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TRAFFIC CONGESTION STUDY AND FINDING ALTERNATE ROUTES USING GIS

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Abstract – *General congestion related data collection and congestion management measure is labour intensive and a heavy investment is needed for these mitigation measures. Hence to make this work feasible, latest technologies like GIS will help to analyze the live traffic situation and suggest the cost effective measures to mitigate the congestion, an attempt was made to use GIS effectively for data collecting, data analyzing and result displaying process. Traffic was disrupted on the Kalady – Thanipuzha stretch. Geographic Information System (GIS) is a computer system for capturing, storing, querying, analyzing and displaying geographic data. GIS represents a new para diagram for the organization of the information and the design, the essential aspect of which is the use of concept of location as the basis of structuring of information systems. The advancement of GIS can be put to effective use to map and analyze road traffic situations using tools like linear referencing, spatial analysis and query which can be easily performed, enhanced by graphical representation. Road characteristics, vehicle origin and destination, vehicular traffic congestion nature and volume data can be integrated to enhance analysis of road traffic situation along road corridors.*

***Key Words*: GIS, Capturing, Storing, Querying, Analyzing, Displaying, Origin and destination, Traffic volume**

1. INTRODUCTION

Kalady or kaladi is a census town located in Angamaly east of the Periyar river, in the Ernakulam district of Kerala, India, not far from Cochin International Airport. It is notable as the birthplace of Shankara, commonly known as Adi shankaracharya, and is a popular destination for Hindu pilgrims. Kalady came to prominence only after its rediscovery in the late 19th century by the then Shankaracharya of Sringery and the subsequent consecration of an Adi Shankara temple in 1910.

Traffic was disrupted on Kalady – Thanipuzha stretch when a large crater developed on the Sree Sankara bridge at mc road, Kalady. The major routes through Kalady are Perumbavoor, Aluva, Angamaly, Malayatoor.

2. LITERATURE REVIEW

F. Farcas a, A. Sivertun IDA (2016) said that traffic noise pollution is a growing problem that highly affects the health of people. To cope with this problem one has to regulate traffic or construct noise barriers inorder to implement effective measures against traffic noise information about its distribution- noise maps is imperative.

Ravindra Kumar Verma, Sangeeta Kumari & K. Tiwary(2014) proves that urbanization is an index of transformation from traditional rural economies to modern industrial one. It is a progressive concentration of population in urban unit. At the moment, India is one among the country of low level of urbanization. In the last 50 years the population of India has grown two-and- a-half times, but urban India has grown nearly 5 times. Planning and managing cities in the new era of globalization and economic liberalization would be a demanding task calling for new skills and approach.

Mr. R. Chandra Prathap, Mr. A. Mohan Rao (2014) shows that existing system of congestion management system requires more reliable data which is expensive to collect and maintain. Hence advancements in data collection and presentation techniques such as Global Positioning System (GPS) and geographic information system(GIS) if properly used will enhance a good traffic congestion management system.

Mazloh Al-Enazi(2016) Jeddah city is the second largest city in Saudi Arabia. Jeddah city has witnessed a remarkably rapid urban growth rate during the past four decades. The aim of this paper is to use many GIS functions (network analyst, shortest path) in evaluating traffic congestions point during working day hours according to road directions. One of the useful GIS functions to be used for this purpose is known as shortest path.

Adebayo H. Oluwasegun(2015) gives an insight of the most congested and voluminous traffic corridors in Lagos Metropolis Nigeria. Traffic congestion is a major transportation problem in Nigerian cities. It occurs when urban road network is no longer able to accommodate the volume of traffic that uses them. This paper demonstrated some techniques in digital mapping. It has shown that digital technology can be used in monitoring traffic situations and its efficiency in terms of speed, efficient accuracy, reliability and economy of the work.

M. Bhagyaiah & B. Shrnagesh(2014) said that globalization has impacted many developing countries across the world. India is one such country, which benefited the most.

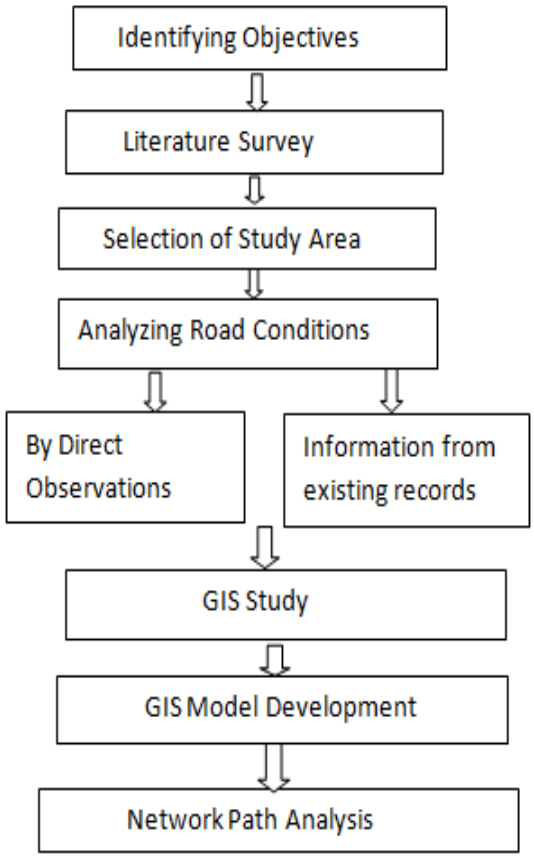
There has been increasing trend in road accidents in Hyderabad over a few years. GIS helps in locating the accident hotspots and also in analyzing the trend of road accidents in Hyderabad.

Stephen Jones(2010) said that for this exercise was the Marsh area of Huddersfield, a medium- sized town in the West Yorkshire region of northern England. The impact of road on the environment is a subject of growing concern. Roads and traffic are variously condemned for increasing ambient noise levels, poor childhood respiratory health, loss of wildlife habitat, the division and dislocation of communities and many other manifestations of social and environmental pathology.

Hemant A. Pandit, Dr. Sumedh(2015) said that trend of urbanization, population increase and the increase in number of registered vehicles induces pressure on traffic movements and makes living in urban area more difficult. Latest technologies like GIS will help to analyze the live traffic situation and suggest the cost effective measures to mitigate the congestion.

3. METHODOLOGY

The methodology adopted is illustrated below.



.3.1 Study Area

Kalady - Thanipuzha is the selected area for conducting the traffic study. It is the place connecting major places like Malayatoor, Angamaly, Aluva, and Perumbavoor.

Fig-1 Kalady route map

3.2 Traffic Survey Details And Traffic Flow Diagram

The average traffic survey data are listed below.

Table -1: Traffic survey data

TIME	CAR/ JEEP	BUS/ TRUCK	TWO WHEELER	AUTO RICKSHAW
8.30-9.30 am	220	240	295	235
9.30-10.30 am	160	180	145	139
10.30-11.30 am	147	156	153	123
11.30 am-12.30 pm	108	144	125	103
12.30- 1.30 pm	173	168	183	120
3.30- 4.30 pm	196	179	222	156
4.30- 5.30 pm	202	186	235	186
5.30-6.30 pm	185	175	210	175
FLOW PCU	1391	4284	784	1237

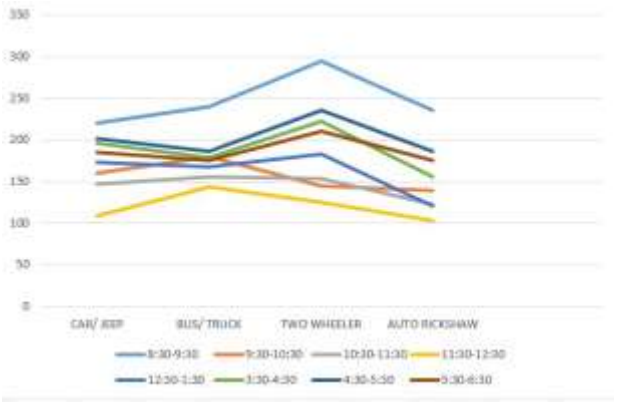


Fig -2: Traffic flow diagram

From this diagram we can easily identify that the peak time of congestion and the type of vehicle causing the congestion.

3.3 Origin And Destination Survey Details

Traffic volume collected by means of origin and destination survey is give below.

Table-2: Origin And Destination Survey Data

Road	Working Day Peak Hour Morning	Working Day Off Peak Hour	Working Day Peak Hour Evening	Holiday Peak Hour Morning	Holiday Off Peak Hour
Perumbavoor-Angamaly	1049	937	1010	874	861
Perumbavoor-Aluva	242	255	232	336	323
Perumbavoor-Malayatoor	242	426	234	108	290
Others	81	85	78	27	92
Angamaly-Perumbavoor	1098	936	854	915	863
Angamaly-Aluva	129	426	389	175	310
Angamaly-Malayatoor	210	255	233	148	264
Others	178	85	78	107	129
Aluva-Perumbavoor	404	511	202	176	265
Aluva-Angamaly	888	988	1057	865	965
Aluva-Malayatoor	242	136	171	165	271
Others	81	68	124	139	65
Malayatoor-Angamaly	222	234	221	215	256
Malayatoor-Aluva	246	221	466	258	265
Malayatoor-Perumbavoor	242	187	124	121	124
Others	65	136	62	37	88

3.4 GPS Survey Details

By using the mobile GPS application called GPS survey we take the GPS co-ordinates of certain locations. They are called control points.

Table- 3: GPS co-ordinates

LATTITUDE	LONGITUDE
10.1617	76.44186
10.1631	76.44095
10.16401	76.4403
10.16461	76.43976
10.16541	76.43928
10.16876	76.44226
10.16825	76.44111
10.16595	76.43999
10.16606	76.43885
10.16339	76.43529
10.16465	76.43977
10.16708	76.43695
10.16659	76.43797
10.16624	76.43867
10.16561	76.43918
10.16502	76.43952
10.16399	76.43586
10.16464	76.4364
10.16513	76.43708
10.16554	76.43796
10.16648	76.43827
10.15917	76.44305
10.16587	76.43889
10.16593	76.43891

4. RESULT ANALYSIS

The results are represented in the form of maps. By those maps we can easily analyze the traffic volume through each routes and we can find the alternate routes. By suggesting alternate routes we can reduce the traffic volume and reduce the congestion at Kalady junction. Study area map, GPS maps, and traffic volume map with different origins are obtained by using the software. And these are used for the analysis and finding the alternate routes using GIS.

The main alternate routes obtained are Kadukkapilly road, Co-operative junction road, School road. Canal road, Mosque road and Sree sankara university road. These routes can be adopted at the time of congestion.

At holidays the traffic volume through the junction is less therefore vehicles can adopt their normal routes to its destinations.

Fig-3: Study Area (Kalady)

Fig-4: GPS survey map

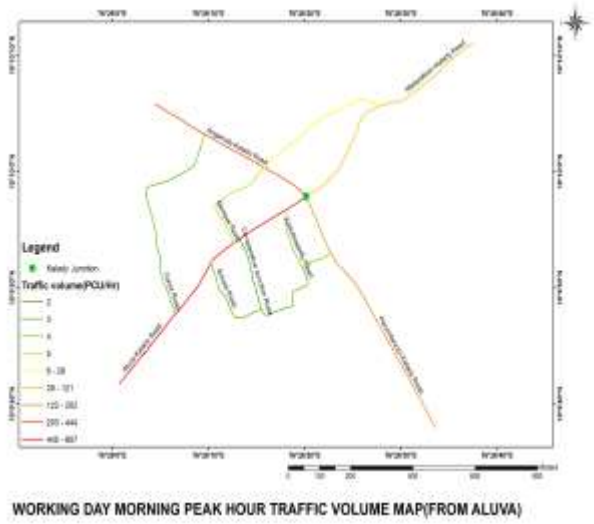


Fig-5: Working Day Morning Peak Hour Traffic Volume Map From Aluva

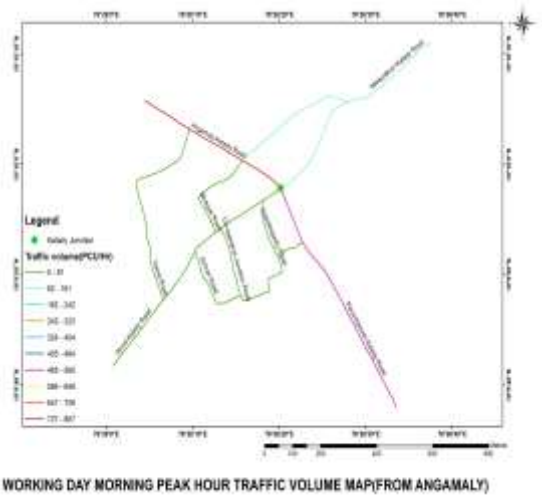


Fig-6: Working Day Morning Peak Hour Traffic Volume From Angamaly

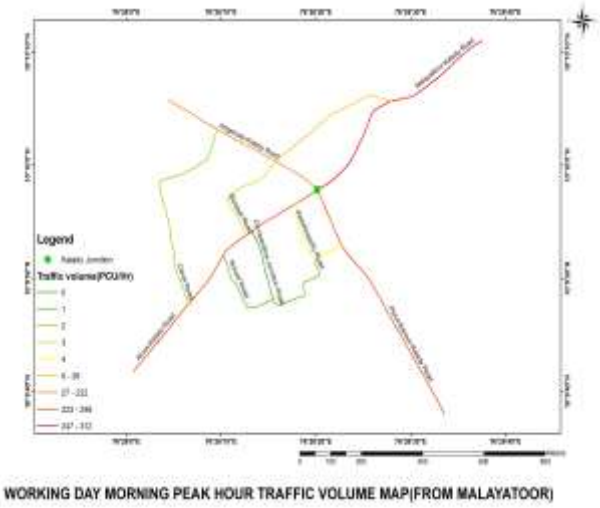


Fig-7: Working Day Morning Peak Hour Traffic Volume Malayatoor

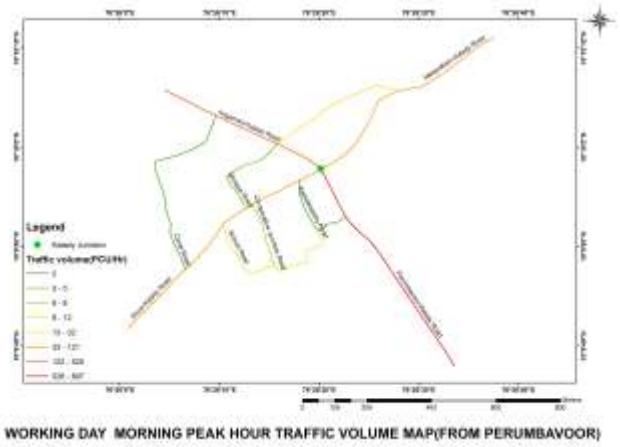


Fig-8: Working Day Morning Peak Hour Traffic Volume Map From Perumbavoor

5. CONCLUSION

By using the traffic congestion study using the GIS software, we find out the alternate routes and these routes can be adopted at time of congestion. Canal road, Mosque road, Sree Sankara University, Kadukkapilly road, Co-operative junction road and School road are the alternate routes that we obtained. At the time of congestion we can adopt these routes to reduce the traffic congestion at the Kalady intersection. As we explained in the role of GIS in the traffic study, here we can reduce the congestion spots.

Fig-9: Alternate Route Map

6. FUTURE SCOPE

Analysis is one of the major and most influential phases of infrastructure lifecycle. Some of the analysis that can be performed by GIS are Water distribution analysis, Traffic management analysis, Soil analysis, River and canal pattern analysis.

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