

STUDY ON GIS BASED URBAN TRANSPORTATION SYSTEM: CASE STUDY OF HYDERABAD

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ABSTRACT:

Urban transport planning is very complex and urban mobility solutions need to be multi-dimensional in nature. Good urban transport planning should be more than just engineering and should encompass other important considerations such as land use planning, energy efficiency, emission characteristics, traffic management, human behavior, economics, finance, public policy, governance, health, safety, gender, disability, affordability, ITS, etc. Role of urban planning and management in Hyderabad is becoming more and more crucial due to the dramatic increase in urban population and allied urban problems. Hyderabad is experiencing a rapid urbanization rate. With the advancement of GIS, which considerably influenced the dynamic nature of urban and regional planning, incorporation of GIS becomes imperative for better and improved decision-making in urban planning and management. It offers a solution to the urban problems and decision-making, which is more reliant to the real-time spatial modelling. Geographic Information Systems (GIS) have long been recognized as a valuable tool for the representation and analysis of transportation system and related activities. Through the well established vector data structure, GIS has provided an efficient means for organizing basic transportation related data in order to facilitate the input, analysis, and display of transportation related results.

Keywords: Urban Management, Geographic Information Systems.

INTRODUCTION:

The urban transportation systems are very complex in nature, due to the fact that they combine different modes of transportation over a limited space in high-density areas with increasing transport demand. With variety of information needed in the field of Transportation, Geographic Information Systems (GIS) is used as a valuable tool for the representation and analysis of transportation systems. Urbanization is an index of transformation from traditional rural economies to modern industrial one. Kingsley Davis has explained urbanization as process of switch from spread out pattern of human settlements to one of concentration in urban centers. Historical evidence suggests that urbanization process is inevitable and universal. GIS have proven to be an integral tool in addressing the needs of transportation systems. Through the well-established vector data structure, GIS has provided an efficient means for organizing basic transportation related data in order to facilitate the input, analysis, and display of results.

Urban Transportation in India: Indian cities of all sizes are facing the crisis of urban transport. Large cities are facing a rapid growth of personal vehicles (two wheelers and cars); and in medium & small cities, different forms of intermediate public transport provided by informal sector are struggling to meet the mobility demands of city residents. Several attempts have been made by planning authorities and experts to address these problems. Land use master plans prepared for most metropolitan cities have a brief chapter on urban transport. Urbanization is an index of transformation from traditional rural economies to

modern industrial one. Kingsley Davis has explained urbanization as process of switch from spread out pattern of human settlements to one of concentration in urban centers. Historical evidence suggests that urbanization process is inevitable and universal. The urban growth causes environmental, social and economic problems. Often, the authorities are unable to steer the development, most of all in the megacities. Most mega-urban regions experience, at least temporarily, a strong polarisation of living conditions with very unevenly distributed incomes, overcrowded and unhealthy living areas and with uncontrolled population growth.

Problems of urbanization:

Problems of urbanization are manifestation of lopsided urbanization, faulty urban planning and urbanization with poor economic base and without having functional categories:

- I. Due to such urbanization, certain basic problems are being witnessed in the fields of:
 - a. Housing;
 - b. Transport; --
 - c. Water supply and Sanitation;
 - d. Water Pollution and Air Pollution.
- II. Megacities grow in urban population not in urban prosperity, and culture. Hence it is urbanization without urban functional characteristics.
- III. Urbanization is degenerating social and economic inequalities, which warrants social conflicts, crimes and anti-social activities. IV. Lopsided and uncontrolled urbanization led to environmental degradation and degradation in the quality of urban life--pollution in sound, air, and water, created by disposal of hazardous waste.

GEOGRAPHICAL INFORMATION SYSTEM (GIS)

GIS has been defined by many ways, by many people: "A Geographic Information System is a facility for preparing, presenting, and interpreting facts that pertain to the surface of the earth. This is a broad definition, a considerably narrower definition, however, is more often employed. In common parlance, a geographic information system or GIS is a configuration of computer hardware and software specifically designed for the acquisition, maintenance, and use of cartographic data.

"A geographic information system (GIS) is an information system that is designed to work with data referenced by spatial or geographic coordinates. In other words, a GIS is both a database system with specific capabilities for spatially-reference data, as well as a set of operations for working with data. In a sense, a GIS may be thought of as a higher order map."

The Geo processing view:

A GIS is a set of information transformation tools that derive new information from existing datasets. These geoprocessing functions take information from existing datasets, apply analytic functions, and write results into new derived datasets. Geoprocessing involves the ability to program your work and to automate workflows by assembling an ordered sequence of operations.

METHODOLOGY:

The project is executed through the following steps

Acquisition of satellite data from NRSC, Balanagar, Hyderabad and toposheet from survey of India (SOI), Hyderabad.

1. Geocoding and Georeferencing of LISS III and PAN digital data by extracting the Ground Control Points (GCPs) from SOI toposheet
2. Digital Image enhancement and application of correction models for making the digital data free from error and distortions in terms of radiometry and geometry of the satellite data.

3. Fusion of PAN and LISS III for merged product preparation of a mosaic. This is FCC mode and is used for visual interpretation to extract the land use/land cover information by applying both pre-visual interpretation, ground truthing and post-visual interpretation of this image mosaic.
4. Preparation of cartographic output for making the data layer ready for scanning for further GIS analysis.
5. Scanning of cartographic output using Ao scanner, digitized data compatible to ARC/INFO GIS software.
6. GIS data manipulation and analysis, linking the spatial data file and attribute data file for the creation of topology.
7. GIS output in the form of land use/land cover map showing various land use/land cover patterns of MCH jurisdiction.
8. Overlay of major road network on the land use/land cover map for the final project as required by MCH administration.

Software:

GIS software provides the functions and tools needed to store, analyze, and display geographic information. GIS softwares in use are MapInfo, ArcInfo, ArcView, AutoCAD Map, etc. The software available can be said to be application specific. When the low cost GIS work is to be carried out desktop MapInfo is the suitable option. It is easy to use and supports many GIS feature. If the user intends to carry out extensive analysis on GIS, ArcInfo is the preferred option. For the people using AutoCAD and willing to step into GIS, AutoCAD Map is a good option.

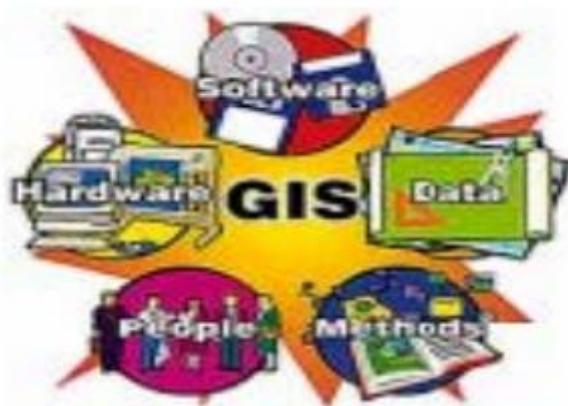


Figure: Component of GIS

Map Making: Maps have a special place in GIS. The process of making maps with GIS is much more flexible than are traditional manual or automated cartography approaches. It begins with database creation. Existing paper maps can be digitized and computer-compatible information can be translated into the GIS.

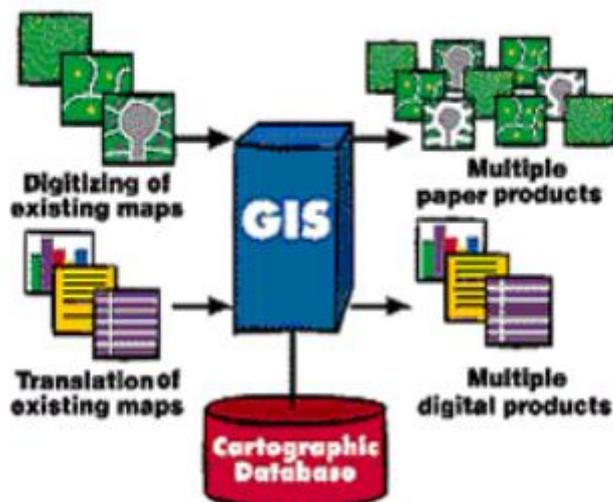


Figure: Map Making (How a GIS Works)

GIS for Transportation: GIS for Transportation is a broad expression that includes all of the activities that involve the use of Geographic Information Systems for some aspect of Transportation planning, management, or science. Government agencies, research institutions, and members of private industry are just some of the entities that routinely build Transportation-GIS applications. These applications can involve any mode of transportation (truck, automobile, train, ship, taxi, airplane, etc.), or may consider other transportation related objects such as pavement, stop signs, or construction equipment. T-GIS applications can be used to monitor traffic accidents that have occurred in the past, or they can plan for changes in the transportation network design for the future. The breadth of the field of T-GIS provides many opportunities for the development of new and innovative applications, and at the same time presents challenges to those who will try to integrate such diverse activities.

The urbanization is measured based on the percent urban population and urban-rural ratio. In Table 1 below, it is shown that in the World, about 47 percent population lives in urban areas by 2001. In the More Developed Countries about three quarters of people live in urban areas, in the Least Developed Countries only around a quarter of the population live in urban areas.

Table: 1 Degree of Urbanization

DEGREE OF URBANIZATION IN WORLD, REGIONS, CONTINENTS AND SELECTED COUNTRIES – 2020			
S. No.	Region/Continent /Country	Percent Urban Population	Urban – Rural ratio
1	World	57.0	91
2	More Developed Region	78.0	317
3	Less Developed Region	49.8	66
4	Least Developed Region	28	35
5	Africa	38.7	61
6	Asia	39.7	58
7	Europe	78.4	297
8	South America	79.8	395
9	North America	79.3	339

10	China	33.4	47
11	India	29.8	39
12	USA	78	339
13	Indonesia	41.9	69
14	Brazil	83.2	435
15	Pakistan	47	59
16	Russian Federation	78.0	348
17	Bangladesh	25.4	32
18	Japan	79.8	367
19	Nigeria	54	79

Implementation of the proposed architecture: the case study An overview of the study area (Hyderabad)

Hyderabad, the capital of Andhra Pradesh State is located in the heart of Deccan Plateau and lies approximately at 17°- 21N latitude and 78°- 30E longitude. The city is bounded by Rangareddy and Medak districts. The urban growth of the city has taken place rapidly to the northeast and northwest and has spread beyond the Municipal limits. The river Musi divides old and new Hyderabad while the former is located on southern bank and latter is located on northern bank.

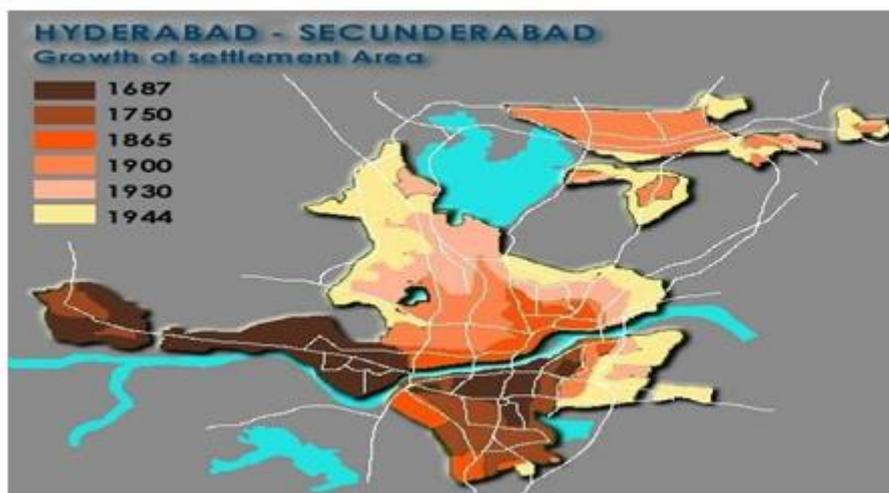


Figure: Hyderabad growth along the years.

Results and Discussion:

The result of the search extrapolated studies related to utilizing of GIS tools for measure urban transport performances especially in 5 indicators i.e. traffic congestion, traffic air pollution, traffic noise pollution, transport infrastructure, and traffic accident. Based on years of publication from 2000, generally the research that discussed the SUT had a tendency to in-crease until 2016. Based on Fig. 1 shows that the interest of researchers is high and increasingly related to GIS analysis for measure urban transport performance. Results of exploration in the search engine revealed 33 studies that specifically deals with GIS analysis in Urban Transport. Based on the search results it shows that at the beginning of the year’s trend up to 2004, but in the year between 2005 and 2006 it experienced a drastic decline and then again showed a trend of trend to increase beginning in 2007 until 2016

Base map

Base map was prepared from SOI toposheet no 56K/7 NE on 1:25000 scale which was overlaid on satellite imagery, IKONOS data. To get an accurate ground control points deletion of certain features like road network, water bodies, canals settlements etc the toposheet are used for exact matching with those on the satellite imagery. This leads to preparation of the base map. The base map showed following features like settlements, which are categorized into dense, medium, sparse etc. The other features like major water bodies, major road network, drainage, pattern etc.

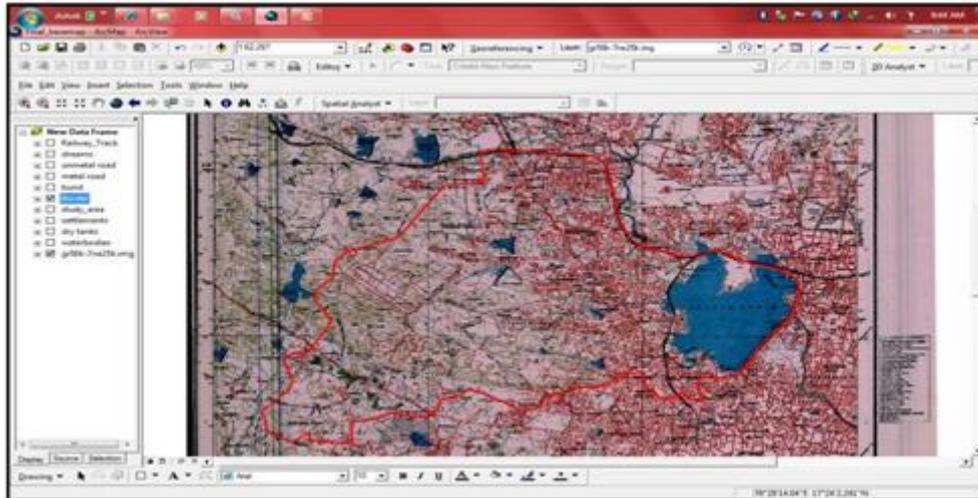


Figure: Subsetting of the Study Area

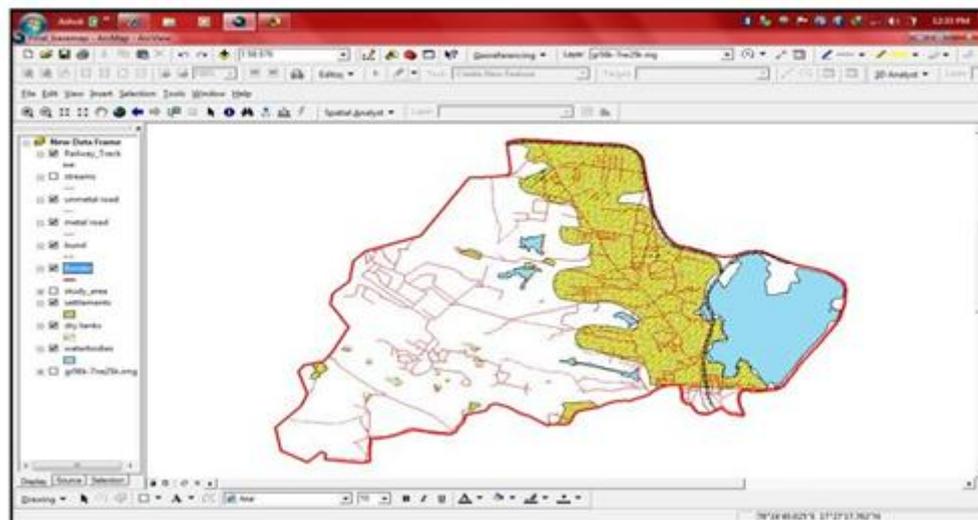


Figure: Base Map of the Study Area

Road network map:

Road network was prepared from SOI toposheet no 56k/7 NE of the respective study area with help of base map prepared. This showed the major roads passing through this zone, which includes NH-9 to Mumbai, which is passing from khairatabad to Sanath Nagar in this zone. And various other roads connecting the settlements, landforms etc. which was very help full during sampling.

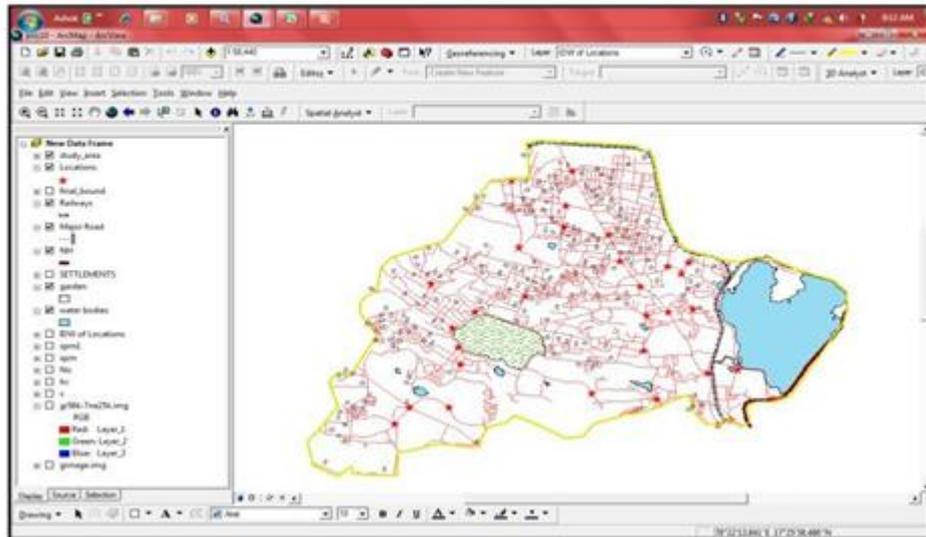


Figure: Road Network Map of the Study Area

Full Orbital link of the city with the Inner and Outer Ring Roads.

1. Intra City MRTS- (Mass Rapid Transit System), (3 corridors)
2. BRTS(Bus Rapid Transport System) on Inner Ring Road, radial roads and Arterial Roads
3. BRTS/Dedicated bus routes/Electric Trams on all roads 24 metres and above.
4. Major transportation corridors to pass through the core city of Hyderabad.

CONCLUSION:

GIS can be effectively used for the analysis of the urban transportation systems of the city. The existing road network maps of the city are quite old and need be updated. The attribute of the city streets can be updated by field data collection programme. GIS into an Integrated Information System, which have to play an important role not only in fighting the urban growth, but used to minimize the many negative effects of urban growth, such as traffic problems, slums and environmental degradation and aid in decision-making by providing data which are utilized for accurate and correct assessment. The urban information system should include some of the areas like urban sprawl, urban land use, zoning, demography, urban environment, urban transportation, housing settlement, urban infrastructure like water supply, sewerage, solid waste disposal, power supply, service facilities.

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