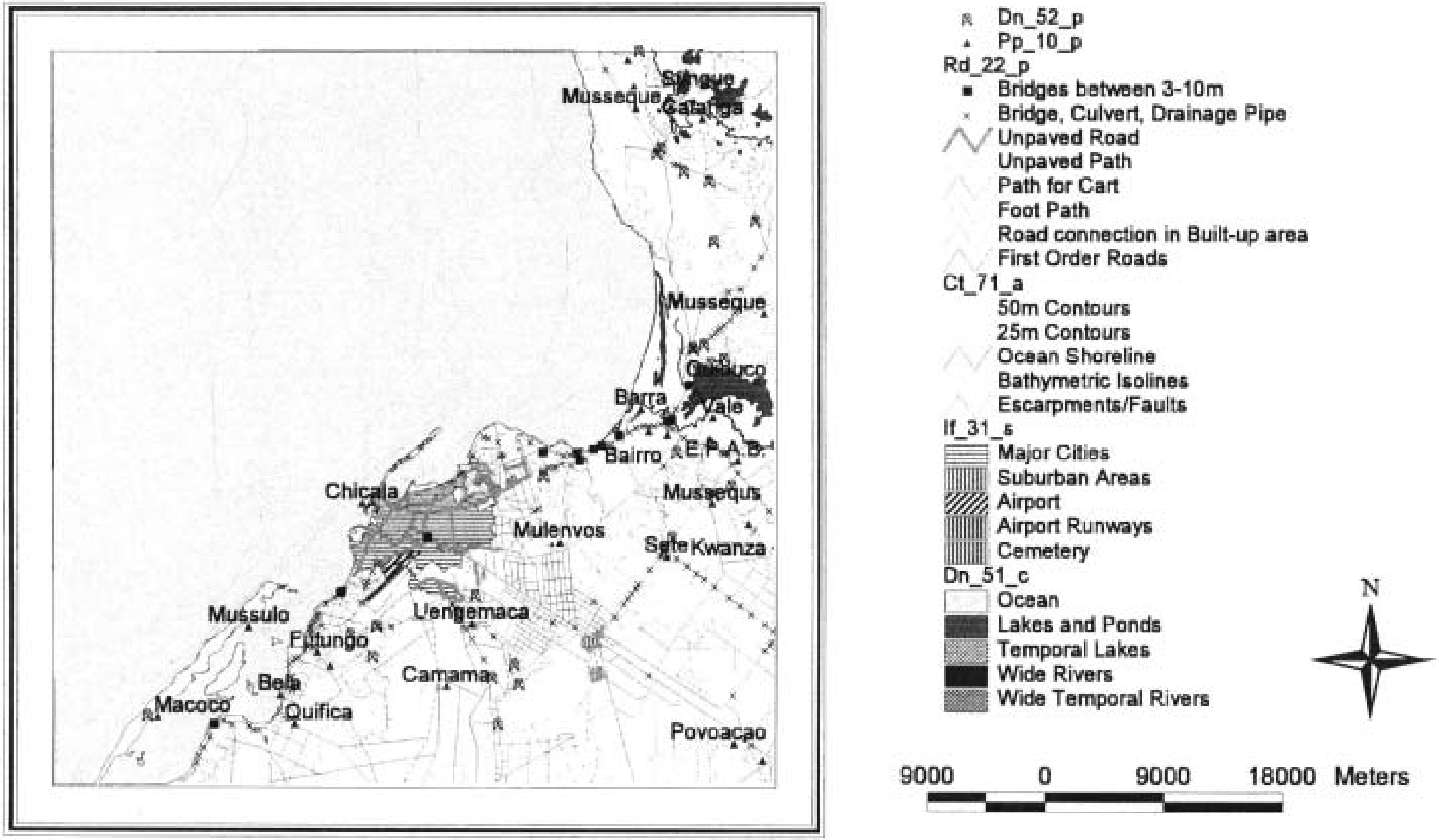
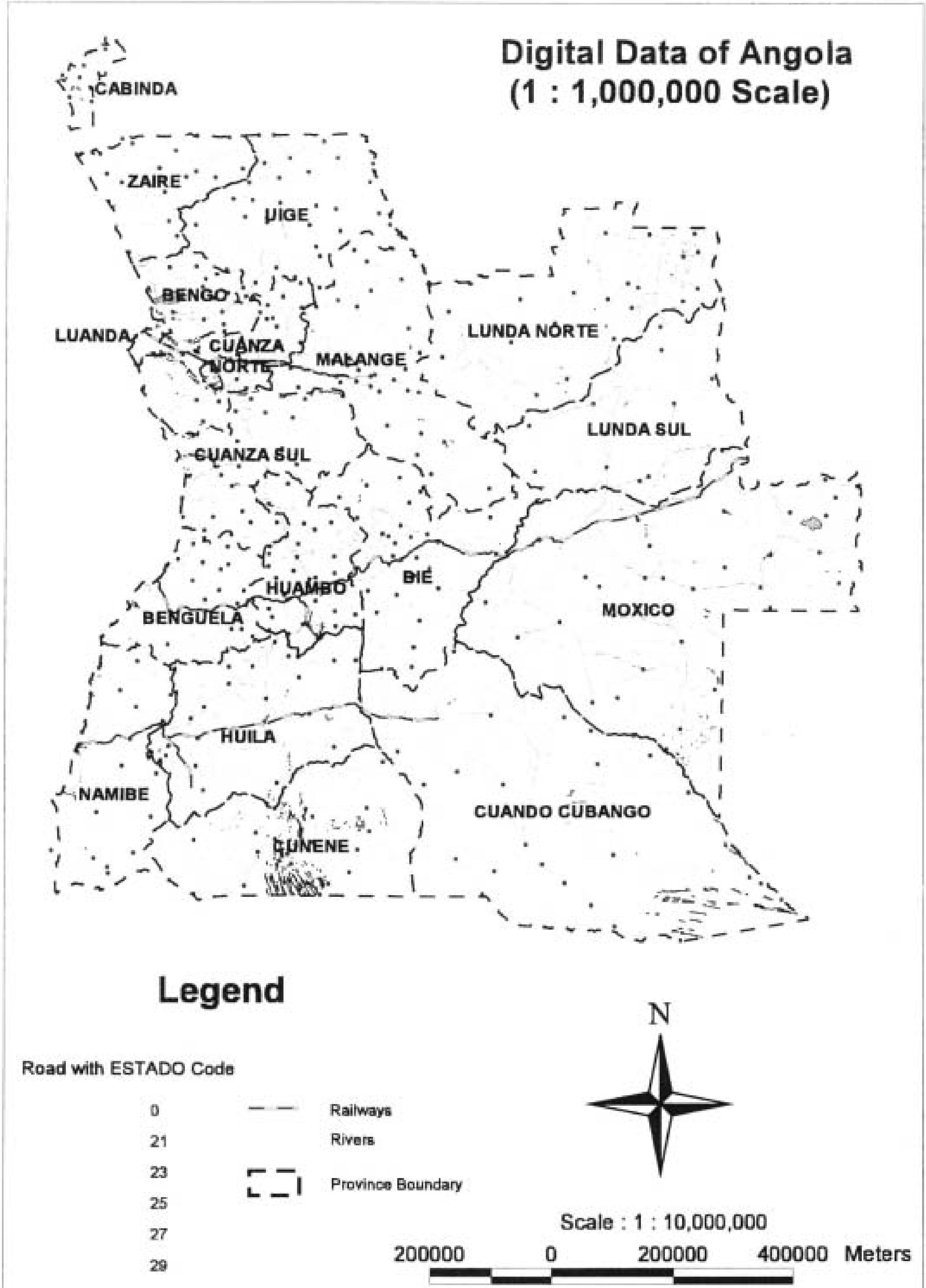
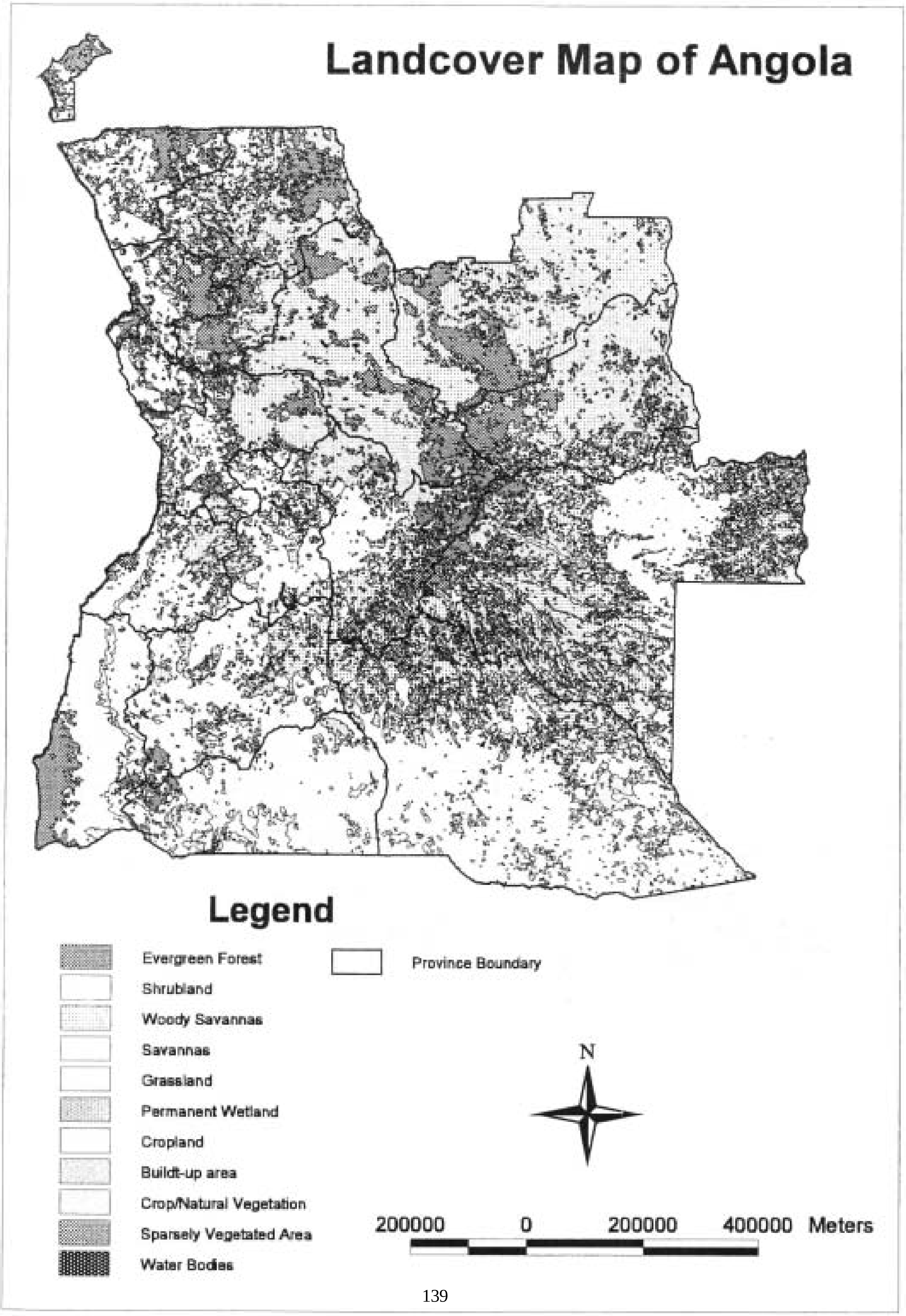
Sample Map Layout for Exercise

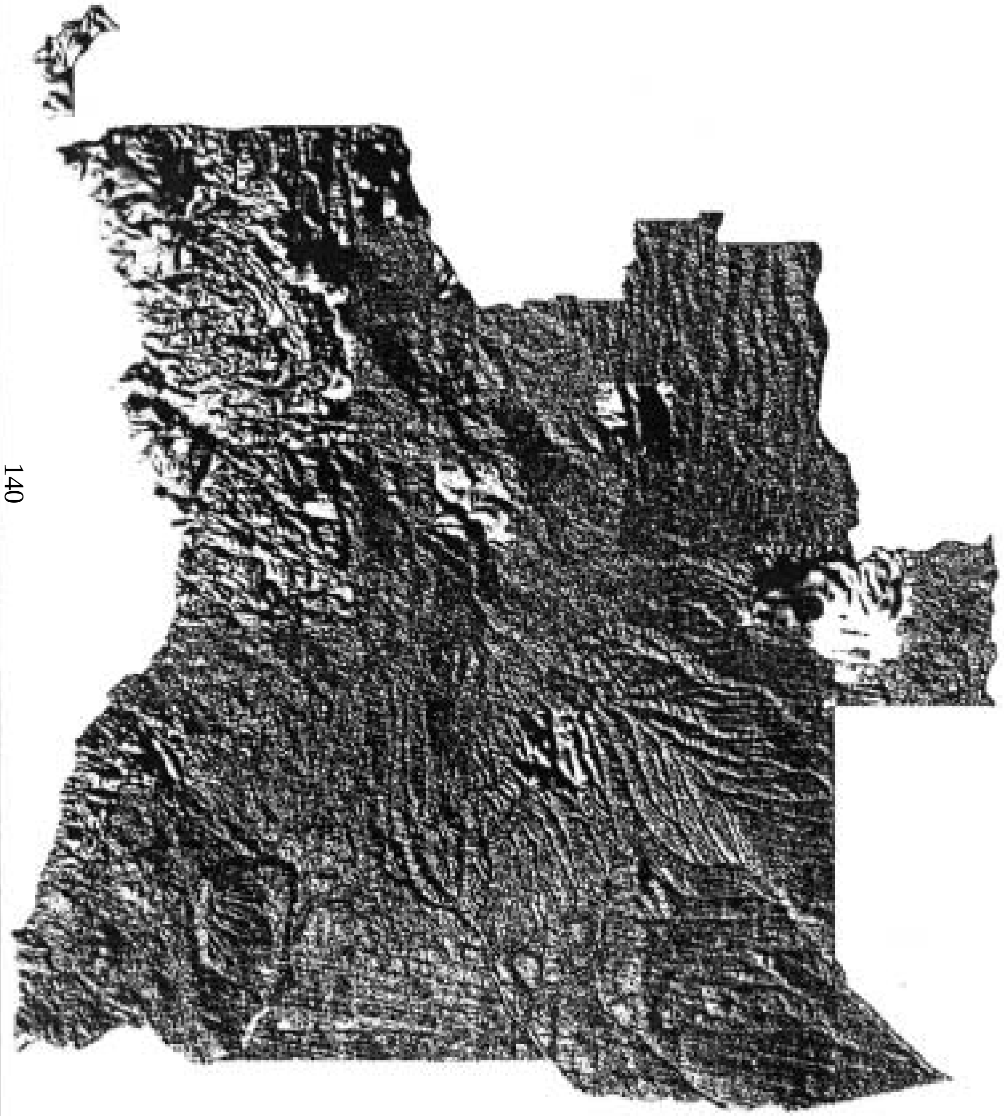



Digital Data of Angola
(1 : 1,000,000 Scale)
CABINDA
ZAIRE
UIGE
BENGO
LUANDA
CUANZA NORTE
MALANGE
LUNDA NORTE
LUNDA SUL
CUANZA SUL
HUAMBO
BIE
MOXICO
BENGUELA
HUILA
NAMIBE
CUNENE
CUANDO CUBANGO
Legend
Road with ESTADO Code
0
21
23
25
27
29
Railways
Rivers
Province Boundary
N
Scale : 1 : 10,000,000
200000 0 200000 400000 Meters


Landcover Map of Angola
Legend
Evergreen Forest
Shrubland
Woody Savannas
Savannas
Grassland
Permanent Wetland
Cropland
Buildt-up area
Crop/Natural Vegetation
Sparsely Vegetated Area
Water Bodies
Province Boundary
N
200000 0 200000 400000 Meters

Hillshade Relief created from DEM

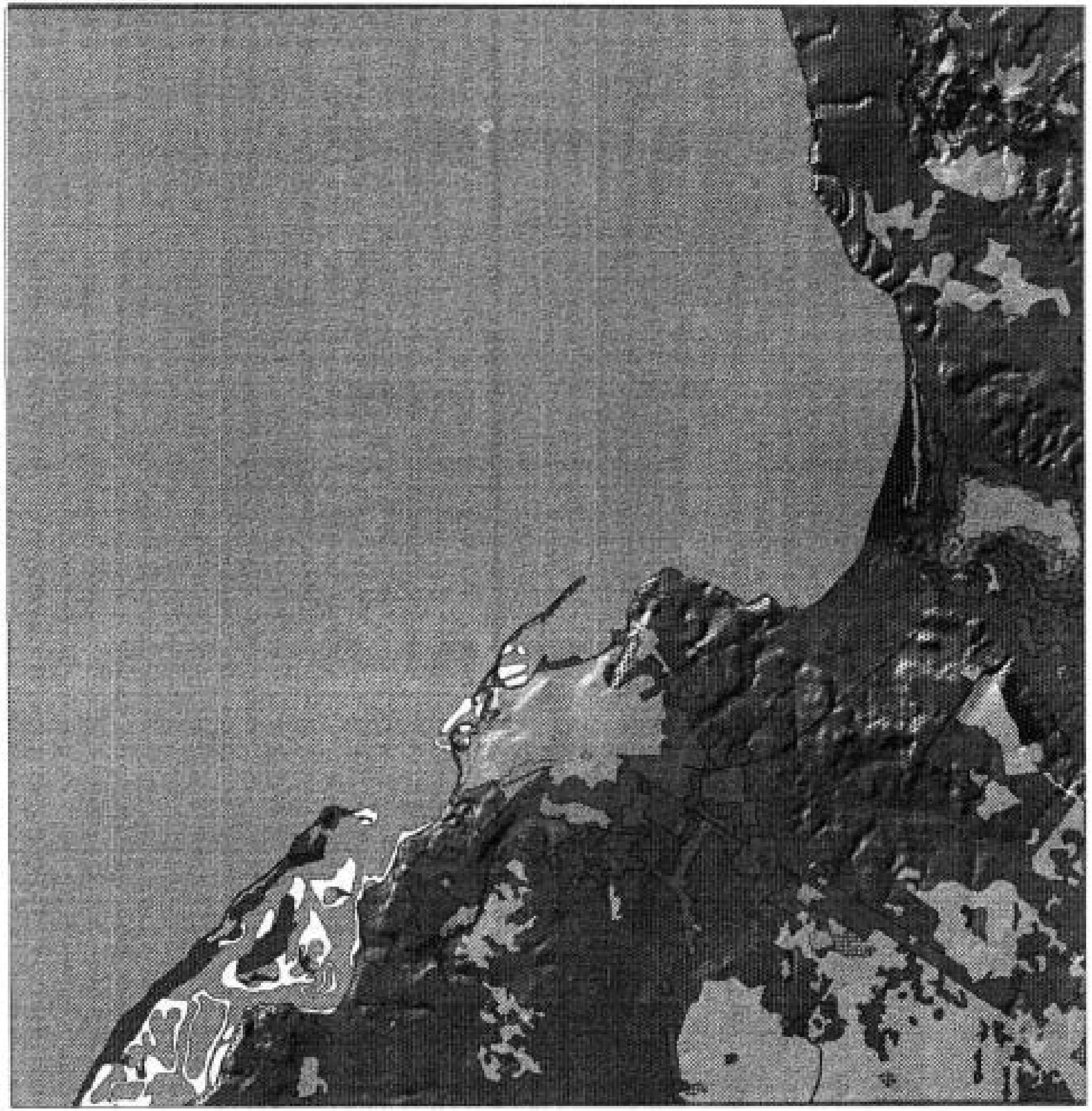
1 Km Resolution



Vegetation Layer draped on Shaded Relif

1 Km Resolution

Sheet No. 89



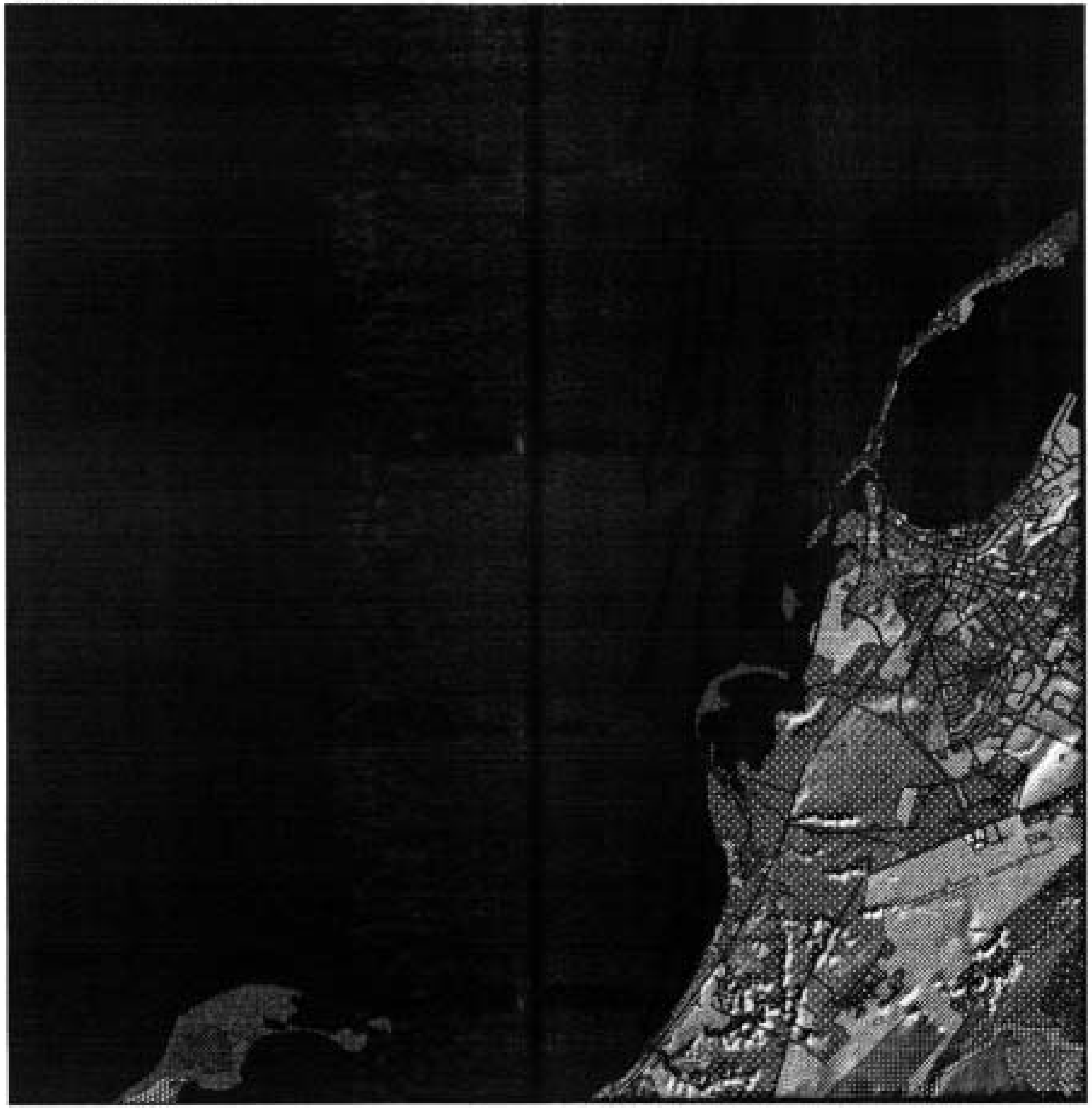
Relief Map

Scale 1 : 100,000

Created from 1 : 25,000 Scale Map Data

Relief Map

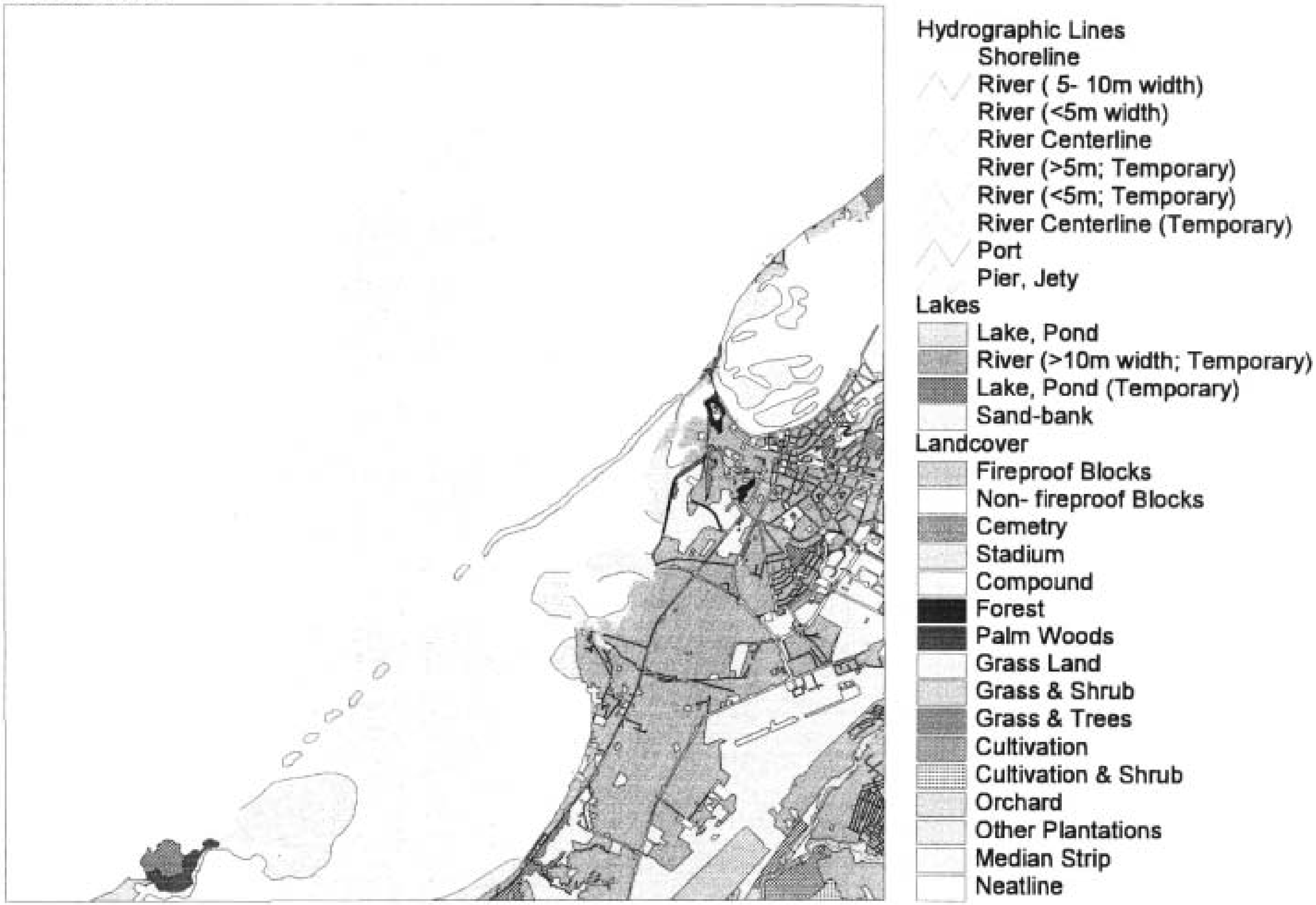
Sheet No. 89-c2



Landcover
- Fireproof Blocks
- Non- fireproof Blocks
- Cemetry
- Stadium
- Compound
- Forest
- Palm Woods
- Grass Land
- Grass & Shrub
- Grass & Trees
- Cultivation
- Cultivation & Shrub
- Orchard
- Other Plantations
- Median Strip

Land Cover - 1 : 25,000 Scale

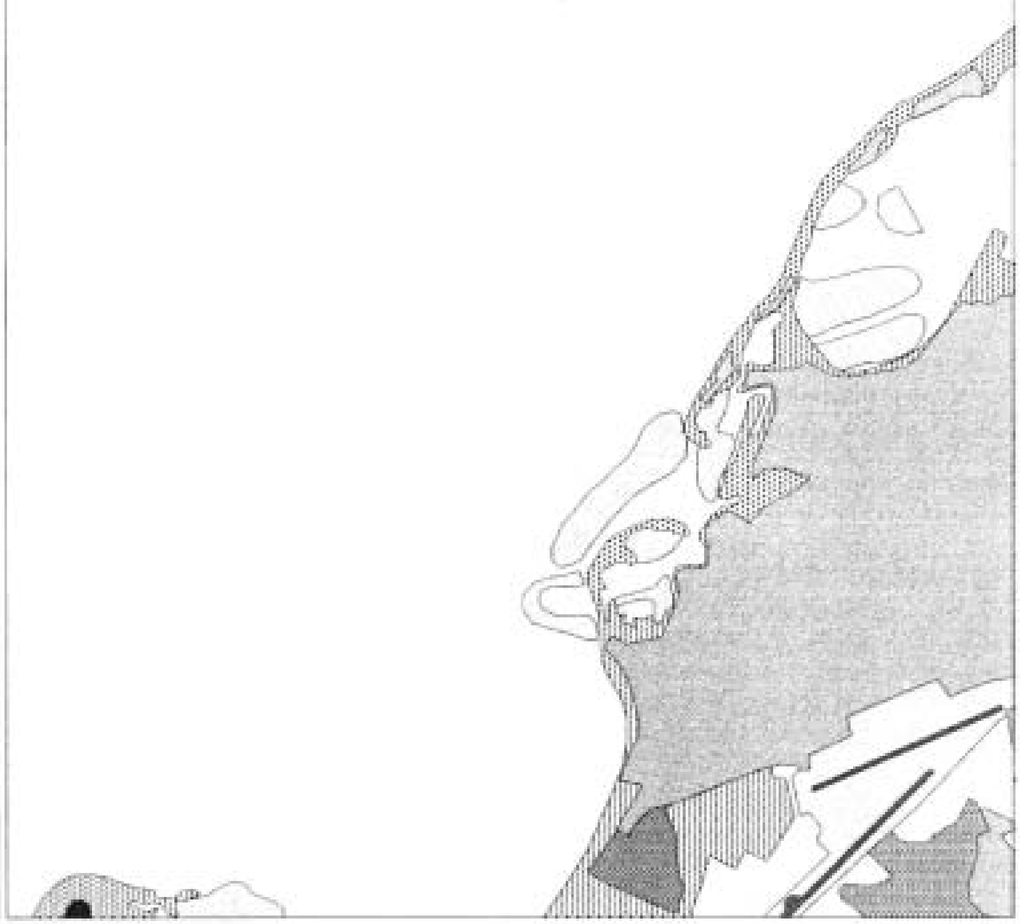
Sheet No. 89-c2



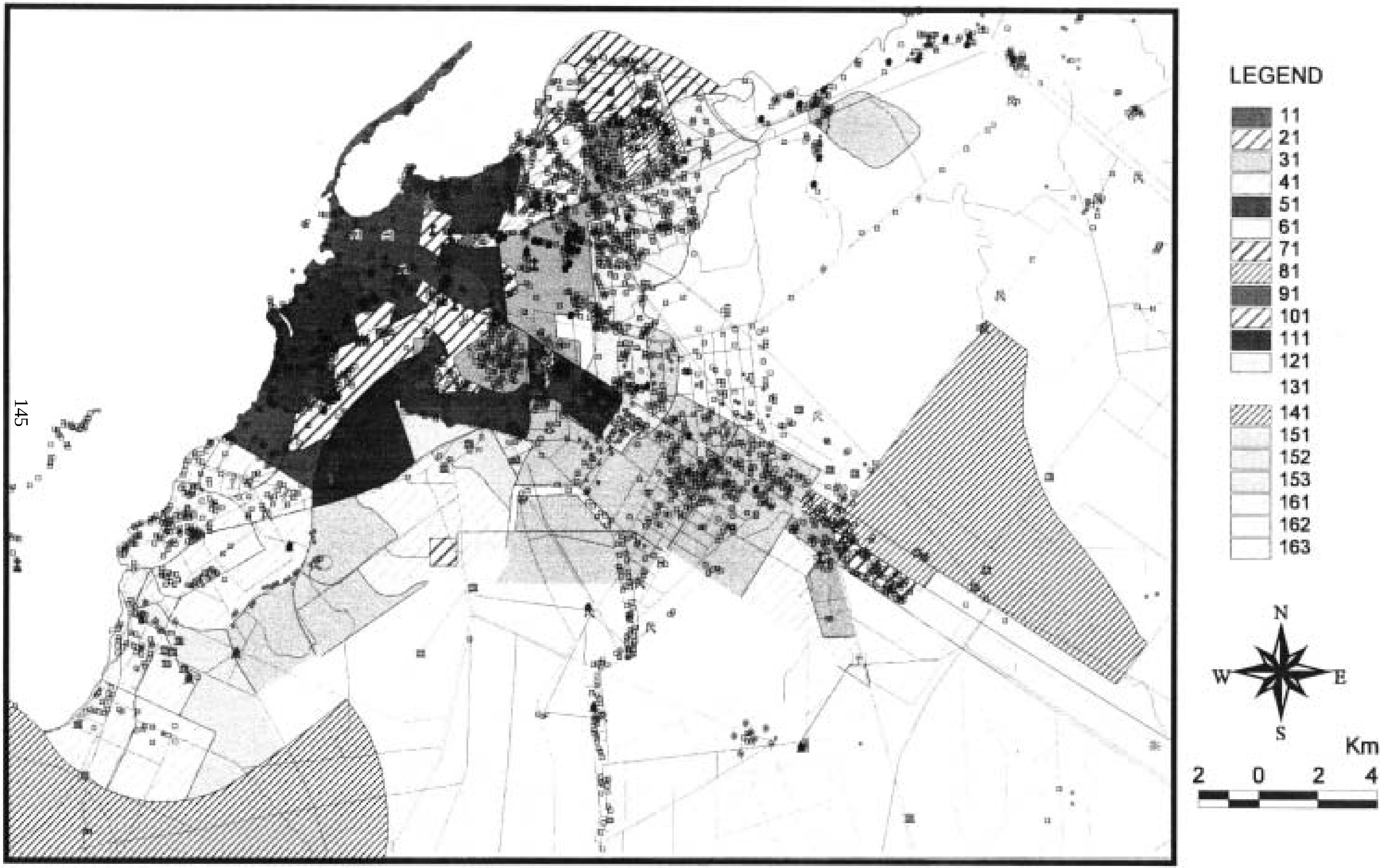
Land Use Changes
A Comparison of 1:25K and 1:100k Maps

Scale 1 : 25,000

Scale 1 : 100,000

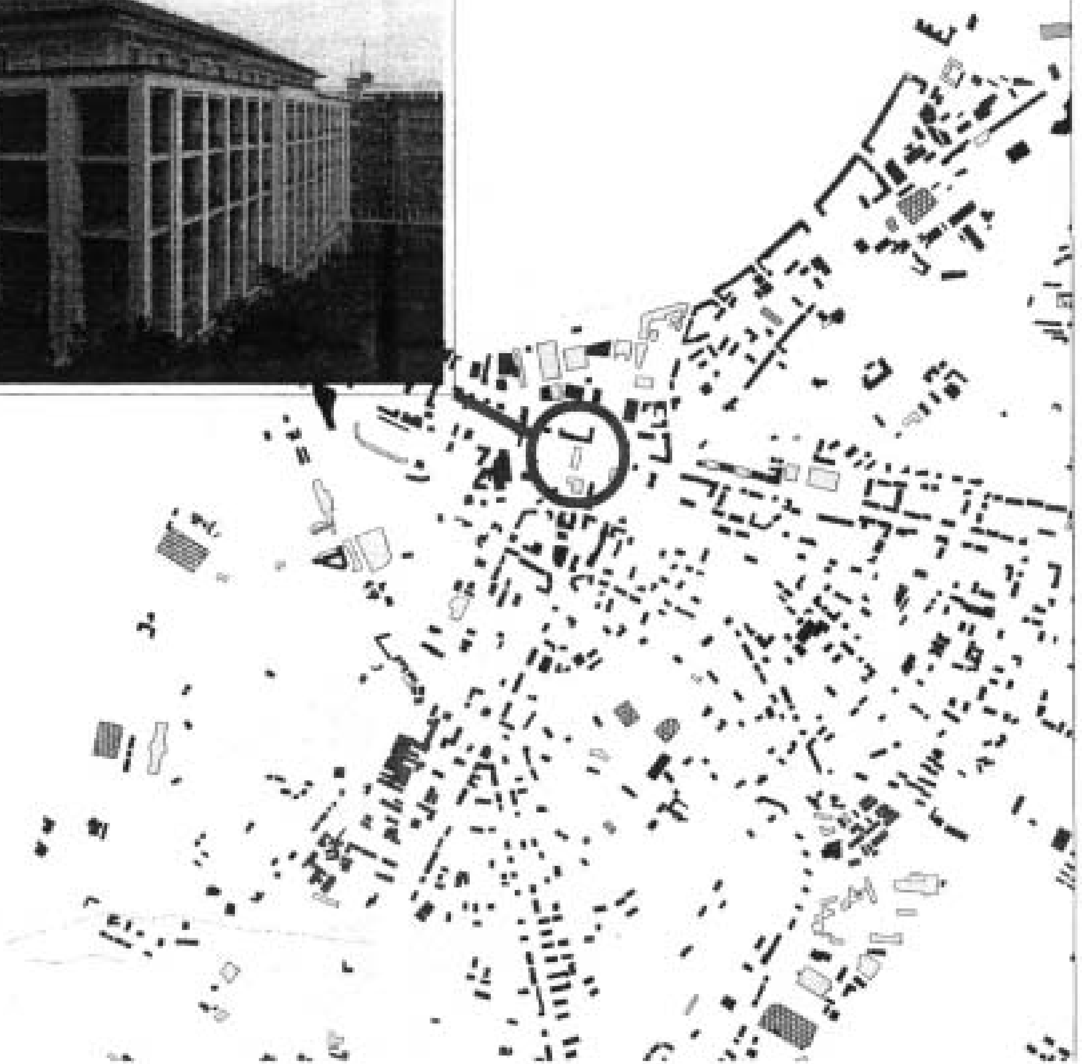


Land Use Plan and Urban Development



5A-9

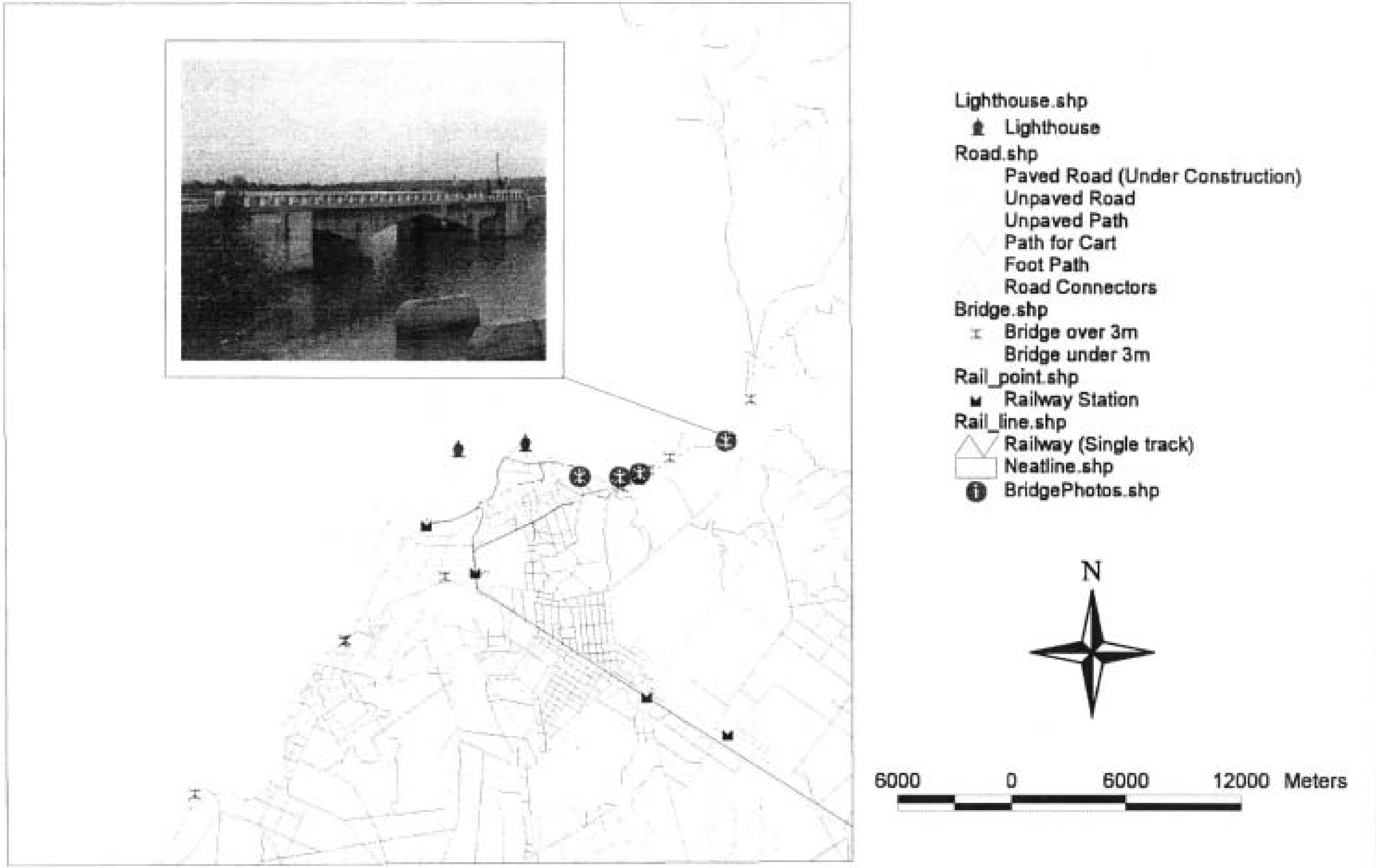
Public Building & Information Retrieval



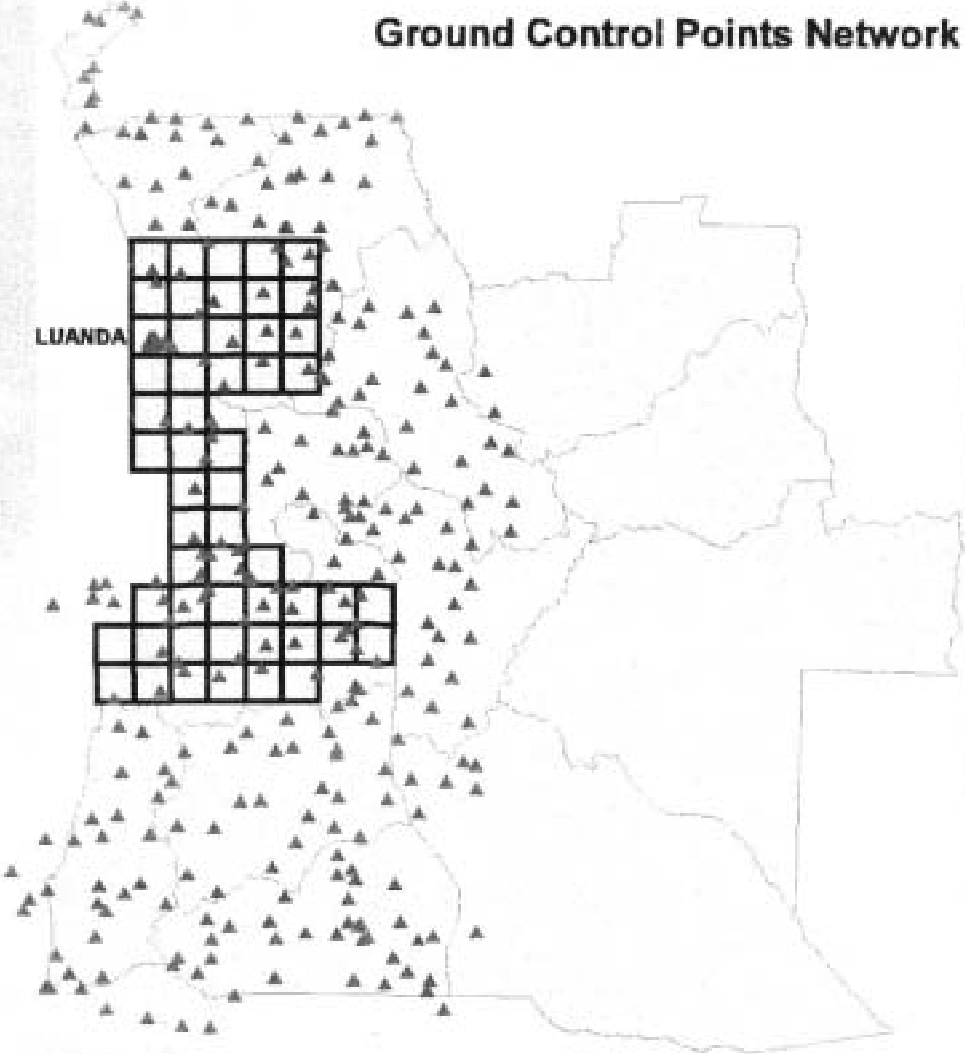
Layer	Number	Name	Stori	Type	Use
3012	01-5	Escola	1	T	Escola
3012	01-6	Pesc(Pescadaria)	1	T	
3012	01-1	Base Marinha	1	T	
3583	03-3	Hotel	5	T	
3586	04-7	Gare Maritima	1	T	
3586	04-8	Porto			
3584	03-2	Desp (Desportivo)			
3583	04-3	Meridian Hotel	25	T	
3012	04-2	Ministrio Comrcio	7	T	
2304	04-4	Estao de Luanda	2	T	
3012	03-1	Militar Museu	1	T	
3012	06-4	Maternidade	2	T	Clnica
3584					
3012					
3012	06-1	Banco Nacional	5	T	
3012					
3012					
3012	06-2	BPC	21	T	
3012	06-3	Ministrio da Indstria	11	T	
3012	05-4	Instituto de Geodsia e	3	T	
3012	05-1	Aduana	4	T	
3012	05-2	Correio	2	T	
3012					
3012					
3012	05-3	Sede Policial	2	T	
3012					
3012					
3012					
3012	05-5	Secretaria da Fazenda	6	T	
3583					
3012	06-5	Museu	2	T	
3012					
3012	06-6	Kinashishi Mercado	3	T	
3012	05-6	Ministrio de Obras Pbl	14	T	
3012	05-7	Palcio Presidencial	3	T	
3012	05-8	Igreja	1	T	Igreja

Sheet No. 89

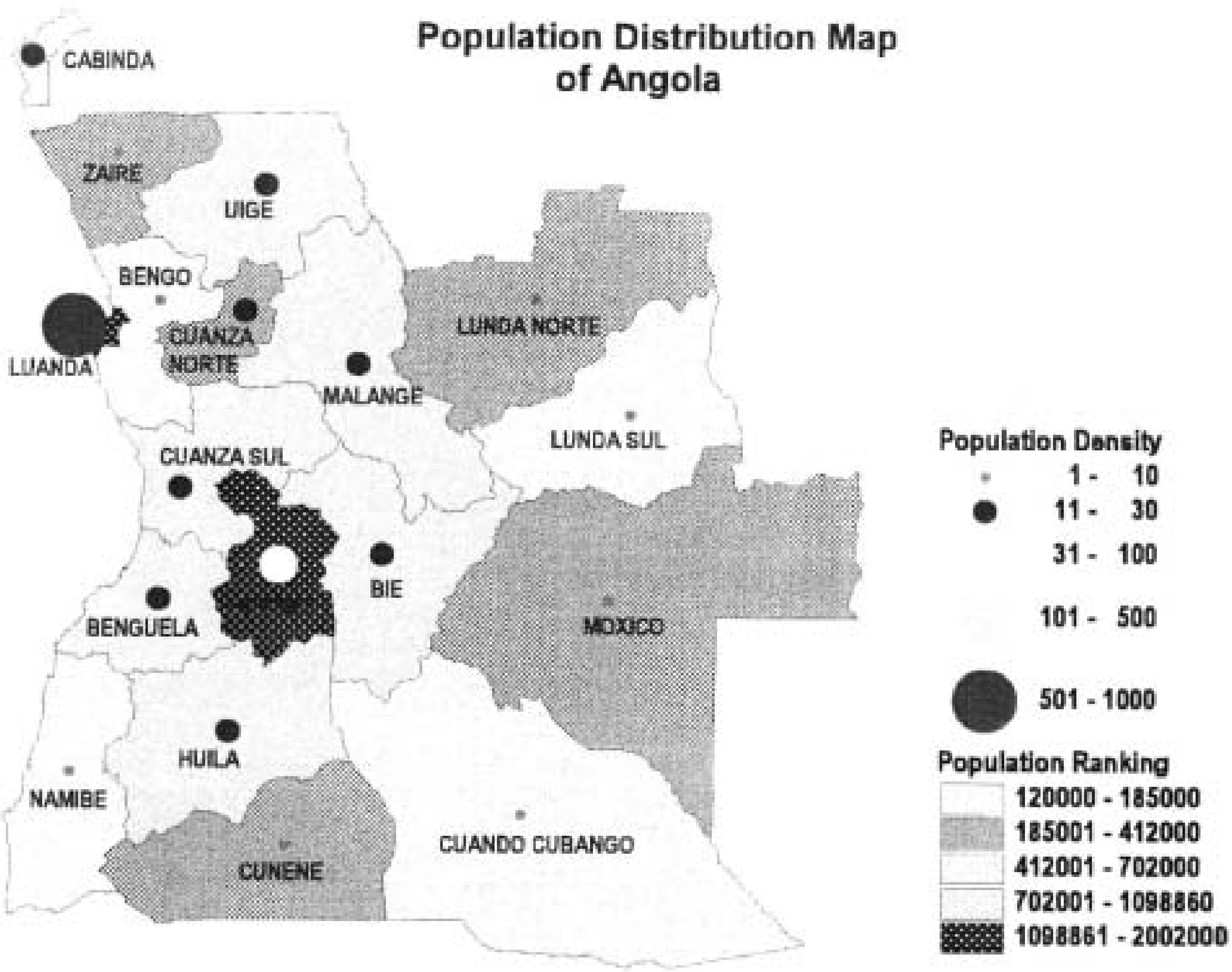
Retrieval Of Facility (Bridge) Management Documents

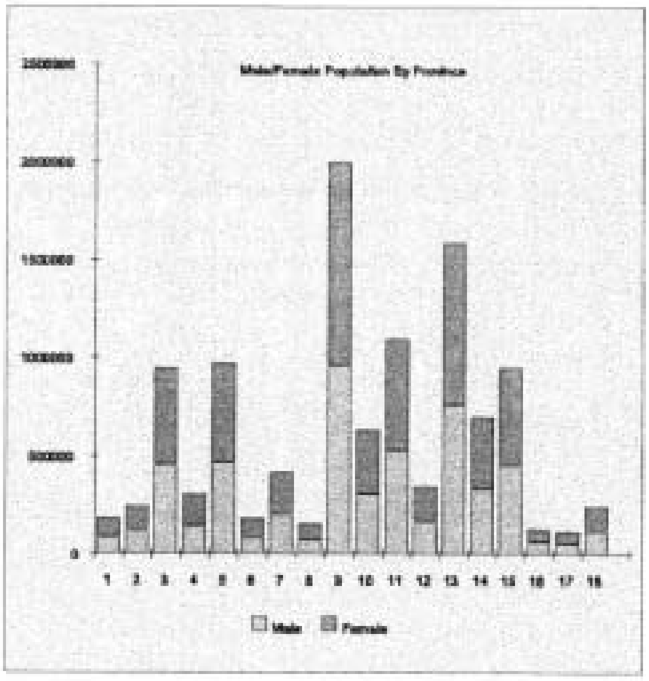


Ground Control Points Network

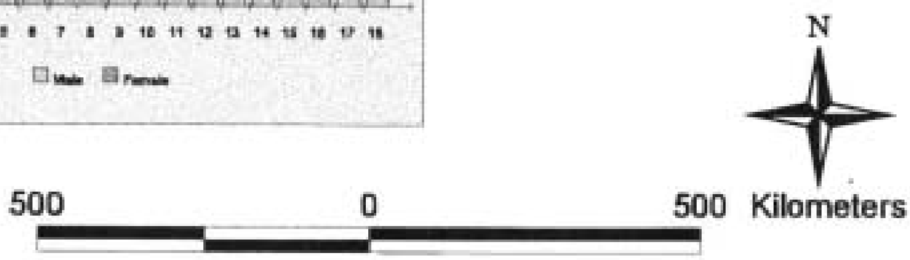


Foli	Vertice	X_utm	Y_utm	Zpot
1	ASTRONOMICO-FRANCES	269241.75	9507793.43	361.60
2	BATA INHUCA	218332.03	9491486.51	285.26
3	BATA SUNDA	234465.17	9485384.74	409.60
4	BENI	287894.60	9498149.50	525.50
5	BUILO SERRE	232449.53	9425682.22	351.93
6	BACA N'COCE(PILAR)	226335.49	9419931.72	48.34
7	BINGAMANGA	221566.39	9370555.13	190.95
8	ILOMBA(PILAR D.)	226241.09	9378284.25	132.58
9	ANDILA	230050.64	9348145.34	281.36
10	COCAMATENA	345226.19	9345660.23	393.79
11	BAMBI	392336.69	9338475.29	540.31
12	BUELA-PORTO	458319.68	9345758.96	545.37
13	BANZA SOSSO	524319.73	9340588.77	945.57
14	MANGANO	581664.35	9340698.04	967.23
15	CHINDA	622241.39	9351734.04	763.36
16	ICUATI	670299.23	9349562.90	745.26
17	BANANA	213878.50	9333568.24	8.04
18	QUIANGA	268716.15	9327383.48	168.43
19	M'PACALA	293835.44	9324367.33	269.03
20	NELUNDO	345263.05	9321464.63	435.68
21	ZALA	406712.56	9316036.56	582.31
22	MUNDIUNGO-2.GANDA	466695.45	9285585.97	1181.39
23	QUISOLANDA	565794.28	9318513.73	987.23
24	BIDI	557926.22	9330586.35	882.29
25	ICOCA	632739.38	9314956.43	660.30
28	GOMA	270834.75	9258015.99	371.45
29	BEMBELO	317335.47	9249781.69	440.03
30	CULUNGO	359825.03	9267885.76	578.26
31	LUNBA	397816.56	9226782.88	583.64
32	BANGANGA-MORRO	479411.12	9253419.14	624.61
33	BUMI	506307.66	9265868.36	1047.23
34	CANGA	567836.07	9263787.80	389.45
35	CANGOLE	622615.02	9254708.39	1089.17
40	BENGUA	315672.75	9194879.69	390.49
41	INAGE	364148.66	9195233.85	747.16
42	BEMBE-MORRO	426957.36	9222103.62	670.37





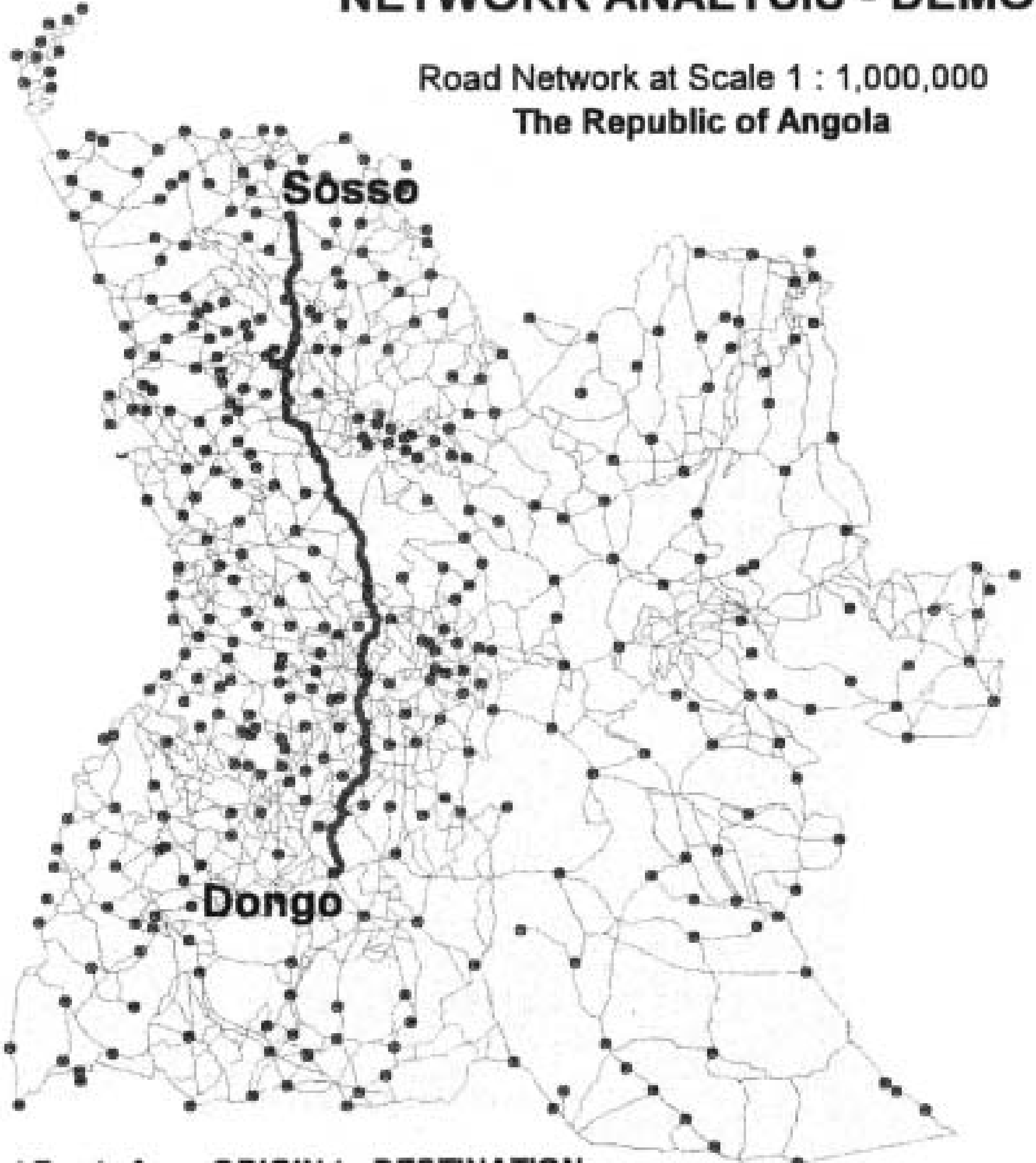
Code	Province	Km_area	Populati	Pop_den	Male	Female
1	CABINDA	7112	185000	26	88940	96060
2	ZAIRE	36005	247000	7	118720	128280
3	UIGE	62072	948000	15	455780	492220
4	LUNDA NORTE	104495	308140	3	148160	159980
5	MALANGE	82737	975000	12	468700	506300
6	BENGO	36630	184000	5	88460	95540
7	CUANZA NORTE	20215	412000	20	198070	213930
8	LUNDA SUL	79037	160000	2	76930	83070
9	LUANDA	2575	2002000	777	962510	1039490
10	CUANZA SUL	51977	634050	12	304850	329200
11	BIE	71269	1098860	15	528290	570570
12	MOXICO	201690	346540	2	166600	179940
13	HUAMBO	37442	1583590	42	761300	822290
14	BENGUELA	38684	702000	18	337500	364500
15	HUILA	78500	948000	12	455770	492230
16	CUANDO CUBANGO	202811	135770	1	65240	70530
17	NAMIBE	57290	121330	2	58340	62990
18	CUNENE	78312	245000	3	117780	127220



NETWORK ANALYSIS - DEMO

Road Network at Scale 1 : 1,000,000

The Republic of Angola



Travel directions
Starting from Sosso
Turn left onto STREET-25
Travel on STREET-25 for 622.34 m
Continue straight onto STREET-23
Travel on STREET-23 for 6959.49 m
Turn left onto STREET-29
Travel on STREET-29 for 51732.87 m
Turn left onto STREET-23
Travel on STREET-23 for 3965.83 m
Continue straight onto STREET-21
Travel on STREET-21 for 9192.30 m
Turn right onto STREET-23
Travel on STREET-23 for 6564.73 m
Turn left onto STREET-29
Travel on STREET-29 for 48639.53 m
Turn left onto STREET-23
Travel on STREET-23 for 38603.17 m

Code	Tname
130	Rito
130	Cueio
130	Kalenga
140	Cambondo,Cambora
130	Ucua
130	Muxerra
130	Quitepa
130	Cangolo
130	Cabo Ledo
130	Mussolo
140	Sombe Grande,Cuio
140	Chiume,Sacarimbo
130	Quiáico
140	Lunua Cassai,Luachimo
130	Mase
140	Longa,Beje

Shortest Route from ORIGIN to DESTINATION

Flood Dangered Road Sections

Laye	Roadlength	Flood Rd	Percent
2107	401.524	59.861	14.9
2107	139.925	30.746	22.0
2107	340.866	39.410	11.6
2106	383.236	24.121	6.3
2106	86.832	59.681	68.7
2106	110.591	5.655	5.1
2107	146.396	74.926	51.2
2107	131.491	54.445	41.4
2107	284.325	158.545	55.8
2107	56.806	3.840	6.8
2107	75.121	3.824	5.1
2107	43.555	43.555	100.0
2107	131.795	54.344	41.2
2108	1249.962	1.465	0.1
2108	1249.962	139.574	11.2
2106	1249.962	20.045	1.6
2108	1249.962	274.887	22.0
2108	1249.962	109.041	8.7
2108	639.561	21.050	3.3
2106	324.365	98.667	30.4
2108	337.241	0.395	0.1
2106	337.241	197.206	58.5
2106	133.637	53.600	40.3
2106	105.362	95.681	90.8
2106	41.033	41.033	100.0
2108	53.041	25.264	47.6
2108	58.866	31.056	52.7
2106	75.056	75.056	100.0
2108	65.176	37.995	58.3
2106	48.412	9.766	20.2
2106	64.003	29.312	45.8
2108	71.525	12.995	18.2
2106	107.592	82.790	76.7
2107	248.581	187.658	75.5

5.7. GIS Operation in Angola

What is important for Angola itself to maintain the GIS in the future is to get familiar with the basic operation of the GIS software as described in the preceding section and also to acquire the professional knowledge on the GIS. The GIS software enables an enormous volume of geographic information database to be jointly used with other ministries and agencies via a network and it is the software required for analysis of the database.

In the present situation within Angola, however, MINOPU can make available little attribute data to be fitted to the geographic and topographic information. It will still take some time to develop sufficient attribute data. Therefore, the GIS operators should first acquire the basic concept of the GIS using Arc/View software of a lower level than Arc/Info and then promote the GIS to other engineers and clerical staff in order to expand GIS supporter groups throughout the entire bureau.

Following these efforts, it is important for these engineers to acquire the basic operation of the Arc/Info software using the Arc/Info manual prepared in this study and to fully understand the objectives and technology of GIS application. For this purpose, it is necessary, of course, that the basic training for a period of at least two weeks should be furnished to GIS staffs at the time of installing the GIS equipment and software.

5.7.1. Preparation of Attribute Data and Map Data Revision

In development of the GIS, the attribute data that the concerned with the GIS within MINOPU should develop promptly is the following:

(1) Attributes for 1/1,000,000-scale maps

The 1/1,000,000-scale maps cover the entire national land, and the attribute data to be prepared is as shown in sample diagrams 5A-12 and 5A-13.

- Control point data from the survey of the entire country (digitized data of triangular points, bench marks and description of each point)
- Other surveyed data (digitized data of indices for existing topographic maps and aerial photos)
- Names of major cities and their population data in each province based on the latest statistics
- Classification of major highways in the entire country

(2) Attributes for 1/100,000-scale topographic maps

- Names of major housing areas and their population data, based on the latest statistics
- Classification of highways based on the latest data
- Digitization of bridge data (See sample diagram 5A-11.)
- Records of natural disasters (Digitized data of types of disaster and coverage of disaster)
- Survey records of control points and other points (Indices for existing topographic maps and aerial photos)

(3) Attributes for 1/25,000-scale topographic maps

- Digitized data of public buildings and collection of digital building images (See sample diagram 5A-10.)
- Digitized data of city disaster records (including floods and landslides)
- Traffic-regulated highway data
- Latest city planning data

It is expected that MINOPU can easily make the maintenance of the public buildings and facilities if these types of data are developed and fitted as the attributes for digital topographic maps, for example by the method shown in the sample diagram 5A-10. In addition, the attribute data may serve for analysis of the shortest section between two points on limited types of road as shown in the sample diagram 5A-14, or for analysis in disaster forecast by overlaying the urban flood data on the distance from any feature as shown in the sample diagram 5A-15 as well as on the relief map data as shown in the sample diagram 5A-6. The development of attribute data is very important because it ensures the future GIS applications to be established by examining these application methods.

However, the topographic map database that has been developed so far was not based on the detailed fieldwork, and insufficient data such as topographic features, geographic names and other names is used. To improve the quality of the data, the database updating system and procedures should be established as a routine work.

The common use of the database with other ministries and agencies concerned will be important not only for cost reduction in data entry but also for the maximum utilization of the database.

5.7.2. Holding the Database Jointly with Related Ministries

The local activity for this project was delayed due to the restrictions of the fieldwork in this fiscal year. In these years in Angola, however, the GIS database development has actively been implemented for the survey and removal of mines by INAROEE (Institute Nacional de Remocao de Obstacolas e Engenhos Exlposivos) and for the survey of acreage of mining districts by Ministry of Geological Survey and Mining. The Statistics Bureau is also using the GIS limited to local areas. In addition, Ministry of Fishery is also planning the early introduction of the GIS.

In particular, INAROEE has acquired the rough raster data covering all the areas of the existing 1/100,000-scale topographic maps and it is now developing the method of making effective use of the GIS.

On the other hand, the engineers of UNDPA (United Nations Demining Program in Angola) that are supervising the GIS of INAROEE are holding the GIS database covering the entire country of Angola. It is desirable that MINOPU will coordinate with these organizations for the joint use of the GIS via a network, economize the work of data acquisition and promote the positive intercourse among their engineers.

5.7.3. MINOPU's Role on GIS Operation

For the completion of the GIS project by MINOPU, a long period of 10 years will be required. The Minster and the responsible Directors who will form the top management of the GIS Center should not be satisfied only with introduction of the most advanced digital GIS technology, but also they should clearly define the purpose and objectives of the GIS in order to budget the continuous education and training project for GIS personnel, and the software version upgrading and data updating. If not, the continuity of the GIS project could not be maintained.

For this purpose, it is preferable that MINOPU will closely cooperate with the department of IGCA that has the control of the geographic data, in order to promote this GIS project as one of the nationally operated projects.

If the change of top management due to reorganization of MINOPU or exchange of the GIS personnel in charge should decline the situation of GIS support, it would be the worst case for the future operation of the GIS. In any organizational change in MINOPU, the staff in charge of GIS should be reeducated for continuous GIS efforts.

If any political or domestic system problem related to the common use of GIS data with other ministries and agencies occurs, such problem should also be solved positively by MINOOU.

For the future full-scale operation of the GIS in MINOPU, the following posts and services will be required:

(1) GIS Project Manager

- Planning of the GIS application programs

- Planning of production of GIS products
- Selection of hardware and software
- Consultation to user
- Communications and coordination with users
- Personnel management
- Reporting to top management

(2) Database Manager

- GIS database designing
- Database maintenance and updating
- Planning of data output and map output
- GIS data set creation
- Data quality control
- Data acquisition planning

(3) Digital Map Engineer

- Updating of digital topographic map data
- Entry of attribute data
- Digital map output

(4) System Operator

- Operation of hardware, software and peripheral equipment
- Consumables management
- File backup
- Software libraries and manuals management

(5) Programmer

- Creation of data conversion and format conversion programs
- Development of customized commands and menus

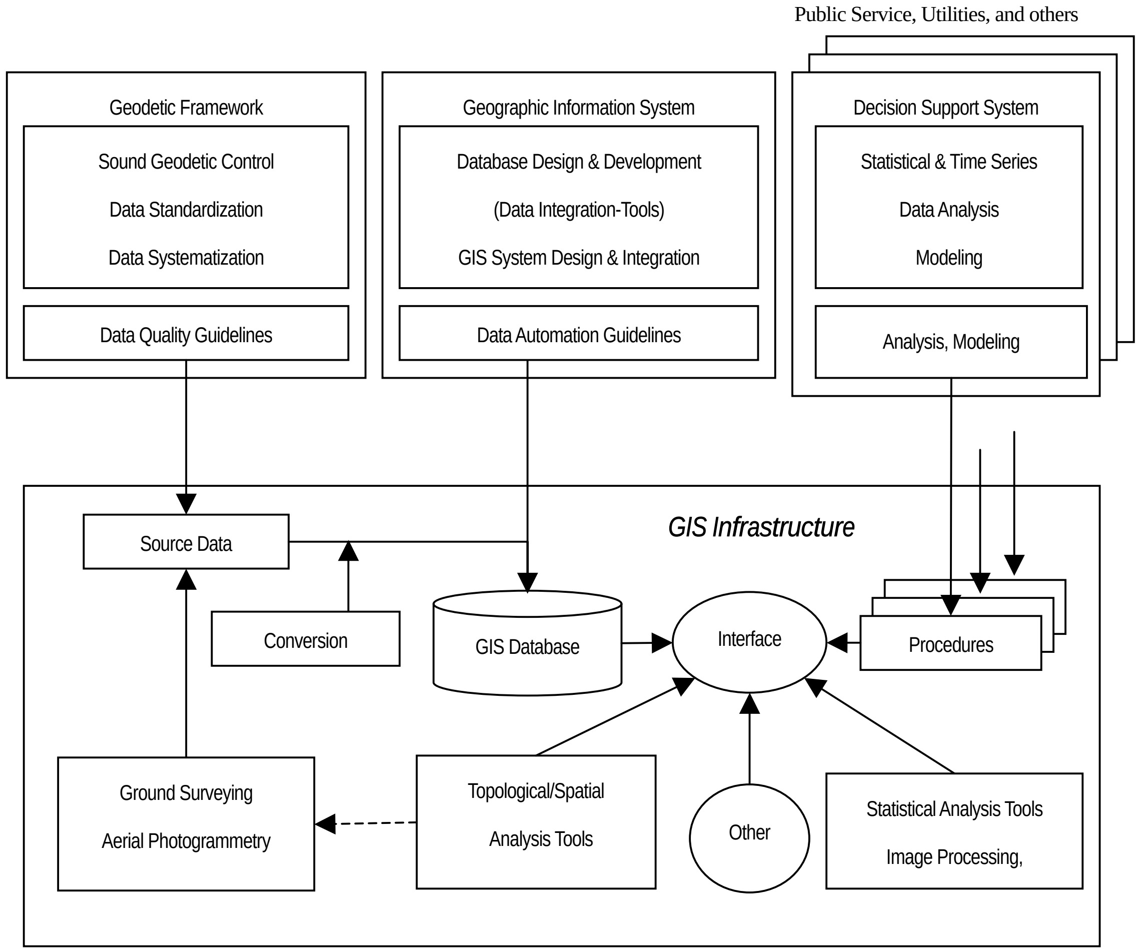
As described above, the continuous operation of the GIS project requires a huge amount of costs and the active efforts of the engineers in charge. It is desired that this project will become the full-scale GIS project of Angola established as a nationally operated project of Angola.

6. Conception of Geographic Information System (GIS)

6.1 Introduction

GIS 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.

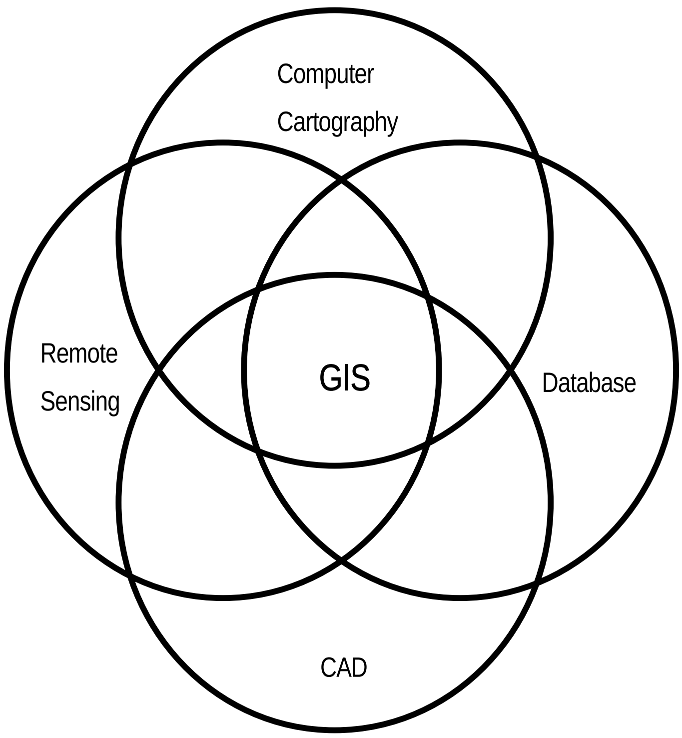
Figure 6.1.1 GIS as Multi-disciplinary Technology



Defining GIS is a difficult task, because it has multi-disciplinary nature of the comprising components; such as, multi-disciplinary technologies, 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 6.1.2 Source Data and Overlaps



As shown in above diagram, the source data come from computer cartography, remote sensing, database, and CAD. What was prepared for the Study is mainly the source data from the computer cartography category. In the first stage of development, existing maps may be digitized for remotely sensed data is 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, 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, links, 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. To analyze 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.

6.2 Application Development

Application development depends on details of data available in the system. Generally, small-scale-spatial data are appropriate for regional or environmental applications; large-scale-spatial data can be used facility management or cadastral mapping. Crain and MacDonald (1984)[1] identified three stages of GIS development. The first stage is an inventory preparation; the second stage is application development for analysis; and the third stage is management uses of GIS. Current stage of the GIS development in Angola is considered to be the first stage of development. In other words, spatial data and information in analogue format are transformed into digital format, and types of land uses or forest inventory are prepared for organized and easy retrieval of data and information. The query is basically simple, but efficiency and productivity of search is enhanced. Updating inventory data needs to be planned and enforced to keep accuracy of spatial data and information. The second stage of GIS development is more analysis oriented. The accumulated data and information in organized layers are combined and process to identify features that were not identified in a simple query in the first stage. The third stage is to develop management functions of GIS. In this process, a GIS becomes from data processing work to a more advanced decision support system. Highly complex data modeling or simulation may be conducted to help make decision on planning and policies.

In the process of GIS development, it is reminded that primary data acquisition and accuracy of the primary data are the foundation of the system. The cost and benefit of data itself and the system shall be carefully planned with maintenance costs of such system is taken into consideration.

6.2.1 GIS Software

Different venders developed GIS software. ARC/INFO, Geo/SQL, and Modular GIS Environment (Intergraph) are three popular GIS software in the world. MapInfo and Atlas GIS are popular desktop mapping systems. In the Study Arc/Info and ArcView are used to prepare the data; some of the features of the software are introduced in this section.

[1] Crain I K, MacDonald CL (1984) From land inventory to land management. Cartographica 21: 40-6.

Table 6.2.1 Popular GIS Software

Name	Type	No. Introduced	Price (US$)
Modular GIS Environment (Intergraph)	GIS	2,500	700
Geo/SQL	GIS	2,000	9,500
ARC/INFO (ESRI)	GIS	1,200	18,000
MapInfo	Desk top mapping	25,000	995
Atlas GIS	Desk top mapping	22,500	2,495

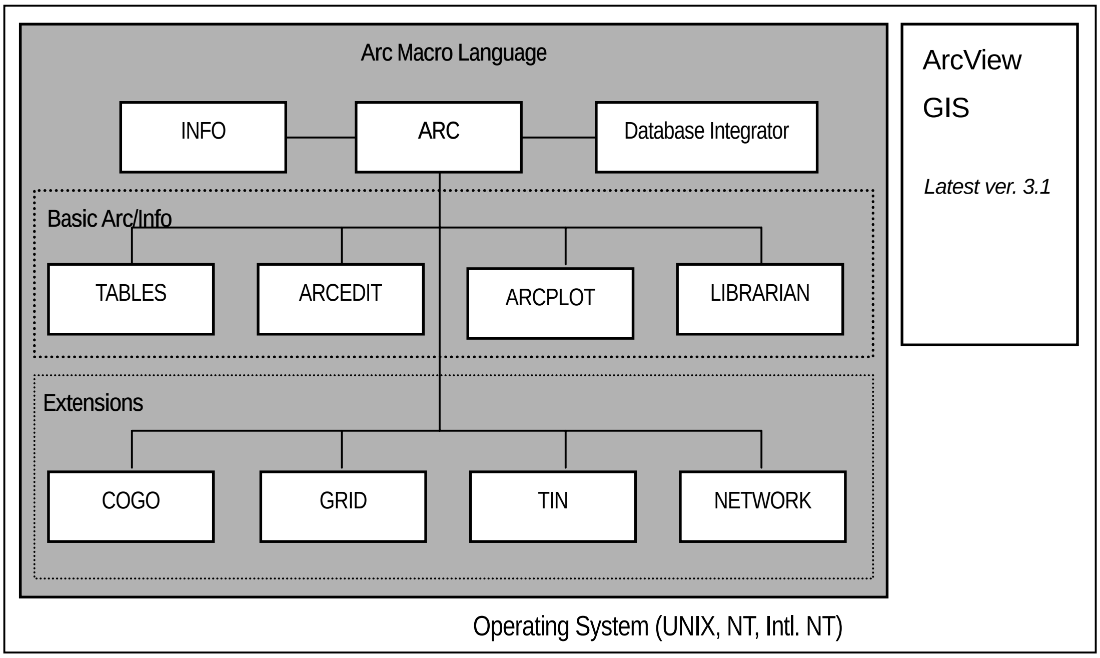
(The World of GeoInfomatics, p.137 1995, Japan)

6.2.2 ARC/INFO and ArcView

Software Structure:

The basic structure of ARC/INFO and ArcView is as in the following Figure.

Figure 6.2.1 Software Structure of ARC/INFO and ArcView



Also available : PC-ARC and ArcView for MS DOS & Windows

Basic Software (Latest version : 7.2)

ARC : GIS Manager (All modules are managed by ARC)

INFO : Relational Database Management System

TABLES : INFO table operations

ARCEDIT : Graphic Editing Module

ARCPLOT : Graphic Display & Output Module

DB Integrator : Link with External RDBMS

AML : Arc Macro Language

Extension

COGO : Coordinate Geometry (Field Survey Data Entry)

GRID : ARC/INFO grid sub-system (raster-type)

TIN : Triangulated Irregular Network (3-D Data Analysis Module)

NETWORK : Network Analysis Module

Using ARC/INFO:

To startup ARC, generally type arc on UNIX or select “arc” in the START menu on NT. But, it can be different depending on the installation. Contact the system administrator in such case. The prompt “Arc:” appears, when ARC is started. All the ARC commands can be executed at the “Arc:” prompt. To use INFO, type Info at the Arc: prompt, then “ENTER COMMAND>” prompt will appear. Only INFO commands will be accepted at this prompt. Other modules, i.e. TABLE, ARCEDIT, and ARCPLOT have to be started at the Arc: prompt, as well. To close any of those sessions, enter <q> (for INFO, <q stop>) and it will return to Arc. Entering <q> at “Arc:”, the arc session will be closed.

Examples :

(1) Arc: **tables**

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All rights reserved.

TABLES Version 7.1.2 (Wed Aug 13 07:45:00 PDT 1997)

Enter Command: **q**

Leaving TABLES...

Arc:

(2) Arc: **Info**

INFO EXCHANGE CALL

23/06/1998 17:45:26

INFO 9.42 11/11/86 52.74.63*

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All rights reserved.

Proprietary to Doric Computer Systems International Ltd.

US Govt Agencies see usage restrictions in Help files (Help Restrictions)

ENTER USER NAME>**arc** -------→ *please note the entry of arc here*

ENTER COMMAND >**q stop**

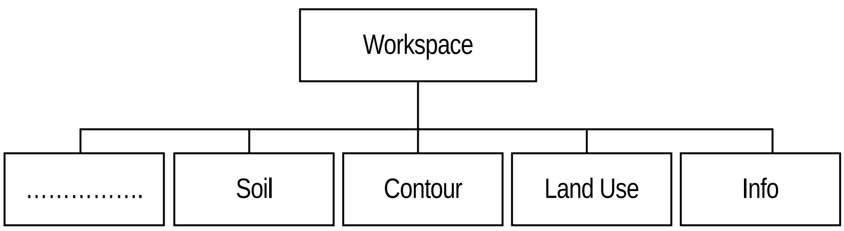
Arc:

ARC/INFO Coverage and Workspace:

The coverage is the framework for vector data storage in ARC/INFO. It generally represents a single set of geographic objects such as roads, parcels, soil units or forest stands in a given area. A coverage supports the geo-relational model - it contains both the spatial (location) and attribute (descriptive) data for geographic features.

An ARC/INFO workspace is the work area used during an ARC/INFO session. Within the computer file system, the workspace is a directory containing one or more geographic data sets (e.g., coverage, tin, grid), a local INFO database, and other supporting data. More than one user can read data from the same workspace, however, it is strongly recommend that only one user access a workspace for creating or updating data (RW access).

Figure 6.2.2 Workspace



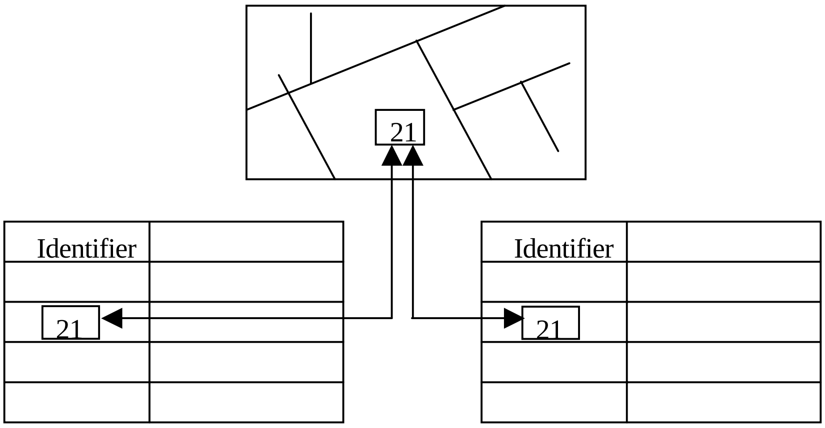
Naming Convention

Coverage names can be from 1 to 13 characters long. Item names in feature attribute tables are limited to 16 characters. The limit of 13 characters for coverage names allows ARC/INFO to append the -ID extension for the Cover-ID item. There may also be some operating system limitations on the length of coverage names (8 characters on PC). On UNIX operating systems, coverage names are converted to lowercase for directory storage.

To facilitate enterprise computing, select a file-naming convention which meets the requirements of all platform types.

Data Model:-

Figure 6.2.3 Data Model



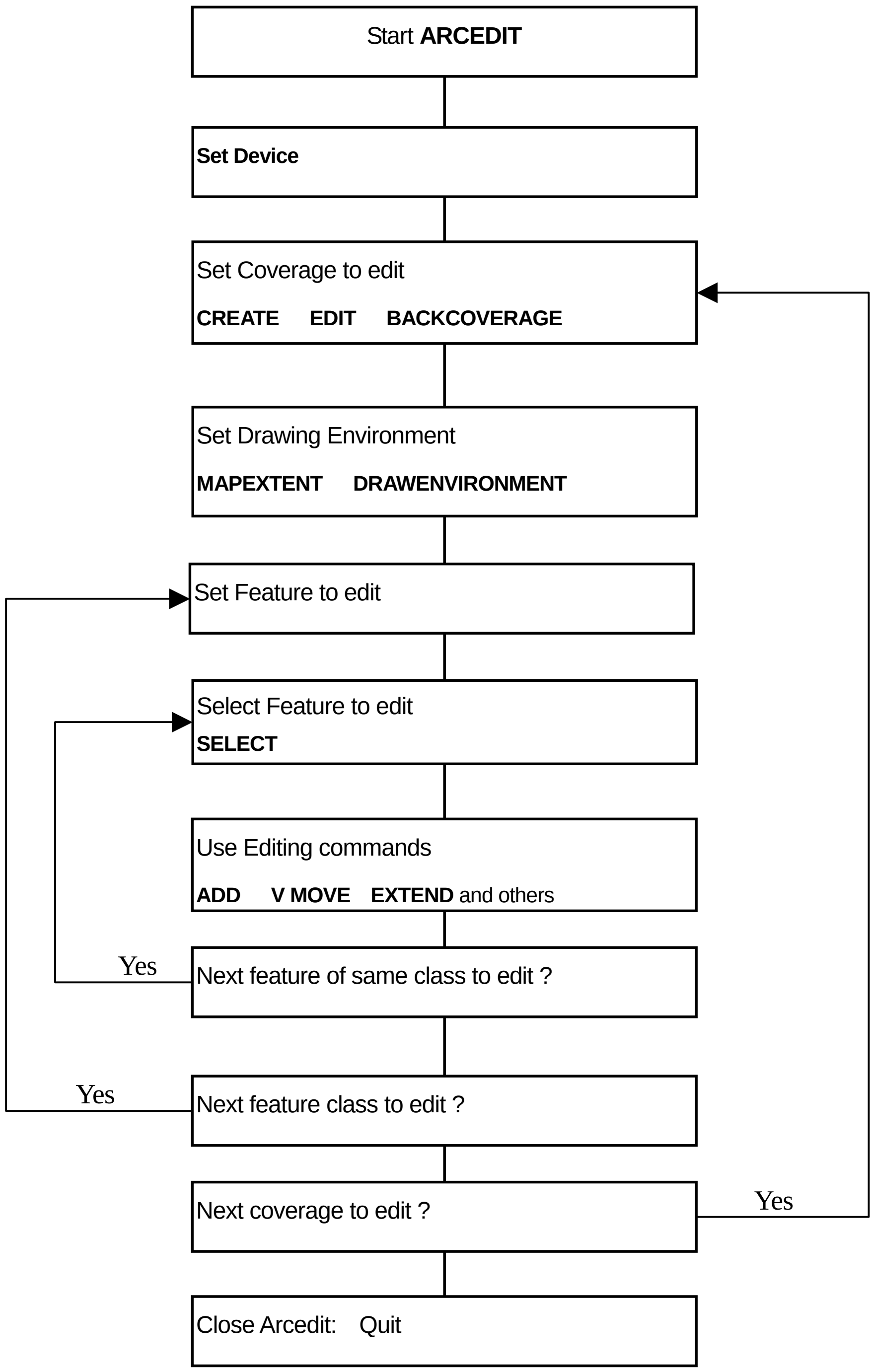
Coordinates
xxx.PAT: Polygon (Point) Attribute

Feature Attribute Table
xxx.AAT: Arc Attribute Table

In the above figure, xxx stands for a user specified “Coverage Name”. When the user specifies a coverage name, ARC/INFO uses that name to create a directory (coverage directory) in the current *Workspace*. All the *Locational Data*, as well as the data from *Feature Attribute Table* are stored under this coverage directory. The *Feature Attribute Table* schema and the path name for the data are stored under INFO directory.

ARCEDIT Operation Procedure:

Figure 6.2.4 ARCEDIT Operation Procedure



NOTE : Coverage Topology MUST be updated using BUILD or CLEAN command after editing

7. Final Results of this Study

The final products delivered to Ministry of Public Works and City Planning (MINOPU) of Angola were as follows:

(1) Aerial photos

① 1/30,000-scale black/white aerial photo negative films	1 set
② 1/10,000-scale color aerial photo negative films	1 set
③ 1/30,000-scale black/white aerial photo contact prints	3 sets
④ 1/10,000-scale color aerial photo contact prints	3 sets

(2) Satellite images

① "SPOT" and "IKONOS" output images	1 set

(3) Ground survey products

① Ground survey product books (GPS control point survey product books and leveling product books)	1 set

(4) Aerial triangulation

① Aerial triangulation product books	1 set
② Aerial triangulation point positive films and contact prints	1 set

(5) 1/25,000-scale topographic map data

① Digital data (CD-ROM)	10 sets

(6) 1/25,000-scale land-use map data

① Digital data (CD-ROM)	10 sets

(7) 1/100,000-scale topographic map data

① Digital data (CD-ROM)	10 sets

(8) 1/1,000,000-scale map data

① Digital data (CD-ROM)	10 sets

(9) Multi-color printed maps

① 1/25,000-scale topographic map prints (11 map sheets) 1,000 copies per sheet

(10) Reports

①	Yearly Report (English/Portuguese)	10 copies each
②	Main Report (English/Portuguese)	10 copies each
③	Summary (English/Portuguese)	10 copies each
④	GIS Operation Manual (English/Portuguese)	10 copies each