



Road Safety Analysis and Identification of Accident Black Spots in Ludhiana Police Commissionerate



A Project Under



December 2019



Road Safety Analysis and Identification of Accident Black Spots in Ludhiana Police Commissionerate

Detailed Report

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EXECUTIVE SUMMARY

A Report on “Road Safety Analysis and Identification of Accident Black Spots in Ludhiana Police Commissionerate is published by the office of Traffic Advisor Punjab with the assistance of Commissioner of Police, Ludhiana Police Commissionerate under Punjab Vision Zero and Tandrut Punjab Mission. This report is a detailed macro and micro-level analysis of traffic and road safety scenario for the entire Ludhiana Police Commissionerate area and further up to Police station level. District wise Ludhiana Police Commissionerate ranks at number 10 when it comes to road accident fatalities against per million populations. In the past three years, a total of 977 people lost their lives in various road accidents reported in Ludhiana Police Commissionerate area. Ludhiana Police Commissionerate as compared to the previous year has shown a declined trend in road fatalities in the past two years, in fact, the total number of deaths has decreased as compared to 2016. Month-wise if we see February, October and November months are relatively more dangerous from road fatalities and accidents point of view for Ludhiana Police Commissionerate. Ludhiana Police Commissionerate can plan month-wise enforcement calendar and human resources deployment as per the available pattern of traffic movement and road accidents. Day wise Tuesday, Thursday and Sundays are more critical for Ludhiana Police Commissionerate and the majority of the road accidental deaths are reported between 6 PM to 9 PM. Based upon such indicators, the effective zero-tolerance micro-level enforcement strategy required to be put in place for the entire Ludhiana Police Commissionerate.

For the detailed analysis, only numbers of fatalities in road accidents are considered due to better reporting and recording of road fatalities. Underreporting of serious and minor road accident cases due to various reasons never provide a clear picture of the area.

Human Population wise it is estimated that 12.3% of Punjab’s total population lives in Ludhiana District and vehicle wise its growing quite rapidly as compared to total vehicles registered in Punjab for past three years, but from road accidental point of view, 6.8% of total road fatalities of Punjab occurred last three year in Ludhiana Police Commissionerate.

The detailed police station wise analysis reveals that Sahnewal, Focal Point and Dehlon are the three major police stations out of Twenty-Nine police stations, in which more than 42% road accident deaths are reported that also includes CrPC cases. All of them are located on either on National Highways, State Highways or Municipal Roads which are major contributors in road accidents fatalities. Sahnewal, Delhon and Division No. 06 Police Station areas are the stations under which maximum Black spots are identified out of all the 91 identified accidental black spots in Ludhiana Police Commissionerate. District police require taking up special engineering improvement and enforcement emphasis in nearly all the police stations that have the majority of Black spots coming under their belt. Out of 91 accidental prone/critical area identified in the Ludhiana Police Commissionerate, 59(65%) of them are on National Highway, this requires the immediate attention of National Highways and PWD authorities through district and state administration. On all such accidental black spot, immediately road marking, road signs and street light with more illumination than rest of the street/road shall be put in place to avoid any further road accidents. 18% of the total road fatalities in the last three years are reported on Municipal Corporation roads. This requires special attention of the Department of Local Government, Punjab.

Through notified “District Road Safety Committees” under the chairmanship of Deputy Commissioner, the matter of engineering improvement of 91 accidental black spots shall be take-up with the active support of National Highways Authority of India (NHAI), PWD (B & R) and local bodies at the earliest. People working under the administration who have a better knowledge of the entire area needs to be roped in to improve the stretches that are vulnerable through proper road safety and road engineering interventions. Bad road geometrics at intersections, Over speeding, wrong parking of trucks along the roadside, undivided highways, Unfinished road Constructions, non-existence of formal Bus Stops, safe pedestrian and cyclist facilities are the key areas where engineering and planning interventions are required immediately. It is pertinent to mention here that, while doing the engineering improvement, kindly avoid foot over bridges as a solution for the safe movement of the pedestrian. Research proved that no one use foot over bridges and such infrastructure do no facilities pedestrian or cyclist but the fast movement of the motorist. Honourable Punjab and Haryana High Court also made the same observation in one of the on-going cases CWP 17530 of 2010. Majority of the road accident victims are two-wheeler

and pedestrian which amounts to 80% of total cases and are impacted largely by Truck/Buses and Cars/Jeeps, apart from engineering improvements effective enforcement at impacting vehicles and victim side is required (target hardening). School falling on National Highways or on Main roads requires special attention of the authorities.

Usage of helmet and seat belt found minimal in Ludhiana Police Commissionerate. Immediately to increase awareness regarding seat belt and helmet with consistent enforcement strategies and ground implementations are desirable. Overall with a target of reducing minimum 15-20% of road fatalities in 2019 is required to be fixed for this critical district. For any additional requirement of enforcement or challan machines, the request can be made through road safety fund. Each police station shall develop its own patrolling and challan strategy in order to improve enforcement within Ludhiana Police Commissionerate.

1.1. About Ludhiana District

Ludhiana consists of the Old City and the New City (or the residential and official quarters of the Colonial British encampment, traditionally known as Civil Lines; as opposed to the Army Lines, which no longer exist as the British Cantonment was abandoned in 1845.

Ludhiana is well connected by rail as it is on main Delhi-Amritsar route and is an important railway junction with lines going to Jalandhar, Ferozepur, Dhuri and Ambala. The city is very well connected with daily or weekly trains to most places in India including the major cities Delhi, Mumbai and Kolkata. For administrative reasons the station is under administrative control of Ferozepur Railway Division. The Indian railways has even started construction of a dedicated freight track between Ludhiana and Kolkata. Ludhiana will now be connected by air with Delhi soon. Various partners will have daily flight between New Delhi and Ludhiana.

Moving inside the city is done mostly by mini-buses, auto-rickshaws, and pedal rickshaws, licensed by the Municipal Corporation. The government has a plan for construction of a metro in Ludhiana. Ludhiana District have NH road network of 144.7 Kms, 56.27 of State Highways, 189.19 Kms of MDR, 517.60 Kms of ODR and considerable length of roads under Municipal Corporation.

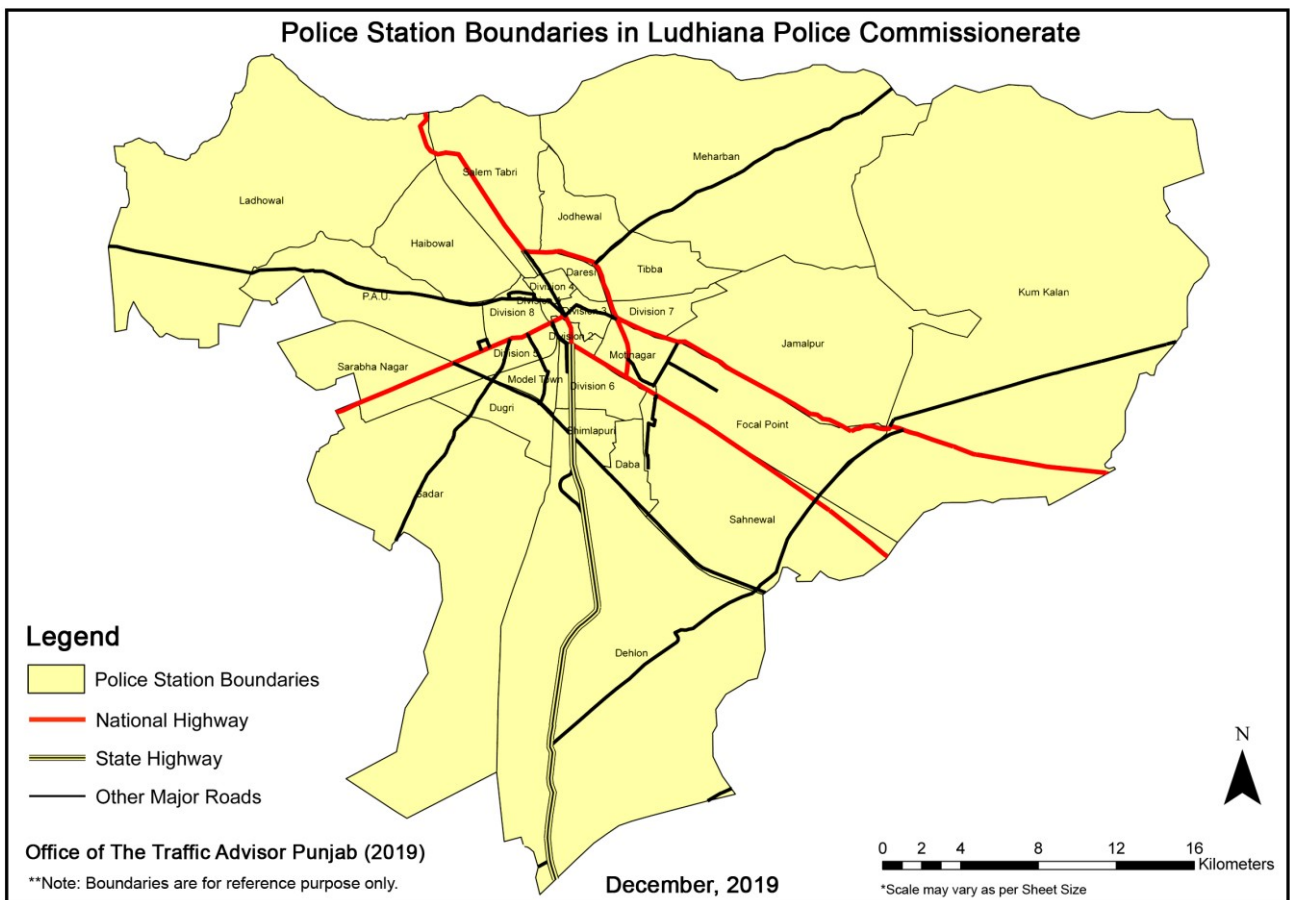


Figure 1: Boundary Map of Various Police Stations within the Ludhiana Commissionerate Area

1.2. Road Accident Scenario in Ludhiana Police Commissionerate

- i. On average, 27 people are losing their lives every month in various Road Accidents within the Ludhiana Police Commissionerate.
- ii. In the past two years, a decrease from 357 road fatalities in 2016 to 332 in 2017 and a drastic decline to 288 road fatalities in 2018 respectively was observed in Ludhiana Police Commissionerate. At the same time, the Punjab state recorded overall inclined trend of 6% in road fatalities.
- iii. Overall Ranking based upon road accident fatalities per million population of Ludhiana Police Commissionerate is at number 157, amongst all the districts of Punjab is at number 10 in the year 2018.
- iv. Number of road accident fatalities per million populations (against 10 lakh) of Ludhiana Police Commissionerate (Health burden due to traffic) in the year 2018 was 157, against the state's average of 155 and National average of 110.
- v. In Ludhiana Police Commissionerate, 80% of the total road fatalities are occurring on National and Municipal Corporation roads. In which 49.3% is shared by National Highways and 30.6% being on Municipal Corporation roads.
- vi. *Approximately 145 km long National Highways are passing through Ludhiana District and are the most accidental prone stretches. The death rate on National Highway-44 alone passing through Ludhiana Police Commissionerate is approximately 9 per kilometer in the past three years. This is 8 times higher than the state average. 59 accidental black spot falls on 56 kilometers of NH length makes it the most critical road section within Ludhiana Police Commissionerate.*
- vii. Over speeding, traffic violation and rough driving are the leading causes of deaths in Ludhiana Police Commissionerate. Police Stations of Sahnewal, Dehlon, Focal Point and Salem Tabri contribute nearly 48% of total accidents in Ludhiana Police Commissionerate.
- viii. Month-wise, mainly February, October and November are the most critical months in Ludhiana Police Commissionerate. In these months, the road accident fatality rate is much above the yearly average of 27 road accidental deaths per month in the past three years.
- ix. Tuesday, Thursday and Sundays are the most critical days accounting to 48% of total road fatalities in Ludhiana Police Commissionerate. On these days, 20-30% more road fatalities compared with a daily average of past three years i.e. 139 deaths/day occurred.
- x. Maximum road accident fatalities occurred between 06 PM to 09 PM in the Ludhiana Police Commissionerate. It accounts for 24.7% of total road accidental fatalities in the past three years.
- xi. Ludhiana Police Commissionerate is recorded with one of the highest motor vehicle registration along with SAS District.

- xii. The gender-wise comparison in road accident deaths in Ludhiana Police Commissionerate revealed that the total number of males and females killed during the last three years were in the ratio of 87%: 13% respectively.
- xiii. As per the socio-economic cost analysis, *1036 Crore* rupees were lost due to road accidents in Ludhiana Police Commissionerate in the past three years.
- xiv. Ludhiana Police Commissionerate has 91 accidental black spots, out of which 59 are on National Highways and 16 on Municipal Roads. On these black spot, more than 5 fatal or serious accidents took place in the last three years. On these spots, in the last three years, 524 people lost their lives and 346 got seriously injured.
- xv. Traffic Police enforcement-wise, a total staff of *240 police persons* are deployed on various Traffic duties in the Ludhiana Police Commissionerate.

Table 1: Comparison of Road Safety Indicators India, Punjab and Ludhiana (2018)

Head	India	Punjab	Ludhiana District
Total Road Network (km)	54,72,144 (as per NHAI record)	70,912 (1.3% of country's total road network length)	907.76 kms
The total length of National Highways(km)	96,260.72 (1.79% of total road network length)	2,677 (2.8% of the total road length within the state)	144.7 kms (16% of the total road length within the district)
Total Area (Sq.km)	32,87,240	50,362	3767 approx.
Road length available per sq.km area	1.01	1.40	Unknown
Total Estimated Population (2018)	1,354,051,854¹	305,01,248 (2.3% of India's Population)	38,51,670 (12.6% of Punjab's Population)
Total road accident fatalities (2018)	1,48,697	4,725	288
Fatalities per million population (Health Burden due to traffic)	110	155	157

¹ <https://www.worldometers.info/world-population/india-population/> accessed on 16th May 2019.

2. Detailed Road Accident Analysis of Ludhiana Commissionerate area

2.1. Police Station Wise Road Fatalities

Sahnawal, Focal point, Dehlon, Salem Tabri & Kum Kalan are the five Police stations in which 54% of the total road accident fatalities are reported in the last three years. Majority of the accidental black spot areas fall within the jurisdiction of these police stations only. These critical police stations have their major portion falling in the area from where National Highway crosses. These Police stations also contributes to most fatal accidents occurring in the district. It is to be taken into account that the Critical points falling on National Highway within these police stations need proper attention for their rectification. Police station wise distribution of road accidental fatalities is shown in Table 2.

Table 2: Year & Police Station Wise Summary of Road Accident Fatalities in Ludhiana Commissionerate

Police Stations/Cases	IPC (Cognizable)				CrPC (Non-Cognizable)				Total			
	Cases	Fatal	Serious	Minor	Cases	Fatal	Serious	Minor	Cases	Fatal	Serious	Minor
Daba	29	19	17	5	2	2	0	0	31	21	17	5
Daresi	26	18	11	9	3	3	0	0	29	21	11	9
Dehlon	106	79	75	35	33	33	2	8	139	112	77	43
Div No.1	7	4	2	2	0	0	0	0	7	4	2	2
Div No.2	26	16	12	9	0	0	0	0	26	16	12	9
Div No.3	18	8	11	3	1	1	0	0	19	9	11	3
Div No.4	20	6	8	3	0	0	0	0	20	6	8	3
Div No.5	34	9	22	5	5	5	0	1	39	14	22	6
Div No.6	44	20	24	7	2	2	0	1	46	22	24	8
Div No.7	49	17	26	10	7	7	0	1	56	24	26	11
Div No.8	26	8	18	7	2	2	0	0	28	10	18	7
Dugri	29	7	23	14	4	4	0	1	33	11	23	15

Police Stations/Cases	IPC (Cognizable)				CrPC (Non-Cognizable)				Total			
	Cases	Fatal	Serious	Minor	Cases	Fatal	Serious	Minor	Cases	Fatal	Serious	Minor
Focal Point	147	109	51	19	6	6	0	1	153	115	51	20
Haibowal	35	16	20	12	0	0	0	0	35	16	20	12
Jamalpur	33	15	22	11	3	3	0	0	36	18	22	11
Jodhewal	52	38	18	10	6	6	1	0	58	44	19	10
Kum Kalan	58	42	25	19	12	12	7	2	70	54	32	21
Laddowal	44	36	17	14	14	14	3	0	58	50	20	14
Meharban	24	14	13	12	0	0	0	0	24	14	13	12
Model Town	26	12	15	10	3	3	0	0	29	15	15	10
Moti Nagar	39	19	19	7	1	1	0	0	40	20	19	7
PAU	43	18	28	7	2	2	0	0	45	20	28	7
Sadar	49	26	32	16	16	15	7	2	65	41	39	18
Sahnewal	173	140	70	35	41	42	3	16	214	182	73	51
Salem Tabri	105	60	54	16	7	7	1	1	112	67	55	17
Sarabha Nagar	36	14	16	10	2	2	0	0	38	16	16	10
SBS Nagar	24	8	12	7	2	2	0	0	26	10	12	7
Shimlapuri	32	17	13	12	4	4	0	0	36	21	13	12
Tibba	8	4	2	2	0	0	0	0	8	4	2	2
Grand Total	1342	799	676	328	178	178	24	34	1520	977	700	362

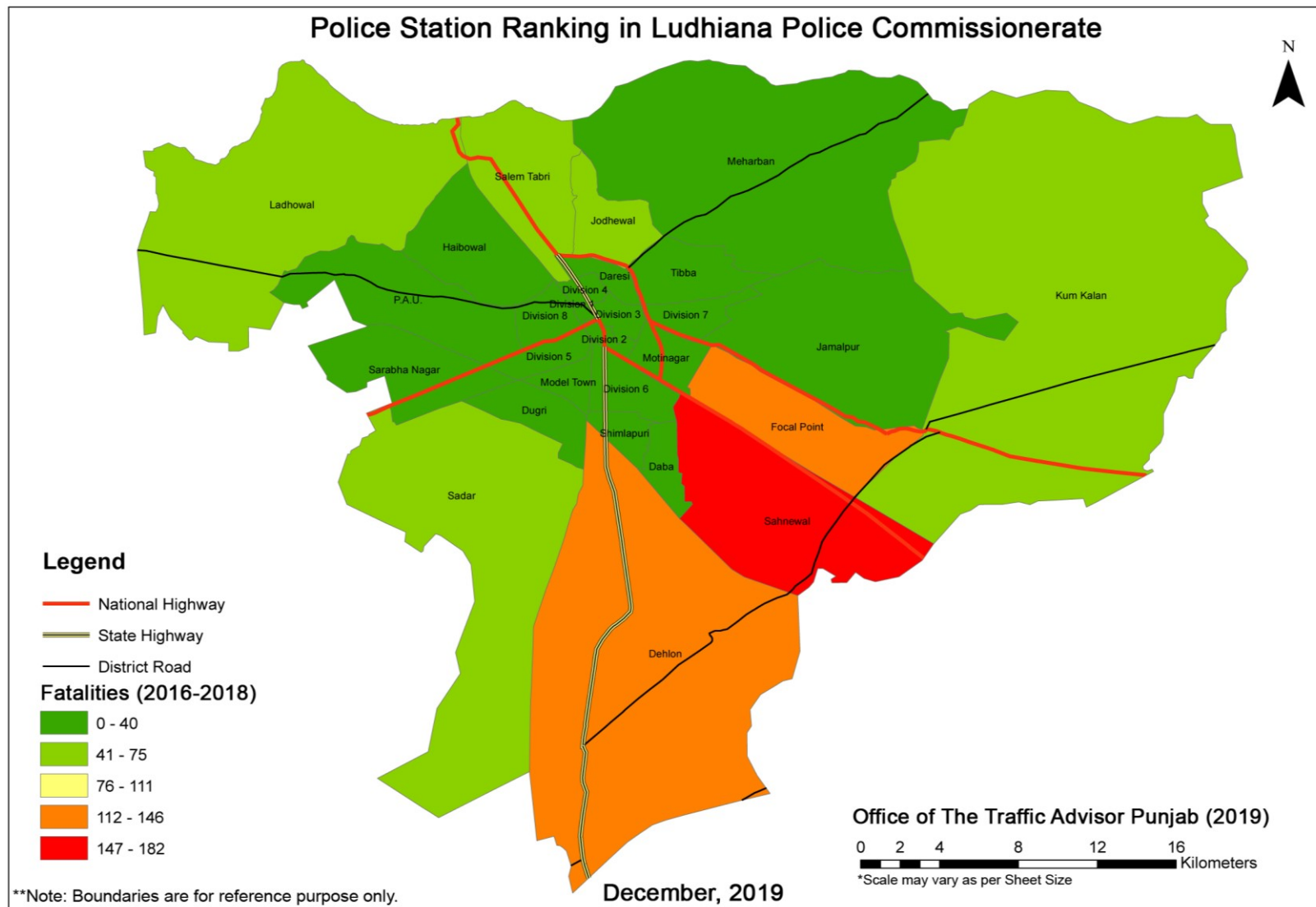


Figure 2: Thematic map showing police station wise road accident fatalities in Ludhiana Commissionerate for the Year 2016, 2017 & 2018

2.2. Police Station Wise Summary of Accidental Black Spots

Out of total 91 accidental black spot areas identified within Ludhiana Commissionerate, 59 are on National Highways, 16 on Municipal Road, 10 on a State highway, 4 on PWD/VR and 2 on GLADA roads as well. These accidental black spots are identified as per the Ministry of Road Transport and Highways Definition. *Road accident black spot on National Highways is a road stretch of about 500m in length in which either 5 road accidents (involving fatalities/grievous injuries) took place during last three calendar years or 10 fatalities took place during last three calendar years.* For the ease, the same definition has been followed for all other types of roads as well. However, it is suggested that Black spots on Municipal Roads within the core area of the city shall have lower fatalities rates to be considered as Accidental Black Spot, i.e. 3 deaths in three years. Table 3 below provides police station wise summary of all accidental black spot as per the category of the road.

Table 3: Police Station and Road Category wise Summary of Road Accidental Black Spots within Ludhiana Commissionerate.

Sr.No	Police Station	Black Spots	Road Type				
			National Highway	State Highway	Municipal Roads	PWD/VR	GLADA
1	Daba	1	0	0	0	1	0
2	Daresi	0	0	0	0	0	0
3	Dehlon	8	0	7	0	1	0
4	Div No.1	1	0	0	1	0	0
5	Div No.2	1	0	0	1	0	0
6	Div No.3	1	0	0	1	0	0
7	Div No.4	1	0	0	1	0	0
8	Div No.5	4	3	0	1	0	0
9	Div No.6	10	7	0	3	0	0
10	Div No.7	4	4	0	0	0	0
11	Div No.8	1	0	0	1	0	0
12	Dugri	1	0	0	0	1	0
13	Focal Point	4	2	0	2	0	0
14	Haibowal	0	0	0	0	0	0
15	Jamalpur	7	6	0	0	0	1
16	Jodhewal	6	6	0	0	0	0
17	Kum Kalan	4	4	0	0	0	0
18	Laddowal	2	2	0	0	0	0
19	Meharban	0	0	0	0	0	0
20	Model Town	2	1	0	1	0	0
21	Moti Nagar	2	2	0	0	0	0
22	PAU	2	0	0	2	0	0
23	Sadar	0	0	0	0	0	0
24	Sahnawal	15	15	0	0	0	0
25	Salem Tabri	6	5	0	1	0	0
26	Sarabha Nagar	2	2	0	0	0	0
27	SBS Nagar	3	0	0	1	1	1
28	Shimlapuri	3	0	3	0	0	0
29	Tibba	0	0	0	0	0	0
	Total	91	59	10	16	4	2

2.3. Month Wise Road Accidents in Ludhiana Commissionerate

Table 4: Month-wise Distribution of People Involved in Different Type of Road Crashes for the Year 2016, 2017 and 2018

Months/People Involved In accidents	Fatal	Serious	Minor
January	86	45	25
February	97	70	24
March	65	58	34
April	65	63	29
May	56	60	27
June	65	56	31
July	84	43	28
August	84	62	38
September	85	67	43
October	109	61	25
November	101	64	27
December	80	51	31
Grand Total	977	700	362

Table 5: Month and Year Wise Distribution of Road Accident Fatalities in Ludhiana Commissionerate

Month/Years	2016	2017	2018	Grand Total
January	27	29	30	86
February	30	36	31	97
March	22	21	22	65
April	17	22	26	65
May	23	17	16	56
June	33	21	11	65
July	26	33	25	84
August	33	23	28	84
September	30	28	27	85
October	37	43	29	109
November	43	37	21	101
December	36	22	22	80
Grand Total	357	332	288	977

Month-wise, if we look into the data, mainly February, October and November are the most critical months in Ludhiana Commissionerate. In these months, as per the month-wise road accident pattern, extra force in traffic enforcement and control can be deployed to reduce the number of road accident fatalities.

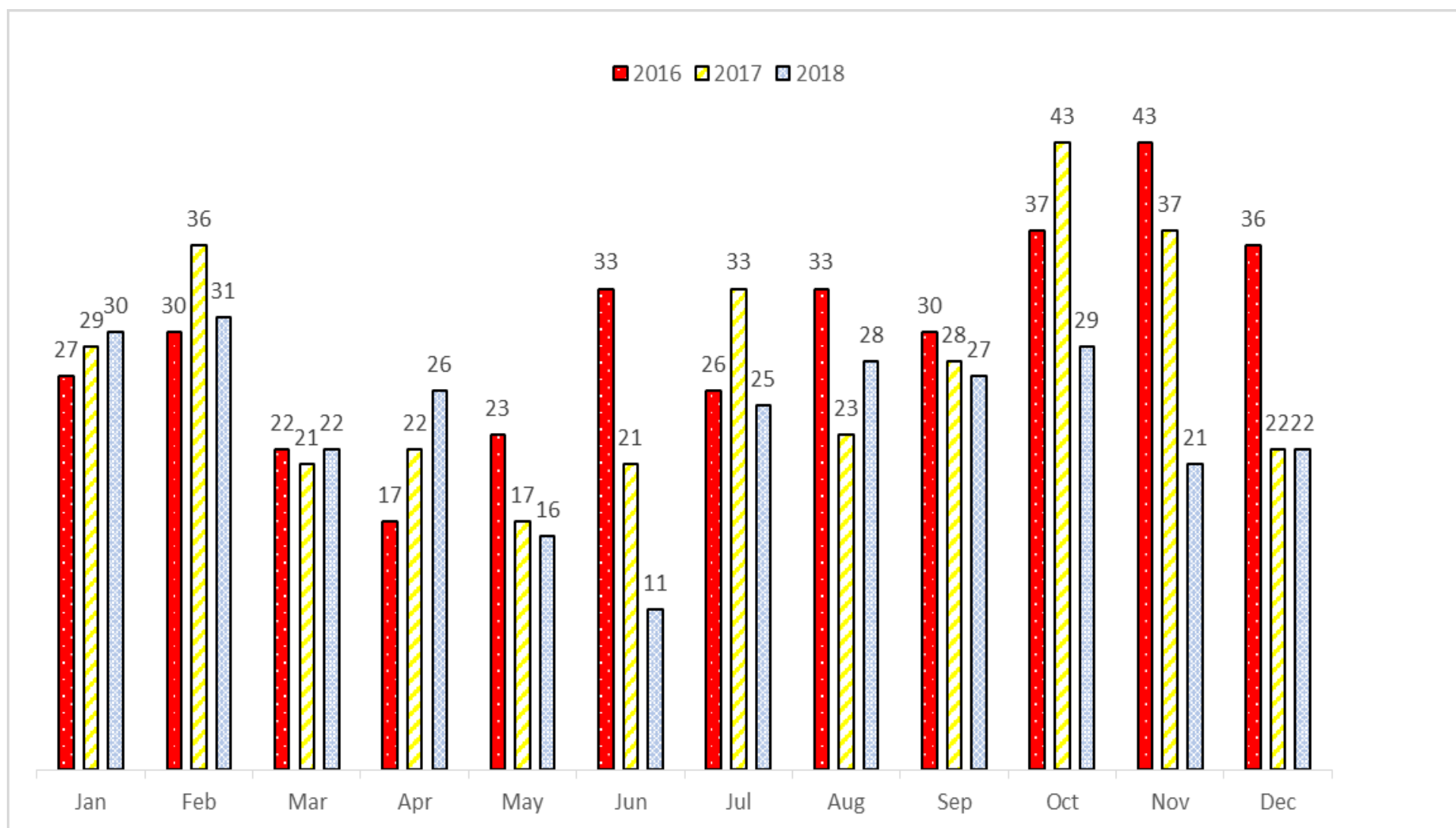


Figure 3: Month and Year Wise Distribution of Road Accident Fatalities in Ludhiana Commissionerate

2.4. Day Wise Analysis

Table 6: Day wise analysis of road accident in Ludhiana Comissionerate for the year 2016, 2017 & 2018

Day / Number of People Died	Fatal	Serious	Minor
Monday	126	86	39
Tuesday	139	84	67
Wednesday	121	87	44
Thursday	146	106	52
Friday	134	93	54
Saturday	128	112	47
Sunday	183	132	59
Grand Total	977	700	362

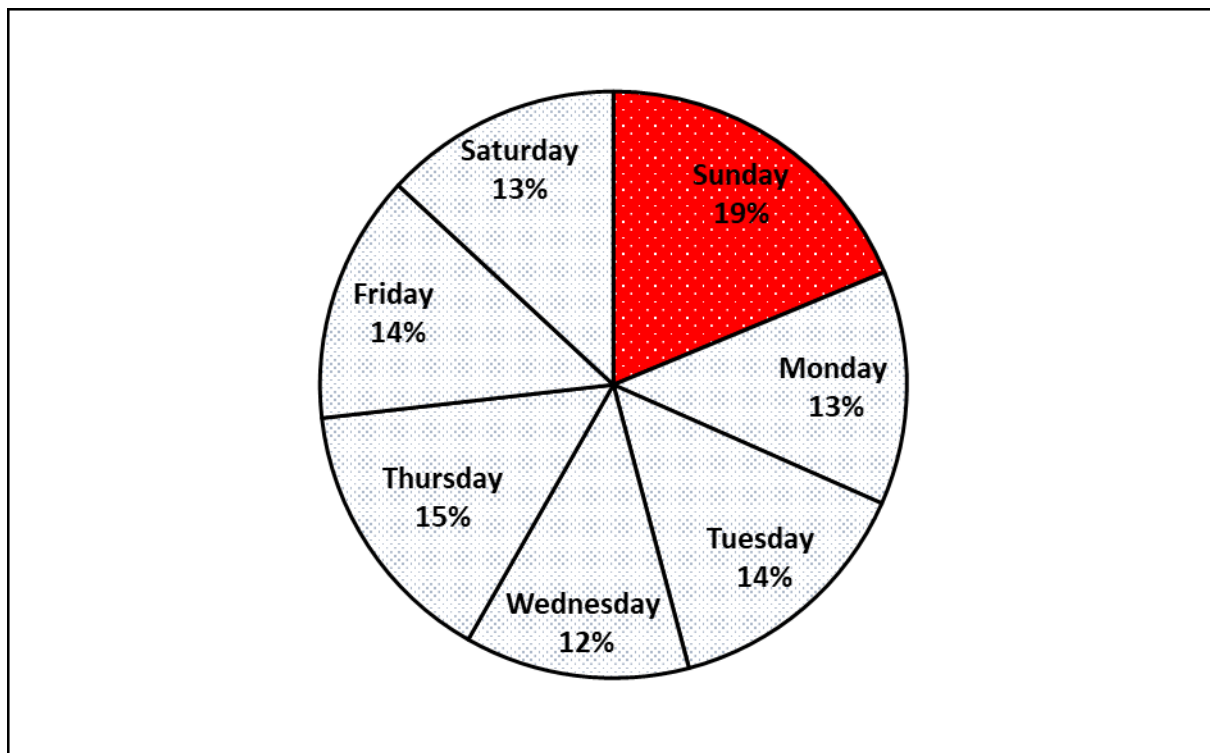


Figure 4: Day-wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

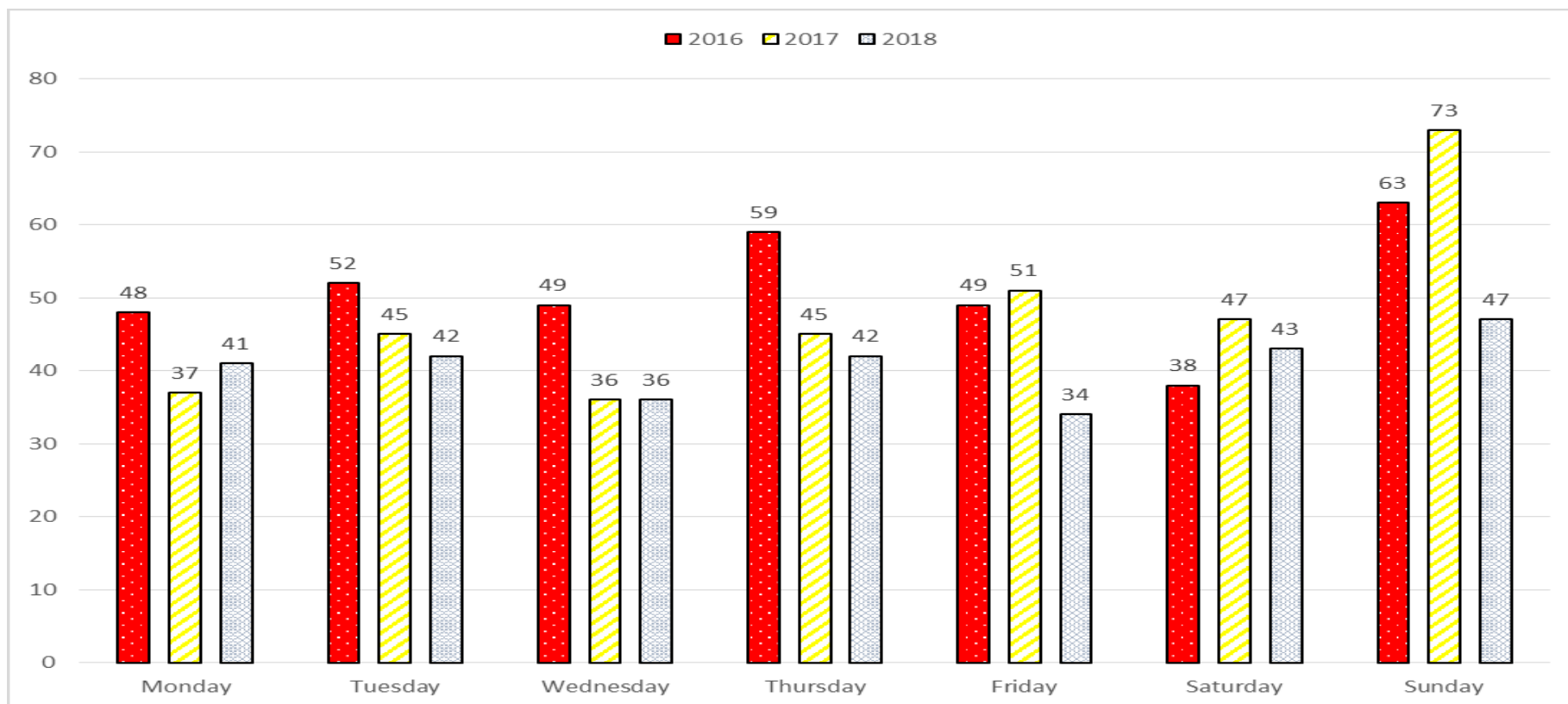


Figure 5: Day-wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

Day wise, if we look into the data mainly Tuesday, Thursday and Sunday are the most critical days accounting to 48% of total road fatalities in Ludhiana Commissionerate. On these days, 20-30% more road fatalities compared with a daily average of past three years i.e. 139 deaths/day occurred. On the critical days, as per the day-wise road fatal accident pattern, extra force in traffic enforcement and control can be deployed to reduce the number of road accident fatalities.

2.5. Time Wise Analysis

Table 7: Time wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

Time Slot	Fatalities
12AM-03AM	146
03AM-06AM	63
06AM-09AM	113
09AM-12PM	111
12PM-03PM	93
03PM-06PM	132
06PM-09PM	242
09PM-12AM	77
Total	977

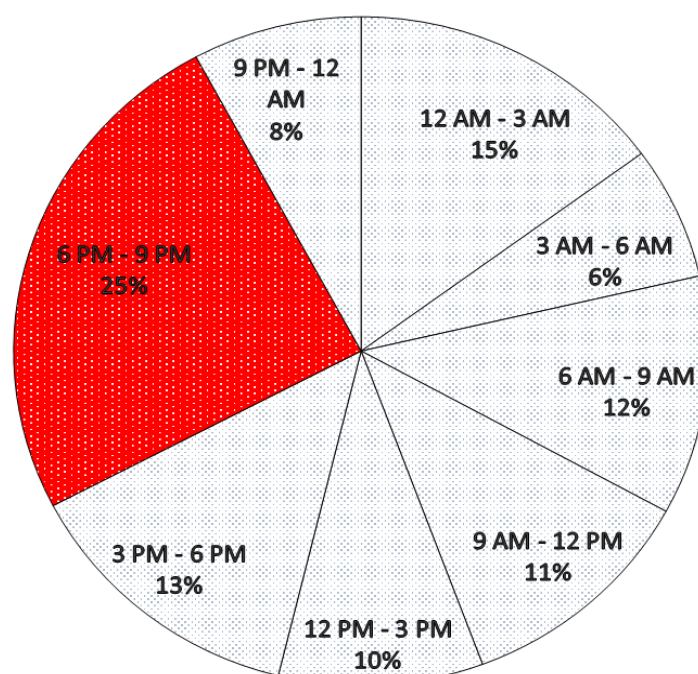


Figure 6: Time wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

Maximum road accident fatalities occurred between 6 PM to 9 PM in the entire Ludhiana Commissionerate. It accounts for 25% of total road accidental fatalities in the past three years. For effective enforcement, time of road crashes is very important. So, in that slot of time, extra force in traffic enforcement and control can be deployed to reduce the number of road accident fatalities. Each police station can develop a zero-tolerance enforcement strategy for such identified critical hours.

2.6. Crash Type Wise Analysis

Table 8: Collision wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

Collision Type	Fatal	Serious	Minor
Head-on Collision	37	77	33
Hit Animal	29	10	10
Hit Cyclist	83	57	16
Hit Fixed Object	28	13	10
Hit from Back	270	251	149
Hit from Side	101	162	97
Hit Pedestrian	333	112	25
Other	20	7	6
Skidding	64	11	15
Unknown	12	0	1
Grand Total	977	700	362

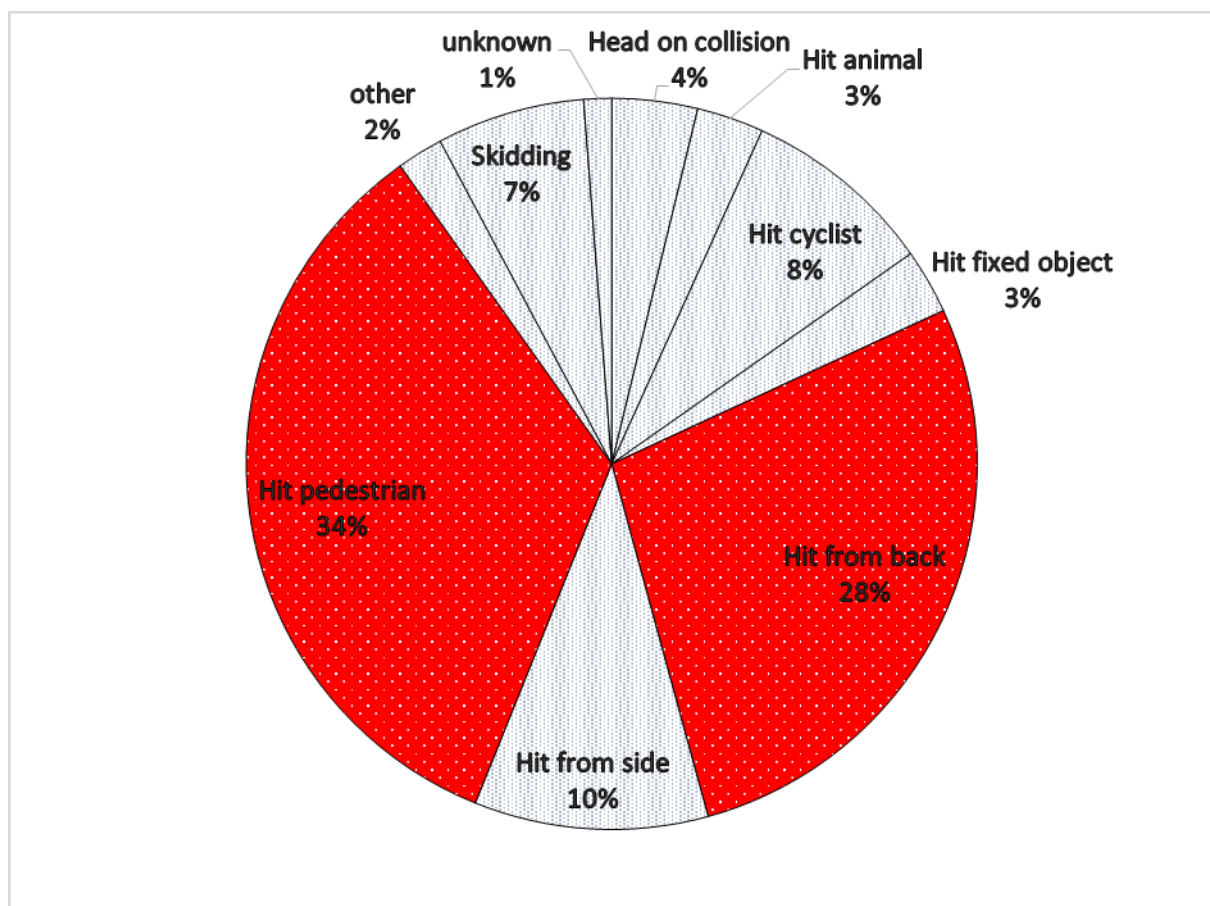


Figure 7: Collision wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

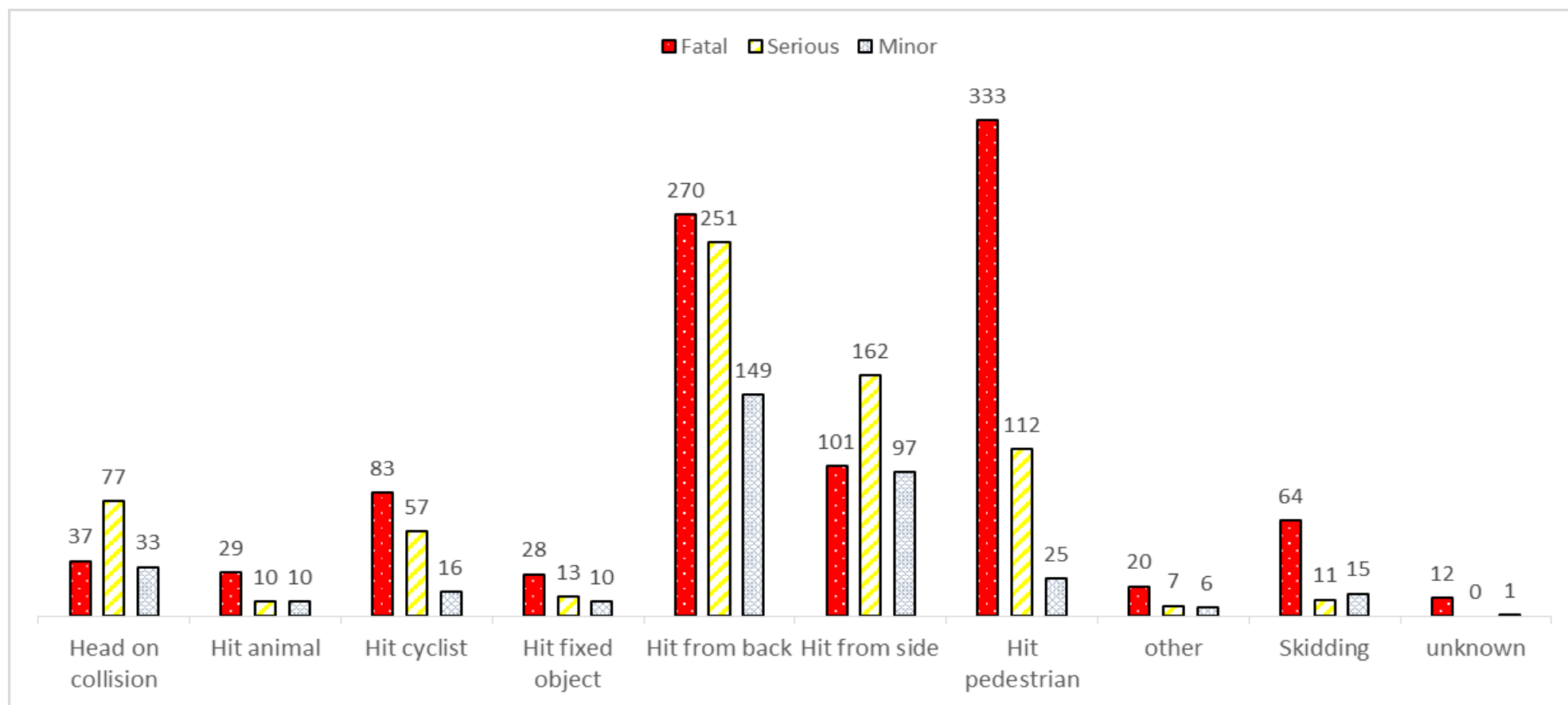


Figure 8: Collision wise analysis of road accident fatalities in Ludhiana Commissionerate for the year 2016, 2017 & 2018

From the above data, it is observed that 34% of the collisions observed are **hit pedestrians** in various road accidents, followed by 28% **hit from the back** and 10% **hit from the side**. This indicates the need for better and safe infrastructure for the pedestrians e.g. Footpaths and Cycle tracks.

2.7. Vehicles Wise Analysis

Table 9: Collision Matrix of Impacting and victim vehicles in Ludhiana Commissionerate for the year 2016, 2017 & 2018

First Vehicle / Second Vehicle	Animal Driven	Bus/ Truck	Car/Jeep /Van/Taxi	Cycle Rickshaw	Cyclist	LCV	Other	Pedestrian	Three Wheeler	Tractor Trolley	Two Wheeler	Grand Total
Animal Driven	0	0	0	0	0	0	0	0	0	0	1	1
Bus/Truck	1	3	17	2	20	2	2	50	1	4	124	226
Car/Jeep/Van/Taxi	0	2	7	2	33	0	0	116	8	1	99	268
Construction Machinery	0	0	1	0	2	0	0	4	0	0	2	9
LCV	0	0	1	0	2	0	0	7	1	0	7	18
Multi Axle Vehicle	0	0	0	0	1	0	0	0	0	0	0	1
Three-Wheeler	0	0	0	0	1	0	0	7	1	0	7	16
Tractor Trolley	0	0	9	1	5	0	0	9	2	0	43	69
Two-Wheeler	1	0	5	0	6	1	0	34	2	1	16	66
Unknown	0	2	1	0	14	0	2	115	1	0	50	185
(blank)	1	2	11	0	7	2	1	10	5	1	78	118
Grand Total	3	9	52	5	91	5	5	352	21	7	427	977
	0.3%	0.9%	5.4%	0.5%	9.4%	0.5%	0.5%	36%	2.1%	0.7%	43.7%	100.0%

From the collision matrix (Table 9), it is clear that there are two major victim groups are Pedestrian and Two-wheeler (

Table 11) and the majority of these fatal accidents are caused by Bus/Truck and Four Wheelers like Car/Jeep (Table 10). This matrix let us find the relation of vehicles moving on the road and how vehicles are vulnerable to each other. A detailed plan and provision of infrastructure need to be provided to mitigate all these mishaps in future.

Table 10: Impacting profile of vehicles in for the year 2016, 2017 & 2018

Impacting Profile	People Killed
Animal Driven	1
Bus/Truck	227
Car/Jeep/Van/Taxi	278
Construction Machinery	9
LCV	20
Three-Wheeler	23
Tractor Trolley	71
Two-Wheeler	143
Unknown	186
Other	19
Grand Total	977

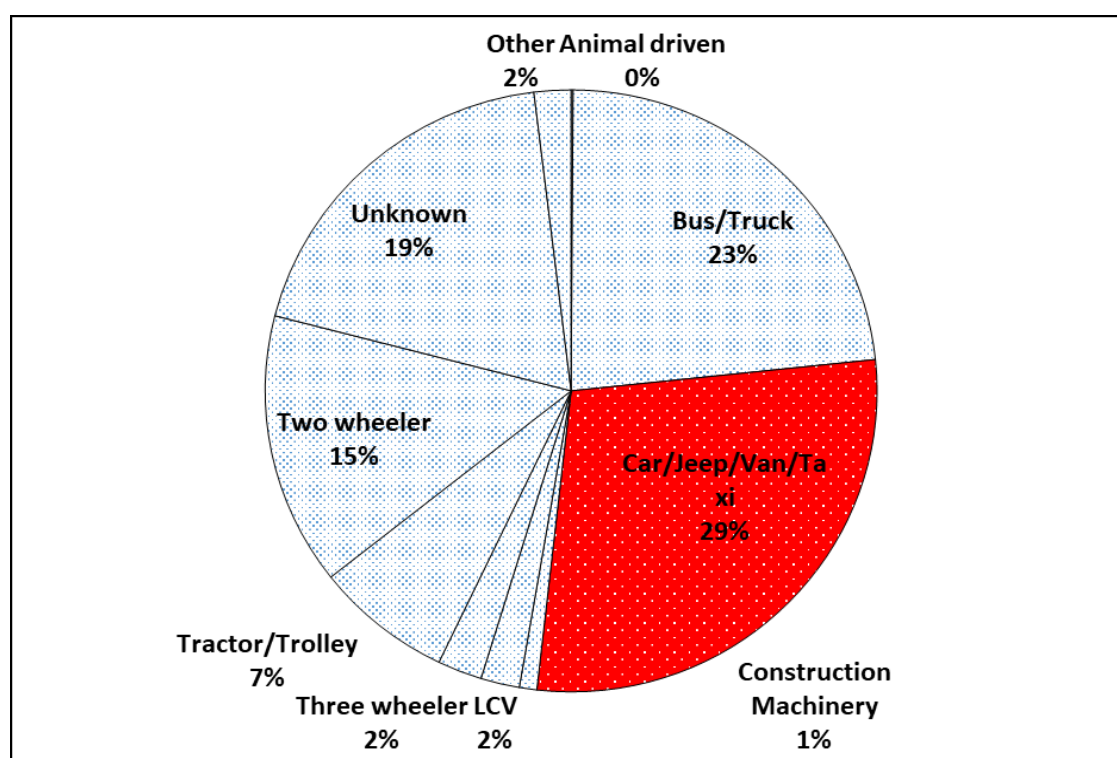


Figure 9: Impacting profile of vehicles in Ludhiana Commissionerate for the year 2016, 2017 & 2018

From the table above it is made very clear the most impactful vehicles on the roads of Ludhiana Commissionerate are the Car/Van/jeep/Taxi and Buses/Trucks which are involved in maximum number of road crashes. Other vehicles moving on the road requires the equally same amount of attention but these two needs to be tackled on immediate basis.

Table 11: Victim profile of vehicles in Ludhiana Commissionerate for the year 2016, 2017 & 2018.

Victim Profile	People Killed
Animal Driven	2
Bus/Truck	10
Car/Jeep/Van/Taxi	53
Cycle Rickshaw	5
Cyclist	91
LCV	5
Other	8
Pedestrian	349
Three-Wheeler	21
Tractor Trolley	7
Two-Wheeler	426
Grand Total	977

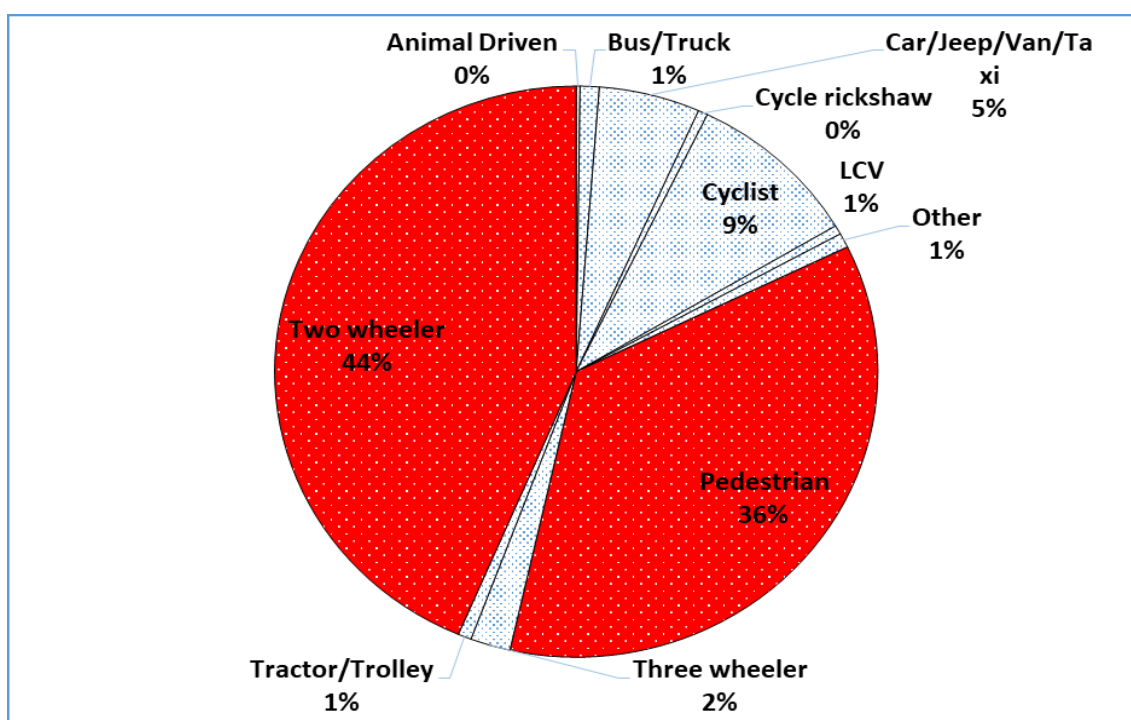


Figure 10: Victim profile of vehicles in Ludhiana Commissionerate for the year 2016, 2017 & 2018.

Majority of the accidents are caused by the Car/Jeep/Van/Taxi category of vehicle. However, the categories Bus/Truck and Car/Jeep/Van/Taxi comprise 52% of the total accident causing impact vehicles. Whereas the majority of the victim classes of vehicles in the road accidents are **Two Wheelers** and **Pedestrian**. These two vehicle classes comprise 80% of total victim vehicles in road accidents. A two-wheeler rider requires target hardening followed by control on the speed of Bus/Truck and Car/Jeeps through effective enforcement at selected locations.

2.8. Road Wise Analysis

Table 12: Road wise analysis of vehicles in road accidents of Ludhiana Commissionerate in the year 2016, 2017 & 2018

Road Type	Fatal	Serious	Minor
NH	482	250	137
SH	85	51	29
MC	299	317	141
MDR	5	9	5
ODR	14	3	6
GLADA	13	9	2
PWD	38	38	32
VR	41	23	10
Grand Total	977	700	362

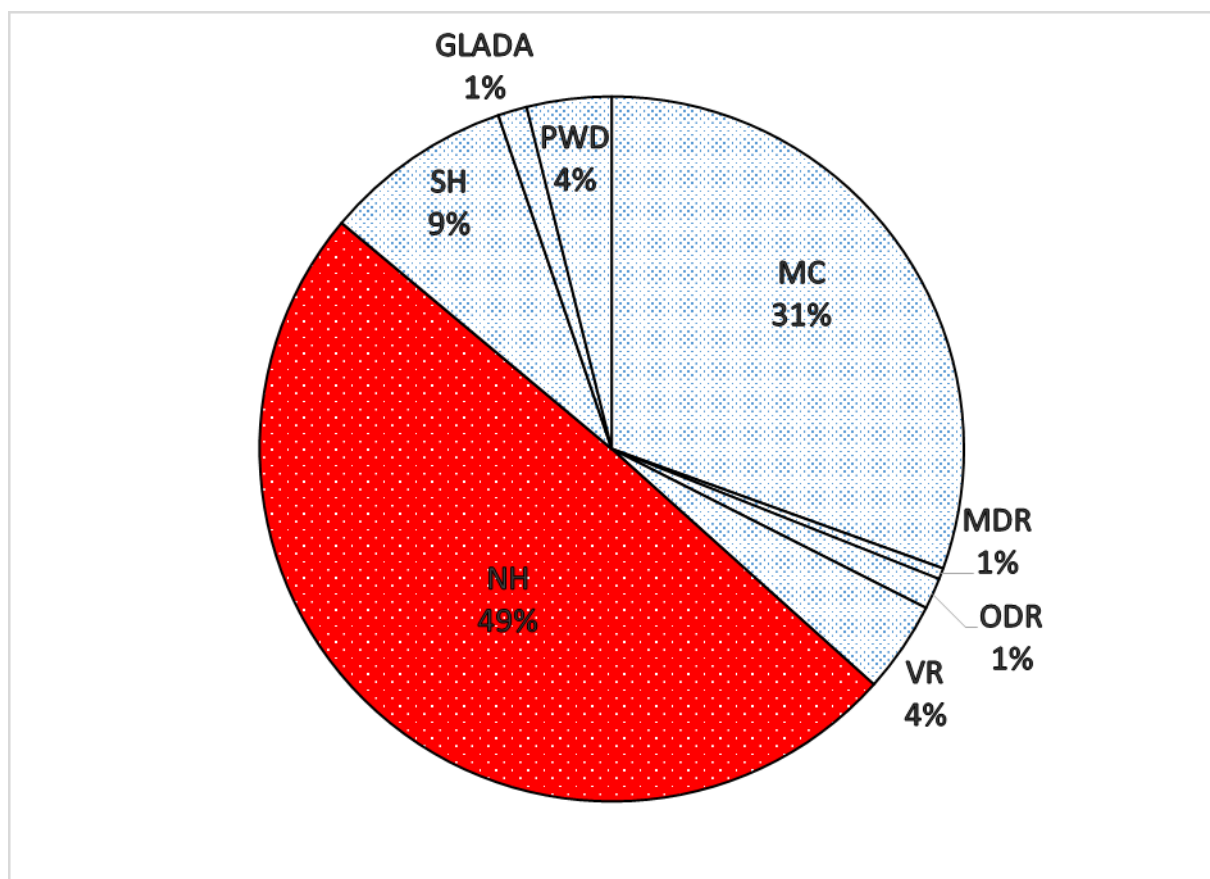


Figure 11: Road wise analysis of vehicles in road accidents of Ludhiana Commissionerate in the year 2016, 2017 & 2018.

As per the analysis summarised in Table 12, majority of the accidents took place on the **National Highways (NH) and Municipal Corporation roads** which comprises of 80% of the total road accidental fatalities in Ludhiana Commissionerate.

2.9. Victim Vehicle wise fatalities on National Highways and Municipal Corporation roads in Ludhiana Commissionerate for the year 2016, 2017 & 2018

Table 13: Victim wise Fatalities on National Highway (NH) falling within Ludhiana Commissionerate area

Year/Vehicle	Animal Driven	Bus/Truck	Car/Jeep/Van/Taxi	Cycle Rickshaw	Cyclist	LCV	Other	Pedestrian	Three Wheeler	Tractor Trolley	Two Wheeler	Grand Total
2016	1	1	20	0	17	1	2	72	0	3	74	191
2017	0	3	8	0	12	0	0	63	3	0	72	161
2018	0	0	6	0	12	0	0	59	1	1	51	130
Grand Total	1	4	34	0	41	1	2	194	4	4	197	482
Percentage	0%	1%	7%	0%	8%	0%	1%	40%	1%	1%	41%	100%

Table 14: Victim wise Fatalities on Municipal Roads (Urban Roads/Streets) falling within Ludhiana Commissionerate area

Year/Vehicle	Animal Driven	Bus/Truck	Car/Jeep/Van/Taxi	Cycle Rickshaw	Cyclist	LCV	Other	Pedestrian	Three Wheeler	Tractor Trolley	Two Wheeler	Grand Total
2016	0	0	4	1	5	0	0	38	3	0	46	97
2017	0	0	3	1	17	0	1	32	5	0	41	100
2018	0	1	2	0	14	2	0	39	2	1	41	102
Grand Total	0	1	9	2	36	2	1	109	10	1	128	299
Percentage	0%	0%	3%	1%	12%	1%	1%	36%	3%	0%	43%	100%

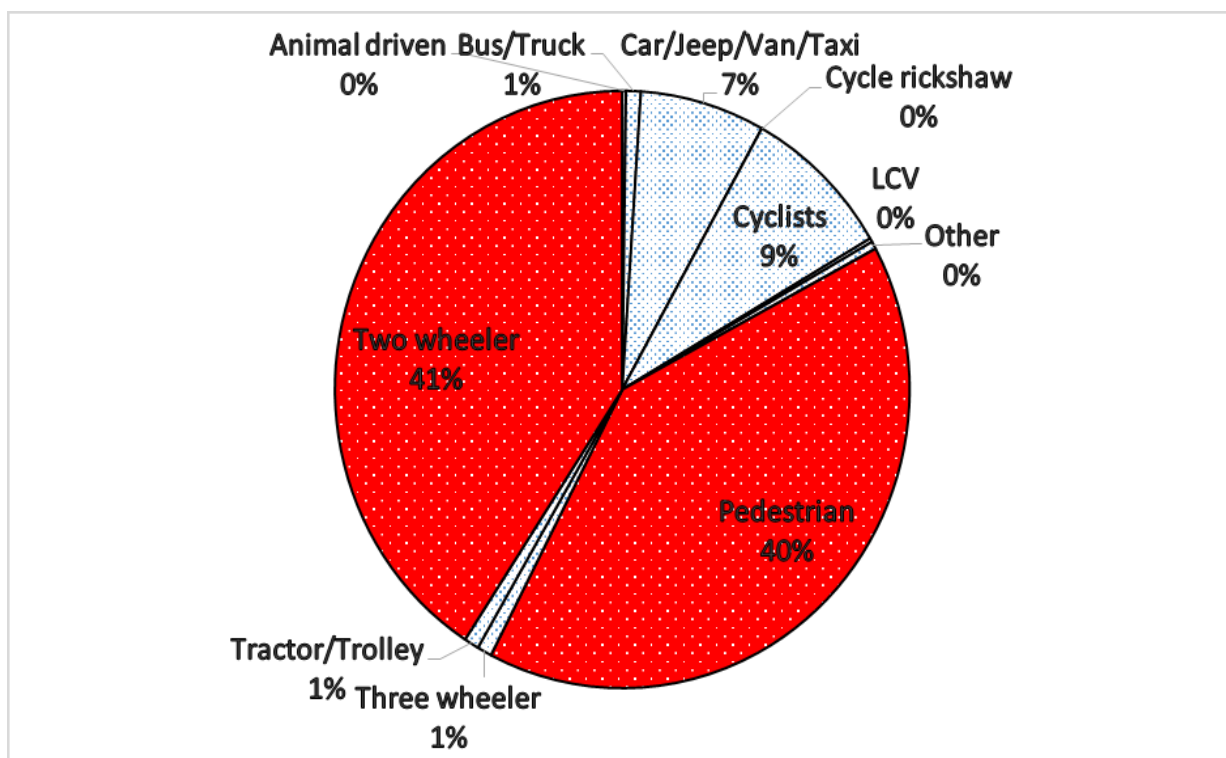


Figure 12: National Highway Victim vehicle wise fatalities percentage

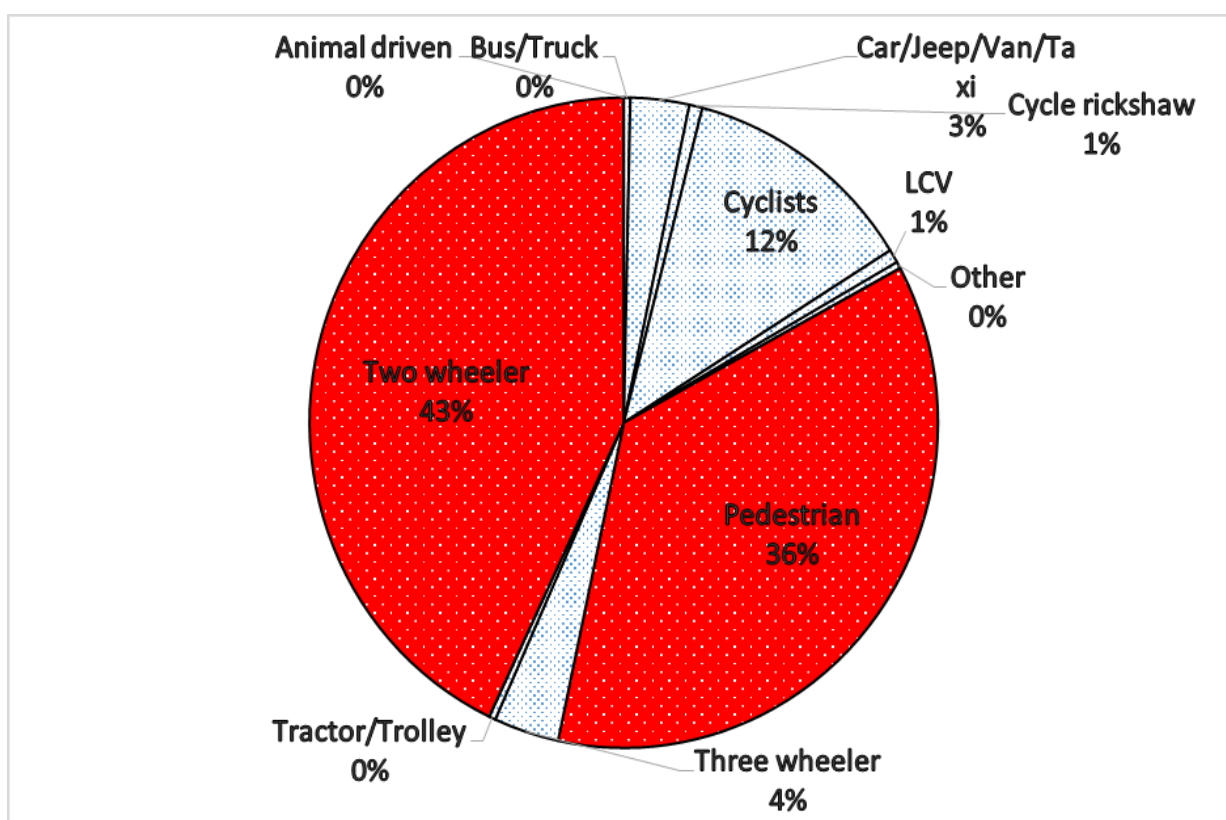


Figure 13: Municipal Corporation Roads victim vehicle wise fatalities percentage.

3. Police Station wise Detailed Road Accident Analysis in Ludhiana Commissionerate Area

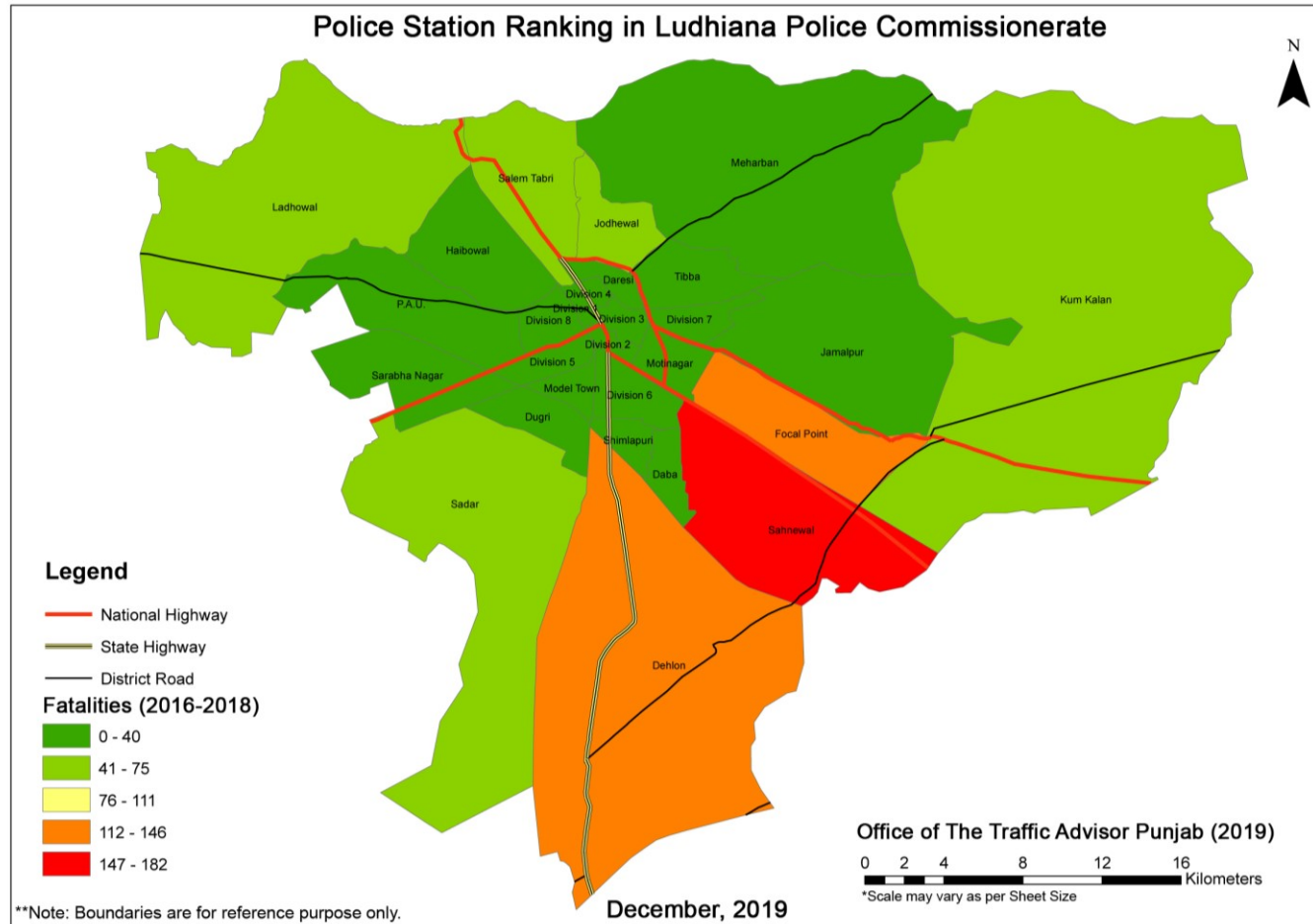


Figure 14: Geographical Boundaries of All Police Stations under Ludhiana Commissionerate District.

In this section of the report, Police station wise detailed road safety analysis of all the Police Stations Falling within the district boundary.

3.1. Month Wise and Police Station Wise Analysis of Road Accidents

Ludhiana Commissionerate is divided into twenty-nine (29) police stations. Daba, Daresi, Dehlon, Div No.1, Div No.2, Div No.3, Div No.4, Div No.5, Div No.6, Div No.7, Div No.8, Dugri, Focal Point, Haibowal, Jamalpur, Jodhewal, Kum Kalan, Laddowal, Meharban, Model Town, Moti Nagar, PAU, Sadar, Sahnewal, Salem Tabri, Sarabha Nagar, SBS Nagar, Shimlapuri, Tibba.

Table 15: Police Station wise analysis:

Police Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Grand Total	Percentage
Daba	1	3	0	2	0	3	3	2	2	1	2	2	21	2%
Daresi	0	0	1	1	0	5	1	4	3	1	3	2	21	2%
Dehlon	9	10	5	7	10	2	12	15	8	12	11	11	112	11%
Div No.1	0	2	0	1	0	0	0	1	0	0	0	0	4	0%
Div No.2	2	4	4	1	1	2	1	0	0	0	1	0	16	2%
Div No.3	3	0	2	0	1	0	0	0	1	0	2	0	9	1%
Div No.4	1	1	1	0	1	1	0	1	0	0	0	0	6	1%
Div No.5	0	2	0	1	0	1	1	3	2	1	2	1	14	1%
Div No.6	2	1	0	3	1	2	3	2	1	1	3	3	22	2%
Div No.7	2	1	2	2	3	3	0	2	1	3	3	2	24	2%
Div No.8	1	0	0	3	0	0	0	0	0	5	0	1	10	1%
Dugri	1	0	2	0	0	1	3	2	1	1	0	0	11	1%
Focal Point	12	14	3	6	5	5	13	8	11	15	10	13	115	12%
Haibowal	0	3	4	1	3	0	1	0	0	0	0	4	16	2%
Jamalpur	2	2	2	2	1	1	1	2	2	1	1	1	18	2%
Jodhewal	2	6	2	4	2	1	4	3	4	6	9	1	44	5%
Kum Kalan	3	7	7	2	8	4	1	2	6	7	3	4	54	6%
Laddowal	5	5	0	3	2	5	5	2	7	7	5	4	50	5%
Meharban	0	2	1	3	1	1	2	0	1	1	1	1	14	1%
Model Town	0	2	1	1	1	0	0	3	3	1	1	2	15	2%
Moti Nagar	0	2	3	2	0	0	1	1	2	6	2	1	20	2%

PAU	2	1	2	1	0	0	5	3	2	2	2	0	20	2%
Sadar	5	5	0	3	4	4	0	1	4	4	10	1	41	4%
Sahnawal	21	19	13	10	5	15	16	20	15	21	13	14	182	19%
Salem tabri	7	4	7	3	4	6	4	4	3	9	10	6	67	7%
Sarabha Nagar	2	0	1	1	2	0	1	1	2	1	3	2	16	2%
SBS Nagar	2	0	0	2	0	0	2	2	0	0	2	0	10	1%
Shimlapuri	2	2	2	0	0	2	1	1	3	3	2	3	21	2%
Tibba	0	0	0	0	1	1	1	0	1	0	0	0	4	0%
Grand Total	87	98	65	65	56	65	82	85	85	109	101	79	977	100
Percentage %	9%	10%	7%	7%	6%	7%	8%	9%	9%	11%	10%	8%	100%	

3.2. Day Wise & Police Station Wise Analysis of Road Accidents

Table 16: Day Wise and Police Station wise analysis

Name of Police Station/Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Grand Total	Percentage %
Daba	1	4	1	3	3	3	6	21	2%
Daresi	3	1	3	8	3	1	2	21	2%
Dehlon	13	16	10	18	15	19	21	112	11%
Div No.1	0	0	1	1	1	0	1	4	0%
Div No.2	1	5	2	5	0	1	2	16	2%
Div No.3	1	0	1	1	0	3	3	9	1%
Div No.4	2	0	1	1	1	1	0	6	1%
Div No.5	2	2	2	0	4	1	3	14	1%
Div No.6	3	2	4	3	2	5	3	22	2%
Div No.7	3	1	5	2	7	2	4	24	2%
Div No.8	2	0	1	1	0	3	3	10	1%

Dugri	2	1	2	0	1	0	5	11	1%
Focal Point	14	17	12	17	17	13	25	115	12%
Haibowal	4	1	4	2	0	1	4	16	2%
Jamalpur	1	6	1	4	2	4	0	18	2%
Jodhewal	4	7	5	9	8	3	8	44	5%
Kum Kalan	9	5	4	7	6	10	13	54	6%
Laddowal	6	9	8	4	8	4	11	50	5%
Meharban	3	4	0	0	2	1	4	14	1%
Model Town	3	1	3	2	4	2	0	15	2%
Moti Nagar	1	2	2	5	4	2	4	20	2%
PAU	5	2	3	2	3	0	5	20	2%
Sadar	9	4	7	3	5	4	9	41	4%
Sahnewal	22	27	29	21	25	32	26	182	19%
Salem tabri	5	9	2	18	9	10	14	67	7%
Sarabha Nagar	2	5	2	2	1	1	3	16	2%
SBS Nagar	0	4	1	2	2	1	0	10	1%
Shimlapuri	4	4	3	4	1	1	4	21	2%
Tibba	1	0	2	1	0	0	0	4	0%
Grand Total	126	139	121	146	134	128	183	977	
Percentage %	13%	14%	12%	15%	14%	13%	19%	100%	

3.3. Time Wise & Police Station Wise Distribution Analysis of Road Accidents

Table 17 : Police Station - time wise matrix for road accidental fatalities

Police Station/Hours	12AM-03AM	03AM-06AM	6AM-9AM	09AM-12PM	12PM-03PM	03PM-06PM	06PM-09PM	09PM-12PM	Grand Total	Percentage %
Daba	6	2	2	4	2	0	2	3	21	2%
Daresi	3	2	3	2	2	5	1	4	21	2%
Dehlon	17	3	14	13	11	13	28	13	112	11%
Div No.1	0	0	1	0	1	0	0	2	4	0%
Div No.2	5	2	0	3	0	0	3	3	16	2%
Div No.3	1	1	0	3	0	1	2	1	9	1%
Div No.4	2	1	0	1	0	1	0	1	6	1%
Div No.5	5	0	0	1	3	2	2	1	14	1%
Div No.6	2	3	4	2	5	1	1	4	22	2%
Div No.7	5	1	2	1	1	2	9	3	24	2%
Div No.8	4	0	0	1	1	1	1	2	10	1%
Dugri	2	2	3	0	2	0	1	1	11	1%
Focal Point	3	4	10	15	13	15	37	19	115	12%
Haibowal	4	2	2	1	2	1	2	2	16	2%
Jamalpur	3	0	4	2	2	2	2	3	18	2%
Jodhewal	7	0	3	10	4	5	9	6	44	5%
Kum Kalan	7	1	10	3	4	4	16	9	54	6%
Laddowal	14	2	2	5	5	4	14	4	50	5%
Meharban	0	0	3	2	2	4	3	0	14	1%
Model Town	0	4	1	1	2	1	2	4	15	2%
Moti Nagar	3	0	1	5	1	3	2	5	20	2%
PAU	5	0	1	4	3	3	3	1	20	2%

Sadar	7	1	1	6	3	6	13	4	41	4%
Sahnewal	19	5	29	22	18	14	54	21	182	19%
Salem tabri	7	2	8	5	1	4	25	15	67	7%
Sarabha Nagar	1	0	1	4	3	1	3	3	16	2%
SBS Nagar	3	0	0	1	2	1	1	2	10	1%
Shimlapuri	4	0	0	2	2	4	5	4	21	2%
Tibba	0	0	0	0	1	2	1	0	4	0%
Grand Total	138	38	105	119	95	100	242	140	977	100%
Percentage %	14%	4%	11%	12%	10%	10%	25%	14%	100%	

4. Accident Black Spots in Ludhiana Commissionerate

4.1. Black Spot Identification – An Overview

This chapter deals with the procedure for identification of vulnerable locations or black spots as they are often called. The procedure described is based on recorded accidents through a thorough analysis of FIRs, data about accidents, traffic conditions, nature of accident, and accident per given road stretch. Other methods that can be used as complements to accident data are not dealt with in this chapter. Examples of such methods are field investigations, conflict studies, questionnaires, and interviews, etc.

Identification is a first step in improving road safety at a black spot. It has to be followed by a diagnosis of the selected spots, finding countermeasures, estimating effects and costs, prioritizing, implementation and at last follow-up and evaluation. These latter stages are discussed in the report. In this chapter, the identification method used by the researchers is purely based on the accident data available at the Police stations and then analysing the same by the help of various software like GIS and others.

4.2. Black Spot identification goals and targets

The overall aim for road safety exercise is to fulfil the safety goals and targets. The goals do not only decide what resources are needed but also influence which mitigation measures should be applied. Goals can, for instance, state that fatalities and severe injuries are to be decreased to or below a certain number. In such a case, mitigation measures aiming at severe casualties are most important and accidents can be allowed to happen as long as they do not result in severe or fatal injuries. On the other hand, if goals are set for accidents, then the mitigation measures should aim at reducing all accidents.

The process of deciding goals and targets is in itself a useful exercise. It increases the safety awareness among involved organizations. So, goals and targets are necessary for future safety work.

If severe accidents are to be reduced, it is necessary to decrease accidents occurring at high speeds and pedestrian accidents, since they often lead to severe consequences. In that case, slight accidents are less interesting, for instance, accidents when a vehicle leaves the roadway where the roadside is flat and without any hazardous objects.

4.3. Methodology adopted

Data Collection: In order to determine the accident-prone locations in Ludhiana Commissionerate, the following data were collected and used.

Police stations limit map obtained from Head office as well as digitized the same using GIS. Accident FIR report analysis for the years 2016, 2017 and 2018. Mapping of the Blackspot as per the given definition.

Collection of Ground Control Points: The GCPs are collected with the help of the GPS. Here there are 91 GCPs collected. From the analysis of FIR reports of Ludhiana Commissionerate.

Data processing: data processing involves the following three steps. The flow chart of the data processing is shown below figure.

Georeferencing: Scanned maps usually do not contain information as to where the area represented on the map fits on the surface of the earth. To establish the relationship between an image coordinate system and a map (x, y) coordinate system we need to align or geo-reference the raster data.

Digitizing: Digitizing is the process of encoding the geographic features in digital form as x, y coordinates. It was carried out to create spatial data from existing hard copy maps and documents. In the Present work, the georeferenced raster image of Ludhiana Commissionerate area is digitized using GIS software with the external help from a GIS expert. This type of digitization is called onscreen digitization. Road network of the study area was digitized as line features. Accident locations are digitized as point features. The above spatial data were organized in a personal geodatabase and feature class. The exact location of accidents was identified by using the measure tool in Arc GIS. By using the measure tool, the spatial location of a particular accidental black spot can be marked by knowing cluster that is vulnerable.

Listing of Black Spots: After Cluster analysis of accidents that are been marked on the map, a proper site visit was done to have photographic evidence of the vulnerable stretch which would be helpful in suggesting mitigation measures to the authorities to reduce the road fatalities.

Elimination of Black Spot

The process of eliminating or improving accident black spots in a road network is composed of several activities, as illustrated in the following figure.

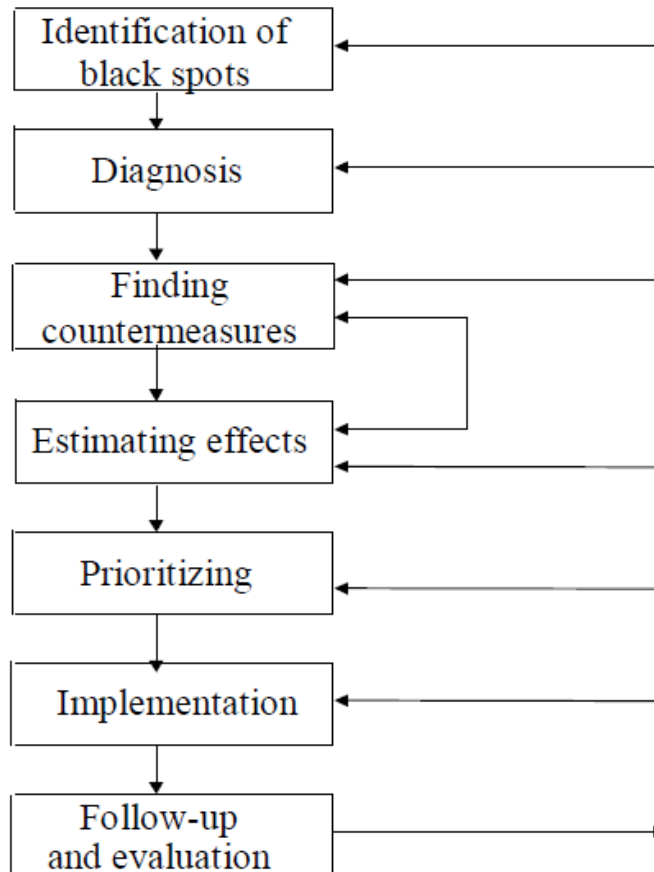


Figure 15: Process of eliminating Black Spot

Identification of black spots is the procedure to locate those spots in the road network that is particularly dangerous, that is, the black spots.

Diagnosis is the process to study what are the problems, the accident contributing factors and the deficiencies for each of the identified black spots.

Finding countermeasures implies a methodical analysis to design suitable countermeasures for each black spot, based on actual problems and deficiencies.

Estimating effects is the process to estimate the safety effects (and if necessary, also other effects) and costs of suitable countermeasures.

Prioritizing implies finding the best action plan (or investment program), according to some defined criteria, and based on estimated effects and costs as well as budget restrictions.

Implementation is the actual realization of the prioritized measures included in the action plan (or investment program).

Follow-up and evaluation are the last and very important step, which aim is to assess the actual results (effects and costs).

4.4. Prioritization of Accident Black Spots

The accident-prone spots were analysed based on the MoRTH definition of Black spots and prioritized based on the District-wise Accident Severity Index (ASI) value.

Definition of Black spot (MoRTH): According to Ministry of Road Transport & Highways (MoRTH), Government of India, road accident black spot on National Highways is a road stretch of about 500m in length in which either 5 road accidents (involving fatalities/grievous injuries) took place during the last three calendar years or 10 fatalities took place during the last three calendar years.

According to the National Highway Authority of India (NHAI), hazardous locations are evaluated based on *Accidents Severity index (ASI)*. Hazardous spots with Accidents Severity Index (ASI) more than the Threshold value ($\text{Average Severity} + 1.5 \times \text{Standard Deviation}$) will be treated as Black spots. For estimation of ASI, the weightage to the fatal accident will be assigned as 7 and to grievous injury accident as 3, was considered based on NHAI's criteria.

The threshold value computation formula for first order, second order, third order, fourth and fifth order priority black spots are given in Table 18.

Table 18: Threshold value of priority black spots

Priority	Threshold Value
First order black spots	Average Severity + 1.5*Standard Deviation
Second order black spots	Average Severity + Standard Deviation
Third order black spots	Average Severity + 0.5*Standard Deviation
Fourth order black spots	Average Severity
Fifth order black spots	Below Average Severity

A total of 91 accidental black spots have been identified in Ludhiana Commissionerate area based on MoRTH's definition and prioritized based on district-wise ASI value. Out of these 91 black spots, 59 are on National Highways, 16 are on Municipal roads and 10 are on State Highways and Majority of these Accidental Black spots are road intersections. Table 19 provides the complete list of these identified accidental black spots, along with details of accidents and geographical coordinates.

Table 19: List of Accident Black Spots in Ludhiana Commissionerate.

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
1	Cheema chowk	Div No.6	NH	30.898231	75.872548	2	2	1	2	5	1	30	5
2	Bhai wala chowk	Div No.5	NH	30.902262	75.832301	3	2	0	2	4	2	28	5
3	Eastman Caste & Forge Ltd	Sahnewal	NH	30.849951	75.950386	7	5	2	17	4	3	134	1
4	Goyal Jeep showroom	Sahnewal	NH	30.858156	75.937076	5	0	1	5	3	2	46	5
5	Lalton dana	Kum Kalan	NH	30.85355	76.058191	4	1	1	5	5	2	52	5
6	Saggu chowk	Div No.8	MC	30.902167	75.821342	5	0	2	2	6	0	32	5
7	Aarti Steels Ltd	Moti Nagar	NH	30.901871	75.905396	1	4	2	2	5	2	31	5
8	Giaspura Flyover	Div No.6 + Sahnewal	NH	30.87892	75.8991	3	3	2	7	1	1	53	5
9	Jawaddi canal bridge	SBS Nagar	PWD	30.882243	75.833465	4	2	1	4	3	0	37	5
10	Red Mango Restaurant	Sahnewal	NH	30.822675	75.99369	1	3	2	4	2	2	36	5
11	Vardhaman chowk	Div no.7	NH	30.905795	75.892355	2	5	1	4	5	1	44	5
12	Kohara Chowk	Kum Kalan + Focal Point + Jamalpur	NH	30.867445	76.005071	3	1	2	6	1	1	46	5

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
13	Govt school, Mundian Kalan	Jamalpur	NH	30.893245	75.926496	3	3	2	6	2	1	49	5
14	Gur. Baba Bagga singh Ji, Jodhewal	Jodhewal	NH	30.932633	75.867506	2	1	3	4	3	1	38	5
15	Dhandari Kalan Bus stop	Sahnewal	NH	30.873898	75.909266	7	8	2	14	5	1	114	1
16	HP Station, Industrial area-A	Div No.6	NH	30.904826	75.881686	3	0	2	4	1	0	31	5
17	Oswal woollen mills	Div No.6	NH	30.881451	75.894491	6	0	1	4	4	0	40	5
18	Hanuman Mandir, Sherpur chowk	Div No.6	NH	30.882948	75.890973	3	3	0	6	3	2	53	5
19	Karabara Chowk	Salem Tabri + Jodhewal	NH	30.936781	75.845943	4	2	1	5	4	0	47	5
20	Transport Nagar	Div No.6	NH	30.896951	75.883835	3	2	2	6	2	0	48	5
21	Dhandari Flyover	Sahnewal	NH	30.865821	75.924368	3	6	10	16	6	5	135	1
22	Jagraon bridge	Div no.1 + Div No.8	MC	30.909151	75.851483	5	0	1	4	3	1	38	5
23	Swani Motors	Sahnewal	NH	30.876673	75.903458	3	4	3	10	2	2	78	3
24	Sahnewal Bridge	Sahnewal	NH	30.8365	75.973268	7	10	6	22	8	6	184	1

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
25	Greenland school	Salem Tabri	NH	30.941846	75.833163	9	6	2	11	6	2	97	1
26	Hotel Nav Classic	Moti Nagar	NH	30.909408	75.883018	2	1	3	1	5	0	22	5
27	Bhogal cycles, Dhandari Kalan	Sahnewal	NH	30.868538	75.919556	3	7	3	10	5	0	85	2
28	Indian oil, Vardhaman	Div No.7	NH	30.907307	75.888497	2	3	2	3	4	2	35	5
29	SEL Textiles	Sahnewal	NH	30.862483	75.929625	3	4	1	8	2	1	63	4
30	Mohandai Oswal hospital	Div No.6	NH	30.889726	75.884218	2	1	4	4	4	0	40	5
31	Sabji Mandi chowk	Haibowal + PAU	MC	30.916581	75.80887	1	1	4	3	4	0	33	5
32	Ramgarh Chowk	Focal Point + Jamalpur	NH	30.868971	75.975096	2	3	0	5	1	0	38	5
33	HP Station, gill bypass	Dehlon	SH	30.851241	75.860265	3	1	2	6	1	0	45	5
34	Metro Mall, near Mittran da Dhaba	Salem tabri	NH	30.953118	75.824633	4	3	3	8	4	1	69	3
35	Manju cinema	Div No.2	MC	30.895926	75.866323	5	3	1	6	4	2	56	4
36	GMT School, Jalandhar Bypass	Salem tabri	NH	30.938227	75.83607	10	5	0	10	10	6	106	1
37	Shivpuri chowk	Jodhewal	NH	30.935312	75.85721	3	2	2	6	3	0	51	5

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
38	Gur. Raru Sahib	Sahnawal	NH	30.839568	75.968466	5	3	0	6	4	0	54	4
39	King Spades Resort	Model town	MC	30.8797	75.847388	3	2	1	4	6	1	47	5
40	Dholewal chowk	Div No.6	MC	30.893582	75.871089	0	5	5	7	3	2	60	4
41	Durga Mata Mandir	Div No.5	MC	30.90685	75.846703	0	3	2	2	3	0	23	5
42	Rattam Hammers, Mundian	Jamalpur	NH	30.888375	75.93527	1	3	3	5	2	2	43	5
43	Tajpur Chowk	Div No.3 + Jodhewal	NH	30.917496	75.876793	8	7	3	16	6	0	130	1
44	Laddowal Chowk	Laddowal	NH	30.977913	75.79262	2	4	0	6	2	1	49	5
45	Dhuri railway line bridge	Dugri	PWD	30.870696	75.853221	2	3	0	2	3	0	23	5
46	Kaddian T-point	Salem tabri	NH	30.966992	75.81387	1	4	3	7	2	1	56	4
47	Baba Than singh Chowk	Div No.3	MC	30.91401	75.867068	2	1	2	1	4	2	21	5
48	Taj Resorts, Dehlon	Dehlon	SH	30.802431	75.869336	2	2	1	4	3	4	41	5
49	Sethi ice cream, Metro road	Jamalpur	GLAD A	30.893133	75.904632	0	3	2	5	1	0	38	5
50	Hardy's world	Laddowal + Salem	NH	30.975441	75.801571	1	4	2	6	5	0	57	4

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
		tabri											
51	Lohgarh Chowk	Dehlon	SH	30.744393	75.849468	5	0	0	2	5	6	35	5
52	Sandali Darwaza Resort	Kum Kalan	NH	30.854195	76.051346	1	3	1	5	5	0	50	5
53	USPC Jain School	Focal Point + Jamalpur	NH	30.897985	75.916576	2	0	6	5	5	0	50	5
54	Samrala Chowk	Div No.7	NH	30.912085	75.878895	6	7	5	9	11	3	99	1
55	Veer Marriage Palace	Focal Point	NH	30.895796	75.921151	0	2	3	3	2	1	28	5
56	Sidhu Highway kitchen	Jamalpur	NH	30.873313	75.966363	3	1	3	5	7	1	57	4
57	Grand Walk mall	Sarabha Nagar	NH	30.886993	75.789868	1	1	4	3	3	1	31	5
58	Sherpur chowk	Div No.6 + Moti Nagar	NH	30.88548	75.886941	1	8	2	9	3	0	72	3
59	Zimidara da Dhaba	Sahnewal	NH	30.847011	75.955658	3	2	1	5	2	1	42	5
60	Gur. Alamgir Gate	Dehlon	SH	30.816865	75.867316	2	7	2	9	9	2	92	2
61	Aarti steels Ltd	Focal Point	MC	30.884211	75.897755	2	2	3	5	2	0	41	5
62	Palm court, Ferozpur road	Sarabha Nagar	NH	30.882046	75.776011	2	4	1	4	4	2	42	5

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
63	Arora palace chowk	Shimlapur i	SH	30.873235	75.858935	4	1	3	4	4	2	42	5
64	Jassian cut	Salem tabri	NH	30.946235	75.830001	2	4	1	7	1	0	52	5
65	Radha Swami ghar	Dehlon	SH	30.842108	75.856428	1	2	2	3	2	0	27	5
66	Jamalpur chowk	Jamalpur	NH	30.901053	75.9094	2	2	1	5	3	3	47	5
67	Haibowal chowk	PAU	MC	30.916161	75.813853	1	2	2	1	5	1	23	5
68	Rania T-point	Dehlon	SH	30.824048	75.866301	1	2	2	4	2	0	34	5
69	HP station, Dehlon-Sahnewal road	Dehlon	VR	30.786751	75.909415	1	2	4	5	4	5	52	5
70	Bus Stand	Div No.5	NH	30.896553	75.845043	3	1	4	7	1	1	53	5
71	Bonn Bread, Jhabewal	Jamalpur + Focal Point	NH	30.881206	75.951361	0	5	4	3	6	5	44	4
72	Isher Nagar Canal Bridge	Daba	NH	30.859059	75.866483	3	5	1	6	5	3	60	4
73	Pakhawal Canal Bridge	SBS Nagar	MC	30.887538	75.825441	1	3	3	4	4	1	41	5
74	UCO Bank, Jugiana	Sahnewal	NH	30.855238	75.941763	3	3	4	11	3	1	87	2
75	Hotel Mohini Resorts	Div No.7	NH	30.903191	75.899531	5	5	2	5	5	3	53	5
76	Shimlapuri cut	Shimlapur i	SH	30.866118	75.859215	4	3	2	4	8	3	55	4

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
77	Preet palace	Model town	NH	30.890053	75.848538	1	1	6	5	5	2	52	5
78	Hiran cut	Kum Kalan	NH	30.859768	76.035498	0	1	4	3	2	1	28	5
79	Bharat Petrol Pump	Salem Tabri	MC	30.931728	75.84128	4	0	2	1	6	1	26	5
80	Jiwan Nagar Chowk	Focal Point	MC	30.888035	75.915181	2	1	2	4	2	0	34	5
81	Giaspura Chowk	Div No.6	MC	30.872566	75.897923	3	1	2	4	3	0	37	5
82	Goyal Hyundai, Kanganwal	Sahnewal	NH	30.860074	75.933672	1	3	1	5	0	1	36	5
83	Kailash Nagar chowk	Jodhewal	NH	30.934071	75.862436	7	6	3	13	4	2	105	1
84	Basti Jodhewal Chowk	Jodhewal + Div No.3	NH	30.929865	75.871606	7	1	7	11	4	9	98	1
85	Bharat Nagar Chowk	Div No.5	NH	30.904225	75.840436	3	1	6	5	7	2	58	4
86	Phullanwal Chowk	SBS Nagar	GLAD A	30.871493	75.813273	2	1	4	4	4	1	41	5
87	Gill Chowk	Shimlapur i	SH	30.890701	75.858448	3	1	4	5	4	1	48	5
88	Pahwa Dharamshala, Chander nagar	Div No.4	MC	30.920343	75.832203	4	0	1	2	3	0	23	5
89	Dada Motors, Dholewal	Div No.6	MC	30.890308	75.876578	1	1	5	8	4	2	70	3

ID	Location of Black Spot	Police Station	Road Type	Co-ordinates		No. of Cases Registered			Total people Involved 2016+2017+2018			Severity Score	Ranking
				Latitude	Longitude	2016	2017	2018	Fatal	Serious	Minor		
	chowk												
90	Sahnewal Khurd	Sahnewal	NH	30.827151	75.987421	0	1	5	3	2	2	29	5
91	Gopalpur	Dehlon	SH	30.729016	75.849706	2	1	2	5	1	0	38	5
									Average Severity Score			53.2	
									Standard Deviation			28.9	

Based upon the severity score and the threshold value criteria given in Table 18 above, we found that only 18% black spots are on Municipal Roads, rest all 65% are on National Highways. The summary of accidental black spots, severity score and summary are given in Table 19, Table 20 and Table 21.

Table 20: Priority Wise Number of Black Spots

Priority	Number of Black Spots	Road Type				
		NH	MC Roads	SH	PWD/VR	GLADA
First order black spots	10	10	0	0	0	0
Second order black spots	3	2	0	1	0	0
Third order black spots	4	3	1	0	0	0
Fourth order black spots	10	6	2	1	1	0
Fifth order black spots	64	38	13	8	3	2
	91	59	16	10	4	2

Table 21: Police Station and Road Category wise Summary of Road Accidental Black Spots within Ludhiana Commissionerate Area.

Sr.No	Police Station	Black Spots	Road Type				
			National Highway	State Highway	Municipal Roads	PWD/VR	GLADA
1	Daba	1	0	0	0	1	0
2	Daresi	0	0	0	0	0	0
3	Dehlon	8	0	7	0	1	0
4	Div No.1	1	0	0	1	0	0
5	Div No.2	1	0	0	1	0	0
6	Div No.3	1	0	0	1	0	0
7	Div No.4	1	0	0	1	0	0
8	Div No.5	4	3	0	1	0	0
9	Div No.6	10	7	0	3	0	0
10	Div No.7	4	4	0	0	0	0
11	Div No.8	1	0	0	1	0	0
12	Dugri	1	0	0	0	1	0
13	Focal Point	4	2	0	2	0	0
14	Haibowal	0	0	0	0	0	0

15	Jamalpur	7	6	0	0	0	1
16	Jodhewal	6	6	0	0	0	0
17	Kum Kalan	4	4	0	0	0	0
18	Laddowal	2	2	0	0	0	0
19	Meharban	0	0	0	0	0	0
20	Model Town	2	1	0	1	0	0
21	Moti Nagar	2	2	0	0	0	0
22	PAU	2	0	0	2	0	0
23	Sadar	0	0	0	0	0	0
24	Sahnawal	15	15	0	0	0	0
25	Salem Tabri	6	5	0	1	0	0
26	Sarabha Nagar	2	2	0	0	0	0
27	SBS Nagar	3	0	0	1	1	1
28	Shimlapuri	3	0	3	0	0	0
29	Tibba	0	0	0	0	0	0
	Total	91	59	10	16	4	2

The detailed map of Accidental Black Spot falling within Ludhiana Commissionerate is shown in

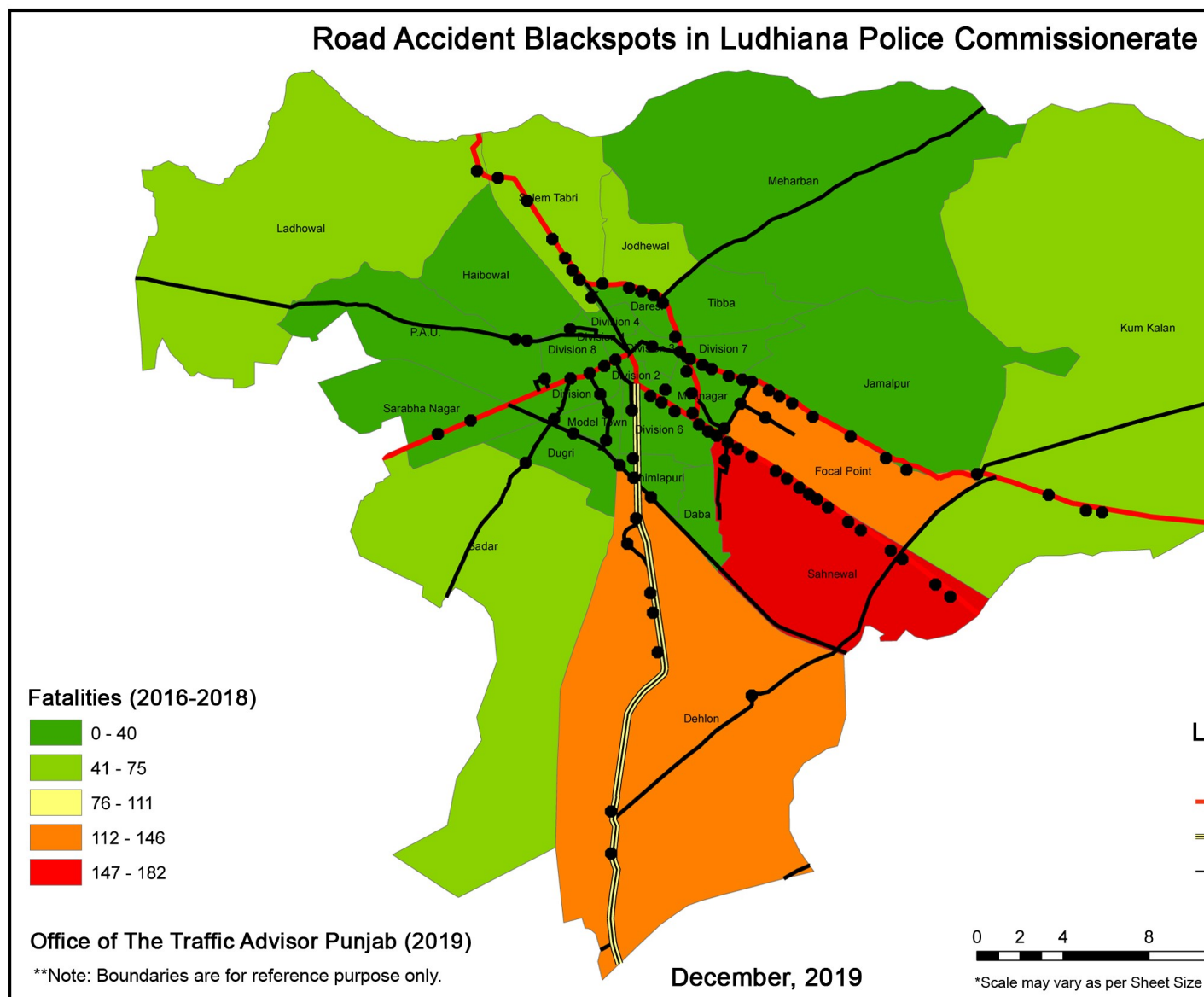


Figure 16 next.

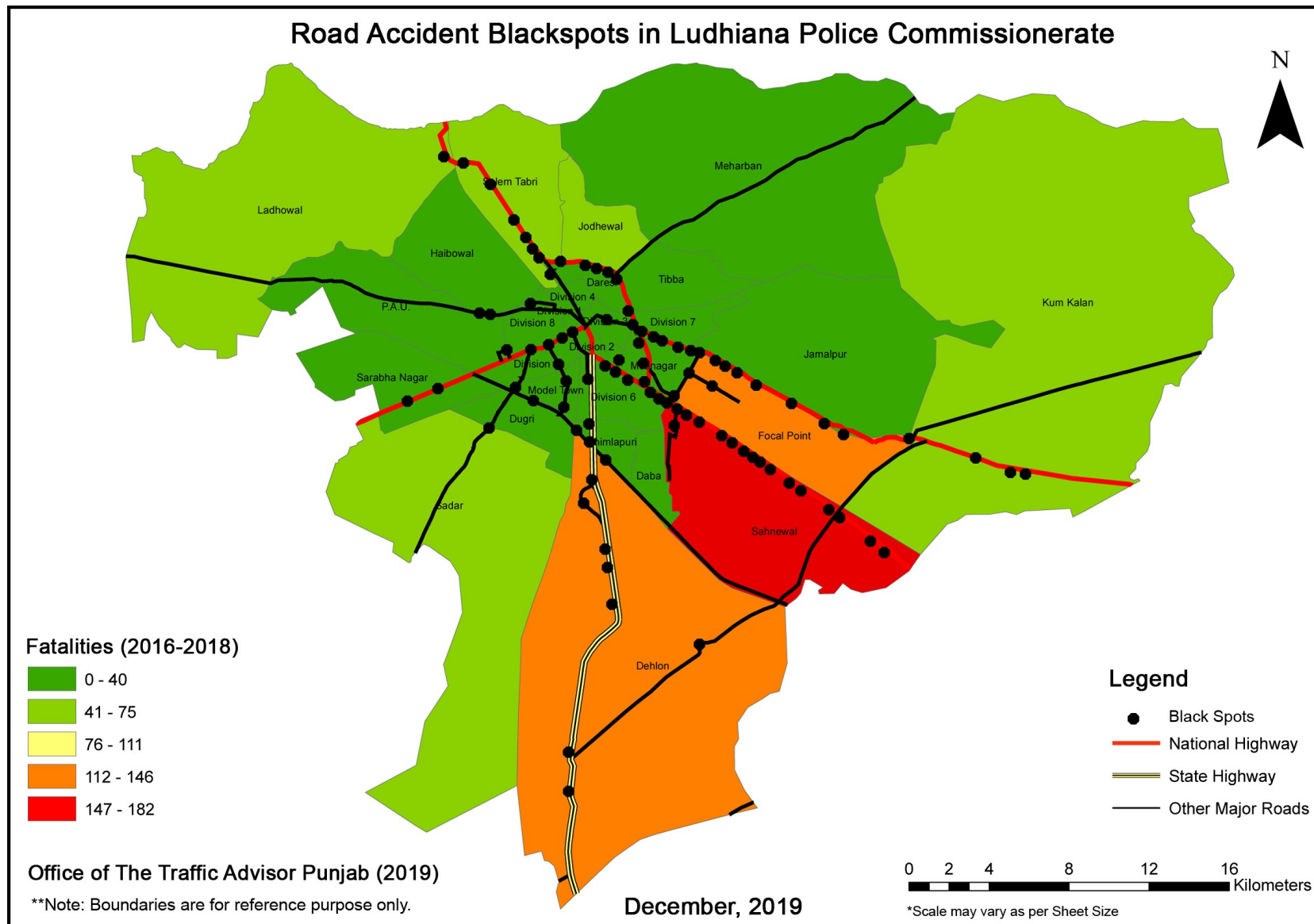


Figure 16: Index Map of Road Accidental Black Spot in Ludhiana Commissionerate District.

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