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Application of GIS in Planning of Facilitate Infrastructure

Vihang V. Waghmare[1]
Post graduate student
Department of Civil Engineering
RMD Sinhgad College of Engineering
Pune, Maharashtra – India

Dr. S D Khandekar[2]
Professor, Head of department,
Department of Civil Engineering, Sinhgad Institute of Technology & Science
Narhe, Pune, Maharashtra – India

Dr. J R Patil[3]
Professor
Department of Civil Engineering,
RMD college of engineering
Pune, Maharashtra – India

Abstract: ***Infrastructure planning plays an important role in the economic development. Application of GIS in this area is wide and can be of great help to reduce operational/ administration time and cost. This is study of Sangli city. District Sangli, Maharashtra, India, is a case study to justify the application of GIS for infrastructural development. The work started with base map preparation used the land use mapping, thematic map, road maps, water line maps, using available data which will help in all of the administrative works. Added desired attributes for help to analysis the financial, taxable and other incomes to the municipal corporation. The maps generated will be help to future plan the development of the city and also for analysis of required services. The study shows benefits of GIS environment in infrastructural planning.***

Keywords: Micro level planning, base map, thematic map, Infrastructural development.

I. INTRODUCTION

The development in the country should be centered on the development of a village, town, city and metropolitan cities. Though several developmental programs have been initiated and executed on various scales, by both central and state government, micro level planning taking an individual part as a centre has not yet been formulated with full thrust. To reach this goal, different base information layer consisting of land components, transportation, land use, demography maps are combined in GIS environment. This will be a model for other village, town and city planning.

Geographical Information system (GIS) is an effective tool in environment, transportation, hydrological and other infrastructural study. GIS is a decision support system involving the integration of spatially referenced data in solving engineering problem. With the help of GIS, information can be stored, updated, manipulated and retrieved when required.

The present study includes collection of information and necessary data for a Sangli city in state of Maharashtra, for planning of infrastructure development using GIS software. Using GIS Software base map, road map, waterline map, tax calculation of property, development plan have been prepared.

II. LITERATURE REVIEW

The concept of infrastructural planning has evolved gradually through changing demands of human beings and environment. Our towns and cities are expanding very fast, resulting in migration of larger number of people from villages to cities in search of employment. The development plan serves as an outline for the future growth of town and as such, its preparation demands high skill, training imagination and experience on the part of person who frames it.

There is need of the any method / software for infrastructural planning. GIS is one of the software applicable for this purpose.The main advantage of using GIS is its ability to access and analyze spatially distributed data with respect to its actual

spatial location overlaid on a base map of the area of coverage that allows analysis not possible with the other database management systems. The main benefit of using the GIS is not merely the user-friendly visual access and display, but also the spatial analysis capability and the applicability to apply standard GIS functionalities such as thematic mapping, charting, network-level analysis, simultaneous access to several layers of data and the overpayment of same, as well as the ability to interface with external programs and software for decision support, data management, and user-specific functions. *[5]*

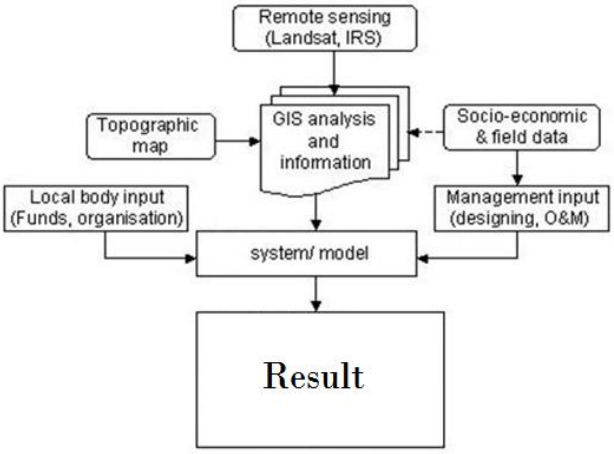


Fig. 1 GIS methodology

III. Research Methodology

The work starting with base map preparation using the land use mapping, thematic map, road maps, water line maps, using available data which will help in all of the administrative works. Adding desired attributes will help to analysis the financial, taxable and other incomes to the municipal corporation. The maps generated will be help to future plan the development of the city and also for analysis of required services. The study shows benefits of GIS environment in infrastructural planning.

There are three surveys are carried out to collect data and other relevant information, required in the process of town planning. These are functional survey, Social Survey, Territorial survey etc. The information and data obtained from various surveys would be exploited to the maximum possible advantages in the preparation of a development plan of an effective development plan of the town.

IV. Result and Discussion

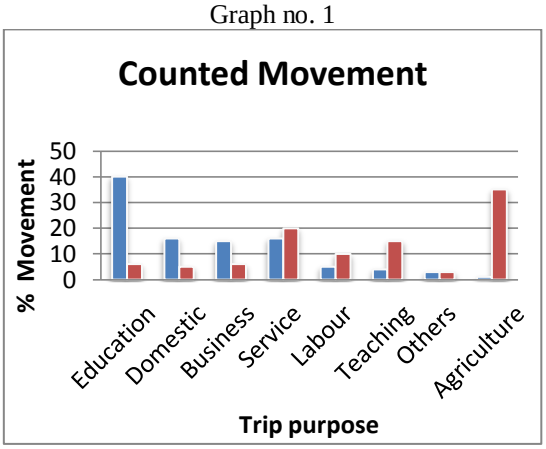
A. Urban and Ruler Road Network

The primary and secondary road system is taken as the existing regional roads of the area and new rural and urban road links are added to it in a prioritized manner. The link options can be either a completely new road alignment or the existing paths and tracks in the area. The road network data of study area did not have the alignment of existing paths and tracks, and therefore, these alignments are not included in this case study. The flow chart of rural and urban road network generation, using accessibility criteria, is shown in Fig. 2, which is implemented in the GIS software package, GPS. In this figure various inputs to compute the accessibility index of a link option are shown. The maximum accessibility network generated for the study area, using this procedure, is shown in Fig. 3. Wherever the generated road links matches with the existing rural and urban roads they overlap.

Construction cost is taken as the other criteria to generate the minimum construction cost rural and urban road network for the same study region. In this case, the accessibility is not required to be calculated. So, there is no need of inputs, such as distance of facility from the counted settlement and travel requirement of uncounted settlement. Minimum accessibility index value criteria for selecting the link options is replaced with the minimum construction cost criteria. The minimum construction cost network thus generated, has the minimum road length to connect all the movement. To compare the minimum construction

cost network with the maximum accessibility network, the characteristics of both networks are summarized in Graph No. 1. In this table, the person-km represents the total amount of travel needed to access the missing functions in the uncounted movement and the cost represents the total construction cost of rural and urban roads in terms of equivalent new road length in km. It can be observed from the table that, the minimum construction cost network involves more amount of travel to satisfy the missing functions of uncounted movement in comparison to maximum accessibility network. This network of rural and urban roads will be thus more economical in long run.

Graph no. 1



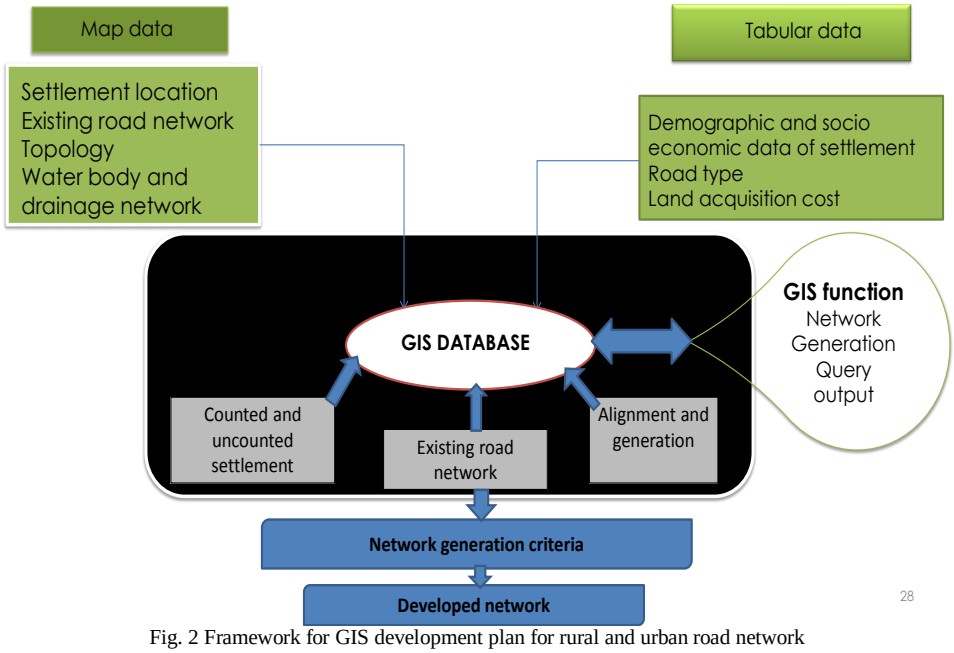


Fig. 2 Framework for GIS development plan for rural and urban road network

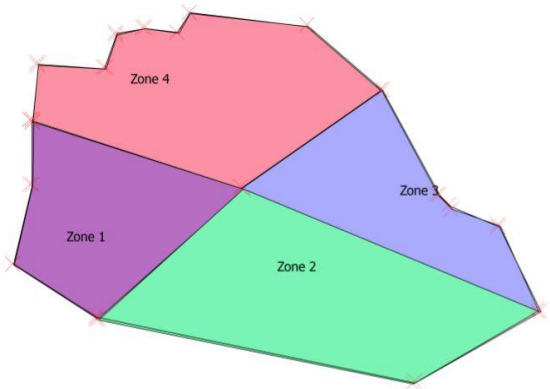


Fig 4. Map of study area (Sangli city)

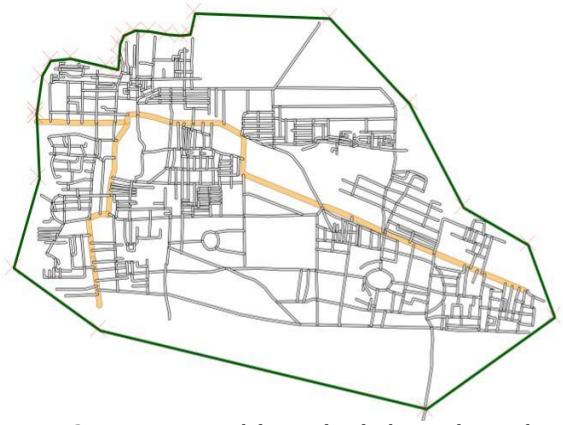


Fig.3 Maximum accessibility rural and urban road network

B. Water line network

Urban area serves a various underground infrastructure, which help to a better living standard in habitat for providing appropriate services. One of these important structures is water line network. This can serve only potable water. In our case this infrastructure fails to provide enough potable water in town. So that measure problems occurs such as weekly one day cutting in water in all area where the requirement is high. In our case (Sangli city) getting the detail extensive survey, which can time and cost wise very expensive. For same work inventory survey requires e.g. Sangli city requires 8 to 10 months for this survey.

This study gives the plan answer of all present questions, regarding all the parameter of water line and surface information. GIS can facilitate the estimation procedure by processing surface information provide in various form.

1. Aerial photographs.
2. Topo sheets.
3. Geographical maps.

1. Problem faced in Sangli city:-

Area change in terms of

-Demography

-Land use

-Living standard

-Increased water (lpcd) demand

-Developing industries and their use of water and discharge.

Fig 8: Diagram of water line network in GIS

4. Applications of GIS in the water industry

Networks are composed of series of counted vector lines. A line is a spatial entity having a single dimension. It is important to describe a line not only by its length but also by its direction and connections so that it contains full information digitally. When lines are counted in a certain pattern they form a network.

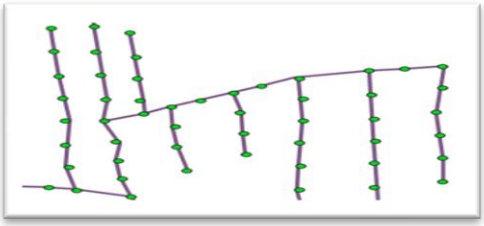


Fig 9: Distribution point and network connection

5. Relevant works

This project tries to look for new planning technique instead of traditional technique. In this project we also rehabilitation of old water line. Through the GIS we try to cost minimization of survey. Under this project we done work on formation of network, attribute table and query.

In this project we define topology, network connection, hydraulics and pumping station where ever necessary. The benefit of this integration is run the whole network in minimum cost and reduces the extra time.

In our database contain whole attributes of the network such as distribution point, connection of network, bed and top level of pipe and coordinates of all points.

C. Taxations

Property tax is the largest source of revenue for most Urban Local Bodies (ULBs) in India. Yet in many ULBs the system for collection of property tax remained far from optimal. Therefore State of Maharashtra initiated a project on Property Tax Information based on Geographical Information System (GIS), to introduce reforms across these municipal bodies in order to improve administrative efficiency, transparent and to provide better citizen services. The, the primary objective of the e-governance component was to:

* Streamline the processes and standardize them across all the municipal bodies in the state.

* Roll-out a standardized software solution covering all the bodies.

* Digitize records and make them available to all stakeholders online.

1. Issues faced by the Department

• Low rate of filing the property tax returns

• High accumulation of arrears

• Negligible penalty for not filing the return.

• Improper assessment of Property tax by ULB Officials which was causing huge revenue loss to the ULB

• Large number of properties were unassisted and not brought under Tax net

• Delay in preparing the list of defaulters

• No uniform procedure of taxation

• Lack of procedural compliance to the act, as Taxation principles followed by some ULBs were not in accordance with the Act

• Tampering of records

• Inaccurate and inconsistent details and data provided by ULB

• Monitoring of ULB Tax performance

• Property records were maintained in manual Development Credit Bank(DCB) registers

• Wrongly assessed properties.

*Issues from the perspective of citizens/service users

• Delay in issuing property tax extract to citizens.

• Non service of hand written property tax notices to the Property owners by ULBs.

2. Steps taken-up towards the implementation of the TIS(Tax Information system) enable GIS based property tax system along with salient feature

1. Field survey of the all properties in the urban area.
2. Preparation to digitize the zone wise maps with individual property having a unique property ID number.
3. Sound database of all properties.
4. Automatic calculation of property tax demand based on built-up area method.

- Property tax demand calculation from pending date.
- Adjustment, dues, fixing of amount.
- All property details in the urban area generation of database.
- All database available to all citizen through GIS, hence the citizen can cross verify the details in case he to do a transaction.
- Easy tracking of the tax defaulters.
- Automatic generation of tax bill, due date notice, demand notice and warrant.
- Information of various types of properties in area.
- This system handles with any office, bank and field payments, with ability of calibration with credit, debit or ATM cards.
- Whole report generates zone, street and city/town wise.(e.g. Defaulters report, zone wise collection.
- GIS enabled till parcel level.

V. CONCLUSION

1. Road development

A new method is developed in GIS which finds least cost road alignment between any two points based on topographic information of the area. It is used to find the actual road alignment of link options and is used in network planning.

2. Water line network

The conclusion of this study to discovered the relationship and the surface properties and water line properties. It has been observed that the selected surface properties have an influence on water network properties. However the selected estimation of water line properties solely from surface parameters requires further work.

3. Taxations

Information about collection of property tax is available at any point of time. Therefore accuracy of out-put is increases. Improve the record to keeping of properties, increase the tax compliance rate and enable the Government official to make the informed the decision, bringing transparency in tax collection in ULBs.

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AUTHOR(S) PROFILE

Mr. Vihang Vijay Waghmare, Pursuing M.E. in construction and Management at Dept. RMD Sinhgad Technical Institute Campus, Warje , Pune.

