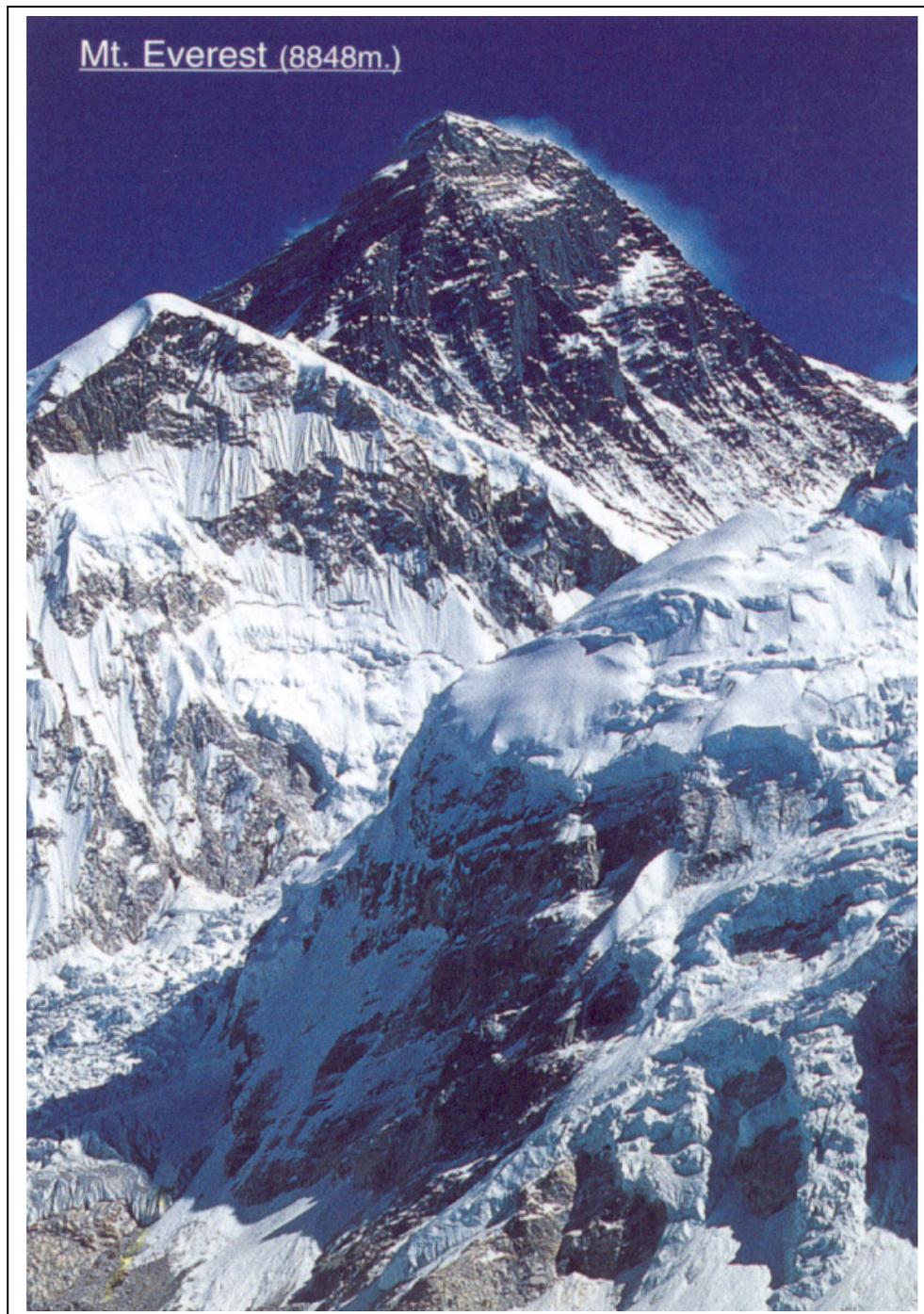


# Nepalese Journal on Geoinformatics

Number : 1

Jestha 2059  
May-June 2002



An annual publication of Survey Department, His Majesty's Government of Nepal

**Published by :** His Majesty's Government of Nepal  
Survey Department  
Min Bhawan, Kathmandu  
Nepal

**Price :** Rs 100

No. of copies : 500

---

© Copyright reserved by Survey Department

---

Printed at Hissi Press

## *Contents*

S. No.	Description	Pages
1	Photographs of the members of Advisory Council	i
2	Photographs of the members of Editorial Board	i
3	Editorial	ii
4	Message from Director General of Survey Department	iii
5	National Geographic Information Infrastructure : A perspective view by Rabin K. Sharma	1
6	Milestones achieved in Fiscal year 2058/59 BS (2001/02 AD)	6
7	Names and Tenures of Head of Survey Department of HMG, Nepal	6
8	Call for articles	6
9	National Geographic Information Infrastructure Programme to support National Geographic Information System in Nepal by RR Chhatkuli	7
10	Participation in major International events by the Survey Department in Fiscal year 2058/59 BS (2001/02 AD)	14
11	Need of licensing in Surveying profession in Nepal by Buddhi Narayan Shrestha	15
12	General information on 23 <sup>rd</sup> Asian Conference on Remote Sensing, 2002	20
13	Georeferencing Cadastral maps in the pretext of Digital Cadastre by Durgendra M. Kayastha	22
14	Handing over of Western Nepal Topographic maps	28
15	Discussion forum on National Geographic Information Infrastructure	28
16	Lecture programme on National Geographic Data Infrastructure	28
17	Interaction programme on land consolidation	28
18	Innovation in Aerial Triangulation by Toya Nath Baral	29
19	Congratulations	34
20	Obituary	34
21	Status of Land Reform, Legislation, Policies, Programmes and its implementation in Nepal by Rabin K. Shrestha	35
22	Information about available maps	43
23	Information about Digital data, Control points and other products	44
24	Database generalization and production of derived maps at 1: 100 000 and 1: 250 000 scales using NTDB in NGII context by Durgendra M. Kayastha	45

## Members of Advisory Council

Babu Ram Acharya



Chairperson

Sri Prakash Mahara



Member

Narayan Bhattarai



Member

Tirtha Bahadur Pradhananga



Member

RajaRamChhatakuli



Member

Narayan Prasad Adhikari



Member

Agnidhar Sharma



Member

Bamdev Dip



Member

Jagat Raj Paudel



Member Secretary

## Members of Editorial Board

Rabin Kaji Sharma



Editor in chief

Toya Nath Baral



Member

Durgendra Man Kayastha



Member

Mahendra Prasad Sigdel



Member

Jagat Raj Paudel



Member

Deepak Sharma Dahal



Member

Sushil Narshing Rajbhandari



Member

## **Editorial**

Journal is one of the appropriate media to disseminate information. With the beginning of the new millennium, new developments in the field of Geoinformatic are rapidly gaining momentum. Therefore, the Survey Department of His Majesty's Government decided to launch the publication of a journal in order to keep abreast the activities in the field of Geoinformatics. In this connection, it is my great privilege to present this first issue of the **Nepalese Journal on Geoinformatics**, an annual publication of Survey Department to begin with. The subject of Geoinformatics encompasses all related fields of maps and geographic data handling like collection, storage, analysis and dissemination of geoinformation and therefore covers all related activities of Surveying and Mapping like Geodesy, Photogrammetry, Remote Sensing, Cartography, Global Positioning System and Geographic information System. This journal will make an attempt to include scientific papers related with all such adverse fields of Geoinformatics. It will also try to accommodate the relevant activities in this field. I believe, this Journal will help in some way to the readers to gain or enhance their knowledge on Geoinformatics in general and with specific focus on its development in Nepal through the articles and other information published in this journal.

At present, the periodicity of this journal has been planned as annual but with the support of the readers and contributors we are hopeful for its more frequent publication. The life of this journal is in the hands of all the individuals belonging to the community of Geoinformatics. They could support us by providing regularly the scientific articles, book reviews, news, information on related courses/conferences etc. so that we could publish them.

Since, this is our first attempt, we may not be able to present this in a level of your satisfaction. Furthermore, there could be a number of shortcomings, which could not be foreseen. We would heartily request all the readers to kindly point out our weaknesses and suggest us for the improvement in the next issues of the journal. Quality and continuity of the journal are the main concerns to us and, obviously, the same will be the expectations of the readers as well. In order to fulfill these expectations, we need your continuous support so that we could be able to face the challenges that may occur in the footsteps of the journal publication.

I would like to express my sincere thanks to all the authors who have kindly contributed by providing articles to this journal. I would also like to express my sincere gratitude to the members of Advisory Council for their creative advice and guidance and I thank all the editorial board members for their cooperation and understanding in bringing out this newly born Nepalese Journal on Geoinformatics. Last but not least, thanks are due to all the wellwishers of this journal.

**Jestha 2058 BS  
May- June 2002 AD**

**Editor in chief**

**Message from Director General of Survey Department  
Mr Babu Ram Acharya**

I am delighted to find that the first issue of the annual publication of Survey Department, the Nepalese Journal on Geoinformatics was brought out on the month of Jestha, 2059, the same month as the establishment of Survey Department. I take this opportunity to congratulate and thank all the members of Editorial Board of this Journal for their initiatives and hard work in publishing the journal on such a historical moment of the Department.

The objectives of this journal are to encourage members of the Geoinformatics community in Nepal in particular, to participate as an author and to disseminate information on activities of Survey Department and recent developments in the field of Geoinformatics. Some of the major activities of the Department are: to make the user community aware of the available products and services in the field of geoinformation production, to find potential customers, to reduce the government subsidy, to promote the use of maps and geoinformation data for development activities and to avoid duplication of efforts by the users. The department is continuously supporting the development programmes by supplying the maps, spatial data, and related documents for the implementation of their activities.

I am confident that the journal will play role of a bridge to communicate with the users in relation to the above issues and will also provide valuable information relating to planning and management in spatial decision support system. In the mean time, it will make considerable contributions to the promotion of geoinformatics and to enable the geoinformation data users community to keep them aware of the latest development in this field.

Finally, I would like to express my sincere request to the members of the geoinformatics community for contributions in the improvement of this journal as well as to use the geoinformation science and technology for the environment protection and poverty reduction of Nepal, so that our coming generation will be benefited with our honest devotion in this field.

**Jestha 2059BS  
May- June 2002 AD**

# National Geographic Information Infrastructure: A Perspective View<sup>1</sup>

*Rabin K. Sharma*  
Chief Survey Officer, Survey Department

## Abstract

*The aim of this paper is to discuss the nature, concept and to provide a perspective view of National Geographic Information Infrastructure [NGII]. The objective of NGII is to integrate the existing data and also data that will be generated in future from various sources and to disseminate the same to the users in a Clearinghouse concept, in which the leading organizations should design a new working policy framework, coordinate the organizations involved in the programme and to provide standard data/information. With this, the country will benefit economically as it will minimize the data duplication and in the mean time maximize the data sharing. Finally, the paper recommends the activities to be initiated for the development of NGII.*

## Introduction

National Geographic Information Infrastructure [NGII] represents a major step forward in the direction of developing digital environment in Nepal, as the basic data necessary to establish, improve and upgrade NGII has already been developed into digital form. The basic data was generated in digital form from the recently published topographic base maps at the scale of 1: 25 000 for southern area and that of 1:50 000 for northern area. NGII takes account of maintaining standards in digital spatial data, and access and use of these data to meet requirement of users community. It is believed that the system will assist in building in good relationship between the organizations involved in Geographical Information System and support its continuing development. This paper tries to provide perspective view of National Geographic Information Infrastructure.

## Concept of NGII

NGII is a computer based system of creating, handling, processing and dissemination of digital data/information. The schematic diagram of NGII is given in Annex I. The information demand coming from various users are related with geographical information applications. Keeping in view of the demand, the information suppliers has to design/create metadata and data base, and to integrate various data, maintain standards, coordinate the users, and to make best utilization of data base. Finally the clearinghouse concept will be introduced to disseminate data/information to the users in which access to metadata services will guide the users to obtain their required data/information.

The most challenging parts of NGII are

- Integration of the data
- Coordination of the related organization
- Maintenance of data standards
- Capacity building
- Clarity of meta data
- Flexibility in data transportation
- Updation of data base
- Easy accessibility to the system
- Educate the stakeholders

---

<sup>1</sup> Paper presented on Discussion forum on National Geographic Information Infrastructure in Nepal, March 7 2002 at Kathmandu, Nepal.

## Information Supply

As mentioned earlier, NGII is an integrated approach in which number of organizations need to participate to create, develop and supply information. The organizations can be categorized into two groups.

The first group generates the **fundamental data sets**. It contain the followings

- Geodetic Data
- Topographic Data
- Digital Elevation Model
- Administrative Boundary
- Geographical Names

The second group generates the **framework data sets**. It contain the followings

- Land use data
- Geological data
- Soil data
- Cadastral data
- Hydrographical data etc

## Metadata services

The establishment of metadata services is an obvious activity of NGII and therefore, plays an important role in implementation of NGII. It also helps to maximize the data sharing and to minimize the data duplication. Consequently, the metadata services shall be given a high priority, as the users are always having problem of finding the information sources that are relevant to their needs. The success of data sharing between the organizations depends upon the coordination policy and the data integration approach. The information users always look after the quality and contents of the data. So, the information supplier should concentrate on the generation of standard data, based on the users requirement.

In general, the metadata should contain the following

- Information Policy
- Data Standards
- Architect of the data
- Specifications
- Procedure of data access
- Security and protection of data
- Pricing Policy
- Copy rights policy etc.

## Database services

The effectiveness and efficiency of the development and implementation of NGII, basically, depends upon the existing capacity and number of staffs possessing management skills on Geographic Information. So, it is necessary to increase its capacity and to develop human resources for effective database services.

The capacity building includes the instrumentation and to provide and develop comprehensive package of software suitable to local environment. The programme for human resource development should be related with three levels namely decision makers, professionals and technologists so as to enable the users towards practical application of GIS.

An adoption and implementation of new technology need organizational restructuring. The management should affirmatively respond to necessary change in the structure of organization and need to communicate and create an atmosphere to accept the changes by the members of the organization.

The major phases of NGII implementation are as follows

- Preparation of concept of NGII comprising of need, user requirement, modification of existing policy, implementation procedure etc.

- Restructuring the organization of the implementing agency and establishment of unit with proper human resources and equipment
- System design including overall task of the system such as specifications, definition of hardware/software; training component, format of end products etc,
- Implementation of NGII comprising of procurement of hardware/software and installation, staff training, database preparation, processing and procedure development, system maintenance, integration of various information system, coordination of several user.

In the mean time Information Management should ensure the following

- Prevent duplication of creation and management of information
- Develop common standards for quality assurance
- Develop format to effectively sharing of information
- Ensure the standards that are achievable within the constraints in terms of economy, technology, human resources, hardware/software, etc.
- Store and retrieve data efficiently and make it easily accessible to all users
- Maintain organizational ownership and security of data
- Ensure the decision regarding confidentiality, security and equity of access to information
- Ensure that the data is meaningful to all the users

### **Information Demand**

Basically the users who demand the information may be grouped as following

Public Sectors : Ministries, Departments, Local authorities, etc.

Private Sector : Planners, research institutes, IT vendors, etc.

Representatives from various groups : NGOs, INGOs, Donors, Associations, etc.

The development of Information Technology has revolutionized the way of handling the system of stakeholders. In general, they are, now-a-days, embarking on reengineering programmes to be able to use new technologies such as GIS, GPS, Remote sensing, Database, internet technology, etc. The GIS refers to all forms of computerized data basically, categorized as fundamental data sets and framework data sets as mentioned above. It is being applied to a network of interconnected systems that manage a wide range of spatial information. In order to fulfill this demand, efficient and effective GIS based information technology become urgent in which a system must be developed for data collection, updating, storing, sharing, and dissemination.

### **Dissemination of Results**

The data/information to be disseminated are the part of the outcomes of NGII and need to evaluate which products could be distributed. The users need to be informed about the details of the products and procedure to access. It could be through a regular publication of information in a form of report or newsletter or web pages. Alternatively, an effective way is to organize regular meetings, interaction programmes or seminars.

The function of data dissemination is partly referred to as an "NGII Clearinghouse" which is defined as a central internet site containing metadata in which the stakeholder could identify and evaluate the existing dataset, put queries of their interests and to understand the procedure for ordering the dataset. So, the NGII clearinghouse is conceived as a facilitator for exchange, sharing and dissemination of dataset. By using a PC with an internet browser a stakeholder could be able to access NGII clearinghouse through which the particular stakeholder will assess and select the data as per their requirement and place an order for the data as directed by it. Then, the organization will send the requested data to the user after fulfillment of the prescribed formalities.

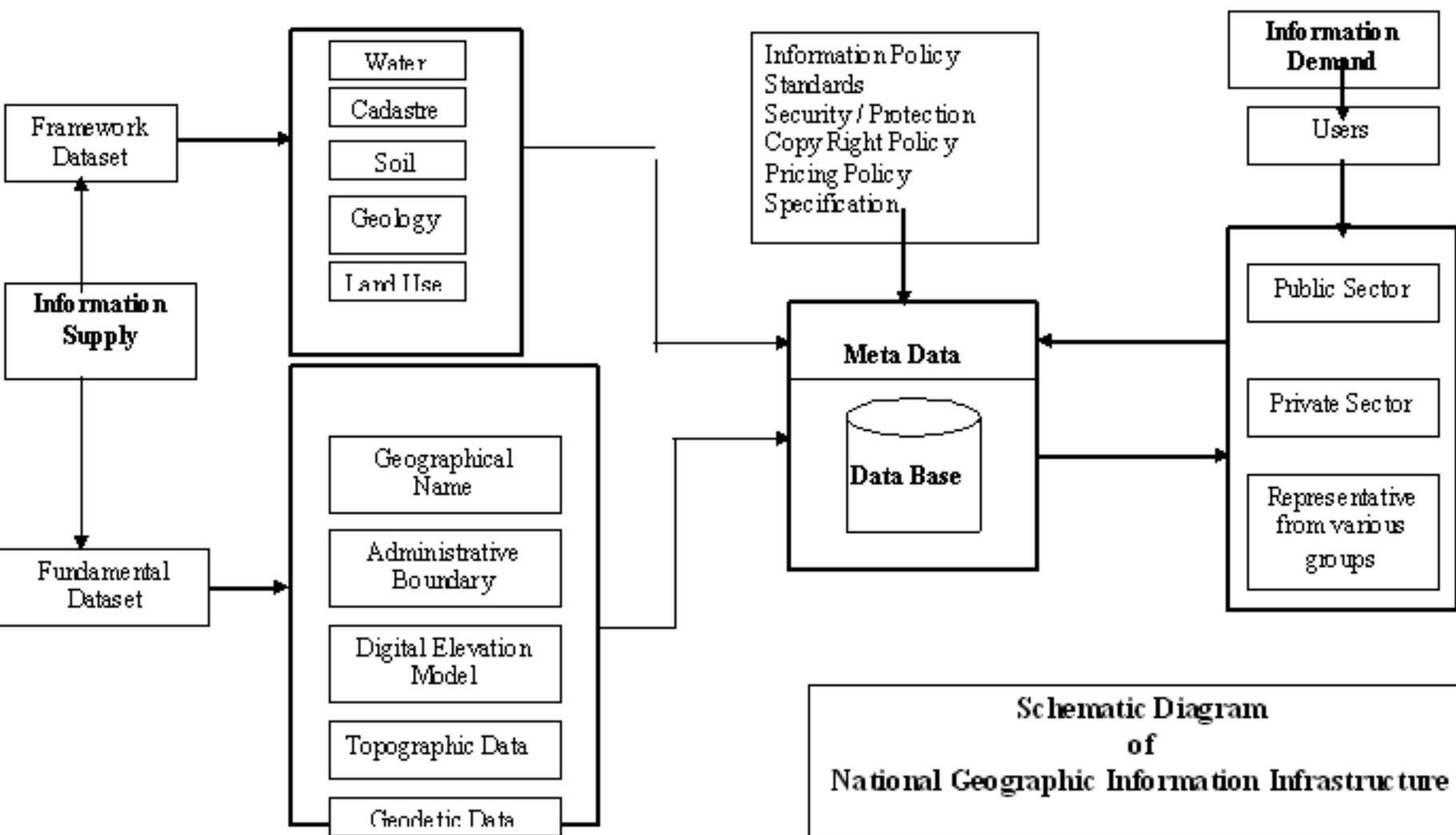
### **Conclusion and recommendations**

It is obvious that application and implementation of new technology have to overcome challenges in terms of capacity building, human resources development and organizational restructuring. Therefore, in order to implement NGII, it is necessary to outline the specific objectives, design effective working model and create environment to participate by number of organizations. The success and full potential of NGII will only be realized if there is affirmative support from the Government and total commitment from the related organizations.

It is also realized that NGII, being a new approach in Geographical Information Technology in our context, it is necessary to educate the decision makers, professionals and stakeholders in order to obtain full support and facilitate the maximum participation of the diverse community of GI users and potential users in NGII.

Finally, efforts should be applied to perform the following activities :

- To launch an awareness programme to educate the related persons
- To develop a new working policy framework
- To establish a clearinghouse for effective data dissemination
- To develop human resources through relevant training programme and academic courses
- To initiate capacity building to establish standard dataset and to integrate the data from several sources.
- To design a mechanism for maintenance of the total system.



**Schematic Diagram  
of  
National Geographic Information Infrastructure**

#### Acknowledgement

The author is thankful to Mr. Babu Ram Acharya , Director General and Mr. Durgendra Man Kayastha, Chief Survey Officer of Survey Department for reading this paper critically and provided fruitful suggestions to produce this paper in this form.

Appendix 1

#### References

1. Arbind Man Tuladhar : Strategic Aspects of Land Information Systems for Land Administration : ITC, The Netherlands.

2. Babu Ram Acharya and Rabin K Sharma : GIS Status in Nepal, Survey Department : A country paper presented in GIS Forum South Asia 99 in Nepal, 1999 , Nepal.
3. Chia Wee Tong : The Major Building Blocks for NALIS , A paper presented on Seminar on Spatial Data Infrastructure in Asia and the Pacific, PCGIAP , April 26, 2001, Japan.
4. Evelyn Yolando Godinez Garcia, and Arbind Man Tuladhar : Development of cadastral Infrastructure in Guatemala : Maximize Data Sharing, Minimize Data Duplicate , Article published in GIM International, Volume 15 Number 8, August 2001.
5. Ian Masser : The Indian National Geospatial Data Infrastructure : Article published in GIM International, Volume 15 Number 8, August 2001.
6. Population and housing Census 2001 in Nepal : Mapping Component ALA 98/170 (Draft Report), 2001.
7. Rabin K Sharma : Strategy for Integrated Land Information System to support Land Management : An approach for LIS Policy :, A technical paper presented in the Seminar on LIS Development Strategy in Nepal, 1997 , Nepal.
8. Seb Lessware : Saving Time and Improving Quality of Information , Data Re-engineering Laser - Scan UK, Article published in GIM International, Volume 15 Number 8, August 2001.
9. Shahin Ghavamian : Report on the Development of a Clearinghouse for Iran: A paper presented on Seminar on Spatial Data Infrastructure in Asia and the Pacific, PCGIAP , April 26, 2001, Japan

#### **Milestones achieved In Fiscal Year 2058/59 BS (2001/02 AD)**

- Publication of Kitta Napi Nirdeshika ( Nepali Version )
- Completion of new Topographical base map series started in 1989 AD
- Completion of digital topographic database based on new topographical base maps
- Implementation of the Land Survey and Measurement Regulations 2001 (“*Jagga Naap Jaanch Niyamawali 2058*”).
- Commencement of National Geographic Information Infrastructure Programme

#### **Names and Tenures of Heads of Survey Department of His Majesty’s Government of Nepal**

Mr Karna Shamsheer JBR	1995 BS- 2008 BS
Mr Tilak Bahadur Raymajhi	2008 BS- 2016 BS
Mr Netra Bahadur Thapa	2016 BS- 2017 BS
Mr Kulbir Singh	2017BS- 2020 BS
Mr Tek Bahadur Raymajhi	2020 BS-2021 BS
Mr JRG Harrop	2021 BS-2028 BS
Mr ArjunBahadur Basnet	2028 BS-2043 BS
Mr Buddhi Narayan Shrestha	2043 BS-2049 BS
Mr Ram Naresh Singh	2049 BS-2051 BS
Mr Punya Prasad Oli	2051 BS-2055 BS
Mr Babu Ram Acharya	2056 BS to date

# National Geographic Information Infrastructure Programme to Support National Geographic Information System in Nepal

R.R. Chhatkuli<sup>1</sup>  
Survey Department, Kathmandu, Nepal  
Email: [ngiip@ccsl.com.np](mailto:ngiip@ccsl.com.np)

## Abstract

*GIS are effective tools for the planning and monitoring of different development projects like engineering, socio-economic, and environmental projects. Due to lack of proper spatial data and geoinformation infrastructure in the past, all GIS projects spent very significant share of their projects on the development of such framework data. Recently the Survey Department of His Majesty's Government of Nepal has launched a national geoinformation infrastructure programme (NGIIP) to support sectoral GISes with spatial data and. The rationale and the objectives of the programme in the context of the open data dissemination policy undertaken in Nepal are outlined.*

## Introduction

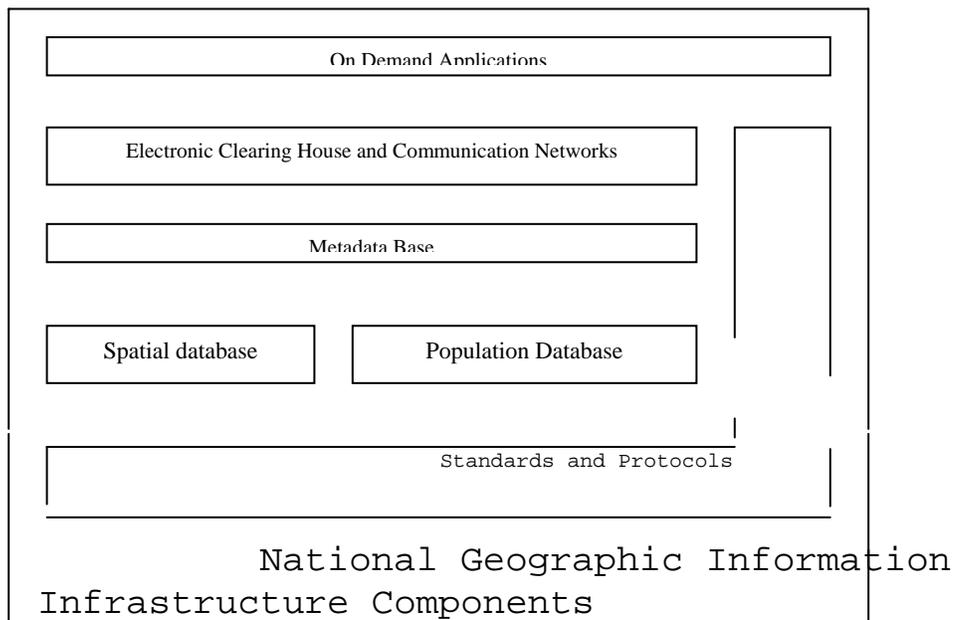
Geographic Information System (GIS) and Remote-sensing (RS) are very effective tools for the study, monitoring and management of different engineering, socio-economic and environmental projects. In any GIS project there are two types of data necessary. Firstly the general framework data and secondly the application-specific data. GIS become versatile, efficient and cost-effective due to the possibility for multifarious applications and usages of general framework spatial and attribute data. In Nepal, due to unavailability of such digital data, each GI Systems had to spend a lot of resources in its development as part of the GIS project. That meant a lot of duplication and loss of resources, which would eventually affect the time, budget and the efficiency of the system. The current national geographic information infrastructure (NGII) initiative undertaken by the Survey Department of His Majesty's Government of Nepal will help in the development of a National Geographic Information System (NGIS) in the country and thereby on the efficiency and cost/time effectiveness of individual GI systems. The NGII initiative to support the proposed NGIS in Nepal is outlined in this paper.

## NGII: The Nepalese Perspective

GIS activities were initiated in Nepal during the Eighth Plan period. Due to lack of a national perspective, the major activities have been the sporadic database creation and mushrooming of isolated systems. The National Geographic Information Infrastructure (NGII) initiative undertaken in Nepal now will be the development of a national spatial data infrastructure (NSDI) and in addition to the fundamental datasets it will assist in developing electronic clearing house, communication network and on-demand applications. A schematic representation of the various components of the Nepalese NGII is as following:

---

<sup>1</sup> Paper presented on Discussion forum on National Geographic Information Infrastructure in Nepal, March 7, 2002 at Kathmandu, Nepal.



#### **Fundamental data coverage:**

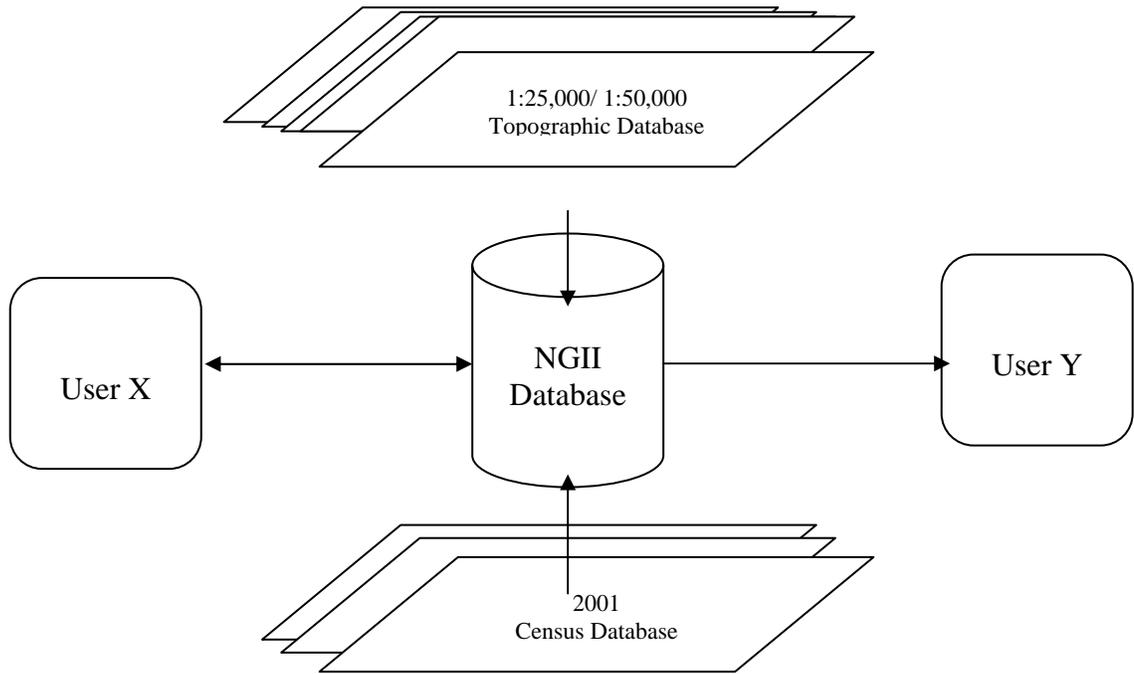
The fundamental dataset in the NGII in Nepal are the National Topographic Database (NTDB) and National Census Database (NCDB). The NTDB will have a horizontal coverage covering the whole country and vertical coverage at the scales of 1:25,000/ 1:50,000; 1:100,000; 1:250,000; 1:500,000 and 1:1M. The primary data input in the NTDB is the digitalization of the 1:25,000/ 1:50,000 topographic basemaps produced by the Survey Department between 1992- 2001. The base data are generalized for the reduced scales and separate data layers are archived in the database. So far out of the proposed 671 map sheets at 1:25,000/ 1:50,000 nearly 90% map sheets have already been digitalized. Generalization for the scales 1:100,000 and 1:250,000 and preparation of data layers on such scales are under research now.

In addition 1:5,000 scale orthophoto database for all the densely populated urban areas and 1:10,000 scale orthophoto database for all the less-densely populated semi-urban areas will also for part of spatial database coverage of NGII.

In summary, basic spatial datasets to be incorporated in NGII are:

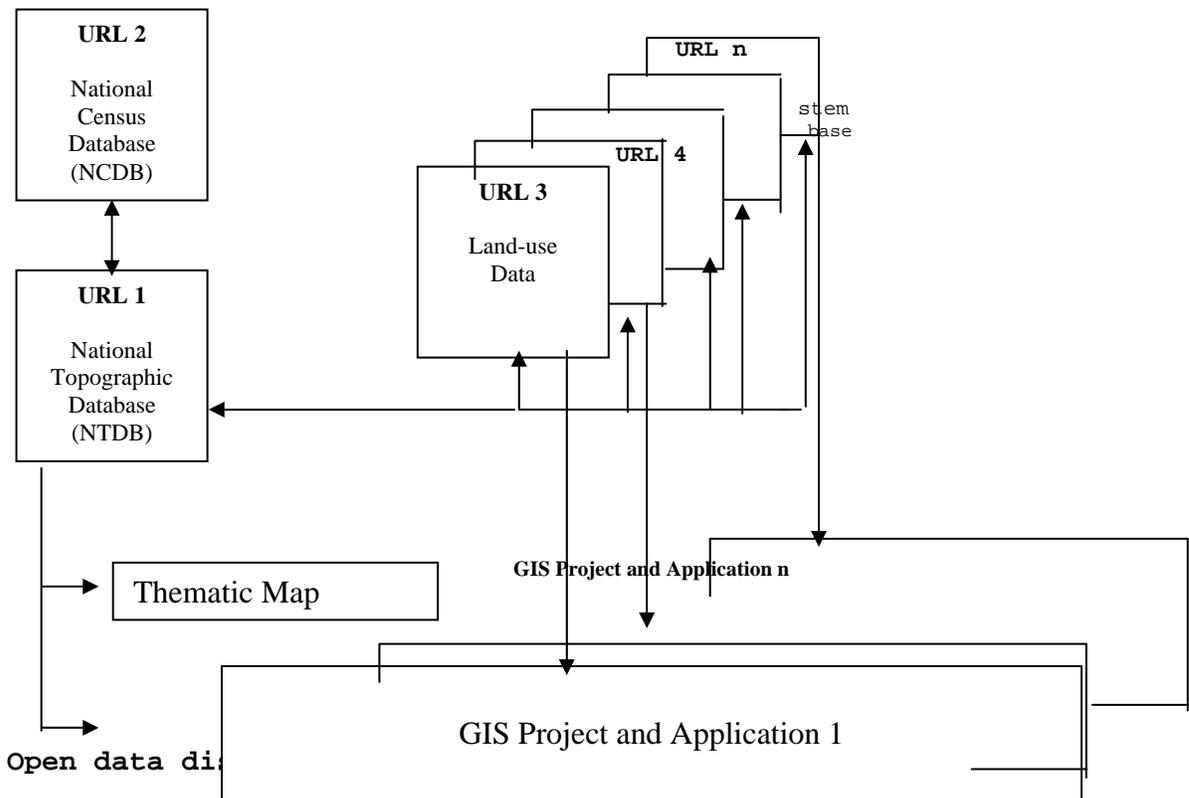
- 1:5,000 scale orthophoto data (for all densely populated urban areas),
- 1:10,000 scale orthophoto data (for all semi-densely populated urban areas),
- 1:25,000 scale (for terai and mountains areas) and 1:50,000 scale (for higher mountains and Himalya areas) topographic database,
- 1:100,000 scale topographic database for whole Nepal,
- 1:250,000 scale topographic database for whole Nepal,
- 1:500,000 scale topographic database for whole Nepal,
- 1:1M scale topographic database for whole Nepal.

The NCDB is based on the results of the decennial national population and housing census. The basic dataset will be that of the National Population and Housing Census 2001. However, the data related to previous censuses will also be incorporated in the database for temporal analysis and trend studies. The NCDB will, therefore have a temporal coverage of decennial interval.



**Data-sharing technology via internet and intranet:**

The NTDB database maintained at the Survey Department (SD) and the NCDB database maintained at the Central Bureau of Statistics (CSB) are at the moment being separately developed. One of the basic characteristics of the Nepalese NGII is that they will be fully integrated and available as fundamental NGII dataset for different application GISes. A generalized schema of the National Geographic Information System (NGIS) will be as following:



The fundamentals of the data production and dissemination policy of Survey Department are the availability, accuracy and affordability. Data and information are worthless, however best they are, when they are not available. In the same

time, it is better to have no data or information than to have inaccurate or wrong data/ information. Thirdly, it is worthless to have the data accessible but the users can not afford them. These matters have been well taken in the data dissemination policy of Survey Department of Nepal. The following are the salient features of data and their dissemination policy in Nepal:

- The data are created with the best quality control as possible within the available technology in-house,
- Quality information are provided as metadata,
- All maps and data are made available to users irrespective of whether they are individual users or institutional/ organizational users. All organized/ unorganized sectors or national/ international users can access data unless they are notified as restricted by His Majesty's Government of Nepal,
- To cater for the affordability of non-commercial or non-profit users and applications, a policy of categorization of users and categorization of pricing has been adopted.

### **Status of NGII Programme in Nepal**

Digitalization of topographic base maps were initiated at the Survey Department was initiated as pilot project already since 1996. Since 1999 a systematic map digitalization and digital mapping project was launched. The NGII Programme of His Majesty's Government of Nepal Survey Department has been launched since June 2001 as an extension of the same project. The NGIIP as such is only six months old at the beginning of its infancy. Many details on design specifications and policy agreements are still to be worked out; so more to say on the mobilization and implementation of the project. Not only the technology, necessary organizational and institutional setups are still to be framed out. Once operational, the NGIIP will be at the hub and provide support in terms of fundamental data needs and on-line communication support to all other GISes in Nepal who join the NGIS. However already, it has started providing fundamental data, off-line, to different users.

The main activities of the NGII programme being undertaken by Survey Department for which the financing have been assured and their current progress status are as following:

- a) NTDB data production
  - 1:5,000 (Approx 7,500 km<sup>2</sup>) and 1:10,000 (Approx 25,000 km<sup>2</sup>) orthophoto data production for urban and semi-urban areas under progress. To be completed by the end of 2002.
  - 1:25,000/ 1:50,000 scale topographic database production: 90% of the country covered, to be completed by middle of 2002.
  - 1:100,000 and 1:250,000 scale topographic database compilation under progress, to be completed by 2002.
  - 1:500,000 and 1:1M database production under planning.
- b) NCDB data production
  - Population and Housing Census 2001 database to be integrated in the system by middle of 2002.
  - Incorporation of previous census data in the database: under planning.
- c) Development of NGIS Master Plan by middle of 2002.
- d) Preparation of population maps and atlas (paper and CD edition) by end of 2003.
- e) Training and expertise for SD, CBS, and participating user agencies by middle of 2003.
- f) Integration of user organizations in the NGII by internet/ intranet by end of 2003.

### **NGII to support NGIS**

The population database in the NGII will be the most reliable data based on national census conducted based on extensive household survey every ten years. More important, the spatial database of NGII will have the following major fundamental datasets, which are essential framework data for all GIS and RS applications:

- Control points,
- Administrative Boundary,
- Designated Areas,
- Transportation network,
- Buildings,
- Landcovers,
- Hydrography,
- Topography,
- Utilities,
- Toponymy.

As is evident, the main objective of NGII is to support NGIS and therefore it can support in one way or other every study and project which applies GIS. Few of the major applications, which can benefit from NGII are following:

- NGII will provide fundamental spatial dataset over which all other data can be related,
- NGII provides for electronic data clearing and communication network for retrieving and sharing other requisite data,
- All secondary data will be based on national standards thereby providing opportunity for a better compatibility,
- Lot of time, efforts and resources are saved due to availability of secondary data,
- Less duplication, less extravagance and more economy.

### **Possible Support Areas of NGII facilities in NGIS**

The products and the hardware, software, networking, training facilities provided by NGII will be useful for all GIS applications in Nepal. For each of the applications listed hereunder, most of the data will be available from NGII and very little data will need to be collected from primary sources. This will make such applications more efficient in terms of time and resources.

NGII can support all study and planning activities, which use spatial and/ or spatially related data for their applications. A comprehensive list will be too large. To name a few, some of the areas where NGII will support GIS activities for national development in Nepal are:

- Study of socioeconomic parameters and socio-economic modeling/ planning,
- Analysis of spatial dimension of gender issues ,
- Study and identification of distribution/ cluster of economically and socially vulnerable class and people,
- Urban planning and urban infrastructure development,
- Route planning and traffic control,
- Land development and landuse planning/ zoning,
- Feasibility study of engineering projects and identification of alternate projects,
- Environment study.

The following are examples of some of the NGII data users and their applications in the first six months of the programme:

<b>Users</b>	<b>Applications</b>
Bagmati Integrated Watershed Management Project	Land-use planning/ mapping
Melamchi Drinking Water Project	Study and design of diversion tunnel scheme
Local Infrastructure and Agriculture Roads Department (DOLIDAR)	Hazard study and rural infrastructure planning
Care Nepal	Watershed studies
National Landuse Project	District and village level landuse study
Ministry of Agriculture and Cooperatives	Agriculture pocket area identification
Ph. D. Student	Ph. D. research study
King Mahendra Trust for Nature Conservation	GIS applications and training for nature conservation
Department of Irrigation	Study and design of irrigation project
Dip Consultancy	Preparation of Technical Proposal
Department of Mines and Geology	Landslide inventory and hazard mapping
Doti District Development Committee	District Periodic Plan
Department of Hydrology and Meteorology	Study of water balance in river basin
Department of Forest	Study of Sub-watershed
Kathmandu Metropolitan City	Urban Geographic Information System
Topographical Survey Branch	Map updating and derived mapping
Surkhet District Development Committee	District Periodic Plan
Nepal Forest Resources and Research Programme	Environmental change study
Integrated Research Application and Development	Hydropower and Approach Road study

## **Organizational Setup for NGII**

A national geographic information system in Nepal when operational will not only change the information handling scenario but will make impact on the decision making system in all organizations in the country. The experiences of other countries show that Survey Department does take a key role in the NGII initiative, but success will be very much dependent on the leadership and vision at the highest level. Therefore a long-term vision for the sustainability of NGII and a suitable organizational and institutional framework becomes absolutely necessary. There are so many activities still to be planned and formulated. A multi-tier organizational set-up is suggested. The following organizational setup is outlined here to initiate discussions in this regard.

### **NGII Council (at the apex level)**

VC National Planning Commission: Chairperson  
Secretaries of different Ministries: Members  
Secretary, MOLRM: Member Secretary

### **NGII Steering Committee**

The present Mapping Committee under the chairpersonship of MOLRM Secretary may be reorganized with additional responsibility of coordinating GIS related activities within ministries. Chief of NGII should be included as a member.

### **NGII Executive Committee**

Director General, Survey Department: Chairperson  
Director Generals of chief executives of related organizations: Members  
Chief, NGIIP: Member Secretary

### **Nodal Committees**

## **Conclusion**

The NGII in Nepal is being developed on bottom-up approach. It is users driven and built-up step by step based on available results and future requirements. The major benefit of this approach is that the system will be on constant development and in the mean time it is delivering results during development period as well.

Survey Department of Nepal has adopted an open data dissemination policy. This provides for a better opportunity for a NGII initiative in Nepal. All individual projects can benefit with cost-effective and efficient implementation of their GIS and RS applications. This will form a basis for the development of National Geographic Information System (NGIS) in Nepal.

The programme is now being developed as a project through Denmark, Finland, EC and HMG/N financing. Necessary long-term vision for organizational and institutional framework for the sustainability of NGII is necessary. A national geographic information system in Nepal when operational will not only change the information handling scenario but will make impact on the decision making system in the country. The experience of other countries shows that Survey Department does take a key role in the NGII initiative. But success will be based on the leadership and vision at the highest level.

## **References**

- Chhatkuli, R.R. (1996); Geoinformatics: A New Challenge to Surveying and Mapping Professionals in Nepal, Nepal Surveyor Vol 1996.
- Chhatkuli, R.R. (2001); NGII Initiative in Nepal to Support Framework Data Requirement for Eco-system Study and Management using GIS and RS; Paper circulated at the 1st Regional Seminar on Geo-Informatics for Asian Eco-System Management, Kathmandu, 2-6 December 2001.
- Chhatkuli, R.R. (2002); Concepts and challenges of National Geographic Information Infrastructure Programme in Nepal, Valedictory Lecture, 5<sup>th</sup> ESRI India Users Conference, New Delhi, 23 January 2002.
- Harvey, Francis (2001); US National Spatial Data Infrastructure (NSDI), GIM Volume 3, March 2001.
- Maser, Ian (2001); The Indian National Geospatial Data Infrastructure, GIM Volume 15, August 2001.
- Roger, Gilles and Lopez, Salvador (2001), Nepal Population and Housing Census 2001: Mapping Component, EC Nepal, July 2001 (Unpublished Revised Draft Report).

**Participation in Major International Events by the officials of Survey Department  
Fiscal Year 2058/59 BS (2001/02 AD)**

1. 12<sup>th</sup> Monitoring Committee Meeting of Western Nepal Topographical Mapping Project (WNTMP) A team of four members led by Mr. Keshab Raj Rajbhandari, the then Secretary, Ministry of Land Reform and Management, Mr. Babu Ram Acharya, Director General, Survey Department, Mr. Narayan B. Karkee Project Manager, WNTMP and Mr. Mahendra P. Sigdel, Chief Survey Officer  
32 Srawan to 7 Bhadra, 2058 BS (16-23 August, 2001 AD); Helsinki, Finland.
2. Joint Group of Experts Meeting of Pancheswor Multi Purpose Project  
Mr. Jagat Raj Paudel, Chief Survey Officer  
4-8 Bhadra ,2058 BS (20 -24 August,2001 AD); New Delhi, India.
3. 24<sup>th</sup> Joint Technical Committee Meeting of Nepal India Boundary Work  
A team of 16 Members led by Mr. Babu Ram Acharya, Director General, Survey Department  
21-22 Bhadra , 2058 BS ( 6-7 September 2001 AD) ; Kathmandu, Nepal
4. Workshop on GIS Technologies for Sustainable Development at Local Level  
Mr. Durgendra M. Kayastha, Chief Survey Officer  
23-25 Ashwin, 2058 BS (9-11 October, 2001AD); New Delhi, India
5. Progress Review Meeting of Mapping work of Pancheswor Multi Purpose Project  
A team of 5 members led by Mr. Rabin K. Sharma, Chief Survey Officer  
24 Ashwin to 3 Kartik , 2058 BS (10-19 October,2001 AD); Dehradun, India
6. 22<sup>nd</sup> Asian Conference on Remote Sensing  
A team of 10 Members led by Mr. Babu Ram Acharya, Director General, Survey Department  
20- 24 Kartik , 2058 BS (5-9 November , 2001 AD); Singapore
7. 1<sup>st</sup> Regional Seminar on Geo-informatics for Asian Ecosystem Management  
A team of 3 Members led by Mr. Babu Ram Acharya, Director General, , Survey Department  
17- 21 Mangsir, 2058 BS (2-6 December, 2001 AD); Kathmandu, Nepal
8. GIS Conference and ESRI User Conference  
Mr. Raja Ram Chhatkuli, Project Chief, NGIIP  
3- 10 Magh, 2058 BS (16-23 January, 2002 AD); New Delhi, India
9. XXII FIG International Congress and International Visitor Programme of US  
Department of State  
Mr. Ananta Raj Pandey, Secretary, Ministry of Land Reform and Management,  
Mr. Babu Ram Acharya, Director General, Survey Department  
Mr. Raja Ram Chhatkuli, Project Chief, NGIIP  
9-14 Baisakh, 2059 BS (22 –27 April, 2002 AD); Washington D.C., USA
10. Workshop on Partnership to Meet Development Challenges in South Asia  
Mr. Rabin K. Sharma, Chief Survey Officer  
18-20 Baisakh, 2059 BS (1-3 May, 2002 AD); Kathmandu, Nepal

# **Need of Licensing in Surveying Profession in Nepal**

Buddhi Narayan Shrestha  
Managing Director, Bhumichitra Mapping Co.

## **Background**

The main purpose of licensing in any profession is to protect the public from unqualified and unscrupulous people in the related field and to utilize the public fund in an appropriate manner. A professional is distinguished by certain characteristics, such as mastery of a particular intellectual skill which is acquired by education and training. Besides, it deserves an outlook that is essentially objective in rendering services to a high standard of conduct, performance and liability with an acceptance of duties to clients, employers and society.

In Nepal, there are provisions to issue licenses to the professionals such as lawyers, medical people, dentist etc. from the concerned organizations in accordance with the articles of the regulation. So far as the licensing system to the surveying professionals in Nepal is concerned, it is not yet promulgated. But it is a high time to formulate and execute the registration system to those professionals who are engaged in surveying and mapping. Because mapping and its related activities are expanding in Nepal in private and public sectors with the pace of time.

## **Licensing / Registration**

Licensing to the professionals is not a new phenomenon in the world. The first regulation of this type was contained in the code of laws of Hammurabi of Babylon in the eighteenth century B.C. But the code was something like "eye for an eye and tooth for a tooth" for example a builder constructed a house that collapsed and killed owner; the builder would be killed. If the collapse caused the death of the owner's son, the builder's son would be killed and so on.

Regarding the licenses to the Surveyors and Engineers, it was started in 1907 in Wyoming. George Washington and Abraham Lincoln of the United of America had possessed surveyor's licenses. Today surveying professionals of the developed countries of the world must obtain licenses before they make practice land surveying. Singapore, Malaysia, Sri Lanka, Japan etc. in the continent of Asia has introduced the system of licensing / registration to the surveyors.

## **Surveyors Duty**

The duty and responsibility of surveyors have been expanded tremendously in this modern world. International Federation of Surveyors (FIG) has established and defined surveyor as a professional person with the academic qualification and technical expertise to practice the science of measurement. They have to assemble and assess land and geographic related information to use for the purpose of planning and implementing the efficient administration of the land, the sea and structures thereon and to instigate the advancement and development of such practices.

Surveyors must understand the licensing governing land and property, the makers on it, the services supporting it and the economics of construction, management, acquisition and disposal. Above all surveyors are fact finders and providers of opinions and advice because they collect, process and establish data, which are generated from the field.

In additions surveyors and professional people who have four basic element i.e. education, organization, experience and exclusion. Education means obtaining of formal school degree and the completion of as many surveying courses as possible. Also it can be of self-education and continuing professional development (CPD) for improvement of personal qualifications and skills by handling tasks and duties through a lifelong process of learning.

Organization means participation in a professional organization and membership of professional Associations, such as Nepal Surveyors Society, Royal Institution of Chartered Surveyors etc. Membership of such as organizations may lead the surveyors towards obtaining the recognition and status of a true professional man. Experience is obtained over the years-undertaking specific tasks and it will be as a gradual transformation of knowledge with the solution of problems.

Exclusion is regarded as to avoid, unfit and unworthy activities which are restricted by the code of ethics or code of professional conduct. One has to bear in mind that here is always a possibility to be expelled from the registered land surveyors, if he had unethical behavior and incompetence on the code of conduct.

In the bygone days land surveying was generally said to include the determination of areas of tracts of land, the surveying needed for preparing descriptions of land establishing or re-establishing land boundaries and the preparation of plots for land tracts and sub-divisions. In course of time with the development of new technology and equipment, surveying have been involved in a board range of activities, which may occur either on, above or below the surface of the land or the sea and may be carried out in association with other professionals.

### **Need of Licensing in Nepal**

Field of surveying and mapping in Nepal is expanding year after another because Nepal is developing its infrastructure with the national resource and international assistance as well. Many development projects have been formulated and implemented for the economic upliftment of the Nepalese people such as local development, traffic management, road construction, urban development, hydro-electric generation projects etc.

All these development projects need exact, accurate, standard and up-to-date maps and map-related data. Capable and competent surveyors could prepare such accurate maps that are required for the planning and implementation of various construction projects. Capability and competency of surveyors can be judged and certified in one way and the other through the registration and licensing system.

It is felt need to manage and issue the licenses to capable surveying and mapping professionals and firms. The licensing system could maintain necessary norms and standards homogeneously on the maps and data, which are prepared also from the private sector companies, agencies and organizations.

For the introduction of licensing system to the Nepalese surveyors and firms, the first and foremost obligation is to be incorporated this issue with an amendment in the existing Land (Survey & Measurement) Act 2019 and its Regulation 2032.

Following provisions should be mentioned in the amended Act and Regulation:

- \* Formulation of National Board of Examiners as Surveying Council.
- \* To fix the minimum academic qualification with an approved course in surveying according to the categorization of licenses.
- \* Minimum years of surveying and mapping experience as an apprentice should be added requirement.
- \* Written examination and viva under the supervision of Board or Council.
- \* Number of Board Examination should be once or twice a year.
- \* Issue of license as a certificate to permit to perform the job with the surveying ethics and code of conduct.
- \* To prohibit a person from practicing surveying and mapping without a license.
- \* To prepare a model code of ethics and professional conduct.
- \* To ensure the discipline of surveying who practice them should meet the needs of the community they serve.

### **Licensing Category**

Category of licenses may be of three types for the time being and it could be added in future as necessary. If we have a look on the classes of Lawyers in Nepal, it is classified as Pleader, Advocate and Senior Advocate. With example of this system, the Licensed Surveyors could be classified as:

- Assistant Surveyor as Basic Type:* To carry out the maintenance of the cadastral maps, demarcation of the parcel boundary, recording of lands and land surveying under the guidance and planning of a Surveyor.

- ❑ *Surveyor as General Practitioner:* To carry on all types of surveys and mapping with computer technology using the equipment and instruments such as GPS Receiver, Total Station Theodolite etc.
- ❑ *Resources Managers as High Grade Surveying Consultant:* To frame terms of Reference of the projects, to prepare Tender Documents, to supervise the work of surveyors.

### **Reasons to be a Licensed / Registered Surveyor**

Surveyors may be desirous to be a Licensed / Registered Surveyor because of the fact that:

- \* To be legalized as a person or firm to perform the duty.
- \* To be recognized the work of a licensed surveyor as per standard set by the concerned authorities.
- \* Registration provides a person recognition as a professional in this community.
- \* Registration raises the status of a surveyor and the profession as a whole.
- \* A registration / licensed surveyor may be offered the job rather than an unregistered one.
- \* The desire for obtaining a license encourages a person to study further and improve his technical ability and aids in his professional career through continuing professional development (CPD).

### **Ethical Principle**

Ethics may be defined as the first duty of a surveyor as normally owes to his clients or employers but as a professional, he also has a duty to the public and to his fellow professionals. It is important that a person must meet certain minimum requirements to obtain license to make practice on land surveying, for example a surveyor:

- \* Must be diligent, impartial, unquestionable and competent in his work though no one can be perfect one hundred percent.
- \* Measures accurately, record and interpret all data based on facts and figures.
- \* Maintains the highest standard of honesty and integrity in ensuring that the information and data he provides are true and complete.
- \* Confers the opinions and advice that he gives are of the highest quality of his ability, giving due consideration to the rights of all parties and keeps concern with the safety and welfare of the public and his employers.
- \* Maintains confidentiality about private information of his current and former clients / employers / the public, unless to make disclosure by the law or client's permission.
- \* Avoids conflict of interests and recognizes the interest of the public.

### **Code of Conduct**

A professional surveyors must follow the code of conduct as:

- \* Not to accept assignment those are outside the scope of his professional competency.
- \* He exercise unbiased and independent professional judgment.
- \* Conducts through research and consulting with other experts as appropriate.
- \* Admits and accepts his own mistakes, if there are.
- \* Encourages his employees for further education also through continuing professional development and facilitates to attend / participate in professional meetings and to become registered.

- \* Cultivates professional obligations of surveyors to society and promotes the surveying profession to clients and public.
- \* Surveyors must not place monetary values above other values as no amount of money is as adequate substitute to a spotless reputation.
- \* He does not receive remuneration for one project from multiple sources without the knowledge of the parties involved.
- \* He employs the expertise of others when his knowledge and ability are inadequate for addressing specific issues.

### **Remarks**

Registration of the surveyors and issuance of licenses to them will help to maintain the accuracy and homogeneity in mapping works in the nation. Concerned department and ministry have to formulate the Act and Regulation to adopt procedures to provide licenses to the professionals and firms. Government agencies should prepare necessary specification, norms and standards on surveying and national map system to enforce the licenses.

Regulation should be established for those qualified Nepalese nationals or foreigners, who work on surveying and mapping of a part or whole of the kingdom to obtain permission / license from the concerned organization. The private sector firms and consultants should carry out productive works whereas their work must be supervised and evaluated by the government agency, whether the final products meet the national standard.

### **Reference**

1. FIG Bulletin No. 2, (1991), Melbourne, Australia.
2. Surveying, W. Norman Thomas, ELBS Editors (1963). U.K.
3. Cadastre 2014, Jurg Kaufmann - Daniel Steudler, FIG, Commission 7, July (1998).
4. Boundary of Nepal (In Nepali), Buddhi Narayan Shrestha, Bhumichitra, Kathmandu (2000)

### ***Call for Articles***

The Editorial Board of Nepalese Journal on Geoinformatics announced to call for articles related with Geoinformatics for the publication on second issue of the journal. Please contact

**Mr Deepak Sharma Dahal**  
Topographical Survey Branch  
Survey Department  
P.O.Box 9435, Kathmandu, Nepal  
Tel: +977-1- 482 929  
Fax: +977-1- 482957  
Email: [planning@sd.htp.com.np](mailto:planning@sd.htp.com.np)  
Website: [www.dos.gov.np](http://www.dos.gov.np)

## **General Information on 23<sup>rd</sup> Asian Conference on Remote Sensing, 2002**

His Majesty's Government, Ministry of Land Reform and Management, Survey Department is organizing the 23<sup>rd</sup> Asian Conference on Remote Sensing (ACRS), the annual event of the Asian Association on Remote Sensing (AARS) in Kathmandu, the capital city of Nepal on 25-29 November, 2002 (9-13 Mangsir, 059 ) to commemorate the International year of the Mountains 2002 declared by the United Nations. The conference is expected to have wide participation of the professionals from all over Asia-Pacific Region and abroad. The 23<sup>rd</sup> ACRS will provide a forum for the participants in exchanging scientific and academic experiences among them.

### **Objectives**

- To discuss problems in remote sensing and GIS in Asia.
- To exchange academic, technical information and applications.
- To promote regional cooperation amongst member countries.
- To promote operational applications of remote sensing and space technology.

### **Highlights of the Conference**

Keynote address on recent development on remote sensing

Technical sessions

Poster sessions

Exhibitions

Conference dinner with cultural event

Student session

Meeting of the AARS delegates

### **Suggested Topics for the technical paper**

Photogrammetry/ Digital Photogrammetry  
Earth Observation from space  
Very High Resolution Mapping  
Mountain Environment and Mapping  
Urban Mapping  
Landuse/ Landcover  
DEM/DTM/DSM  
Soil and Agriculture  
SAR/ InSar  
New Observation Systems  
Ecology/ Geomorphology  
Infrastructure Planning and Management

Data Processing and Algorithms  
Water Resources  
Hazard Mitigation and Disaster Management  
Education  
Oceanography and Coastal Zone Monitoring  
Hyperspectral Data Acquisition and Systems  
GIS and Data Integration  
Economic Development, Tourism and Public Health  
GPS  
Forestry  
Others

**Registration forms for Participation are available from 23<sup>rd</sup> ACRS Secretariat**

For more information, please contact

Abstract / Full paper should be submitted to

**Rabin K. Sharma**  
Member Secretary  
23<sup>rd</sup> ACRS Secretariat, Survey Department  
Baneshwor, Kathmandu, Nepal

**Mailing Address**  
GPO Box 9435, Kathmandu, Nepal

**Tel:** 977 1 479 417 / 482 562  
**Fax:** 977 1 473836 / 482 957  
**Email:** [info@acrs2002kathmandu.gov.np](mailto:info@acrs2002kathmandu.gov.np)  
**Website:** [www.acrs2002kathmandu.gov.np](http://www.acrs2002kathmandu.gov.np)

**Durgendra M. Kayastha**  
Technical Director  
23<sup>rd</sup> ACRS Secretariat, Survey Department  
Baneshwor, Kathmandu, Nepal

**Mailing Address**  
GPO Box 9435, Kathmandu, Nepal

**Tel:** 977 1 479 417 / 482 562  
**Fax:** 977 1 473836 / 482 957  
**Email:** [abstract@acrs2002kathmandu.gov.np](mailto:abstract@acrs2002kathmandu.gov.np)  
[paper@acrs2002kathmandu.gov.np](mailto:paper@acrs2002kathmandu.gov.np)  
**Website:** [www.dos.gov.np](http://www.dos.gov.np)

**GEOREFERENCING CADASTRAL MAPS IN THE PRETEXT OF DIGITAL CADASTRE<sup>1</sup>**

Durgendra M Kayastha  
National Geographic Information Infrastructure Project  
Survey Department  
HMG Nepal

*Abstract: Cadastral data is an essential component of Land Information system (LIS), the importance of this resource cannot be overemphasized as the land is the basic entity upon which all other development programmes are planned and activities are undertaken. In the context of LIS, digital cadastral data more specifically the digital cadastral parcel is the fundamental spatial unit on which database is created, maintained and operated upon. In this context availability of digital cadastral data is so fundamental that there is an urgent need for the same. Considering the resources required for creating a digital cadastral database a fresh, an alternate solution must be sought as the data is already available in analogue form and efforts should be made in making use of available data. This paper therefore focuses on conversion of analogue maps to digital format, especially dealing with maps having no reference coordinate to base.*

**Introduction**

For most of the local application, land forms an integral part of the system, thus cadastral maps forms the basis of such application. It is imperative that cadastral data and maps are available for such application and therefore such data should be well maintained. But availability of cadastral maps especially in digital format is still a problem area. Immediate new

mapping may be a near impossible task considering the time and resources required for preparing such maps of the entire kingdom; hence efforts should be made towards utilizing the existing maps to create a digital cadastral database.

### **Cadastral mapping in Nepal**

Systematic cadastral mapping began in 1964 with the promulgation of land reform act 1962. The focus at that time was to obtain land records to support enactment of new land reform in the country and to generate land revenue. Due to unavailability of national coordinate system and the geodetic network to base such mapping, controls based on local baselines were being used to map the cadastral parcels.

Later, with the establishment of national geodetic network, all subsequent mapping were carried out based on the new coordinate system computed on Everest 1830 spheroid using Modified UTM projection.

In all some 38 districts were mapped on local coordinate system and the remaining 37 districts were mapped based on the national coordinate system. Even in the districts where mapping was based on national coordinate system, there are several dense settlement areas where mapping was based on the local system which also need to be mapped in new system. The districts, where previous mapping were based on local coordinate system, are now being resurveyed based on the national coordinate system.

The reason for resurvey of course was that, with time, the parcels have undergone many changes including fragmentation in addition to changes in the ownership and the condition of those maps are not very good in many cases apart from the fact that these maps were not based on national coordinate system, so a new mapping at larger scale was thought to be the only solution.

- 
1. *Paper presented on workshop on GIS Technologies Sustainable Development at local level, Oct. 9-11, 2001 at New Delhi, India.*

### **Need for geo-referencing cadastral maps**

Cadastral maps in the present context of this paper refers to those map sheets that have no coordinate base i.e. the maps prepared based on local baselines and are invariably called island maps. Geo-referencing issues therefore is related to these maps only. Cadastral maps prepared based on national coordinate system are not considered in this paper unless otherwise specifically mentioned.

Though agriculture remains a predominant occupation in the country, evidence can be found indicating gradual shift in land use especially in the semi-urban and urban fringe areas. Analogue map-based land management cannot support the overwhelming demand from the user communities for the land-based information. Moreover analogue processing of cadastral parcel data for landuse zoning, preparing land consolidation plans, assessment of amount of land holding etc., which forms the priority area of the government would be very difficult. Digital processing on the other hand would possibly be very efficient and also expected to provide new insights and open up new possibilities in understanding problem due to ease in operation and processing efficiency may be dramatically improved.

Similarly associating other socio-economic data would become much easier if such cadastral data are available in digital format. In order for utilizing the data efficiently, and to efficiently assess land-based resources encompassing larger areas, all such data need to be referenced in a national system of coordinates. Furthermore, land records are gradually being converted to digital format by the land management office and a new application developed indigenously called DLIS is being used for digital land administration presently in two districts. So it has become necessary that the corresponding maps should also be in digital format more so in national coordinate base to facilitate compatibility and smooth functioning of entire land management activities in Nepal.

Conversion of coordinated cadastral maps as well as island maps to digital format is, therefore, needed. For coordinated maps, as those maps are already geo-referenced, the process entails analogue to digital conversion only, whereas, in case of island maps, geo-referencing is a crucial task. For compatibility, and also to establish a seamless database geo-referencing of maps is a must. The question of whether to geo-reference the old island maps and create digital database

or defer the decision of creating digital cadastral database of such areas until geo-referenced maps are produced after the process of resurvey is a vital one.

Despite the effort of new mapping, which will eventually take a long time, conversion of existing maps to digital format was felt necessary at least for the time until resurvey in the 38 districts are completed.

While in rural sectors the intended method of converting existing maps to digital format may possibly be the optimum solution, in urban areas the process is not expected to yield useful data, hence additional efforts are also being made towards direct digital acquisition of cadastral information in such areas. As a pilot work numerical cadastral surveying have already been taken up in one small urban area using digital instruments. The outcome however needs evaluation in terms of feasibility of the approach.

### An overview of digital cadastral system

Prior to discussing the process of geo-referencing the cadastral maps, an overview of the digital cadastral system as being presently studied may provide the basis. The need for the digital cadastral system has been accepted on the basis of several reasons some of which are listed as follows:

- Land fragmentation resulting in small parcel size.
- Substantial increase in the cost of land at least in the densely populated urban areas, resulting in a need of a system to support sub-meter level plot boundary demarcation (error regime of few centimeters are demanded in many cases.).
- Due to scale limitation small plots need to be recorded as so called *File Maps*.
- Ease of use of new computer based technology.
- Relating cadastral data with several other data resulting in multi-purpose cadastral system, which is at best very difficult at present.
- Problem of maintaining paper maps for the extended period of time.
- Re-computation and demarcation of plot boundary in the field become error prone due to the scale limitation as well as poor condition of maps.
- Substantial increase in land transaction.

Considering the limitation in the present cadastral system and the additional demand of the user communities have directed the land survey and management agencies to improve its services considerably. This has led to a provisional study resulting in a conceptual model of the digital cadastral system as depicted in figure 1.

The proposed system has seven components in all including the database itself. The component modules are viz Land adjudication module, Data collection module, Data processing module, Data delivery module, Data archive module, Data maintenance module and Database. The system is geared towards numerical cadastral system and it forms a basic core system encompassing geometry of cadastral parcel. The system will be tightly linked with the attribute database and other land administration components.

As envisioned, full implementation of the system will take long time as it is still being conceptualized and may not

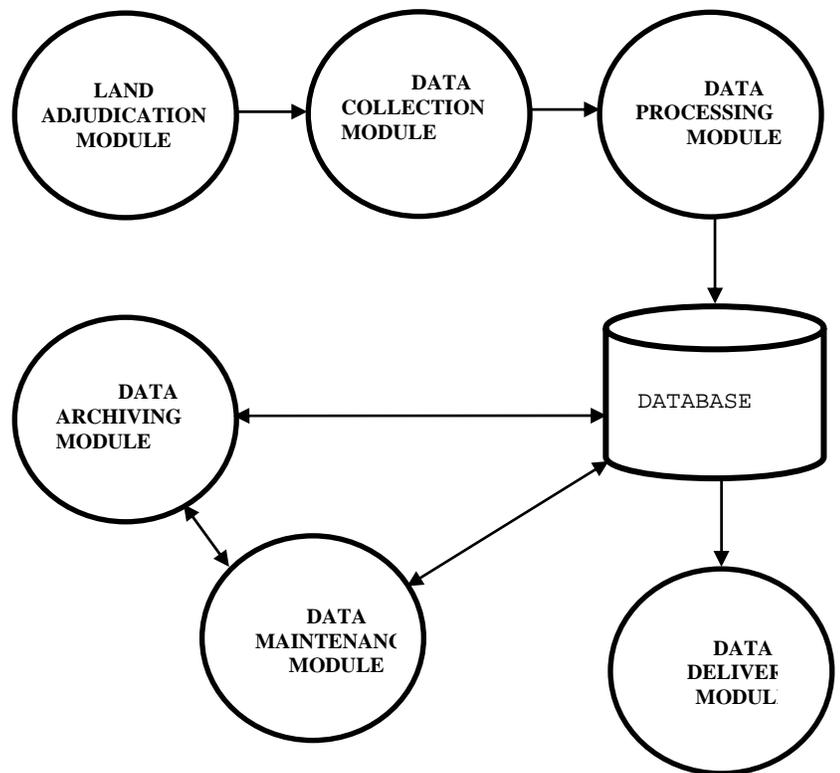


Figure 1: Digital Cadastral System Modules

be employed in the rural sectors of the country. Besides new data collection as per the system module need extensive resource allocation, which may need justification, as cadastral maps are already there in the country. In this pretext, it would be necessary to explore the possibility of obtaining required digital cadastral data making use of existing maps.

Keeping aside other components, if we focus on the two modules viz. data collection and data processing modules, parcel based digital data especially geometry can be obtained using existing maps. The following sections are devoted to explore the possibilities.

### Conversion to digital format

#### Basic problems:

Fundamental problem in the conversion process is the unavailability of reference coordinate on these maps. Secondly physical condition of maps in some cases may be very bad due to continuous use for long time such as dimensional distortion, legibility of drawings and figures etc. Third problem is the level of update of details; for instance the parcel boundaries may be updated but other features like building geometry and landuse type might not have been up-to-date. Fourth problem could be the mismatching of details at the edges of the maps. In addition there are problems associated with conversion of so called file maps which are made in a separate sheet scaling out the parent parcel from the original map followed by parcel fragmentation on these derived plots, which was necessary because the fragmentation could not be done on the original maps due to limitation in scale.

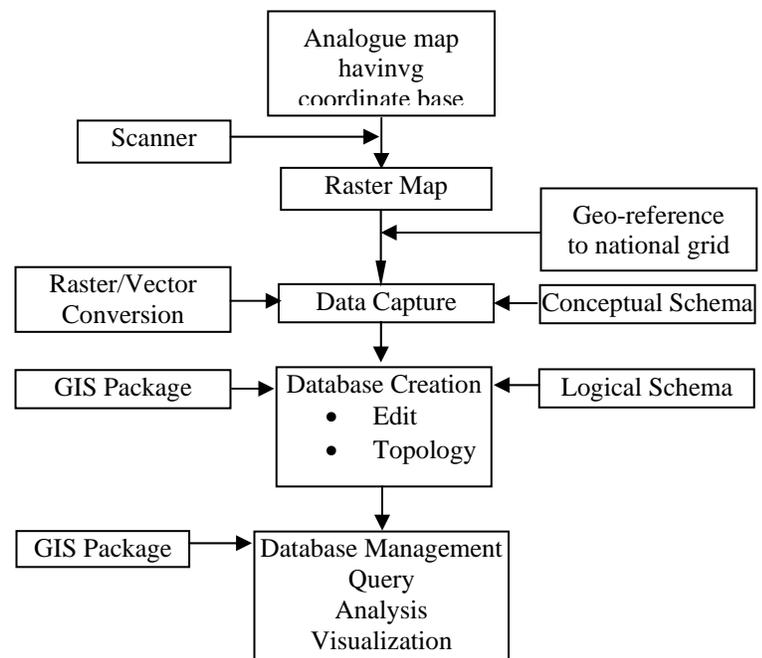
In case of map sheets based on national coordinate system the problem areas are the same as described above except the problem of reference coordinate and mismatching of features across adjoining sheets.

#### Referencing the maps to national coordinate system

This section applies to map sheets having no coordinate system.

In order to reference the maps, it would be necessary to select sufficient number of points (features) on the map, that may be identified clearly on the ground. These points then need to be marked on the ground and a new survey carried out to compute coordinates of these points with sufficient accuracy in national system of coordinate using suitable method. This process will have to be continued for every map sheet. The main problem however would be to find such common points in sufficient numbers.

The set of new coordinate of these marked points will form a basis to map the cadastral sheets to the national coordinate system. Before committing the transformation it would be essential to verify whether it meets the basic geometric accuracy requirement of the final product. The mapping method could be a simple affine transformation, rubber sheeting or some other rigorous transformation methods. The selection of method may again be dependent upon the quality of map in case. In most cases, if sufficiently well spread set of control points could be selected, a simple affine transformation should yield acceptable result.



**Figure 2: Generic process model for conversion of cadastral map to digital database.**

Once the acceptable transformation is found the rest of the procedure is to digitize individual sheets following the standard specification as to feature coding, attribute coding etc. followed by processing of vector data for geometric editing, building of topology and edge matching etc. Individual map sheet based on quality may be scanned and digitized using standard vector-raster conversion packages, followed by standard editing using vector based GIS packages. Individual vector files may then be combined to form a seamless database. The standard specification as to the data model and processing modalities etc. should however be prepared and accepted, prior to the actual digitizing process.

### Issues and implications

The process described above, though seems straightforward, have several implications as to dealing with the geometric accuracy of vectors, apart from adjustment of mismatched vectors across the edges of map sheets. In addition, one should bear in mind the discrepancies to be found between the computed new areas of parcels compared to the corresponding area already been adopted. So, a special rule must also be formulated to cater to such discrepancies as to acceptable limiting value in difference in area value, methods and threshold value for discrepancy in vectors across the edges etc.

In addition building the database of control points may be a big task taking long time considering that such group of points would be required for each individual sheet which are many in numbers. GPS method could be a ready assistance in this regard, yet the time required may still be not acceptable. However, this is the best method one could adopt.

### An alternate approach

Alternate solutions may however, be adopted sacrificing the geometric accuracy of the vectors for a while to make up for the time and avoiding immediate resource allocation. This however should be followed by gradual reengineering of the database in due course.

The suggested approaches are outlined in the following:

Overlay or draw a local grid on the map sheet conforming to the designated scale and produce a scanned image of the map. Digitize the map registering it to the grid drawn. Create vector database based on the local grid on sheet basis.

This way one can have digital cadastral layers based on individual sheet grid. Continue using the sheet based vector database for general land administration until the time when a single national coordinate system would be applied to all sheet-based database. The problem with this approach is that due to independent coordinate system in each sheet adjoining sheet data may not be edgematched or joined to form a seamless database. But this should not hinder the general land administration activities such as ownership transfer, fragmentation of land parcel, land consolidation etc. as the system adopted would be a direct translation of cadastral sheet to digital cadastral sheet only, however it will facilitate working in digital environment.

The advantage in this approach, however,

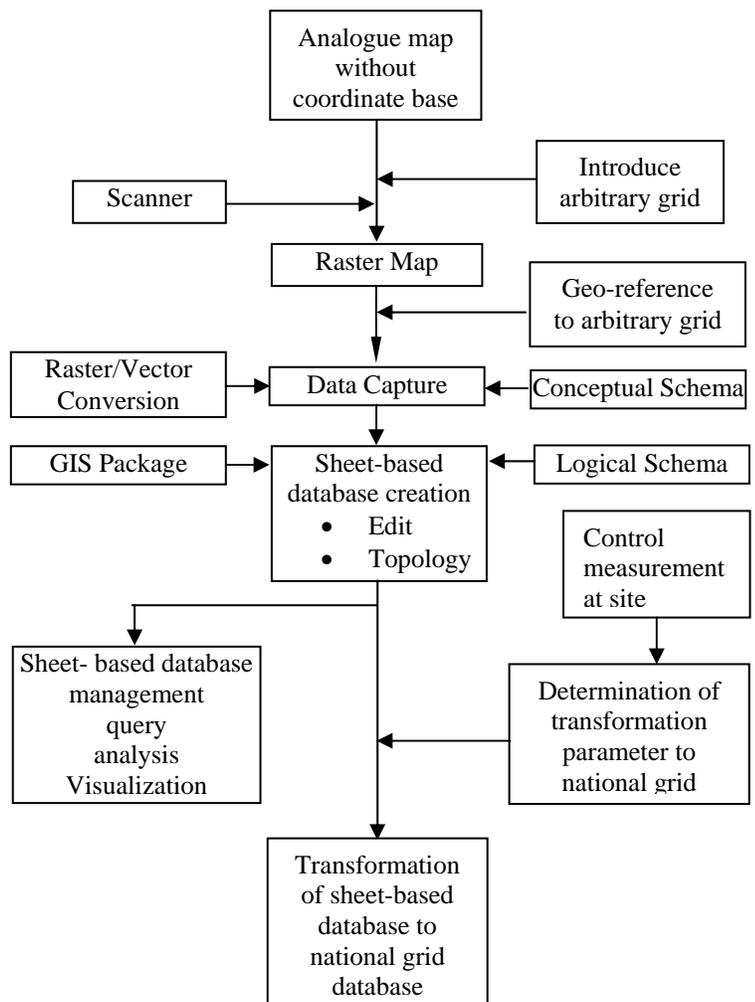


Figure 3: Process model for conversion of map without coordinate to digital cadastral database.

would be the personnel currently working in the land survey sections would get a chance to gradually migrate from analogue to digital technology. The resources may be input in phased manner. This will be an approach of gradual and phased transition to digital cadastre. However, the linking of this database to national coordinate system using the GPS or some suitable methods should continuously be taken up as well also in phased manner assigning priority to areas adjacent to the districts where cadastral sheets are in national coordinate system.

### **Advantages and limitations of the alternate approach**

It is well known that digitizing of maps and thereby creating a database accounts to almost 80 percent of the works in development of a seamless geo-spatial database. So national coordinate system or arbitrary coordinate system, the process of digitizing is the same and takes same amount of time. Without waiting for determination of transformation parameters for individual sheets one can start digitizing them. Once digitized, transformation to national system would entail minimum time once the transformation parameters are ready. Thus, work could progress simultaneously in two fronts, viz. digitizing to arbitrary system and measurement for transformation to national system of coordinates. One obvious drawback of this approach, however, is that distortion owing to sheet dimension may not be adjusted immediately. This process has to wait until the transformation parameters are determined.

Even in this approach one should be ready with the specifications and standards as to data model, feature codes, vectorization procedures, etc. prior to starting the actual digitization.

### **Conclusion**

Digital cadastral database is fundamental to the success of land information system. In order to enhance the capability of the system, it is therefore, imperative that data on land parcel are available in the system in proper format, which will enable the system to gradually migrate to a full-fledged multi-purpose cadastral system. But creation of geo-spatial database is a long process, but the regular land administration cannot be halted until the system is up and running. So two pronged phased approach of converting the existing cadastral maps to digital cadastral database is proposed herein. This is especially suited for the case where two different types of cadastral maps are in use. Creation of database to national specification using coordinated sheets may proceed following standard procedure in one side while local grid-based database be created using island maps complemented by control points measurement for determination of transformation parameters on the other. It should however be noted that the accuracy of data created using these approach be closely monitored and modified to make such data acceptable to the database.

#### **Interaction Programme on Land Consolidation**

Cadastral Survey Branch of Survey Department organized an interaction programme on Land Consolidation. Discussion and deliberation on the concept paper on Land Consolidation developed by the Survey Department was carried out under the Chairmanship of Mr Babu Ram Acharya, Director General of Survey Department.

#### **Lecture Programme on National Geographic Data Infrastructure (NGDI)**

National Geographic Information Infrastructure Project, Survey Department and Nepal Surveyor Society jointly organized a lecture programme on NGDI on 23 Magh , 2058 BS (5 Feb. 2002 AD). Prof. Dr. Bengt Rystedt , ICA President delivered the lecture on Concept of NGDI. Mr. R.R. Chhatkuli highlighted on the status of initiatives taken on the national geographic information infrastructure in Nepal.

## **Handing over of Western Nepal Topographic Maps**

On 29 Chaitra, 2058 BS (11 April, 2002 AD), His Excellency Mr Asko Luukkainen, Charge d ' Affairs a.i., Embassy of Finland, Kathmandu handed over the topographical maps to Honorable Minister of State Mr Ram Janam Chaudhary, Ministry of Land Reform and Management, in a ceremony organized by Western Nepal Topographic Mapping Project. The maps were prepared by Western Nepal Topographic Mapping Project of Survey Department with the technical and financial cooperation from the Government of Finland. There are 254 map sheets covering area of Terai and middle mountain at the scale of 1: 25 000 and 79 map sheets at the scale of 1: 50 000 covering the area of high hills and Himalayas. In this ceremony, a Souvenir publication of Survey Department containing articles related to topographic mapping was distributed to the participants.

## **Innovation in Aerial Triangulation**

Toya Nath Baral  
Chief Survey Department  
Survey Department

### **INTRODUCTION**

Photogrammetry is still undergoing a phase of change. The challenge consists not only in the allround transition to digital photogrammetry, but also in the transition to second-generation digital photogrammetric Workstation (DPWS) as an end to end, workflow oriented solution. Different data sources such as GIS databases or various sensor data must jointly be processed in the future (DOrstel, 1999).

AAT has earned itself a place within the DPWS chain. The former operating principle which has the primary function of controlling the measuring process does only play a secondary role these days. The demand for fast data validation, self-checking mechanisms and a block-wide, end product-oriented approach does have a considerable impact on the importance of AAT. The new generation of DPWS is characterized by the addition of further data sources such as GPS/fNS measurements and the output of improved high quality orientation data.

As summarized by Tang (Tang, 1999) a new AAT approach must incorporate methods for efficient blunder detection and elimination, increase the number of multi-ray points, ensure an even point distribution, include techniques to process poorly textured areas, and provide users with an intuitive and instructive interface for handling cases of automation failure.

Innovative technologies like GPS/INS are more and more challenging the business of aerial triangulation, and thus compete with the next generation of AAT systems (Cramer, 1999). Although the determination of the exterior orientation parameters by the GPS/INS systems has been improved significantly, the accuracy of these parameters is still not good enough for standard photogrammetric applications. Therefore, the integration of self calibrating block adjustment (Ebner 1976) to compensate for systematic image errors based on available tie points and a combined block adjustment computing for shift and drift parameters must be implemented.

This paper concentrates on some main aspects of generating high-quality exterior orientation data within the new ImageStation Automatic Aerial Triangulation System (ISAT) only. A More comprehensive description on the complete workflow of (ISAT) is given by Madani ( Madani et al., 2001).

### **NEW IMAGESTATION AERIAL TRIANGULATION**

The principle of the PHODIS digital AAT procedure is to generate a dense cloud of tie points well distributed over the entire block only. An external Bundle Block Adjustment program (BBA) is then called to detect and eliminate blunders in the measurements and finally determine image exterior orientation parameters. This working strategy was based on the fact that BBA programs have been used in the photogrammetric practice since long. However, it requires advance techniques of blunder detection inside the BBA programs. On the other hand, it still need to get the entire system performance optimized.

To work based on very roughly known input data of exterior orientation is another significant feature of the PHODIS AT system, which has been proven to be advantageous for many years. With the increasing GPS/INS application for imaging flights today, an optimum integration of high quality exterior orientation data delivered by GPS/INS systems, such as the POS Z/I 510 system, is implemented in the new AAT system. In this case, a complete AAT is not necessary, since only few points are sufficient for system calibration and quality control of direct measured EO parameters. Here, the user expects that the automatic procedure can make use of the high quality orientation input to reduce the processing time to a very limit.

Considering this, it is obvious that a fundamental change in the implemented AAT approach needs to take place. In the new ISAT solution the following main features were added:

- High quality tie points by integrated free net adjustment
- Detection of geometrically weak area.
- Optimized processing in case of precise EO
- Computation of exterior orientation (EO) shift and drift parameters during BBA.

### High Quality tie points

To generate a set of high quality tie points out of the extracted point measurements a robust free net adjustment is introduced. The bundle block adjustment takes place at intermediate pyramid levels, each time after extracting tie points. As results, blunders are eliminated from the measurements on one hand, line improved EO parameters of each image are obtained and can be used late to track down identified features more precisely on the other.

Based on the tie points, a-priori project wide standard deviation, given EO parameters and corresponding standard deviations, the least squares adjustment is started. Residuals of the observations are forwarded to the implemented weighting function, and new weights are computed and assigned to the observations for the next iteration. If the weight of an observation is smaller than a predefined threshold, the corresponding photo point can be marked as a blunder. The task of a weighting function is to generate large weights for good observations (small residuals) and small weights for bad observations (large residuals). ISAT uses the Danish Method (Kubik et al., 1987) for robust estimation. Alternatively, the well known Stuttgart method can be used. The robust adjustment is internally repeated until no more points can be removed, or a predefined threshold is reached.

After finishing BBA at the intermediate level, a consistent and reliable set of image coordinates is available. This set of image coordinates is essential for the weak area detection.

### Detection of geometrically weak areas

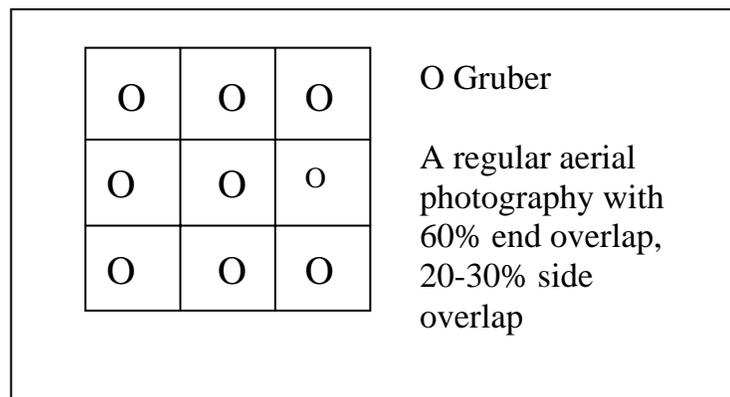
One of the major tasks of the embedded BBA is to detect the geometrically weak areas over a photogrammetric block to manage the internal matching strategy and to tag those areas for operator interaction.

In order to tag geometrically weak areas the image area is subdivided into a regular 3x3 grid (see figure1). Each grid mesh represents a von Gruber area, where the availability of tie points is a prerequisite for a stable geometric block connection. Detected tie points in each of those grid meshes can now be investigated by several criteria. As a pre-knowledge an expected overlapping level for each mesh can be defined.

The criteria to evaluate weak areas are

- The tie point quality derived from the point residual provided by BBA
- The number of multi-ray points in the grid mesh.

If points in a mess are not able to deliver a sufficiently accurate solution for the final BBA the mesh area is tagged as a weak area.



**Figure 1: 3\*3 regular grid**

Weak area information is passed to the matching kernel to control point extraction. The paramount goal of this processing step is to close as many weak areas as possible by automatically searching for tie points in multiply overlapping areas. Hereby points with high connectivity are preferred.

This processing part is one of the most important steps to output a tie point list which has well distributed, highly connected points without blunders.

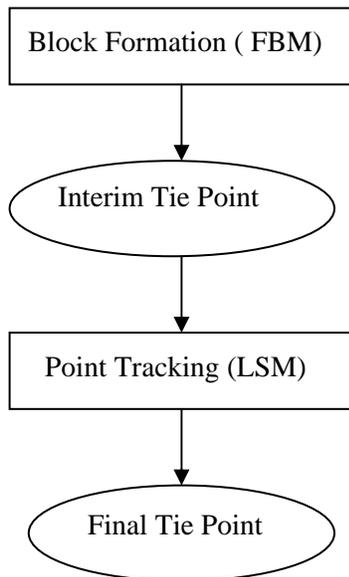
As the automatically generated point list may contain weak areas, especially in poor textured image parts Image Station offers a semi-automatic procedure to measure points in those areas. This function guides the user to the detected weak areas, opens all involved images and offers semiautomatic point measurement functions to insert tie points into weak areas.

**Optimized processing in case of precise EO**

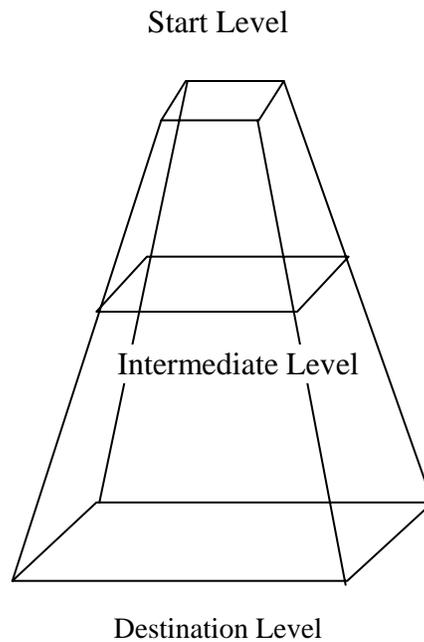
Having just roughly known EO parameters available the AAT approach starts with a block formation based on feature-based matching (FBM) and automatic relative orientation at the start level (see figure 2), and runs through the intermediate level to generate a primary point list. This step serves to connect the whole image block and to deliver relative EO parameters for each image. In case of available GPS/INS EO, because of the good geometric determinability, the block formation step must not be preferred. In this case the tie point list can be generated forming the block directly at the intermediate pyramid level.

As a consequence matching can be started directly from the intermediate level and focused on multiply overlapping areas which can be defined precisely.

Based on the precise EO the forward intersection can deliver the most reliable check on blunders in the tie point list and thus guarantees a high quality of the remaining points. Furthermore, based on the good quality of tie points, the point tracking based on least squares matching (LSM) can work faster than that in the general case because well-qualified input points improve the success rate of the matching as well.



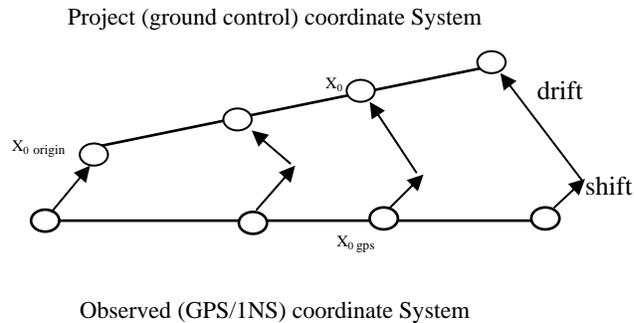
*Figure 2: Structure of AAT*  
**Computation of EO shift and parameters during BBA**  
 exterior orientation shift and drift corrections are applied to the 3 positions as well as to the 3 strip 12 additional parameters (as the bundle block adjustment). Then



The camera orientation angles. At a maximum, per free unknowns) are estimated during, they are applied to the EO parameters (see figure 3). These parameters are normally used during aerial triangulation process only. For subsequent applications, the corrected EO parameters in the final Project Coordinate System ( $X_o$ ,  $Y_o$ ,  $Z_o$ ,  $\omega_o$ ,  $\phi_o$ , and  $\kappa_o$ ) are exported.

exterior orientation shift and drift corrections are applied to the 3 positions as well as to the 3 strip 12 additional parameters (as the bundle block adjustment). Then

The weights for the given exterior orientation parameters are either derived from the GPS/INS post processing software or are estimated by the user. If no observations for the parameters are provided, the approximate values will be zero. If some photos do not have GPS and/or INS information, their EO parameters will be estimated during BBA.



**Figure 3: EO corrected by shift and drift parameter**

## CONCLUSION

The introduced Image Station Aerial Triangulation package replaces the former MATCH AT based triangulation package. The ISAT product delivers fully automatically determined homogenous, well-distributed and best-matched multi-ray tie points. This is achieved by a built-in robust bundle block adjustment during all phases of the image matching operation. The embedded robust bundle block adjustment is performed in a sense of free net adjustment. The bundle block adjustment is improved to optionally compute sensor self calibration as well as shift and drift parameters. ISAT is provided with improved search algorithms to find sufficient and well-distributed tie points in the overlapping regions. An efficient blunder detection and a well-thought weak area handling serve for an optimized workflow. Input of EO information delivered by GPS/INS sensors is used to reduce the processing time and allows ISAT to be used as an efficient validation tool as well.

## REFERENCES

Week '99, Fritsch D., Spiller R. (Eds.), Heidelberg, 59-70.

Cramer M. (1999): Direct Geocoding - Is Aerial Triangulation Obsolete? Photogrammetric

Dorstel C. (1999): Perspectives for aerial triangulation offered by Z/I Imaging. Photogrammetric Week'99, Fritsch D., Spiller R. (Eds.), Heidelberg, 205-210,

Ebner H. (1976): Self-Calibrating Block Adjustment. Bildmessung und Luftbildwesen 44, 128-139.

Kubik, K., Merchant D., Schenk T. (1987): Robust Estimation in Photogrammetry. Photo grammetric Engineering and Remote Sensing (53) 2, 167-169.

Madan, M., Dorstel, C., Zeitler, W., Tang, L. (2001): Z/I Imaging New Automatic Aerial Triangulation System. ASPRS 2001 , St. Louis, USA, Mai 21-24, 2001.

## Congratulations

Survey Department is privileged to congratulate the former Director General Mr Buddhi Narayan Shrestha on receiving the prestigious Madan Puraskar 2057 BS (2000 AD) worth Rupees one hundred thousand and a letter of appreciation awarded by Madan Puraskar Guthi, Lalitpur on 2 Kartik 2058, ( 18 Oct, 2001 AD) for his book, *Nepal Ko Simana* (Boundry of Nepal). The publication is the result of unique research carried out by Mr. Shrestha on the subject and supplements with many maps so far unpublished and inaccessible to general readers.

## Obituary

On 19 April 2002 Survey officials in Kathmandu, Nepal offered homage to Mr Z. M. Wiedner who passed away on 15 Chaitra , 2058 BS (28 march, 2002 AD) at Prague in Czech Republic. Mr Wiedner was in Nepal first time during 2026-2033 BS (1969-1976 AD) under UNDP and again joined Survey Department as a Geodetic Advisor in 2044 BS ( 1987 AD). Establishment of National Geodetic Framework, Establishment of Nagarkot Observatory, Publication of Geodetic Instruction Book were some of the outstanding works done during his stay in Nepal.

## Status of Land Reforms, the Legislation, Policies, Programmes, and its Implementation in Nepal<sup>1</sup>

Rabin K. Sharma  
Chief Survey Officer, Survey Department  
Ministry of Land Reform and Management

### Introduction

Land is the place where all human and animals performs its activities as well as all natural activities occur. It is also the source where people's need such as food, clothes, shelter and energy comes. The land is fixed and the population is growing, therefore each and every moment land to man ratio is decreasing. If a proper balance between land and population is not maintained social and political stability in the nation would not be possible. The secret of success in maintaining this balance lies on the availability of proper and reliable land records and proper utilization of lands. Because of lack in scientific land recording and proper cadastral system effective land management and land administration become a major problem. So most of cases pending in the civil court are related to land.

Similarly, better services to the public, higher revenue collection and proper utilization of land has drawn a national focus in Nepal. Again, Nepalese economy is based on the agriculture production. Some of the reasons for low productivity of land are lack of basic infrastructure, haphazardly scattered, and unevenly seized parcels and unplanned subsistence farming practices. So, the concern of today is to increase production through modernizing agricultural techniques and to divert the excessive pressure on land to other sectors of the economy.

Due to increasing population, it is being a global concern that there is a need to minimize the effect of environmental pollution. This is applicable in our context as well, otherwise grave consequence to be faced by our coming generation is imminent. Due to landless or *Sukumbasi* problem, encroachment on the public and government land for squatter farming and settlement have been alarming. This has also resulted in environmental problem in the country. Bonded labor or *kamaiya* had been another problem facing in the Nepalese society.

Therefore, a careful consideration in these issues should be seriously addressed for which sufficient knowledge and information about land is essential. This could facilitate the transparent land administration, planning and controlling the activities on land. On this context, a comprehensive and perspective land reform programme is necessary in order to support good governance, social justice, environmental protection, improve productivity of land, poverty reduction and sustainable development.

## Organization structure of Ministry of Land Reform and Management

On July 2000, His Majesty's Government (HMG) restructured the organization of Ministry of Land Reform and Management (MOLRAM). Accordingly, the Department of Land Revenue and the Department of Land Reform were merged into one organization under the name of Department of Land Reform and Management. The Survey Training Centre of Survey Department was separated from the department and given the status of the department with the new name, Land Management Training Centre. Again the Archive Section of Survey Department and the Land Information System Project of the ministry were combined to form a new department under the name of Department of Land Information and Archive. With this restructuring, the present organizational structure of the ministry is given in the Annex-I.

---

<sup>1</sup> Paper presented on workshop on " Partnership to meet Development Challenges in South Asia" May 1-3, 2002 at Kathmandu, Nepal.

Besides, Survey Department, Department of Land Reform and Management, and *Guthi* Corporation has the network of offices in the districts.

### Problems and Challenges

The problems and challenges faced during the implementation of activities of ninth five year plan could be listed as follows:-

- Lack of skilled human resources
- Shortage of adequate resources and infrastructure
- Requirement of amendment in existing laws
- Lack of coordination between the related organizations
- Difficulties in access of land by landless and economically poor groups of people
- Hesitation in application of modern techniques
- Existence of dual ownership in practice
- Fragmentation of agriculture land
- Lack of effective implementation of land use planning
- Rehabilitation of land less people still exists.

### Legislation

Land Reform activities are governed by the related Acts and Laws. The existing major Acts are listed as follows:-

- ◆ *Birta* Eradication Act 2016 (Third amendment 2049)
- ◆ Land Survey Act 2019 (Eighth Amendment 2056)
- ◆ Land Related Act 2021 (Fifth Amendment 2058)
- ◆ *Guthi* Corporation Act 2033 (Second Amendment 2049)
- ◆ Land Revenue Act 2034 (Fifth Amendment 2054)

Similarly the related Rules are as follows:-

- ◆ *Birta* Eradication Rules 2017 (Sixth amendment 2058)
- ◆ Land Related Rules 2021 (Twelfth amendment 2041)
- ◆ *Guthi* Corporation Rules 2033
- ◆ Land Revenue Rules 2036 (Forth amendment 2055)
- ◆ Land Survey Rules 2058

Besides these major Acts and Rules there exists 64 Acts which are related with the land. Therefore, Ministry of Land Reform and Management is planning to formulate National Land Policy as well as to formulate Integrated Land Related Act.

## Land Reform Policies

In the ninth five year plan of HMG, the land reform policies are specified as follows:-

- ◆ To create appropriate opportunities to increase agricultural production and income by providing the certificate of land ownership to the family of the farmers who are dependent on agriculture.
- ◆ To make balance and productiveness by reforming existing distribution systems of land ownership.
- ◆ To eliminate the tenant system of dual ownership on land
- ◆ To control the fragmentation of land and to promote land consolidation activities
- ◆ To manage agricultural and non-agricultural land use through the development of land use system.
- ◆ To provide sense of security in land ownership through simplified and scientific way in land administration.
- ◆ To disseminate land related data and information of surveying and mapping by giving priority to the sectors where there could be more development and economic activities.
- ◆ To prepare a single land certificate for one landowner based on land ownership records after finalizing the initial area of the land of entire kingdom.
- ◆ To establish modern land information system by networking computer system for optimization of utilization of land information.
- ◆ To maintain the boundary lines of each parcels throughout the kingdom.

The current fiscal year is the final year of the ninth plan and HMG is in a state of finalizing the tenth five-year plans. Therefore, after evaluation from the results and achievements of the ninth plan Ministry of Land Reform and Management proposed to include the following major sectors in the policy of the tenth plan.

- ◆ To distribute the land acquire from the land holding limitation
- ◆ To control on land fragmentation and to motivate land consolidation
- ◆ To develop and improve land use zoning
- ◆ To manage the problems of landless (*sukumbasi*) and bonded labor (*kamaiya*)
- ◆ To establish land records in scientific way and to reform in land ownership pattern.
- ◆ To update all the data/information related with surveying & mapping
- ◆ To develop National Geographic Information Infrastructure
- ◆ To manage effectively the *Guthi* activities and to secure its property.
- ◆ To prepare a land records of female land owners
- ◆ To develop adequate human resources.

## Programmes

The land reform programmes was launched in 2021B.S. It has certainly brought awareness in the people. The programmes such as relieving peasants from burden of loans, freed from local exploitation, fixed ceiling on land holding and providing agricultural credit through compulsory saving schemes have given social security and justice. Although there have been certain achievements, but due to lack of both political commitments and administrative efficiency the programme has witnessed losing momentum. Therefore, HMG realized that there is a need to consider seriously on land reform programmes. Accordingly, in 1996 a ten points time bound package programme was designed. They are:

- ◆ Abolition of dual control on land
- ◆ Settlement of the remaining cases on land holding ceiling
- ◆ Protection of public and governmental land.
- ◆ Settlement programmes for *sukumbasi* people
- ◆ Implementation of agricultural development programme for uplifting *kamaiyas*
- ◆ Providing agricultural credit facility
- ◆ Application of Land use planning
- ◆ Development of Integrated land information system
- ◆ Implementation of Land consolidation programme
- ◆ Protection and improvement of *Guthi* land

The objective of this reform programme was to introduce a new dimension in land reform programme and expected to achieve the following results:-

- ◆ to increase agricultural production by proper utilization of land
- ◆ to increase employment opportunities in agricultural sector
- ◆ to divert pressure of the population from agriculture to other sectors of the economy

Again, due to political instability and the slackness in administrative efficiency, most of these programmes would not materialized and from the evaluation of achievement of the programme which were implemented, it clearly indicated that they are also not progressing as per the expectations. Therefore, HMG decided to reengineer the current land reform programme. And on *sravan 32, 2058 BS*, Prime Minister announced to implement a Revolutionary Land Reform programme. After the announcement of the programme, necessary land reform legislation has been approved by the parliament. This has already obtained royal ascent. The major high lights of this new legislation are a revised land holding ceiling, provision for land use planning and land consolidation. The objectives of these measures are to acquire land for the landless as well as to improve on the productivity and the production of land. This, in turn, directed towards the following.:

- ◆ Poverty reduction
- ◆ Environmental protection
- ◆ Good governance
- ◆ Social Justice

To address these issues, the following programmes are considered for renovation / re-strengthening.

- ◆ Reengineering of Cadastral system
- ◆ Land Information System and Archive
- ◆ Land Use Planning
- ◆ Land Consolidation
- ◆ Ex-*kamaiya* rehabilitation
- ◆ *Sukumbasi* rehabilitation
- ◆ National Geographic Information Infrastructure
- ◆ Human Resource Development

### **Program Implementation**

To fulfil the objectives of Ministry of Land Reform and Management and to support the announcement of revolutionary land reform program, the ministry planned to implement the following programs through its line and functional agencies.

#### **Survey Department**

- To establish a national network of control points throughout the country.
- To prepare cadastral plans for all districts.
- To prepare topographical base maps.
- To prepare administrative and land resources maps.
- To establish a National Topographical Database (NTDB) through digital technology.
- To carry out international boundary survey works and to fulfil other international commitment of Nepal regarding surveying and mapping.
- To maintain central land record archive.
- To co-ordinate surveying mapping and GIS activities in Nepal.

#### **Land Management Training Center**

To conduct the following training courses

- ◆ Basic Surveying Course
- ◆ Junior Surveyor Course
- ◆ Senior Surveyor Courses
- ◆ Special Courses on Surveying and mapping such as Cartography and Map Reproduction, Photogrammetry, Survey Computation etc.
- ◆ Special Courses on Land Management Course

#### **Department of Land Reform and Management**

- ◆ To formulate National Land Act
- ◆ To formulate an Integrated Land Related Act
- ◆ To distribute the land obtained from the land holding ceiling program to agricultural labors, landless people, real small peasants etc.
- ◆ To develop an evaluation criteria to make it object oriented and factual based for the land evaluation operation
- ◆ To provide land management services through one door system by restructuring the organization and by strengthening and reforming the land record ownership.

#### **Department of Land Information and Archives**

- ◆ To design a computer system to replace the current manual system in district land revenue office
- ◆ To capture the land related data from the registers to build the digital database.
- ◆ To operate parallelly the computer system and traditional system
- ◆ To design a spatial database system
- ◆ To scan the field books and cadastral maps of various district office to archive in an electronic media.

#### **Guthi corporation**

- ◆ To mobilize the local people for the preservation of religious program of *Guthi* and *Math Mandirs*.
- ◆ To establish a *Guthi* records in a central level.

#### **Land use Planning Project**

- ◆ To update the existing land use maps
- ◆ To prepare large scale land use maps
- ◆ To prepare District Profile

#### **Kamaiya Development Program**

- ◆ To implement skill development activities for creation of self employment
- ◆ To implement various awareness programs
- ◆ To provide settlement, drinking water and health facilities for rehabilitation
- ◆ To implement programs for establishment of Group Mobile Fund to create self-income by restructuring the group division.

#### **Status of the Programmes.**

The status of the major activities of the ministry are as follows :

##### Land Resources Mapping Programme

Topographic Survey Branch of Survey Department carried out land resources mapping programme of the country in the 1980's with the assistance of the Government of Canada. Mapping covering whole country on the themes Land Utilization, Land Capability and Land System at the scale 1:50 000, Geological maps at the scale 1:125 000 and Climatological maps at the scale 1:250 000 as well as detailed reports were also published.

##### Topographical Base Mapping Programme

Topographic Survey Branch of Survey Department received UNDP assistance in 1970's for strengthening its capacity on surveying and mapping. This has provided infrastructure for carrying out all topographic mapping programmes. Preparation and publication of topographic base maps were initiated in 1989 with JICA assistance for Lumbini Zone topographic mapping. Then in 1992, Government of Finland supported to conduct topographic base mapping of the remaining 13 Zones of Nepal to cover the whole country. The mapping has been completed on December 2001.

##### National Geographic Information Infrastructure Programme

Survey Department has initiated a National Geographic Information Infrastructure Programme (NGIIP) to support sectoral GISes with necessary data, technical standards and building physical environment and capability for Geographic Information handling. As a basic contribution to the programme digital topographic database for the whole country will be ready by the middle of 2002 with the assistance of the Government of Denmark and Finland. More support from the European Commission is forth coming to pursue the NGII Programme.

#### Cadastral Survey Programme

Mapping and recording of land ownership was initiated in 1965 to support the land reform programme. By the ninth plan period whole of the privately owned land in the country, except in the very densely built-up settlement blocks in the urban areas has been surveyed and land ownership certificate issued to the land owners. However, re-survey with more improved technology like numerical methods and preparation of parcel plans are felt necessary for accurate delineation of the parcel boundaries.

#### Land Information System (LIS) Programme

MOLRAM has initiated LIS Programme since the last six years using HMG/N resources along with some support from Government of Sweden basically to support for transfer of technology. Much has been done in the sector but not to the full satisfaction. The major reason being lack of adequate expertise and the resources.

#### Land Consolidation Programme

The land improvement and consolidation scheme was conceptualized since long, so a concept paper was developed based on the study work carried out in 1999. However, adequate know-how and other resource have been eagerly felt for its successful implementation.

#### Land Use Planning Programme

Haphazard land use practices being practice in Nepal. So, the ministry has established land use project in 2001 to look into the issues of land use policy.

#### *Sukumbasi* Rehabilitation Programme

The *sukumbasi* problem was being addressed in the past by providing small parcel of land to the landless. However, land being limited, this approach has been considered not so sustainable, therefore MOLRAM is looking at alternate programme for *sukumbasi* rehabilitation.

#### Ex-*Kamaiya* Rehabilitation Programme

The *Kamaiya* system of agriculture labor prevailing in five districts (Dang, Banke, Bardiya, Kailali and Kanchanpur) of Western Nepal was considered a social crime to be address by the Government. The Government abolished this system in 2002 AD. The government has given first priority to the families with landless and homeless to provide 0.17 hectare of land along with 35 Cubic Feet of timber and Rs.10 000 to each family for their shelter. The major problem is to provide skills to these *ex-kamaiyas* and provide them means of livelihood and assimilate them in the society. In this context, ILO has been giving form support to this programme.

#### **Conclusion**

It seems that the Government has a clear concept on Land Reform activities for the upliftment of people in Nepal. But, due to political instability, administrative inefficiency, lack of skilled human resources and prominent resource gap, the progress so far made for the land reform programmes has not been as desired. Therefore, proper consideration in these issues and effective implementation of land reform programmes is essential in order to gain support from all the concerned sectors and to obtain positive attitude towards the programme from the related people. To fulfill these requirements, the resources from the HMG/Nepal alone could not be adequate and so it is felt necessary to obtain bi-lateral / multi-lateral assistance for some of the sectors of the ministry.

## References

- 1 Half yearly ten points preparatory measures for Land Reform 1996
- 2 Ninth Five year plan, 1997
- 3 Evaluation of the Nepalese proposal for building IS, 1997
- 4 Final Report on the study of land use plan, 1999
- 5 Land Information System in Nepal ( status and strategies ) 1999
- 6 National Mapping (issues and Strategies) 1999
- 7 Land Registration in Nepalese Perspective: Bekha Lal Shrestha, 1999.
- 8 Brochure of Department of Land Information and Archeive, 2001
- 9 Brochure of Land Management Training Centre,2001
- 10 Draft of Tenth Five year plan 2002
- 11 Annual Progress Review Report on Ministry of Land Reform and Management, 2002
- 12 Plans and Activities of Ministry of Land Reform and Management, 2002

## Available maps

S.No	Description	Coverage	No. of sheets	Price per sheet
1	1:50 000 Topo Sheets	Whole Nepal	266	30.00
2	1:25 000 Topo Maps	Terai and mid mountain region of Nepal	590	80.00
3	1:50 000 Topo maps	High mountain and Himalayan region of Nepal	116	80.00
4	1:50 000 Land Utilization maps	Whole Nepal	266	20.00
5	1:50 000 Land Capability Maps	Whole Nepal	266	20.00
6	1:50 000 Land System maps	Whole Nepal	266	20.00
7	1:125 000 Geological Maps	Whole Nepal	82	20.00
8	1:250 000 Climatological Maps	Western Nepal	7	20.00
9	1:125 000 Districts Maps (Nepali)	Whole Nepal	76	20.00
10	1:250 000 Zonal Maps (Nepali)	Whole Nepal	14	20.00
11	1:500 000 Regional Maps (Nepali)	Whole Nepal	5	20.00
12	1:500 000 Regional Maps (English)	Whole Nepal	5	20.00
13	1:500 000 Maps (English)	Whole Nepal	3	20.00
14	1:1 million Nepal Map (Nepali)	Nepal	1	20.00
15	1:1 million Nepal Map (Nepali)	Nepal	1	20.00
16	1:2 million Nepal Map (Nepali)	Nepal	1	10.00
17	1:2 million Nepal Map (Nepali)	Nepal	1	10.00
18	1:10 000 Kathmandu City Map	Kathmandu	1	80.00
19	1:2 million Releif Map (English)	Nepal	1	10.00
20	1:2 million Physiographic Map (English)	Nepal	1	10.00
21	1:50 000 Sagarmatha Area	Around Sagarmatha (Mt Everest region)	1	150.00

22	1:10 000 Maps Pokhara Area	Pokhara	17	30.00
23	1:10 000 Biratnagar Area	Biratnagar	20	30.00
24	1:2 000 Metropolitan Maps	Kathmandu/Patan/Bhaktapur	50	30.00
25	1:10 000 Karnali Chisapani	Chisapani	305	30.00
26	VDC/Municipality Maps	Whole Nepal	4181	30.00
27	Large Scale Maps	Different scales and areas	-	30.00

### Digital Data Layers

LAYER	Class		
	(A) Rs	(B) Rs	(C) US\$
ADMINISTRATIVE	500	1 000	30
TRANSPORTATION	1 000	2 000	60
BUILDING	300	600	20
LANDCOVER	1 500	3 000	100
HYDROGRAPHIC	1 200	2 400	80
CONTOUR	1 200	2 400	80
UTILITY	100	200	10
DESIGNATED AREA	100	200	10
<b>FULL SHEET</b>	<b>5 000</b>	<b>10 000</b>	<b>300</b>

(A) Nepalese Researchers, Students, HMG Organizations, Non-Government Organization (Non-profit), HMG Affiliated institutions.

(B) Nepalese Private Company (Consultant, Contractors)

(C) Foreign Organizations, Consultants, Contractors.

### Control Points

Type	Control Points	Price per point
Trig. point	First Order	Rs 2 000.00
Trig. point	Second Order	Rs 1 500.00
Trig. point	Third Order	Rs 800.00
Trig. point	Fourth Order	Rs 100.00
Bench Mark	High Precision	Rs 500.00
Bench Mark	Third Order	Rs 100.00
Gravity Point	High Precision	Rs 500.00
Gravity Point	Lower Precision	Rs 100.00

### Other Products

Product	Price per sheet
<b>Aerial Photograph</b>	
a) Contact Print (25cmx25cm)	Rs 65.00
b) Dia-Positive Print (25cmx25cm)	Rs 70.00
c) Enlargements (50cmx50cm)	Rs 325.00
d) Enlargements (75cmx75cm)	Rs 650.00
e) Enlargements (100cmx100cm)	Rs 1200.00
<b>Map Transparency</b>	
a) 25cm*25cm	Rs 310.00
b) 50cm*50cm	Rs 550.00
c) 75cm*75cm	Rs 800.00
d) 100cm*100cm	Rs 1250.00
<b>Diazo/Blue Prints/Photo copies</b>	
a) Full map sheet	Rs 30.00
b) Half size (Foolscap size)	Rs 15.00
c) Quarter size	Rs 7.50

In case of the materials supplied by the clients, the office will charge 25% of the marked price only as service charge.

## **Database generalization and production of derived maps at 1:100000 and 1:250000 scales using NTDB in NGII context**

Durgendra M. Kayastha

***Abstract:** Multi resolution geodatabase will support diverse application requirements ranging in scale and resolution. Creation of such a database primarily enhances production of derived maps, which is one of the key application areas within NGII context. The paper identifies the processes involved specifically in the area of production of derived maps.*

### **Introduction**

National Geographic Information Infrastructure (NGII) may be defined as the technologies, policies, and people necessary to promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors, and the academic community.

Building of geospatial information infrastructure reduces duplication of effort among agencies, improve quality and reduce costs related to geographic information. The objectives of such an infrastructure is to make geographic data more accessible to the public, to increase the benefits of using available data, and to establish key partnerships among data producer and users to increase data availability.

Geospatial data, at least the framework data (basic topographic data) forms the basis upon which other geospatial data may be built. In order to support diverse application needs at varying level even the basic framework data need to be made available at several resolution or scales.

In the context of NGIIP (National Geographic Information Infrastructure Project), production of lower resolution databases has been planned in addition to NTDB supporting production of smaller scale topographic maps as well as regional and national level planning activities. Preparation of database and subsequent production of maps at 1: 100000 and 1:250000 are briefly outlined in this paper.

### **Base data (NTDB)**

Basic framework data is organized at sheet level and are maintained as different layers. The principal data classes are Topography, Building, Transportation, Landcover, Hydrography, Utilities, Administration, Designated Areas, and Vilname.

The NTDB is based on the basic topographic maps that are of two scales. Data based on 1:25000 sheet cover 7'30" by 7'30" area while that based on 1:50000 sheet cover 15' by 15' area. The difference in data content is according to the change in scale.

---

*1Paper presented in "Discussion Forum on 'National Geographic Information Infrastructure in Nepal'" held on March 6, 2002, in Kathmandu, organized by National Geographic Information Infrastructure Project, Survey Department*

Within each data class the data layers are actually maintained as follows:

Class	Coverage			Remarks
	Point	Line	Area	
Topography	Topog_pt	Topog_ln		Contours and spot elevation
Transportation		Trans_ln	Trans_ar	Roads and trails
Landcover			Landc_ar	Landcover types
Hydrography		Hydro_ln	Hydro_ar	Streams and rivers
Designated Area		Desig_ln	Desig_ar	National parks and reserves
Utilities		Utili_ln	Utili_pt	Electricity Lines
Administration		Admin_ln	Admin_ar	Administrative boundary
Ward	Ward_pt	Ward_ln	Ward_ar	Ward boundary
Place Name	Vilname			Place names
Building	Build_pt		Build_ar	Isolated building and built-up areas

### Specification for 1:100000 and 1:250000 mapping

Topographical Survey Branch, Survey Department has already prepared mapping specifications for 1:100000. The specifications provide for the data types that the database will contain. However there will be some changes in the specifications to adapt to the requirements in terms of the database.

There also will be some departure from the specification previously prepared by the Survey Department in cases of symbols. The symbol specification will be prepared conforming to the possibilities in the software used.

### Data Model

#### Data model for NTDB100 and NTDB250

*Items marked \* will not be implemented in NTDB250*

Class: Transportation

Subclass: Road

Subsubclass: Highways, Feeder roads, District roads, Other roads,

Subclass: Major trail (only in the mountains)

Subclass: Railway

Subclass: Ropeway

Subclass: Airport

Subsubclass: Runway \*

Class: Building and Settlement

Subclass: Building \*

Subsubclass: Religious building

Subsubclass: Others \*

Subclass: City/Village

Class: Topography

Subclass: Contour

Subclass: Characteristic point

Subsubclass: Peak, Pass

Subclass: Spot elevation

Class: Landcover

Subclass: Cultivation \*

Subclass: Vegetation

Subsubclass: Forest

Subsubclass: Bush \*

Subclass: Other

Subsubclass: Snow

Class: Hydrography  
 Subclass: River  
 Subclass: Glacier  
 Subclass: Lake  
 Subclass: Canal  
 Subclass: Structure \*

Class: Place Names

Class: Administrative Area  
 Subclass: Country  
 Subsubclass: Region  
 Subsubsubclass: Zone  
 Subsubsubsubclass: District  
 Subsubsubsubsubclass: VDC/Municipality

Class: Designated area  
 Subclass: National Parks/Wild life reserves

The contour data will be maintained at an interval of 100 metre with index contour at 500 metres in all cases irrespective of the area being covered contrary to 50 metres for the plains as specified in the specification for 1:100000 maps. Similarly the contour interval will be 200 metres in the case of 1:250000 with index contour at 1000 metres.

### Naming Convention

Following the sheet numbering system, data pertaining to a particular sheet will be extracted from the NTDB and stored in a new folder with the parent directory name as NTDB100. The sub folder name will be the sheet number itself slightly rearranged. That is the alphabet part of the sheet number and the number part itself is switched in order to represent the folder name. The naming convention for the coverage in NTDB100 will be as follows (e.g. \\NTDB100\A2787\to100\_in).

Data Class	Coverage Name			Feature Type
	Point	Line	Area	
Topography	To100_pt	To100_ln		Contours and Spot elevation
Building	Bu100_pt	Bu100_ln	Bu100_ar	Settlement
Land Cover	La100_pt	La100_ln	La100_ar	Landcover area
Hydrography	Hy100_pt	Hy100_ln	Hy100_ar	River edges
Transportation	Tr100_pt	Tr100_ln	Tr100_ar	Roads
Designated Area	De100_pt	De100_ln	De100_ar	National Park and protected areas
Admin Area	Ad100_pt	Ad100_ln	Ad100_ar	Regional/Zonal/District/VDC/Ward
Place Name	Vi100_pt			Place names

Similarly, data layers pertaining to a particular 1:250000 sheet will be extracted from the NTDB100 and stored in a new folder with NTDB250 as the parent directory name followed by the first four number of the sheet number preceded by the alphabet part of the sheet number as sub-folder name. The naming convention for the coverage in NTDB250 will be as follows (e.g. \\NTDB250\E2781\to250\_in).

Data Class	Coverage Name			Feature Type
	Point	Line	Area	
Topography	To250_pt	To250_ln		Contours and Spot elevation
Building	Bu250_pt	Bu250_ln	Bu250_ar	Settlement
Land Cover	La250_pt	La250_ln	La250_ar	Landcover area
Hydrography	Hy250_pt	Hy250_ln	Hy250_ar	River edges
Transportation	Tr250_pt	Tr250_ln	Tr250_ar	Roads
Designated Area	De250_pt	De250_ln	De250_ar	National Park and protected areas
Admin Area	Ad250_pt	Ad250_ln	Ad250_ar	Regional/Zonal/District/VDC/Ward
Place Name	Vi250_pt			Place names

Utilities and controls data will not be used at this database level.

## **Basic Steps for 1:100000 and 1:250000 database and mapping**

Following is the general steps to be followed for 1:100000 and 1:250000 database:

1. Generalization by feature class
2. Editing of geometry and attributes including matching of features horizontally and vertically
3. Final database preparation
4. Map design
5. Map composition
6. Printing of Maps

### **Generalization by feature class**

Stepped generalization procedure may be followed that means generalization will be made in several steps. The first step would be to generalize NTDB feature to NTDB100 features. Second step is the generalization of features of NTDB100 to NTDB250 features. Similarly the lower resolution level database will be obtained by generalizing features set of the immediate higher resolution database.

Generalization entails two fundamental steps viz. selection or deletion of features and geometric processing for thinning, displacement etc.

Based on the feature class/subclass encoding in the NTDB database, several features may be deleted, which will not be represented in the NTDB100. But this general approach is only a part of the process, as this process might not eliminate or might remove certain features that may need to be represented in the NTDB100. Hence a rigorous approach of encoding additional attribute to individual vector may be performed which enables selective and controlled extraction of required data only.

Once required data at higher geometric resolution but at reduced content is obtained the remaining work is to process for obtaining right geometry and topology. The process includes geometric thinning of vertices and editing for topology and intra-layer matching.

### **Editing of geometry and attributes including matching of features horizontally and vertically.**

With the generalization of vectors and related area and point features, the shift in the position of vectors will result in mismatch of features. Similarly small area feature may have to be merged with the adjacent large area feature. Small line segments of different attribute may require to be changed, e.g. feature (line segment) depicting a bridge may be removed or attribute or feature code changed to match with contiguous line feature etc.

After these processes, one more run of edge matching will have to be performed to match feature between the sheets. All these changes have to be made interactively more or less to match features and attributes vertically and horizontally.

### **Map database preparation**

The process entails draft printing of maps at desired scale and checking for consistency of data as to density, requirement of important features and names at the right places etc. and correcting the discrepancy and finally archiving the dataset as NTDB100 dataset. This is used for further application i.e. in our case production of 1:100000 maps.

Similarly, based on NTDB100 database, NTDB250 database will be generated following the same procedure. NTDB250 database will be used for further application such as production of 1:250000 maps.

### **Map design**

Designing of map layout (i.e. preparation of style sheets including symbols, text, diagrams etc.) will be carried out taking into consideration the mapping specification for 1:100000/1:250000. Specification for 1:100000 previously prepared by the Survey Department and the software and hardware that are available will also be taken into consideration, in addition to the desired output that could be obtained in the given situation

Several programs and symbol design will have to be done at this phase.

## Map composition

Suitable routine will be prepared to automate the production process minimizing user intervention to the limit as far as possible. One should however bear in mind that total automation might not be feasible at this point.

## Printing of Maps

This is the final stage of the 1:100000/1:250000 mapping where the output will be generated using the routines prepared and based on the database. Out put will be a hardcopy pull out using available plotter.

## Generalization approach

### Places

Places should be selected to represent the general pattern of settlement distribution as far as possible. Hence the names of places should first be selected based on importance of such places at different levels, such as national, regional, zonal, district, and VDC and Municipality levels.

In order to achieve this additional attribute field NML may be coded in each of the place name. The domain of values for NML may be obtained by using the following table.

Level of importance	Head-quarters	Religious	Commercial	Touristic	Historical	Others
National	10	11	12	13	14	15
Regional	20	21	22	23	24	25
Zonal	30	31	32	33	34	35
District	40	41	42	43	44	45
VDC/Municipality	50	51	52	53	54	55
Local	60	61	62	63	64	65

Based on the value of NML selective extraction of place names could be facilitated. Further it should also be considered that no two places should be closer than certain threshold distance. The value of threshold depends on the database resolution level. In case of NTDB100 the threshold distance may be 1000m.

## Transportation network

Due to rugged nature of the terrain, different types of transportation routes have varying significance and are closely related with the area. For instance, in the northern mountain region where there is no access to vehicular road, several trails will be more important as these are the only means of movement. This is not the case in the southern plains. Besides, it is important that roads and trails should be shown to places depicted in the map.

It is therefore necessary to improvise certain methods to support identification of such important trails at different levels of importance. A straightforward approach would be to introduce additional attribute field showing importance level.

## Buildings and Settlements

Religious buildings, factories, etc should be coded with additional attribute value showing their importance. Other buildings may be processed to obtain distribution pattern. Depending on the cluster size point or polygon could be created.

## Topography

Depending on the specification, contours are selectively extracted. Further processing is performed as to geometric generalization and editing for inconsistencies such as small ring contours, crossing of contour lines, mismatch with the spot elevation and other features etc.

## Hydrography

Streams and rivers in the NTDB database should be coded with stream order value. This will provide basis for selective extraction of streams and rivers. The extracted vectors will then be processed for generalization of shapes as required.

## Landcover and Hydrography

First step would be to combine some of the landcover subclasses. The resulting data will be examined for small areas. If necessary, such small areas will be merged with adjoining larger areas. In some cases, applying constrained growth, small areas of importance may be enlarged. Once a suitable generalization in areas is obtained, the vectors will be processed for line thinning and final data will be created. Similar approach will be applied for Designated Areas as well.

## Administrative Area

Boundary segments will be generalized followed by the polygonization to obtain required area coverage.

## Further Testing

Conceptually the methods have been identified. Some of the generalization can be done in raster environment while many others could be achieved within the vector-processing environment. Most of the process experimented upon could be programmed to minimize interactive sessions. The efficiency of the methods and the data models need further refinement.

## Conclusion

As the testing process has not been finalized yet, a thorough result can not be explained yet. But the document has outlined the processes involved. In order for the testing work to progress a task group may be assigned with the necessary equipment and software for the purpose. Actual details on the share of automation and interactive intervention can be decided after all phases of testing have been completed. However, a 1:100000 scale and 1:250000 scale topographic layer on NGII topographic database have been planned. This will also give a tremendous support to derived topographic mapping of Survey Department at these scales.

## References:

- Esri, 2002.** Working with Geodatabase: Powerful Multiuser Editing and Sophisticated Data Integrity, 9 p.  
**Esri, 2000.** Map Generalization in GIS: Practical Solutions with Workstation Arcinfo Software, 19 p.  
**Jaakola, Olli, 1997.** Quality and Automatic generalization of Land Cover Data. Academic dissertation, Department of Geography, Faculty of Science, University of Helsinki, 154 p.  
**Kilpelainen, Tiina, 1997.** Multiple Representation and Generalization of Geo-Databases for Topographic Maps. Doctoral dissertation. Publication of Finnish Geodetic Institute No. 124, Helsinki, 229 p.

### Discussion Forum on National Geographic Information Infrastructure (NGII)

A discussion forum on NGII was organized on Falgun 23, 2058 BS (7th March, 2002 AD) by Survey Department to educate and to provide information on NGII and related programmes mainly to the staffs of the Survey Department. The forum was conducted in the gracious presence of Mr Anant Raj Pandey, Secretary, Ministry of Land Reform and Management, as a chief guest. Three papers namely (1) National Geographic Information Infrastructure: A perspective view, (2) National Geographic Information Infrastructure Programme to support National Geographic Information System in Nepal and (3) Database Generalization and production of derived maps at 1: 100 000 and 1: 250 000 using NTDB in NGIS context were presented by Mr Rabin K Sharma, Chief Survey Officer, Mr Raja Ram Chhatkuli, Project Chief and Mr Durgendra Man Kayastha, Chief Survey Officer respectively and the programme concluded after discussions on the topics. The three papers are incorporated in this issue of the Journal.