

**Attached documents**

# MINUTES OF MEETING

**MINUTES OF MEETING  
FOR  
THE STUDY  
FOR  
THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR  
THE CITY OF NAIROBI  
IN  
THE REPUBLIC OF KENYA**

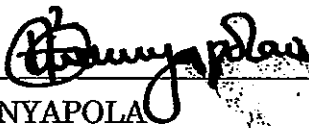
**AGREED UPON BETWEEN  
THE AUTHORITIES CONCERNED**

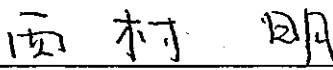
**AND**


**JICA STUDY TEAM  
(JAPAN INTERNATIONAL COOPERATION AGENCY)**

**NAIROBI**

**14<sup>TH</sup> February, 2003**

  
\_\_\_\_\_  
H. NYAPOLA  
Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement

  
\_\_\_\_\_  
AKIRA NISHIMURA  
Leader  
JICA Study Team  
Japan International Cooperation Agency  
(JICA)

  
\_\_\_\_\_  
P. M. KIBINDA  
(Witness)  
Director of City Planning  
Nairobi City Council

Japan International Cooperation Agency Study Team for "The Study for The Establishment of The Spatial Data Framework for The City of Nairobi in The Republic of Kenya" (hereinafter referred to as "JICA Study Team"), Survey of Kenya (hereinafter referred to as "SOK") and Nairobi City Council (hereinafter referred to as "NCC") held a meeting concerning the Inception Report of "The Study for The Establishment of The Spatial Data Framework for the City of Nairobi in The Republic of Kenya" on the 11<sup>th</sup> day of February 2003, from 11:40 to 13:00. The meeting took place at KISM meeting room in a friendly atmosphere.

JICA Study Team emphasized on the following points at the meeting.

- a) The capacity building for the personnel related to spatial data infrastructure and GIS in counterpart agencies.
- b) The establishment of spatial data infrastructure (digital topographic map) covering the city of Nairobi excluding the Nairobi National Park and restricted areas.
- c) The construction of GIS model system as a tool for better services such as maintenance and improvement of infrastructure in Nairobi City.
- d) The dissemination of the study results and GIS technology to the potential stakeholders in collaboration with SOK and NCC.
- e) The establishment and strengthening cooperation framework among SOK, NCC and JICA Study Team in order to implement the study smoothly and successfully, and to serve the public and the potential stakeholders after the cooperation period.

SOK pointed out that the international boundary presented on location map in IC/R was not correct, in particular with respect to boundary with Sudan. JICA Study Team promised to correct the international boundary in the next report.

SOK asked which reference ellipsoid applied to ground control point survey. JICA Study Team responded that SOK and JICA Study Team would discuss and agree on the reference ellipsoid.

KISM asked JICA Study Team to explain the approach of human resource development in detail. JICA Study Team explained again and in detail.

The conclusions of the discussions were as follows:

1. In principle SOK and NCC agreed on the Inception Report prepared by JICA Study Team.
2. SOK requested the followings to JICA Study Team:
  - (1) The Counterpart personnel shall take the opportunity of training in such areas as GIS and digital photogrammetry in Japan.
  - (2) The Equipment for technical transfer in phase1 in Kenya, for example GPS receivers and Digital level, shall be given to SOK side just after phase1 in Kenya not after completion of the study.

JICA Study Team promised to convey these requests to the JICA Headquarters.

The members who attended the meeting are listed in Appendix-1.

LIST OF ATTENDANTSKenyan Side:

Department of Surveys, Ministry of Lands and Settlement

Mr. H. NYAPOLA	Director of Surveys
Mr. K. MWERO	Deputy Director of Surveys
Mr. C. N. MBARIA	Senior Assistant Director of Surveys
Mr. B. N. OWINO	Senior Assistant Director of Surveys
Mr. J.G. HALAKE	Senior Assistant Director
Mr. J. SOGOH	Principal, Kenya Institute of Surveying and Mapping

The City of Nairobi

Mr. P. M. KIBINDA	Director of City planning
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Japanese Side:

Mr. A. NISHIMURA	Leader of JICA Study Team
Mr. K. ISHIZUKA	Surveyor
Mr. S. NISHIO	Surveyor
Mr. K. MASUDA	GIS Engineer
Mr. C. KIGASAWA	GIS Engineer
Mr. K. TSUDA	Coordinator

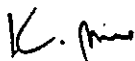
Mr. T. NARUSE	JICA Headquarters in Tokyo
Ms. R. FUNABA	JICA Headquarters in Tokyo
Mr. H. KAWANOBE	JICA KENYA in Nairobi
Mr. J. SABAI	JICA KENYA in Nairobi

Mr. K. CHUJO	Technical appraisal and evaluation consultant, IDI
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Mr. H. UNE	JICA Expert
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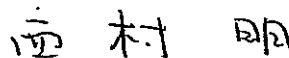
**MINUTES OF MEETING  
FOR  
THE STUDY  
FOR  
THE ESTABLISHMENT OF THE SPATIAL DATA  
FRAMEWORK  
FOR  
THE CITY OF NAIROBI  
IN  
THE REPUBLIC OF KENYA  
AGREED UPON BETWEEN  
THE AUTHORITIES CONCERNED  
AND  
JICA STUDY TEAM  
(JAPAN INTERNATIONAL COOPERATION AGENCY)**

**NAIROBI  
28<sup>TH</sup> March, 2003**



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**K. MWERO**  
Deputy Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement



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**AKIRA NISHIMURA**  
Leader  
JICA Study Team  
Japan International Cooperation Agency  
(JICA)

Japan International Cooperation Agency Study Team for "The Study for The Establishment of The Spatial Data Framework for The City of Nairobi in The Republic of Kenya" (hereinafter referred to as "JICA Study Team"), Survey of Kenya (hereinafter referred to as "SOK") and Nairobi City Council (hereinafter referred to as "NCC") held a meeting concerning the Progress Report 1 of "The Study for The Establishment of The Spatial Data Framework for the City of Nairobi in The Republic of Kenya" on the 26<sup>th</sup> day of March 2003, from 10:10 to 12:10. The meeting took place at KISM meeting room in a friendly atmosphere.

JICA Study Team emphasized on the following points at the meeting.

- a) The results of the technology transfer ( Pricking, GPS survey, Ordinary levelling) are almost sufficient.
- b) It is expected that further practical experience related to the technology transfer, for example Pricking, installation of aerial photo signal, setting up the level and various computations might be carried out in future.
- c) The results of the consultation on works related to GIS.

In the meeting, several questions were raised as follows:

1. How many photo control points did the study team establish as permanent points?  
Ans. The study team established all 22 photo control points as permanent marks.
2. Will the study team try to prepare the point description in detail?  
Ans. The study team has not yet decided whether or not to prepare the point description in detail.
3. When the study team established a photo control point, did the study team prepare a reference point to find a photo control point easily?  
Ans. The study team did not prepare a reference point or witness marks, because the photo control point was temporary point.
4. Regarding an area of aerial photography, under the condition of expanding urban area, why didn't the study team take aerial photography to cover the extended Nairobi city area?  
Ans. The study team replied that the study was carried out based on Scope of Work(S/W) and the area to be taken was specified in the S/W. Therefore the study team could not take aerial photography beyond what was agreed in the S/W.
5. What was the condition of the bench mark?  
Ans. The study team found several first order bench marks along the railway line and few second order bench marks. Most of the second order bench marks were destroyed.
6. When will the study team begin technology transfer of GIS to NCC?  
Ans. The study team replied that technology transfer of GIS would begin in mid July 2003.
7. When will the study team deliver the results of the study?  
Ans. The result will be delivered by Feb 2005.

The conclusions of the discussions were as follows:

1. In principle SOK and NCC agreed on the Progress Report 1 prepared by JICA Study Team.

2. SOK and NCC requested again the following training from JICA:

- (1) The Counterpart personnel shall take the opportunity of training in such areas as GIS and management of photogrammetric project in Japan again.

JICA Study Team promised to convey the request to the JICA Headquarters.

The members who attended the meeting are listed in Appendix-1.



LIST OF ATTENDANTSKenyan Side:

Department of Surveys, Ministry of Lands and Settlement

Mr. K. MWERO	Deputy Director of Surveys
Mr. C. N. MBARIA	Senior Assistant Director of Surveys
Mr. J. SOGOH	Principal, Kenya Institute of Surveying and Mapping
Mr. B. N. OWINO	Senior Assistant Director of Surveys
Mr. J. K. MATHENGE	Senior Assistant Director of Surveys
M/S. MARY OBAT	Senior Cartographic Assistant

The City of Nairobi

Mr. J. KAGUONGO	City Planning, Land surveyor
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Japanese Side:

Mr. A. NISHIMURA	Leader of JICA Study Team
Mr. S. NISHIO	Surveyor
Mr. J. SABAI	JICA KENYA in Nairobi
Mr. H. UNE	JICA Expert

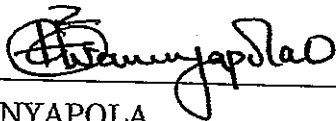
MINUTES OF MEETING  
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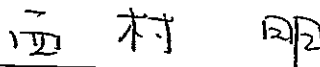
AND

JICA STUDY TEAM  
(JAPAN INTERNATIONAL COOPERATION AGENCY)

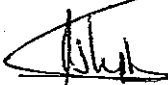
NAIROBI  
6<sup>TH</sup> August, 2003



H. NYAPOLA  
Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement



AKIRA NISHIMURA  
Leader  
JICA Study Team  
Japan International Cooperation Agency  
(JICA)



J. S. KIGERA  
(Witness)  
Director of City Planning  
Nairobi City Council

Japan International Cooperation Agency Study Team for "The Study for The Establishment of The Spatial Data Framework for The City of Nairobi in The Republic of Kenya" (hereinafter referred to as "JICA Study Team"), Survey of Kenya (hereinafter referred to as "SOK") and Nairobi City Council (hereinafter referred to as "NCC") held a meeting concerning the Interim Report of "The Study for The Establishment of The Spatial Data Framework for the City of Nairobi in The Republic of Kenya" on the 31<sup>st</sup> day of July 2003, from 10:00 to 11:40. The meeting took place at KISM meeting room in a friendly atmosphere.

JICA Study Team emphasized on the following points at the meeting.

- a) The results of the technology transfer ( Pricking, GPS survey, Ordinary levelling, GIS) are almost sufficient.
- b) It is expected that further practical experience related to the technology transfer, for example Pricking, installation of aerial photo signal, setting up the level, various computations and GIS might be carried out in future.
- c) The future development of study results.

In the meeting, several questions were raised as follows:

1. How will the study team carry out technology transfer of aerial triangulation?

Ans. The technology transfer of aerial triangulation is delayed due to lack of hardware and software.

In the next phase in Kenya, the study team will carry out the technology transfer of aerial triangulation using the equipment that JICA will supply.

2. How will the study team reflect the outcome of technology transfer in the curriculum of AICAD?

Ans. The study team will consult with the AICAD on the curriculum of GIS based on the outcome of the technology transfer.

3. Several kinds of regulations and manuals will be prepared by the study team. What kinds of conceptions will the study team prepare regulations and manuals based on?

Ans. The study team will try to prepare these regulations and manuals based on global standards, for example ISO.

4. Geographical names should be expressed on the topographic map. How will the study team collect and express geographical names?

Ans. The study team replied that they had old topographic maps scale 1/2,500 and 1/5,000 part of Nairobi city and will basically apply these geographical names on the new maps. Furthermore, the study team will carry out supplementary field identification in the field mainly in order to correct and collect geographical names.

5. Will the study team express cadastral boundary on the topographic map after transforming the co-ordinates?

Ans. The study team will not express cadastral boundary on the topographic map. But in case of the construction of GIS database for the centre areas(15.0 k m<sup>2</sup>) of Nairobi, it will construct a database of cadastral boundary.

The conclusions of the discussions were as follows:

1. In principle SOK and NCC agreed on the Interim Report prepared by JICA Study Team.
2. SOK and NCC requested the following matters to JICA:
  - (1) The Equipment for technical transfer in phase2 in Kenya, for example GIS software and hardware, shall be given to SOK side and NCC side after completion of the study.

JICA Study Team promised to convey the request to the JICA Headquarters.

The members who attended the meeting are listed in Appendix-1.

LIST OF ATTENDANTSKenyan Side:

Department of Surveys, Ministry of Lands and Settlement

Mr. K. MWERO	Deputy Director of Surveys
Mr. C. N. MBARIA	Senior Assistant Director of Surveys
Mr. B. N. OWINO	Senior Assistant Director of Surveys
Mr. J. E. R. ODUOL	Senior Assistant Director of Surveys
Mr. E. M. MURAGE	Senior Assistant Director of Surveys
Mr. W. F. A. OJUNJU	Land Surveyor I

The City of Nairobi

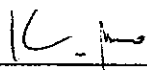
Mr. J. S. KIGERA	Director of City Planning, Nairobi City Council
Mr. P. T. ODONGO	Deputy Director of City Planning, Nairobi City Council

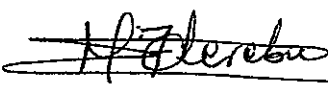
Japanese Side:

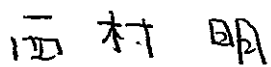
Mr. A. NISHIMURA	Leader of JICA Study Team
Mr. K. MASUDA	GIS Engineer
Mr. K. TSUDA	Coordinator
Mr. H. MORI	Technical appraisal and evaluation consultant, IDI
Mr. H. UNE	JICA Expert

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AND  
JICA STUDY TEAM  
(JAPAN INTERNATIONAL COOPERATION AGENCY)**

**NAIROBI  
23<sup>TH</sup> June, 2004**

  
\_\_\_\_\_  
**K. MWERO**  
Ag. Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement

  
\_\_\_\_\_  
**Francis M. NDEREBA**  
(Witness)  
Director of City Planning  
City Council of Nairobi

  
\_\_\_\_\_  
**AKIRA NISHIMURA**  
Leader  
JICA Study Team  
Japan International Cooperation Agency  
(JICA)

Japan International Cooperation Agency Study Team for "The Study for The Establishment of The Spatial Data Framework for The City of Nairobi in The Republic of Kenya" (hereinafter referred to as "JICA Study Team"), Survey of Kenya (hereinafter referred to as "SOK") and Nairobi City Council (hereinafter referred to as "NCC") held a meeting concerning the Progress Report 2 of "The Study for The Establishment of The Spatial Data Framework for the City of Nairobi in The Republic of Kenya" on the 17<sup>th</sup> day of June 2004, from 10:30 to 12:10. The meeting took place at KISM meeting room in a friendly atmosphere.

JICA Study Team emphasized on the following points at the meeting.

- a) The results of the technology transfer (Digital photogrammetry, Supplementary field identification, GIS Technology) are almost sufficient.
- b) It is expected that further practical experience related to the technology transfer.

In the meeting, several questions were raised as follows:

1. When does SOK proofread the topographic maps before printing the final maps?

Ans. The study team pledged to send the sets of output topographic maps from Japan.

In a few days, the study team will be able to hand over the maps to SOK for proofreading.

SOK confirmed that it would take about three (3) weeks to proofread the sets of output topographic map.

2. Why is the target area for GIS model system limited to an area of only 15 km<sup>2</sup>?

Ans. The study has been carrying out based on the Scope of Work(S/W) that was signed on 19<sup>th</sup> November 2002 among SOK, NCC and JICA. This is the reason why the target area for GIS model system was limited to 15 km<sup>2</sup>.

3. What is the difference between the spatial data infrastructure that will be produced in the study and the National Spatial Data Infrastructure (NSDI)?

Ans. The spatial data infrastructure that will be produced in the study is an example of NSDI.

The study team would like to ask that SOK discusses further the results of the study and its specification with stakeholders in order to define the specification of NSDI for Kenya.

4. Does the study team consider the number of equipment supplied under the study and the period of technology transfer adequate for expansion of the GIS model systems to cover other areas in Nairobi?

Ans. Frankly speaking, the study team doesn't think that the number of equipment are enough to expand GIS model system to other areas in Nairobi.

Concerning the period of technology transfer of GIS, the study team promises to convey to the JICA Headquarters that SOK and NCC would like to prolong its period.

5. Is it possible to work and network SOK and NCC activities related to the study?

Ans. It is possible. The study team explained how to go about constructing a network between SOK and NCC.

The conclusions of the discussions were as follows:

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1. In principle SOK and NCC agreed on the Progress Report 2 prepared by JICA Study Team.
2. SOK and NCC requested the following matters to JICA:
  - (1) The Equipment for technical transfer in Kenya, for example Digital photogrammetric equipments, GIS software and hardware, shall be given to SOK side and NCC side after completion of the study.
  - (2) The period of technology transfer related to GIS be prolonged.
  - (3) The Counterpart personnel shall take the opportunity of training in such areas as GIS and digital cartographic technique in Japan.

JICA Study Team promised to convey the request to the JICA Headquarters.

The following items were agreed upon between the Survey of Kenya and the JICA Study Team:

1. Copyright on topographic maps and various types of topographic map data.  
The copyright on the 1:2,500 and 1:5,000 scale topographic maps and various types of topographic map data of the same scale produced in the Study shall belong to the Survey of Kenya and JICA.
2. Updating topographic maps and various types of topographic map data.  
JICA agreed that the Survey of Kenya can update the topographic maps and the various types of topographic map data produced in the Study.
3. Use of topographic maps and various types of topographic map data.  
The Survey of Kenya agreed to allow the use of the topographic maps and various types of topographic map data produced in the Study in other JICA projects in Kenya without charge.
4. Copyright notification.  
JICA agreed to specify in writing to the effect that the Survey of Kenya holds the copyright on the topographic maps and the various types of topographic map data produced in the Study.
5. JICA logo and sentence.  
JICA logo and following sentence will be expressed on printed topographic map.  
"This map was prepared jointly by the Japan International Cooperation Agency (JICA) and the Government of the Republic of Kenya under the Japanese Government Technical Cooperation Program."

The members who attended the meeting are listed in Appendix-1.

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**LIST OF ATTENDANTS****Kenyan Side:****Survey of Kenya**

Mr. K. MWERO

Ag. Director of Surveys

Mr. B. N. OWINO

Senior Assistant Director of Surveys (Mapping)

Mr. C. N. MBARIA

Senior Assistant Director of Surveys

(Geodetic &amp; Computer Services)

Mr. R. M. MURUGU

Assistant Director (Adjudication)

Mr. P. K. WANYOIKE

Assistant Director (Cadastral)

Mrs. P. GITIMU

Assistant Director (Planning &amp; Policy)

Mr. H. M. NGOMO

Land Surveyor I (Oi/C Computer assisted Mapping)

Mr. P. M. GOTA

Superintending Land Surveyor

(Oi/C Computer assisted Mapping)

Mr. I. O. OUMA

Land Surveyor I Representing Ag.

Senior Assistant Director (Administration)

Mr. W. ABUTO

Ag. Deputy Principal (KISM)

**Nairobi City Council**

Mr. F. M. NDEREBA

Director of City Planning

Mr. P. K. MUTUGI

Deputy Director, City Planning Department

Mr. J. K. BARREH

Assistant Director (FP), City Planning Department

Co-ordinator JICA/GIS Project (NCC)

**Japanese Side:****JICA Study Team**

Mr. A. NISHIMURA

Leader of JICA Study Team

Ms. C. KIGASAWA

GIS Engineer

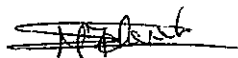
Mr. K. CHUJO

Technical appraisal and evaluation consultant, IDI

**JICA Kenya Office**

Mr. G. WALUSE

Programme Officer



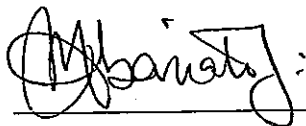
MEMORANDUM

# Memorandum

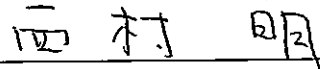
19 - February - 2003

The following items agreed upon between Survey of Kenya and JICA Study Team

1. Reference Ellipsoid is Clarke 1880(modified)
2. Projection System is UTM (Universal Travers Mercator) in Zone 37
3. Meridian of Origin is 39° 00' East of Greenwich
4. Latitude of Origin is Equator
5. Scale Factor at origin is 0.9996
6. False coordinate of origin is 500,000m Easting and 10,000,000m Northing
7. Unit of measurement is Metre
8. Sheet size is 1.5km by 2.0km for scale 1:2,500 and 3km by 4km for scale 1:5,000.
9. Sheet division for each scale is indicated in the attached Figure.
10. The area for scale 1:5000 and the area for scale 1:2500 are indicated in the attached Figure.



C. N. MBARIA  
Senior Assistant Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement



AKIRA NISHIMURA  
Leader  
JICA Study Team

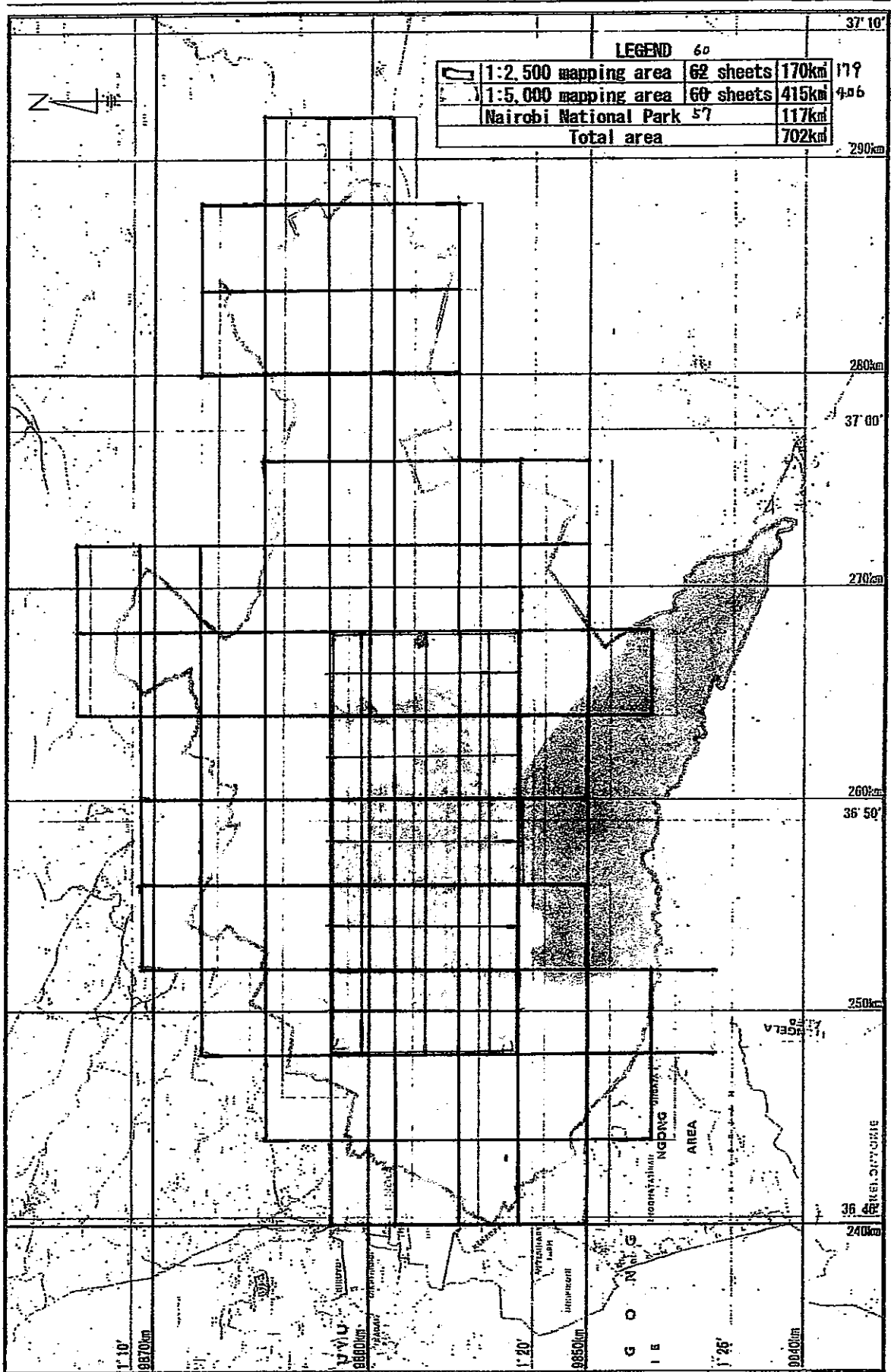


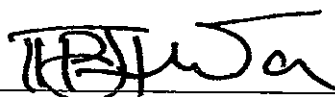
Figure 1.3 Scope of digital mapping/sheet division

# Memorandum

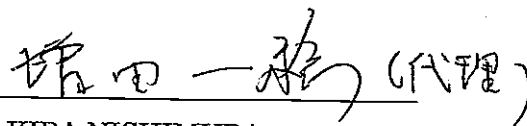
27- February - 2003

The following items agreed upon among Nairobi city council, Survey of Kenya and JICA Study Team

1. GIS database of spatial data infrastructure shall be created for the entire city of Nairobi except for the Nairobi National Park. Data source of the GIS database is digital topographic data which shall be established by this project.
2. GIS database which is specially beneficial to various departments of Nairobi City Council shall be established for at least 15km<sup>2</sup> within Central Business District (CBD) of Nairobi City. This GIS database consists of map data and attributes data. Major data subjects shall be administrative boundary, road network and locations of related facilities and etc.
3. GIS model system especially designed to support administrative operations shall be constructed for the area of at least 15km<sup>2</sup> within Central Business District (CBD) of Nairobi City.



P. M. KIBINDA  
Director of City Planning  
Nairobi City Council



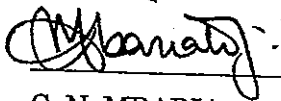
AKIRA NISHIMURA  
Leader  
JICA Study Team

# Memorandum

28<sup>th</sup> - March - 2003

The following items agreed upon between Survey of Kenya and JICA Study Team:

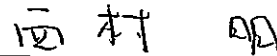
1. The equipments to be used in the technology transfer  
Survey of Kenya will keep the equipments to be used in the technology transfer by getting the permission of provision from JICA.(see the attachments)



C. N. MBARIA

Senior Assistant Director of Surveys

Survey of Kenya



AKIRA NISHIMURA

Leader

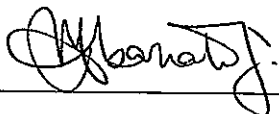
JICA Study Team

# Memorandum

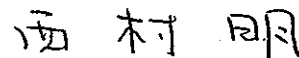
7<sup>th</sup> - August - 2003

The following items agreed upon between Survey of Kenya and JICA Study Team:

1. The target area of digital plotting and digital compilation by SOK  
Survey of Kenya agreed to carry out a digital plotting and a digital compilation for targeted area 64.55km<sup>2</sup> (1/5,000) and 15.0 km<sup>2</sup> (1/25,00)(see the attachments)

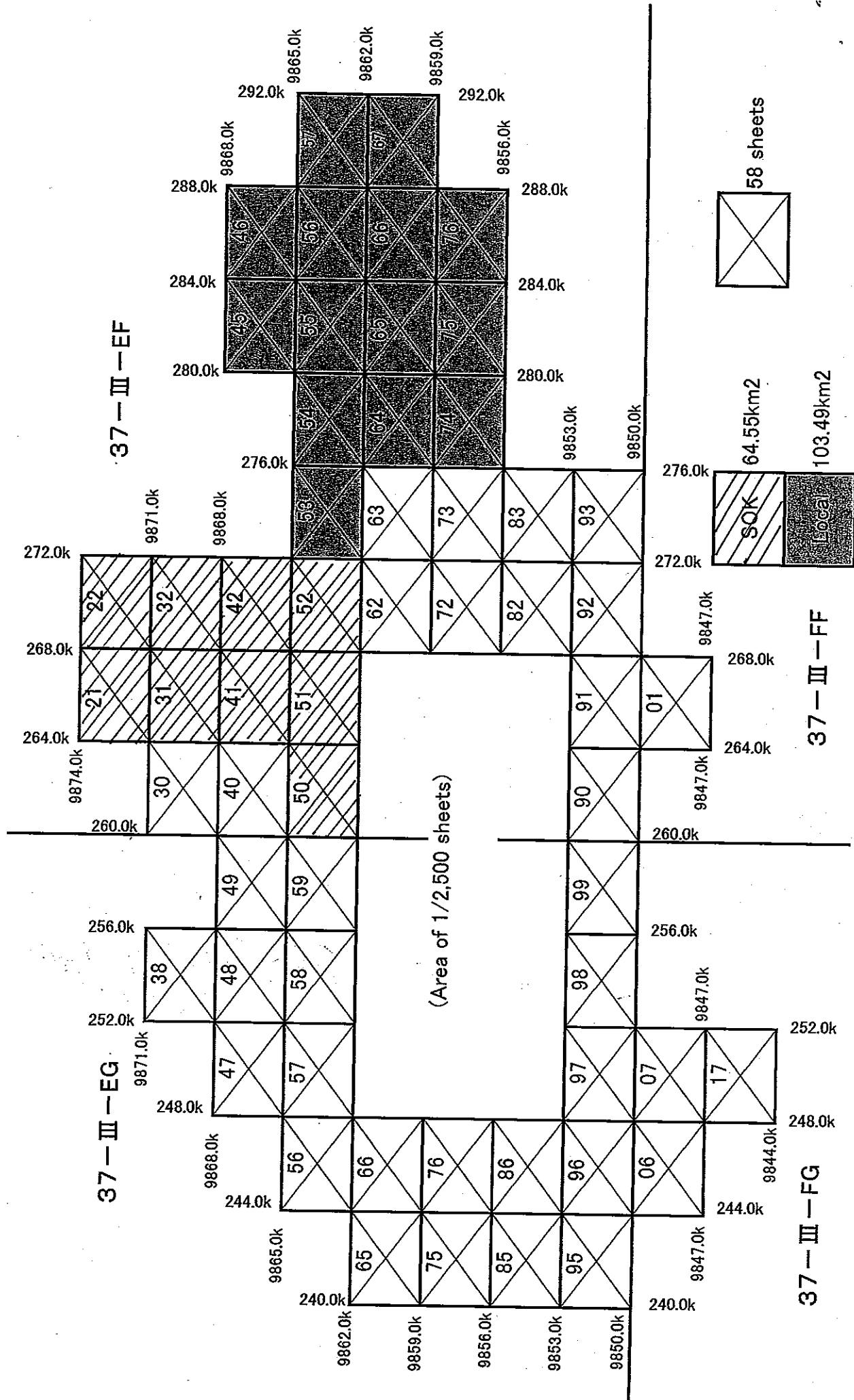


C. N. MBARIA  
Senior Assistant Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement



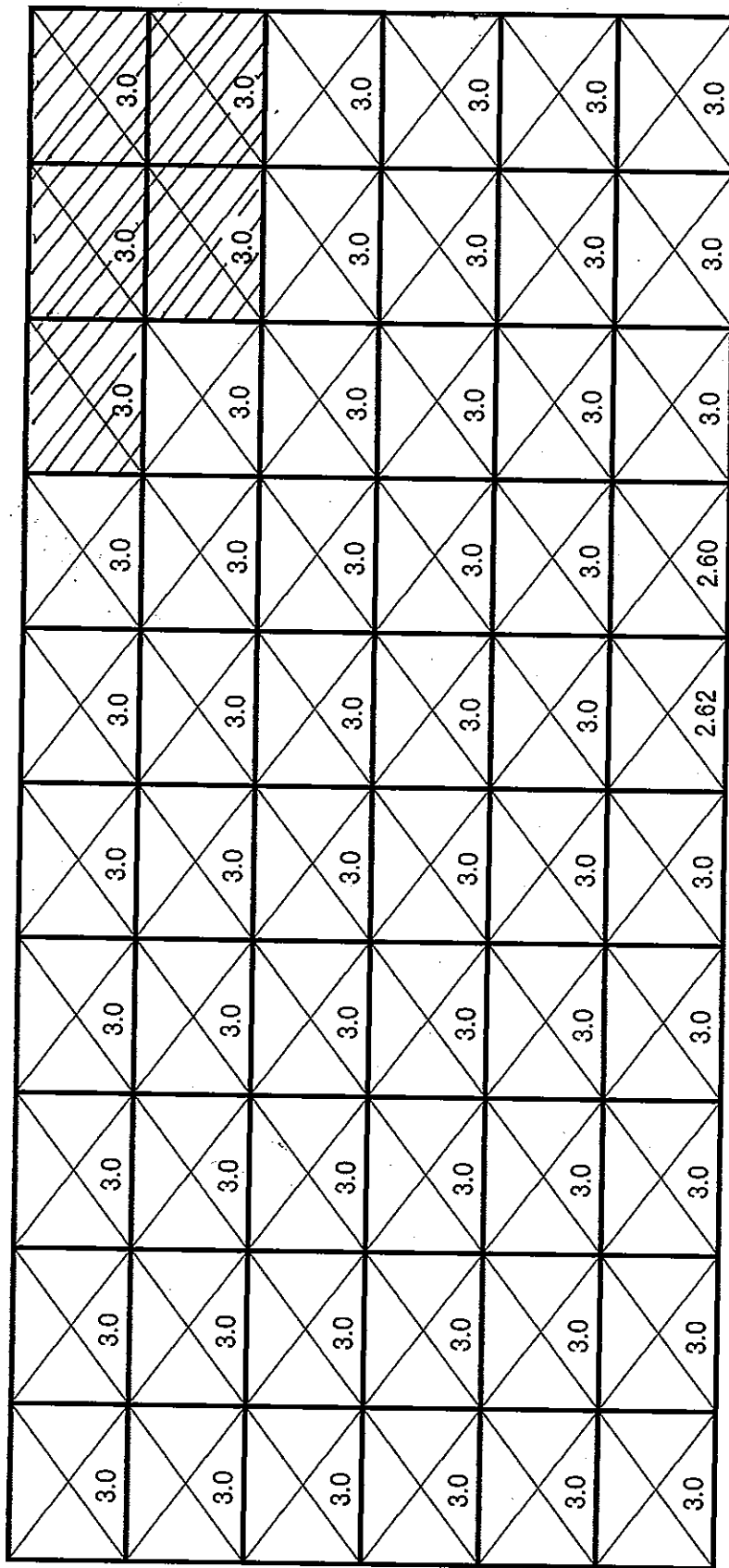
AKIRA NISHIMURA  
Leader  
JICA Study Team

# Sheet Index (1/5,000) of Nairobi GIS

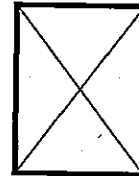




# Sheet Index (1/2,500) of Nairobi GIS



15km<sup>2</sup>



60 sheets

# Memorandum

7<sup>th</sup> - August - 2003

The following items agreed upon between Survey of Kenya and JICA Study Team:

1. The equipments to be used in the technology transfer

Survey of Kenya will keep the following equipments to be used in the technology transfer by next phase in KENYA.

\* Hardware

Desktop PC (Dell precision 350)	2 sets
20-inch LCD monitor	2 sets
Uninterruptible power supply	2 sets

\*Software

ArcGIS(ArcInfo 8.3)	1 sets
Spatial Analyst	1 sets
3D Analyst	1 sets
Windows 2000	2 sets
Microsoft Office XP Pro	2 sets
Antivirus software	2 sets
License Key for ArcGIS	1 set

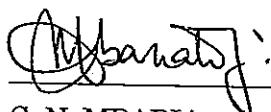
In case of the loss and broken above hardware and software, SOK will bear the responsibility.

2. The prohibition against the installation of any other software

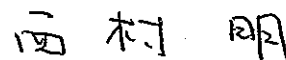
Survey of Kenya agrees not to install any other software into above hardware.

3. The proper utilization of above hardware and software

Survey of Kenya agrees to utilize above hardware and software properly when Participants of technology transfer for GIS review their skills in order to keep and progress their ability to handle software.



C. N. MBARIA  
Senior Assistant Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement



AKIRA NISHIMURA  
Leader  
JICA Study Team

# Memorandum

3<sup>th</sup> - December - 2003

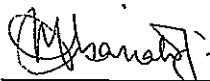
The following items were agreed upon between Survey of Kenya and JICA Study Team:

1. The results of ground control point survey

Survey of Kenya has received the results of ground control point survey on December 3, 2003.


2. The results of aerial triangulation

Survey of Kenya has received the results of aerial triangulation on December 3, 2003.



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C. N. MBARIA  
Senior Assistant Director of Surveys  
Survey of Kenya  
Ministry of Lands and Settlement



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AKIRA NISHIMURA  
Leader  
JICA Study Team

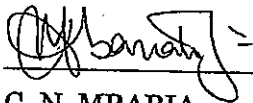
# Memorandum

9<sup>th</sup> - January - 2004

The following items were agreed upon between Survey of Kenya and JICA Study Team:

1. The Negative film of Aerial photographs

Survey of Kenya has received the negative film of aerial photographs on January 9, 2004.



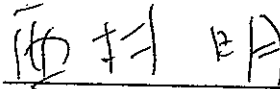
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C. N. MBARIA

Senior Assistant Director of Surveys

Survey of Kenya

Ministry of Lands and Settlement



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AKIRA NISHIMURA

Leader

JICA Study Team

**SPECIFICATION  
FOR  
AERIAL PHOTOGRAPHY**

**Annex II**

**SPECIFICATION  
FOR  
AERIAL PHOTOGRAPHY  
ON  
THE STUDY  
FOR  
THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI  
IN  
THE REPUBLIC OF KENYA**

## **Chapter 1    General**

### ***Section 1   Background***

The Scope of Work on the Study for the Establishment of the Spatial Data Framework for the city of Nairobi in the Republic of Kenya (hereinafter referred to as "the Study") was agreed upon by the Ministry of Lands and Settlement, the Nairobi City Council and the Japan International Cooperation Agency (JICA) on September 12, 2002.

JICA has decided to carry out aerial photography during the Study, and assigned the work to the JICA Study Team. The Contractor under the supervision of the JICA Study Team shall carry out aerial photography in the Republic of Kenya.

### ***Section 2   Specification***

Aerial photography shall be conducted using the photogrammetric mapping method, in accordance with the Detailed Specification attached hereto.

### ***Section 3   Scope of Works***

Aerial photography (color) for the Topographic Maps shall cover the City of Nairobi in the Republic of Kenya, equivalent to approximately 702 km<sup>2</sup>, and be carried out at a photo scale of 1:15,000 (see attached Figure 1).

### ***Section 4   Unit of Measurement***

In accordance with the Japanese Law of Measurement, the metric system shall be used.

### ***Section 5   Language and Documentation***

As a rule, the language and documentation to be used for the execution of aerial photography shall be English.

## Chapter 2 Detailed Specification

### *Section 1 Execution of the Work*

All the works shall be executed in accordance with this specification, and the instructions and requirements of the Supervisor of the JICA Study Team (hereinafter referred to as "the Supervisor").

### *Section 2 Aerial Photography*

The aerial photography works shall be carried out based on the following technical items:

#### Aircraft

The aircraft shall meet the following requirements:

1. Stable when fully loaded while in flight to the required height.
2. Unobstructed vision in all directions.
3. Capable of installing apparatus at a position where exhaust fumes will not affect the photography works.
4. Equipped with a GPS flight navigation system suitable to local conditions.
5. Have an undistorted and calibrated viewfinder window glass, if necessary.

#### Camera

The aerial camera shall have a wide-angle lens with a 23 cm x 23 cm format and a 15 cm focal length, e.g. Leica RC-30, and it shall meet the following specifications:

1. Minimum resolution: 30 lines/mm
2. Maximum tangential distortion: 0.015 mm
3. Maximum radial distortion: 0.01 mm
4. Flatness of film: less than 0.01 mm
5. Rotating inter-lens shutter
6. Calibration report certified within 3 years with following items:
  - a. Camera number and lens number
  - b. Position of principal point relative to fiducial marks (in 0.01 mm)
  - c. Calibrated focal length (in 0.01 mm)
  - d. Radial distortion
  - e. Observer's name and number of report
7. The aerial camera should be equipped with an airborne GPS system with GPS ground control points.

The following data shall be submitted to the Supervisor.



- a. Raw data of airborne GPS measured every 1.5 seconds and the ground control shall be stored on CD-ROM.
- b. Event record that records the time for each exposure shall be stored on CD-ROM.
- c. Computed coordinates list of the projection center for each exposure shall be stored on CD-ROM.

### Films

Aerial negative films (color) shall have the following performance capabilities:

1. After processing, the ratio of differential change in dimension between longitudinal and lateral shall not exceed 0.01 mm.
2. The ratio of differential change shall also be less than 0.001 % per 1 % relative humidity.
3. The spectral sensitivity shall be panchromatic unless otherwise specified.

### Flight plan

The flights shall be carried out in accordance with the following estimated work volume and the flight plan in the attached figure prepared by the Supervisor (See Figure 1).

1. At a scale of 1:15,000
  - a. Covered area:                      Approx. 702 km<sup>2</sup>
  - b. Flight lines:                        Approx. 15 lines
  - c. Photographs:                        Approx. 305 photos.

The Contractor shall adopt the geographic coordinates (Latitude & Longitude) of both ends on the each flight line to be instructed by the Supervisor for GPS navigation.

### Flight

The flight shall satisfy the following items:

1. Forward overlap and lateral overlap, crab, tip and tilt shall be secured within the following tolerances:
  - a. Forward overlap:                      More than 55 % and less than 65 %
  - b. Lateral overlap:                        More than 10 %
  - c. Crab:                                      Less than 10 degrees
  - d. Tip & tilt:                                Less than 5 degrees
2. The tone of the photographs shall allow for details in the shade to be interpreted.
3. When a flight line is broken, the broken part shall be covered by a forward overlap of more than 2 models.
4. Photo images should be free of cloud or mist. However, a photo scale of 1:15,000 may

be permissible up to 5 %, if covered by photographs of adjacent strips.

### **Re-flights**

Re-flights shall be carried out immediately if the film is rejected, in accordance with the guidance of the Supervisor.

### **Flight record**

The following information shall be written on the flight record.

1. Name of contractor
2. Name of photographing organization
3. Film number
4. Start and finish times of flights
5. Date of flights
6. Camera number, lens number and magazine number
7. Calibrated focal length
8. Aperture opening, filter number and exposure time
9. Type of film
10. Type of aircraft
11. Flight altitude

## ***Section 3 Photo Processing***

### **Negative films**

Processing of negative films shall be carried out as follows:

1. A developer specified by manufacturer's recommendations, or an equivalent one shall be used.
2. Developing shall be carried out in such a manner that the negative contains all highlights and shadow details, and the camera recording data is legible.
3. The fixer shall be acid-based and fixing shall be carried out well enough to remove unused silver halide.
4. Washing shall be carried out to remove undesirable residues.
5. In drying, distortions shall be avoided.
6. Photo-images shall not be marred by scratches, fingerprints, smudges, or shrinkage in the photo processing.
7. The films of all photos that are to be used will be annotated as instructed by the Supervisor.

E.g. A sample of film annotation is as follows:

**NAIROBI C-5 15/02/2003 1:15,000 SOK/JICA**

**Photo index maps**

Photo index maps shall be prepared by using a topographic map at a scale of 1:100,000.

**Chapter 3 Flight and Photography Permits and Work Schedule**

When obtaining the flight and photography permits, the Contractor shall give full cooperation to the Supervisor and be sure to obtain the permits promptly. All the aerial photography shall be completed by 15th of March, 2003.

**Chapter 4 Deliverables**

The Contractor shall deliver the following final results and products to the place designated by the JICA Study Team by hand.

The Contractor shall submit one set of contact prints (black and white) to the Study Team in Nairobi within one week after completion of photographing in order to decide on whether or not to accept the aerial photographs.

**Photographs and the other reports**

- |                                               |                                             |
|-----------------------------------------------|---------------------------------------------|
| 1. Contact prints(Color):                     | 1 set                                       |
| 2. Contact prints(Black and White)            | 3 sets                                      |
| 3. Negative films:                            | 1 set                                       |
| 4. Diapositive films:                         | 1 set                                       |
| 5. Quality control sheet                      | 1 set                                       |
| 6. Photo index map (scale 1:100,000):         | 1 set of original and 3 sets of photocopies |
| 7. Raw data of airborne GPS:                  | 1 set (CD-ROM and printed sheets)           |
| 8. Recorded time data (event record):         | 1 set (CD-ROM and printed sheets)           |
| 9. Coordinates list of the projection center: | 1 set (CD-ROM and printed sheets)           |
| 10. Certified calibration records of camera:  | 1set                                        |
| 11. Flight records:                           | 1set                                        |
| 12. Weekly progress reports:                  | 1set for every week                         |

## Annex III

## BILL OF QUANTITIES

Item No.	Descriptions	Unit	Volume	Unit Price (US\$)	Amount (US\$)
1	Mobilization and demobilization	L.S.	1		35,275.00
2	Aerial photography (Photo scale of 1:15,000; Color with DGPS)	K m <sup>2</sup>	702		25,460.00
3	Film Processing (Color)	L.S.	1		3,500.00
4	1 set of Contact Prints (Color)	photos	305	12.00	3,660.00
5	3 sets of Contact Prints (Black and White)	photos	915	5.00	4,575.00
6	1 set of Diapositives (Black and White)	sheets	305	6.00	1,830.00
7	Flight Index & Flight Reports	L.S.	1		1,000.00
8	DGPS Registration and Computations	L.S.	1		4,500.00
9	Reports	L.S.	1		3,700.00
Total					83,500.00

**SPECIFICATION  
FOR  
DIGITAL PLOTTING AND COMPILATION**

**Annex II**

**SPECIFICATION  
FOR  
DIGITAL PLOTTING AND COMPILATION  
ON  
THE STUDY  
FOR  
THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI  
IN  
THE REPUBLIC OF KENYA**

## **Chapter 1    General**

### ***Section 1    Background***

The Scope of Work on the Study for the Establishment of the Spatial Data Framework for the City of Nairobi in the Republic of Kenya (hereinafter referred to as "the Study") was agreed upon among the Ministry of Lands and Settlement, the Nairobi City Council and the Japan International Cooperation Agency (JICA) on September 12, 2002.

JICA has decided to carry out digital plotting and compilation during the Study, and assigned the work to the JICA Study Team. The Contractor under the supervision of the JICA Study Team shall carry out digital plotting and compilation in the Republic of Kenya.

### ***Section 2    Specification***

Digital plotting and compilation shall be conducted using the photogrammetric mapping method, in accordance with the Detailed Specification attached hereto.

### ***Section 3    Scope of Works***

Digital plotting and compilation for the Topographic Maps shall cover the eastern part of the City of Nairobi in the Republic of Kenya, equivalent to approximately 103.49 km<sup>2</sup>, and be carried out at a mapping scale of 1:5,000 (see attached Figure 1).

### ***Section 4    Unit of Measurement***

The metric system shall be used.

### ***Section 5    Language and Documentation***

As a rule, the language and documentation to be used for the execution of digital plotting and compilation shall be English.

## Chapter 2 Detailed Specification

### *Section 1 Execution of the Work*

All the works shall be executed in accordance with this specification, and the instructions and requirements of the Supervisor of the JICA Study Team (hereinafter referred to as “the Supervisor”).

### *Section 2 Scale Level and Accuracy of Topographic Maps and the Scope*

#### Article 1 Scale level and sheet division of topographic maps

- 1 : The scale level of topographic maps shall be 5000.
- 2 : The sheet size shall be 4km × 3km.

#### Article 2 Accuracy of topographic maps

The accuracy of topographic maps shall be as follows:

- 1 : The standard deviation of the horizontal position of all features shall be within 0.5mm on the map.
- 2 : The standard deviation of spot heights shall be within 1/3 of the contour interval.
- 3 : The standard deviation of the heights of contours shall be within 1/2 of the contour interval.

#### Article 3 Scope of plotting and compilation

- 1 : The scope of plotting and compilation shall be as shown in Figure 1 .
- 2 : The plotting and compilation shall cover approximately 103.49km<sup>2</sup> with 14 sheets.

### *Section 3 Digital plotting*

The digital plotting works shall be carried out based on the following technical items:

#### Article 4 Digital plotting

- 1 : Digital plotting refers to the work of obtaining and recording map information in a numerical format using a digital plotter.

#### Article 5 Digital plotter



- 1 : The digital plotter to be used in digital plotting must meet the following requirements:
  - a. The digital plotter should have a function for inputting and recording X, Y, Z coordinate values and the map symbol classification code.
  - b. The reading accuracy of the digital plotter shall be within the standard deviation of 0.15m, and the resolution of the coordinate reading device shall be 0.075m or more.
  - c. In order to ensure the accuracy of the digital plotter, it shall be inspected and adjusted prior to the commencement of work.

#### Article 6 Unit of coordinate values to be obtained

- 1 : The coordinate values in digital plotting shall be in m to the second decimal place.

#### Article 7 Monitoring

- 1 : During digital plotting, the position, shape, etc of the data shall be graphically displayed in order to check it.

#### Article 8 Orientation

- 1 : Relative orientation and absolute orientation shall be carried out using the results of aerial triangulation.
- 2 : The residual y-parallax in relative orientation and the error of horizontal position and height in absolute orientation shall not exceed the following values:
  - a. The residual y-parallax of tie points shall be within 0.02mm on contact positive film.
  - b. The error of horizontal position in absolute orientation shall be within 0.3mm on the map.
  - c. The error of height in absolute orientation shall be within 1.0m.

#### Article 9 Scope of plotting

- 1 : The scope of plotting for each model shall be within the area enclosed by the outermost tie points of the model.

#### Article 10 Symbols at the time of plotting

- 1 : As a rule, the symbols at the time of digital plotting shall be map symbols, however abbreviated signs and symbols, text, etc, can be used as deemed appropriate.

#### Article 11 Digital plotting

- 1 : Digital plotting shall be conducted in the following order: linear objects, buildings,

vegetation and contours. Care shall be taken to ensure that there are no omissions.

- 2 : If there are sections that are difficult to interpret due to obstructions such as shadow and halation or sections that cannot be plotted, the scope of such sections shall be identified and the necessary items shall be noted in a supplementary field survey.
- 3 : In digital plotting, the following items shall be kept in mind:
  - a. As much as possible, deformed surface areas shall be indicated with contours. The symbol prescribed for such areas shall be used according to conditions.
  - b. Contours shall be plotted one by one, and supplementary contours of the necessary areas shall not be omitted.
  - c. The heights of peaks, depressions, passes, etc shall be determined and, if necessary, recorded to ensure that their contours are not omitted when plotting.
- 4 : The position of spot heights shall be selected in consideration of the facility of interpreting the terrain. The standard density shall be one point every  $4\text{cm}^2$  on the map. Moreover, after measuring the height of spot heights once, they shall be remeasured as a check. The positions to be selected for the spot heights shall be as follows:
  - a. Major peaks
  - b. Major road junctions, saddles bisected by a road, other important saddles
  - c. Valleys, river confluences, vast valley bottoms and riverbeds
  - d. Major critical points of slopes
  - e. The deepest plottable section of a depression
- 5 : The method for obtaining digitally plotted data through digital plotting shall be in accordance with the symbols regulations in Annex V.
- 6 : The digitally plotted data consists of a single file per map sheet.

#### Article 12 Feature class code

- 1 : As a rule, a feature class code shall be attached to the digitally plotted data obtained in order to indicate their type.
- 2 : Refer to symbols regulation in Annex IV regarding the feature class code.

#### Article 13 Production of output maps

- 1 : Output maps shall be produced from the digitally plotted data at a scale level of topographic maps using a computer aided drafting machine or plotter.

#### Article 14 Inspection of digitally plotted data

- 1 : Using the output maps, the digitally plotted data shall be inspected for the following:
  - a. Omissions in digital plotting, errors in horizontal position and height
  - b. Quality of adjoining
  - c. Quality of the position, density and height values of spot heights
  - d. Quality of the geographic data

#### Article 15 Results of digital plotting

- 1 : The results of digital plotting are as follows
  - a. Digitally plotted data
  - b. Maps for inspecting digitally plotted data
  - c. Orientation records

#### ***Section 4 Digital compilation***

The digital compilation works shall be carried out based on the following technical items:

#### Article 16 Digital compilation

- 1 : Digital compilation refers to the work of compiling digitally plotted data to produce compiled data using a compiler.

#### Article 17 Digital compiler

- 1 : The standard configuration and features of the digital compiler shall be as follows:
  - a. The digital compiler shall be composed of a computer, a graphics display, and a tablet or digitizer.
  - b. It shall have an interactive computing function and be capable of adding, deleting, and correcting topographic map data.

#### Article 18 Input of digitally plotted data and other data

- 1 : Digitally plotted data and other data shall be input into the digital compiler.

#### Article 19 Digital compilation

- 1 : The data input into the digital compiler shall be processed, i.e. added to, deleted and corrected, using the digital compiler to produce compiled data.
- 2 : Contour data shall be inspected using the graphics display or output maps and any

discrepancies shall be corrected.

- 3 : Adjoining is carried out between models and adjacent sheets to tie the coordinates. This work shall be implemented according to the following standards:
  - a. If the deviance of topographic and planimetric features is calculated as 0.7mm or less on the map, the concerned graphics shall be corrected and fully processed.
  - b. If the deviance of the topographic and planimetric features exceeds 0.7mm on the map, digital plotting work must be carried out again.
- 4 : The data items defined as having three dimensional coordinate values in Data Acquisition Method and Data Type of Annex V shall have the Z value (elevation value) at the time of plotting. As for the other data items, the Z value (elevation value) shall be 0.00m.
- 5 : Digital compilation shall be carried out in sheet units.

#### Article 20 Production of output maps

- 1 : Output maps shall be produced from the digitally compiled data at a scale level of topographic maps using a computer aided drafting machine or plotter.

#### Article 21 Inspection of digitally compiled data

- 1 : Using the output maps, the digitally compiled data shall be checked for the following:
  - a. Omissions in digital compiling
  - b. Quality of adjoining
  - c. Quality of the cartographic data
- 2 : The data shall be inspected for inconsistencies using a check program.

#### Article 22 Results of digital compilation

- 1 : The results of digital compilation are as follows:
  - a. Digitally compiled data
  - b. Maps for inspecting digitally compiled data
- 2 : The format of the digitally compiled data shall be as follows:
  - a. Digitally compiled data shall be in sheet units.
  - b. Each map sheet file shall contain individual files for each map symbol category.
  - c. The layer name shall be the six-digit number composed of the Class Code, Item Code and Expression Code.
  - d. The format of the digitally compiled data shall be DXF version 11.

### Chapter 3 Work Schedule

All the digital mapping and compilation shall be completed by August 5, 2003.

### Chapter 4 Deliverables

The Contractor shall deliver the following final results and products to the JICA Study Team.

#### Digital mapping and compilation

- |    |                                                          |                |
|----|----------------------------------------------------------|----------------|
| 1. | 1: 5000 topographic map color printout                   | 2 sets         |
| 2. | 1: 5000 topographic map digital data files (e.g. CD-ROM) | 2 sets         |
| 3. | DM data file operating manual                            | 2 sets         |
| 4. | Weekly progress reports                                  | 1 set per week |
| 5. | Other data                                               | 1 set          |

**Annex III****BILL OF QUANTITIES**

<b>Item No.</b>	<b>Descriptions</b>	<b>Unit</b>	<b>Volume</b>	<b>Unit Price (US\$)</b>	<b>Amount (US\$)</b>
1	Preparations and delivery	L.S.	1	5,000	5,000.00
2	Digital plotting	k m <sup>2</sup>	103.49	444.50	46,000.00
3	Digital compilation	k m <sup>2</sup>	103.49	62.80	6,500.00
4	18% VAT				9,540.00
Total					US\$ 62,540.00

**SPECIFICATION  
FOR  
THE SURVEY TRAFFIC CONDITIONS**

**Annex II**

**SPECIFICATION  
FOR  
THE SURVEY ON TRAFFIC CONDITIONS  
ON  
THE STUDY  
FOR  
THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI  
IN  
THE REPUBLIC OF KENYA**



## **Chapter 1    General**

### ***Section 1    Background***

The Scope of Work on the Study for the Establishment of the Spatial Data Framework for the City of Nairobi in the Republic of Kenya (hereinafter referred to as "the Study") was agreed upon among the Ministry of Lands and Settlement, the Nairobi City Council and the Japan International Cooperation Agency (JICA) on September 12, 2002.

JICA has decided to carry out a survey on traffic conditions during the Study, and assigned the work to the JICA Study Team. The Contractor under the supervision of the JICA Study Team shall carry out the survey on traffic conditions in the Republic of Kenya.

### ***Section 2    Specification***

The survey on traffic conditions shall be conducted in accordance with the Detailed Specification attached hereto.

### ***Section 3    Scope of Works***

The survey on traffic conditions shall cover the central part of the City of Nairobi in the Republic of Kenya, equivalent to 15.00 km<sup>2</sup> (see attached Figure 1).

### ***Section 4    Unit of Measurement***

The metric system shall be used.

### ***Section 5    Language and Documentation***

As a rule, the language and documentation to be used for the execution of traffic surveillance shall be English.

## Chapter 2 Detailed Specification

### *Section 1 Execution of the Work*

All the works shall be executed in accordance with this specification, and the instructions and requirements of the Supervisor of the JICA Study Team (hereinafter referred to as "the Supervisor").

### *Section 2 Background, Objective and Scope*

#### Article 1 The background of the survey on traffic conditions

Traffic congestion in the central part of Nairobi, particularly in the morning and evening, has become a serious problem.

The traffic load, including through traffic, concentrates in the center of the city and at this stage, there are no bypasses to divert traffic.

Moreover, the intersections are of rotary type and it is supposed that the operation/management capacity of intersections will decrease due to a decline in road manners and an increase in rule violations. This is thought to be the main obstacle to traffic and one of the causes of congestion.

#### Article 2 The objective of the survey on traffic conditions

In order to improve the road traffic problems as described above, it is necessary to understand road traffic conditions, which are the basic information for implementing effective improvement measures, and to identify the sources of congestion, which are the targets of traffic improvement.

Therefore, this survey aims to gain an understanding of the current traffic conditions in Nairobi City as well as the causes of traffic congestion in order to obtain basic data to formulate improvement plans for traffic congestion in the future.

The specific objectives of the survey are as follows:

a. Survey of traffic movement

Objective: To gain an understanding of the number of vehicles that flow through the city center.

Method: Study the traffic volume by vehicle-type on the main roadways in the city.

b. Survey of traffic/congestion at intersections

Objective: To gain an understanding of congestion in the city center and the causes.

Method: Study the traffic volume by turning movement and monitor the congestion situation at the intersections of main roadways in the city.

### Article 3 The scope of the survey on traffic conditions

The survey on traffic conditions shall be conducted in the central part of Nairobi (15 km<sup>2</sup>).

The area for the study is as shown in Figure 1. (See attached Figure 1)

### **Section 3 Survey Items**

#### Article 4 Survey item

The survey on traffic conditions shall be carried out based on the following survey items.

1. Survey of traffic movement
  - a. Study of traffic volume by vehicle-type (by direction/vehicle-type)
2. Survey of traffic/congestion at intersections
  - a. Study of traffic volume by turning movement
  - b. Monitoring of congestion situation (length of back-up/delay time)

#### Article 5 Number of surveys and time period

The survey shall be conducted for a period of 12 continuous hours on a weekday.

The number of surveys shall be three.

(Survey conditions)

The survey shall be conducted on a sunny day.

The start time of the survey will be discussed separately.

### **Section 4 Survey Method**

#### Article 6 Survey of traffic movement

##### 1. Survey of traffic volume by vehicle-type

- a. Summary: The survey shall be conducted for a 12-hour period during the day on a weekday. The automobile traffic volume at the survey point shall be measured by vehicle-type, direction and time. The total number of cars shall be calculated on an hourly basis.
- b. Method: Monitors shall be stationed at the specified points and tally the number of passing cars by vehicle-type using a counter.
- c. Time period: The survey shall be conducted for a period of 12-hours during the day on a weekday. Details shall be discussed separately.
- d. Counting interval: The traffic volume by vehicle-type shall be calculated every hour.  
(The cumulative traffic volume shall be recorded)

- e. Classification of direction: On roads, traffic shall be classified into inbound and outbound; at intersections, traffic shall be classified into approaching and departing from the intersection.
- f. Vehicle classification: Vehicles shall be classified into the following four groups:
  - Small: Sedan, 4WD, Pickup
  - Bus
  - Lorry
  - Matatu

Article 7 Survey of traffic/congestion at intersections

1. Survey of traffic volume by turning movement

- a. Summary: The survey shall be conducted for a 12-hour period during the day on a weekday. The automobile traffic volume at intersections shall be calculated by turning movement (straight, right turn, left turn), vehicle-type and time. The volume shall be calculated on an hourly basis.
- b. Method: Monitors shall be stationed at the specified points and tally the number of vehicles by turning movement, vehicle-type, and time using a counter.
- c. Time period: The survey shall be conducted for a period of 12 hours during the day on a weekday. Details shall be discussed separately.
- e. Counting interval: The traffic volume by turning movement (straight, right turn, left turn) and vehicle-type shall be calculated every hour.
- f. Classification of turning movement: "Turning movement" shall be straight, right turn and left turn.
- g. Vehicle classification: Vehicles shall be classified into the following four groups:
  - Small: Sedan, 4WD, Pickup
  - Bus
  - Lorry
  - Matatu

2. Monitoring of congestion situation (length of back-up, delay time)

- a. Summary: The survey shall be conducted for a period of 12-hours during the day on a weekday, and the length of the back-up and delay time of traffic approaching the intersection shall be monitored. Measurements shall be made every hour on the map.
- b. Method: The following surveys shall be conducted at the specified points,
  - For the survey on the length of back-up, the distance from the stop line at the intersection to the end of the backup shall be measured to the nearest 10m every hour.

- As for the survey on the amount of delay, the time a vehicle arrives at the end of the backup and the time the same car reaches the stop line at the intersection shall be recorded every hour. The vehicle-type shall also be recorded. This shall be conducted on five vehicles every hour.
- c. Time period: The survey shall be conducted for a period of 12-hours during the day on a weekday.
- d. Survey points: The survey shall be conducted at the specified intersections where the traffic is approaching.

### ***Section 5 Survey Preparation and Enforcement***

#### **Article 8 Survey Preparation**

Prior to conducting the survey, the intersections to be monitored shall be studied and the locations of where monitors will be stationed shall be confirmed on site in consideration of safety.

#### **Article 9 Survey Enforcement**

Chairs shall be placed at the survey points along the sidewalk and the survey shall be carried out.

The chairs shall be placed in a safe position which will not obstruct pedestrian or bicycle movement.

#### **Article 10 Contact system**

The office representative and field representative shall be established.

### ***Section 6 Arrangement of survey results***

#### **Article 11 Results of the survey on traffic volume by vehicle-type**

The survey results shall be arranged as follows:

- Specify the location of the survey point.
- Specify the date of the survey and weather on that day.
- Specify the name of the monitors.
- Specify the cumulative number of passing vehicles by direction, vehicle-type, and time.

#### **Article 12 Results of the survey on traffic/congestion at intersections**

1. Results of survey on traffic volume by turning movement

The survey results shall be arranged as follows:

- Specify the location of the survey point.
- Specify the date of the survey and the weather on that day.
- Specify the name of the monitors.
- Specify the cumulative number of vehicles by turning movement (straight, right turn, left turn), vehicle-type, and time.

2. Results of monitoring on the congestion situation (length of the backup, amount of delay)

The survey results shall be arranged as follows:

- Specify the location of the survey point.
- Specify the date of the survey and weather on that day.
- Specify the name of the monitors.
- Specify the length of backup every hour on a map.
- Specify the average delay every hour (average the delay time of five vehicles and round to the minute).

### Chapter 3 Work Schedule

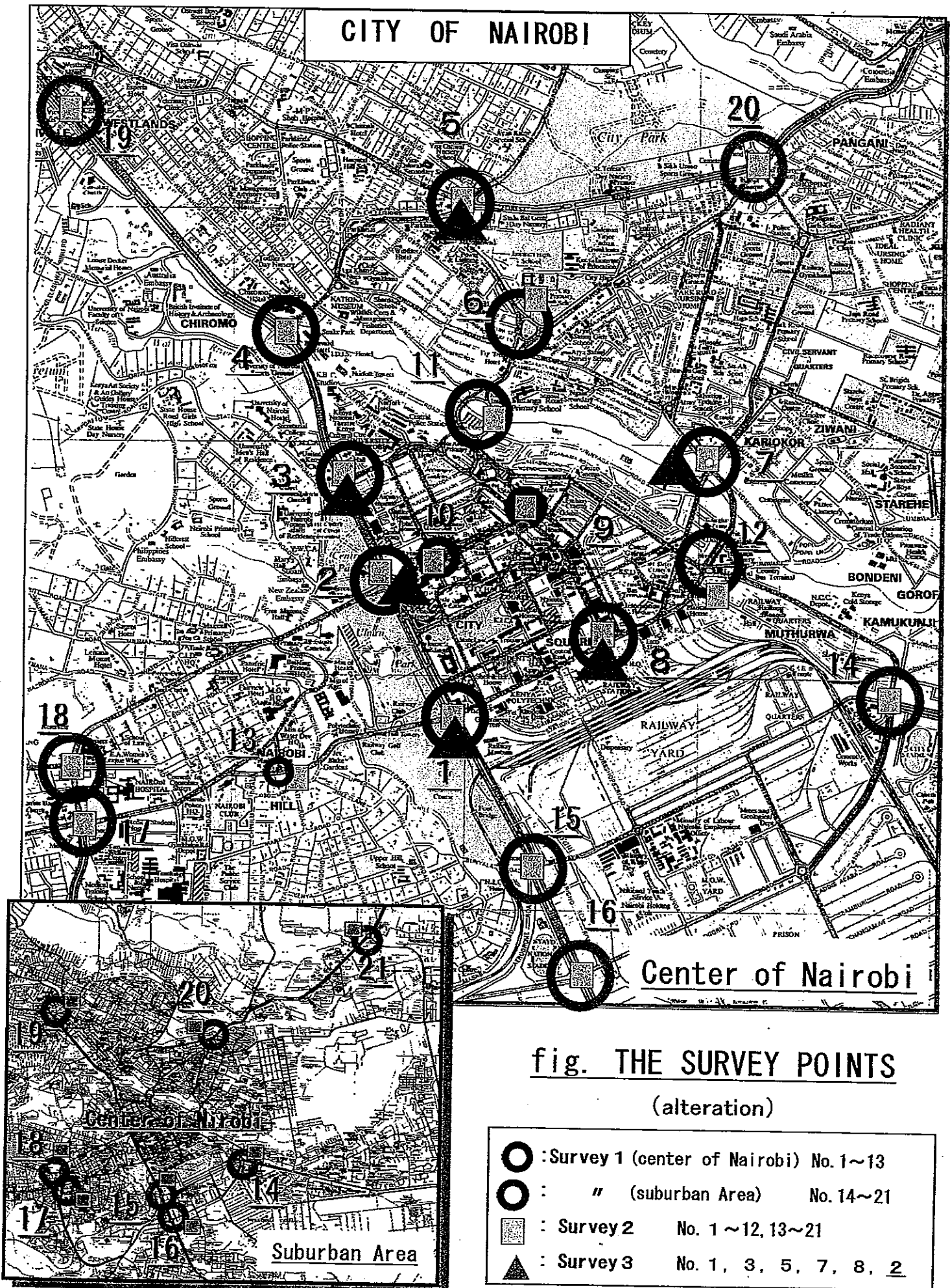
The survey on traffic conditions shall be completed by February 4, 2004.

### Chapter 4 Deliverables

The Contractor shall deliver the following final results and products to the JICA Study Team.

**The survey on traffic conditions**

1. Survey sheets of study of traffic volume by vehicle-type (by direction/vehicle) 1 set
2. Survey sheets of study of traffic volume by turning movement 1 set
3. Survey sheets of monitoring of congestion situation 1 set
4. Other data 1 set





**SPECIFICATION  
FOR  
THE VERIFICATION STUDY  
OF  
WATER SUPPLY AND SEWAGE**

**Annex II**

**SPECIFICATION  
FOR  
THE VERIFICATION STUDY OF WATER SUPPLY AND SEWAGE  
FACILITIES  
ON  
THE STUDY  
FOR  
THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI  
IN  
THE REPUBLIC OF KENYA**

## **Chapter 1    General**

### ***Section 1    Background***

The Scope of Work on the Study for the Establishment of the Spatial Data Framework for the City of Nairobi in the Republic of Kenya (hereinafter referred to as “the Study”) was agreed upon among the Ministry of Lands and Settlement, the Nairobi City Council and the Japan International Cooperation Agency (JICA) on September 12, 2002.

JICA has decided to carry out a verification study of water supply and sewage facilities during the Study, and assigned the work to the JICA Study Team. The Contractor under the supervision of the JICA Study Team shall carry out the verification study of water supply and sewage facilities in the Republic of Kenya.

### ***Section 2    Specification***

The verification study of water supply and sewage facilities shall be conducted in accordance with the Detailed Specification attached hereto.

### ***Section 3    Scope of Works***

The verification study of water supply and sewage facilities shall cover the central part of the City of Nairobi in the Republic of Kenya, equivalent to 15.00 km<sup>2</sup> (see attached Figure 1).

### ***Section 4    Unit of Measurement***

The metric system shall be used.

### ***Section 5    Language and Documentation***

As a rule, the language and documentation to be used for the execution of the verification study of water supply and sewage facilities shall be English.

## Chapter 2 Detailed Specification

### *Section 1 Execution of the Work*

All the works shall be executed in accordance with this specification, and the instructions and requirements of the Supervisor of the JICA Study Team (hereinafter referred to as "the Supervisor").

### *Section 2 Background, Objective and Scope*

#### Article 1 Background

As a result of discussions with the counterpart agency (NCC), it was decided that a GIS model system to support the management of water supply and sewerage facilities was to be constructed as one of the GIS model systems. For the model system, it is important to obtain the information (positional information and attribute information) on all water supply and sewerage facilities and to verify its reliability. Therefore, of that information, the positional information of the most important facilities that can be checked above ground (manholes, valves) shall be verified in the field.

#### Article 2 Objective of study

This study aims to verify the location of existing water supply and sewage facilities such as manholes and valves based on the management maps compiled on the digital topographic map (scale: 1/2,500) from the existing data on the water supply and sewage systems. The results are to be used in the GIS model system to support water supply and sewage management in Nairobi.

#### Article 3 Scope of study

The study shall be conducted on the existing water supply and sewage facilities located in the central part of Nairobi (15 km<sup>2</sup>).

The management maps for the study are as shown in the attached Figure 1.

### *Section 3 Verification Study*

The verification study of water supply and sewage facilities shall be carried out as follows:

#### Article 4 Material provided

The following 1: 2500-scale maps will be provided by the JICA Study Team:

1. Management maps for water supply facilities: 5 sheets

- |                                           |          |
|-------------------------------------------|----------|
| 2. Copies of the above management maps:   | 5 sheets |
| 3. Management maps for sewage facilities: | 5 sheets |
| 4. Copies of the above management maps:   | 5 sheets |

Article 5 Equipment to be used in the study

All the equipment to be used in the study will be prepared by the Contractor.

Article 6 Study method

The location of existing facilities on each management map shall be verified in the field according to the method below:

1. Facilities that can be measured

- A) The center of the existing facilities shall be measured by the offset survey from objects (fences, walls, houses and etc.) on the base map.
- B) As a rule, in measuring the location based on the offset survey, the horizontal distance shall be measured from objects in three directions.
- C) The measurement unit of distance shall be in centimeters.
- D) The type of the laid existing facility shall be verified, if possible.

Based on the management maps for the water supply and sewage facilities, the existing facilities can be classified into the following groups.

**【Water supply】**

- a. Fire Hydrant
- b. Sluice Valve
- c. Pressure Reducing Valve
- d. Sluice Valve Closed
- e. Meter/Dall Tube

**【Sewerage】**

- a. Manhole
- b. Storm drain

2. Items that cannot be measured

The reason why a facility cannot be measured must be indicated on the base map (i.e. facility exists on grounds where entry is not permitted, etc.)

The reason must also be successively reported to the Supervisor in charge.

- 3. The underground, lost or unaccounted facilities due to topographical change shall be successively reported to the Supervisor in charge.

4. Inspection and arrangement method

The inspection and arrangement method shall be as directed by the Supervisor.

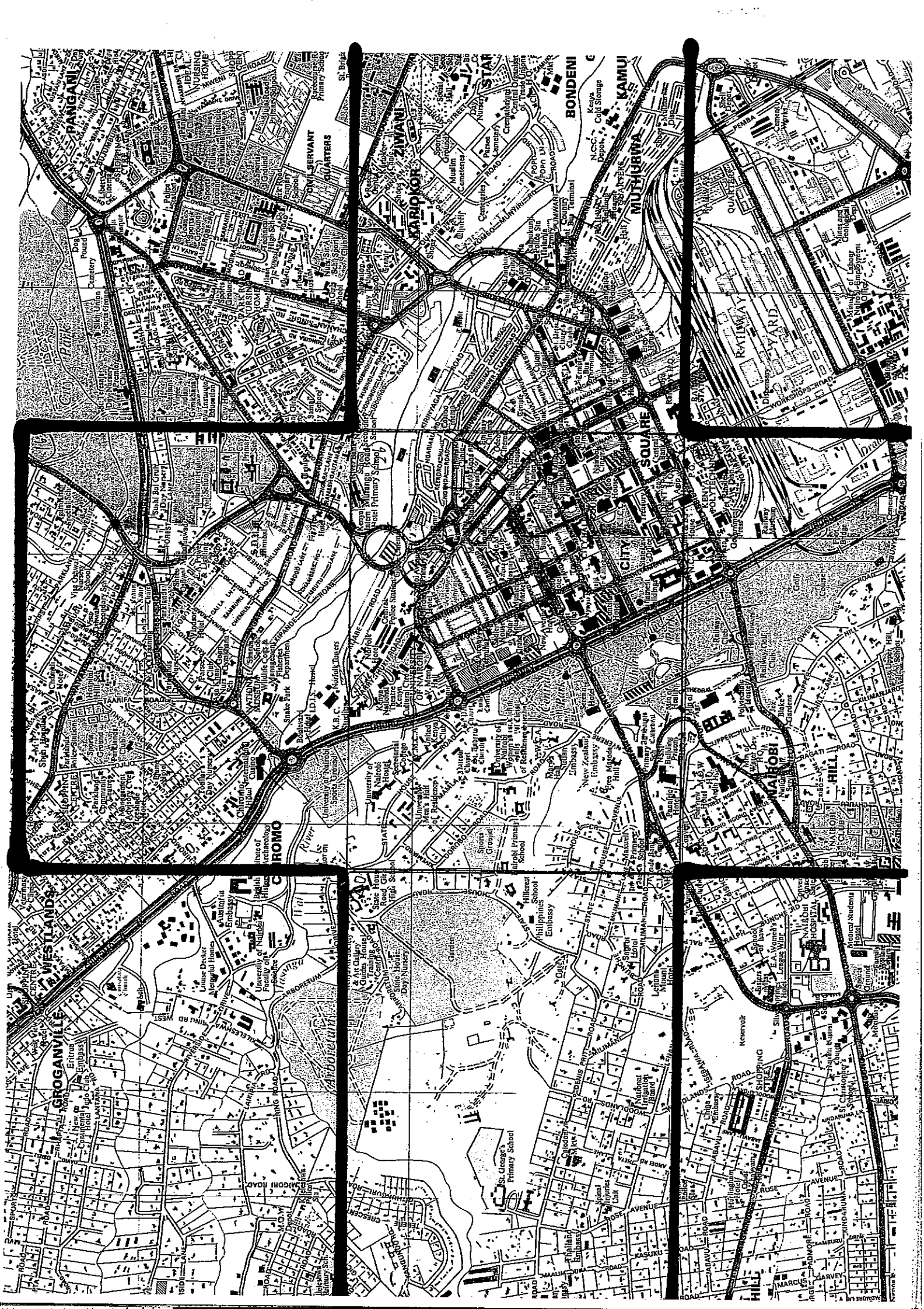
### **Chapter 3    Work Schedule**

The verification study of water supply and sewage facilities shall be completed by February 10, 2004.

### **Chapter 4    Final Results and Products to be Delivered**

The Contractor shall deliver the following final results and products to the JICA Study Team.

- |                                                          |       |
|----------------------------------------------------------|-------|
| 1. Verified management maps:                             | 1 set |
| 2. Arranged management maps for water supply facilities: | 1 set |
| 3. Arranged management maps for sewage facilities:       | 1 set |



**ATTACHED DOCUMENT 1**



Date	Meeting	Name	Department	Division	Title	Contact Info	
February 5, 2003	NCC committee meeting	P.M. Kibinda	City Planning		D		NCC technical team
		Rose K. Muema	City Planning	Development Control	AD	0722-774346 rkmuema@yahoo.com	NCC technical team
		Job Kagungo	City Planning	Land Survey		jkagungo@yahoo.com	NCC technical team
		Mukungi I'm	Town clerk	Land Valuation & rating			NCC technical team
		Philip Magaga Omunga	Town clerk	Land Valuation & rating			NCC technical team
		Cecilia Wamutitu	Housing Development				NCC technical team
		J.M. Kamwai	Water & Sewerage			0722-516025	NCC technical team
		Eng. S.K. Mburu	City Engineer			224281 ext2331 mburusk@wananchi.com	NCC technical team
		Mary Gachocho	City Planning				NCC technical team
	City Planning interview	Oyato	City Planning	Land Survey	manager	0722-331095	
		Patrick T. Odongo	City Planning		DD		
	Valuation interview	Mukungi I'm	Town clerk	Land Valuation & rating			NCC technical team
		Philip Magaga Omunda	Town clerk	Land Valuation & rating			NCC technical team
February 6, 2003	SOK meeting	P.M. GOTA	Computer Assisted Mapping		land Surveyor	0722-643381 gotapm@yahoo.com	
		F.K.N Masaku	Geodetic	SUPT			
		J. Nanzala	CAMP		survey tech		
		F.M. Menge			cartographer		
		R.M. MERUGU?	Ares	Ag,Ag			
		P.Gitimu	Mapping	Ag,Ag			
		E.O. GAYA	CAMP				
		D. Njuin			Principal Photogrammetrist		
		R.M. Kavulya	Geodetic				
		D.W. Mwangi	Geodetic				
		J.K. Rotich	Geodetic				
	NCC meeting	J.N. ILARMICI	Social Services&Housing				
		L.P. OKOTH	MOH		C	Ext 2387	
		J.M. Kilenzo	MOH		AC	0722-394676	
		Margaret Thiongo	Education		AD	Ext2570 D221166 thiongo@today's.co.ke	
February 7, 2003	NCC meeting	John Muraya	City Treasurer's	Rates		0783-883949 0722-868357 Ext 2201/2205	
		Chris K. Alwayngi	City Treasurer's	Rates		0722-472396	
		Wilson K. Maritim	Environment			0721-216440	
		Christine O. Galeb	City Inspectorate			0722-754852	

Date	Meeting	Name	Department	Division	Title	Contact Info
	NCC City Treasurer/Rates	John Muraya	City Treasurer's	Rates		0733-883949 0722-868357 Ext 2201/2205
		Chris K. Alwayngi	City Treasurer's	Rates		0722-472396
	NCC Environment	Wilson K. Maritim	Environment			0721-216440
February 10, 2003	NCC Water & Sewerage	J.M. Kamwai	Water & Sewerage	Water		
		L.M. Mushyoka		Water	GM	210391
		Lucy Njambi	Water & Sewerage	Sewerage		0722-763221
	NCC City Engineer	S.K. Mburu	City Engineer	Deputy City Engineer		224281 ext2331 mburusk@wananchi.com
		A.T. Keno		Operations & Services		224281 ext2240
		F.N. Karanta		Structural		224281 ext2254
		G.N. Kamau		Operations & Services		224281 ext2285
		S.G. Mwangi		Engineering survey		22481 ext 2576
		S.M. Muthawa		Roads		ext2153
		G.M. Waima		Traffic Engineering		ext2172
		R.M. Muno		Estates & Development		ext2160
		S.M. Muthawa		Roads		ext2153
February 12, 2003	NCC City Inspectorate	Peter Kyalungu	City Inspectorate	Inspectorate & Prosecution	C	0722-705766
		Christine O. Galeb	City Inspectorate			0722-754852
	NCC MOH	Dr. Njange J.N	Medical Officer of Health		D	02-248316 02-210633(FAX)
		L.P. OKOTH	MOH		C	Ext 2387
		J.M. Kilonzo	MOH		AC	0722-394676
February 13, 2003	NCC City Engineer	G.M. Waima	City Engineer	Traffic Engineering		ext2172
		A.T. Keno		Operations & Services		224281 ext2240
		R.M. Muno		Estates & Development		ext2160
	NCC SS&H	Kariuki	Social Service & Housing		D	0722-825149
	NCC Education	J.O. Okumu	Education		D	0722-224996
		Margaret Thiongo	Education		AD	Ext2570 D221166 thiongo@todays.co.ke
February 14, 2003	NCC City Engineer	S.G. Mwangi		Engineering survey		22481 ext 2576
February 19, 2003	SOK & NCC Meeting	P.M. Kibinda	(NCC)City Planning		D	
						NCC technical team

Date	Meeting	Name	Department	Division	Title	Contact Info	SOK committee member
		C.N. Mbaria	(SOK)Geodetic & Computer		SAD		
February 21, 2003	NCC committee meeting	Rose K. Muema	City Planning	Development Control	AD	0722-774346	NCC technical team
		Job Kaguongo	City Planning	Land Survey		kaguongo@yahoo.com	NCC technical team
		Mary Gachocho	City Planning				NCC technical team
		Mukungi I'm	Town clerk	Land Valuation & rating			NCC technical team
		Philip Magaga Omunga	Town clerk	Land Valuation & rating			NCC technical team
		J.M. Kamwal	Water & Sewerage				NCC technical team
		Eng. S.K. Mburu	City Engineer			0722-516025	NCC technical team
		John Muraya	City Treasurer's	Rates		0733-883949	
				Rates		0722-868357	
		Chris K. Alwayngi	City Treasurer's	Rates		Ext 2201/2205	
						0722-472396	
February 25, 2003	NCC City Planning	Rose K. Muema	City Planning	Development Control	AD	0722-774346	NCC technical team
		?	City Planning	Forward Planning			
		?	City Planning	Deputy Director	DD		
		Keter K Willy	City Planning		planner	0722-881118	
						keterw@yahoo.com	
	NCC City Engineer	Eng. S.K. Mburu	City Engineering		DD	224281 ext2331	NCC technical team
						imburusk@wananchi.com	
	NCC Environment	Wilson K. Maritim	Environment			0721-216440	
	NCC City Inspectorate	Christine O. Caleb	City Inspectorate			0722-754852	NCC technical team
February 26, 2003	NCC Valuation	Mukungi I'm	Town clerk	Land Valuation & rating		pomunga@yahoo.com	NCC technical team
						pomunga@uonbi.ac.ke	
		Philip Magaga Omunga	Town clerk	Land Valuation & rating			NCC technical team
February 27, 2003	NCC SS&H	Kariuki	Social Service & Housing		D	0722-825149	
February 28, 2003	NCC Education	Margaret Thiongo	Education		AD	Ext2570 D221166	
						thiongo@todays.co.ke	
	NCC City Engineer	J.K. Mwangi	City Engineer	Traffic Engineering(transportation section)		indifakamande@yahoo.com	
	NCC Environment	W.K. Maritim	Environment			224281 ext2378	
						maritimwilson@yahoo.co	



**ATTACHED DOCUMENT 2**

No.	Classification	Gathering date	The name of material	The source	Remarks
1	Document	5th, Feb	Subdivision Comment Sheet	NCC, City Planning, Development Control Div.	A4 5P
2	Document	5th, Feb	Application For Development Control	NCC, City Planning, Building Survey Div.	A4 2P
3	Document	5th, Feb	Submitted Plans Comment Sheet	NCC, City Planning, Development Control Div.	A4 1P
4	Booklet	6th, Feb	Information Brochure 2002 Edition	NCC, Education	
5	Booklet	7th, Feb	Save the Nairobi Rivers (Project Summary by UNEP)	NCC, Environment	
6	Map	10th, Feb	Digital Mapping of Nairobi showing the Clean Water Supply Network	NCC, Water & Sewerage, Project Implementation Div.	A1 1sheet
7	Excel file	10th, Feb	Road Surface Condition	NCC, City Engineer, Roads Div.	NRROADS-0.xlw
8	Document	11th, Feb	Description of Department's Work	NCC, Housing Development	A4 3P
9	Document	12th, Feb	Names of Divisions and Sections at City Inspectorate	NCC, City Inspectorate	A4 1P
10	Map	13th, Feb	Layout of Traffic Signals and One Way Road.	NCC, City Engineer, Operation & Services	A4 1P
11	Map	13th, Feb	Proposed Traffic Signals Junctions Layout Plan and Interjunction Cab	NCC, City Engineer, Traffic Management & Transportat	A2 1sheet 1:1,500
12	Map	13th, Feb	Central Area Off-Street Car Parks and One Way Traffic Systems	NCC, City Engineer, Traffic Management & Transportat	A0 1sheet 1:2,500
13	Document	13th, Feb	Daily Work Order Performance Record	NCC, City Engineer, Structuring	A4 1P
14	Document	25th, Feb	Accident Data	NCC, City Engineer	A4 1P print out (original in Excel file)
15	Document	27th, Feb	Description of Department's Work	NCC, Social Services & Housing	A4 27P
16	Document	28th, Feb	The Impact of Additional Pupil Enrolment of Facilities	NCC, Education	A4 12P
17	Document	28th, Feb	List of Schools per Division and Their Telephone Numbers	NCC, Education	A4 8P
18	Document	28th, Feb	List of Premises Collection in CBD	NCC, Education	A4 1P
19	Excel file	28th, Feb	Road Inventory	NCC, Environment	A4 1P
20	Map	28th, Feb	Valuation Map	NCC, City Engineer	A4 2P print out & file
21	Map	28th, Feb	Kenya Parliamentary Constituencies Map	NCC, Town Clerk, Valuation	A14sheet 1:1,250
22	Map	28th, Feb	Parliamentary Constituency Nairobi Area	SOK, Mapping	A0 1sheet 1:1,000,000
23	Map	28th, Feb	Kenya Route Map	SOK, Mapping	A1 1sheet 1:50,000
24	Map	3th, Mar	Zoning Map	SOK, Mapping	A1 1sheet 1:1,000,000
25	Map	3th, Mar	Building Plan Map (Based on Topo Cadastral Map by SOK)	NCC, City Planning, Forward Planning	A0 1sheet 1:33,330
26	Map	3th, Mar	Nairobi Water Supply Distribution System	NCC, City Planning	A0 2sheet 1:2,500
27	Document	3th, Mar	Health Facilities Under Nairobi Health Management Board	NCC, Water & Sewerage	A1 1sheet 1:2,500
28	Document	3th, Mar	List of Heal Center, Dispensaries & Clinics	NCC, MOH	A4 2P
29	Document	3th, Mar	A Policy on "Rezoning Strategy" for Year 2000 - CBD	NCC, MOH	A4 3P
30	Document	3th, Mar	Plot Ratios and Plot Coverages in Nairobi City	NCC, City Planning	A4 12P
				NCC, City Planning	A4 6P

**ATTACHED DOCUMENT 3**

# EDUCATION

## THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA

Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

[1] What is your division's main task? What kind of service / information do you provide?

<Main task> To provide and promote quality basic Education for all children from Nursery to Primary level. Our main task is Education Service Delivery		
For citizens	For other divisions at the City Council	For the government
Office counter work	Provide xx to OO div.	Annual/project reporting
Via TEL / FAX / Internet	Collaborating on projects with other div/dept.	Deliver local information (township level) petition
City Education Department	Liase with other depts such as water Planning + Development City Engineer and Environment for school sites.	Collaborating on projects with government Collaborate with Ministry of Education for Quality Improvement and policy implementation

[2] Current uses of topographic maps

<u>Current state of establishment / uses of topographic maps &amp; topographic database</u> We have no topographic maps. hence we do not use them.
<u>Potential needs / problems of using topographic maps</u> We need topographic maps for planning purposes especially for <del>school</del> mapping.
<u>Current state of exchanging topographic information and maps with other divisions / future interavailability of topographic info &amp; maps</u> It would be very useful and would <del>increase</del> minimise delays and logistical problems associated with lack of data.

[3] Current uses of paper-based information and digital database

<u>Current state of establishment / uses of paper-based information and digital database</u> Data is all in the files. We use files. Problem of updating data. due to retrieval difficulties/storage problems.
<u>Potential needs / problems of using paper-based information and digital database</u> Need to computerise all information to ensure smooth operations. in the entire organisation.
<u>Current state of exchanging paper-based information and digital database with other divisions / future interavailability</u> Very slow, <del>unreliable</del> inaccurate and subject to interference on transit. Departments operate as individual units yet they should be networked for effectiveness and efficiency.



[4] Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
Education Dept. is responsible for Educational Services, for children and young adults. (NFE). It has to liaise with other departments for other services like water, <del>facilities</del> <sup>facilities</sup> and building.	
Other departments' roles in the Nairobi City Council	
City Engineering Dept.	Public Health Dept.
City Planning Dept.	Housing & Development
Water & Sewerage Dept.	City Education Dept. - Division of Education
Dept. of Environment	City Inspection Dept.
Social Service & Housing Dept.	City Library Service
City Treasure Dept.	
Your opinion on necessary collaboration with other departments and divisions	
✓ Nairobi City Council's ten departments should operate as one whole organization since none of them can survive without the other.	

[5] Key matters and challenges in your dept. / Future plans (incl. organizational computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt; Provision of Educational facilities (Additional) to accommodate the additional number of children admitted through the free Primary Education.</p> <p>&lt;long term&gt; Planning for future growth and expansion of facilities.</p> <p>• School mapping</p>	<p>Priority</p> <p>1 ✓</p> <p>3</p> <p>4</p> <p>2 ✓</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>• Computerization plan ✓ immediate</li> <li>• Cooperation with NSDI - Very necessary</li> </ul>	

[6] Key matters and challenges in the City Council / Future plans (incl. computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt; - ✓ Improvement of Management Systems, Improvement of Service Delivery.</p> <p>&lt;long term&gt; - Sustained growth and effective service provision to Nairobians.</p>	<p>Priority</p> <p>1 ✓</p> <p>3</p> <p>4</p> <p>2 ✓</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>• Computerization plan ✓ immediate</li> <li>• Cooperation with NSDI - very necessary, and essential.</li> </ul>	

[7] Understanding and use of GIS

Do you use GIS for work now?

NO

YES

Q1 : Are you interested in using GIS for your work?

YES.

Q2 : Do you have already have any plan to use GIS?

YES.

Q3 : Do you have any specific GIS software you want to use?

Not quite familiar  
with any.

Q4: How do you think the outputs of this Study will benefit your work?

It will ~~also~~ help us  
improve efficiency in  
work outputs.

Q1 : What kind of tasks do you use GIS for?

Q2 : Do you have any GIS-related plans in the near future?

Q3 : What kind of GIS database have you established for your work?

Q4 : Which GIS software do you use? (type, extensions, # of licenses)

Q5 : Are there any GIS applications that you may want to try in future? For that, what kind of database do you think necessary?

Q6 : Do you have any specific GIS software you want to use?

Q7 : How do you think the outputs of this Study will benefit your work?

CITY EDUCATION OFFICE  
P. O. Box 30288

18 FEB 200

GARRON KIRWA

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA**

Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

[1] What is your division's main task? What kind of service / information do you provide?

**HOUSING, SOCIAL SERVICES**

<Main task>		
<b>RENTAL HOUSING, SOCIAL WELFARE &amp; TRADING SERVICES.</b>		
For citizens	For other divisions at the City Council	For the government
Office counter work <b>YES</b>	Provide xx to oo div.	Annual/project reporting
Via TEL / FAX / Internet	Collaborating on projects with other div./dept.	Deliver local information (township level)
<b>TELEPHONE</b>	<b>YES</b>	petition
		Collaborating on projects with government

[2] Current uses of topographic maps **N/A**

<u>Current state of establishment / uses of topographic maps &amp; topographic database</u>
<b>NONE</b>
<u>Potential needs / problems of using topographic maps</u>
<b>YES. SITUATION LOCATION OF THE EXISTING PHYSICAL ESTABLISHMENT - HOUSES, MARKET SOCIAL HALL</b>
<u>Current state of exchanging topographic information and maps with other divisions / future interavailability of topographic info &amp; maps</u>
<b>NONE</b>

[3] Current uses of paper-based information and digital database **YES**

<u>Current state of establishment / uses of paper-based information and digital database</u>
<b>YES.</b>
<u>Potential needs / problems of using paper-based information and digital database</u>
<b>COMPUTERISE</b>
<u>Current state of exchanging paper-based information and digital database with other divisions / future interavailability</u>
<b>YES.</b>

[4] Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
The Department is charged with the Management of rental Housing, Markets, Social Halls	
Other departments' roles in the Nairobi City Council	
City Engineering Dept.	Public Health Dept.
City Planning Dept.	Housing & Development
Water & Sewerage Dept.	City Education Dept.
Dept. of Environment	City Inspection Dept.
Social Service & Housing Dept.	City Library Service
City Treasure Dept.	
SEVERAL COLLABORATION WITH OTHER DEPTT.	
Your opinion on necessary collaboration with other departments and divisions	
SHOULD BE INITIATED.	

[5] Key matters and challenges in your dept. / Future plans (incl. organizational computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt;</p> <p>&lt;long term&gt;</p>	<p>Priority</p> <p>1 ✓</p> <p>3</p> <p>4</p> <p>2 ✓</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>• Computerization plan ✓</li> <li>• Cooperation with NSDI</li> </ul>	

[6] Key matters and challenges in the City Council / Future plans (incl. computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt;</p> <p>&lt;long term&gt;</p>	<p>Priority</p> <p>1 ✓</p> <p>3</p> <p>4</p> <p>2</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>• Computerization plan ✓</li> <li>• Cooperation with NSDI</li> </ul>	

[7] Understanding and use of GIS

Do you use GIS for work now?

NO

YES

Q1 : Are you interested in using GIS for your work?

Q2 : Do you have already have any plan to use GIS?

Q3 : Do you have any specific GIS software you want to use?

Q4 : How do you think the outputs of this Study will benefit your work?

Q1 : What kind of tasks do you use GIS for?

Q2 : Do you have any GIS-related plans in the near future?

Q3 : What kind of GIS database have you established for your work?

Q4 : Which GIS software do you use? (type, extensions, # of licenses)

Q5 : Are there any GIS applications that you may want to try in future? For that, what kind of database do you think necessary?

Q6 : Do you have any specific GIS software you want to use?

Q7 : How do you think the outputs of this Study will benefit your work?

*Mamun*  
ASST. DIRECTOR (N)  
NAIPDI CITY COUNCIL  
DATE: 19/02/2022

# PUBLIC HEALTH DEPARTMENT

## THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA

### Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

[1] What is your division's main task? What kind of service / information do you provide? (APT)

<Main task> 1. PROMOTE HEALTH 2. PREVENT DISEASES 3. IMPROVE HUMAN LIFE.		
For citizens	For other divisions at the City Council	For the government
Office counter work	Provide xx to oo div.	Annual/project reporting
Via TEL / FAX / Internet	Collaborating on projects with other div./dept.	Deliver local information (township level)
PROVIDE CURATIVE PROMOTIVE AND PREVENTIVE HEALTH SERVICES TO CITIZENS.	COLLABORATE WITH OTHER DEPARTMENTS IN PROVISION OF SERVICES	petition Collaborating on projects with government WE ARE MANDATED TO PROVIDE HEALTH SERVICES ON BEHALF OF GOVERNMENT.

[2] Current uses of topographic maps

<u>Current state of establishment / uses of topographic maps &amp; topographic database</u> ✓ OLD TOPOGRAPHIC MAPS ARE AVAILABLE AND DILAPIDATED WITH INADEQUATE INFORMATION.
<u>Potential needs / problems of using topographic maps</u> ✓ WE NEED UPDATED MODERN TOPOGRAPHIC MAPS. TOPOGRAPHIC MAPS ARE NOT USUALLY LEGIBLE AND HENCE LEADING TO USE OF MAGNIFYING GLASSES.
<u>Current state of exchanging topographic information and maps with other divisions / future interavailability of topographic info &amp; maps</u> ✓ INADEQUATE AND INTERDEPARTMENTAL EXCHANGE IS LACKING. NEED FOR FUTURE INTERAVAILABILITY OF TOPOGRAPHIC MAPS.

[3] Current uses of paper-based information and digital database

<u>Current state of establishment / uses of paper-based information and digital database</u> ✓ AVAILABLE BUT WITHIN INDIVIDUAL DEPARTMENTS
<u>Potential needs / problems of using paper-based information and digital database</u> REQUIRE STORAGE SPACE. LARGE VOLUMES OF PAPERWORK IS USED WHICH IS LIKELY TO BE TORN & DISFIGURED, HENCE INFORMATION IS INCOMPLETE.
<u>Current state of exchanging paper-based information and digital database with other divisions / future interavailability</u> ✓ IT IS LACKING

[4] Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
CO-ORDINATE WITH OTHER DEPARTMENTS WHEN IMPLIMENTING HEALTH SERVICES PROGRAMMES.	
Other departments' roles in the Nairobi City Council	
City Engineering Dept.	Public Health Dept.
City Planning Dept.	Housing & Development
Water & Sewerage Dept.	City Education Dept.
Dept. of Environment	City Inspection Dept.
Social Service & Housing Dept.	City Library Service
City Treasure Dept.	
Your opinion on necessary collaboration with other departments and divisions	
THE EXISTING RELATIONSHIP IS UNSATISFACTORY. THERE IS NEED TO ENCOURAGE INTERDEPARTMENTAL CO-OPERATION	

[5] Key matters and challenges in your dept. / Future plans (incl. organizational computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt; OBTAIN GIS MAPS &amp; COMMENTS</p> <p>&lt;long term&gt; OBTAIN MANPOWER. ACQUIRE MODERN EQUIPMENT AND SPACE.</p>	<p>① INADEQUATE DATA COLLECTION</p> <p>② INADEQUATE DATA ANALYSIS</p> <p>③ LACK OF DATA STORAGE FACILITIES.</p> <p>④ INADEQUATE DATA RETRIEVAL</p>	<p>Priority</p> <p>1</p> <p>3</p> <p>4</p> <p>2</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>Computerization plan</li> <li>Cooperation with NSDI</li> </ul>	<p>PROVISION OF BUDGETARY ALLOCATION</p>	

\* [6] Key matters and challenges in the City Council / Future plans (incl. computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt;</p> <p>&lt;long term&gt;</p>	<p>1. DATA COLLECTION</p> <p>2. DATA ANALYSIS</p> <p>3. DATA STORAGE</p> <p>4. INADEQUATE DATA RETRIEVAL</p>	<p>Priority</p> <p>1</p> <p>3</p> <p>4</p> <p>2</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>Computerization plan</li> <li>Cooperation with NSDI</li> </ul>		

[7] Understanding and use of GIS

Do you use GIS for work now?

NO

YES

Q1 : Are you interested in using GIS for your work?

Q2 : Do you have already have any plan to use GIS?

Q3 : Do you have any specific GIS software you want to use?

Q4 : How do you think the outputs of this Study will benefit your work?

Q1 : What kind of tasks do you use GIS for?

Q2 : Do you have any GIS-related plans in the near future?

Q3 : What kind of GIS database have you established for your work?

Q4 : Which GIS software do you use? (type, extensions, # of licenses)

Q5 : Are there any GIS applications that you may want to try in future? For that, what kind of database do you think necessary?

Q6 : Do you have any specific GIS software you want to use?

Q7 : How do you think the outputs of this Study will benefit your work?



THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA

2/12  
#0

Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

[1] What is your division's main task? What kind of service / information do you provide?

<Main task> ENFORCEMENT OF ALL NAIROBI CITY COUNCIL BY-LAWS AND OTHER LAWS RELATED TO COUNCIL OPERATIONS.		
For citizens	For other divisions at the City Council	For the government
Office counter work	Provide XX to OO div.	Annual/project reporting
Via TEL / FAX / Internet	Collaborating on projects with other div./dept.	Deliver local information (township level)
SERVICE PROVISION TO THE PUBLIC	SERVICE PROVISION TO OTHER DEPARTMENTS.	petition
- CIVIC EDUCATION ON MAINTAINANCE OF LAW AND ORDER.		Collaborating on projects with government
		CO-OPERATES WITH OTHER LAW ENFORCEMENT ARMS OF THE GOVERNMENT TO MAINTAIN PEACE AND ORDER.

[2] Current uses of topographic maps

Current state of establishment / uses of topographic maps & topographic database

- Identification of specific areas for the purposes of law-enforcement.
- Identification of po area population densities.
- Identification of crime-prone areas.

Potential needs / problems of using topographic maps

- Lack of trained personnel to use topographic maps.

Current state of exchanging topographic information and maps with other divisions / future interavailability of topographic info & maps

[3] Current uses of paper-based information and digital database

Current state of establishment / uses of paper-based information and digital database

The department only uses paper-based information.

Potential needs / problems of using paper-based information and digital database


- Paper-based information - are cumbersome to refer to.
- Occupies very big spaces in storage.
- Can easily be damaged.

Current state of exchanging paper-based information and digital database with other divisions / future interavailability


[4] Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
→ Inspectorate department is the link between all other departments of the Council on enforcement matters.	
Other departments' roles in the Nairobi City Council	
City Engineering Dept.	Public Health Dept.
City Planning Dept.	Housing & Development
Water & Sewerage Dept.	City Education Dept.
Dept. of Environment	City Inspection Dept. Enforcement
Social Service & Housing Dept.	City Library Service
City Treasure Dept.	
Your opinion on necessary collaboration with other departments and divisions	
→ There is need to enhance, our inter-departmental communication systems to avoid duplication of work/roles.	

[5] Key matters and challenges in your dept. / Future plans (incl. organizational computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt; Capacity building on IT and G.I.S. Technical support in establishment of G.I.S systems.</p> <p>&lt;long term&gt; A department that is fully computerized, with upto date G.I. Systems.</p>		<p>Priority</p> <p>1</p> <p>3</p> <p>4</p> <p>2</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>• Computerization plan ✓</li> <li>• Cooperation with NSDI</li> </ul>		

[6] Key matters and challenges in the City Council / Future plans (incl. computerization plan)

<p>Key matters and challenges</p> <p>&lt;short term&gt; AS IN S.</p> <p>&lt;long term&gt;</p>		<p>Priority</p> <p>1</p> <p>3</p> <p>4</p> <p>2</p> <p>5</p>
<p>Future plans</p> <ul style="list-style-type: none"> <li>• Computerization plan</li> <li>• Cooperation with NSDI</li> </ul>		

[7] Understanding and use of GIS

Do you use GIS for work now?

NO

YES

Q1 : Are you interested in using GIS for your work?

YES

Q2 : Do you have already have any plan to use GIS?

- NOT YET

Q3 : Do you have any specific GIS software you want to use?

NO.

Q4 : How do you think the outputs of this Study will benefit your work?

- It will make our work easier.  
by - Making it possible to track the movement of our officers and vehicles in the field.  
- We shall also be able to identify specific areas of operations easily.

Q1 : What kind of tasks do you use GIS for?

Q2 : Do you have any GIS-related plans in the near future?

Q3 : What kind of GIS database have you established for your work?

Q4 : Which GIS software do you use? (type, extensions, # of licenses)

Q5 : Are there any GIS applications that you may want to try in future? For that, what kind of database do you think necessary?

Q6 : Do you have any specific GIS software you want to use?

Q7 : How do you think the outputs of this Study will benefit your work?

CITY COUNCIL OF NAIROBI

CITY ENGINEERS' DEPARTMENT

AVAILABLE DATA

- ✓1. Registry Index Maps for Dagoretti of 1990
- ✓2. Structure Plans for Karen, Hill Area and Lower Kilimani.
- ✓3. Privately Developed Road Schemes. Plans available.
4. Other Reports - H.P Gauff Drainage Inception Report – 1986
  - Wilbur Smith Report – Maintenance Policy Document
  - Post Buckley Report
  - Transurb Report – Proposed Transport Policy document for the City of Nairobi

予備的な  
PRELIMINARY REQUIREMENTS

- ✓ 1. Spatial Data – Plots, land reference numbers, Road Reserves, Riparian wayleaves, contours etc.
- ✓ 2. Road information – Type, condition, length, width, type of surface last rehabilitation/maintenance with costs etc. (*Register of Road*).
3. Riparian and drainage way leaves - Indicate – highest water mark
  - 川沿の 許可 - Tying up of the wayleaves and those proposed.
  - Developments on flood plains and natural water courses outfall drains
- ✓ 4. Structure plans – update and mapping
  - Indicate that road surrenders provided and proposed
5. Services wayleaves – indicate existing and proposed
  - Other services – Postal mailbox and Telephone booths, Power turrets, Drainage infrastructure (high capacity)
  - Telephone/Power – indicate services/ Wayleaves whether aerial or underground (classified).
- ✓ 6. Types of developments – Estates indicating the type of housing.
- ✓ 7. Water and sewer lines.
- ✓ 8. Property details including services – Rates, water, Power, Telephone and others.
- ✓ 9. Natural features, tree cover.
- ✓ 10. Type of activity taking place in the locality.
- ✓ 11. Geotechnical data.
12. Water bodies and areas that cannot be drained.
- ✓ 13. Natural earth drains.
- ✓ 14. Street lighting infrastructure.
- ✓ 15. Fire fighting installation and requirements.

15<sup>th</sup> February 2003

**CITY ENGINEERS DEPARTMENT**

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA  
FRAMEWORK FOR THE CITY OF NAIROBI IN THE REPUBLIC OF  
KENYA**

Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

- (1) What is your division's main task? What kind of service/information do you provide?

<b>&lt;Main task&gt; Infrastructure (Especially roads, drains, street lights, etc.) Development, Management and Maintenance</b>		
<b>For Citizens</b>	<b>For other divisions at the City Council</b>	<b>For the government</b>
Office counter work	Provide XX to OO div.	Annual/project reporting
Via TEL/FAX/Internet	Collaborating on project with other div./dept.	Deliver local information (township level 0 petition
		Collaborating on projects with government

- (2) Current use of topographic maps. We have six sheets for part of Nairobi printed in 1976 thus the information they have is not up to date, but could be used in infrastructure development and management. Scale 1:10,000 ✓

Current state of establishment/uses of topographic maps & topographic database
<b>With only 6 sheets covering part of Nairobi instead of 10 sheets the current use is Limited.</b>
Potential needs/problems of using topographic maps
<b>Nairobi being a major commercial and industrial centre and continuing to grow, up to Date topographic maps for planning infrastructure are required for planning purposes</b>
Current state of exchange of topographic information and maps with other divisions/future interavailability of topographic info & maps
<b>There is little exchange with other service providers (e.g. from Power and Lighting Co., Telekom, Water and Sewerage Department (NCC)) but much more is necessary.</b>

**CITY ENGINEERS DEPARTMENT**

- (3) Current uses of paper-based information and digital database  
**Road planning, design, construction, development, maintenance, streetlighting activities and other utilities e.g. Storm water drains, sewers**

Current state of establishment/uses of paper-based information and digital database
<b>All works done on paper based currently</b>
Potential needs/problems of using paper-based information and digital database
<b>Paper-based information is bulky and it is not easy to add more information like digital data. Paper based information useful in project evolution and implementation</b>
Current state of exchange paper-based information and digital database with other divisions/future Interavailability
<b>Exchange is limited</b>

- (4) Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
<b>There is limited cooperation between Planning, Water &amp; Sewerage Departments</b>	
Other department's roles in the Nairobi City Council	
City Engineering department	Public Health Department
City Planning	Housing & Development
<b>Department Land use planning</b>	
Water & Sewerage Department	City Education Department
<b>Water collection and distribution; Sewerage disposal</b>	
Department of Environment	City Inspection Department
Social Services & Housing Department	City Treasurer's Department
City Library Services	
Your opinion on necessary collaboration with other departments and divisions	
<b>With digital data in a central place collaboration with other departments will be enhanced thus enabling making of informed and consultative decisions on current and future developments.</b>	

**CITY ENGINEERS DEPARTMENT**

(5) Key matters and challenges in your department/future plans (incl. Organizational computerization plan)

Key matters and challenges	Priority
<short term>	1
<b>It is not possible to monitor all developments Affecting infrastructure in the department (Priority 1)</b>	3
	4
	2
	5
<long term>	
<b>Planning the needs for growing and dynamic population (Priority 2)</b>	

Future plans
◆ Computerisation plan – <b>Training and transfer of technology is required</b>
◆ Co-operation with NSDI – <b>Necessary</b> /

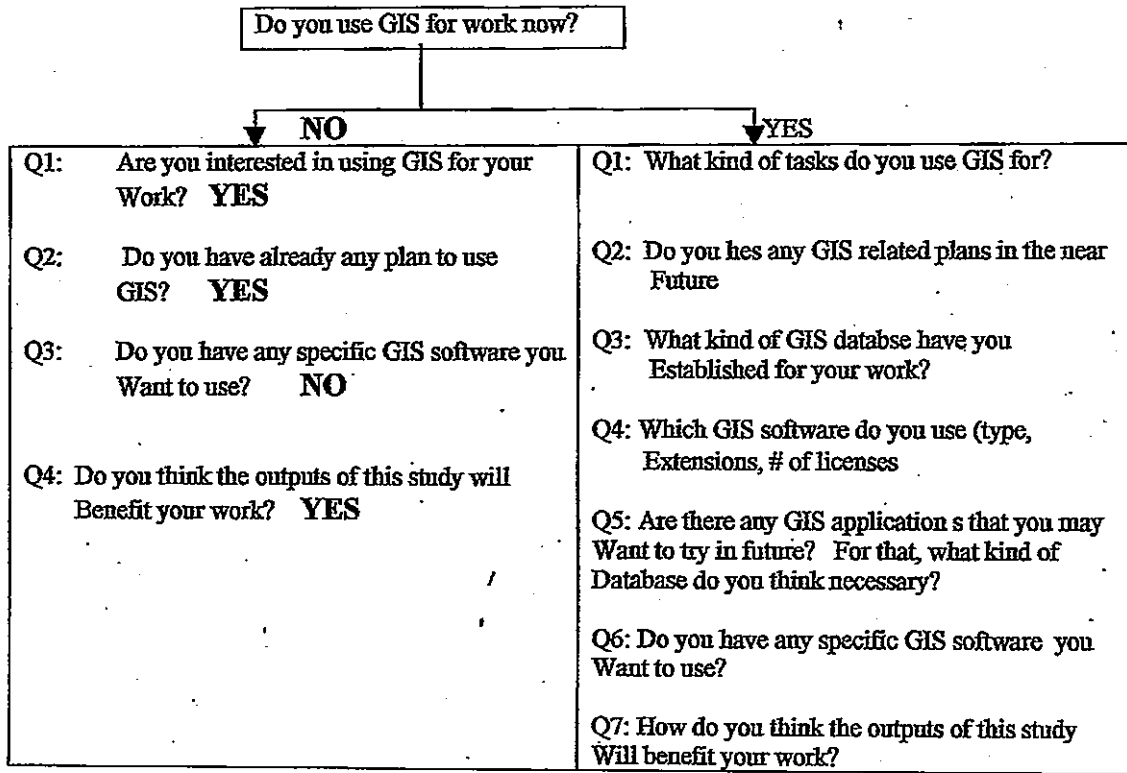
(6) Key matters and challenges in the City Council/Future plans (incl. Computerization plan)

Key matters and challenges	Priority
<short term>	1
<b>Co-ordination of developments affecting Various departments (Priority 1)</b>	3
	4
	2
	5
<long term>	
<b>Computerisation should involve all service and user departments (Priority 2)</b>	

Future plans
◆ Computerization plan – <b>Updating data for decision making (Priority 1)</b>
◆ Co-operation with NSDI – <b>Necessary</b>

**CITY ENGINEERS DEPARTMENT**

(7) Understanding and use of GIS





# Water & Sewerage

## THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA

Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

[1] What is your division's main task? What kind of service / information do you provide?

<Main task> <b>PLANNING, DESIGN, DEVELOPMENT &amp; MAINTENANCE OF WATER SUPPLY &amp; SEWERAGE SYSTEMS</b>		
For citizens	For other divisions at the City Council	For the government
Office counter work	Provide xx to OO div.	Annual/project reporting
Via TEL / FAX / Internet	Collaborating on projects with other div/dept.	Deliver local information (township level)
VIA TEL & Direct Contact at Council		petition
		Collaborating on projects with government
		On Annual Budgets & foreign funded projects thro' Min. of Local Govt.

[2] Current uses of topographic maps

- (i) Choice of suitable location of water mains & sewerage systems
- (ii) location of properties for Billing

Current state of establishment / uses of topographic maps & topographic database

✓ Available database is in hard copies held in cabinets for reference. No Digital Database

Potential needs / problems of using topographic maps

✓ access, updating and prevention of unauthorised access of the same & also reliable storage.

Current state of exchanging topographic information and maps with other divisions / future interavailability of topographic info & maps

The Dept of water relies heavily on planning section, Survey of Kenya and inhouse updated topo. maps.

[3] Current uses of paper-based information and digital database

**Design of Water & Sewerage Systems - their location on maps.**

Current state of establishment / uses of paper-based information and digital database

There exists a hard copy database in steel cabinets but digital database is not yet fully developed, inspite of an effort in 1987

Potential needs / problems of using paper-based information and digital database

Paper based topographical data before digitising the same. Digitised Database can often be used for OR of water & sewerage systems.

Current state of exchanging paper-based information and digital database with other divisions / future interavailability

Proposed development is circulated in hard copies for approval by other departments before implementation. No digital database is available for sharing

[4] Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
Water Departments designs water reticulation systems to suit proposed Estates & physical planning submitted to it from Planning Dept.	
Other departments' roles in the Nairobi City Council	
City Engineering Dept.	Public Health Dept.
City Planning Dept.	Housing & Development
Water & Sewerage Dept.	City Education Dept.
Dept. of Environment	City Inspection Dept.
Social Service & Housing Dept.	City Library Service
City Treasure Dept.	Town clerk's Dept.
Your opinion on necessary collaboration with other departments and divisions	
Proposals by other departments should be circulated for comments by each Division before implementation	

[5] Key matters and challenges in your dept. / Future plans (incl. organizational computerization plan)

Key matters and challenges	(i) Improvement of performance of existing systems (Optimization of system) (ii) Leakage control (iii) Improvement of billing system (iv) Technical manpower development (v) digital mapping	Priority 1 (iii) 3 (ii) 4 (i) 2 (iv) 5 (v)
<short term> <long term>		
Future plans	• Computerization plan Emphasis is on accurate Billing system • Cooperation with NSDI	

[6] Key matters and challenges in the City Council / Future plans (incl. computerization plan)

Key matters and challenges	(i) capturing information on all its customers eg all property details (ii) digitization of all topographic data (iii) coordination of all physical development proposals (iv) prompt accurate billing system	Priority 1 (i) 3 (ii) 4 (iii) 2 (iv) 5
<short term> <long term>		
Future plans	• Computerization plan (i) Topographic base maps • Cooperation with NSDI (ii) Creation of accurate customer database (iii) monthly accurate billing • long term - Easily accessible & interchangeable database	

[7] Understanding and use of GIS

Do you use GIS for work now?

NO

YES

Q1 : Are you interested in using GIS for your work?

YES

Q2 : Do you have already have any plan to use GIS?

YES. It is suggested that once the customer information is captured in computers, proper billing can be done. expansion of existing systems can also be improved.

Q3 : Do you have any specific GIS software you want to use?

No preference yet. Study is expected to recommend a suitable GIS system.

Q4 : How do you think the outputs of this Study will benefit your work?

(i) The study may enhance billing system if base maps are properly digitised

(ii) Expansion of existing systems & maintenance of the same will also be improved by GIS.

Q1 : What kind of tasks do you use GIS for?

Q2 : Do you have any GIS-related plans in the near future?

Q3 : What kind of GIS database have you established for your work?

Q4 : Which GIS software do you use? (type, extensions, # of licenses)

Q5 : Are there any GIS applications that you may want to try in future? For that, what kind of database do you think necessary?

Q6 : Do you have any specific GIS software you want to use?

Q7 : How do you think the outputs of this Study will benefit your work?

## DEPARTMENT OF ENVIRONMENT (DOE)

### 1. Main Task

The Department of Environment is mandated with the responsibility of Local Environmental Planning and Management that covers land, air and water. Services rendered include:-

- Solid Waste Management
- Parks and Open Spaces Management
- Environmental Monitoring
- Enforcement of Environmental Legislation

Information/data provided:-

- Solid waste generation rates
- Consultancy/training on plant nurseries and beautification services
- Categories of solid waste and composition
- Standards for waste and effluent
- Air pollution standards
- Recycling and Composting activities

### 2. Current uses of topographic maps

Uses:-

Location of environmental land use e.g. open spaces

Other uses:-

Size of land, inventory of biodiversity are limited.

Problems of uses:-

- ✓▪ Capacity building issues
- ✓▪ Interpretation of environmental data
- ✓▪ Updating of the maps

Potential needs maps can be used in:-

Indicating forest/vegetation cover, landscaping development, siting of solid waste collection centres, location of dumping grounds, siting of landfill sites.

### 3. Current uses of paper based information and digital database

- Paper based information heavily used vis-a vis digital
- Problems of paper based information

- Storage capacity – cumbersome
  - Retrieval process difficult
  - Locating information
- Exchange of information using paper-based information in use -
    - Digital limited
    - Future inter availability – Networking desired

**4. Co-operation with other Departments**

- Department of Environment's role in the Council is mainly a service Department complimenting developments of other Departments – It has an initial consideration and the final touch of development planning and implementation in other Departments.
- **Opinion** - ✓ Require networking and information exchange with other Departments and divisions.

**5. Key matters and challenges - Department of Environment**

- Department's Organisational Structure to include IMS – 1<sup>st</sup> priority (ST)
- ✓ Capacity building on IT and GIS - 2<sup>nd</sup> priority (ST)
- Logistical and technical support in the establishment of GIS systems for Department of Environment (LT)

6. As in 5 above

7. (i) Yes (ii) Yes under NSDI (iii) To develop  
 (iv) Easier planning and management

*networking + information sharing.*

*mainly this project*

## CHAPTER 4 ORGANIZATIONAL STUDY

### 4.1 General Summary Of The Rates System

Rates System involves records of registered plots within the NCC jurisdiction. It involves billing of plots within the circumference of Githurai – Karen, Ruai-Kinoo, and Karura Forest – Kitengela. (註)

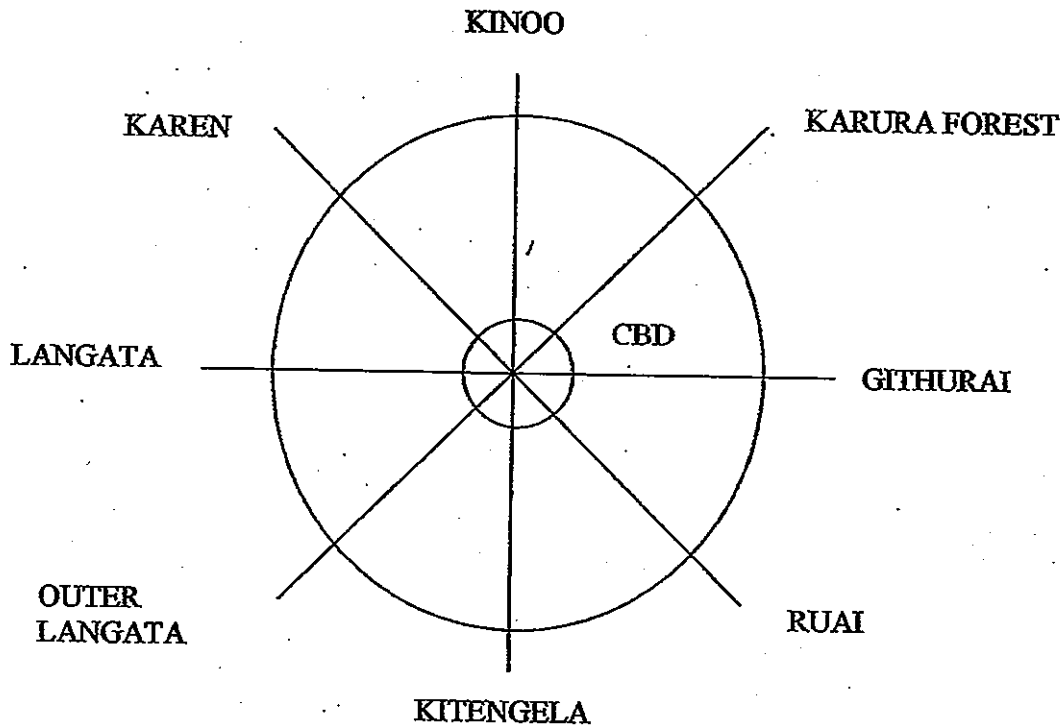


Figure 4.0 Extent of Rateable Land in Nairobi

借地・借家 自由不動産 所有権制の  
Most of the plots involved are leasehold, freehold and titled. These are further categorised into different classes:

- Residential
- Commercial
- Agricultural
- Industrial
- Farms
- Exempt

For record purposes the records are further divided into 9 zones, that is A-F, G, H-N, P-R, S, T-U, V-W and X. These zones are:

- A-F Town Centre
- G Outer Nairobi – Industrial Area
- H-N Milimani and Muthaiga
- P-R Eastleigh and Mathare Valley
- S Buruburu
- T-U Former Kiambu, Karura Forest and Runda
- V Kayole, Komorock, Mombasa Road
- W Karen and Langata
- X Further Kiambu, areas of Kangemi, Riruta, Dagoretti, Kikuyu, Kinoo, etc.

The rates are charged as approved by the minister on yearly basis. The rates are based on a certain percentage levied on undeveloped site value (U.S.V) for example:

YEAR	PERCENTAGE RATES
1992 -	5%
1993 -	7%
1994 -	9%
1995 -	9%
1996 -	12%
1997 -	13%
1998 to 2000 -	14%
2001 -	15%

However some classes for example residential and agricultural used to be given remissions up until 1998.

#### 4.1.1 Rates Cycle From Data Capture To Reports And Billing

### **Source Documents**

Mainly from valuation, S.V.R, memos, computer section through payroll deductions schedules. Cash office receipts, bank drafts.

Once land is bought, the transfer documents are supposed to be registered in the Lands Office for registration. These source documents outline the owner details, area in hectares or acres, the purchase price, the agreements, the location, etc.

### **Lands Office**

This is the authority for all land ownership. The registration of lands upon production of the source documents above registered the plot of land in the names and the particulars as to be found in the agreement; upon this the Commissioner of Lands issues a title deed which is also registered in his (registers) registry for future reference. Any changes to the title must be notified to the registrar for updating his files e.g. subdivision, sale transfer charge, new development amalgamation etc.

### **✓ Valuation**

Once a title is issued by the above office a document known as "Memorandum of Registration of Lands" is posted or sent to the local valuation offices e.g. City Council, Municipal Council, and Urban Council for information about the new environment to their existing records or change of ownership.

This memorandum gives details of

- (i) Purpose of document e.g. Transfer, New
- (ii) Date of document
- (iii) Transferor
- (iv) Transferee
- (v) Address
- (vi) LR, block or description
- (vii) Location
- (viii) Consideration e.g. price
- (ix) Term of lease



- (x) Annual rent
- (xi) Date due
- (xii) Presenter, delivered by
- (xiii) Date of presentation

The above document (commonly known as "Memorandum") helps the local valuation offices update their records or book plots of land for rating purposes. This valuation is done applying known formulas that are recognised by the valuation bodies.

### **Rates**

The Valuation office later compiles all the memoranda for one year and any other bookings and prepares a document or a roll commonly known as a supplementary valuation roll (S.V.R.). This roll details all the information in the Memorandum of Registration of Land and any other relevant data the rating offices may require for rating purposes e.g. class, year of booking, etc.

The rating department upon receipt of the Land Valuation Roll from the Valuation Office allocates the plots a computerised serial number for easy indexing and forwards the Serialized Manual Land Valuation Roll to the Computer Room for Data Entry.

### **Data Entry Room**

Since this data as at now is still in the manual stage, the roll is taken to the Computer Punch Room for electronic punching and batching. All the details in the roll are punched to create a file, which can be electronically accessed. Since all the details are already included in the roll by the rates office as pertains the site value, year of registration rates struck (percentage rate as approved by the Minister), the file now is complete and upon checking, and verification by the rates office, the last process of billing is undertaken.

Since all what is needed in billing is accessible, the bill is sent to the ratepayer whether in batches of 2 years, 3 years or 1 year depending on the time the above process (from source documents to billing time) takes.

## **Input Data**

Most of the data input in the system can be summed up as property description and particulars.

- Name - all three (first, middle, surname) including others if properly owned by several people.
- Computer Serial No. - index as to be used to access the information in the account.
- Valuation No. - Valuation office index as at time of recording
- Property description - This details the property number e.g. LR number, block number, parcel number detailing the sections and the plot no. e.g. 36/14/20, 1870/v/210 i.e. 1870 is in no v/is section and 210 is plot no.
- Situation (Location) - This details the place or physical address where to find the plot, including road, street, estate and city.
- Area - This details the acreage in size
- Address - This relates to the most current address including changes to the existing and in case of any change the same is informed to the rating office for amendments.
- User/Class - This mostly relates to the mode the property is required in e.g. Residential, industrial commercial, agricultural, charitable Organisations etc.
- Site value - This relates to the undeveloped value of the plot in Kenya Shillings. This valuation as explained above is done by the Valuers using the laid down formulas. It is such value that the rating office use to determine the value of the property to be levied as rates payable.

## **The Billing Process**

Once the Local Council makes a proposal to the Minister for Local authority, e.g. NCC, and the proposal accepted the rating office advises the Computer Manager to initial the billing process.

The Computer personnel will input the percentage to the rates master instructing the programme to charge either 10%, 15%, 12% etc. to all existing accounts based on the current U.S.V. (Undeveloped Site Value). Once this is done, the current stationery is made available and a sample batch is taken to rates office for verification.

If they are satisfied that the current mathematics are applied, they seek a go ahead and the demand notes are produced electronically. These are later sorted to ensure that all the bills read current particulars e.g. box no., name, those which require higher value stamps e.g. outside country like Europe, America are classified separate for billing, other which relate to one person in bulk e. land buying companies are set aside for weighing in the post office.

Usually the Nairobi City Council postage is prepaid through a franking machine hence postage is not done manually by stamps. However, if any of the bills are returned for wrong address, the same is referred to our search officers who conduct a search in the lands office and the records are amended accordingly.

#### **Debtors Handling**

Each year rates are raised depending on the user. This is what is referred to as debits. These form the N.C.C. rates debtors.

Once the ratepayer pays the account the same is reduced from their accounts through posting of the receipt batches.

#### **Creditors**

The system does not have creditors in short the only creditors are inter – fund transactions in the General fund for water fund.

#### **Remission**

Remissions were considered only up to 1997. A remission is just like a tax relief and is reduced from the account depending on the agreed percentage.

Interest is levied on late ratepayers. The dues are supposed to be paid before May and a charge of 2% per month is levied each month the rate goes unpaid. This is added separately to the outstanding balances but does not attract interest. However for any account paid while charged interest, the credit clears the interest first.

### **Ledgers**

1. A-F - handled by 2 officers
2. G - handled by 2 officers
3. H-N - handled by 2 officers
4. P-R - handled by 2 officers
5. S - handled by 2 officers
6. T-U - handled by 2 officers
7. V - handled by 2 officers
8. W - handled by 2 officers
9. X - handled by 2 officers

### **Controls and Ledger workings**

Each ledger holder gets stubs from the receipt accountant. These are supposed to be posted to the ledgers via duplicate posting. The stub's amount is calculated to show interest and principal separately and the same is posted to the ledger in the two separate columns. The account is posted with all the receipts paid even if paid by instalments. By the end of the year the accounts (all the Ledgers) are balanced and then compared to the available electronic (computer) balances for checking and controls.

### **Output Reports**

Usually the Rates Office requires periodic reports for update purposes. These include:

#### **1. Annual bills**

The bills are produced annually since rates fall due on every 1<sup>st</sup> January of a year. This is an important document as it outlines and advises the ratepayer of his indebtedness to the rating authority.

## **2. Mid year statement**

This is done in June every year. This serves as a reminder to the ratepayer for his account is still in debt. It also helps the local authority to detect the responsiveness of the ratepayers since the rate authority can tell who responded to the January bill and those who are still in debt.

## **3. Legal notice**

This is done in December of every year. Usually this serves as a threat to the ratepayers (rates defaulters) who are still in debt of months down the year. It threatens the ratepayer with a legal action within 14 days if he/she doesn't pay up the rates.

## **4. Rates tabulations**

These are usually done in December or very early January. This helps to keep the years transactions manually as all accounts are printed in statement form and bound into tabulations, which serve as referral documents for the transactions of that year. These also act as a control for both electronics and manual tabulation since you can detect easily any change of position of close of the year both electronic and manual.

## **5. Financial year reports**

These are done in June or specifically 30<sup>th</sup> June for the final year accounts. These reports details the total arrears, debits for that year, any interest charged, any discount allowed for early payment, any receipts for that period which includes adjustments like NDS, journal entries, adjustments, deductions, etc and closing balances. These reports are important for the budgetary and audit purposes.

## **6. Monthly reports**

These are usually required to gauge the responses of the demand notes. This is done by manual collection e.g. summing the total collection and getting the balances on monthly basis.

### Summary of Source Documents

- a. Supplementary valuation roll (S.V.R.) this is the referral document for records relating to rates matters.
- b. Documents e.g. title deeds, from the source offices.
- c. Receipts for balancing and postings clearance certificates are also documents common in rates section.
- d. Plans and occupation certificates are also common
- e. Clearance forms for retirees' registrations and deaths.

#### 4.1.1 Structure of the Rates Section

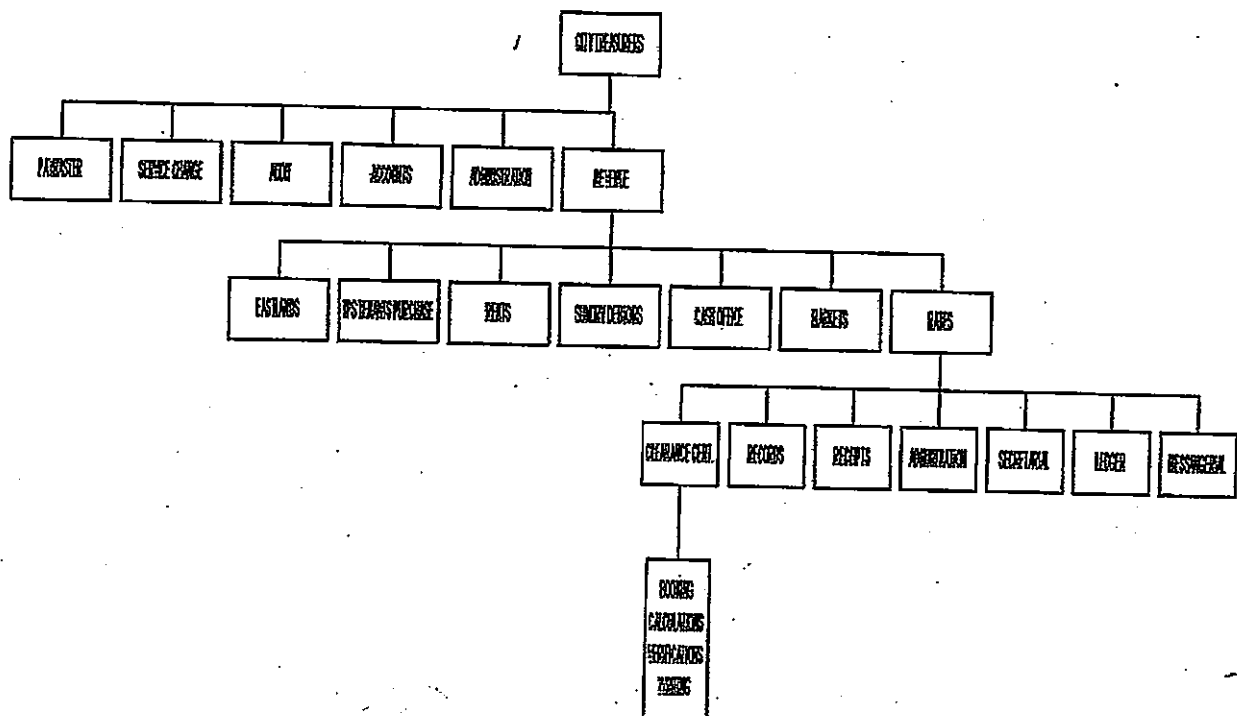


Figure 4.1 Organizational Chart of NCC Rates Section

## Functions Of Rates Section

The rates section will among other functions:

- (ii) Record transactions as relate to land transfers, land sub division, developments etc.
- (iii) Issuance of clearance certificates is also undertaken in the same office.
- (iv) Calculate billing amounts, sending and or dispatching bills to the ratepayers is also another function of rates offices.
- (v) Be the Custodian of both electronic and manual (print) data.
- (vi) Account for all payments relating to rate payments posting to both electronic and manual records are also a major function of rate offices.
- (vii) Execute clearance and approval of plans for plot development e.g. Construction of sites, building of extensions to existing buildings, canopies, private streets amalgamations of properties are also cleared in the same office.
- (viii) Execute clearance and approval of occupational certificates
- (ix) Hold custody of all records of provisional valuation both accounting and custody for future reference.
- (x) The rates section deals with landowners at times of billing. Also when the payers have a problem with their accounts. When they want to change their particular e.g. address, ownership, sub-division, clearance certificate etc

#### **Job description of the staff**

##### **Chief Accountant Rates (1 Officer)**

- a. All correspondences relating to rate matters dealing direct with the general public or matters, which require decision-making.
- b. Overall in charge
- c. Sectional administration of personal matters.
- d. Assistant to Chief Revenue Officer (C.R.O)

##### **Accountant In charge (1 Officer)**

- a. Deputy to Chief Accountant rates
- b. Staff records, attendance register leaves and correspondences
- c. Answering to general public relevant questions relating to rates signing of clearance certificates, plans, occupational certificates, etc.



**Receipts: Accountants (3 Officers)**

- a. Daily receipts balancing and postings
- b. Confirmation of receipts
- c. Correction and answering to relevant questions as pertains posting, transfers accounts etc.

**Records Accountants (4 Officers)**

- a. Computer data input
- b. Variations corrections adjustments
- c. Change of addresses etc

**Ledger Accountants (18 Officers)**

- a. Manual posting of ledger.
- b. Writing of bills manually, reducing discounts and applying interest.
- c. In charge of all ledger transactions e.g. Deletions, insertions, RDS, JES, adjustments etc.

**Clearance Certificate Accountants (4 Officers)**

- a. Calculations
- b. Verifications e.g. receipts, payments e.g. /cash, cheque, money order, bank drafts, bank statements.
- c. Writing up of the clearance certificates.
- d. Issuing and dispatching of the same.

**Secretarial (2 Officers)**

- a. Typing related documents
- b. In charge of all messengers

**Messenger (2 Officer)**

- a. Preparing tea for office
- b. Dusting of desks
- c. Operating messengerial services.

### **Qualifications of Rates Section Staff**

In general since this is a purely accounting area, most of the personnel are accountants and officers with accounting knowledge. There's need for staff training and computer training for the rates personnel. Frequent training is conducted to ensure this is achieved. Also personnel are promoted for relevant areas, which fall vacant. Computer literacy is also encouraged in this section with workshops being conducted frequently.

### **Sections Interacting With Rates Section:**

#### **Valuation Section**

- a. Most of rates data is gotten from valuation section.
- b. This section is interacted with on hourly basis for some records, which are incomplete, requires confirmation with the valuation section.

#### **Computer Section**

- a. Since most data is electronically collected computer section is a major partner of rates section.
- b. Raw data from rates is transferred into information by computer data.

#### **Cash Office**

- a. Most receipts are from cash office where cash is received.
- b. Receipts tabulations using diskettes is compared by computer.

#### **Audit**

All receipts are audited by audit before posting.

#### **City Planning**

All plans are approved by rates office before development.

#### **Paymaster**

Staff rates deductions are gotten from several sections.

### **Distribution of Workload**

The rates section is mostly busy in January when sending bills. January to May when offering discounts customers pay more than other times. June, July when sending reminder statements. August to September we send legal notices then the customers respond until November when in December the preparations for New Year demand notices are required.

In general all the year is busy throughout until the other months being utilized for posting of manual receipts.

### **Documents Exchanges Between Rates and Other Sections**

Most documents exchanged between rates and valuation section includes memos, supplementary valuation rolls, correspondences, and memorandums.

Most of these relate to variations in original records e.g. sub divisions, change of ownership, amalgamation, sales etc.

Most documents include:

- Receipts tabulations
- Receipts printout
- Computer data originating from valuation to punch room.
- Billing is done by computer section.
- The computer section also does amendments, which relate to rates.
- The same sections also produce staff deductions electronically.

### **4.2 Known Problems**

✓ Most of the rates are not collected due to a number of factors:

#### **(i) Lack of effective enforcement**

No clear enforcement authority, which can compel a ratepayer to pay without fail.

#### **(ii) Economic factors**

Some plots have no economic value especially the undeveloped ones hence ratepayers see no need to pay for non-producing properties.

**(iii) Incomplete records**

Some records can however not be captured if the owners do not register them, others have no clear details of the owners address hence cannot be reached by the bills.

**(iv) Non-payment of rates**

Some ratepayers generally ignore paying rates reasoning that the Local Authority renders no services and hence there is no need to pay.

**4.3 Suggested Improvements**

1. Getting ways of enforcing revenue or rates collections
2. Hastening the process as described in the rates cycle
3. Effective data capturing methods e.g. valuation capturing the data electronically thus reducing the manual punching in the punch room.
4. Conducting ground surveys to detect any unregistered properties.
5. Requesting periodic update from the lands office to ensure no loss of data en route to the valuation office.
6. Effecting strict guidelines as to the procedure of subdividing, amalgamation, transfer so that loss of data is minimized.
- 7.

**4.4 Stage 1: Investigation Of The Current Environment**

Like in any SSADM project it was assumed that a Project Initiation Document (PID) triggered the project. This document formed the terms of reference with an agreement to proceed with the project.

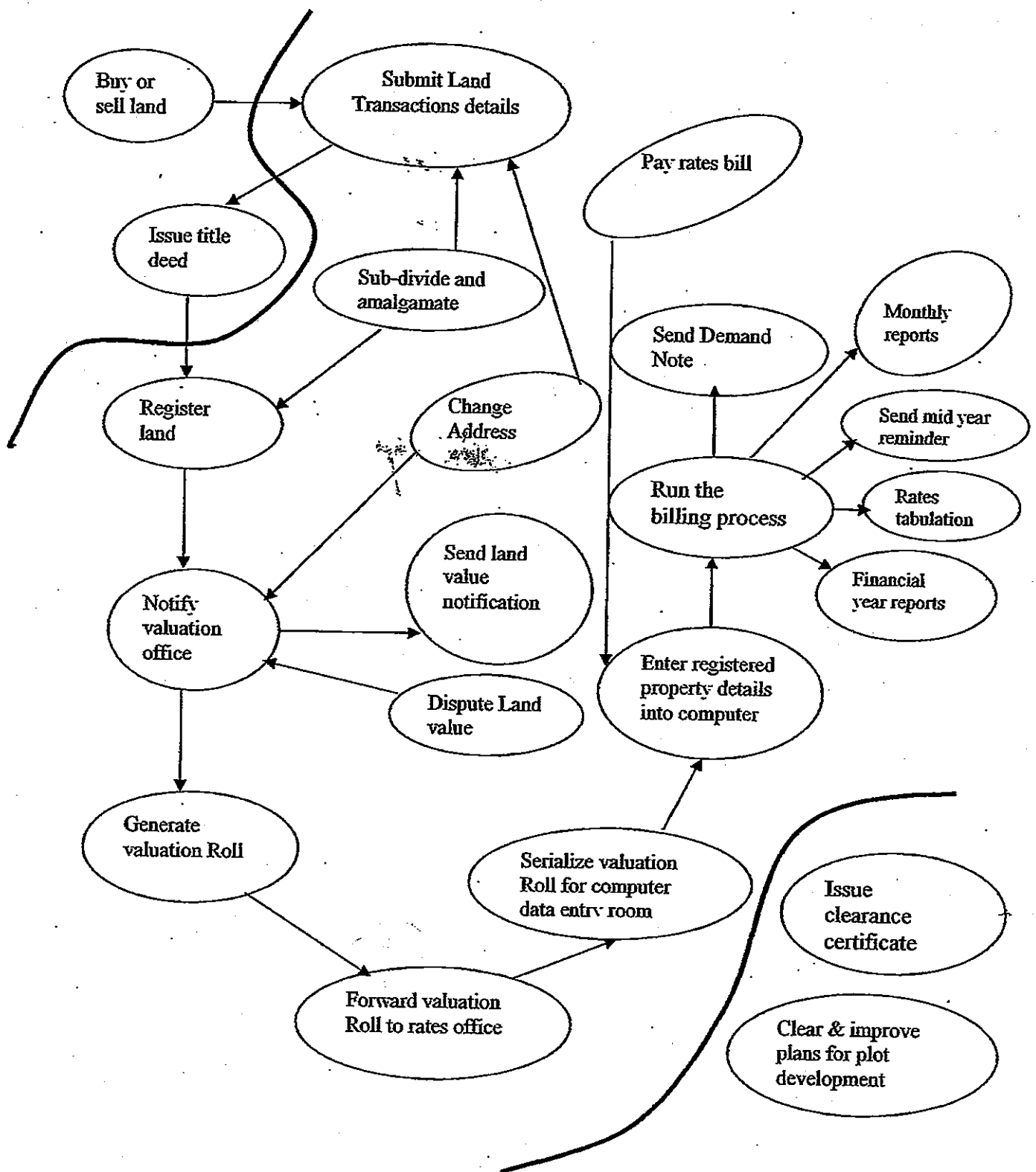


Figure 4.2 NCC Rates System Business Activity Model

The NCC Rates Business Activity Model summarizes the business activities undertaken at the rates section. It is a model that depicts the transaction between the rates section and the landowner and between the rates section and other sections in the Nairobi City Council. It also shows the transactions between the rates section and NCC employees. The bold curved lines are used to demarcate the Rates System boundary.

In the NCC Rates Work Practice Model below is a detailed account of each of the processes in the system, the type of process whether manual, computerized or transitional. The work practice model also shows the owner of the process and gives a description of each of the processes in the Rates System.

**Interview with Receipt Accountant Rates Section conducted on 07-10-02**

**Debtors Handling:**

Each year rates are raised depending on the user. This is what is referred to as debits. These form the N.C.C. rates debtors.

Once the ratepayer pays the account the same is reduced from their accounts through posting of the receipt stubs.

**Creditors:**

The system does not have creditors in short the only creditors are inter – fund transactions in the General fund for water fund.

**Remission:**

Only up to 1997 where remission was considered remission is just like a tax relief and is reduced from the account depending on the agreed percentage,

**Interest:**

Interest is a charge levied on late ratepayers. The dues are supposed to be paid in May and a charge of 2% per month is levied each month the rate goes unpaid. This is added separately to the outstanding balances but does not attract interest. However any account paid while charged interest the credit clears the interest first. Principal grows after one year. We first debit interest on payment before principal.

**Centres:**

A-F	-	handled by 2 officers
G	-	handled by 2 officers
H-N	-	handled by 2 officers
P-R	-	handled by 2 officers
S	-	handled by 2 officers
T-U	-	handled by 2 officers
V-W	-	handled by 4 officers
X	-	handled by 2 officers

**Controls:****Ledger workings:**

Each ledger holder gets stubs from the receipt accountants. This is supposed to be posted to the ledgers via duplicate posting. The stub's amount is calculated to show interest and principal separately and the same is posted to the ledger in the 2 separate columns. The account is posted until all that is paid is captured even if paid by instalment. By the end of the year the accounts are balanced to the available electronic (computer) balances for checking and controls.

**Report compiled by John Muraya flow charts by Francis Gachenga**



# VALUATION SECTION - TOWN CLERK DEPARTMENT.

## THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA

Questionnaire on daily work contents and GIS recognition

<Regarding your division's responsibilities>

[1] What is your division's main task? What kind of service / information do you provide?

<Main task> PROPERTY TAX ASSESSMENT & ADMINISTRATION; ASSET MANAGEMENT & GENERAL LAND ADMINISTRATION.

For citizens	For other divisions at the City Council	For the government
Office counter work	Provide xx to 00 div.	Annual/project reporting
Via TEL / FAX / Internet	Collaborating on projects with other div/dept.	Deliver local information (township level)
STORAGE & RETRIEVAL OF PROPERTY RECORDS	ADVISORY ON PROPERTY TAX STATUS.	petition
ADVISORY ON PROPERTY TAX	ADVISORY ON COUNCILS PROPERTY RENTAL VALUES	Collaborating on projects with government
ADVISORY ON PROPERTY VALUES FOR TAX ASSESSMENT.	ADVICE ON INSURANCE RENEWAL OF SUBLEASES	ADVICE ON RENEWAL OF SUBLEASES
	PREPARE UPDATE MAP SHEETS FOR USE BY NCC DEPARTMENTS	ADVISORY ON STAND PREMIUM FOR NCC OWNED PLOTS

[2] Current uses of topographic maps

Current state of establishment / uses of topographic maps & topographic database

- FOR LOCATING PROPERTIES
- UPDATING VALUATION MAP SHEETS.

Potential needs / problems of using topographic maps

- NO UPDATES TO SHEETS
- NO SECTORIAL SUBSHEETS FOR SPECIFIC LOCATIONS

Current state of exchanging topographic information and maps with other divisions / future interavailability of topographic info & maps

- Minimal

[3] Current uses of paper-based information and digital database

Current state of establishment / uses of paper-based information and digital database

- NO DIGITAL DATABASE FOR MAPS
- PROPERTY RECORDS ARE COMPUTERIZED
- COMPUTERIZE PROPERTY MEETING - RELATIONAL DATABASE

Potential needs / problems of using paper-based information and digital database

- DIGITIZE MAPS & PROPERTY RECORDS - GIS BASED
- COMPUTERIZE PROPERTY RECORDS - RELATIONAL DATABASE

Current state of exchanging paper-based information and digital database with other divisions / future interavailability

- MINIMAL INTERACTIVE

[4] Regarding cooperation with other departments

Your department's role in the Nairobi City Council	
POLICY IMPLEMENTATION, COORDINATION DEALS WITH LAND ADMINISTRATION (LEASES, LEASES); VALUATION OF ALL CITY PROPERTIES FOR TAX & OTHER PURPOSES & CITY ADMINISTRATION.	
Other departments' roles in the Nairobi City Council	
City Engineering Dept.	Public Health Dept.
City Planning Dept.	Housing & Development
Water & Sewerage Dept.	City Education Dept.
Dept. of Environment	City Inspection Dept.
Social Service & Housing Dept.	City Library Service
City Treasure Dept.	Town Clerk Dept.
Your opinion on necessary collaboration with other departments and divisions	
NECESSARY FOR EFFICIENT SERVICE DELIVERY	

[5] Key matters and challenges in your dept. / Future plans (incl. organizational computerization plan)

Key matters and challenges		Priority
<short term>	1. CAPACITY BUILDING & TRAINING	
<long term>	2. COMPUTERIZATION OF PROPERTY RECORDS FOR ALL CITY PROPERTIES	3
	3. ESTABLISHING LAND INFORMATION SYSTEM	4
	4. DEVELOP INTEGRATED PROPERTY DATABASE	2
		5
Future plans		
	• Computerization plan FOR REAL ESTATE DATABASE	
	• Cooperation with NSDI FOR MULTIDATABASE LIS.	

[6] Key matters and challenges in the City Council / Future plans (incl. computerization plan)

Key matters and challenges		Priority
<short term>		
<long term>		3
		4
		2
		5
Future plans		
	• Computerization plan	
	• Cooperation with NSDI	

[7] Understanding and use of GIS

Do you use GIS for work now?

NO

YES

Q1 : Are you interested in using GIS for your work?

YES

Q2 : Do you have already have any plan to use GIS?

PRELIMINARY

Q3 : Do you have any specific GIS software you want to use?

MULTI USER ~~GIS~~ DATABASE

Q4 : How do you think the outputs of this Study will benefit your work?

1. IMPROVES TRAVEL CAPACITY
2. ENHANCES EFFICIENCY IN SERVICE DELIVERY.

Q1 : What kind of tasks do you use GIS for?

Q2 : Do you have any GIS-related plans in the near future?

Q3 : What kind of GIS database have you established for your work?

Q4 : Which GIS software do you use? (type, extensions, # of licenses)

Q5 : Are there any GIS applications that you may want to try in future? For that, what kind of database do you think necessary?

Q6 : Do you have any specific GIS software you want to use?

Q7 : How do you think the outputs of this Study will benefit your work?

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL  
DATA FRAMEWORK FOR THE CITY OF NAIROBI IN THE  
REPUBLIC OF KENYA**

**CITY PLANNING DEPARTMENT**

**1a) Department's main task**

The main task of the City Planning Department is to plan and manage urban development to ensure social, economic and environmental sustainability.

**1b) Information provided to citizens**

- Information on development guidelines such as building plans, sub divisions, change of user, extension of lease.
- Information on development proposals such as area policies, service development, zoning, population, information e.t.c.
- Information on topographic maps as per the request of the citizens for example site location, plot numbers and location of various services.
- Information on cadastral surveys.

All these information is provided through the following channels:

- Telephone
- Physical enquiries
- Notice boards
- Consultative meetings with the stakeholders
- Media

**1c) Information provided to other departments**

- The City Planning department provides planning of all activities that have a social impact to all departments in the council such as supply and utilization of land. For example to the City Education Department through survey of schools, to the Social Services department by survey of markets and social facilities and provide topographic information to the City Engineering department and Water and Sewerage department.
- Provide spatial data to all departments such as the spatial distribution of infrastructure, site locations, plot numbers and location of various services.

**1d) Information provided to the government**

- Provide the government with information on development approved and what is constructed.
- Provide the government with information on land use changes
- Provide the government with information on planned supply of land for various uses such as roads, markets and hospitals.
- Provide information on infrastructure development such as schools, hospitals, and markets.
- Provide information on completed cadastral survey works to the Ministry of Lands and Settlement.

**2a) Current state of establishment/uses of topographic database**

Currently the department is relying on very old topographic sheets, which are on scales 1:2,500 (CBD); 1: 5,000 (all other areas outside CBD) and 1: 50,000 (entire Nairobi).

5K-13      5K-14  
Current uses of topographic maps include the following:

- Preparation of policy plans
- Land use development
- Zoning
- Development control
- Reference data for topographical work and routing.

**2b) Potential needs/problems of using topographic maps**

**Problems**

- ✓ • Maps not updated
- ✓ • Scale of maps are not adequate
- Maps not comprehensive in incorporating all details such as infrastructural development.

**Potential Needs**

- Need to have updated maps
- Need to have comprehensive maps that include all development changes such as changes in land use, spatial distribution of facilities, infrastructural development e.t.c.
- Need to incorporate all cadastral information both in the CBD and the extended areas.
- Have a system of updating all development changes.

**2c) Current state of exchanging topographic information and maps with other divisions/ future interavailability of topographic information & maps**

Currently exchange of maps with other departments is done manually. The department is using maps from one source which is Survey of Kenya (SOK) and current updates are only limited to inclusion of a few features.

**3a) Current state of establishment/uses of paper based information and digital database**

Currently the department is manually using and storing paper based information.

**3b) Potential needs/problems of using paper-based information and digital database**

**Potential Needs**

- Need to have easily retrievable paper information
- Need to secure data properly
- Prevent loss of information by tear and wear.
- Proper record keeping

**Problems**

- Cumbersome data storage
- Loss of data
- Wear and tear of information
- Lack of proper filing systems.

**3c) Current state of exchanging paper-based information and digital database with other divisions**

- Circulating paper-based information manually to other divisions and departments.

**4) Key matters and challenges in the department/future plans**

**Short term challenges**

- Updated maps
- Poor collection, compilation and analysis of data.
- Poor management of information systems
- Poor accessibility of information by the public.
- Capacity building in GIS information systems.

### Long term challenges

- ✓ • Digitalization of information that integrates all spatial information with all other aspects.
- Computerization of information.
- ✓ • Integrated interdepartmental information linkage systems.

### Future plans

- ✓ • Computerized updated maps
- ✓ • Public relations customer desk.

### 5) **Key matters and challenges in the City Council**

#### Short term

- Inefficient data capturing, processing and analysis.
- ✓ • Poor management of information systems.
- ✓ • Lack of an integrated information system within the departments and this leads to duplication of information.
- ✓ • Inadequate training in GIS information systems.

#### Long term

- ✓ • Interlinked information system with all departments.
- Coming up with a strategy of ensuring that the key partners in this project will sustain the information exchange and continuous update.
- Repackaging data collected by other stakeholders such as Central Bureau of Statistics and the Central Government for use by the City Council.

#### Future plans

- Interlinked GIS system
- ✓ • Computerized updated maps
- ✓ • Public relations customer desk.

### 6. **Understanding and Use of GIS**

No.

### Q1. **Are you interested in using GIS for your work?**

Yes

**Q2. Do you have already any plan to use GIS?**

Yes.

**Q3. Do you have any specific GIS software you want to use?**

No.

**Q4. How do you think the outputs of this study will benefit your work?**

- Computerized GIS system will enhance the production of updated maps and policy plans that will lead to better planning and service delivery.
- Improve up to date information to developers, government and all other stakeholders.
- Enhance revenue collection for the council.



**ATTACHED DOCUMENT 4**

# **TECNOLOGY TRANSFER OF GIS**

**Examination**  
**for**  
**1<sup>st</sup> GIS Technology Transfer Training**

**July 25, 2003**

**Name :** \_\_\_\_\_ :

**Q1: Point out three issues that are essential to install, manage, and maintain GIS hardware and software in a sustainable way.**

1. ( )
2. ( )
3. ( )

**Q2: Draw a conceptual diagram of GIS components.**

**Q3: Point out four benefits that an organization can expect by setting up GIS**

1. ( )
2. ( )
3. ( )
4. ( )

**Q4: What are the three products of ArcGIS?**

1. ( )
2. ( )
3. ( )

**Q5: What are the three applications of ArcGIS?**

1. ( )
2. ( )
3. ( )

**Q6: Indicate a few main functions of those three applications you answered in Q5**

**Q7: What are the four data models supported in ArcGIS?**

1. ( )
2. ( )
3. ( )
4. ( )



## GIS Technical Transfer Training (July 17 to July 25)

### Final Exam

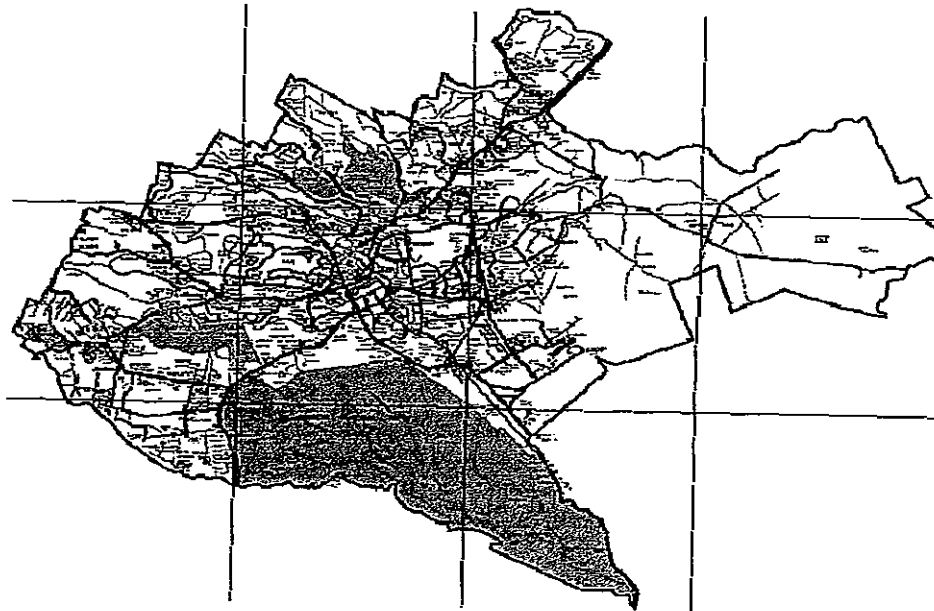
#### Story Setting:

You have a map of Nairobi City which shows location of the parks within the city. You want to know which parks are located closer to the populated points in order to think about allocation of a new park.

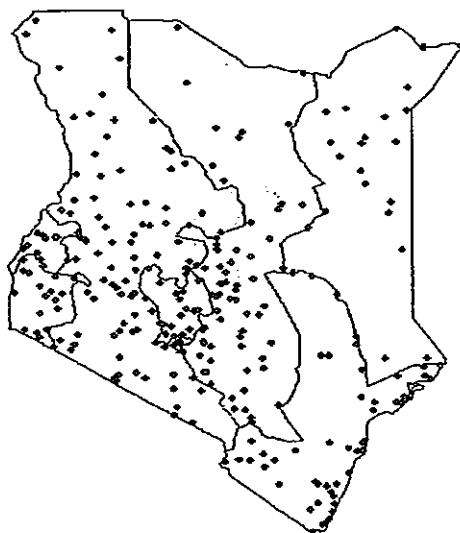
#### Your Task:

- A) You will create a new polygon shapefile from the scanned map of Nairobi City which indicate the location of the parks. Also you'll give attributes to the new polygons and set symbols.
- B) You will overlay your new polygon shapefile on the existing point shapefile showing the location of populated places. And select the parks by location of the populated places.

Your data:





nairobi\_parkrec.tif (image)



populated\_kenya.shp (point)




## Prerequisite:

1. Name "nairobi parks.shp" for your new polygon shapefile
2. When you add a field to the attribute table of "nairobi\_parks.shp", specify the attribute field as follows.  
Name: parkid  
Type: short integer
3. Use the red identical numbers on a map as the attribute value of "parkid" in nairobi\_parks.shp
4. In order to select the parks near the populated points, use the function of "Select by Location"  
(Please don't use measure  tool ) Select the parks within the distance of 5,000m from populated points.

## Tips:

### # Overall process

To complete Task A, refer to  
Day THREE Hands on Training: Part2 and  
Day FOUR Hands on Training: Part1  
(Key points: create new shape file, georeference, digitize, create a new  
attribute field, set display unit for your working data frame )

To complete TaskB, refer to  
Day FOUR Hands on Training: Part2

**Good luck with you all !!!**

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA**

**Program on 2<sup>nd</sup> GIS Technology Transfer at AICAD**

Period	Time	Participant	Number of participants	Contents on Technology Transfer
Dec. 08 (M) ~ Dec. 11 (T)	9:30 – 16:00	NCC	10	Explanation of Technology Transfer & Review
Dec. 15 (M) ~ Dec. 19 (F)	9:30 – 16:00	SOK	10	Explanation of Technology Transfer & Review
Jan. 05 (M) ~ Jan. 09 (F)	9:30 – 16:00	NCC	10	Database Design <ul style="list-style-type: none"> <li>● How to make a database specification</li> <li>● How to make a base map for input</li> </ul>
Jan. 12 (M) ~ Jan. 16 (F)	9:30 – 16:00	SOK	10	Database Design <ul style="list-style-type: none"> <li>● How to make a database specification</li> <li>● How to make a base map for input</li> </ul>
Jan. 19 (M) ~ Jan. 23 (F)	9:30 – 16:00	NCC	10	Data Creation <ul style="list-style-type: none"> <li>● How to create a spatial data</li> <li>● How to create an attribute data</li> </ul>
Jan. 26 (M) ~ Jan. 30 (F)	9:30 – 16:00	SOK	10	Data Creation <ul style="list-style-type: none"> <li>● How to create a spatial data</li> <li>● How to create an attribute data</li> </ul>
Feb. 02 (M) ~ Feb. 06 (F)	9:30 – 16:00	NCC	10	Data Editing <ul style="list-style-type: none"> <li>● How to edit a spatial data</li> <li>● How to edit an attribute data</li> </ul>
Feb. 09 (M) ~ Feb. 13 (F)	9:30 – 16:00	SOK	10	Data Editing <ul style="list-style-type: none"> <li>● How to edit a spatial data</li> <li>● How to edit an attribute data</li> </ul>

### **Trainees from Survey of Kenya**

<b>PC No.</b>	<b>Name</b>	<b>Sex</b>	<b>Affiliation</b>
010-01	Florence M. Menge	F	Cartgraphic Assistant
010-03	Martins A. Okanga	M	Cartgraphic Assistant
010-05	Mary A. Obat	F	Cartgraphic Assistant
010-07	Teresia W. Mungai	F	Cartgraphic Assistant
010-08	Nancy N. Wanjira	F	Cartgraphic Assistant
010-10	Wallace C. Ngolo	M	Cartgraphic Assistant
010-12	Faith J. Birir	F	Cartgraphic Assistant
010-13	Joseph M. Manzala	M	Surveyor Assistant
010-15	Hemoryck O. Arodi	M	Photolithographer Assistant
010-16	John M. Mwairo	M	Photogrammetrist Assistant

### **Trainees from Nairobi City Council**

<b>PC No.</b>	<b>Name</b>	<b>Sex</b>	<b>Affiliation</b>
010-01	Keter K. Willy	M	City Planning
010-03	Titus Kimeu	M	City Engineering
010-05	Ignas Mukungi	F	Valuation
010-07	Rose Muema	F	City Planning
010-08	Anderson Njenga	M	City Engineering
010-10	Gyneth Magiri	F	Valuation
010-12	Eliud Munene	M	Water & Sewage
010-13	George Kariuki	M	City Planning
010-15	Asenath M. Kibore	F	City Planning
010-16	John M. Kamwai	M	Water & Sewage





**Written Examination**  
**for**  
**2<sup>nd</sup> GIS Technology Transfer Training**

**February 12, 2004**

**Name :** \_\_\_\_\_ **:**

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA**

Q1: Point out three issues that are essential to install, manage, and maintain GIS hardware and software in a sustainable way.

1. ( )
2. ( )
3. ( )

Q2: Point out four benefits that an organization can expect by setting up GIS

1. ( )
2. ( )
3. ( )
4. ( )

Q3: What are the three products of ArcGIS?

1. ( )
2. ( )
3. ( )

Q4: What are the three applications of ArcGIS?

1. ( )
2. ( )
3. ( )



Q5: Indicate a few main functions of those three applications you answered in Q4

Q6: What are the four data models supported in ArcGIS?

1. ( )
2. ( )
3. ( )
4. ( )

Q7: Indicate a few data types for each of the four data models you answered in Q6

Q8: What are the data formats that can be used by ArcGIS Desktop

1. ( )
2. ( )
3. ( )

Q9: Describe the characteristics of the three data formats you answered in Q8

Q10: What is the following information for UTM of the Nairobi City

- |                    |     |
|--------------------|-----|
| Zone No.           | ( ) |
| Central Meridian   | ( ) |
| Scale Factor       | ( ) |
| Latitude of Origin | ( ) |
| False Easting      | ( ) |
| False Northing     | ( ) |

Q11: Describe the long title following abbreviations

1. UTM ( )
2. WGS ( )
3. GIS ( )

**Practical Examination**  
**for**  
**2<sup>nd</sup> GIS Technology Transfer Training**

**February 12, 2004**

**Name :** \_\_\_\_\_ :

Q1: Create a new folder named "SOKEXAM" under C drive of your PC.

Q2: Copy folders named "Georef", "DXF", "Nogeoref", and "Image" that are "\\ LAB2SERVER \ EXAM into C:\SOKEXAM of your PC.

Q3: Add a coordinate system to "admin\_kenya\_noprj.shp" that is C: SOKEXAM \ Nogeoref.

- Datum is WGS 84

Q4 Add coordinate systems to "79-1.shp" that is C: \ SOKEXAM \ Nogeoref.

- Datum is WGS 84

Q5: Rectify a "373EG792SE.jpg" that is C: \ SOKEXAM \ Image.

- Cell size is 0.25m
- Output file name is Rec792se
- Output file type is ERDAS Imagine
- Output file must be stored "C: \ SOKEXAM \ Image

Q6: Add coordinate systems to "Rec792se.img"

- Datum is Clarke 1880 Arc

Q7: Data Conversion

Convert "78-2.DXF" that is C: \ SOKEXAM \ DXF to a Geodatabase format.

- Name of Geodatabase is "Topodata"
- Name of Dataset is "Line"
- Name of Feature class is "Contour"
- Converted layers are "710100", "710200" and "710300"
- Projected coordinate system is UTM Zone 37
- Geographic coordinate system is WGS 84
- Topodata geodatabase must be created in C: \ SOKEXAM \ DXF

Q8: Calculate a population density (persons / sqkm) using "admin\_kenya\_utm37.shp" that is C: \ SOKEXAM \ Georef.

**Q9: Create an administrative boundary polygon**

- Referred data is "admin\_kenya.shp" that is C: \ SOKEXAM \ Georef.
- Name of Geodatabase is "GISDATA"
- Name of Dataset is "Polygon"
- Name of Feature class is "Administration"
- Geographic coordinate system is WGS 84
- GISDATA Geodatabase must be created in C: \ SOKEXAM \ Georef

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA**

**Program on 3<sup>rd</sup> GIS Technology Transfer at AICAD**

**1. Program**

Period	Time	Participant	Number of participants	Contents on Technology Transfer
Jun. 07 ~ Jun. 11	9:00 – 15:30	SOK	10	Review of 2 <sup>nd</sup> training How to create GIS topographic data
Jun. 14 ~ Jun. 18	9:00 – 15:30	NCC	10	Review of 2 <sup>nd</sup> training
Jun. 21 ~ Jun. 25	9:00 – 15:30	SOK	10	Spatial analysis 3D analysis
Jun. 28 ~ Jul. 02	9:00 – 15:30	NCC	10	Spatial analysis 3D analysis

**2. Time schedule**

09:00 – 10:30 GIS training (Part 1)  
 10:30 – 11:00 Tea break  
 11:00 – 12:30 GIS training (Part 2)  
 12:30 – 13:30 Lunch  
 13:30 – 15:00 GIS training (Part 3)  
 15:00 – 15:30 Tea break or GIS training  
 15:30 Finish

**3. Pick up time**

NCC' trainees shall be picked up at 07:50 a.m.  
 SOK's trainees shall be picked up at 08:20 a.m.

Trainees from Survey of Kenya

6

PC No.	Name	Sex	Affiliation	7	8	9	10	11	14	15	16	17	18	Attendance	Exam (P)	Total	Record
010-02	Florence M. Menge	F	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-03	Martins A. Okanga	M	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-05	Mary A. Obat	F	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-07	Teresia W. Mungai	F	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	100	200	A++
010-08	Nancy N. Wanjira	F	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-10	Wallace C. Ngolo	M	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	90	190	A++
010-12	Faith J. Birir	F	Cartographic Assistant	○	○	○	○	○	○	○	○	○	○	100	90	190	A++
010-13	Joseph M. Manzala	M	Surveyor Assistant	○	○	○	○	○	○	○	○	○	○	100	90	190	A++
010-15	Hemoryck O. Arodi	M	Photolithographer Assistant	○	○	○	○	○	○	○	○	○	○	100	100	200	A++
010-16	John M. Mwalro	M	Photogrammetrist Assistant	×	○	○	△	○	○	△	○	○	○	80	100	180	A+

▲ A.M. Absence

△ P.M. Absence

× Whole day Absence

Trainees from Nairobi City Council

6 7

PC No.	Name	Sex	Affiliation	21	22	23	24	25	28	29	30	1	2	Attendance	Exam (P)	Total	Record
010-02	Keter K. Willy	M	City Planning	○	○	○	○	○	○	○	○	○	○	100	70	170	A
010-03	Titus Kimeu	M	City Engineering	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-08	John K. Barreh	M	City Planning	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-13	Owen Ywsaya	M	Public Health	○	○	○	○	○	○	○	○	○	○	100	60	160	B++
010-10	Anderson Njenga	M	City Engineering	○	○	○	○	○	○	○	○	○	○	100	90	190	A++
010-16	Gyneth Magiri	F	Valuation	○	○	○	○	○	○	○	○	○	○	100	95	195	A++
010-12	Eliud Munene	M	Water & Sewage	○	○	○	○	○	○	○	○	○	○	100	100	200	A++
010-05	George Kariuki	M	City Planning	○	○	○	○	○	○	○	○	○	○	100	80	180	A+
010-07	Asenath M. Kibore	F	City Planning	■	■	■	■	■	○	○	○	○	○	75	60	135	C
010-15	John M. Kamwai	M	Water & Sewage	△	○	○	○	○	○	○	○	○	○	95	70	165	B++

▲ A.M. Absence  
 △ P.M. Absence  
 × Whole day Absence  
 ■ Overseas education



**Practical Examination**  
**for**  
**3rd GIS Technology Transfer Training**

**July 2, 2004**

**Name :** \_\_\_\_\_ :

**Q1: Georeferencing Data**

1) Create a Geodatabase named "Topo782" in the C:\NCC\Exam

2) Create the following Datasets in the Topo782 geodatabase.

- ✧ Administration
- ✧ Transportation
- ✧ Buildings
- ✧ Water
- ✧ Topographic

(#1) Projection is UTM Zone 37, Datum is Clarke 1880 Arc must be used.

(#2) X,Y Domain is as follows

- ✧ Xmin = 254,000 m
- ✧ Xmax = 256,000 m
- ✧ Ymin = 9,857,500 m
- ✧ Ymax = 9,859,000 m

**Q2: Data Conversion**

1) Convert the following layers of 78-2.DXF file to the each dataset in the Topo782 geodatabase

Layer code	Dataset name	Feature class name
110800	Administration	Admbnd (Line)
210101, 210201, 210202 210301, 210302,	Transportation	Road (Line)
300100, 300200	Buildings	Building (Polygon)
510301, 510401, 510402	Water	River (Line)
710100, 710200, 710300	Topographic	Contour (Line)

**Q3: Layout**

1) Create a Topographic Map for 78-2 (1:10,000) using layout function and print out.

Following information is expressed.

- ✧ Administrative boundary (Line)
- ✧ Road network (Line)
- ✧ Buildings (Polygon)
- ✧ River (Line)
- ✧ Contour lines (Line)

Following items are attached in the Layout

- ✧ Title
- ✧ North Arrow
- ✧ Legend
- ✧ Scale bar
- ✧ Scale text

#### **Q4 3D Analysis**

Create the following data using Topo782's contour line feature.

- ◇ TIN (saved file name : TIN782)
- ◇ DEM (saved file name : DEM782)
- ◇ Slope (saved file name : SLP782)
- ◇ Aspect (saved file name : ASP782)

(#1) Cell size is 1 metre

(#2) Each data is stored in the C:\NCC\Exam

#### **Q5 Spatial Analysis**

(1) Find area based on following conditions, and print out.

DEM < 1700 [and] DEM > 1730 [and] 5 < Slope < 10

(2) Find area based on following conditions, and print out.

1700 < DEM < 1730 [and] 10 < Slope < 20

**THE STUDY FOR THE ESTABLISHMENT OF THE SPATIAL DATA FRAMEWORK  
FOR THE CITY OF NAIROBI IN THE REPUBLIC OF KENYA**

**Program on 4<sup>th</sup> GIS Technology Transfer at AICAD**

**1. Program**

Period	Time	Participant	Number of participants	Contents on Technology Transfer
Sep. 06 ~ Sep. 10	9:00 – 15:30	SOK	10	Review of 3 <sup>rd</sup> training ArcMap, ArcCatalog, ArcToolbox, Spatial analysis, 3D analysis
Sep. 13 ~ Sep. 17	9:00 – 15:30	SOK	10	Creating Topographic GIS data Exam.
Sep. 20 ~ Sep. 24	9:00 – 15:30	NCC	10	Review of 3 <sup>rd</sup> training ArcMap, ArcCatalog, ArcToolbox, Spatial analysis, 3D analysis
Sep. 27 ~ Oct. 01	9:00 – 15:30	NCC	10	Applications of Spatial analysis & 3D analysis Exam.

**2. Time schedule**

09:00 – 10:30 GIS training (Part 1)  
 10:30 – 11:00 Tea break  
 11:00 – 12:30 GIS training (Part 2)  
 12:30 – 13:30 Lunch  
 13:30 – 15:00 GIS training (Part 3)  
 15:00 – 15:30 Conclusion & Tea break

**3. Pick up time**

NCC's trainees shall be picked up at 08:00 a.m. at NCC.  
 SOK's trainees shall be picked up at 08:30 a.m. at SOK.

TECHNOLOGY TRANSFER  
OF  
DIGITAL PHOTOGRAMMETRY

## Trainees from Survey of Kenya

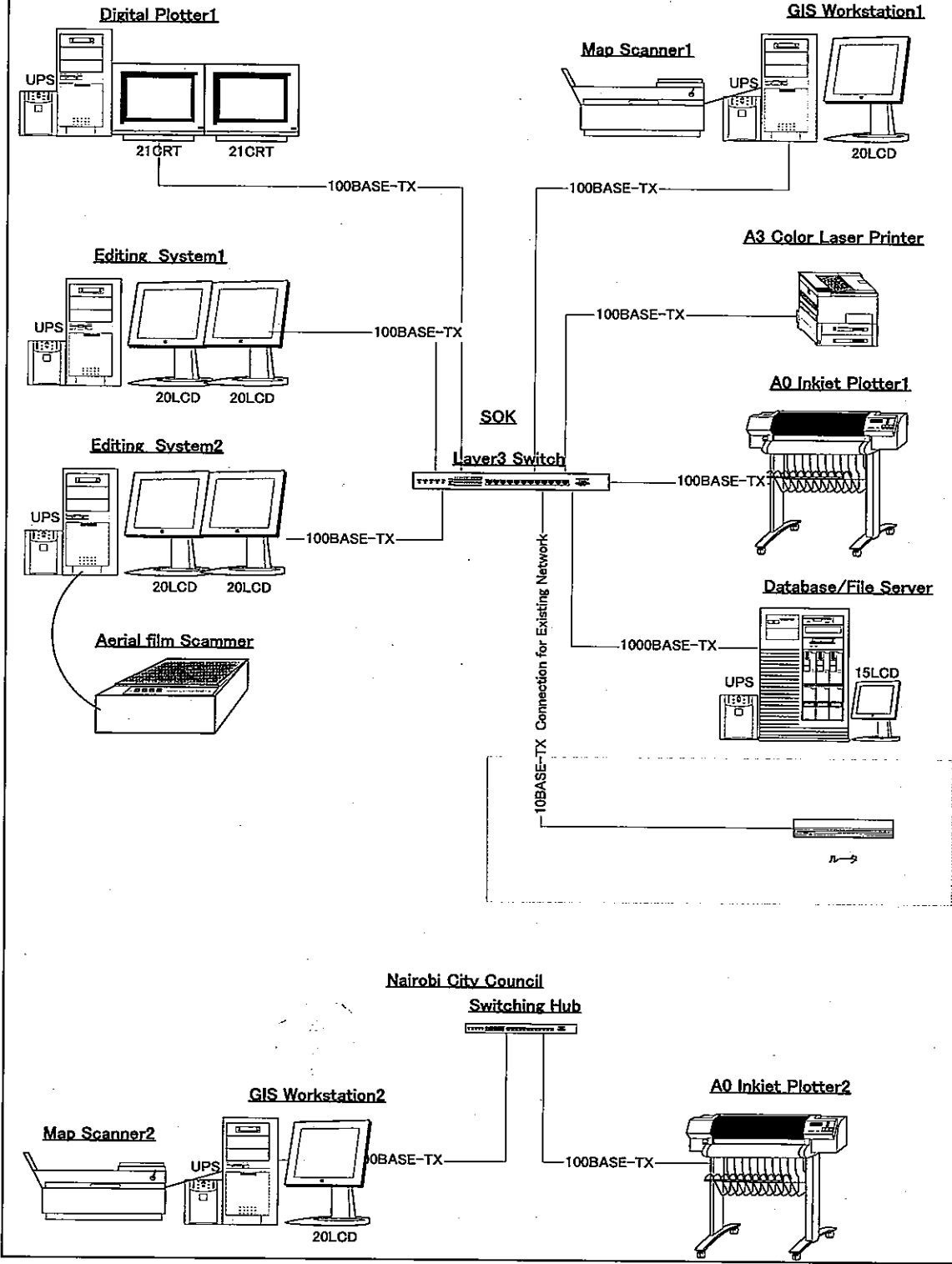
Name	Sex	Affiliation
Mutuku. M. KENNEDY	M	Photogrammerist
Kalego. J. T. O	M	Photogrammerist
Kimuige.LAZARUS	M	Photogrammerist
Joseph. M. GATIMU	M	Photogrammerist
Peter. R. KABWIMA	M	Photogrammerist

**Schedule of Photogrammetry technology transfer**

Day	Category	Course	Contents
8-Dec-03	mon	Basis	Micro Station
9-Dec-03	tue	"	"
10-Dec-03	wed	"	"
11-Dec-03	thu	"	"
12-Dec-03	fri		
13-Dec-03	sat		
14-Dec-03	sun		
15-Dec-03	mon	Basis	Micro Station
16-Dec-03	tue	"	"
17-Dec-03	wed	"	IRAS/C
18-Dec-03	thu	"	"
19-Dec-03	fri	"	TNTmips
20-Dec-03	sat		
21-Dec-03	sun		
22-Dec-03	mon	Basis	"
23-Dec-03	tue	"	"
24-Dec-03	wed		
25-Dec-03	thu		
26-Dec-03	fri		
27-Dec-03	sat		
28-Dec-03	sun		
29-Dec-03	mon		
30-Dec-03	tue		
31-Dec-03	wed		
1-Jan-04	thu		
2-Jan-04	fri		
3-Jan-04	sat		
4-Jan-04	sun		
5-Jan-04	mon	Basis	Image Station
6-Jan-04	tue	"	"
7-Jan-04	wed	"	Aerial Triangulation
8-Jan-04	thu	"	"
9-Jan-04	fri	"	"
10-Jan-04	sat		
11-Jan-04	sun		
12-Jan-04	mon	Basis	Image Station
13-Jan-04	tue	"	"
14-Jan-04	wed	"	Feature collection
15-Jan-04	thu	"	"
16-Jan-04	fri	"	" Utilize Ortho images
17-Jan-04	sat		
18-Jan-04	sun		
19-Jan-04	mon	Practical Technique	Scanning Images
20-Jan-04	tue	"	"
21-Jan-04	wed	"	Plotting
22-Jan-04	thu	"	"
23-Jan-04	fri	"	"
24-Jan-04	sat		
25-Jan-04	sun		
26-Jan-04	mon	Practical Technique	Plotting
27-Jan-04	tue	"	"
28-Jan-04	wed	"	Editing
29-Jan-04	thu	"	"
30-Jan-04	fri	"	"
31-Jan-04	sat		
1-Feb-04	sun		
2-Feb-04	mon	Practical Technique	"
3-Feb-04	tue	"	Printing
4-Feb-04	wed	"	Publishing
5-Feb-04	thu	"	Quality check
6-Feb-04	fri	"	Data conversion
7-Feb-04	sat		
8-Feb-04	sun		
9-Feb-04	mon	Applied Technique	Micro Station
10-Feb-04	tue	"	"
11-Feb-04	wed	"	TNTmips
12-Feb-04	thu	"	"
13-Feb-04	fri	"	"
14-Feb-04	sat		
15-Feb-04	sun		
16-Feb-04	mon	Related Technique	Network Administration
17-Feb-04	tue	"	ISO Standardization
18-Feb-04	wed	"	"
19-Feb-04	thu	Q & A	Q & A
20-Feb-04	fri	"	"

\*Daily Time Table: 9:30am-12:00am, 2:00pm-4:00pm (Short brake at 10:30-10:45am)

ナイロビ市GISデータ基盤整備計画調査 技術移転機材 構成図 2004/2/17





## ● Appendix: examination

### 1. Basis of MicroStation

Put suitable word into blanks in sentence from selection box bellow to complete explanation of MicroStation;

(14point / 2point each)

Attributes of MicroStation consists of (1) \_\_\_\_\_, Color, Weight, Style, Construction, Fill.

(1) \_\_\_\_\_ defines separate layer like DXF layer using 63 unique numbers.

When you create brand new DGN file, file is duplicated from (2) \_\_\_\_\_.

(2) \_\_\_\_\_ is located same folder as program files in default. After create Brand new DGN file, you have to configure setting of file, especially (3) \_\_\_\_\_ is very important to define measurable unit, because (3) \_\_\_\_\_ is unable to change once you start work on the DGN file.

(4) \_\_\_\_\_ also should be configured "default" to keep common color for communication in workgroup.

When you edit MicroStation DGN file, you may click left button on mouse as "Yes", "Select" "continue", you may click right button on mouse as "No", "cancel", you may click left and right button at once as snap operation called (5) \_\_\_\_\_. (5) \_\_\_\_\_ has several mode to snap cursor on to particular precise position of existing element..

MicroStation has recyclable symbols that called (6) \_\_\_\_\_.

(6) \_\_\_\_\_ is created from DGN elements, and user can register user-defined symbols.

(7) \_\_\_\_\_ gives you temporary boundary to define areas for other commands. It's can be defined "Inside", "Overlap", "Clip", "Void", "Void Overlap", "void clip".

<Selection Box>

Seed file, Tentative, View control, Level, Cell library, Working Unit, Align, Color Table, Symbol library, Feature Table, Fence, Layer, Undo, Redo, Command, Select by attribute,

## 2. Basis of IRAS/C

IRAS/C is application software of MicroStation. Describe main purpose of this software for mapping project in a box bellow;

(14point)

## 3. Basis of TNT mips

TNT mips is integrated GIS and Mapping software. Fill the blank followings to complete descriptions of object type.

(10point / 5point each)

The RVC data file contains all objects to be created by TNTmips. Each object may include sub objects such as display and database. The system can always hold the relative positional relations of the objects properly so that users do not need to be aware of the storage locations of each object. The main data types to be created by TNTmips are described below.

- :  
These data are of graphic data type with a Topological structure. This data type is applied to basic linear features such as roads and rivers of which a GIS base map is composed.
- CAD:  
These data are of graphic type to represent geometric forms such as circles. This data type is applied to the features such as independent houses in the background of a GIS, which do not need to be analyzed with a Topological structure.
- :  
This data type consists of a 2-dimensional array that is represented by image data.
- TIN:  
This data type is a surface represented by a series of triangle polygons.

#### 4. Basis of ImageStation

Fill blanks using suitable words and complete a composition.

(20point / 5point each)

When you start Photogrammetric work on ImageStation, you have to create new (1) \_\_\_\_\_.

(1) \_\_\_\_\_ is consisting of parameters such as coordinate system, and several folders for providing place to store various data.

Once you create the (1) \_\_\_\_\_, you are going ranch (2) \_\_\_\_\_ wizard to define specific aerial (2) \_\_\_\_\_ using certificate provided by manufacturer.

You also have to prepare scanned images. Images should be stored into image folder under (1) \_\_\_\_\_. And continuously register photos (images) and models. When you register photos and models, (3) \_\_\_\_\_ wizard helps you naming each photos and models also interpolate each exposure coordinate by start and end coordinate of strips.

Finally you have to prepare (4) \_\_\_\_\_ file. There are two possibilities to create (4) \_\_\_\_\_ file. You can enter (4) \_\_\_\_\_ name and coordinates by Graphic user interface, and you can import text file containing (4) \_\_\_\_\_ name and coordinates as (4) \_\_\_\_\_ file.

#### 5. Triangulation

Following table is describing aerial triangulation on ImageStation. Add number on first column as correct order of triangulation

(12point / 2point each)

Order	Step	Description
( )	Triangulation computation	Determine coordinates for all the points bundle adjustment method.
( 7 )	Bulk Orient	Computation exterior orientation and generate stereo models at once. Before process, back up is strongly recommended.
( )	Multiphoto (observe tie points between strip and strip, and control points)	Pass point A and E should be transferred on other strip around overlapped area.
( )	Multiphoto (observe pass points in strip)	Manual observation is strongly recommended.
( 1 )	Image format conversion	Images should be converted to tiled tiff as native image format.
( )	Interior orientation	Image rotation should be determined by camera definition.
( )	Dencify	Process all the tie points to convert control points. Before process, back up is strongly recommended.

## 6. Plotting and Editing

Following composition is describing how to carry out plotting. Choose correct words from boxes and put circle on correct words to complete composition.

(20point / 5point each)

- During plotting, Plotting operator should make sure (definition of features / regulation of plotting) all the time for capturing features by correct code.
- According to Data specification, we should proceed plotting (Layer structure by layer structure / Design file level by level).
- If you are unable to snap a line to existing element, (Undershoot / Overshoot) is better for cleaning data on editing phase.
- Every end of the day, data files should be (baked up / renamed) for disaster recovering.

## 7. Network Administration

Answer Yes or No following question related with network administration.

(10point / 2point each)

- You can log in by administrator account for dairy work, because it's convenient.  
An. \_\_\_\_\_
- When you find network confliction, then you are going to report problems administrator.  
An. \_\_\_\_\_
- If it's necessary, you may ask to administrator to be given personal user account for using network resources.  
An. \_\_\_\_\_
- Password should be recorded on behind of computer in case you forget your password.  
An. \_\_\_\_\_
- If it's necessary, you should give someone your user account.  
An. \_\_\_\_\_

□

**TECNOLOGY TRANSFER OF  
ORDINARY LEVELLING**

## THE NAIROBI MAPPING PROJECT PERSONNEL

### OVERALL TEAM SUPERVISOR:

Festus N. Masaku                      Surveyor              Survey of Kenya

### TEAM CARTOGRAPHER:

P. M. Thunguri                      Cartographer      Survey of Kenya

### GPS SURVEYORS TEAM:

1. Charles O. Gaya	Surveyor	Survey of Kenya
2. Julius. K. Rotich.	Surveyor	Survey of Kenya
3. R. Kavulya Muthama	Surveyor	Survey of Kenya
4. James. M. Mwara.	Surveyor	Survey of Kenya

### LEVELLING SURVEYORS TEAM:

1. David. W. Mwangi	Surveyor	Survey of Kenya
2. Wilson Kibiru.	Surveyor	Survey of Kenya
3. Abach Owino	Surveyor	Survey of Kenya

### DEPARTMENTAL STAFFMEN:

1. Onespro Njuguna Kamere	SubStaff	Survey of Kenya
2. Enos K. Ogwenno	SubStaff	Survey of Kenya
3. Sammy Katiku	SubStaff	Survey of Kenya
4. Evans K. Mwangombe	SubStaff	Survey of Kenya
5. Edward Mbala	SubStaff	Survey of Kenya
6. Seth Mutuvachi	SubStaff	Survey of Kenya

### GPS HELPERS

1. George Rosana Omwange	ID NO. 21675657
2. Robert Kimutai Korir	ID NO. 21273562
3. Evans Mboroia Mbaya	ID NO. 20859874
4. Jeremiah M. Njungu	ID NO.2175519771 (Abstract)

### LEVELLING HELPERS

1. Michael Mwai	ID No:	22577422
2. Ngigii Macharia	ID No:	2931048
3. Jeremiah Kariuki	ID No:	21153206

## Tentative Schedule of Ordinary Levelling

2003/2/7

	Date		Ishizuka	Grupe A	Grupe B	Grupe C	Remarks
1	10-Feb	Mon	Confirmation of BM's	Preparation	Preparation	Preparation	at the office
2	11-Feb	Tue	Field Recon of Routes	Field Recon of Routes	Field Recon of Routes	Field Recon of Routes	at the field
3	12-Feb	Wed	ditto	ditto	ditto	ditto	at the field
4	13-Feb	Thu	ditto	ditto	ditto	ditto	at the field
5	14-Feb	Fri	ditto	ditto	ditto	ditto	at the field
6	15-Feb	Sat	ditto	ditto	ditto	ditto	at the field
7	16-Feb	Sun					
8	17-Feb	Mon	Field Recon of Routes	Field Recon of Routes	Field Recon of Routes	Field Recon of Routes	at the field
9	18-Feb	Tue	ditto	ditto	ditto	ditto	at the field
10	19-Feb	Wed	Training	Training	Training	Training	at the field
11	20-Feb	Thu	ditto	ditto	ditto	ditto	at the field
12	21-Feb	Fri	Measurement	Measurement	Measurement	Measurement	at the field
13	22-Feb	Sat	ditto	ditto	ditto	ditto	at the field
14	23-Feb	Sun					
15	24-Feb	Mon	Measurement	Measurement	Measurement	Measurement	at the field
16	25-Feb	Tue	ditto	ditto	ditto	ditto	at the field
17	26-Feb	Wed	ditto	ditto	ditto	ditto	at the field
18	27-Feb	Thu	ditto	ditto	ditto	ditto	at the field
19	28-Feb	Fri	ditto	ditto	ditto	ditto	at the field
20	1/Mar	Sat	ditto	ditto	ditto	ditto	at the field
21	2/Mar	Sun					
22	3/Mar	Mon	Measurement	Measurement	Measurement	Measurement	at the field
23	4/Mar	Tue	ditto	ditto	ditto	ditto	at the field
24	5/Mar	Wed	ditto	ditto	ditto	ditto	at the field
25	6/Mar	Thu	ditto	ditto	ditto	ditto	at the field
26	7/Mar	Fri	ditto	ditto	ditto	ditto	at the field
27	8/Mar	Sat	ditto	ditto	ditto	ditto	at the field
28	9/Mar	Sun					
29	10/Mar	Mon	Measurement	Measurement	Measurement	Measurement	at the field
30	11/Mar	Tue	ditto	ditto	ditto	ditto	at the field
31	12/Mar	Wed	ditto	ditto	ditto	ditto	at the field
32	13/Mar	Thu	ditto	ditto	ditto	ditto	at the field
33	14/Mar	Fri	ditto	ditto	ditto	ditto	at the field
34	15/Mar	Sat	ditto	ditto	ditto	ditto	at the field
35	16/Mar	Sun					
36	17/Mar	Mon	Measurement	Measurement	Measurement	Measurement	at the field
37	18/Mar	Tue	ditto	ditto	ditto	ditto	at the field
38	19/Mar	Wed	ditto	ditto	ditto	ditto	at the field
39	20/Mar	Thu	ditto	ditto	ditto	ditto	at the field
40	21/Mar	Fri	ditto	ditto	ditto	ditto	at the office
41	22/Mar	Sat	Network Ajustment	Network Ajustment	Network Ajustment	Network Ajustment	at the office
42	23/Mar	Sun					
43	24/Mar	Mon	Network Ajustment	Arrengement	Arrengement	Arrengement	at the office
44	25/Mar	Tue	Arrengement	ditto	ditto	ditto	at the office
45	26/Mar	Wed	ditto	ditto	ditto	ditto	at the office
46	27/Mar	Thu	ditto	ditto	ditto	ditto	at the office
47	28/Mar	Fri	ditto	ditto	ditto	ditto	At the office
48	29/Mar	Sat					
49	30/Mar	Sun					
50	31/Mar	Mon					

**TECNOLOGY TRANSFER OF  
FIELD IDENTIFICATION**



**Member List of Field Identification Team**

**Mr. D. K. E. Njubi (Photogrammetric Division)**

**Mr. D. W. Mwangi (Geodesy Division)**

**Mr. J. T. O. Kalego (Photogrammetric Division)**

**Mr. J. M. Catimu (Photogrammetric Division)**

**Mr. K. Nyamaii (Photogrammetric Division)**

**Work Schedule for Field Identification**

As of May 21, 2003

Month	Day	Week	Contents of Field Identification
May	22	THU	Preparatory work
	23	FRI	Preparatory work
	24	SAT	Holiday
	25	SUN	Holiday
	26	MON	Meeting with SOK and preparatory work
	27	TUE	Transfer technology of field identification
	28	WED	Transfer technology of field identification
	29	THU	Training of Field identification
	30	FRI	Training of Field identification
	31	SAT	Holiday
July	1	SUN	Holiday
	2	MON	National holiday
	3	TUE	Field identification
	4	WED	Field identification
	5	THU	Field identification
	6	FRI	Arrangement work
	7	SAT	Holiday
	8	SUN	Holiday
	9	MON	Field identification
	10	TUE	Field identification
	11	WED	Field identification
	12	THU	Arrangement work
	13	FRI	Arrangement work
	14	SAT	Holiday
	15	SUN	Holiday
	16	MON	Meeting with SOK

TECHNOLOGY TRANSFER  
OF  
SUPPLEMENTARY  
FIELD IDENTIFICATION

# SUPPLEMENTARY FIELD IDENTIFICATION TEAMS

<i>Group</i>	<i>Officer's Name</i>	<i>Designation</i>	<i>Officer's Name</i>	<i>Designation</i>
A	D. Njubi	Photogrammetrist	D.W. Mwangi	Surveyor
B	Abach Owino	Surveyor	Asenath Omollo	Cartographer
C	J.M. Mwara	Surveyor	Shadrack Igenda	Photogrammetrist
D	Waiharo	Cartographer	K Nyamai	Photogrammetrist
E	Wilson Kibiru	Surveyor	Teresia Muthoni	Photogrammetrist

Work Schedule for Supplemental Field Identification

as of Dec. 09, 2003

Month	Day	Week	Contents of Supplemental Field Identification	Remarks
Dec	1	MON	Preparatory work	
	2	TUE	ditto	
	3	WED	ditto	
	4	THU	ditto	
	5	FRI	Meeting and preparatory work	
	6	SAT		
	7	SUN		
	8	MON	Check and arrange administrative/political boundaries with names (1:2,500 & 1:5,000 sheet)	arrange on overlay using drawing pen
	9	TUE	ditto	ditto
	10	WED	ditto	ditto
	11	THU	ditto	ditto
	12	FRI		
	13	SAT		
	14	SUN		
	15	MON	Check and arrange administrative/political boundaries with names (1:2,500 & 1:5,000 sheet)	arrange on overlay using drawing pen
	16	TUE	ditto	ditto
	17	WED	ditto	ditto
	18	THU	Check or marking annotated names/symbols and topographic features to be identified (1:2,500 & 1:5,000 sheet)	check on overlay, and mark on field work sheet
	19	FRI	ditto	ditto
	20	SAT		
	21	SUN		
	22	MON	Check or marking annotated names/symbols and topographic features to be identified (1:2,500 & 1:5,000 sheet)	check on overlay, and mark on field work sheet
	23	TUE	ditto	ditto
	24	WED	ditto (half a day)	ditto
	25	THU		
	26	FRI		
	27	SAT		
	28	SUN		
	29	MON	Check or marking annotated names/symbols and topographic features to be identified (1:2,500 & 1:5,000 sheet)	check on overlay, and mark on field work sheet
	30	TUE	ditto	ditto
	31	WED	ditto	ditto
Jan	1	THU		
	2	FRI	Exercise of field identification together with all group nearby SOK	identify on field work sheet use
	3	SAT		
	4	SUN		
	5	MON	Field identification (1:2,500 sheet)	identify on field work sheet using pencil
	6	TUE	ditto	ditto
	7	WED	ditto	ditto
	8	THU	ditto	ditto
	9	FRI	ditto	ditto
	10	SAT		
	11	SUN		
	12	MON	Arrangement work or field identification (1:2,500 sheet)	arrangement work using drawing pen, field work using pencil
	13	TUE	ditto	ditto
	14	WED	ditto	ditto
	15	THU	ditto	ditto
	16	FRI	ditto	ditto
	17	SAT		
	18	SUN		
	19	MON	Field identification (1:2,500 sheet)	identify on field work sheet using pencil
	20	TUE	ditto	ditto
	21	WED	ditto	ditto
	22	THU	ditto	ditto
	23	FRI	ditto	ditto
	24	SAT		
	25	SUN		
	26	MON	Arrangement work or field identification (1:2,500 sheet)	arrangement work using drawing pen, field work using pencil
	27	TUE	ditto	ditto
	28	WED	Arrangement work or field identification (1:2,500 or 1:5,000 sheet)	ditto
	29	THU	ditto	ditto
	30	FRI	ditto	ditto
	31	SAT		
Feb	1	SUN		
	2	MON	Field identification (1:5,000 sheet)	identify on field work sheet using pencil
	3	TUE	ditto	ditto
	4	WED	ditto	ditto
	5	THU	ditto	ditto
	6	FRI	ditto	ditto
	7	SAT		
	8	SUN		
	9	MON	Arrangement work or field identification (1:5,000 sheet)	arrangement work using drawing pen, field work using pencil
	10	TUE	ditto	ditto
	11	WED	ditto	ditto
	12	THU	ditto	ditto
	13	FRI	ditto	ditto
	14	SAT		
	15	SUN		
	16	MON	Arrangement work or field identification (1:5,000 sheet)	arrangement work using drawing pen, field work using pencil
	17	TUE	ditto	ditto
	18	WED	ditto	ditto
	19	THU	Arrangement work	ditto
	20	FRI	Authorization of final results by SOK	ditto
	21	SAT		
	22	SUN		
	23	MON		
	24	TUE		

# Specification of GIS model system

## Description of Various Functions of GIS Model System

Function Level 1	Function Level 2	Function Level 3	Definition
<b>"Display Functions"</b>	Graphic Data Display Functions	Simple Display	Displays all graphic data
		Zoom in Display	Enlarges displayed data
		Zoom out Display	Reduces displayed data
		Select Scale	Displays data at a desired scale
		Change Layer Position	Changes the order of layers
		Add Layer	Adds new layer
		Delete Layer	Deletes displayed layer
	Attribute Data Display Functions	Display All Attribute Data	Displays all attribute data of the desired graphic data
Display Selected Attribute Data		Displays required attribute data of the desired graphic data	
<b>"Edit Functions"</b>	Graphic Data Edit Functions	Add Graphic Data	Adds new graphic data
		Change Graphic Data	Changes the shape and position of graphic data
		Delete Graphic Data	Deletes graphic data
	Attribute Data Edit Functions	Add Attribute Data	Adds new attribute data as new record or field
		Change Attribute Data	Change existing attribute data
		Delete Attribute Data	Deletes existing attribute information and fields
<b>"Analysis Function"</b>	Search/Query function	Simple Searches and Queries	Conducts simple searches using query builder
		Compound Searches and Queries	Conducts compound queries with query builder using operational symbols such as "and", "or", ">=", and "<="
	Overlay Analysis Function	Simple Overlay Operations	Conducts basic arithmetic operations (addition, subtraction, multiplication, division) by overlaying multiple layers using overlay builder
		Weighted Overlay Operations	Conducts basic arithmetic operations (addition, subtraction, multiplication, division) by weighting each layer using overlay builder

<b>"Analysis Function"</b>	Graphic Data Analysis Functions	Clip	Cuts out data in the desired area
		Merge	Merges multiple data
		Dissolve	Aggregates data with specified attributes
		Buffering	Generates space around a given point
<b>"Output Functions"</b>	Layout Functions	Create legend	Creates a legend on the layout screen
		Create scale	Puts a scale bar and scale values on the layout screen
		Create title	Enters the title of the map sheet on the layout
		Create orientation	Puts the orientation on the layout
	Data Output Functions	Output Image Data	Outputs the data on the screen as image data (tif, jpg, bmp, etc.)
		Output Attribute Data	Outputs attribute tables as Excel and dBASE files
		Print	Print out graphic data and attribute data using a printer and plotter
<b>"Transformation Functions"</b>	Coordinate Conversion Functions	UTM Conversion	Converts latitude/longitude coordinate data to UTM coordinates
		Latitude/Longitude Conversion	Converts UTM coordinates data to latitude/longitude coordinates
	Data Conversion Functions	CAD→Shape Conversion	Converts CAD data to Shape data
		Shape→CAD Conversion	Converts Shape data to CAD data
		Shape→Geodatabase Conversion	Converts Shape data to Geodatabase data
		Geodatabase→Shape Conversion	Converts Geodatabase data to Shape data
		Vector-Raster Conversion	Converts vector data (polygons, lines, points) to grid data



## Data Items of Databases

Database name	Type of data item	Data item
Spatial data infrastructure databases	Graphic	All topographic and planimetric feature items defined by topographic map data
GIS databases to support NCC works	Graphic	Administrative boundaries
		Road network intersections
		Cadastral boundaries
		Water and sewer facilities
		Medical facilities
		Educational facilities
		Social welfare facilities
		Vegetation
		Wetlands
		Land use
	Attribute	Administrative names
	Graphic	Results of traffic volume survey analysis
		Owner, land classification, area, etc, of land
		Attribute information of water and sewer facilities
		Attribute information of medical facilities (specialty, no. of doctors, etc.)
Attribute information of welfare facilities (type, etc.)		
Type of vegetation		
Type, area etc. of land use		
GIS model system to support traffic management	Graphic	Centerline of road
	Attribute	Road name
		Road name code
		Results of traffic volume survey analysis
		Road surface conditions (paved, etc.)
		Road width
		Road length
GIS model system to support water and sewer system	Graphic	Pipes
		Facilities (manhole, valve type, etc)

management	Attribute	ID number
		Type of facility
		Pipe diameter
GIS model system to support water and sewer system management	Attribute	Length
		Material
		Gradient
		Zone
		Record
		Status
		Location
GIS model system to support cadastral management	Graphic	Property boundaries
	Attribute	Name of owner
		Area
		Land classification
		Address (including lot number)

**ATTACHED DOCUMENT 5**

## Chapter 1 Current Situation and Issues of GIS Model System

### 1.1 Assessment of Current Situation

The following factors must be carefully considered when operating and managing GIS as a sustainable system. None of these factors must be lacking and all must be maintained in good balance.

- ◆ Database
- ◆ System
- ◆ Equipment (software, hardware)
- ◆ Personnel
- ◆ System operation (organization, finance)

Firstly, the current situation of the GIS model system is analyzed, and then the challenges are identified and suggestions of implementable projects are made.

#### (1) Database

##### a) Coverage

In developing the GIS database, it was decided that the basic policy is to support the tasks of NCC. The coverage of NCC management is the entire Nairobi City of 702 km<sup>2</sup> (595km<sup>2</sup>, excluding the Nairobi National Park). However as is described in the earlier chapter, the target area of the GIS model system only covers 15km<sup>2</sup> (1:2,500\*5sheet) in the central part of the City.

##### b) Contents

The sources of information used to establish the database were the paper maps and documents that are utilized in the respective departments at NCC for daily works. However some were produced as far back as the 1970's and very few of them have been systematically revised and maintained. Though accuracy and reliability of the data sources remains questionable, the study team utilized those maps and documents to develop the GIS database. The details of the database is described in the metadata, and the following table lists the major maps and documents used as data source for the database construction. (Table 1.1)

#### 【Maps】

Title	Scale	Year	Producer	Frequency of Updating	Remarks
Medical Facilities	1:50,000	2003	NCC Public Health Dept.	Annually	
Land Use Map : Zoning Map	1:50,000	1979	NCC City Planning Dept.	Every 10 Years	Zoning is reviewed every 10years; Land use is reviewed annually
Nairobi Water Supply Distribution System	1:2.500	1986	NCC Sewer and Water Dept.		

Sewerage System Nairobi Hill Area	1:500 1:100	1980's	NCC Sewer and Water Dept.		Two types of maps: Section and Layout
NCC Educational Facilities Map	1:50,000	recent	NCC	No definite period	The location is approximate area
Social Facilities	1:50,000	recent	NCC	No definite period	The location is approximate area
Map of Greater Nairobi with Street Index	1:22,500	recent	Tourist Maps Co., Ltd.		
Valuation Map	1:1,250		NCC Valuation, City Treasurer	No definite period	

**【Documents】**

Title	Year	Producer	Frequency of Updating	Remarks
Kenya Medical Directory	2003	NCC Public Health Dept.	Annually	
Landuse Policy Document		NCC City Planning Dept.	Not definite	
Schools Statistics Inventory	2003	NCC Education Dept.	Monthly	Only for public primary schools
Social Facilities Inventory		NCC Social Services & Housing Dept.		
Road Network Handbook	recent			(A to Z of Nairobi)
Third Nairobi Water Supply Project	1986	Howard Homphreys & Partners Consulting Engineers	(Distribution System Shortterm Plan to 1995 Volume2 Appendices)	

Table 1.1 Major data source for the database construction for the model system

c) Design

In the process of database design, the study team and NCC conducted a series of meetings in order to discuss the fields, contents, structure, and future possible use of the data. Only the databases which could be established within a financial, time, and technical framework of a model system were realized. In practical usage of the database, additional layers and attribute fields should be added.

Also, because the hardware and software provided by JICA is just one set, networking environment where multiple users access the database and edit it simultaneously is not considered.

(2) System

a) System development environment

**【Development Policy】**

◆ User friendly interface

Since the major users of the model system are assumed not to be familiar with computers and GIS, the system aims to have user friendly interface and be easy for the users to operate.

◆ Compliant with GIS database

The source information of the database is versatile, such as existing paper maps and

documents, extracting a part of the spatial data infrastructure, external digital database, or images etc. Therefore consideration was paid for the data schema and contents that there won't be any inconsistency between the database and the system.

◆ Extensible in the future

The model system put emphasis not on advance job analysis purpose but on basic data search-display purpose. However, it is designed to be a base platform that NCC can start and extend from it in the future.

**[Development Environment]**

- ◆ Microsoft Windows XP Professional
- ◆ ArcObjects
- ◆ VB Script
- ◆ Visual Basic 6.0 SP6

b) Extensibility of functions

The GIS software adopted in the project is ArcGIS (ESRI Inc., hereafter ESRI). The extensibility of its functions is assured under the development environment of Visual Basic for Applications (VBA), which is embedded in ArcGIS Desktop (ArcMap, ArcCatalog, etc.), as well as use of Component Object Model (COM) components developed by major computer languages (Visual Basic, Visual C++, Visual J++, etc.) . In this system development, Visual Basic is adopted to create COM components (ActiveX DLL) instead of VBA since there is a need for more developing flexibility than VBA can offer, such as creating original windows (dialogue windows). The COM components are automatically loaded when ArcGIS starts and all the customized functions are activated in ArcGIS.

In this model system, seventeen functions as common basic and analysis functions and two functions for each of the four model systems as specific analysis functions were created, based on the result of discussions with NCC and the study team.

(3) GIS software and hardware

a) GIS software

ArcInfo, ArcGIS series (ESRI Inc.), the software adopted for this model system, is one of the most powerful and widely used software. A variety of functions are prepared such as overlay, neighbor analysis, generalization, adjoining map sheets, coordinate conversion, file format conversion, etc.

Also, Spatial Analyst (raster data analysis functions) and 3D Analyst (3D data display and analysis functions) were added to ArcInfo as additional modules. The products of ESRI expand functionality by adding modules according to users' needs. In this project, the above two modules

were added by considering the tasks of NCC.

As with all other kinds of software, new versions of GIS software are released day after day. In case of the products of ESRI, any version ups and technical help are supported within a year from the day of purchase. However, it is necessary to pay the cost and make a contract of software maintenance for version ups and technical support from the second year.

b) GIS hardware

The set of GIS equipment provided to NCC is the minimum set of equipment necessary for GIS utilization. Because it is necessary to process large volume data such as images and raster data with GIS, the study team selected

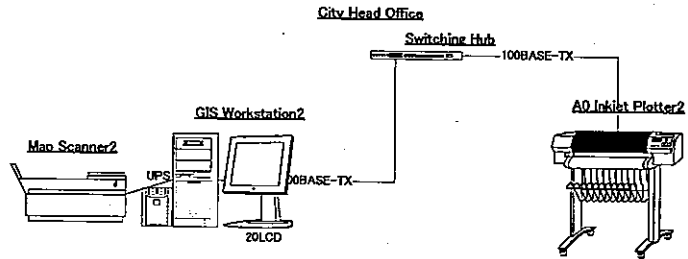


Figure 1.1 Equipment for NCC

high performance equipment. The introduced personal computer is going to function both as a GIS license server and a GIS client computer for the time being. A scanner mandatory for the digitalization of paper maps and a plotter for printing large size maps such as A0 are also introduced. The diagram (Figure 4.1) shows the provided components of GIS equipment.

The list (Table 1.2) describes the detailed specification of the GIS hardware that was provided by JICA for NCC.

Product Name	Mfr	Qty	Specifications
<b>Map scanner</b>			
Ose 4730	Ose	1	BW /A0size /800dpi or more
Original map protecting sheet	Ose	1	
SCSI cable		1	
<b>Software</b>			
TWAIN Driver	Ose	1	
<b>Ink jet plotter</b>			
Designjet 1055CM plus	HP (Hewlett Packard)	1	<Interface>100BASE-TX <Specification>Method : color ink jet system, Resolution : 600dpi x 600dpi, Output Size : max. A0, Memory : 64MB, Hard Disk : 7.5GB or more, Output Signal : HP-GL · HP-GL2 · HP-RTL · Postscript, Power : 100~240V, Supported OS : Windows2000 · Windows XPProfessional · WindowsNT4.0
128MBRAM	HP	1	
<b>Supplies</b>			
hp80 value pack black	HP	2	Ink system
hp80 value pack cyan	HP	2	Ink system
hp80 value pack masenda	HP	2	Ink system
hp80 value pack yellow	HP	2	Ink system
C6810A (914mmx91m)	HP	10	Roll paper, A0
<b>GIS work station</b>			
<b>Software</b>			
ArcGIS	ESRI		
Arc/Info		1	Basic module
Spatial Analyst Extension		1	Spatial data analysis module
3D Analyst Extension		1	3D analysis module
MS-Office XP Professional(E)	Microsoft	1	For data management
Internet Security Professional	Symantech	1	Anti Virus Software
<b>Hardware</b>			
Dell Precision 530	DELL	1	<CPU>P4 2.8GHz /<HD>U160SCSI 120GB or more /<Memory>1GBRAM /<Drive>DVD-RAM, CD-RW, FD /<Interface>100BASE-TX, USB2.0*4, IEEE1394, ext.SCSI, <Video Controller>128MB or more, 2port, Modem
2000FP	DELL	1	20inch LCD
Smart-UPS1500(E)	APC	1	Permanent power supply
<b>Switching Hub</b>			
<b>Hardware</b>			
Switching Hub		1	<Specification> No. of ports:24, Standard: 10BASE-T·100BASE-TX·1000BASE-T.
Category6Cable40m		4	<Specification> Length : 40m, Category : 6

Table 1.2 GIS equipment list for NCC

4) Personnel

As is mentioned earlier, the participants of the GIS training from NCC and SOK acquired the techniques and skills of GIS basic operation, editing, converting, spatial analysis, 3D analysis etc. The trainees were selected from those departments in which GIS can be effectively utilized. The professional level of the trainees varies, so that not only juniors who actually work on operations but also seniors who make decisions will grasp the capability of GIS and the possibility of its use. In this way, the study team hopes that the sustainability of GIS will be assured technically and organizationally.

City Engineer	3 trainees: Development, maintenance, and management of city infrastructure
City Planning	3 trainees: City planning, development, building permit contact
Town Clerk (Valuation)	2 trainees: Valuation and collection of property tax, property and land management
Nairobi Water & Sewer Co., Ltd.	2 trainees : management, operation, and development of water and sewer network

The trainees of the GIS training worked at the same time as a cross sectional task force group which cooperated in data collection, and discussion about database design and model system development and contributed to incorporate ideas and needs from the point of daily works.

(5) System operation (organization, finance)

a) Organization

NCC consists of eleven departments, each responsible for a particular public services. Among them, the City Planning department actively committed and cooperated in this project (highlighted in red in the figure 1.2). The City Planning department cooperates with other departments in daily works and its connection with others greatly contributed to

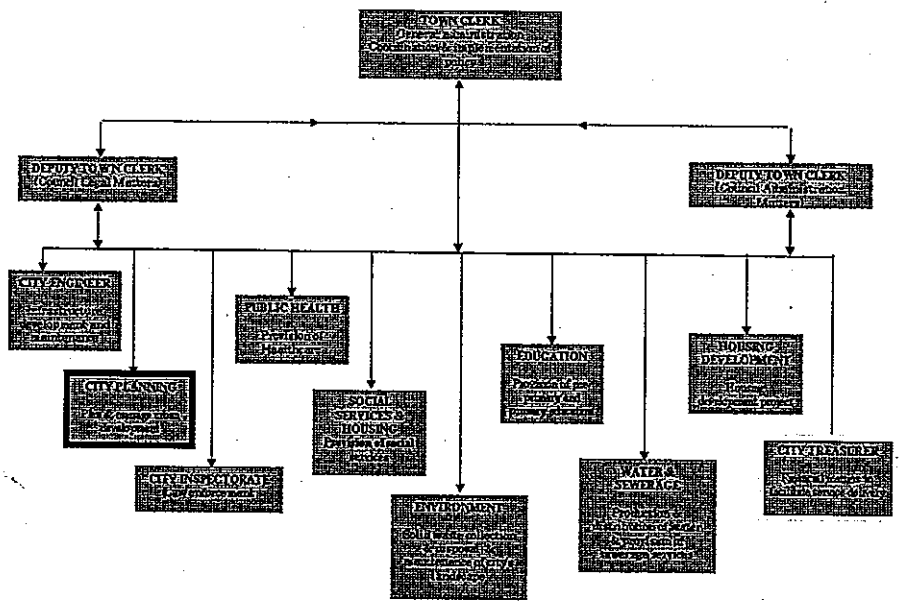


Figure 1.2 NCC Organizational Chart

this project. However, it is beyond the City Planning department's mandate to cross sectionally organize and progress the GIS initiative within NCC and cannot act as a leading body continuously after the project period.

On the other hand, there is Computer section in City Treasurer department (highlighted in yellow in the Figure 1.2) which provides computer-related services to all the NCC departments. The main tasks currently are to issue various taxation bills (water, sewerage, rates, benefit), calculate cost, maintain account books, and prepare payrolls of NCC personnel. In completion of those tasks, the



computers used at the relevant departments are networked by LAN, so that all the data management and calculation are centralized at the Computer section. Other than that, all the computers used in the rest of the departments and sections are either stand-alone computers or networked internally within the department, not networked throughout all of NCC.

b) Finance

Financial backup is essential in operating sustainable GIS. It is costly just to maintain hardware, software, database, human resources, supplies etc., and often the case in the developing countries, it is a heavy burden to finance all these expenses especially when the equipment is the latest model. The current financial status of NCC is extremely severe where revenue (mainly rates) generation cannot keep up with the total expenses.

The below describes the severe NCC financial situation.

“It is apparent that the problem confronting NCC is one of fiscal imbalance as signified by the large gap between revenues and expenditures. Over the years, expenditures have grown at a much faster rate than revenues creating a serious financial crisis which will continue to exert severe strain on the ability of the Council to provide satisfactory levels and quality of service. During the FY 2002/03, General Fund revenues amount to Kshs.3.5 billion against estimated requirements of Kshs.8.0 billion.” (NAIROBI CITY COUNCIL, ESTIMATES FOR THE YEAR ENDING 30<sup>TH</sup> JUNE 2003 AND PROJECTIONS FOR FINANCIAL YEAR 2003/2004)

Under this condition, it is quite difficult to allocate budget since introduction of GIS is not something directly producing or generating revenues for NCC. Therefore, through understanding and cooperation of all the departments are mandatory. Also it is important to analyze and calculate the actual benefit expected to be delivered by the use of GIS, gain full understanding of the senior staffs, and continuously allocate budget for GIS operation and maintenance. Because it is the first time that GIS is fully introduced to NCC, no budget is allocated for GIS operation and maintenance. Just as a reference, the estimates of the Computer Section of City Treasurer’s Department for fiscal year 2002-2003 and 2003-2004 is as follows (Table 1.3).

SECTION	YEAR	NO. OF STAFF	PERSONNEL	OPERATIONS	MAINTENANCE	TOTAL
COMPUTER	02-03	87	11,527,863	13,010,000	3,100,000	27,637,864
COMPUTER	03-04	66	15,266,000	11,100,000	620,000	26,986,000

Table 1.3 Estimates of the Computer Section of City Treasurer’s Department (Year 2002-2003,

**1.2 Issues**

As described in the basic policy of the GIS model system, the system aims to support the tasks of the departments in NCC and also to support finding measures for improving and solving urban problems (traffic, slum, etc.).

Based on the analysis of the current condition, the future challenges for NCC to realize the above aims of the model system through the use of GIS can be summarized as follows.

1) Database

a) Coverage

The target are of the model system was 15km<sup>2</sup> so it is necessary to expand the data coverage.

b) Contents

The accuracy and reliability of the data sources were questionable so it is necessary to verify if the database can be utilized for the practices at NCC.

c) Design

It is necessary to modify data structure and add contents based on the needs of the users in the practices. It is also necessary to shift from Personal GeoDatabase to Multi-user GeoDatabase in case of a substantial increase of data volume or change of editing environment from stand-alone to network.

2) System

a) System development environment

In developing the system, the adopted development environment may change in future such as release of new version of development language or operation system and it will be a challenge to make adjustments to those changes.

b) Extensibility of functions

It is necessary to add more functions and change software interface by programming in order to make the model system become more practical and useful in the practices. It may also be necessary to rewrite the program codes when the new version of GIS software is released.

3) GIS software and hardware

a) GIS software

Since the maintenance contract to assure new releases and technical support of GIS software is expensive, it will be a challenge to manage financing for it.

b) GIS hardware

In order to maintain equipment and purchase supplies such as plotter ink and papers, it is necessary for NCC to finance it for sustainable use of GIS.

4) Personnel

As an achievement of GIS training, all the trainees acquired knowledge and techniques of GIS operation. However, the opportunity for them to use computers in the daily work is very limited or none existed, and it is a challenge to sustain their achievement after

completing the project. Also, as the database expands and the GIS editing environment changes, it will be a challenge to secure professionals of programming and database management.

5) System operation

a) Organization

In order to use and develop GIS database and system cross-sectionally at NCC, it is necessary to establish an organizational setup which centralizes all the works related GIS and serves all the NCC departments. Currently there is nothing like it; however it will be a key how to cooperate with Computer section in the City Treasurer department which oversees all the IT related works. Cooperation with the Computer section or establishing a new unit under it should be carefully considered.

b) Finance

The financial condition of NCC is very severe now. The major reasons why revenue cannot be secured to meet the expenses is its weak financial foundation and lack of accurate and efficient tax billing and collection. The NCC summarizes the reasons and challenges for not being able to collect revenue correctly as follows.

- ① Low revenue base due to limited traditional sources. On average, NCC expects to collect approximately 40% of its base revenue from property taxes alone. Over-dependence on a single revenue source poses a fiscal risk.
- ② Lack of reliable and effective revenue control systems.
- ③ Gross under-registration of Single Business Permits and corresponding loss of revenue.
- ④ Failure to implement and levy property rates under the 2001 Valuation Roll following High Court ruling against the Council.
- ⑤ Delayed implementation of increases in housing rents and other fees and charges pending approval by MoI.G.
- ⑥ Low billing and collection efficiencies due to lack of incentives and low staff morale, and inaccurate maintenance of debtors accounts.

(NAIROBI CITY COUNCIL, ESTIMATES FOR THE YEAR ENDING 30<sup>TH</sup> JUNE 2003 AND PROJECTIONS FOR FINANCIAL YEAR 2003/2004)

On the other hand, at least minimum budget is necessary to sustain and manage GIS equipment, database and system provided by the project. This will be a challenge for NCC to generate these budgets under this situation.

## Chapter 2 Recommendations to Counterpart Agency

## 2.1 Future Image and Plans

It will not be easy to overcome the various challenges and introduce GIS efficiently. By studying the successful cases of the Japanese local authorities that launched GIS within the organization (Report on successful GIS implementation at the local authorities, Fiscal Year 2003, Ministry of Transportation, Japan), it is understood that there are two major purposes of introducing GIS in the beginning. One is to

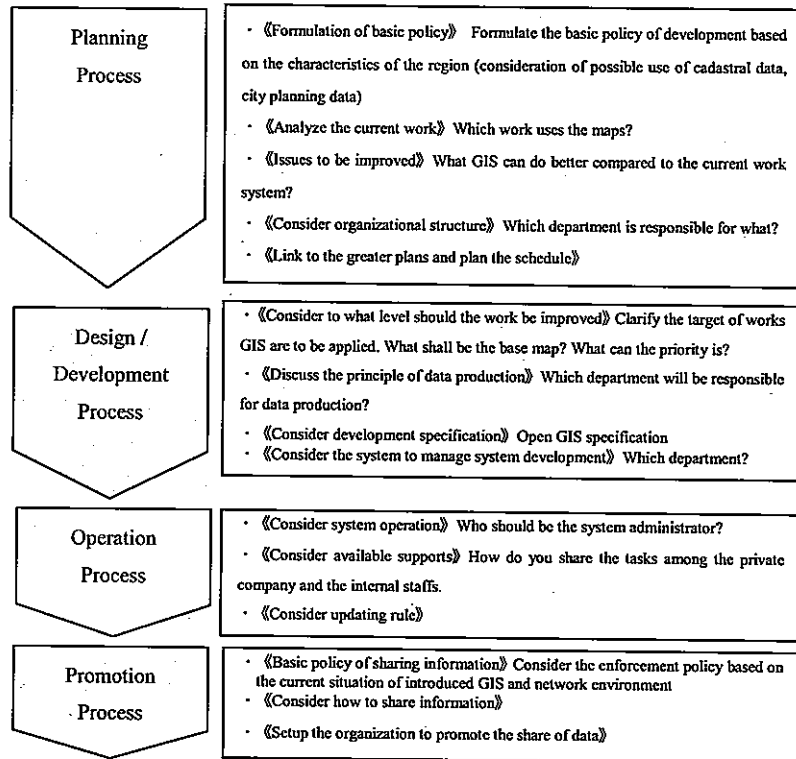


Figure 1 Process and checkpoints of GIS introduction

construct GIS data platform (cadastre data, city zoning data, etc.) as common information infrastructure, so called "Inter Departmental GIS", and the other is to construct specialize GIS (water/sewer management, roads, etc.) , so called "Work Specific GIS". Whichever the case is, the common characteristic of successful cases is that 1) Implemented as planned and by following steps, 2) Responsibility clearly defined and intersectional working group organized, 3) Cost and benefit calculated quantitatively, and 4) Consistent construction policy from the beginning.

Figure 2.1 describes the process and also the checkpoints at each process based on the experience of the municipalities and local authorities in Japan when introducing GIS. It is hoped that NCC refers to those checkpoints at each process of implementing GIS in the future.

As for NCC, the minimum complete set of GIS such as equipment, training, data, and system is provided for the first time through this project. It can be said that the trainees / task force group were engaged from the planning process to design/development process and operation through GIS model system development. However, it is still a prototype and the real challenge for NCC to implement GIS has just started.

Thus, the study team suggests the introduction of GIS to NCC as shown below (Figure 2.2) followed by detailed description of each stage.

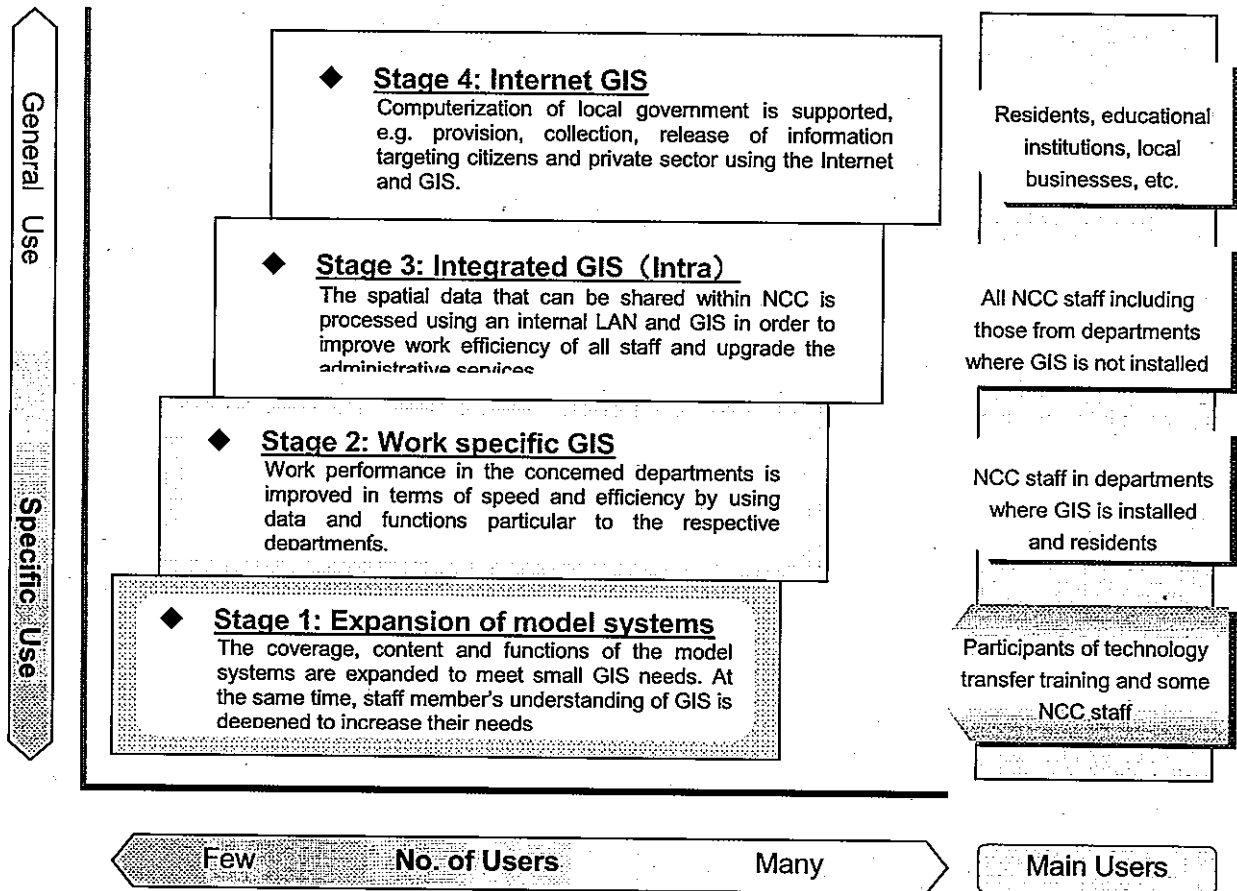


Figure2.2 Introduction of GIS to NCC by stage

**Fist Stage: Expansion of data coverage and functions of the model system**

At this stage, the NCC personnel who received the GIS technical transfer training take the initiative and use the provided equipment, to focus on expanding the model system. NCC staffs construct the database from the area of importance and priority and expand the data coverage. At the same time, they verify the constructed database from the point of geographic location and contents and update it. They also analyze necessary functions for the use in professional practices and add them to the model system. Above all, the most important thing at this stage is to further the understanding of the NCC personnel who had no opportunity to know GIS to increase their potential needs of the use of GIS for making their work more efficient and effective. The fruits of the first stage lead to the second stage: Establishment of Work Specific GIS. The detailed proposals for the fist stage are described in the next chapter six.

**Second Stage: Establishment of Work Specific GIS and Establishment of Common Data Infrastructure**

«Establishment of Work Specific GIS»

At this stage, it is assumed that the understanding of GIS by NCC personnel is matured and it is expected that the needs for introducing GIS to their practices have increased. It is then ready to establish work specific GIS at this stage. The purpose is to improve the speed and efficiency of works by utilizing the GIS system and database that are especially designed and customized for each of the needs of professional practices; That is, to construct an individual complete GIS system and database each for cadastre management, road management, water network management, sewer network management, and so on. These systems are no longer a model system but are scaled up to enterprise level that should computerize and automate the current daily work cycle. These systems should reduce cost, improve accuracy and efficiency of service delivery, and contribute to maximize revenue generations.

As with NCC, forty percent of revenues are dependent on property tax and this situation is causing a huge risk on NCC's financial status for being dependent on only one income resource. Base on this background, the study team suggests prioritizing and implementing the **GIS Cadastral Management System**. Needless to say that it is effective in increasing revenue generations but also it is also most versatile and can be widely used since cadastral information is the key to all other urban infrastructure management.

When planning the introduction of GIS Cadastral Management System, the following key points should be considered.

- Keys of Data

Be flexible about data accuracy as long as it is within the minimum accuracy requirement and has no problem in using it in practices since the source of data varies and the accuracy varies at the same time.

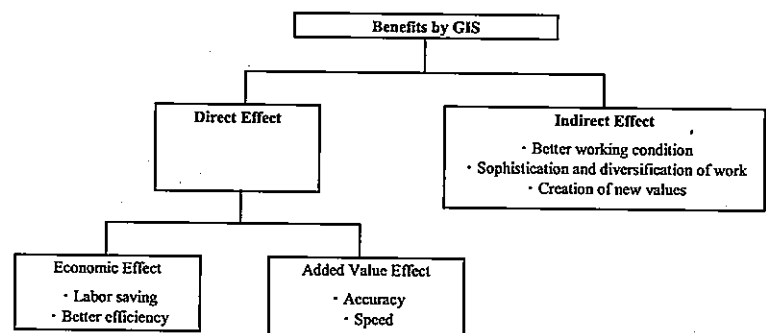


Figure 2.3 Groups of benefits gained by GIS

- Keys of System

Construct a user-friendly system which does not require complicated computer operations

- Keys of Equipment

It is important to look toward the Integrated GIS which will be implemented in the next stage; however, at this stage, consider the minimum investment to realize the work specific GIS and try not to overreach to the fully networked environment etc. which will be very costly and may lead to suspension of the entire GIS initiatives in the end.

- Keys of Organization and Operation

It is important to clarify the purpose of the use of GIS and analyze quantitatively the benefit of introducing GIS to the work cycles so that it will be more persuasive in budgeting for GIS. Follow Figure 2.3 which shows the group of benefits expected to gain from

introduction of GIS and clarify the factors of expected effects. For each identified factor, set specific targets for achievement and estimate the effect by comparing the factors before and after.

Groups of expected effects by introducing GIS

- (1) Quality improvement on business processing
  - Accuracy (Added value effect)
  - Sophistication (Indirect effect)
  - Simplification (Added value effect)
  - Better document presentation (Indirect effect)
- (2) Improvement on information management
  - Speed of information transmission (Added value effect)
  - Accuracy of information transmission (Added value effect)
  - Simplification of information usage (Added value effect)
  - Integration of information management (Economic effect)
  - Sharing and mutual usage of information (Economic effect)
  - Responding to increased amount of information (Added value effect)
  - Data protection (Added value effect)
- (3) Reduction of labor
  - Downsizing manpower (Economic effect)
  - Restraining increase of manpower (Economic effect)
  - Reduction of expenses (Economic effect)
- Shortening time for business processing (Economic effect)
- Reduction of overtime working (Economic effect)
- (4) Improvement on work environment
  - Efficient use of work space (Economic effect)
  - Reduction of simple repetitive work (Economic effect)
  - Improvement of communication (Indirect effect)
  - Improvement of employee morale (Indirect effect)
- (5) Improvement of public service delivery
  - Simplification of process (Added value effect)
  - Accuracy (Added value effect)
  - Speed (Added value effect)
  - Quality (Added value effect)
- (6) Quality improvement of administration
  - Optimization of decision making (Added value effect)
  - Accelerating decision making (Added value effect)
  - Adjusting to diversity of demands on administration (Indirect effect)
  - Securement of reliability (Indirect effect)

**«Development of Common Data Infrastructure»**

While promoting the introduction of work specific GIS, it is important to develop data infrastructure and manage various kinds of GIS database for use in future stages. It is sometimes the case that duplicated investments are made on the same database development when work specific GIS are introduced. In order to avoid this duplication of effort, it is crucial to identify the data that shall be shared and commonly used among the departments and develop and maintain this data infrastructure as common property by the initiative of cross sectional GIS organization in NCC. The list of data features specified as "common spatial data" in Japan (larger than 1:2,500 scale) is as follows. (Table 2.1) This is discussed and decided by the government of Japan, and it is crucial that at least NCC should discuss well and decide on the data features and specifications when any initiative by Kenyan government can not be expected. When developing common data infrastructure,

the budget of construction cost should be allocated from NCC's general fund since it is not targeting a specific department but is to be utilized by the entire Council in the future. Another way of securing budget is to collect small amount from each department by the basket system so that all the stakeholders at NCC share the cost and the benefits.

As a reference, the data items specified by the Japanese government for the local authorities as "common spatial data" (1:2,500 level or larger) is listed below. Looking into each of the data items, some are similar to those established by this project as the spatial data infrastructure (DXF format) and the topographic GIS database (ESRI Geodatabase) at 1:2,500 and 1:5,000. The corresponding code numbers of the topographic GIS database are shown also in the same list.

Data Item	Type	Contents	SDI (CODE#)
Administrative bound	Polygon	Administrative boundary	110100 - 111000
Plot boundary	Polygon	Land property boundary	N/A
Plot boundary point	Point	Plot boundary defined by surveyed points	N/A
Control point	Point	Triangulation point, and all the national control point	980100 - 980500
City boundary	Polygon	City boundary	N/A
Road center line	Line	Center line of roads	212000
Road	Polygon	Road width larger than 180cm	210101 - 210401
Pedestrian road	Line		210501 - 210601
Building	Polygon	Building compound larger than 10m <sup>2</sup>	300100 - 300400
Railway	Line	Center line of railways, monorails, etc.	210101
Water line	Line	River, narrow river, canal etc.	510301 - 510501
Lake / Pond / Swamp	Line	Lake, pond, swamp	510201 - 510211
Coastal line	Line	Coastal line	510101
Water related construction	Line	Dam, water gate, breakwater	521201 - 521801
Elevation	Surface	Base height from the earth surface	DEM
Image	Image	Aerial photo, satellite images, and other image data	Orthophoto

Table 2.1 Common spatial data list in Japan

### 《Establishment of GIS unit》

While pursuing the development of work specific GIS, it is essential to establish an organizational set-up to support the development of common data infrastructure and promote cross departmental cooperation. The proposal is to establish a GIS unit under the Computer Section in the City Treasurer Department (highlighted green in the figure 2.4) so that the following functions can be centralized and strengthened. The GIS unit serves as an inter-departmental organization which provides database and technical support and adjusts and harmonizes the development of work specific GIS with a view of the intranet GIS in the next stage.

- ◆ Adjustment among various departments and promotion for diverse application to the work
- ◆ Determination on the data specification of common data infrastructure and database development



- ◆ GIS technical support (maintenance and management of system, database, software, equipment)
- ◆ Assistance in utilizing private companies in database and system development

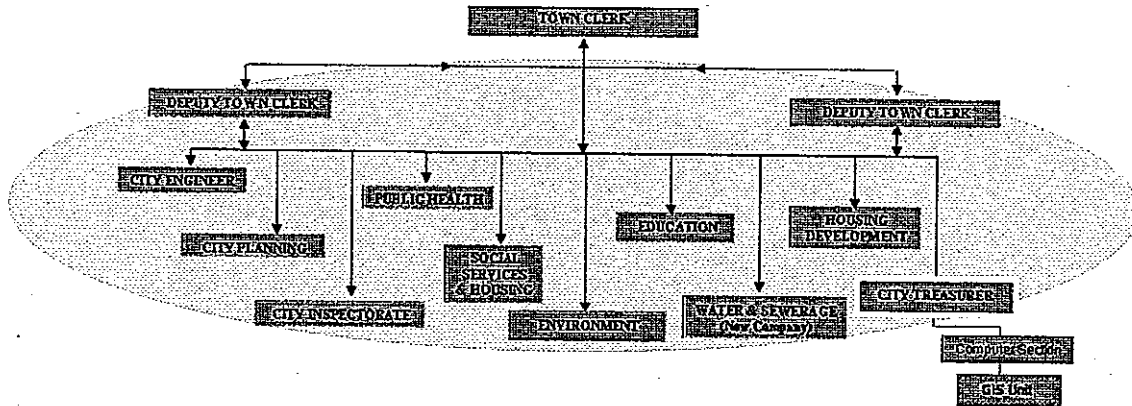


Figure 2.4 GIS unit within NCC

### Third Stage: Development of Intranet GIS (Integrated GIS)

Integrated GIS is defined as follows.

Identify the spatial data which can be commonly used, develop and maintain it systematically so that multiple departments can utilize the necessary data in operation

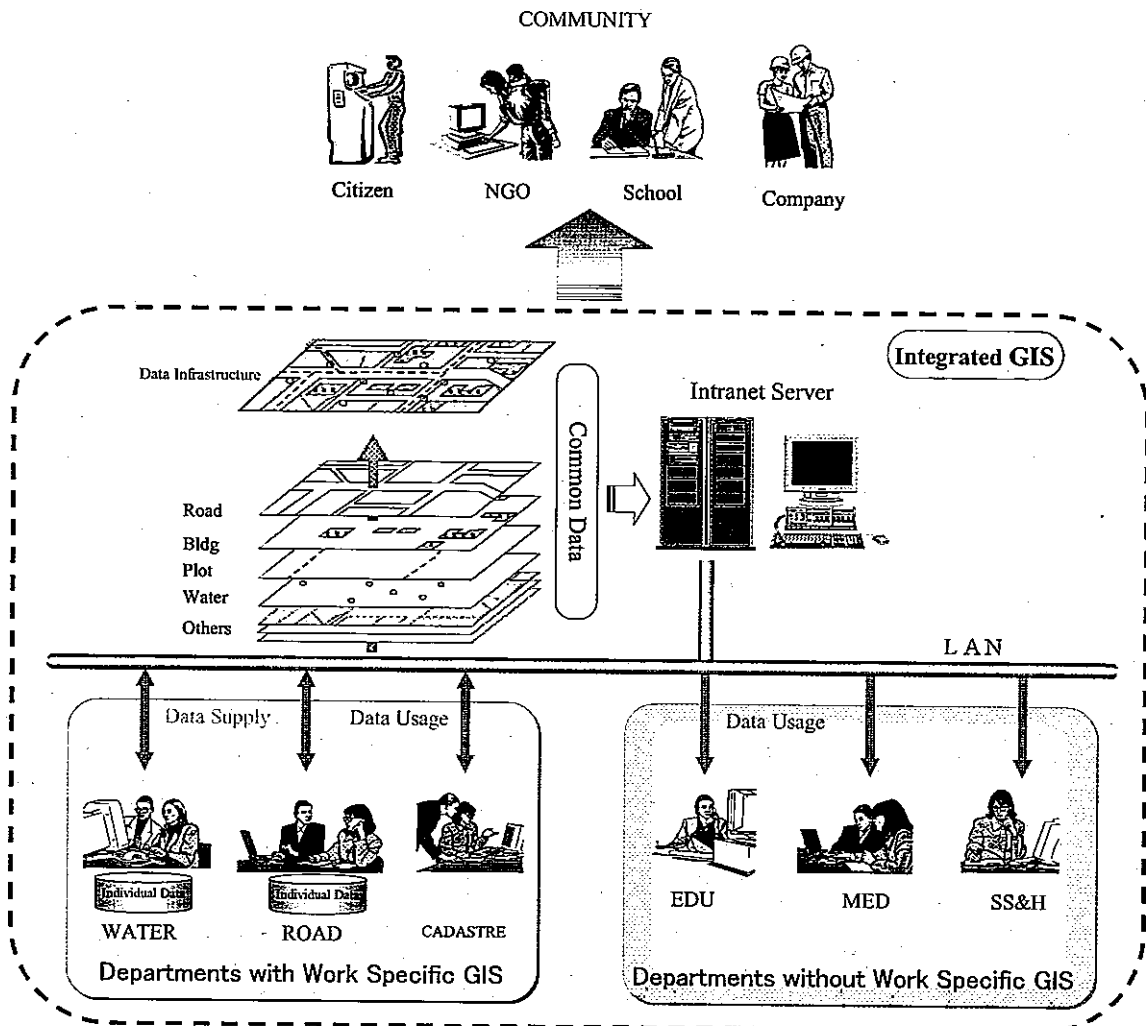


Figure2.5 Integrated GIS

In the second stage, the personnel who use work specific GIS in the respective departments and those who work for the GIS unit are the only GIS users at NCC. However, in this third stage, the goal is to allow the rest of the departments to access GIS through LAN and acquire necessary maps and attribute information to utilize in their works.

It is the precondition that LAN is established in NCC and client computers of each department are networked and work specific GIS is performing stably at the respective departments. Also common data infrastructure should be developed by the GIS unit.

Since GIS is a part of the IT world, it is crucial to incorporate with IT policy of NCC and the Kenyan government and develops GIS as a part of the whole IT strategy.

According to DRAFT STRATEGIC PLAN 2004-2009 (NCC, April 2004) which shows the future vision of NCC, Information and Communication Technology (ICT) is raised as one of the 10 strategic issues. In the description of current status, it is said that most of the work is done manually and that leads to the problem of information management and hinders quality service delivery to the citizen.

“Council is not adequately prepared to effectively utilize the available ICT in its operations. Most of the operations of the Council are carried out manually. This has resulted in its poor record keeping and performance in service delivery. It is important to develop an ICT system in the Council, which will avail timely information at all levels. In addition staffs need to be developed in this area so as to be proactive in service delivery.” ( DRAFT STRATEGIC PLAN 2004-2009 NCC, April 2004)

In order to improve this situation, the following strategies and corresponding actions are scheduled.

(Table 2.2) It is crucial to include GIS as a part of ICT needs which are planned to be assessed in December 2005 and lead to the purchase of equipment and capacity building. During the period of “Implement and use ICT in the Council Operations” in June 2007, it is suggested that a smooth transition from Work Specific GIS to Integrated GIS and improvement of work efficiency and speed at NCC be realized.

Strategy	Action	Responsibility	Time Frame	Performance Indicator
1) Identify ICT needs of Council	Appoint a consultant to undertake ICT needs assessment	TC HODs	Dec 2005	* Report on ICT needs submitted
	Develop an ICT policy			* ICT policy and strategy developed and implemented
2) Install and use the ICT system	Purchase ICT tools and equipment	TC HODs	Dec 2006	* ICT system in place
	Train staff in use of ICT	HRM	Dec 2006	* Number of trained staff
3) Implement and use ICT in the Council Operations	Promote increased use of ICT in the Council	HODs Senior Offices	June 2007	* Services accessible using e-government * Efficiency
	Develop, maintain and use of Council Website	Council TC HODs	Immediate & Continuous	* Updated website

Table 2.2 NCC ICT Strategic Plan

(TC: Town Clerk, HODs: Head of Departments, HRM: Human Resource Management)

#### **Forth Stage: Development of Internet GIS**

At this stage, NCC staffs promote the concept of e-government, collect, and disclose information to citizens, private companies, etc. by use of the internet and GIS. Other than NCC staffs, the major users vary such as governmental organizations, citizens, educational institutes, private companies and so on.

In the previous stage, the purpose is to build an integrated GIS for the cross-departmental use of GIS within NCC. In this stage, it is expected to expand the internal use of GIS to broader use throughout the internet. GIS is a technique that can improve the efficiency and speed of conventional activities and also create a variety of value added services in the field of administration, industries,

and citizens' lives.

There are many preconditions to realize the internet GIS, such as construction of communications infrastructure, dissemination of IT use among the citizens, development of spatial data infrastructure, and progress in research and development of GIS application by the private companies in a variety to fields. Strong initiative by the government is crucial. However, it is not too early for the NCC to start considering what kind of information and services they should provide to the rest of the world once the future vision becomes true.

## 2.2 Recommendations to NCC

### 2.2.1 Overview of Plans for Priority Projects

As is suggested earlier in 2.1, GIS should be introduced to NCC in stages. In this section, the proposals for expanding data coverage and system functions in the first stage are summarized based on the discussion with NCC personnel. For each model system, 1) data coverage, 2) scale, 3) accuracy, 4) update frequency, 5) additional attributes, 6) additional layers, and 7) additional functions are discussed in the following.

It is supposed that all the proposed work including data collecting, organization, and GIS data entry will be completed by the respective personnel of NCC by use of the equipment provided by this project.

#### 1) Cadastre Model System

The GIS database developed in relation to cadastral management is Property Polygon. This was constructed by digitizing the valuation maps, creating polygons, and attaching the attribute information provided in the form of MS Access Database by Valuation section. As is shown in Table 2.3, the attributes include plot number, land owner details, and other information related to land valuation.

Field name	Field type	Field size	Remarks
ID	Text	15	ID number
LRN	Text	20	Land reference number
SN	Text	10	Serial number
VBN	Text	20	Valuation book number
MAP_SHEETNO	Text	20	Map sheet number
Own_detail	Text	255	Name and BOX of ratable owner
Telephone	Text	15	Telephone number of ratable owner
Area	Double		Area (unit is Ha.)
Value_	Integer		Value of property (unit is kes)
USER_	Text	30	Original user
Situation	Text	50	Description of location
Tenure	Text	20	Tenure (Lease hold or Freehand or Trust land)
Lease	Integer		Lease term (unit is years)
Rates	Integer		Rates payable (unit is KES)

Table 2.3 Property Polygon Attribute List

#### ① Data coverage

The data coverage is expanded from the current 15km<sup>2</sup> (shown blue in the figure 2.6) to the area of 105 km<sup>2</sup> (shown yellow in the same). It is 35 map sheets at 1:2,500 (7 times larger than the target area of the model system).

②Scale

The data scale is maintained at the level of 1:2,500. This is not large enough to precisely measure area on GIS. However Property Polygon should be used as an index map and the details such as surveyed area and other personal information related to property is stored as the attributes of the polygons. When necessary, 1:500 level database shall be developed only for the densely urbanized area in the future.

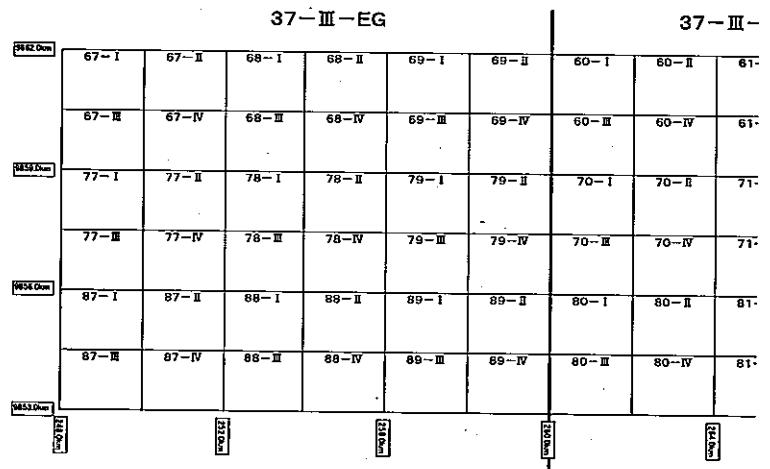


Figure 2.6 Data Coverage of Property Polygon

③Accuracy

It is necessary to conduct field surveys to verify geographic position and confirm cadastre attribute information by the NCC personnel.

④Update frequency

At minimum, the data should be verified and updated once a year.

⑤Additional attributes

Target layer : Property\_pol

In order to accurately charge and collect property tax, two attribute fields, Term of lease and Commencement, shall be added. In addition, the attribute fields which are already prepared but to be filled in prior to others are the followings; Tenure, Lease, Situation.

Graphic type : polygon

Scale of the original maps : 1:1,250 (Valuation Map)

Reference material : Title Deeds, Certificate of Lease

Attribute fields: Refer to the table below

Field name	Field type	Field size	Remarks	Data Source
Term of lease	Text			<ul style="list-style-type: none"> <li>• TITLE Deeds,</li> <li>• Certificate of Lease</li> </ul>
Commencement	Date			

In addition to the above attribute fields, the following attribute fields area already prepared and to be filled as priority.

Field name	Field type	Field size	Remarks	Data Source
Tenure	Text	20	Type of ownership (Free hold, Lease hold, NCC, Kenya Railways)	<ul style="list-style-type: none"> <li>TITLE Deeds,</li> <li>Certificate of Lease</li> </ul>
Lease	Integer		Lease term (unit is years)	
Situation	Text	50	Description of location	Topographic maps

⑥ Additional layers

Additional layer : Planning Zones

This is the zoning map showing the planning zones. Its attributes include building code which is derived from the month notices and all kinds of details about the zones are utilized in land development, land valuation, city planning, and taxation purposes.

Graphic type : polygon

Scale of the original maps : 1:2,500 (Zoning Map)

Reference material : Zoning Table, Planning Policies

Attribute fields: Refer to the table below

Field name	Field type	Field size	Remarks	Data Source
Zone	Number			<ul style="list-style-type: none"> <li>Zoning Map</li> <li>Zoning Table</li> <li>Planning policies</li> </ul>
Density	Number			
Ratio	Number		Plot Ratio	
Grdcov	Number		Ground Coverage	
MinPlot	Number		Minimum plot size	
ActDevelop	Text		Actual Development (single, Multi Dwellings)	

Additional layer : Outdoor Advertisements

This is the point data showing the outdoor advertisements such as signboards, billboards and advertisement towers which NCC generates advertising rates. This data will help generating accurate and efficient collection of the licensing fees.

Graphic type : point

Scale of the original maps : 1:100 – 1:250 (Approved Plans)

Reference material : Licenses, Policies

Attribute fields: Refer to the table below

Field name	Field type	Field size	Remarks	Data Source
Type	Text		Type (Billboards, Suburb Signs, Under Canopy, Sky Signs, etc)	<ul style="list-style-type: none"> <li>Approved Plans</li> <li>Licenses</li> <li>Policies</li> </ul>
Size	Number			
Location	Text		Location (Road Reserve, Private Property, Public Utility Land, etc.)	

⑦ Additional functions

No additional functions are necessary for now.

2) Road Model System

The GIS database constructed for road management indicates the road network (line) and intersections (point). The road network was generated from the center line of the spatial data infrastructure (1:2,500) by converting it to GIS database and appending the attribute information. The intersection data was generated by automatically creating nodes at the intersecting point of the roads and attribute information is appended. The lists of attributes are shown in Table 2.4, Table 2.5.

Field name	Field type	Field size	Remarks
ID	Text	15	ID number
Code	Text	6	Road code
Name	Text	50	Road name
Length	Text	255	Road length (unit is km)
Width	Double		Road width (unit is m)
Roadstart	Text	255	Adjoining road at the starting point
Roadend	Text	255	Adjoining road at the ending point
Lane	Integer		Number of road lanes
Class	Text	15	Class of road (Arterial, Primary or Feeder)
Condition	Text	15	Condition of road surface (paved, unpaved earth, unpaved gravel)
Material	Text	30	Material of road surface (asphalt or gravel or hardcore)
Estate	Text	30	Estate name of road location
PublicT	Text	5	M (Matafu) or B (Bus)
Authority	Text	7	Authority of roads (NCC or MPOV or PRIV)
Mapno	Text	30	NCC's original map sheet number
Parking	Integer		Number of parking spaces
Shape_Length	Double		Length of each line segment calculated by ArcGIS

Table 2.4 Road Network Line Attribute List

Field name	Field type	Field size	Remarks
ID	Text	15	ID number
Signal	Integer		With or without signal
Type	Integer		Type of intersection (Junction or Rotary)
Station	Integer		Numbers used as junction ID during the traffic volume survey
Jam_survey	Integer		Whether or not field survey of traffic congestion was done
Path1	Text	50	Directory path for hyper linking to EXCEL worksheet of traffic volume (survey type 1) [book:sheet]
Path2	Text	50	Directory path for hyper linking to EXCEL worksheet of traffic volume by directions (survey type 2) [book:sheet]
Path3	Text	50	Directory path for hyper linking to EXCEL worksheet of congestion survey (survey type 3) [book:sheet]

Table 2.5 Intersection Point Attribute List

①Data coverage

Data coverage is extended from the current 15km<sup>2</sup> (blue in the figure 2.7) to 400km<sup>2</sup> (circled orange in the same figure, EAST 267,000m, WEST 247,000m, NOTRH 9,868,250m, SOUTH 9,848,250m) which is proximately 26 times as large as the model system coverage. It is going to cover 20km × 20km including the central part of the city.

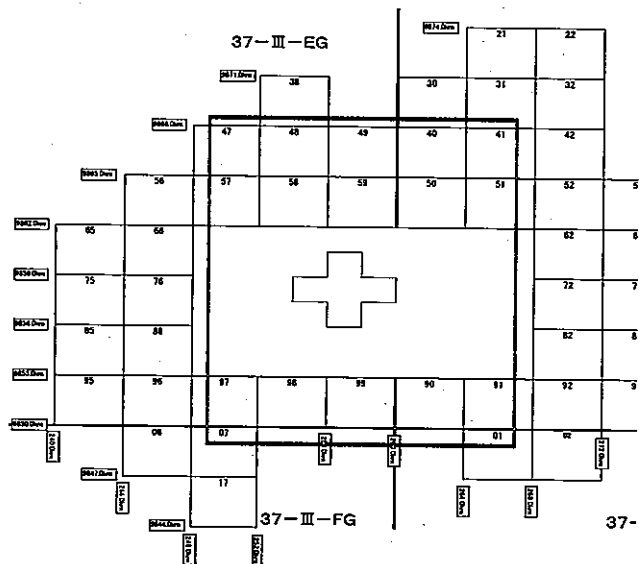


Figure 2.7 Road / Intersection Data Coverage

②Scale

The data scale is maintained at the level of 1:2,500. However the area for which the 1:5,000

topographic data was produced will adopt 1:5,000 level.

③Accuracy

Field survey should be conducted to verify the road condition and positional accuracy.

④Update frequency

At minimum, the data should be verified and updated once every 6 months.

⑤Additional attributes

Target layer: Road lin macro

In order to be used for the additional function of “Display Road Congestion Indicator”, the maximum number of cars that a road is capable of handling is added as an additional attribute. For the purpose of road planning and maintenance, the estimated cost and actual cost of road construction are input as the attributes of mcost\_est and mcost\_act. In addition, the attribute fields which are already prepared and to be filled in prior to others are the following; Lane, Parking, Authority.

Graphic type : line

Scale of the original maps : 1:2,500 and 1:5,000 (Topographic Map)

Attribute fields: MaxVol, mcost\_est, mcost\_act, lane, parking, authority

Field name	Field type	Field size	Remarks	Data Source
MaxVol	Integer		Maximum capacity of the road ( vehicles / hour / lane) Maximum capacity of the road is the number of vehicles that can run without congestion for a certain period of time (1hour or 1day). The value changes depending on how many lanes the road has. The following is the standard value used in Japan. For multiple lane road (more than 4 lanes) 2,200 vehicles / hour / lane For two lane road (two lanes) 2,500 vehicles / hour/ two lanes e.g. In case of 6 lanes road: MaxVol = 2,200 * 6 = 13,200 vehicles / hour In case of 2 lanes road: MaxVol = 2,500 vehicles / hour	To be specified
mcost_est	Integer		Estimated maintenance cost for the year (unit is KES)	budget book
mcost_act	Integer		Actual maintenance cost for the year (unit is KES)	budget book

In addition to the above attribute fields, the following attribute fields are already prepared and to be filled as priority.

Field name	Field type	Field size	Remarks	Purpose
Lane	Integer		Number of road lanes	To calculate traffic volume capacity per road
Parking	Integer		Number of parking spaces	For efficient collection of parking fees
Authority	Text	7	Authority of roads (NCC, MPOV, or PRIV)	For road maintenance

⑥Additional layers

Additional layer: Street Lighting

This is a point data showing the location of the equipment related to roads such as street lights. It is to be used in managing and planning of street lighting system.

Graphic type : point



Scale of the original maps : To be specified

Attribute fields: Refer to the table below

Field name	Field type	Field size	Remarks	Data Source
ID	Text	15	ID number	To be specified
Code	Text	6	Road code	
Name	Text	50	Road name	
Length	Text	255	Road length (unit is km)	
Width	Double		Road width (unit is m)	
Roadstart	Text	255	Adjoining road at the starting point	
Roadend	Text	255	Adjoining road at the ending point	
Streetlight	Text	15	(Installed or Not Installed)	
Streetlight_cnd	Text	10	Condition of streetlight (Connected or Not Connected)	
Estate	Text	30	Estate name of road location	

## ⑥ Additional functions

### Display Road Congestion Indicator

This is to color classify the road network by current road congestion condition using the result of traffic volume survey and the maximum road capacity of each road segment. In Japan, the maximum road capacity is specified per lane per day or 12 hours and varies depending on the number of lanes. This information is useful for understanding the congestion situation and also planning new road developments. The necessary attribute value (MaxVol) should be prepared in using this function.

[System Requirements Definition]

Scope: Road model system

Actors and interests: Users of the road model system; to be able to identify the congested roads currently in order to plan the future development of roads.

Goal: To color classify the road network by current road congestion condition using the result of traffic volume survey and the maximum road capacity of each road segment.

Preconditions: The road model system is properly started up.

Main Success Scenario:

- The system displays Display Congestion Level button on the toolbar.
- The user selects the button.
- The system displays a window for the user to select 1) which survey result to be used (survey date and time) and 2) how many classification classes to be used to indicate the congestion level.
- The user inputs necessary parameters. Then the system calculates as follows.

The system divides the result of traffic volume survey (vehicles/hour) by the maximum road capacity (vehicles/hour/lane or vehicles/hour/2 lanes). The calculation result indicates congestion level of that road segment. When the result is above 1.0, it indicates the current traffic volume exceeds actual capacity of the road.

Example (4 lane road at 7:00 AM):

Surveyed number of vehicles (vehicles/ hour): 10,000

Maximum number of vehicles (vehicles/hour/lane): 2,200 (vehicles/hour/lane) \* 4 (lane) = 8,800

$10,000 / 8,800 = 1.136$  (congestion level)

- The system changes the legend of the map and colors the road network by congestion level with

the given number of classification classes.

### 3) Water Model System

The GIS database constructed for water management includes the water network (line) and chambers (point). The water network was digitalized by scanning the network maps (1:2,500) provided by NCC. The attributes of the

Field name	Field type	Field size	Remarks
ID	Text	15	ID number
Length	Double		Pipe length (unit is m)
Diameter	Double		Diameter of pipe (unit is mm)
Material	Text	20	Material of pipe
Gradient	Text	20	Gradient of pipe (by ratio, 1:80, 1:27)
Zone_	Text	30	Description of supplied zone
DRG1	Text	20	NCC's original drawing number
DRG2	Text	20	NCC's original drawing number

Table 2.6 Water Network Line Attribute List

water network was summarized by reading information on the maps into the attribute inventory. The chamber points were also created in the same way as the water network. In February 2004, the study team conducted a series of field surveys and the survey results are also incorporated in the GIS database. The lists of attributes are shown in Table 2.6, Table 2.7.

Field name	Field type	Field size	Remarks
ID	Text	15	ID number
Material	Text	15	Material of chamber
Type	Text	30	Type of chamber (Reducer, Fire hydrant, Sluice valve, Pressure reducing valve, Meter/Dall Tube, Air Valve)
Location	Text	20	Ground position; verified or unverified
X_coord	Double		X Coordinates (Easting)
Y_coord	Double		Y Coordinates (Northing)
Status	Text	10	Only applies to Sluice Valve; Closed or Open

Table 2.7 Chamber Point Attribute List

#### ①Coverage

Data coverage is extended from the current 15km<sup>2</sup> (light blue in the figure 2.8) to 588km<sup>2</sup> (blue in the same figure, EAST Kayole Estate, WEST Kangemi Estate, NORTH Kimathi Estate, SOUTH Nairobi National Park, which is approximately 39 times as large as the model system coverage.

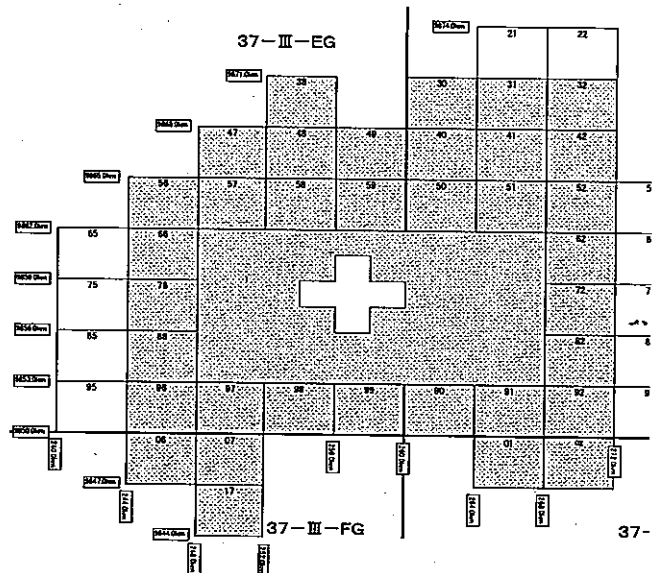


Figure 2.8 Water Network Line / Chamber Point Data Coverage

#### ②Scale

The data scale is maintained at the level of 1:2,500. This is not large enough to perform precise measurements on GIS. However, Water Network and Chamber should be used as an index map and the details are stored as the attributes of the lines and points. The printout of this database is expected to be used on the field.

③ Accuracy

In order to improve data reliability, GIS database should be verified by field surveys and updated frequently. Especially when a new water pipe or a chamber point is established, this field identification is essential.

④ Update frequency

It is ideal if data update is performed as a part of daily activities. However, due to financial restrictions, data update should be done once a year at minimum.

⑤ Additional attribute

Target layer: water lin

In practice, it is important to maintain information of water supply zones so it is to be added.

Graphic type : line

Scale of the original maps : 1:2,500

Attribute fields: Zone\_

Field name	Field type	Field size	Remarks	Data Source
Zone_	Text	30	Description of supplied zones	To be specified

⑥ Additional layers

Additional layer: Nodes

Irrespective of availability of water facilities, this point data shows the location of connecting location of the pipes.

Graphic type : point

Scale of the original maps : 1:2,500

Attribute fields: To be decided

Field name	Field type	Field size	Remarks	Data Source
To be specified				To be specified

⑦ Additional functions

Simulate Construction Cost for Water Network

The "Simulate Construction Cost" function was created in order to calculate the installation cost when laying new pipe lines. The user inputs parameters and draws a line on the screen so that the system calculates the cost of construction based on the length of the line and the given parameters.

The proposal is to add one more parameter to be given by the user. The cost is largely affected by the size of the pipe so the parameter of the pipe size is added. However in actual calculation, the additional parameter will not effect the calculation but will be used only to indicate the size of the pipe. The user should already consider the size when he/she keys in the other cost per unit parameters.

[System Requirements Definition]

Scope: Water model system

Actors and interests: Users of water model system; to digitize a tentative line on the screen and be able to determine that distance and approximate cost of laying a pipe; to display the results so that it can be used as reference material in actual construction projects. Although it will be necessary to adjust the functions according to actual tasks, at the present stage, the system design should be focused on user-friendly operation without having to prepare in advance and process the data required for analysis.

Goal: To simulate the total construction cost of water line

Preconditions: The water model system is started up and the data is loaded.

Main Success Scenario:

- The system displays a Simulate Construction Cost command button on the toolbar.
- The user clicks the command button.
- The system checks that the required data and settings are loaded.
- The system displays a dialogue for entering in the parameters (size of pipe: mm or inch, cost of excavation: KES/m, laying and back filling cost: KES/m, testing and sterilizing cost: KES/m, material cost: KES/m) for working out the cost.
- The system prompts the user to digitize a line for water pipe construction.
- The user digitizes a line.

- The system calculates total construction cost [(excavation cost + laying & back filling cost + testing & sterilizing cost + material cost) \* distance] and display the line and the result.
- When the user double clicks, finish line digitizing. And the system displays the result as follows.

Distance : XXXX m  
 Size of pipe : XXX mm / XXX inch  
 Cost of Excavation / Distance: XXX KES / m  
 Cost of Laying & Back Filling / Distance: XXX KES / m  
 Cost of Testing & Sterilizing / Distance: XXX KES / m  
 Cost of Material: XXX KES / m  
 Total cost of construction: XXXX KES

- The system remains displaying the digitized line features and the results of calculation until the user clicks the clear button

4) Sewerage Model System

The GIS database constructed for sewer management includes the sewer network (line) and manholes (point). The sewer network was digitalized by scanning the network maps

Field name	Field type	Field size	Remarks
SR	Text	20	Serial Record number
ID	Text	15	ID number
Length	Double		Pipe length (unit is m)
Diameter	Double		Diameter of pipe (unit is mm)
Gradient	Text	15	Gradient of pipe (by ratio, 1:80, 1:27, maximum decimal points = 2, for example 1:80.99)
Material	Text	30	Material of pipe
Area_estate	Text	30	Name of the area / estate served
Record	Integer		Year of construction
PDS	Text	20	Privately Developed Sewer number

Table 2.8 Sewerage Network Line Attribute List

(1:2,500) provided by NCC. The attributes of the sewer network were

summarized by reading information on the maps into the attribute inventory. The manhole points were also created in the same way as the sewer network. In February 2004, the study team conducted the series of field surveys and the survey results are also incorporated in the GIS database. The lists of attributes are shown in Table 2.8, Table 2.9.

Field name	Field type	Field size	Remarks
ID	Text	15	ID number
IL_in	Double		Invert Level (unit is m) incoming
IL_out	Double		Invert Level (unit is m) outgoing
GL	Double		Ground Level (unit is m)
Type	Text	20	Type of manhole (normal or drop)
Status	Text	20	Ground position verified or unverified
X_coord	Double		X Coordinates (Easting)
Y_coord	Double		Y Coordinates (Northing)

Table 2.9 Manhole Point Attribute List

① Coverage

Data coverage is extended from the current 15km<sup>2</sup> (light blue in the figure 2.9) to 391km<sup>2</sup> (circled brown in the same figure, EAST 270,000m, WEST 247,000m, NORTH 987,000m, SOUTH 985,300m) which is proximately 26 times as large as the model system coverage.

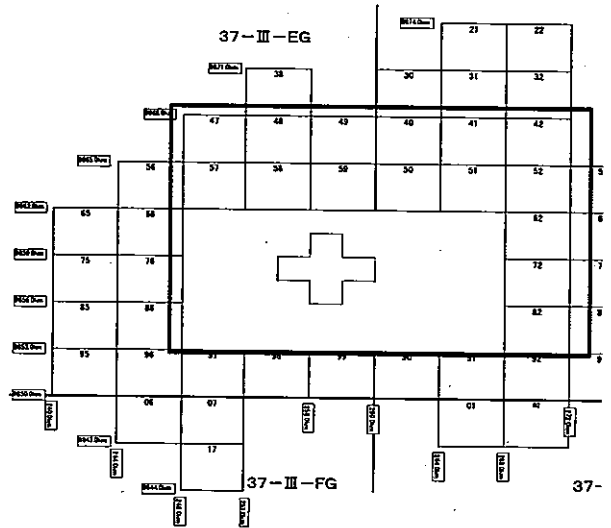


Figure 2.9 Sewerage Network Line / Manhole Point Data Coverage

② Scale

The data scale is maintained at the level of 1:2,500. This is not large enough to perform precise measurements on GIS. However, the sewer network and manholes should be used as an index map and the details are stored as the attributes of the lines and points. The printout of this database is expected to be used on the field.

③ Accuracy

The location of the manholes should be identified on field by less than 1 meter accuracy. Also, attribute information should be verified and updated.

④ Update frequency

It is ideal if data update is performed as a part of daily activities. However, due to financial restriction, data update should be done once a year at minimum.

⑤ Additional attributes

Target layer : sewer lin

It is important to maintain information on what material is used in the sewer surrounds for the

purpose of maintenance and new development, so the new attribute field is added.

Graphic type : line

Scale of the original maps : 1:2,500

Attribute fields: Pipe\_surr

Field name	Field type	Field size	Remarks	Data Source
Pipe_surr	Text	10	Sewage pipe surround (Class A, B, C, or D)	To be specified

Target layer: manhole\_pnt

In order to maintain and develop new manholes, it is necessary to know what kind of material is used for the existing ones, so the new attribute field is added.

Graphic type : point

Scale of the original maps : 1:2,500

Attribute fields: Design (materials used for manholes)

Field name	Field type	Field size	Remarks	Data Source
Design	Text	20	Manhole design specification (Concrete, Masonry, or Combination)	To be specified

⑥ Additional layers

No additional layer is necessary for now.

⑦ Additional functions

Simulate Excavation Cost for Sewerage Network

The "Simulate Excavation Cost" function was created in order to calculate the excavation cost when laying new pipe lines. The user inputs parameters and draw a line on screen so that the system calculates the cost of construction based on the length of the line and the given parameters.

The proposal is to add one more parameter to be given by the user. The cost is largely affected by the size of the pipe so the parameter of the pipe size is added. However in actual calculation, the additional parameter will not effect the calculation but will be used only to indicate the size of the pipe. The user should already consider the size when he/she keys in the other cost per unit parameters.

[Requirements Specification]

Scope: Sewage model system

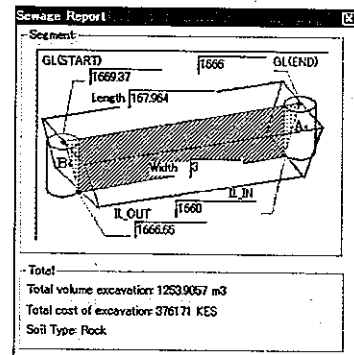
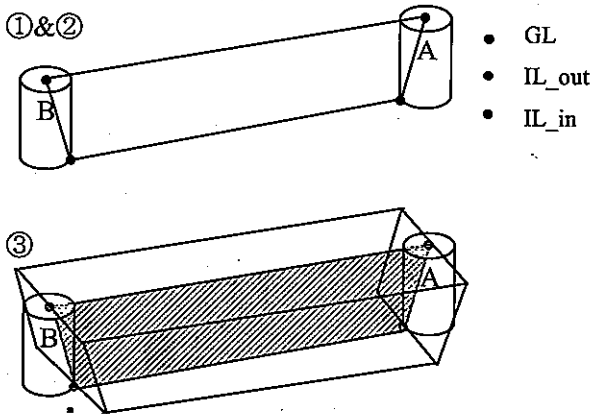
Actors and interests: Users of sewage model system; to digitize a tentative line on the screen and be able to determine that distance and approximate cost of laying a pipe; to display the results so that it can be used as reference material in actual construction projects. Although it will be necessary to adjust the functions according to actual tasks, at the present stage, the system design should be focused on user-friendly operation without having to prepare and process the data required for analysis.

Goal: To simulate the excavation cost simulation of sewer line construction

Preconditions: The sewage model system is started up and the data is loaded.

Main Success Scenario:

- The system displays a Simulate Excavation Cost command button on the toolbar.
- The user clicks the command button.
- The system checks that the required data and settings are loaded.
- The system displays a dialogue for entering in the parameters (unit cost, material, cost/unit, size of pipe) for working out the cost.
- The system displays a message instructing the user to digitize a line to carry out the simulation on the screen.
- The user clicks on the manhole as a starting node.
- The system confirms if there is any manhole around the starting node.
- The system confirms if the manhole found around the starting node has GL, IL\_IN, and IL\_OUT values. If not, the system displays a dialogue to prompt the user to input values or cancel to stop the scenario.
- If the system can not find any manhole around, it displays a dialogue for the user to input GL, IL\_IN, and IL\_OUT values as a temporary manhole.
- The system memorizes the values of GL, IL\_IN, and IL\_OUT.



- The system calculates the volume as illustrated above and displays the drawn line and the calculation result on screen.
- The system repeats the procedure every time the user clicks on the manholes as starting nodes.
- When the user double clicks, the system finishes digitizing line mode.
- The system displays the result of calculation as below.  
 Total volume of excavation: XXXX m3  
 Total cost of excavation: XXXX KES  
 Material: XXXXX  
 Size of pipe: XXX mm / XXX inch
- The system remains displaying the digitized line features and the results of calculation until the user clicks the clear button

### Find the Nearest Manhole

When a new building is constructed, the drain outlets of the building have to be connected to the existing sewer network. In deciding which manhole to be connected to the drain outlets, it is necessary to simulate the cost of laying a new pipe at minimum cost. This additional function enables the user to search for the closest manhole from the location where the user indicates as a drain outlet. Then it is possible to simulate its excavation cost by using Simulate Excavation Cost

function.

[System Requirements Definition]

Scope: Sewerage model system

Actors and interests: Users of sewerage model system; to indicate a drain outlet of a building and find out which existing manhole is closest in distance.

Goal: To search and find the closest manhole from the drain outlet.

Preconditions: The sewerage model system is started up and the data is loaded.

Main success scenario:

- The system displays a Find the Nearest Manhole command button on the toolbar.
- The user clicks on the command button.
- The system checks that the required data and settings are loaded.
- The user clicks on the location of the drain outlet.
- The system search for the manhole which is located closest in Euclidean distance (in a straight line).
- The system highlights the searched manhole.

## 2.2.2 Improvements for Realization of Plans

Because it requires vast time and cost to introduce GIS at the early stage, it is quite difficult to reach the point where GIS is successfully in operation. As with the local authorities in Japan, there are cases when they had to withdraw from GIS activities because the cost expanded much more than the estimate or it took so long to complete the database and system development that the information was already outdated and became of no use.

Here, the challenges that need to be overcome in order to successfully realize the plan are discussed, focusing on organizational structure, system operation, and finance.

### (1) Organizational structure

At the end of the project, all the GIS equipment including hardware, software, plotter, and scanner, and GIS model system and database will be placed in the room of GIS Center which was provided by the Town Clerk. This room is to be utilized as a GIS Center for all the GIS users at NCC to edit data, create maps, and print maps. Until the GIS unit is established under the Computer Section, this GIS Center will take the initiative to expand data coverage, content, and function of the model system. It should also meet small GIS needs and actively hold activities and trainings to deepen understandings and needs of GIS of NCC personnel.

### (2) System operation and management

For the time being, the computers are not networked within NCC, so it is not possible to use GIS through LAN from the client computers. Therefore, the users have to come to GIS Center to use GIS. In such environment where many NCC personnel come to GIS Center to access GIS databases for a variety of purposes, it is essential to clearly define the task and responsibility of the administrator and the users and operate the system systematically.

The discussions and suggestions for the GIS Center regarding 1) data management and 2) system



operation are summarized below.

1) Data Management

[Type]

It is assumed that when the system is first introduced, the users will have little understanding of the data except for those received the trainings. Therefore, consideration must be given to avoiding corruption of system and data due to operational errors. As a result, the JICA study team and NCC agreed that the following data groups should be generated for the model system.

1. Master geodatabase: The geodatabase constructed and delivered by the JICA side will be the master geodatabase when the system is in operation. The master data will be stored on back-up media (CD-ROM) to ensure its integrity and it will be possible to recover the original master data whenever necessary. The master database and backup data will be stored at GIS center at NCC.
2. Edited geodatabase: The changes made in routine work will be updated to a geodatabase, which will be maintained as the edited geodatabase. If the use of GIS becomes established in the user organization, the master geodatabase will be replaced with this edited geodatabase only by the user with proper authority and IT skill. The EDITED GeoDatabase will be stored at GIS center at NCC.
3. Working database: A portion or all of the data is extracted for carrying out various analysis work and data processing. The user should recognize that this data analysis and processing work and the editing work in 2 is completely separate works in order to maintain the integrity of the data. Each working GeoDatabase will be stored at each department of NCC.
4. System setting database: This database will maintain the various setting information required to execute the program. It will only be accessed from the program and it is assumed that the users, including the system manager, will not modify it directly.

[Responsibility]

It is crucial to clearly define the responsibility of data update and maintenance so that the GIS model system and its database is sustainably used and expanded. The following (Table 2.10) suggests by which department / section at NCC and other organizations should maintain the existing GIS database. The appointment of responsibilities among departments and sections are determined by the relevancy between database contents and departments' tasks and accessibility to source data/documents of GIS database.

Dataset	Feature Class	Type	Contents	Appointment of Responsibility
administration	adm_pol_01	Poly	Admin boundary (for each administrative level)	Survey of Kenya
	adm_pol_02			
	adm_pol_03			
	adm_pol_04			
	adm_pol_05			
	adm_pol_06			
	adm_pol_07			

	adm_pol_08			
	adm_pol_09			
	adm_pol_10			
<b>transportation</b>	road_lin_macro	Line	Road network	City Engineer
	road_lin_micro			
	inter_pnt_macro	Point	Intersection	
	Inter_pnt_micro			
	road_map_index	Poly	Road map index	
<b>property</b>	property_pol	Poly	Property plot	Valuation Section
	valuation_map_index	Poly	Valuation map index	
<b>water</b>	water_lin	Line	Water network	Water and Sewer Company
	chamber_pnt	Pont	Water facilities	
	meter_pnt	Point	Water meter	
	water_map_index	Poly	Water map index	
<b>sewage</b>	sewage_lin	Line	Sewer network	Water and Sewer Company
	manhole_pnt	Point	Manhole	
	sewer_map_index	Poly	Sewer map index	
<b>education</b>	education_pnt	Point	Edu facilities	Education
<b>medical</b>	medical_pnt	Point	Med facilities	Public Health
<b>social</b>	social_pnt	Point	Social facilities	Social Services & Housing
<b>vegetation</b>	veg_pol	Poly	Vegetation	Survey of Kenya
	veg_pnt	Point		
<b>wetland</b>	wet_pol	Poly	Waters	Survey of Kenya
	wet_lin	Line		
<b>landuse</b>	land_pol	Poly	Landuse	City Planning

Table 2.10 Appointment of Responsibilities

[Backup]

It is the most basic yet definite way to back up data in order to recover from un-recoverable corruption on database. Since several different levels of database are created, custodians for each data group must be clearly identified and their responsibility must be well recognized by all.

1. Master GeoDatabase

Responsible personnel: Data and System Administrators

Frequency of backing up: Every 6 months

Back up media: CD-ROM labeled by the date of backup

Storage: Steel cabinet equipped with a lock

Backup records: Documented in a simple table showing the detail of backup history (Date, Executor, Remarks)

Physical location of backups for NOW: GIS center where the equipment will be housed in.

Physical location of backups in FUTURE: GIS Unit at Computer Section where all database and administrative/management tasks will be centralized.

2. EDITED GeoDatabase

Responsible personnel: Two Data Editors per department

Frequency of backing up: Everyday

Back up media: CD-ROM

Storage: Steel cabinet equipped with a lock

Physical location of backups for NOW: GIS center where the JICA donated equipment will be housed in.

Physical location of backups in FUTURE:①GIS Unit at Computer Section where all of the database and administrative/management tasks will be centralized. ②Each department of NCC where any kind of data editing may occur by client PCs.

### 3. Working GeoDatabase

Responsible personnel: Each Data Editors

Frequency of backing up: On each editor's choice

Back up media: On each editor's choice

Storage: On each editor's choice

Physical location of backups: Each department of NCC where any kind of data editing may occur by client PCs.

### [Data Security]

The system is designed in order to suit the current IT environment at NCC (computers not networked, stand-alone GIS hardware and software for the time being). However in order to increase the security of the system, consideration has to be given to the following issues.

- Physical settings

Lock on the entrance door of the GIS center (GIS center)

Lock on the steel cabinet where master database is stored (GIS center)

Lock on where the license hardware key is put (GIS center)

- Login settings

Password request when logging in the GIS server computer (GIS center)

Password request when updating master database (GIS center)

Password request when updating EDITED database with working database (Each department)

Password request when editing working database (Each department)

- Software settings

Password requested when opening master database from its backup CD-ROM (GIS center)

Anti-virus protection (All locations)

## 2) System Operation

As is described in the previous section, the model system maintains several levels of database so that data integrity shall be secured. In relation to this, users should also be grouped by their responsibility and data accessibility. The followings describe roles of administrators, editors, and viewers of the data and system. Considering the condition of available hardware / software / human resource at NCC, details at 1<sup>st</sup> STAGE and FUTURE perspectives are discussed in the followings. Below illustrates how the system should be operated at NCC.

### [System Operation Diagram]

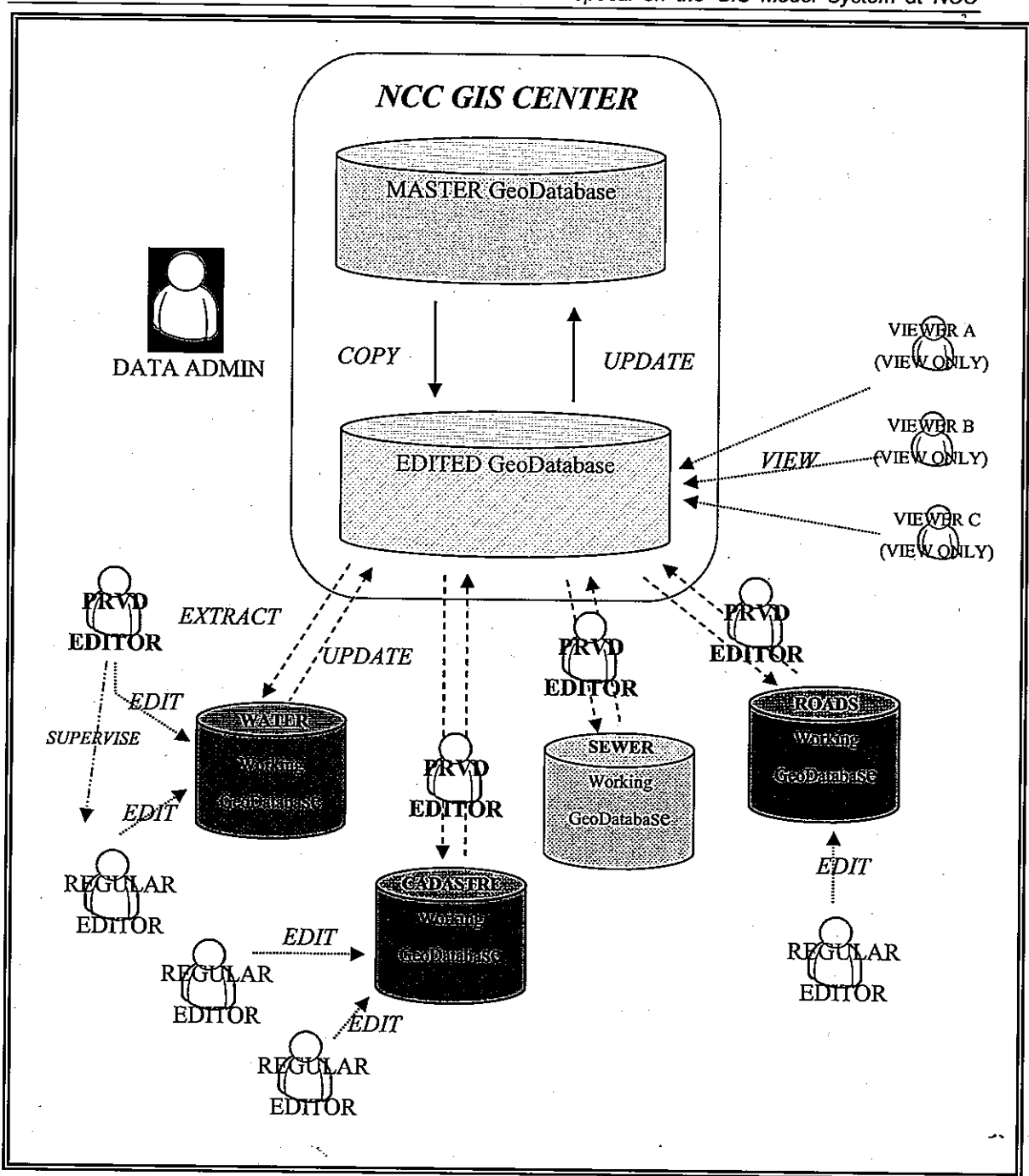


Figure 2.10 System Operation Diagram

[User Responsibility]

- ✓ Data and system administrator ( at most 2 personnel)

The task is

- to ensure security of GIS equipment, software, and other supplies,
- to administrate user privilege of each user,
- to start up and shut down the server computer where GIS software and database is installed,
- to document the history of startups and shutdowns of the GIS server computer,
- to monitor uses of software, database, equipment, and other office supplies (paper, cartridge),



DATA ADMIN

- to back up Master GeoDatabase in back-up media (CD-ROM) in every 6 months,
- to document back up records in a simple table showing the detail of backup history (Date, Executor, Remarks etc.)
- to recover data and system when necessary,
- to assist GIS and computer users

	AT 1 <sup>st</sup> STAGE	FUTURE
Appropriate personnel	Two trainees who attended the GIS training with JICA study team	Two full time IT specialists employed by NCC

- ✓ Privileged data editor ( at most 2 personnel per department)  
The task is



- to extract a portion or all of the EDITED GeoDatabase and create Working GeoDatabase for carrying out various editing, analysis, and data processing at each department of NCC,
- to verify all the changes on Working GeoDatabase made by regular data editors in order to ensure data quality,
- to update EDITED GeoDatabase with Working GeoDatabase edited by regular data editors,
- to backup EDITED GeoDatabase everyday in back-up media (CD-ROM)
- to start up or shut down the server computer when Data and System Administrator is absent
- to train and assist regular data editors with GIS technical issues
- to carry out query, analysis, and output of the result

	AT 1 <sup>st</sup> STAGE	FUTURE
Appropriate personnel	Two trainees per department who joined JICA GIS training courses	Two of the well trained personnel per department

- ✓ Regular data editor  
The task is



- to edit Working GeoDatabase
- to carry out query, analysis, and output of the result
- to assist data viewers

	AT 1 <sup>st</sup> STAGE	FUTURE
Appropriate personnel	All the trainees from each department who joined JICA GIS training courses	All the well trained personnel from each department

- ✓ Data viewer  
The task is



- to view EDITED GeoDatabase and perform query, analysis, and output for their own purposes

	AT 1 <sup>st</sup> STAGE	FUTURE
Appropriate personnel	All the personnel interested in GIS at NCC	All the personnel interested in and need GIS at NCC, the citizen, and the others

**(3) Finance**

The investment in data development is the heaviest and generally accounts for 70-80 % of the total initial cost. The cost of hardware and software is falling but is still are very expensive in Kenya. Also the cost for human resources is not negligible. The groups of investment cost are shown as below (Figure 2.11).

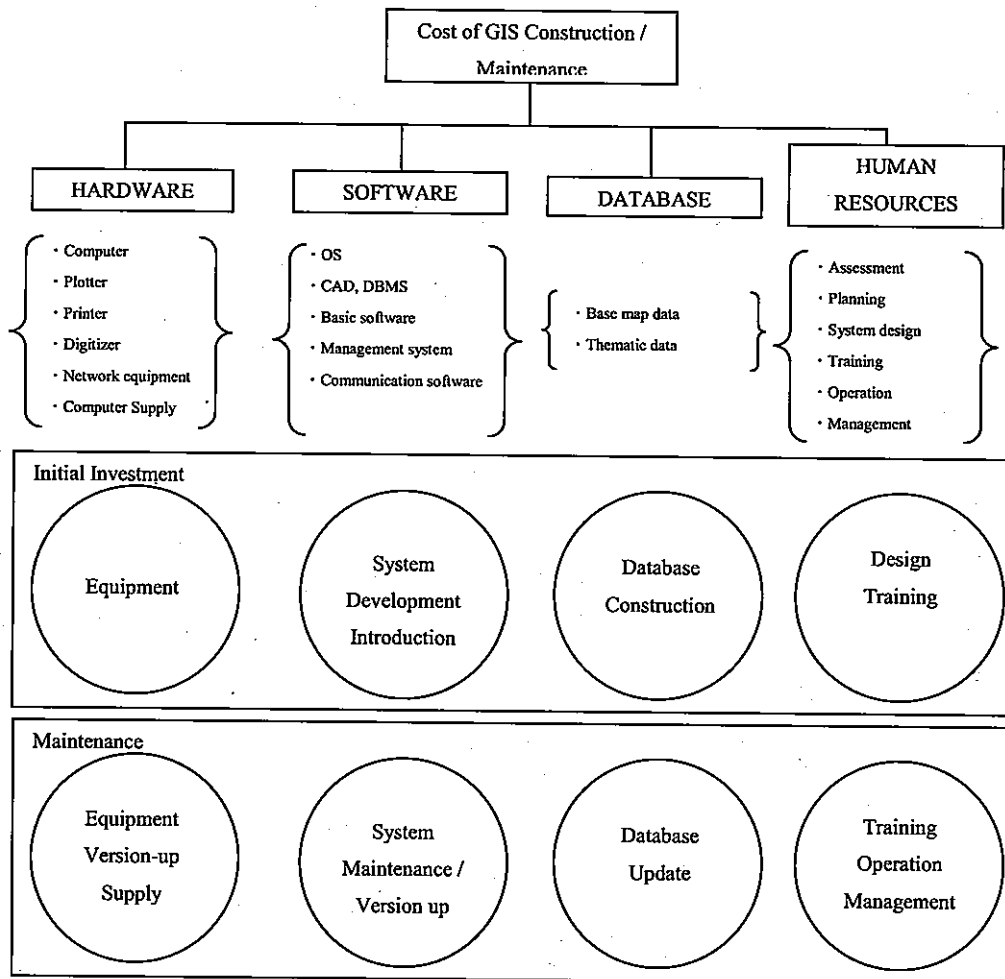


Figure 2.11 Groups of Investment Cost for GIS

In regard to maintenance cost, it is generally said that the cost of upgrading hardware and software is 5 % of the initial investment. On the other hand, the maintenance cost of the database is totally different, ranging from a few percent of the initial investment to the total replacement.

As with NCC, the current situation is that a minimum set of hardware and software, database, and system is installed and 10 personnel received the GIS training, which means a long way is still ahead and the initial investment is yet to be made.

1) Cost estimates

[Hardware maintenance cost]

It is a worldwide trend that the rate of hardware is dropping, however it is necessary to annually allocate the budget of 2-6% of the initial cost of purchase in order to maintain the equipment at minimum. Table 2.11 shows the maintenance cost of the provided equipment in case of the purchase of equipment of the same performance level in Japan. The local cost in Kenya must be confirmed, but it is calculated that 69,400Ksh to 162,000Ksh may be annually necessary for maintaining the provided equipment.

Table 2.11 Estimate of hardware maintenance cost  
(Based on the 2-6% of the cost of purchase)

Hardware	2%	6%
Scanner	23,200	69,600
Plotter	43,050	86,100
GIS Workstation	3,150	6,300
<b>TOTAL (Ksh)</b>	<b>69,400</b>	<b>162,000</b>

[Software maintenance cost]

Other than GIS, there are many types of software that should be maintained such as Windows, Microsoft Office, antivirus software, etc. Fortunately other than GIS software, it is possible to download patch and upgrade programs from the internet at no cost. Regarding GIS software, there is most likely to be a charge

ESRI Inc. charges for the maintenance contract from the second year of the purchase in order for them to upgrade the software and provide technical support. The contract is made annually and should be continuous. Table 2.12 shows an estimate of the maintenance cost offered by the ESRI representative in Kenya (Oakar Services Ltd.). Based on this, it is required for NCC to allocate 371,200Ksh annually for the maintenance cost of the GIS software.

Table 2.12 Estimate of maintenance cost of GIS licenses for July 7, 2004 to July 6<sup>th</sup>, 2005

Description	Qty	Unit Price	Total
Primary Maintenance on ArcInfo Floating License	1	Ksh 240,000	Ksh 240,000
Primary Maintenance on ArcGIS 3D Analyst Concurrent Use License	1	Ksh 40,000	Ksh 40,000
Primary Maintenance on ArcGIS Spatial Analyst Concurrent Use License	1	Ksh 40,000	Ksh 40,000
		<b>VAT 16%</b>	<b>51,200</b>
		<b>TOTAL(Ksh)</b>	<b>371.200</b>

[Database development cost]

Figure 2.13 shows the estimated man-hours for the proposed database expansion described as priority project in 2.2.1. This estimation is made based on the experience of developing a similar GIS database of the model system done by the study team and only for the workload of GIS data entry. In the complete work flow of GIS database construction, there are more processes as shown in Figure 2.12 and this estimation is made just for those highlighted blue in the figure. It is assumed to require almost the same amount of work to collect data, create the base maps for data entry and create the attribute inventories.

Table2.13 Estimate of cost for expanding GIS database

Model	Layer	Type	Attribute	Field	更新内容	A: Area	B:Work days	C: Cost	D:TOTAL	E:	F:
Cada	Property_pol	Polygon	ALL	Expand the area (spatial&attr)		90	120	60000		6	20
			Term of Lease	Input additional attributes		105	35	17500		7	5
			Commencement	Input additional attributes		105	35	17500		7	5
	Planning_zones	Polygon	ALL	Input additional layers (spatial&attr)		105	21	10500		7	3
	Outdoor_advertizements	Point	ALL	Input additional layers (spatial&attr)		105	35	17500	123000	7	5
Road	Road_lin_macro	Line	ALL	Expand the area (spatial&attr)		385	513	256667		26	20
			MaxVol	Input additional attributes		400	267	133333		27	10
			mcost_est	Input additional attributes		400	53	26667		27	2
			mcost_act	Input additional attributes		400	53	26667		27	2
			Street_Lighting	Point	ALL	Input additional layers (spatial&attr)		400	213	106667	550000
Water	Water_lin	Line	ALL	Expand the area (spatial&attr)		573	764	382000		38	20
	Nodes	Point	ALL	Input additional layers (spatial&attr)		588	314	156800	538800	39	8
Sewer	Sewer_lin	Line	ALL	Expand the area (spatial&attr)		391	521	260667		26	20
			Pipe_surr	Input additional attributes		376	201	100267		25	8
			Manhole_pnt	Point	Design	Input additional attributes		376	201	100267	461200

A: Additional data coverage (km<sup>2</sup>)

B: Necessary work days (days ; in case a single operator does the work)

C: Personnel cost (Ksh ; multiplying B days and 500 Ksh assuming 500ksh per day is the average operator cost at NCC)

D:TOTAL (Ksh ; total cost per model)

As reference

E: Additional area is XX times as large as 15km<sup>2</sup>

F: Work days need to complete similar data development of the size of 15km<sup>2</sup> by the JICA study team (days ; in case a single operator does the work)



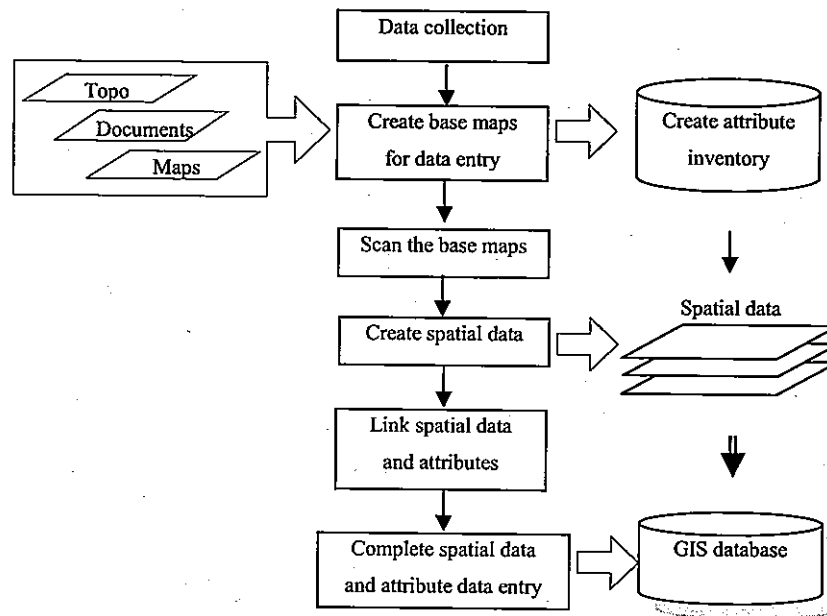


Figure 2.12 Work flow of GIS database development

## [Human resources cost]

The technical skills and fields are different from each implementation stage of GIS and consequently the cost of human resources varies. Generally speaking, when the local authority fully introduces GIS, it is common to engage with a private consulting company to plan, design, and construct the system and database in the beginning.

As for NCC, it is proposed to expand the model system as the first stage (shown in the figure 2.2) by using the provided equipment with the initiative of the trainees who received the GIS technical transfer training. The aim is to further develop the database and the functions by the own effort of the NCC personnel. The most important part of this stage is to make as many NCC staffs as possible aware that GIS is a practical tool to assist their works and effective service delivery and lead them to develop the work specific GIS which meets specific needs of the departmental duties. After completing the first stage, now NCC personnel will be able to analyze the users' needs and adequately incorporate them into designing the data specification.

The provided equipment may not be enough if as many as NCC personnel as possible will be trained. In this case, it is proposed to utilize the African Institute for Capacity Development (AICAD) GIS facility. From the experience of the study team using their GIS lab, it is ideal for training and data development since it has 10 ArcGIS licenses with a full set of extension modules and networking environment. Table 2.14 shows the rate of the use of GIS computer lab at AICAD.

Table 2.14 AICAD Rates for GIS computer lab( Aug 2004)

Facility	Facility Description	Remarks	Rate Per Day
Computer Lab	Desktop top computer: PACKAGE PER PERSON	Only for computer use	700
	ArcGIS: PACKAGE PER PERSON	Only for ArcGIS license use	3,500
		<b>TOTAL (Ksh)</b>	<b>4,200</b>

The benefit of using AICAD's computer lab is not only for the training but also to maximize the work efficiency to expand the database of the model system with the maximum 10 trainees / operators. Any of the trainees who participated in the technical transfer training can be a trainer now. It is expected that a few personnel should be trained as GIS data operator from the departments that are appointed to be responsible for maintaining the database. If 10 personnel are trained and engaged in the data entry for two weeks, the cost of using AICAD GIS computer lab will be 420,000Ksh, which is equivalent to completing 100 person / day of data entry.

2) Secure financial resources

To summarize the above estimates, the approximate cost to maintain GIS at NCC after the completion of the project is as follows.

[Hardware maintenance cost]	162,000Ksh	
[Software maintenance cost]	371,000Ksh	
[Database development cost]	3,346 (person/day)	= approx. 1,673,000 Ksh
[Human resources cost]	420,000Ksh	(10 personnel engaged for 2 weeks at AICAD )

It will not be easy for NCC to manage raising the budget for those costs in view of the recent financial status. It is essential to consider it as a prior investment that will improve work efficiency and service provision, manage to collect more revenues, and eventually improve financial status of NCC. With full understanding and united motivation, the budget should be allocated to cover the costs for GIS related activities.

A brief suggestion to raise the needed budget is as follows.

① Provide small services to the department of NCC using GIS and generate revenue

Using the provided scanner, scan the paper maps and create a library of the map images. Plot the scanned image of the maps with the plotter on demand and collect small revenues. In this way, it may cost less than making large size copies at the copy shops, which reduces the expense of the departments of NCC. Also, the revenue can be used for operating and maintaining the GIS Center. The followings are some examples of services that the GIS Center can provide to the other departments.

- Map scanning and large size printing
- Creating thematic maps
- Information search and creating report

② Collect small budget from the respective departments

The GIS model system was designed to be as versatile as possible and be utilized by many departments. Also, GIS enables us to perform information search and map creation that is not possible with paper maps. It is proposed that this common resource with full potential needs to be carefully maintained and expanded by the assistance of the departments that share these visions. The database and system developed jointly with the departments should be shared and utilized for their own purposes.

③ Allocate budget to the GIS Center as one of the indirect departments

As is the case with the Computer Section in the City Treasurer department, it is proposed to NCC to allocate budget for the maintenance and operation of the GIS Center. As the legitimate reason, it is important to quantitatively analyze and clarify the benefit of having the GIS Center such as improved efficiency, reduction of expenses, reduction of labor cost, etc. By referring to the description of the establishment of work specific GIS in the second stage in 2.1.2, it is strongly recommended that NCC estimates the benefits expected to gain by the use of GIS quantitatively.