

G.I.S. for Urban Planning

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Abstract:- Urban and Regional planning underlies the very fabric of the society as we know it today. Without planning and foresight, our cities, towns, rural areas, and residential communities will not run efficiently. While communities today face many challenges, some of them, such as pollution and traffic, can be addressed by careful and creative planning. It is the planner's job to address such problems and provide viable solutions for the current scenario and the future. The state of Goa covers an area of 3702 Sq.km. and it comprises of two districts viz. North Goa and South Goa with headquarters' at Panjim and Margao cities respectively. It lies between the latitudes 14°53'54"N and 15°40'00"N and longitudes 73°40'33"E and 74°20'13"E. As per demographics of 2011 census, it harbours a population of 1,458,545 which accounts for India's 4th smallest. It is one of India's richest state with a GDP per capita 2.5 times that of the country. Margao is one of the major cities of Goa, located in South Goa in the District. The city covers an area of 37.2 Sq.km. and caters for a population of 1, 94,134 as per the survey of 2011, and is the 2nd largest. It is located between the latitude 15°16'25"N and longitude 73°57'29"E. Being one of the busiest city, it involves bulky traffic movements. During the past 3 years, a total of 958 deaths have been reported in the city due to road accidents. The city faces traffic congestion, especially on the Aquem-Margao route, and also parking issues. In addition to this, the city also faces sewage treatment problems and disposal and treatment of solid waste. All this hampers the development this major city, hence a proper planning of each sector and implementation of the same is required. Geographic Information System is one of the tools that can enable proper planning and can help to understand the core areas of these problems. It is a digital approach towards such problems, giving better results as it is a single platform that combines spatial and non-spatial data.

Keywords:- G.I.S, Global positioning system (GPS), Accident prone site, Road accident analysis basis on yearly, monthly, hourly.

I. INTRODUCTION

1.1 The Challenge of Urbanization:-

Urbanization requires comprehensive development of Physical, institutional, social and economic infrastructure. All are important in improving the quality of life and attracting people and investments for the city, setting in motion a virtuous cycle of growth and development. Urban design is the multi-disciplinary process of shaping the physical setting of life in cities, towns and villages; it involves the design of spaces, landscapes, buildings and group of buildings and the establishments of frameworks and processes that facilitate successful development.

Cities currently generate 80% of the Global GDP while accommodating over 50% of the world population on 3% of its surface area, with the wealthiest 100 cities generating 35% of the Global GDP. However, deficient planning and infrastructure can reduce business productivity by as much as 40%. The discipline of urban and spatial planning is underrepresented in many developing areas, with 0.97 accredited planners per 100,000 people in some African countries and 0.23 in India. This is in comparison to 37.63 in the United Kingdom and 12.77 in the United States.

Cities are gaining a new presence in both academic and public policy circles. Cities matter because the productivity benefits they provide to knowledge intensive business are important for regional and national prosperity. In the developing world, cities will compete among themselves, regardless of size and hierarchy, to become regional centers. In attracting high-tech industries. To be successful, they need to do three sets of actions: improve business environments and city management, develop adequate infrastructure which may include "Super infrastructure", and market the city's image through "visible" projects and business facilitation.

1.2 Project Background

The city of Margao is the state's commercial capital with a population of 1, 94,134, as per 2011 census. It is one of the most fast growing and rapidly developing cities in India with a high level of local citizens' education compared with other cities of the state. The city has several prestigious schools and colleges, as well as many shopping and business centres. It harbours a lot of working professionals who need to travel to and fro from the city.

With growing number of vehicles on the roads, the traffic situation is witnessing a big challenge. In last five years, it has witnessed a big spike in the registration of new vehicles

which had increased manifold. Compared to the last decade there is more 4 wheeler on the road than, the 2 wheeler. The entry and exit to the city get completely chocked in the mornings and evenings every day. In addition to this, the numbers of accidents have increased manifold claiming life. A traffic accident has multi-faceted characteristics associated with it. For a proper traffic accident analysis, use of G.I.S. technology has become an inevitable tool. The traditional accident database is a summary spread sheet format using codes and milepost to denote location, type and severity of accidents. Geo-referenced accident database is location-referenced. It incorporates a G.I.S. Graphical interface with the accident information to allow for query searches on various accidents attributes.

G.I.S. has proved to be a good tool for analysing multifaceted nature of accidents. While road safety is a critical issue, yet it is handled in an adhoc manner. G.I.S. can prove to be an efficient tool for developing a required database of the accident spots, and based on it sufficient management strategies' can be successfully proposed.

1.3 Objectives:

- ◆ To apply GIS for analyzing the different aspects of the nature of accidents according to yearly, monthly and vehicular variation.
- ◆ To apply GIS for developing an efficient database on road accident taking Margao city as a study.
- ◆ To identify traffic congestion area at peak times.
- ◆ To find accident prone sites of Margao city.
- ◆ To suggest alternate ways to improve the traffic condition of Margao city.

1.4 Scope of the work

- ◆ To make use of GIS in Structural Road Mapping.
- ◆ To study the Road way and Traffic conditions of the selected Accident spots.
- ◆ To plan Transport system and Traffic Management.
- ◆ To carry out Traffic surveys and other reconnaissance surveys.
- ◆ To analyze the existing Traffic situations and Travel characteristics.
- ◆ To identify the some of the factors causing accidents and to study their significance.
- ◆ To know required gradient to be provided for easy movement of Traffic without any accident by doing spot speed analysis.
- ◆ To enable better planning of the road traffic and hence smart planning of the transportation sector as a whole.

1.5 Description of the study area: Margao

Area:-City -15.10 sq.km, Metro –22.1sq.km.

Geographical Position:-Situated between latitude of 15°16'25"N and Longitude of 73°57'29"E.

South Boundary: - Davorlim

North Boundary: - Raia

East Boundary: - Curtorim

West Boundary : - Navelim

Access : - By road, 33km from Panjim and 27km from Vasco. By rail, in the city it as an intersection point of konkan Railway and south western railway. By air, via Dabolim airport situated at 23km from the city.

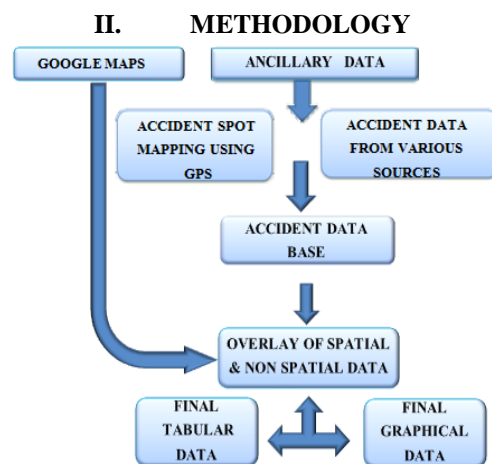
1.6 Necessity:-

Total number of deaths that have taken place in the State of Goa for the years i.e. 2013, 2014, 2015 and 2016 (upto 29.02.2016) on National/State Highway and Other roads are as under:-

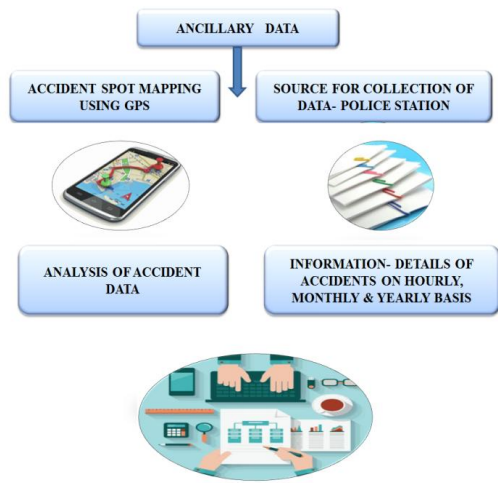
Sr.no	National Highway	State Highway	Other	Total number of person died
2011	87	-	163	250
2012	138	1	170	309
2013	97	-	238	335
2014	91	-	181	272
2015	142	-	245	387
Total	555	1	997	1553

Table 1. Accident analysis on basis of road 2011-2015

The total number of deaths occurred in the city of Margao between 2011-15 comes to 74 nos.

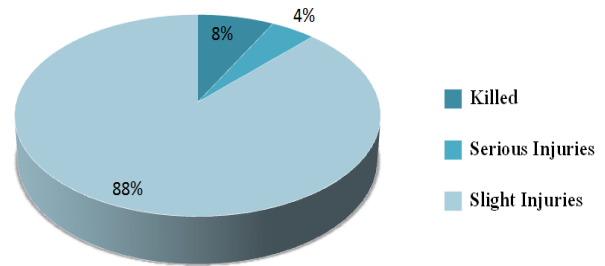


Flow Chat 1 Data and methods employed for the study



Sr.No	Period	Type of Accident				Total Accident	Person Killed/Injuries			Total
		Fatal	Serious	Slight	Minor		Killed	Serious Injuries	Slight Injuries	
1	2011	11	06	101	142	272	13	08	132	425
2	2012	18	09	183	178	388	18	10	219	635
3	2013	10	05	131	235	381	10	05	156	552
4	2014	16	08	119	283	426	16	09	155	606
5	2015	16	10	127	235	388	17	11	184	600

Accident date for year 2011-2015



Flow chat 2 Flow chart showing progress of the study

Accident data was collected from police stations for the years 2011-2015. Excel sheets of the same were prepared. The accident locations were plotted using a G.P.S. based application called "G.P.S. Essentials". The data collected was used for plotting maps by means of Q.G.I.S. software.

- ◆ Mapping the accident spots using Q.G.I.S
- ◆ Locating the corner co-ordinate using Google earth
- ◆ Transporting the Google Earth image to Q GIS window
- ◆ Geo referencing the image in Q GIS
- ◆ Digitizing the image
- ◆ Composing the map using Print composer of Q GIS
- ◆ Exporting the Map as an image

Based on the maps, analysis was carried out to know the most accident prone sites in the city.

III. RESULT AND ANALYSIS

a. Graphical Form:

Accident analysis on yearly basis:-

Here the query was carried on the whole date set as per year and categorized as per level injury and concerned Police Station. The procedures for query using Q GIS in order to show the distribution of different levels of accident injury from the year 2011-2015. It has been absorbed that the total number of accident for the particular years is more or less same for the other years. In year 2012, accidents have increased. Maps are powerful and effective way to show what pattern is occurring with accident data spatially and all the maps were prepared for five different years.

Total percentage of accident on basis of Person killed/injured in 2011-2015

Accident Analysis on Vehicle Basis:-

The query to the database is performed using type of vehicle involved in accidents. The vehicles have been classified into three categories.

Heavy Vehicles: - Truck, Bus, Tractor.

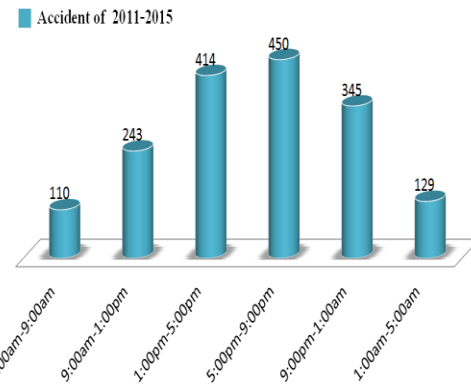
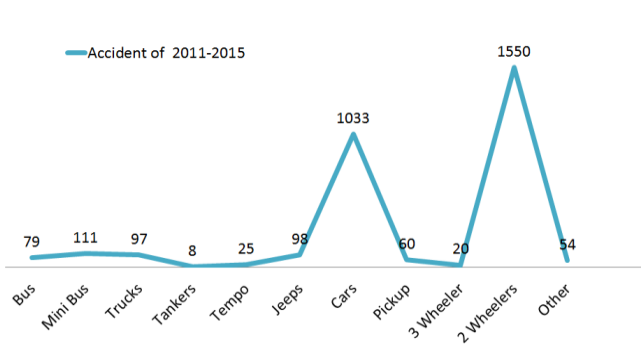
Medium Vehicles: - Private Car, Jeep, Van, Auto Rickshaw, Taxi, Pickup.

Light Vehicles: - Motorcycle, Scooter, Cycle.

It can be clearly seen that light type of vehicles are more involved in accidents as compared to other type of vehicles on the major city roads. This is due to harsh and negligible driving. Also medium vehicles are next regard to accidents. The possible reason could be the driving under influence of alcohol, using mobile phone. The remedial measures for enforcement of traffic rules have to be strictly enforced by traffic police.

Sr.No	Period	Type of Vehicle										Total	
		Bus	Mini Bus	Trucks	Tanker s	Tempo s	Jeeps	Cars	Pick-up	3 Wheeler	2 Wheel e r		Unknow n/other
1	2011	12	22	21	-	07	19	170	08	15	179	13	466
2	2012	16	26	16	01	06	25	219	14	10	389	07	729
3	2013	15	21	20	03	06	22	177	10	08	290	09	581
4	2014	21	25	19	02	02	16	212	12	11	382	11	713
5	2015	15	17	21	02	04	16	255	16	06	310	14	676
	Total	79	111	97	8	25	98	1033	60	50	1550	54	

Accident analysis on vehicle basis



Accident Basis On Type Of Vehicles In 2011-2015

4.1.1 Accident analysis according to time:

Accidents display a specific trend as per time of the day. The number of accidents occurred during the 5:00 pm-9:00pm. In this study, the time of accident occurrence has been split into four.

5:00AM-9:00AM :- Morning time (Jogging ,school and office rush time)

9:00AM – 5:00 PM:-Day time

5:00 PM – 9:00 PM :-Office to Home rush time

9:00PM -5:00 AM:-Night time

Sr.no	5:00am-9:00am	9:00am-1:00pm	1:00pm-5:00pm	5:00pm-9:00pm	9:00pm-1:00am	1:00am-5:00am
2011	5	22	56	71	67	28
2012	16	20	68	84	79	38
2013	17	25	83	88	89	48
2014	33	85	109	115	60	15
2015	39	91	98	92	50	-
Total	110	243	414	450	345	129

Accident analysis according to time 2011-2015

Accident Analysis According To Time 2011-2015

Sr no	Police Station	Total Number of Accidents	Slight	Minor	Fatal
1	Ambaji	14	4	9	1
2	Fatorda	96	38	40	18
3	Old Market	92	30	56	6
4	Monte Hill	2		2	
5	Pajifond	32	11	15	3
6	Calconda	18	5	9	1
7	Rawanfond	47	15	30	2
8	Navelim	126	39	69	19
9	Aquem	45	18	25	
10	Borda	47	16	26	3
11	Arlem	13	3	6	4
12	Gogal	61	24	30	7
13	Malbhat	11	5	6	
15	Davorlim	15	5	8	
16	Ktc bus stand	33	11	18	4
17	Dhramapur	22	8	12	2
18	Agali	15	4	10	1
19	Comba	17	5	11	2
20	Mungal bridge	8	4	4	
21	Khareband	15	4	10	1

Accident analysis according to places 2011-2015

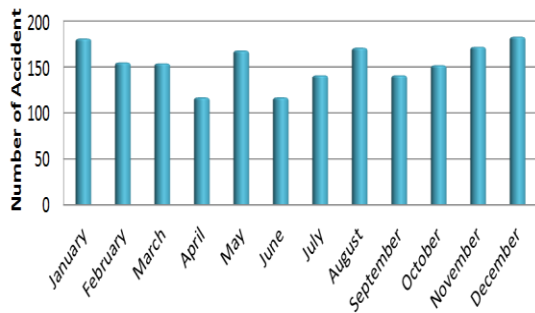
4.1.1 Accident analysis on Monthly Basis:-

Here the database has been queried for accidents as per month for the year 2011-2015 using Q GIS. This query yield results for accidents occurring in each month for the year's 2011-2015. It is clearly seen that the maximum number of accidents occurred in the month of January. This could be large number of tourist vehicles, which pass through

Margao city. These graphs shows the maximum accidents occurred in the month of December, September, November, January, May month respectively in Year 2011,2012,2013,2014 and 2015

Sr.No	MONTH	Year of Accident					Total Accident
		2011	2012	2013	2014	2015	
1	DECEMBER	34	44	38	32	35	183
2	NOVEMBER	22	37	48	33	32	172
3	OCTOBER	20	34	29	34	35	152
4	SEPTEMBER	14	45	37	21	24	141
5	AUGUEST	18	39	43	34	37	171
6	JULY	24	29	28	30	30	141
7	JUNE	19	28	10	30	30	117
8	MAY	30	19	48	33	38	168
9	APRIL	22	22	7	42	24	117
10	MARCH	25	25	25	43	36	154
11	FEBRUARY	18	38	30	38	31	155
12	JANUARY	26	32	38	56	29	181

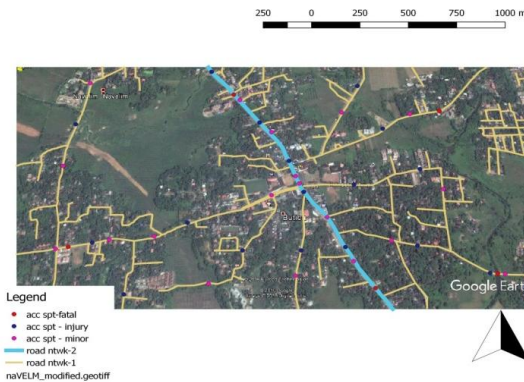
Accident of data of Margao (2011)



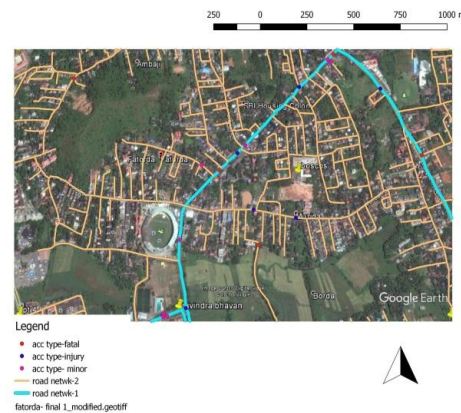
Monthly Accident Analysis Of Margao City 2011-2015

Map

As per the analysis carried out for the years 2011-2015, Navelim and Fatorda were the most accident prone zones of the city.



Map 1 Navelim



Map 2 Fatorda

IV. CONCLUSION

We have prepared the database of accidents of Margao City and finally we concluded as follows: Maximum accident occurred at the peak time i.e.5:00PM-9:00PM. This can be due to the reason as it is peak hour of closing time of the offices of Margao City. Also, heavy traffic, Poor Street lighting, narrow road or improper may be the cause for it. Using this database the local government can plan for the reduction of Accident rate in area. We also found that maximum accidents are caused because Common people do not follow traffic rules properly. The study clearly indicates there is an urgent need to adopt proper traffic management procedures to check the growth of accidents. Nearly 18% of accidents cause death. GIS has proved to be a good tool for analyzing multifaceted nature of accidents.

This study demonstrates the application of GIS for developing an efficient database on road accident in Margao city .if such type of database is developed, a proper analysis of accidents can be undertaken and suitable management

strategies for traffic regulation can be successfully proposed and hence the accidents rate can be reduced.

FUTURE SCOPE OF THE PROJECT

- ❖ To re-design the fatal accident spots.
- ❖ To study the traffic congestion in the city.
- ❖ To study the parking problems in the city.
- ❖ To provide necessary solutions the parking related issues.
- ❖ To study solid waste management of the city in detail.

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