

Development of Cadastral Information System using by Geographical Information System (GIS): A case of Around Gabriel sefar in Assosa Town

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ABSTRACT: *World-wide, much attention has been given to cadastral development. As a consequence of experiences made during recent decades, several authors have stated the need of research in the domain of cadastre and proposed methodologies to be used. The purpose of this paper is to contribute to the acceptance of project methodologies needed for cadastral information system development, and thereby enhance theory in the cadastral domain. The paper reviews that what social communities get benefit on cadastral information system and identifies the methodologies used to perform. The review focuses on the institutional, social, political and economic aspects of cadastral information system development, with technical aspects. The main conclusion of this project paper is containing the development of cadastral information system. That is show cadastre is relates as much to people and institutions, as it relates to land, and that cadastral information systems are shaped by social, political and economic conditions, of the study area. From definition cadastral information system is a system which contains both cadastral mapping system and land registration system, which both has their own roles in cadastral information system development. So that researcher focuses on the development of CIS concept and Collections of socio-economic data for each land parcel and plotting the collecting survey data. Based on this researcher is prepared the cadastral map with different land use type like residential, commercial and green area by analyzing the different raw data that collected from different data source. And also, searcher try to identify what are the problems are exist in social communities and find*

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the method how to reduce the problems and recommend the municipal government for what they must be improve for the feature based on the previous problem.

Keywords: *cadastral information system; land information system; land registration system and geographic information system*

1. INTRODUCTION

1.1. Background of the Study:

Land is a fundamental to life as we know it like food, fiber, habitation, recreation, and so forth, because most human activities and developmental efforts are based on land. In most countries, legal systems have developed around the original administrative systems and use the cadastre to define the dimensions and location of land parcels described in legal documentation. The cadastre is a fundamental source of data in disputes and lawsuits between landowners. “Cadastre is normally a parcel based and up-to-date land information system containing a record of interests in land (i.e. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, and ownership or control of those interests, and often the value of the parcel and its improvements. It may be established for fiscal purposes (e.g. valuation and equitable taxation), legal purposes (convincing), to assist in the management of land and land use (e.g. for planning and other administrative purposes), and enables sustainable development and environmental protection. Cadastral Information Systems (CIS) have been defined by the International Federation of Surveyors (FIG) as follows: “... a tool for legal, administrative and economic decision-making and an aid for planning and development. A cadastral information system consists, on the one hand, of a data base containing spatially referenced land-related data for a defined area and, on the other, of procedures and techniques for the systematic collection, updating, processing and distribution of the data. The base of a land information system is a uniform spatial referencing system, which also simplifies the linking of data within the system with other land-related data. The operation of a cadastral Information System (CIS) includes the acquisition and assemblage of data, their processing, storage, and maintenance; and their retrieval, analysis and dissemination. The usefulness of such a system will depend upon up-to-datedness, accuracy, completeness, and accessibility, and also upon the extent to which the system is designed for the benefit of the user

rather than for the producer of the information (Dale and McLaughlin, 1988). Land parcels can be defined by physical demarcation on the ground or by a mathematical description usually based on a co-ordinate system. The accuracy and cost of cadastral surveys is dependent on the accuracy needed for boundary descriptions. The accuracy should reflect factors such as the value of the land, the risk and cost of land disputes and the information needs of the users of the cadastre. A cadastre is supposed to provide statistics of all issues relating to ownership, use and status of landed property in a given geographical area. The development or improvement of cadastral information system (CIS) was a broad view of system concepts. If it is ensure that operate efficiently for many purposes besides the basic tasks of providing legal security by titles, or deeds and data for property taxation. Cadastral systems must serve a multi-purpose use and thereby meet the challenge of a modern GIS and IT environment. The research proposal will present a number of examples to illustrate this multi-purpose use. A principal concern of any country in the world today is to defined and better understanding of cadastral information system (CIS) owing to excessive population growth in many countries. There has been increasing pressure on land and its resources for purposes of shelter, food, better living condition and an improved market economy (plateau, 1996). In Ethiopia, cadastral information system has been generally based on traditional and customary institutions and laws. This is true in all urban and rural areas through Addis Ababa has relatively better land registration system (Interview, Solomon, 2008). However, recently some decisive steps are taken to improve the cadastral information system in the country. In case of Assosa town cadastral information system is based on the traditional way to explain the land parcel of the societies. So that in our study tries to use technological software and develop cadastral information system in modern way.

1.2. Statement of the Problem:

Assosa Town has get problems relate of cadastral information system (CIS) which is currently exists, to explain this problem; first it is better to analyze and identify what are the existing problems. Some of those identified problems regarding to the town are: The data is not well organized, that means the traditional way of land registration and organizing of spatial and non spatial data is not prepared properly with the help of arc GIS software. And also, the Assosa town municipal office have not previously well organize cadastral map which its combined with master plan of the town that assisted with different software. Additionally,

this town has the problem of cadastral Information system and property registration system, in case of, the location and position of the land dimension for every land parcel, parcel number, type of land boundary, land use, land registration, land disputes etc. so that, our project tries to answer or reduce those problem identify above.

1.3. Objectives:

1.3.1. General Objectives

The Main objective of the study is to develop cadastral information system using GIS software for the land management system in the case of Assosa Town around Gabriel sefar.

1.3.2. Specific Objectives:

1. Make better land management system of the area.
2. Create spatial and non-spatial database system.
3. minimize disputes between the adjacent property owners,
4. Identify the social problems in the study area and fulfill the desired service for societies.
5. Compare the existing and the new techniques of cadastral information system in the study area.

1.4. Significance of the Study:

This project will give further understanding on the problem of land information system and its consequence on students, and other community in Assosa. The successful achievement of this study is hoped to help the society in Assosa and it is important to become to the solution by analysis the problem.

2. LITERATURE REVIEW

Cadastral Survey are the oldest types of survey and are performed for locating property lines, subdividing land into smaller parts, determining land areas and other information involving the transfer of land from one person to another. These surveys are also called land surveys, property surveys or boundary surveys. Cadastral surveys document the boundaries of land ownership, by the production of documents, diagrams, sketches, plans, charts, and maps. They were originally used to ensure reliable facts for land valuation and taxation. It's come from Roman word known cadastre which means, a system of keeping records on land parcels (property) with respect to their geographic extent of the past,

current and future rights and land interests in property. Cadastral Surveying is a broader term embracing all kinds of land surveying and is a general term referring to extensive surveys relating to land boundaries and subdivisions made to create units suitable for transfer or to define limitations of title. And also it is used to identification, demarcation, measuring and mapping of new or changed legal parcel boundaries. It usually includes the process of re-establishing lost boundaries and sometimes resolving disputes over boundaries or other interests in real property. Cadastral surveying is the term generally used to describe the gathering and recoding of data about land parcels, even where the records do not form part of an official cadastre, cadastral surveys are concerned with geometrical data, especially the size, shape and location of each land parcel. It could be the best way of land controlling and know the land ownership by the governmental office or agency. From any the cadastral system the cadastral map is the base for formulation of cadastral information system because, it's based on digital cadastral map in which attributes and map data on cadastral Unit stored in the same data base which cannot be ignored. The technical design of a cadastral system in a developing country needs a precise definition of the requirements and aims at such a system. A cadastral information system is not a monolithic block. It should be designed to fulfill the changing legal demands and demands of administration and the private sector. It should be able to develop it into a basic Land Information System (LIS) of great variety and flexibility for planning, environmental protection etc. The role of this land information system is to enhance them management and control of land resources, for sustainable development in the area.

2.1. Historical Development of Cadastral system:

The term comes from Latin base term Cadastre referring to a registry of lands. So actually Cadastral Surveying is surveying having to do with determining and defining land ownership and boundaries. So that cadastral system is, the practice of finding boundaries is a purely legal process, not a purely scientific process. The boundary surveyor in finding an old survey must be cognizant of the legal description of the land and any conflicts which may affect it. This involves not only knowledge but skills in research and investigation. Then the surveyor must be part archeologist to find physical evidence of previous surveys and occupation on the ground. Throughout the process the surveyor must understand the

concepts of good measurements to find and describe what is found, and be able to interpret its relationship to the record.

2.1.1. Classification of Cadastral System:

They can be grouped under three general heads.

1. Tax Cadastre
2. Real Cadastre
3. Legal Cadastre
4. Fiscal cadastre
5. Multipurpose cadastre

The Tax Cadastre:

It is a system of survey where information is collected for land taxation. The tax may be assessed based on area of land, type of land, value of land and produce of the land. The physical survey may be represented by sketch. Usually, accuracy of the survey is low since main objective is tax collection. The determination of rightful ownership is not done since main objective is tax collection. As long as someone agrees to pay taxes, it does not matter to the government who the rightful owners are.

Real Cadastre:

In contrast, the real property Cadastre is executed mainly for the physical mapping of land holding boundaries and locating real other properties for land inventory. Real property includes not only land, but also buildings, trees etc., which are permanently fixed to it. Minerals below the surface are also integral part. However, in the legal courts of many countries; private ownership of mineral deposits does not necessarily follow from the ownership of the land.

Legal Cadastre:

Surveys are which furnishes information for the registration of the land. Determination of legal Ownership and Registration of legal transactions is called as legal cadastre. The requirements of physical survey of land boundaries preceding registration may not be necessary since registration can be based on old documents. Thus, in general, the legal cadastre is a complement to both property cadastre and tax cadastre. Hence, the most

efficient approach is to take all three objectives together and integrate the three types of cadastres in one system. This, in essence is Land Information System or LIS.

Fiscal cadastre

Fiscal cadastre is a record of information necessary for levying property taxes, which includes location and value of parcel. Frequently, the occupant of the parcel is identified for tax purpose, and no effort is made to determine the legal owner. Governments need income, which generally is generated through some sort of taxes. One major resource in country that can be taxed is land and land related properties. Thus, a fiscal cadastre must include enough information to calculate a value using certain valuation.

Multipurpose cadastre

An integrated land information system containing legal (e.g., property ownership or cadastre), physical (e.g., topography, man-made features), and cultural (e.g., land use, demographics) information in a common and accurate reference framework. The reference framework typically is established with rigorous geodetic and survey control standards, such as the state plane and latitude/longitude coordinate systems. The Cadastre is made up of multiple independent, interrelated layers commonly used to describe the graphic component of a GIS database. Each layer contains a set of homogeneous map features registered position ally to other database layers through a common coordinate system. Data are separated into layers based on logical relationships and the graphic portrayal of sets of features. A relatively new development that incorporates, at one source, the data concerning the legal and fiscal cadastre along with information on land use, infrastructure, buildings, soil and other factors.

2.1. 2. The important role of the cadastre in the society:

Most jurisdictions have some form of registration of legal documents, ownership, or use rights. In some cases, a new system may be introduced to replace existing systems or informal arrangements. In the Federal Republic of Ethiopia a good working system to guarantee the security of land tenure has been established. With a long history of land registration in this country it is a proven fact that a good working system of land registration is very important for a developed society and as well for a developing country. Investments in land and buildings have been very difficult or even not been possible before

re-establishing a land registration system like in the rest of the country. The cadastral system in this country with its additional contents in maps and records now has the function of a basic Land Information System.

3. METHODOLOGY

The project has both quantitative and qualitative research design this means, quantitative for close ended question and qualitative for open ended questions. Also, the project has both field work and office works for collecting and processing the overall data. After the preparation of different questions in the form of socio-economic data and other open ended question to gain detail information about the surrounding from the society of Gabriel sefar and the cadastral office of Assosa town, then we observe the site of the boundary area of Gabriel sefar and start the field work at some part of the kebele. The different books and internet service to gather about the documentation for preparation of Cadastral information system using GIS software and finally we rearrange all the collected data to precede the project work.

3.1. Three dimensional surface of our project area:

The three-dimensional surface of the area is show XYZ coordinate of the surface. Which means it is show the level or elevation of the area which expressed by the up and down of the area. This three-dimensional surface of the area is designed by using the surfer software.

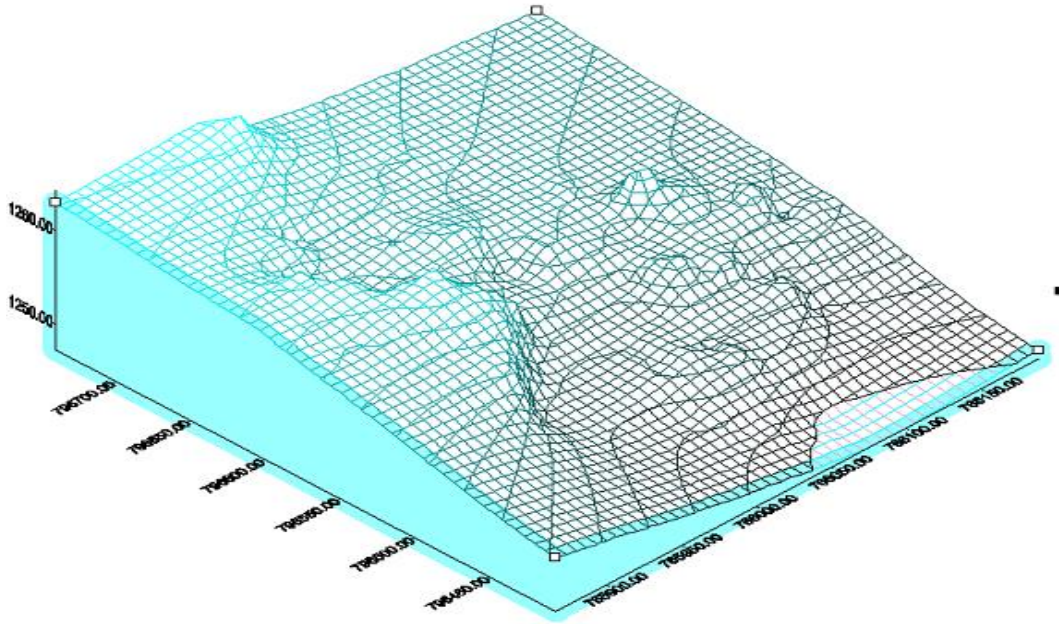


Figure 3.1: that show the three-dimensional surface of our project area

3.2. Contour map of our project area:

Contour nothing but it shows the up and down of the area and its expressed by the Z coordinates. And also it show the level of the area that that to be excavate and fill for the purpose of different structure. The contour interval is the elevation distance between succeed contours.

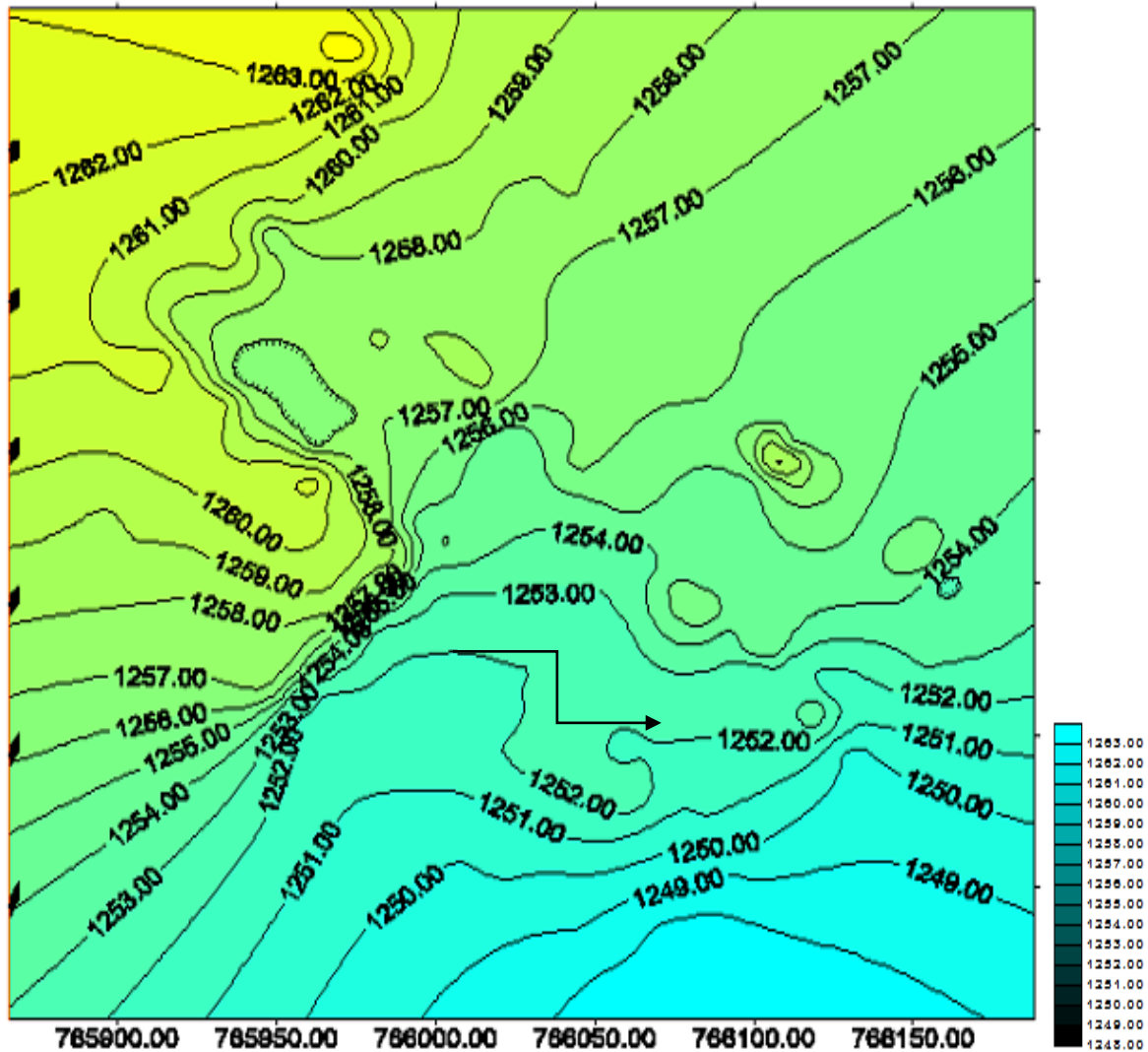


Figure 3.2: contour map of the project area

3.3. Topography of the study area

The physical features of the study area are characterized by a topography dominated by gentle slopes and localized steep slopes. There is also a large area of land in the study area under residential, commercial and green area. The topography of the study is more characterized by flat area with average elevation of 1235 m above sea level. Generally, the area is flatted so that it is comfortable for constructing different structure because it is simple to excavate.



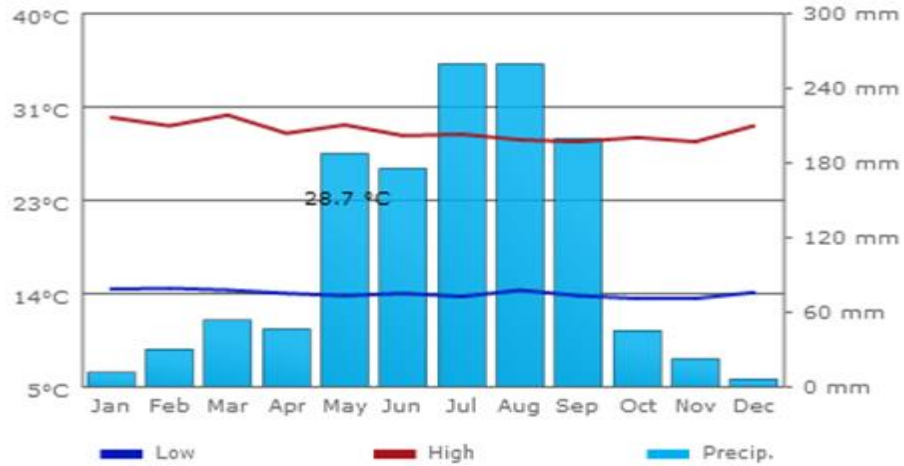
Table 3.1 climate of Assosa town

Month	Jan	Feb	Mar	Apr	may	June
Average high in °C	30	29	30	29	30	29
Average low in °C	14	14	14	14	14	14

Average precipitation in mm	11	30	53	46	187	175
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month	July	Aug	Sept	Oct	Nov	Dec
Average high in °C	29	28	28	28	28	29
Average low in °C	13	14	14	13	13	14
Average precipitation in mm	259	259	199	45	22	6

Figure: Climate chart of Assosa



3.4. Road Network:

Construction of all-weather roads were begun in the late 1970s, and by 1988 they extended from Assosa in three directions: south to Gilgal (built with Cuban help), southeast to Wallega and north to Begi. Road network of our project area is planned in systematic way. But it not comforts able since it is macadam and gravel

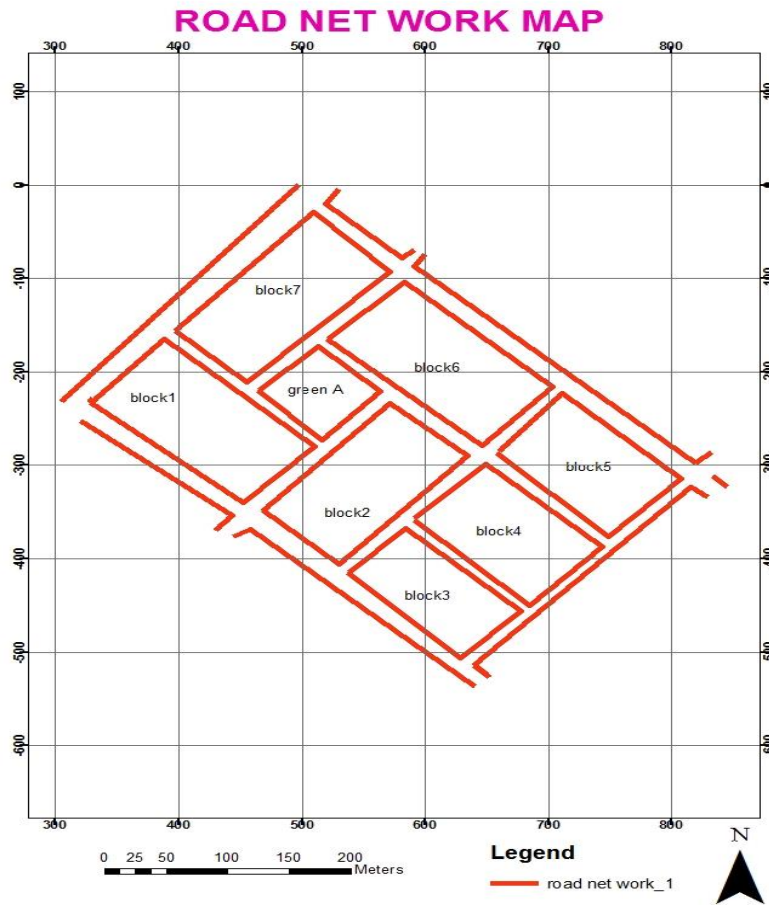


Figure 3.3: road network map

3.5. Parcel numbering or parcel id (PI):

Is used to manage information about land and relate parcels to other themes or layers in an automated land information management system. Within a GIS, numbering system may need to be reviewed and revised to accommodate the multiple uses of the GIS. With current GIS technology, the parcel numbering does not have to be tied to specific geographic locations. The numbering should be:

- Simple-easily understood;
- Unique-each parcel number must be unique
- Economical-implementation and maintenance cost-effective

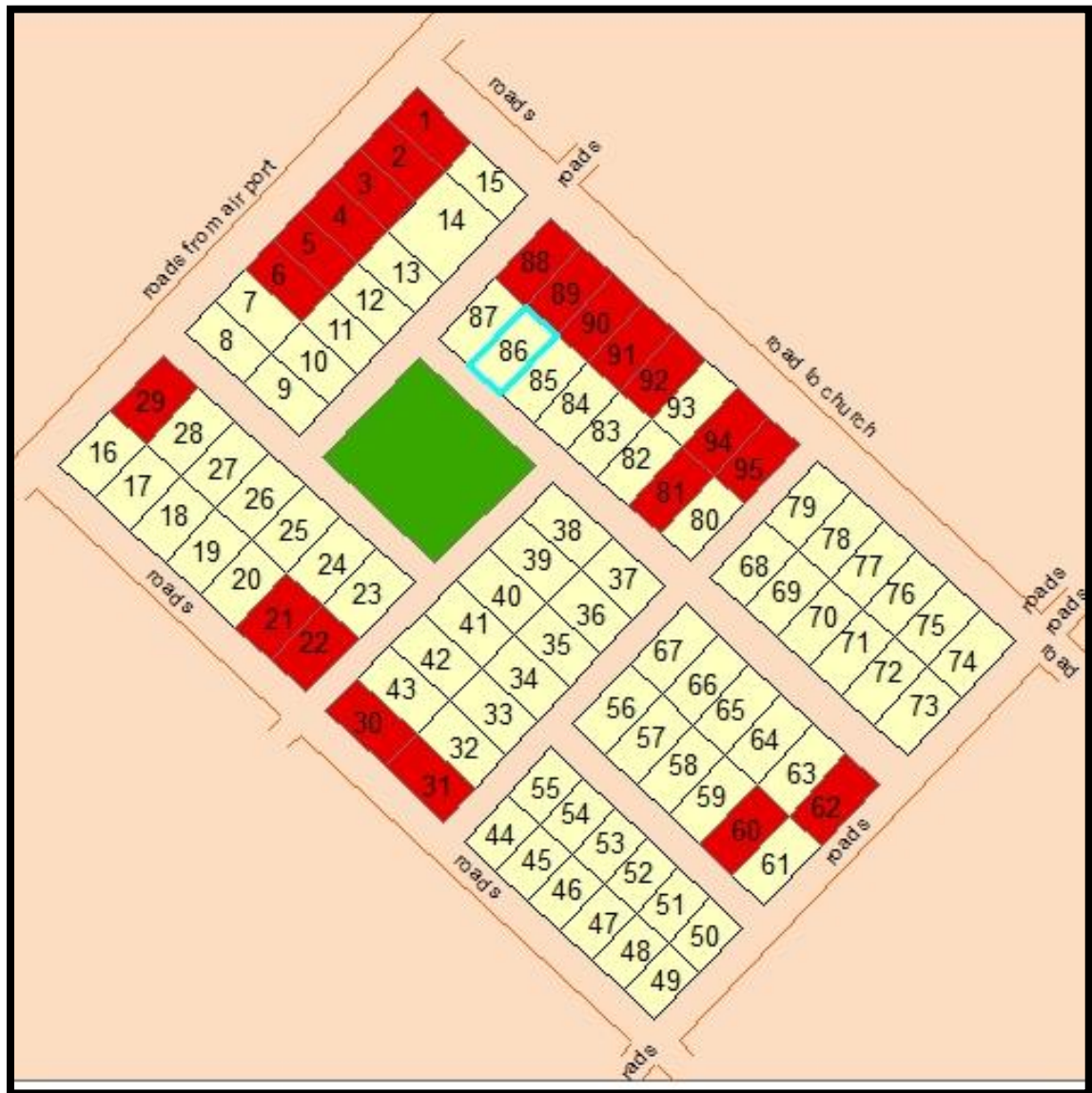


Figure 3.4: Cadastral map of the area with parcel numbers

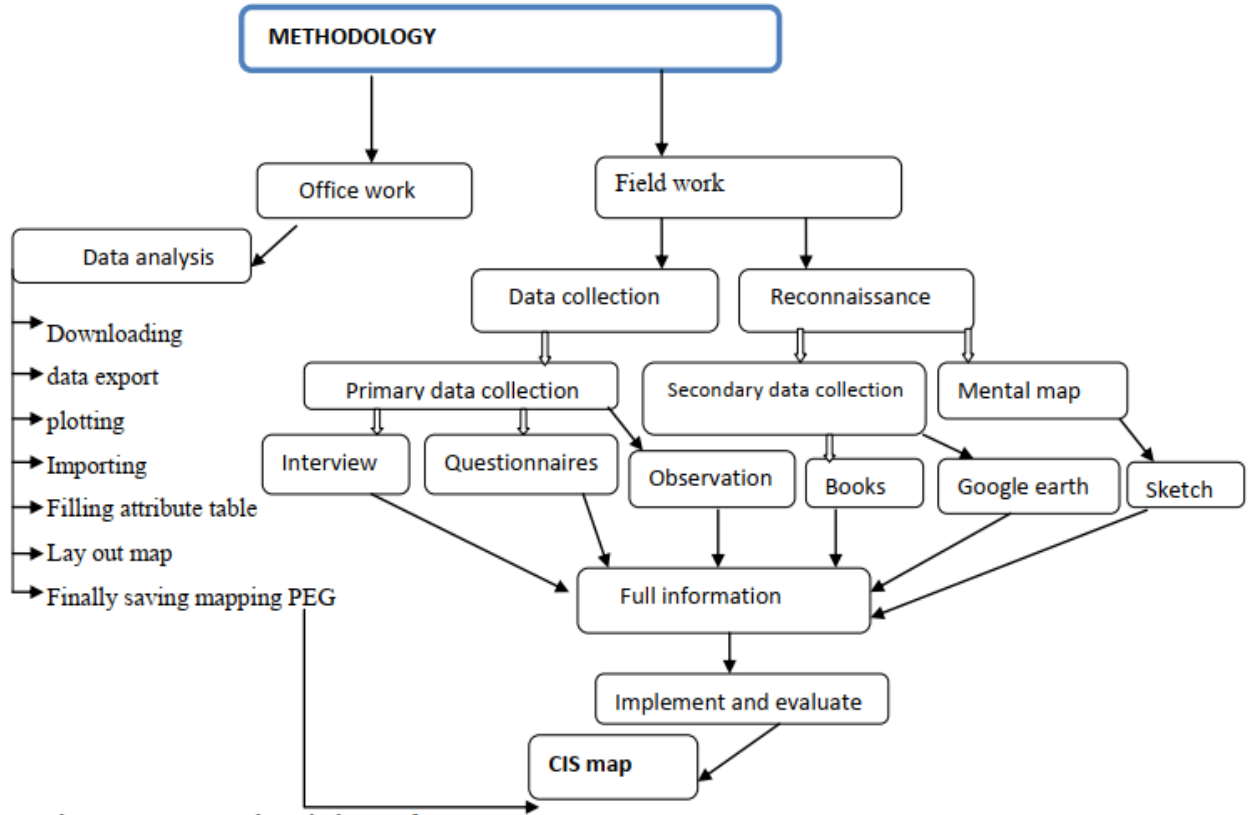


Figure 3.5: systematic techniques of CIS

Down loading data:

Down loading refers to transferring of the collected data to the computer. After collecting data on the field by using different survey instruments like GPS, total station and other, it should be transferred to the computer for further office work, using different down loading software. For our project since use GPS we are down loading by using mobile window center.

B. Data export

After downloading the data will be save in the excel by CSV. Comma delimited in order read on Auto cad. It is the way of data transfer from the excel to auto cad. It is the process of changing the GPS (Trimble) data format to excel data format this process is done by using Trimble business center software.

C. Plotting the Collected Data

After down loading the gather cadastral data should have to plot and check all the parcels. However, before plotting is should be first importing into the Auto cad. The plotting is

based on the point number of each building corner reading, since according to recorded the point number of each reading on the free hand sketch of the study area. Since, taking also some offset measurement from the field, are also generating all the selected data's and recorded on the excel data; their new coordinates From the AutoCAD.

D. Importing AutoCAD data to Arc GIS

Since this project is developing the cadastral information using GIS, and also the GIS only enable to integrate the socio-economic data with the spatial data, then after plotting all the data with the spatial data, then after plotting all the data's on the Auto CAD they should be importing to the Arc GIS.

How to imported CAD data to arc GIS:

- After saving the AutoCAD data by a file format sample AUTOCAD drawing, And by a file name suppose, cadastral drawing part, it is ready to import to Arc GIS.
- Open Arc GIS as a blank space → make the project window active
- From the file menu, choose extension
- In the extension dialog, click the Geo database
- Import from CAD
- Click the add them button
- In the dialog that appears, navigate to the directory that contain the drawing File you want to add, in this case cadastral. Double click the directory name. The drawing File will appear in the list at the left of the dialog. Then the drawing of the cadastral that we plot on auto cad is changed to the Geo database, which is comfortable for writing the socio economic in attribute table.

E. Lay out map (presenting)

Finally, our cadastral map makes enter different element of map such as legend, north arrow, frame, title and scale.

4. RESULT AND DISCUSSION

According to this study or this project the cadastre is a parcel-based and up to date information system which contains a record of interest in land. The vision of this project parcel-based information system for the future is to develop modern cadastral infrastructures that facilitate efficient land and property markets protect the land rights of all. So, parcel based information system can be seen as the basic infrastructure to support different systems

in the area of land management. In general, parcel information can be included land rights, land values, land use, housing and building, Administration code, owner information, their occupation, land acquisition, date of acquisition , tax information, parcel land use type, housing facilities, social infrastructure used by house hold, social problem in the area, waste disposal and pollution problem type can be summarized as the following table below.

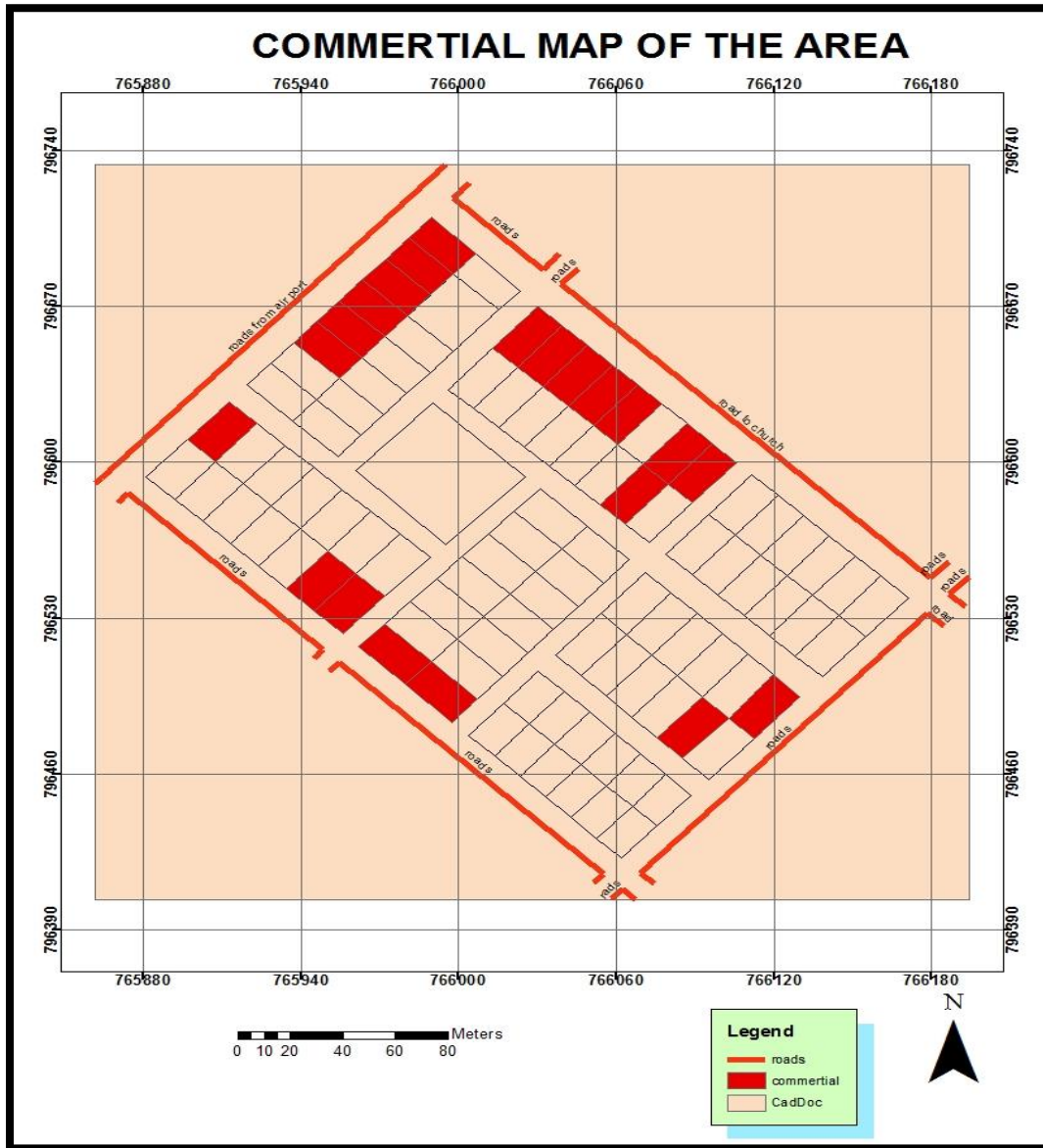


Figure 4.1: commercial map of the project area

4.2. Residential area map

A residential area is a land use in which housing predominates, as opposed to industrial and commercial areas. Housing may vary significantly between, and through, residential areas. These include single-family housing, multi-family residential, or mobile homes. Its area is a land use in which housing predominates, as opposed to industrial and commercial areas. Housing may vary significantly between, and through, residential areas. These include single-family housing, multifamily residential, or mobile homes. Residential development is the dominant land-use within the city, offering residents a high quality and much sought after residential environment and providing. The residential land use designations provide for housing and other land uses that are integral to, and supportive of, a residential environment. Housing may take many forms ranging in density and scale from detached homes to high-rise apartment structures. To provide opportunities for the development of a broad range of residential uses that will satisfy housing requirements, and to provide for compatibility issues to be suitably addressed, three categories of residential land use have been identified. From the study the project area above 8 hectare is covered by residential area. From 95 parcel information gathered above 76 parcels covered by residential. Therefore, the same procedure is done for commercial area. It is represented by yellow color to identify from the other land use type, the figure below shows map of residential area with its attribute table.

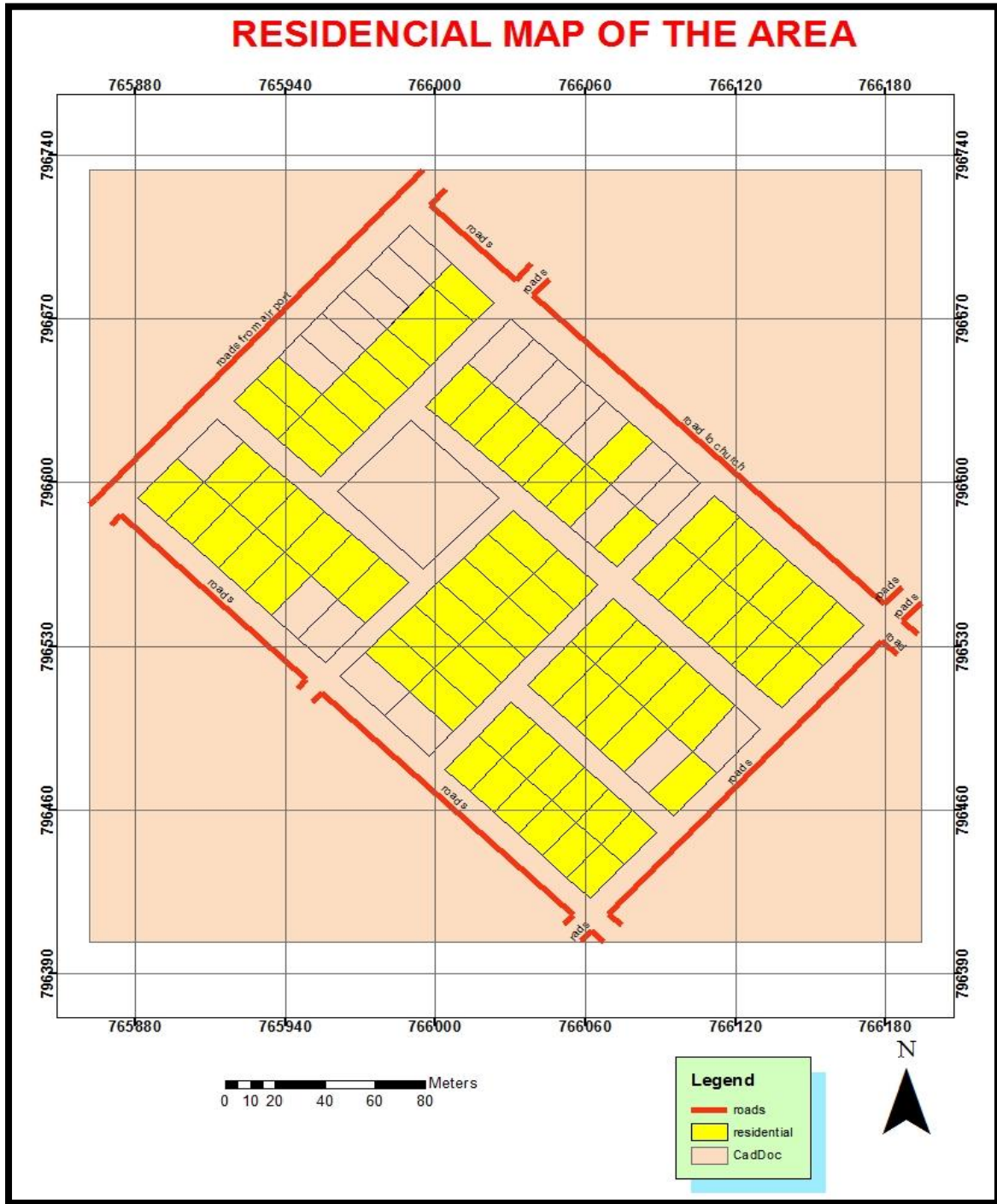


Figure 4.2: residential map of the area

4.3.Green area map:

This is a map which shows the open space between the blocks, which covered the Area of 600 care meters. This area is use for the different purpose. Especially for recreational, and which is used for make beauty of the area.

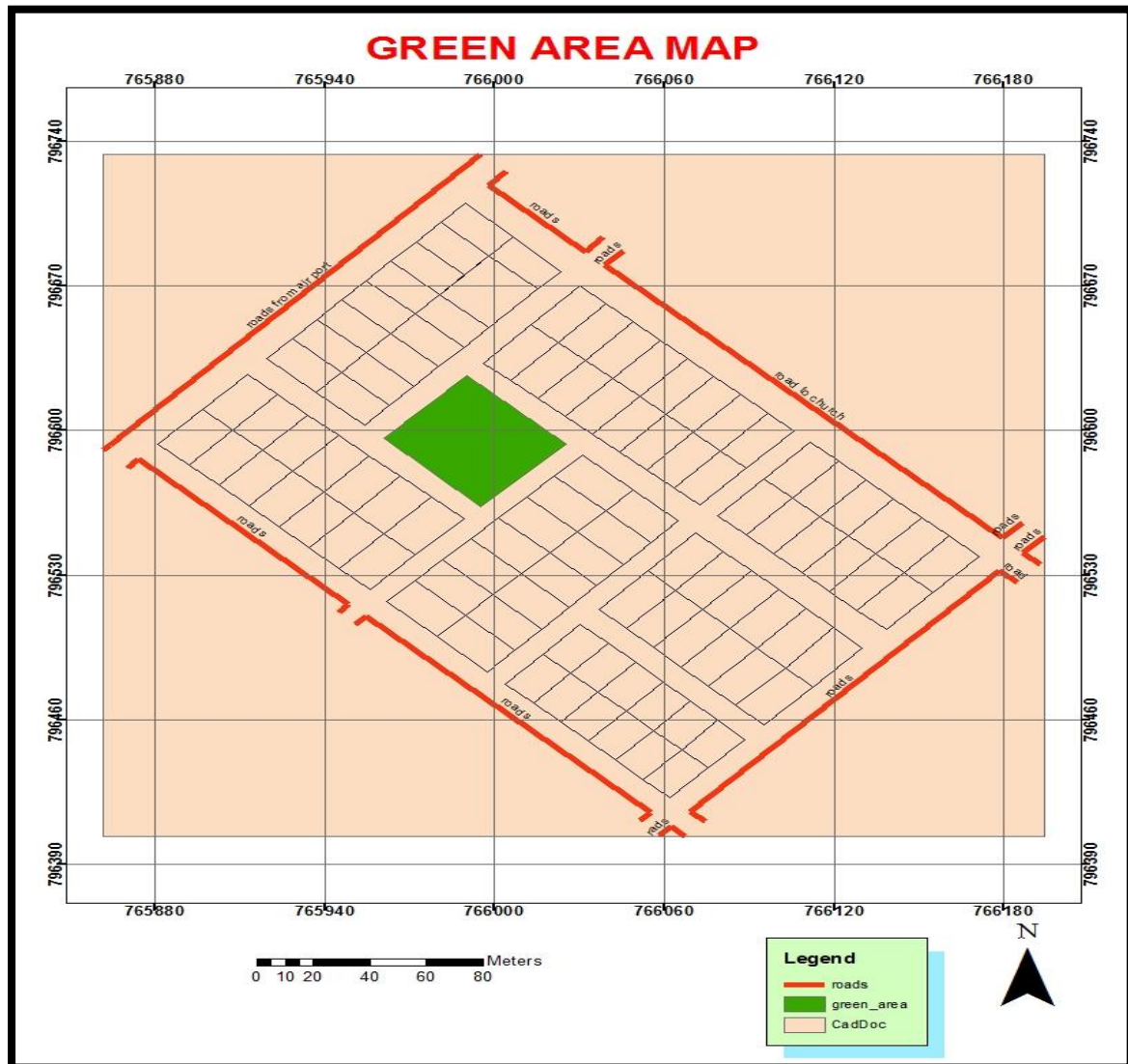


Figure 4.3: Green area map

All facility area:

All facility area is the areas which have all facility which is most important for human living like water facility, telecom facility, electric power facility and other things

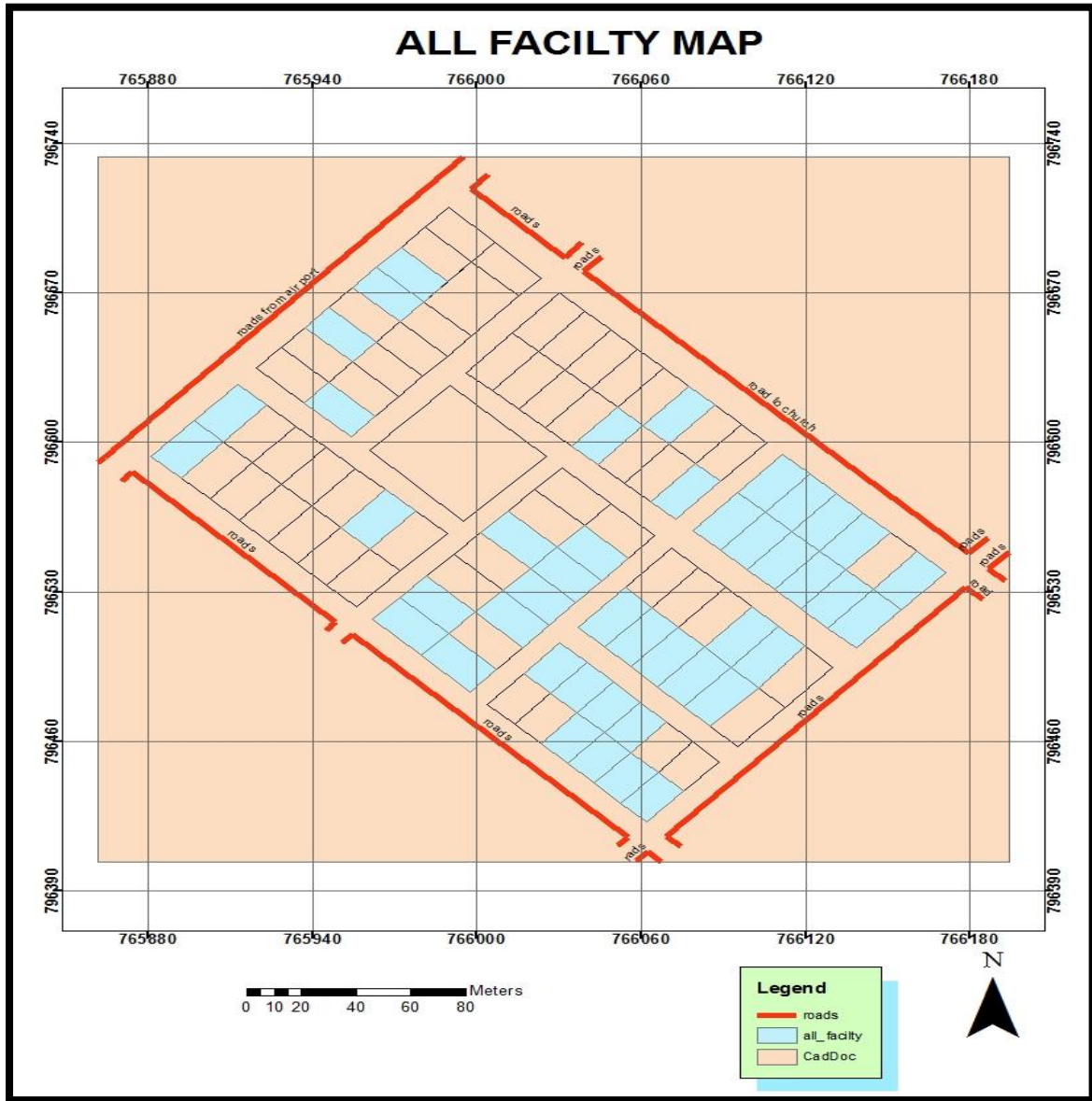


Figure 4.4: all facility map

No facility area or parcels

No facility parcels are the parcels which have no one facility which is most important for human beings which may they gate from the city administration like water facility, electric, power faculty and other important things.

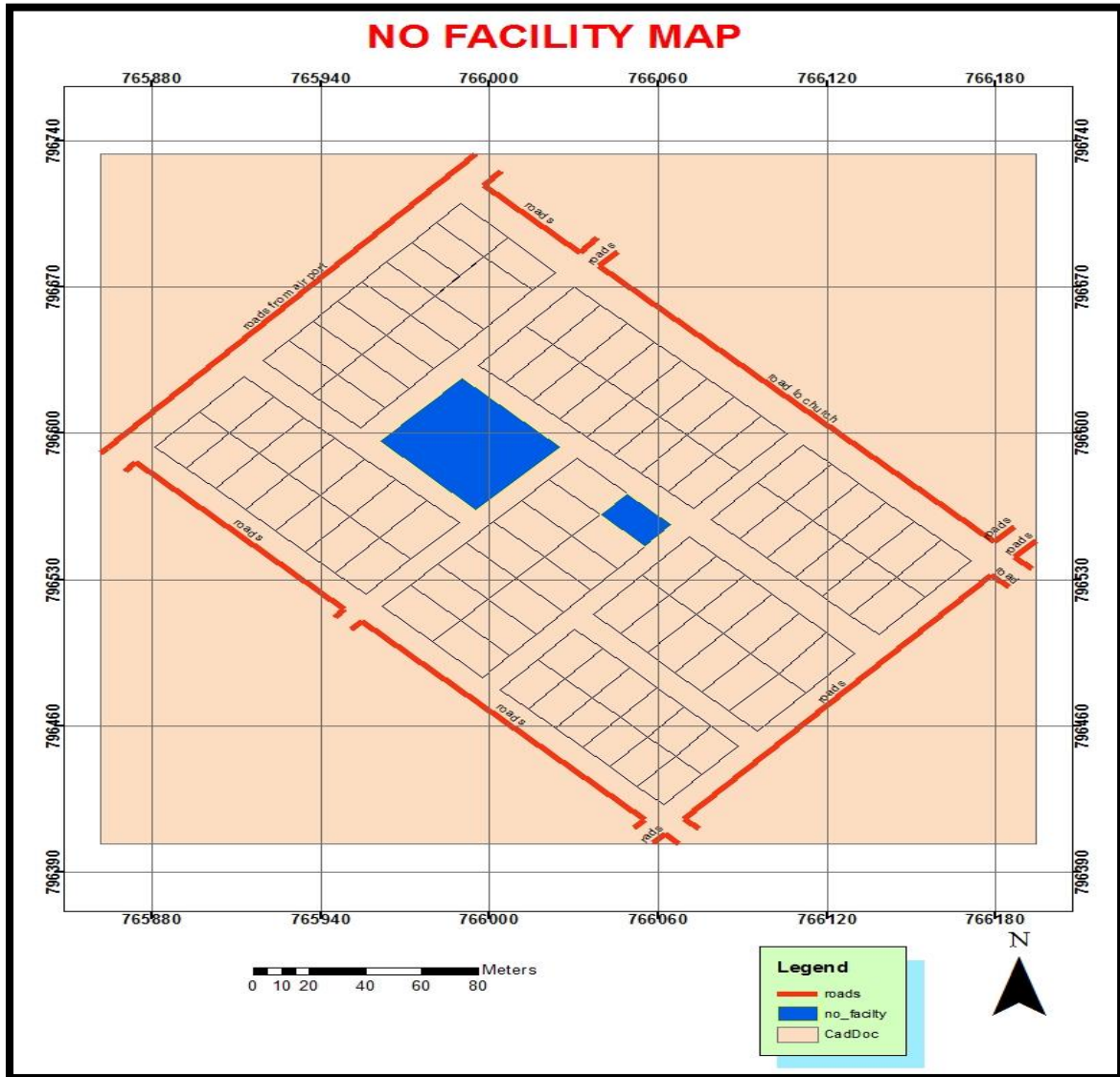


Figure 4.5 No facility map

Limited facility parcels

Limited facility area is the area or parcels which have some facility but not all facility is fulfilled and the area may be need additional service from the city administration for the feature. Especially according to our study area their mostly faced by the telephone facility, so that the city administration must have think to fulfilled for the feature



Figure 4.6: limited facility map

Road network map

Road network is the road that linked the block each other. And which is giving the service for the societies without congestion and struggle. Having this idea road is also one type land use in the area. Which is covered around 2.1 hectares from the total area of the study.

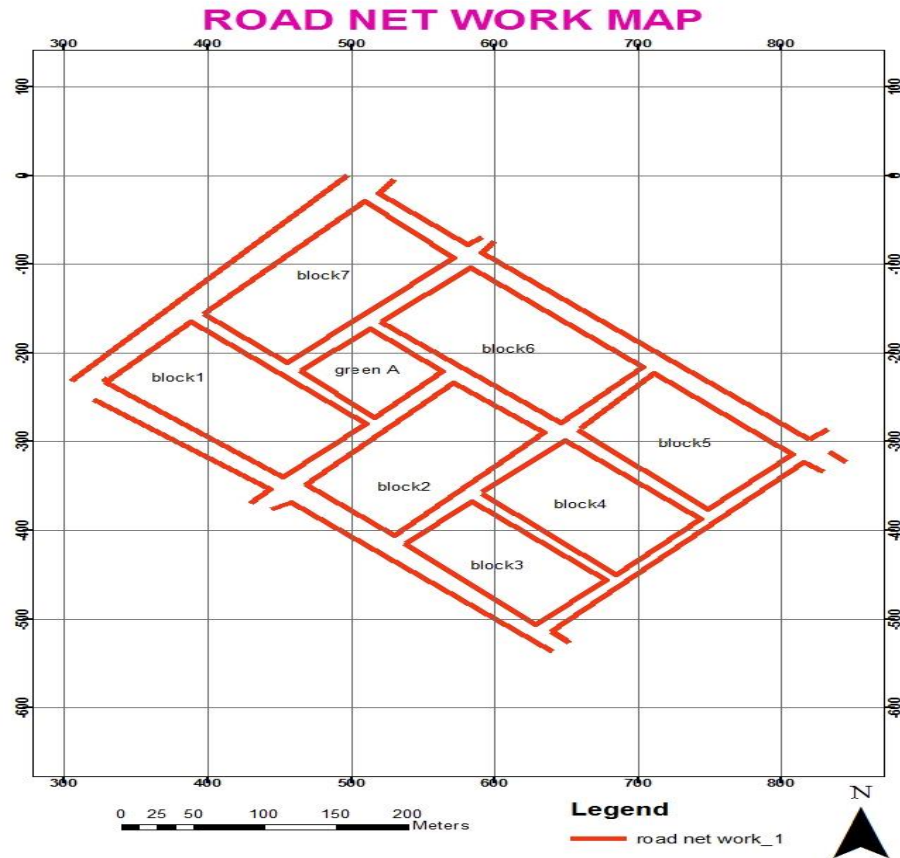


Figure 5.7: road net work map

Final output of map

In our project area there are 95 parcels and one green area so that output of the map is containing those land use with full information. These maps can be used very easy for planning and other purposes. The cadastral maps should be suitable as a basis for development plans and for the revision of the official map series. According to the legal tasks of the cadastral maps the contents are based on terrestrial surveys (boundaries, houses and buildings). So that our project area maps contain geographical information about:

- ✓ parcel boundaries and corner point markings,
- ✓ numbering of parcels,
- ✓ boundaries of districts,
- ✓ survey control points,

- ✓ outlines of houses and buildings,
- ✓ house numbers,
- ✓ street names,
- ✓ type of land use,

That information is used to identify one parcel or one property owners of land from the others. It makes easy to read and understand what is land use type, location, size and shape of the parcel.

Conclusion and Recommendations

Conclusion:

It is true that cadastre is defined as a parcel based and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, ownership or control of those interests, and often the value of the parcel and its improvements. so our project is a develop of cadastral information system and by using GIS which is an organized collection of computer hard ware and software, data and analyst to effective capture, store, manipulation, analyze and retrieve all types of spatial and non-spatial information, we gathered field data (survey data) that is data for spatial and attributes which is the socio economic data of study area. From these data we prepare a cadastral map using GIS both hard copy and soft copy in order to display the socio-economic data of each parcel. Based on these data's and information we may also conclude that: -

- ◆ There are around one hundred percent in the study area, from these parcels about fifty percent is covered by are residential land use constructions and about forty percent is occupied by commercial land use type.
- ◆ As we study the area there are some problem regarding to social facility service like telephone, electricity, water and another important things, depend on this, about the sixty percent of parcel have limited facility and about thirty eight percent all facility and about two percent have no facilities. So that we try to identify those problems and it must gate solution for the features.

- ◆ The owners and users of the study area are tends to these occupations. That are, Government employer, teacher, merchants, electrician, drivers, nurse etc. Also there are a lot of owners (users) without occupation, they aid from their family members.
- ◆ The desired service infrastructures are like road, sewerage system and west disposal are must be improved in the project area.

Recommendations:

There were some difficulties encountered as challenges to resume the project work.

These are;

- ✚ The municipal government in the town is not within the modern development of cadastral information system, this makes the institution lack of well-organized cadastral map. Thus, the municipal government has to apply the modern software, like GIS and have a cadastral map of the town.
- ✚ As we see, our project area is mostly covered by residential and commercial land use type but its best if the municipal government considers and adds some industrial and agricultural land use which is give the service and make development in the area.
- ✚ The town has no some desired service infrastructures like sewerage system and standard roads so that, the municipal government in the town must be identify and analyze those problems and solve for the features.
- ✚ As our research is GIS (geographical information system) based technology which is used to analyze, manipulate and store data in modern way. so, it's best if the municipal government in the town is use this technology to solve different problem regarding to land management system.
- ✚ The time scheduled to proceed the project work has not been started on time, this makes busy working without concentration. Therefore, the department has to apply the time schedule on time to progress the project successfully.
- ✚ The source of materials like references, guide lines, computers etc., to make easy the work, It is not sufficiently available; this makes the project work difficulty. So that it is better to fulfill all necessary materials to succeed the work.

- ✚ There should be a close relationship between the universities, specifically surveying Engineering department and Kebeles and municipal administrative to cooperate for the students during field work in every aspect. To minimize such a problem there should be pre linkage of the society and university with a legal way.

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