

# ROAD TRAFFIC ACCIDENTS: THREATENING SURAT CITY

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**ABSTRACT:** Accidents are now one of the major causes of death. In 2004, projections of World Health Organization predicted that the number of people dying in road accidents will acquire third position by 2020 among causes of un-natural deaths worldwide. It was reported in India, a total of 98,254 people died on roads through year 2005. Surat city was declared as fastest growing city in the most recent Census of India. This paper discusses over pattern and distribution of vehicular growth and road traffic accidents occurring in Surat city. All the data thus collected and are analyzed statistically. On an average, it was observed that fatal cases share 7% of total accidents occurring on roads of Surat. 80% of accidents occur at location of staggered intersections of two-lane roads. Almost 60% victims of road fatality belong to the age-group between 25-44 years who are the *economy generators* for the city and the country as well. Analysis shows that there is considerable lacking of law enforcement while managing the traffic on roads of Surat. Moreover, roads are well lacking public awareness in terms of their behavior on roads. It was also observed that the City Development Plan has no influence with road accident fatalities though death of a bread-winner in a family may cause large economical and social imbalance. Overall, the road traffic accidents in Surat are alarmingly becoming threat for the advancement and must be reduced by any means to achieve development in real sense!

## 1. INTRODUCTION

Road accident or traffic accident has been defined as a collision occurring on a public road and involving at least one moving vehicle. Among all types of accidents, those caused by motor vehicles claim the largest toll of life and tend to be most serious. The World Health Organization (WHO) estimates that, each year, almost 1.2 million people die in road crashes worldwide and as many as 50 million are injured or disabled. WHO projects that fatality occurred due to road accidents will attain 3<sup>rd</sup> top ranking by 2020 from 9<sup>th</sup> ranking in the year 2003.

In India, the incidences of accidental deaths have shown a mixed trend during the decade 1995-2005 with an increase of over 32.2 percent in the year 2005. A total of 2,94,175 accidental deaths were reported in the country during 2005 (16,912 more than such deaths reported in 2004) showing an increase of 6.1 percent as compared to previous year. A total of 98,254 persons were killed in road accidents with 36.2% share in un-natural total deaths. Road accidents share 30.2% over various causes of accidental deaths during 2005. For the same year, Gujarat State was sharing 6.7% among accidental deaths in major states whereas road accidents in the state shared 9.20% for a total 1,23,402 Km length of surface roads.

Surat came up as the fastest growing city with a decadal growth rate of 62.38% in the Census of India, 2001. Moreover, it is the second largest metropolitan of

the state accommodating more than 24.33 Lacs population and 9<sup>th</sup> largest city of the country. Surat city had an area of 112.28 Sq Km in year 2005 in which total length of roads were 1, 134 Km. In July 2006, the city limits were expanded to an increased area of 334 Sq Km having roads of length more than 1300 Km (estimated). Surat has a wide spread road network with approximately 11 Km of road length per Sq Km of city limits. In the city, 95% roads are surfaced either with bitumen or with concrete. Out of 5% un-surfaced roads, 4% roads permit motorized traffic and only 1% of total roads do not permit any vehicular movements.

The city is having a variety in road network consisting of arterial roads larger than 60 Mt width, sub-arterial roads, collector streets and residential streets showing a wide variation in size. Surat city roads have a number of traffic management devices having 89 traffic islands, 29 traffic signals, 114 traffic blinkers. Moreover, 95 Km of roads are with dividers / central medians which also assist in traffic management. Surat Municipal Corporation has taken initiatives and provided opportunity for the private organizations to sponsor traffic islands to construct and maintain fountains and other urban beautification elements.

Most of roads in Surat seem considerably encroached upon through parked vehicles, hawkers and road side business activities. This results not only in restricting the traffic flow, but also putting the road users' life at great risk. This paper attempts to analyse

the road accidents in Surat and distribution of accident types for the year 2006. A hidden epidemic is taking place each year and threatening the city.

The remainder of the paper is organized as follows: Section 2 provides an over view of city demography and vehicular population and growth of the same. Road inventory is described under Section 3. Road accidents in Surat are analysed in detail under Section 4 with and finally with provisions of Development Plan of Surat in Section 5 and Section 6 concludes the paper.

## 2. DEMOGRAPHICS AND VEHICLE GROWTH

Due to rapid industrialization, with the large establishments of KRIBHCO, L & T, ESSAR, NTPC, Reliance industries etc. and in addition, the traditional textile industries, diamond industries and construction activities has made Surat an important growth magnet for the state. Also relatively peaceful and harmonious social environment and moderate climate has attracted the migrants into permanent settlers in the city. This resulted in higher decadal growth compared to any city in the state in last two decades. This statistics of the population of the Surat city from census year 1901 to 2001 is contained in Table 1. Moreover, it is highlighting centurial increase in city area by about 14 times, coupled with about 20 times increase in the population. Data shows the abrupt rise in the decadal population after 1981 highlighting effect of substantial in-migration making the city population grow.

**Table 1 DEMOGRAPHY FOR SURAT**

Year	Area (In Sq Km)	Population (In Lacs)	Density (In ppHa)	Sex Ratio
1901	8.18	1.19	145.85	953
1911	8.18	1.14	140.42	926
1921	8.18	1.17	143.56	902
1931	8.18	0.98	120.94	868
1941	8.18	1.71	209.58	898
1951	8.18	2.23	272.83	916
1961	8.18	2.88	352.11	915
1971	33.85	4.71	139.33	887
1981	55.56	7.76	139.77	857
1991	111.16	14.98	134.83	839
2001	112.28	24.33	216.76	777
2007	333.95	-N. A.-	-N.A.-	-N.A.-

(Source: Surat Municipal Corporation, 2007)

Surat city has seen an unprecedented growth in last four decades recording the latest as the highest growth rate in the country and a sudden population rise. The City now ranks the 9th largest city in the country. Coupled with this, the spill over of population into periphery has also been observed. The jurisdictional limits of the Surat Municipal Corporation (SMC) have also been extended regularly to include the outgrowth. There are about 6.50 Lacs of people (2001) residing in the immediate periphery of the city. Yet, with the growth in population sex-ratio figures are continuously falling which is not a sign of healthy social progress.

In the last decade, vehicular population has been observed to have rapid growth rate due to quantum and spread of activities concentrated in city. The socio-economic development and inadequate mass transport system have led to the growth of the vehicle population in Surat is high. Increase in vehicle volume on road is a matter of worry for efficient traffic management.

**Table 2 DECADAL VEHICULAR POPULATION**

Year	Total Vehicles	MTW		Cars	
		Nos.	%	Nos.	%
1996	4,86,743	3,81,967	78.47	36,661	7.53
1997	5,29,879	4,15,424	78.40	40,959	7.73
1998	5,82,442	4,56,176	78.32	46,106	7.91
1999	6,42,293	5,05,238	78.66	50,714	7.89
2000	7,08,323	5,59,533	78.99	57,293	8.08
2001	7,61,650	6,02,583	91.20	63,808	8.37
2002	8,18,883	6,49,572	79.32	70,033	8.55
2003	8,96,844	7,12,928	79.50	77,239	8.61
2004	9,82,713	7,81,775	79.55	85,638	8.71
2005	10,89,689	8,68,476	79.70	95,465	8.76
2006	12,11,150	9,64,843	79.70	1,08,334	8.94
	149 %	153 %	80.16 (Avg.)	196 %	8.28 (Avg.)

(Source: R. T. O. Surat, 2006)

In 1996, the total vehicles were nearly 4.86 Lacs rising to nearly 12.11 Lacs in 2006. This shows an increase of 149 % during last ten years. Table 2 shows the decadal data regarding vehicular growth in Surat city. The category wise data shows that number of motorized two wheelers (MTW) and motorcars have increased by 153% and 196% respectively in latest decade. Alarming growth rate of vehicles emerge a need for better road network with safe driving conditions. Also, such rise in MTW and car population show ineffective mass transportation facility.

A very typical composition of vehicle population exists in Surat city. Out of all vehicles being registered each year the major vehicles are two wheelers (almost 80%), four wheelers-cars and three wheelers-Auto rickshaws with a decadal average rate of 80.16%, 8.28% and 4.48% respectively, sum of which comes out to be 92.92%. This shows that the prevailing mode of transportation in the city is private and public transport facility is lacking. Decadal growth rate of MTW in Surat is 153% which shows a high utilization of personal vehicles for the daily trips for various purposes.

## 3. ROAD INVENTORY

Recent efforts to improve traffic management on the city roads have resulted in effective widening of almost all major corridors of the city. Roads had a city land-use share of 9.96 Sq Km by the year 1995-96, but during the year 2006 it was reported that the roads in the city cover an area of 28.29 Sq Km, having about 25 % of the SMC area (i.e. 112 Sq Km). So far, 80 percent of the area of the city has been effectively connected through a

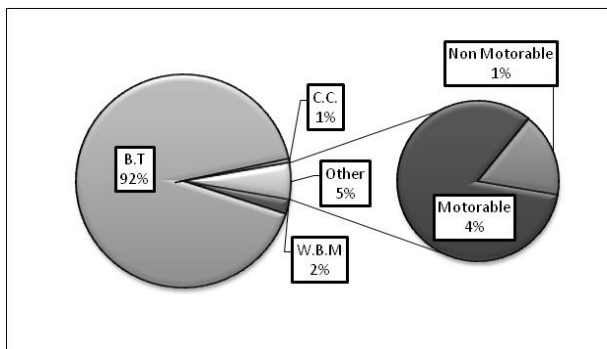
total length of 1233.046 Km by end of year 2006 of road network.

**Table 3 LENGTH OF ROADS**

Sr.	Description	Length
1	Total road length as on 31.03.2005	1133.370
2	Road length added during 1.4.2005 to 31.03.2006 (New Roads)	99.676
3	Total road length as on year ended 31.03.2006 (total of Sr. No. 1 & 2)	1233.046

(Source: Surat Municipal Corporation, 2006.)

As mentioned earlier, 95% roads of Surat city are well surfaced and the rest is un-surfaced (See Figure: 1). Sooner or later, these 5% un-surfaced roads will also be well surfaced roads. Out of the total un-surfaced roads, 4% roads permit motorized traffic and only 1% roads do not permit vehicles. On the contrary, 1% roads are surfaced with cement concrete which is a costly affair yet; such a road reduces operation costs of vehicles. Higher speeds may be permitted on such roads but not at the cost of safety of VRUs.



**Figure 1 ROADS LENGTH DISTRIBUTION**

There are a total of 89 intersections in the city that have traffic islands. Of these, 42 junctions have traffic islands or channelizers which are sponsored. These junctions were mostly constructed largely during the years 1998-2001. Considering the rapid growth of vehicles, coupled with the poor public transport system, SMC has taken up a number of traffic management initiatives during the past decade. Road dividers of about 67.0 km length were added to the existing 28 km length. Traffic signals were installed at 25 junctions and traffic islands were constructed at 45 junctions. Traffic blinkers were also installed at 28 junctions in the city. Following table provide inventory of traffic junctions in surat.

**Table 4 TRAFFIC JUNCTION INVENTORY**

Junctions	Till 1994	1995-2005	Total
Traffic Islands	9	80	89
Traffic signals	4	25	29
Traffic blinkers	43	82	114
Dividers (Km)	28	66.95	94.95

(Source: SMC, 2006)

In various zones, SMC has initiated traffic management through sponsorships made available from various organizations. These organizations sponsor a particular traffic island or channelizers to maintain it throughout the year. Various organizations sponsor landscapes and traffic awareness for the people welfare, though these organizations get space for their own commercials too. Table 5 narrates detail of such sponsored traffic islands in different zones.

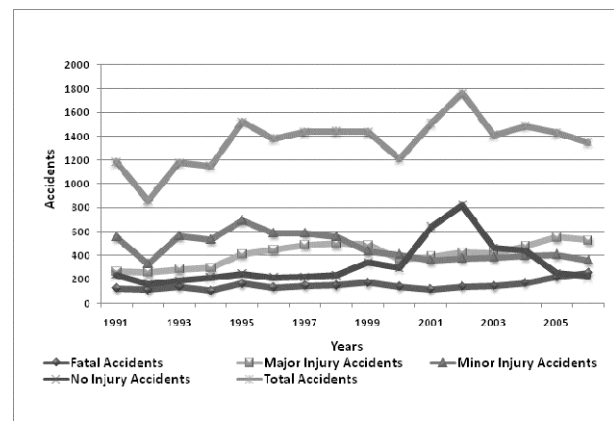
**Table 5 TRAFFIC MANAGEMENT INVENTORY**

Zone	No. of Traffic Islands and Channelizers (Sponsored)
Central	6
North	6
East	6
West	10
South	3
South-East	1
South-West	10
<b>Total</b>	<b>42</b>

(Source: Surat City Development Plan, 2006-12)

#### 4. ROAD TRAFFIC ACCIDENTS IN SURAT

Data was studied for year-wise record of road accidents observed in Surat along with occurrence of Fatality (F), Grievous Injury (GI) and Minor Injury (MI) cases. There was some Non-injury (NI) accidents also detected resulting in property losses only. Figure 2 show trend observed for the road traffic accidents occurred on roads of Surat city.



**Figure 2 ROAD TRAFFIC ACCIDENT PATTERN**

(Source: Surat City Traffic Police, 2007)

With data available from year 1991, we derive that each year approximately 1350 accidents are occurring on roads of Surat. Based on these average values, distribution of accidents is shown in Figure 3. This diagram represents the percentage share in degree of brutality of road traffic accident type. 11% accidents are fatal which led people to death and in 30% accidents victims have to accept major injuries or disabilities where as 35% accidents with lesser injuries.

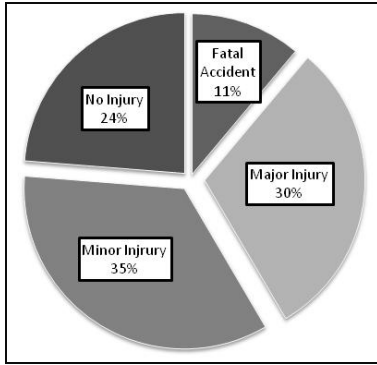


Figure 3 SHARE OF ACCIDENT TYPE

#### 4.1 Accident Severity Index

The accident severity index measures the seriousness of the accident and the availability of medical facilities in the city. Figure 4 signifies accident severity index of Surat city which shows that the number of deaths per 100 accidents. For Surat this index is moderately low. The values indicate that medical facilities are available (for post-crash stage) within the reach from accident spots. This aspect indirectly indicates that the health related infrastructure and facilities are at good level. It can be well observed that though the rate is low yet it is increasing significantly.

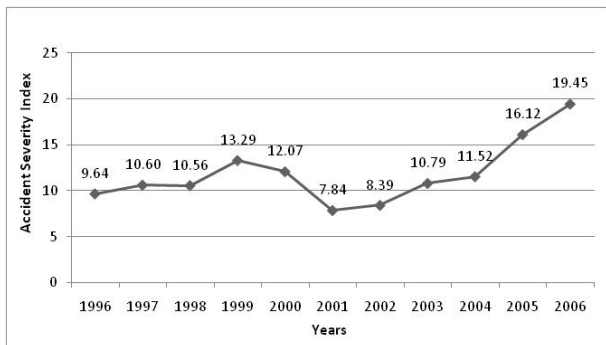


Figure 4 ACCIDENT SEVERITY INDEX

It shall be noted here that the accident severity index is lower for the years 2001 and 2002 in which maximum accidents occurred during the decade (Refer Figure 2). This may be the result of prompt post-crash services and availability of good medical facilities.

Traffic police of Surat may not be able to record all the minor accidents occurring on the roads of the city and this might have led to little increase in the accident severity index over past a few years.

#### 4.2 Vehicle-wise Accident Rates

Table 6 accounts the number of accidents by involvement of various types of vehicles during the year 2006. Such a detailed data for previous years are not available so that to derive predominance of a particular vehicle type involvement. Still, each year increase in total vehicles, MTW share almost 80%; it is obvious that MTW share may be higher (almost 25%) in accidents also.

Table 6 VEHICLE INVOLVEMENTS IN ROAD ACCIDENTS (YEAR 2006)

Type of vehicle primarily responsible	Number of Accidents				
	F	GI	MI	NI	Total
MTW	46	160	85	35	326
Moped	3	2	3	14	22
Auto rickshaw	15	96	79	42	232
Motor car	23	62	51	23	159
Jeep	2	4	5	3	14
Taxi/cab	5	21	2	5	33
Bus	13	16	14	4	47
Truck	59	64	33	32	188
Tempo	33	58	44	33	168
Articulated vehicle	0	0	0	2	2
Tractor	8	6	9	1	24
Other vehicle	46	38	20	28	132

(Source: The Traffic Police, Sura)

#### 4.3 Accidents by Nature of Occurrence

Table 7 point out different type of accidents that occur during the year 2006. The accidents are divided in a few most occurring types. In Surat city, mostly observed type of road accident is of head on collision, rear end collision and hit & run type in nature.

Table 7 ACCIDENTS BY NATURE OF OCCURRENCE (YEAR 2006)

Nature of Accident	Person Killed	Number of Accidents				
		F	GI	MI	NI	Total
Overturning	12	12	15	18	5	50
Head on collision	31	29	112	70	23	234
Rear end collision	54	49	92	73	19	233
Collision brush	13	12	30	7	16	65
Right angled collision	4	4	10	16	7	37
Skidding	7	6	6	4	4	20
Right turn collision	3	3	10	6	1	20
Hit & run	48	48	91	72	35	246
Others	90	90	161	79	112	442

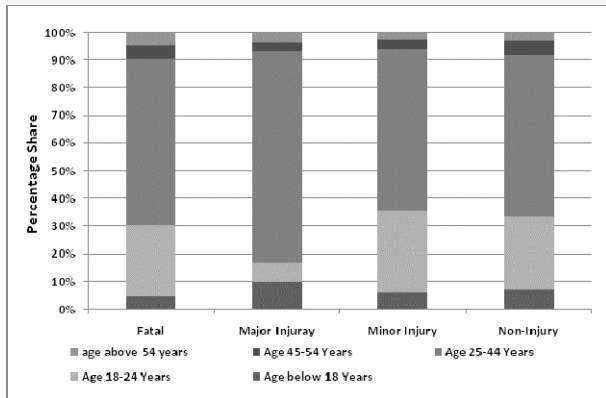
(Source: The Traffic Police, Surat)

Major proportion of head on collision indicates that the roads which are prone to accidents are not segregated for different direction of traffic movement. A large portion of hit & run cases predict either lacuna in public awareness for accidents or escapism due to unknown reason. 19% fatality and similar proportion of injuries was observed in hit & run cases. Rear end collision share in fatality was detected as 20% and it had a largest fatality share such occurrence. Here, other type of accidents share a major portion of the total occurrence and information in the dead is unavailable thus if details of such incidence get worked out, the analysis of accidents may be derive with some prompt results. Such an analysis may be helpful for future planning of better traffic management.

#### 4.4 Age-wise Distribution of Accident Victims

This data states that the child fatality is relatively low in Surat city. The adult work age group (18-54 years of age) account for more than 80 % of all causality. The data distribution is reconstructed by age group in three majors as age up to 18 years, 18-54 years and above 54

years of age; Figure 5 shows the percentage shared by each group.



**Figure 5 ACCIDENT DISTRIBUTIONS BY VICTIM AGE (YEAR 2006)**

(Source: The Traffic Police, Surat)

In all the accident cases, it was observed that the major percentage share is from persons belonging to an age group of 18-54 years. It shows that the effect of all these accidents is on economically active cohort of the city.

#### 4.5 Location based Accident Distribution

Table 8 stands for accident distribution with respect to location of its occurrence. It is to note that, as per records made available by The Traffic Police, Surat; it is shown that during year 2006, all the 1347 road accidents occurred have identified as to be taking place at location of intersection only. There is not even a single event mentioned which had occurred on mid-block section of road though accidents have been classified according to the type of road which is discussed in following section.

**Table 8 ACCIDENTS ON JUNCTIONS – YEAR 2006**

Junction Type	Accidents	Fatality	Injury
T-Junction	193	32	165
Y-Junction	34	4	23
Four arm junction	103	30	45
Staggered Junction	998	190	723
Junction with more than four arms	4	1	3
Round about junction	15	5	6

(Source: The Traffic Police, Surat)

Here, it is important to note that the major of accident occurrence, fatality and injuries took place on staggered junctions, yet these junctions are signalised or controlled manually, details are not available. Almost 74% of accidents were occurred on such junctions with a share of about 3/4<sup>th</sup> of the total fatality. For better investigation and analysis yet better data collection practice shall be in force.

**Table 9 LOCATION BASED DISTRIBUTION – YEAR 2006**

Carriageway	Accidents	Fatality	Injury
Single lane	275	52	190
Two lanes	1044	206	748
Three lanes or more with median	13	1	13
Four lanes or more with median	15	3	14

(Source: The Traffic Police, Surat)

Table 9 presents accident distribution as of its occurrence on type of road carriage way. It is to observe that the major proportion of accident is accumulated on carriage way with two lanes. Generally, such carriage ways do not permit movement of vehicles with higher speed, questionably higher rate of accidents are observed.

#### 5. DEVELOPMENT PLAN CONSIDERATIONS

Surat is an important commercial hub for the region. A number of diamond and textile industries are established in the city and these industries supply goods around the world. As of today, the city is progressing very fast in each development aspects. The City Development Plan already has been published and under revision due to extension of city limits. It was observed that road traffic accidents were nowhere mentioned. As such the results of road traffic accidents affect human life and economy as well as social structure; the same shall be included in the development plan. Also, measures to reduce the road traffic accidents shall be worked out and enforce with the help of law.

#### 6. CONCLUSION

Surat is emerging as a mega city showing high values of growth rate and spatial expansions. It has become a hub for variety of industries and commercial activities. Vehicular population is increasing largely with major proportion of two-wheelers (almost 80%) which are a part of vulnerable road users. With a rate of accidents occurring on roads, it seems that there is considerable lacking of enforcement of effective traffic management. Also in this regards, major of the accident cases are of 'Hit & Run' nature showing a lacuna in public awareness. Almost 80% of accidents were reported on two lane road at staggered intersection. This show a need to have prompt attention which can be furnished by providing blinkers, signs and markings on local two lane roads resulting in educating people to some extent and reduction in accident occurrence. The revision of Development Plan which is already in progress shall identify Road Traffic Accidents as one of the key component and incorporate provisions for accident reduction mechanisms as the epidemic which is taking place on city roads may have large social and financial impact.

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