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Spatio-Temporal Distribution Of Road Accidents In Haryana

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Abstract

Present paper is an effort to analyse the spatio-temporal distribution of road accidents in Haryana (2006-07 to 2015-16). Roads are the key to the development of an economy. A good road network constitutes the basic infrastructure that accelerates the development process through connectivity and opening up of the backward regions to trade and investment. Here with the development of road network, the number of road accidents have also increased which make it a most horrible and pronounced disaster in India as well as in the state of Haryana. The most prominent feature exhibited by the data is that the total accidents, person killed and injured have increased by approximately 1.5 times during the last two decades. It is also a practise to explain the accident population relationship in terms of Accident Risk. The analysis revealed that only one district falls in very high risk index i.e. Gurgaon and only two districts Jind and Palwal observed low accident risk. Severity index shows the seriousness of an accident and it is defined as the number of person killed per 100 accidents. Severity index is calculated which shows the seriousness of an accident and the index fluctuates in the given time period. The road accident has become most common and fatal disaster of present time.

Keywords: Accident risk, disaster, damage, causalities.

Introduction

The increasing dependency on transport system in today's life has led to increase in number of vehicles, roads etc. which is considered as the development of any economy or country. But the increasing number of roads and vehicles also leads to the road accidents which are very

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frequently occurred and becomes a serious problem for the society. It is neglected in today's busy life but after some it becomes a disaster for our society. It is a manmade disaster which affects the society. Disasters are called man-made if they are the result of human action be it intentional or unintentional. Therefore whether it is intentional or unintentional, all kinds of man-made disasters lead to human suffering, loss of life and long-term damage to the economy of a Nation (Srinivas, 2010). Accidents in which a large number of people are affected are also categorized as disasters.The rapid expansion of road transport has brought with it the challenge of addressing adverse factors such as the increase in road accidents. Road accidents are a human tragedy. It involves high human suffering and monetary costs in terms of premature deaths, injuries, loss of productivity etc. Most deaths and injuries due to road accidents are invisible to society. They are a hidden epidemic. In India, motor vehicles including two wheelers are growing at a faster rate than the economic and population growth. Global Status Report on Road Safety (WHO, 2009) has estimated that 1.2 million people die on the world's road every year, and as many as 50 million others are injured. Over 90% of deaths occurred in low income and middle income countries, which have only 48% of the world's registered vehicles. The problem of road safety is acute in India. In the year 2008 alone, number of road accidents were 4.8 lakh resulting in close to 1.2 lakh deaths and 5.2 lakh injured, many of whom are disabled for rest of their lives. Sadly, many of these victims are economically active young people. As per the World Road Statistics (2009) cross country comparisons of incidence of road accident related deaths and injury (accidents per lakh persons) shows lower incidence of both the parameters for India in comparison to many developed and developing countries. The number of road accident deaths per lakh of population at 10.5 in India was much lower compared with 12.72 in Korea and 13.68 in USA. Similarly, injury accidents per lakh of population for both in India and China were substantially lower at around 36.69 and 24.82 respectively when compared to U.K. (298.54), USA (579.68), France (131.75), and Germany (408.23). The scenario of road accidents at state level even in tiny states is also discouraging. In Himachal Pradesh the annual average of road accidents is around 3000 resulting in to more than one thousand per annum while the number of injured persons in these accidents are around five thousands (Sharma and Kumari, 2014).

The increasing number of road and traffic accidents is a challenging issue to the transportation systems. It not only concern with health issues but also associated with economic burden on the

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society. Therefore, it is an important task for the safety analysts to carry out a comprehensive study of road accidents to identify the factors that causes an accident to happen, so that preventive actions can be taken to overcome the accident rate and severity of accidents consequences.

Rationale of the Study

Government of India, Ministry Road Transport and Highways 2010 states that during the year 2010 there were around 5 lakhs accidents, which resulted in deaths of 1,34,513 people and injured more than 5 lakhs persons in India. These numbers translated into 1 road accident every minute, and 1 road accident death every four minutes. The analysis of road accident data 2015 reveals that about 1,374 accidents and 400 deaths take place every day on Indian roads which further translates into 57 accidents and loss of 17 lives on an average every hour in our country. The rate of accidental deaths per thousand registered vehicles has helps Haryana to fall in top thirteen highest accident prone states in the country as per the report released on accidental deaths by National Crime Record Bureau (NCRB, 2015). A report said that during last 10 years till 2015, state Haryana has witnessed around 11,233 road accidents in which 4,865 people have been killed and 10,349 others injured. Data recorded by police shows that on an average around 11,000 road accidents are taking place in the state in which around 2,000 people being killed and 5,000 others are being injured each year. Road accidents in Haryana have been rampant and in 2016 alone state have recorded 11,211 accidents in which 4,838 people have been killed and others10,337 people injured.

It is surprising that the large numbers of casualties on the roads of public concern for prevention does not yet seem to be sufficiently aroused. When a fatal accident occurs in air or rail transport a full inquiry and investigation are held, but these are not usual for road accidents, although the numbers killed are very much greater.

Objectives

Major objectives of the study:

• To analyse the spatio-temporal distribution of road accidents in study area.

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• To examine the pattern of severity and accident risk of road accidents in the study area.

Data Base & Methodology

The present study is entirely based on the secondary sources of data. The main sources of secondary data are the published and unpublished records of Haryana Government. In order to assess the spatio-temporal changes in number of total accidents, person injured and killed has been computed. The district wise data for road accidents has been analysed for the period of 2006-2016 while a conceptual summary has been analysed with effect from 1966-2015. Arc GIS software has been also used to show the spatial and temporal distribution and variation among road accidents during different years in the study area. The different indices are calculated which have been given as below.

1) Accident Severity Index: $ASI = \frac{PK}{TA} \times 100$

PK- Number of person killed T- Total number of accidents

2) Accident Risk: $AR = \frac{TA}{P} \times 100$

TA-Total number of accidents P- Population

Study Area

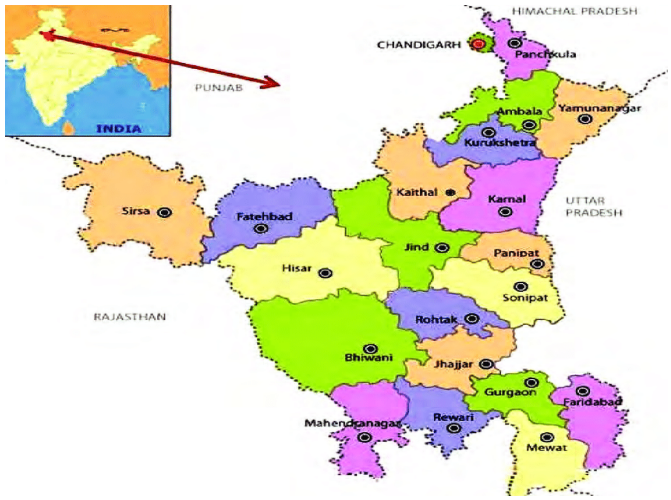

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Fig:1, The state of Haryana forms the study area of present analysis. Haryana is carved out of the former state of East Punjab on 1November 1966 on linguistic basis. Haryana is situated in North India with the area of 44,212 Sq. Km. It is ranked 21st in terms of area in India. It lies between 29°58' to 30°30' north latitude and 74°54' to 77°22'east longitude. Chandigarh is the capital of Haryana, Faridabad in National Capital Region is the most populous city of the state and Gurugram is the financial hub of NCR with major companies located in it. Haryana has 6 administrative divisions, 22 districts, 72 sub-divisions, 93 revenue tehsils, and 140 development blocks. Haryana is a non-coastal, interior state. It is located at an altitude of 200 meters to 1200 meters or 700-3600 feet over sea surface. Geographically, the state can be divided into the regions i.e. The Shivalik mountain range in the northeast,The Yamuna-Ghaggar basin, creating the biggest portion of the state, The Aravalli mountain range to the south and Semi-arid sandy plateaus in the southwest.

Haryana has a total road length of 23,684 kilometres. There are 29 national highways with a total length of 1,461 kilometres (908 mi) and many state highways, which have a total length of 2,494 kilometres. The most remote parts of the state are linked with metalled roads. Its modern bus fleet of 3,864 buses covers a distance of 1.15 million km per day, and it was the first state in the country to introduce luxury video coaches. Ancient Delhi Multan Road and Grand Trunk Road (GT Road) pass through Haryana. GT Road is one of South Asia's oldest and longest major road which passes through the districts of Sonipat, Panipat, Karnal, Kurukshetra and Ambala in north Haryana where it enters Delhi and subsequently the industrial town of Faridabad on its way. The state government proposes to construct Express highways and freeways for speedier vehicular traffic. The 135.6 kilometres Kundli-Manesar-PalwalExpressway (KMP) will provide a high-speed link to northern Haryana with its southern districts such as Sonepat, Gurgaon, Jhajjar and Faridabad. The work on the project has already started and was scheduled to be completed by July 2013. The Delhi-Agra Expressway (NH-2) that passes through Faridabad is beingwidened to six lanes from current four lanes. It will further boost Faridabad's connectivity with Delhi.

Discussion

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India is a signatory to Brasilia Declaration (2004) and is committed to reduce the number of road accidents and fatalities by 50 per cent by 2020.However, with one of the highest motorization growth rate in the world accompanied by rapid expansion in road network and urbanization over the years, our country is faced with serious impacts on road safety levels (NCRB, 2016). The total number of road accidents increased by 2.5 per cent from 4, 89,400 in 2014 to 5, 01,423 in 2015. The total number of persons killed in road accidents increased by 4.6 per cent from 1, 39,671 in 2014 to 1,46,133in 2015. Road accident injuries have also increased by 1.4 per cent from 4, 93,474 in 2014 to 5,00,279in 2015. The severity of road accidents, measured in terms of number of persons killed per 100 accidents has increased from 28.5 in 2014 to 29.1 in 2015. The analysis of road accident data 2015 reveals that about 1,374 accidents and 400 deaths take place every day on Indian roads which further translates into 57 accidents and loss of 17 lives on an average every hour in our country. Generally speaking, traffic junctions are accident prone areas. About 49 per cent of total accidents took place on the junctions itself during the calendar year2015 as against 57 per cent reported during 2014.

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Year	Total Accidents	Person Killed	Person Injured
1966	335	140	241
1970	660	257	549
1975	759	354	827
1980	1552	594	1649
1985	2676	968	3321
1990	4707	2118	5448
1995	6677	2574	6808
2000	8392	2974	8562
2005	9520	3419	8975
2010	10934	4724	9891
2015	11233	4865	10349

Source: Statistical Abstract Haryana (1966-2015)

Table.1. Trends of Road Accidents in Haryana

Road Accident in Haryana 1966-2015

Table: 1, shows the trends of Road Accidents in Haryana for about five decades from 1966 to 2015 and it observed the increasing pattern during this time period. Here increasing pattern refers to increase in number of total road accidents as well as the number of person killed and injured during last three decades. The time period shown in table is taken with the difference of five year because it makes a clear picture of changes taken place from 1966 to 2015. The most prominent feature exhibited by the table is that the total accidents, person killed and injured have increased by approximately 1.5 times during the last two decades. The reason of this increase may be that the population and number of vehicle also increased. There are many more reasons due to which the number has gone increased. They include lack of awareness among people about safety

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measures, the condition of roads, driving skills etc. In a earlier study the downward trend in road accident rates was studied but in present study the upward trend is dicussed (Bjornskau and Gafni, 2000). The positive relation of total accidents, person killed and injured also shown in figure 2. The study started from 1966 because Haryana state carved out of the former state of East Punjab on 01 November 1966.

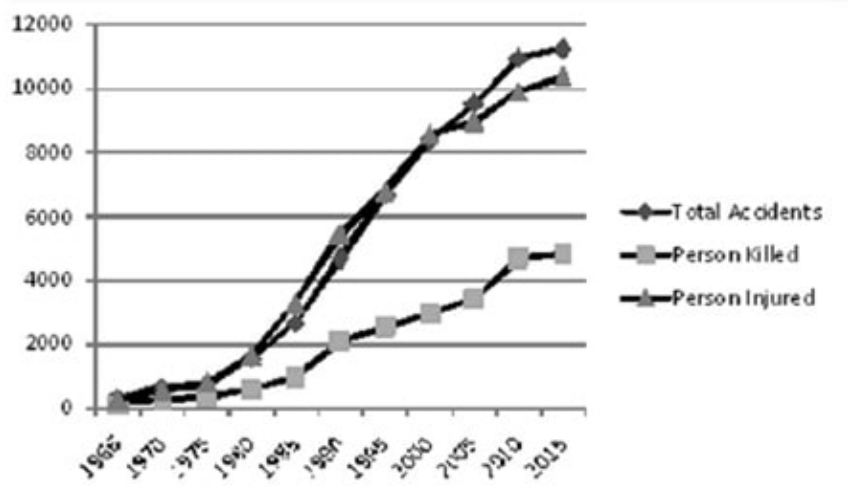

Fig.2. Trends of Road Accidents 1966-2015

Total Accidents

Table: 2 and fig: 3, reveals the spatio-temporal distribution of total accidents in the study area. Number of accidents observes the fluctuations over the last 10 years. The scenario of road accidents in Haryana can be fluctuate means increase or decreases in the last 10 years. It is observed through data that Gurgaon have highest total number of accidents it may be due to the nearness of Delhi. Gurgaon is affected by Delhi traffic due to which the road accidents are high. Faridabad is on second in the number of accidents which is followed by Sonipat, Rewari, Hisar, Karnal, kurukshetra, Panipat and Yamunanagar. The number of accidents was lowest (30) in Ambala in 2006-07 but it is going to increase over the time and in 2015-16 reached to 598.A previous study of Oyo state, Nigeria shows the spatio-temporal analysis of road accidents and fluctuations obsevered in that study area (Jegede, 1998).

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Fig. 3.

Total Person Killed and Injured Persons in Haryana (2006-2016)

Table: 3, reveals that the number of person killed in different districts of Haryana. The number of person killed is highest in Sonipat followed by Faridabad, Gurgaon, Karnal and Panipat. A previous study of Himachal Pradesh reveals that the number of accidents as well as the number of people injured and killed have been growing during the last two decades as the number of vehicles and the frequency of movement has also increased (Sharma and Kumari, 2017). Total number of accidents is highest in Gurgaon but person killed is in Sonipat due to lack of medical facilities. There is number of factors which affects the relationship of total accidents and person killed. It is not necessary to have positive relation in between this.

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Table, 2. Total Accidents and Accident Risk in Haryana (2006-2016)

S/N	Districts / Years	2006-07		2007-08		2008-09		2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
		TA	AR	TA	AR	TA	AR	TA	AR	TA	AR	TA	AR	TA	AR	TA	AR	TA	AR	TA	AR
01	Ambala	30	2.96	622	61.3	594	58.6	566	55.8	545	48.3	588	52.1	549	48.7	592	52.5	572	50.7	598	53
02	Panchkula	304	64.9	295	63	321	68.5	266	56.8	269	47.9	253	45.1	220	39.2	251	44.7	217	38.7	222	39.6
03	Yamunanagar	438	42	452	43.4	455	43.7	447	42.9	385	31.7	418	34.4	340	28	346	28.5	397	32.7	458	37.7
04	Kurukshetra	562	68.1	606	73.4	562	68.1	582	70.5	594	61.6	459	47.6	396	41.1	453	47	446	46.2	585	57.5
05	Kaithal	264	27.9	294	31.1	299	31.6	357	37.7	308	28.7	319	29.7	308	28.7	340	31.6	354	33	351	32.7
06	Karnal	678	53.2	723	56.7	651	51.1	609	47.8	601	37.2	598	36.9	513	48.8	370	34.3	360	33.3	670	63.8
07	Panipat	461	47.7	488	50.4	502	51.9	503	52	503	41.7	520	43.1	450	37.3	553	45.9	582	48.3	560	46.5
08	Sonipat	745	58.2	713	55.7	789	61.7	774	60.5	743	51.2	701	48.3	718	49.5	792	54.6	814	56.1	866	59.7
09	Rohtak	417	44.4	506	53.8	466	49.6	455	48.4	493	46.5	407	38.4	441	41.6	459	43.3	416	39.2	460	43.9
10	Jhajjar	364	41.4	417	49.7	417	47.4	399	45.3	435	47.5	460	48	408	42.6	478	49.9	463	48.3	483	50.4
11	Faridabad	586	29.4	1392	69.9	791	39.7	739	37.1	682	37.7	734	40.6	674	37.2	678	37.5	638	35.3	671	37.1
12	Gurgaon	1109	127	1291	148	1291	148	1165	134	1141	75.3	971	64.1	1085	71.6	1120	74	1177	77.7	1142	75.4
13	Mewat	355	35.7	397	40	307	30.9	374	37.6	393	36.1	464	42.6	420	38.6	421	38.6	373	34.2	425	39
14	Rewari	693	90.5	707	92.4	702	91.7	571	74.6	676	75.1	629	69.9	567	65	523	58.1	596	66.2	602	66.9
15	Mahendragarh	575	70.8	549	67.6	448	55.1	581	71.5	475	51.5	477	51.7	373	40.5	336	36.4	473	51.3	461	50
16	Bhiwani	531	37.3	610	42.8	563	39.5	611	42.9	577	35.3	528	32.3	539	33	536	32.8	629	38.5	627	38.4
17	Jind	137	11.5	349	29.3	359	30.2	418	35.1	425	31.9	370	27.7	369	27.7	394	29.5	337	25.3	358	26.8
18	Hisar	568	37	539	35.1	567	36.9	580	37.7	572	32.8	627	36	563	32.3	576	33	601	34.5	644	36.9
19	Fatehabad	210	26	223	27.7	226	28	245	30.4	226	24	213	22.6	200	21.2	264	28	296	30.4	276	29.3
20	Sirsa	280	25.1	282	25.3	290	26	330	28.7	292	22.5	284	21.9	254	19.6	275	21.2	335	25.9	305	23.5
21	Palwal					547	52.5	673	64.5	498	47.8	535	51.3	475	45.6	406	38.9	447	42.9	471	45.2

TA- Total Accidents, AR- Accident risk Index

Table. 3. Total Person Killed and Injured in Haryana (2006-2016)

District/Years	2006-07		2007-08		2008-09		2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16	
	K	I	K	I	K	I	K	I	K	I	K	I	K	I	K	I	K	I	K	I
Ambala	11	36	267	603	227	635	270	502	244	383	256	430	243	420	223	491	219	401	224	450
Bhiwani	216	544	236	625	210	585	234	548	222	529	194	549	234	563	205	507	270	625	238	637
Faridabad	453	701	494	1051	290	648	227	570	235	545	249	595	338	521	209	508	248	462	206	538
Fatehabad	66	195	99	226	101	147	107	245	117	226	99	280	105	214	101	280	101	298	104	273
Gurgaon	393	815	462	907	490	919	424	791	441	856	462	754	462	747	487	744	430	1144	447	791
Hisar	196	481	189	482	201	446	234	481	258	497	271	525	250	512	255	559	248	595	253	633
Jhajjar	207	295	217	456	207	408	193	408	244	411	272	310	185	369	254	436	246	382	275	380
Jind	161	85	187	249	171	360	189	307	227	358	168	295	184	265	189	308	161	302	174	352
Kaithal	110	286	99	282	120	311	140	379	119	293	141	295	137	293	147	333	137	424	161	320
Karnal	293	680	287	735	292	633	250	573	284	522	246	601	233	476	272	481	282	428	318	533
Kurukshetra	213	639	210	623	231	568	244	502	255	576	208	421	198	439	206	420	203	374	272	518
Mahendragarh	150	546	151	502	156	495	240	500	144	590	186	539	129	268	122	365	167	481	178	535
Mewat	90	330	125	330	86	275	105	352	136	400	135	340	163	590	175	378	144	315	141	454
Palwal					243	565	275	843	247	457	252	398	246	394	195	368	195	350	209	365
Panchkula	119	226	110	255	157	215	113	228	133	173	116	244	115	268	112	295	130	271	110	305
Panipat	226	440	232	481	215	287	295	449	283	432	257	432	249	390	264	543	285	496	271	584
Rewari	198	890	236	857	232	865	164	690	267	809	221	685	236	627	210	527	253	590	261	601
Rohtak	249	392	267	528	217	456	216	457	217	528	190	380	223	474	240	432	210	489	213	514
Sirsa	130	258	105	271	165	296	156	375	130	284	149	258	144	261	115	241	148	232	154	302
Sonipat	636	176	298	673	319	693	323	757	351	736	291	727	344	692	362	785	377	804	401	845
Yamunanagar	174	456	189	455	170	394	196	367	153	286	181	468	143	436	149	377	159	382	228	407
TOTAL	4291	8471	4460	10591	4500	10201	4595	10324	4707	9891	4544	9526	4561	9219	4492	9378	4613	9845	4838	10337

K=Killed , I = Injured

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