

Identification and Improvement of Accident Black Spots on N.H.- 3 District Una, Himachal Pradesh – A Case Study

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Abstract

As the population is increases day by day the numbers of vehicles are also increasing. As the vehicles are increasing, number of accidents also increases. The accidents are due to Human error or road parameters. Analysis of previous data indicates that 66% of the accidents occur due to human error and 33% due to road parameters such as road and vehicle interaction, other road user and environmental factors. India has a road network of 3.3 million km consisting of National Highway (NH), State Highway (SH), Major District Roads (MDR) and Other District roads (ODR). National Highways constitute 2% of the total road length and carries more than 40% of passenger traffic and 85% of goods traffic has registered more accidents accounting for 20%, as compared to other roads. Road safety has recently become a major concern in most modern societies. The identification of sites (black spots) that are more dangerous from accident point of view can help in better scheduling road safety policies. The study includes collection of secondary accident data and prioritizing the accident prone locations by using Weighted Severity Index (WSI) method. WSI method follows a system of assigning scores based on the number and severity of accidents in that particular location in the last few years. This paper lays emphasis on accident studies on the National Highway - 3 in the District Una, State of Himachal Pradesh, India. So the main aim of this study is therefore, to identify the major accident black spots on National Highway -3 and improvement in it.

Keywords: *Black spot, Weighted Severity Index*

I. Introduction

The increase in the number of motor vehicles is due to the growth of population and fastly growth of technology and economics. As the mobility increases, the probability of accidents also increases. The basic elements in traffic accidents are road users, vehicles, road and its condition, road geometry and environmental factors etc. The fatality rate is more in developing countries as compare to developed countries. The main cause of road accidents are drunken driving, careless and rash driving, over speeding, sudden braking, skidding, traffic rule violation, sudden twists and turns while driving etc..Moreover, road accidents can affect 1% of annual gross product resources of the developing countries. Road accidents cannot be totally prevent/stop, but by using suitable traffic engineering, safety plan and management measures, the accident rate can be decrease. One of the most important factors to reduce traffic is identification of hazard locations. During recent years, road safety and fastly growth of traffic has become a major concern throughout the world. Road traffic accident is a major problem leading to fatalities, injury and property loss and severely impacting the society. According to the statistics released by National Crime Records Bureau (NCRB), approximately 1,39,091 persons lost their lives in 4,40,042 road accidents in India during 2012. Road accidents increase means number of vehicles also increases. In India tremendous increase in the total number of registered motor vehicles in last few years. According to a report total number of registered motor vehicles increased from about 0.3 million as on 31st March 1951 to 159.5 million as on 31st March 2012.

It is estimated that the economic losses due to road accidents in India are over Rs 100 billion per year. The identification of accident location, analysis and treatment of road accident black spots are widely regarded as one of the most effective approaches to road accident prevention. Black spot is a place on a road that is considered to be dangerous because several accidents have happened there. Accidents happened their because of variety of reasons, such as a sharp curves in a straight road, so oncoming traffic is concealed, if design of junction are not proper on a fast road, poor or concealed warning signs at a cross-roads. Accident black spots can be improve by improving the signage, speed restrictions, improving sightlines, straightening bends etc.

In Himachal Pradesh in last ten years 33,922 accidents occur in which 10,727 peoples died and approximately 54,702 peoples injured. It shows that every year in Himachal Pradesh more than 1000 peoples died in road accidents. The major causes of road accidents in Himachal Pradesh are condition of roads are not good and also the rough driving is responsible for this.

II. Methods use for study work

1. Primary method
2. Secondary method by using WSI.

2.1 Data Collection

1. Primary data
2. Secondary data.

III. Analysis of Data

3.1 Analysis of Primary data

For Primary data we needed the following:

1. **Details of road Inventory**
2. **Signage inventory**

3.1.1 Details of road Inventory

Road Inventory includes name of the road, Length of the road, Type of road (Flexible or Rigid), Width of the road etc.

(a) Name of the Road & Length of the Road

Name of the road is Jalandhar, Hoshiarpur, Gagret, MubarikpurAmb, Nadaun, Hamirpur, Sarkaghat, Dharampur, Mandi, Kullu, Manali road.

Length of the Total Road

Single Lanes (in kms.) 125.905.

Intermediate Lane (in kms.) 21.065

Double Lane (in kms.) 171.525

Total Length (in kms.) 318.495

But the length taken for case study is 29 kms. in Una Distt.

(b) Type of Road: The road is flexible types i.e. bitumen road.



Fig 1.1: National Highway – 3.

Source: <http://www.bing.com/images/search?q=road%20amb%20una>.

So in this we can collect the data related to the road inventory and study that what are the faults in that and how we can improve it.

(c) Bridges

Table 1.1: Number of major and minor bridges with span and Carriageway width

Name of Bridge	Span (meter)	Carriageway Width (meter)	Type of Bridge
Gagretkhad	105 m	6.60 m	Major bridge
Shivbari	34 m	6.60 m	Minor bridge
Sawan gap	36 m	6.60 m	Minor bridge
Sawan River	158.60 m	6.60 m	Major bridge
Jangolikhad	77 m	5.50 m	Major bridge
Karlohikhad	186.55 m	5.50 m	Major bridge
Amb khad-1	18.25 m	5.50 m	Minor bridge
Ambkhad -2	48.80 m	5.50 m	Minor bridge
KheranKhad	53.20 m	5.50 m	Minor bridge

Source: Site visit data.

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So there are 4 major bridges and 5 minor bridges with the carriageway width of 4.25 m to 6.60 m and span of 18.25 m to 186.55 m.

3.1.2 Signage inventory

Traffic signs are important elements of the highway because they guide, warn, and inform the drivers for the safely and efficiently movement on the roads. Well maintained sign important as they help to drivers to make good decision.



Fig 1.2: National Highway-3 with Sign Board.

Source: <http://www.bing.com/images/search?q=road%20amb%20una>.

So, in sign inventory we study about the different types of signs and their proper position where it is require. And Maintenance of signs are also very important.

In this accident data is needed, which we can collect from the related area Police stations. And to analysis the secondary data we use the WSI method.

Weighted Severity Index, (WSI) = (5 x K) + (3 x GI) + (1 x MI)

Where, **K** is the number of persons killed,

GI is the number of injured,

MI is the number of non - injured.

After calculations we get the value of WSI by which we can find/tell that on which point of road has more Weighted Severity Index value and consider it as black spot. More the Severity value more the dangerous road section/site.

By this we get the black spots and we can find the causes of accidents at their and how we can improve/stop it.

3.2 Analysis of Secondary data

3.2.1 Different types of data collected from Police stations

Table 1.2: Road Accidents in Distt. Una (Himachal Pradesh) : 2011 to 2014

Year	Total Accidents	Deaths	Injured	Non-Injured	Severity Index
2011	257	85	442	6	1757
2012	239	57	436	5	1598
2013	239	63	462	4	1705
2014	259	82	391	9	1592

Source: Office of the Superintendent of Police Una, Distt. Una (H.P.).

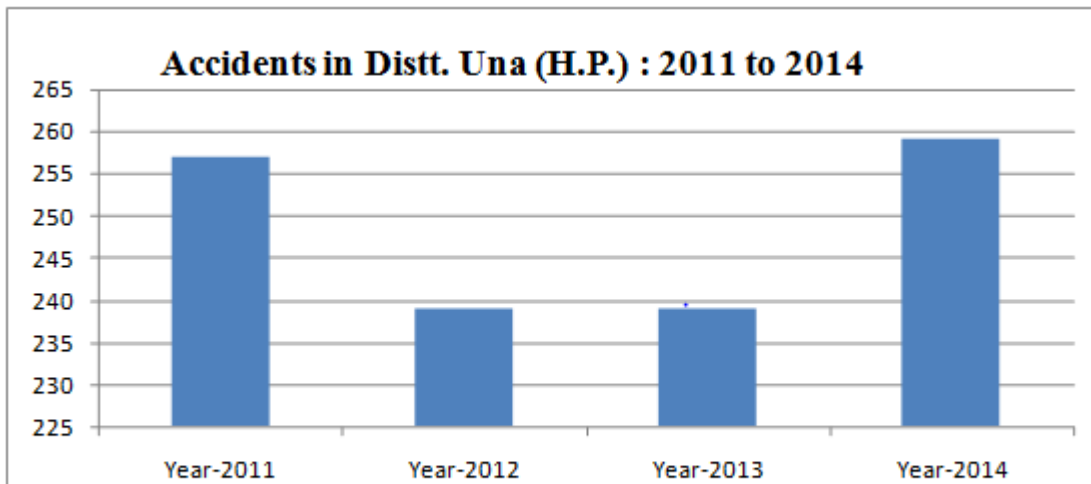


Fig 1.3: Road Accidents in Distt. Una (Himachal Pradesh) : 2011 to 2014.

Source: Office of the Superintendent of Police Una, Distt. Una (H.P.).

Table 1.3: Road Accidents on NH-3: 2011 to 2014

Year	Total Accidents	Deaths	Injured	Non-Injured	Severity Index
2011	16	5	25	0	100
2012	12	2	15	0	55
2013	3	1	5	0	20
2014	9	6	20	0	90

Source: Office of the Superintendent of Police Una, Distt. Una (H.P.).

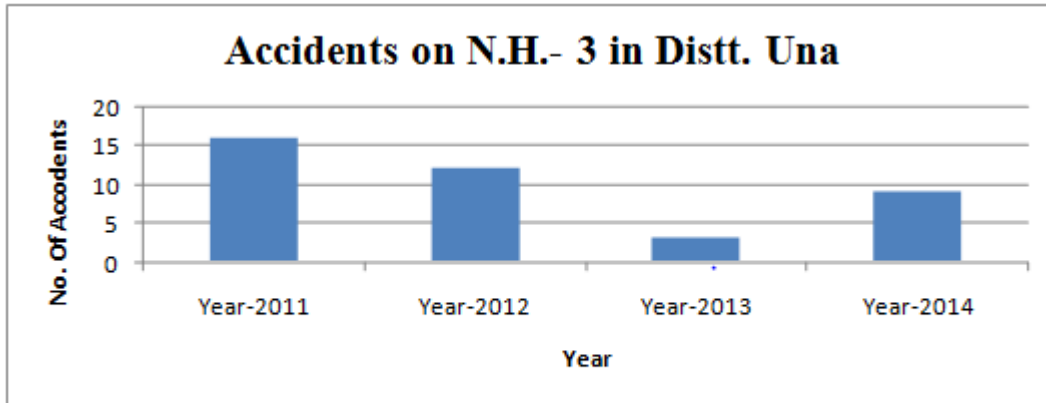


Fig 1.4: Road Accidents on N.H.-3 in Distt. Una (Himachal Pradesh): 2011 to 2014.
 Source: Office of the Superintendent of Police Una, Distt. Una (H.P.).

Table 1.4: Types of Vehicles Involved in Accidents on NH- 3 : 2011 to 2014

Year	Bus	Truck	Car	Jeep	Motor Cycle	Tractor	Three Wheller	On Foot
2011	2	5	4	1	3	1	0	0
2012	0	1	4	0	7	0	0	0
2013	1	1	0	0	1	0	0	0
2014	2	4	2	0	1	0	0	0

Source : Office of the Superintendent of Police Una, Distt. Una (H.P.).

Table1.5: Number of Accidents at Day or Night on NH- 3: 2011 to 2014

Year	Day	Night
2011	13	3
2012	8	4
2013	2	1
2014	6	3

Source : Office of the Superintendent of Police Una, Distt. Una (H.P.).

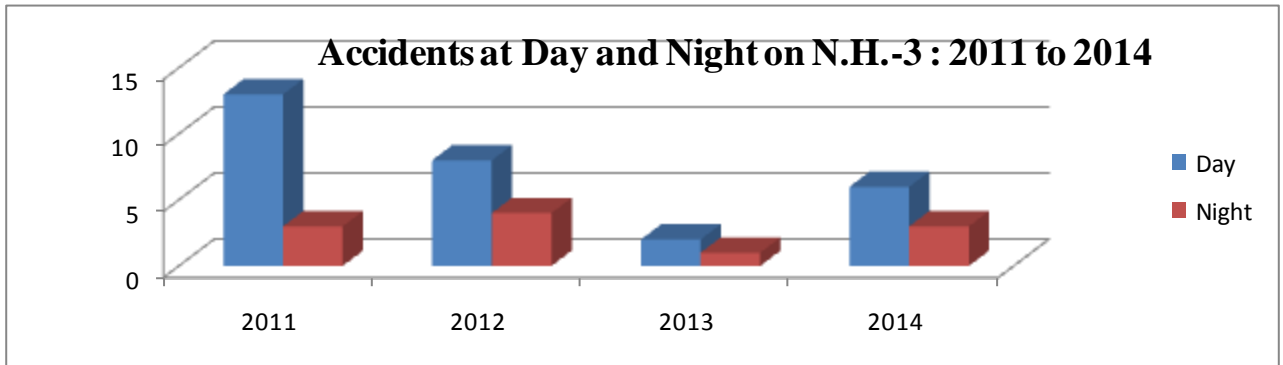


Fig 1.5 : Number of Accidents at Day or Night on NH- 3 : 2011 to 2014.
Source : Office of the Superintendent of Police Una, Distt. Una (H.P.).

Table 1.6: Different Ages of Persons involved in Accidents on NH- 3: 2011 to 2014

Age	8 to 14 years	15 to 24 years	25 to 65 years	65 years & above
Year				
2011	0	9	7	0
2012	0	8	4	0
2013	0	2	1	0
2014	0	6	3	0

Source : Office of the Superintendent of Police Una, Distt. Una (H.P.).

3.2.2 Accident Density

$$\text{Accident density} = A/L * T$$

Where A = Total number of accidents, L = length of road, T = Number of years.

$$\text{Accident density} = 40/29 * 4 = 0.34$$

$$\text{Accident density} = 0.34$$

3.2.3 Accident Rate per km

$$R = A/L$$

Where A = Total number of accidents occur in one year.

L = Length of control section in km.

$$R = 40/29 = 1.37$$

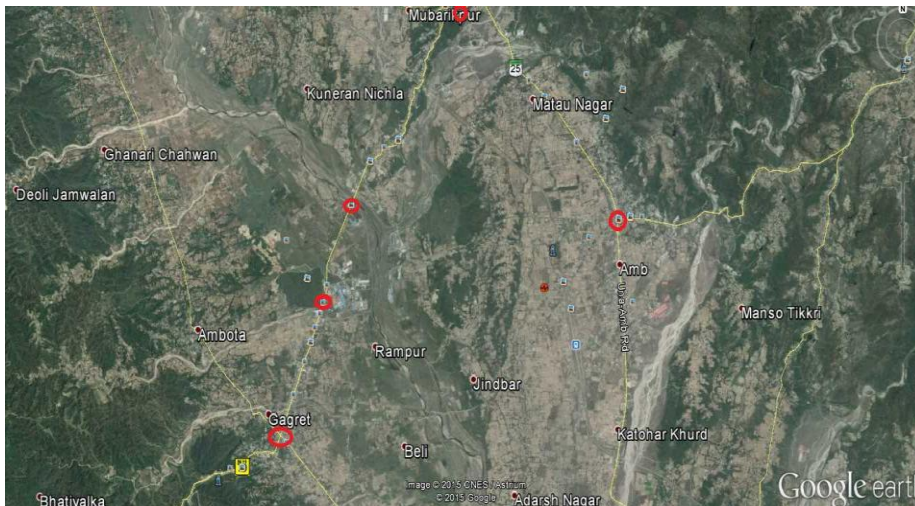
3.2.4 Black spots

Table 1.7: Top ranked accident spots on NH- 3 in District Una

Place	WSI Value
Near Shiv bari	82
Near Mubarakpur	68
Gagret City	59
Near Alfa Hotel	29
Amb	27

Source: Study work.

The WSI value of Shiv bari is highest so it means that Shiv bari spot is more dangerous than other spots. After that Mubarakpur, Gagret city, near Alfa hotel and in last Amb spot.



Map 1.1: Black spots on N.H.-3 from Gagret to Amb.

Source: Google earth.

3.3 Analysis of Primary Data

3.3.1 Road Inventory Survey

From the road inventory survey it is observed that, the carriage way width of all stretches varies from 6 m to 8 m. But on bridges the carriageway width is 5.50 m to 6.60 m. So on some places as the carriageway width is less, is not sufficient for accommodating huge traffic and width is not satisfying the standards of national highways.

The road inventory survey is carried out in identified accident stretches on NH - 3 in Gagret, Mubarakpur, Amb. Footpath, drainage facility is absent or in poor condition in the study stretches. In some stretches the shoulder is also absent and condition of road is also poor as construction work is going on.

3.3.2 Traffic Volume Count

The traffic volume count gives the measure of how many vehicles passthrough a particular location during a period of time. According to the traffic volume, the time can be classified to peak hour and off peak hour. For any traffic infrastructure design and accident study peak hour traffic volume is necessary. So, in the present study, four hour traffic volume count was taken for all the spots and peak hour traffic in terms of Passenger Car Unit (PCU) was found. From the survey it was observed that the road stretch under consideration carries mixed traffic of fast and slow moving vehicles. The highest peak hour traffic observed at Amb and lowest at Shiv bari.

Table 1.8: Traffic volume in terms of PCUs.

Accident Black Spot	Peak Hour Traffic Volume (PCU)
Amb	410
Gagret City	371
Near Mubarakpur	329
Near Alfa Hotel	283
Near Shiv bari	278

Source: Site visit survey

3.3.3 Signage Inventory

During the signage inventory it is observed that on most of the required places the sign boards are absent like sign board before narrow bridge, right/left turn etc. and also on some places the boards are in poor conditions.

3.3.4 Speed and Delay Study

The speed and delay study was carried out by using moving observer method on entire identified black spots on N.H.-3 in Distt.Una to find out the average journey speed and delay of the traffic stream.

The maximum speed without delay is observe at Near Alfa hotel i.e. 47.45 km/hr and minimum at Amb i.e. 26.67 km/hr. The maximum delay is at Amb i.e. of 12seconds which is due to pedestrian crossing and no signal on junction nor the rotary is their so vehicles are moving according to themselves. The main causes of delay of these points are pedestrian crossings, parking problems etc.

Table 1.9: Speed and Delay study

Place	Average journey speed (km/hr)	
	Without Delay	With Delay
Gagret City	34.88	34.79
Near Alfa Hotel	47.45	47.42
Near Shiv bari	35.39	35.37
Near Mubarakpur	34.20	34.14
Amb	26.67	26.55

Source: Site visit survey.

IV. Result And Discussions

4.1 Near Shiv bari

Shiv bari is identified as the most vulnerable accident stretch on NH- 3 in District Una.





Fig 1.6: Shiv bari accident locations.
Source: Site visit photography.

- Identified stretch has the necessary lane width and condition of road is also good. But absence of shoulder is the main cause of accidents.
- The marking is absent on the left & right side of the road.

4.1.1 Suggestions for improvement





Fig 1.7: Suggestions for improvement of Shiv bari location.
Source: Site visit photography.

1. Provide the shoulder of width 1.0 m on hill side and 2.0 m on valley side in Mountainous Terrain.
2. Roadway Width in Mountainous Terrain is 10.0 m (exclusive of parapets and drains).
3. Provide the guard rails on the valley side of the road.
4. Use the sign boards to inform the drivers about the turns, speed etc.
5. Proper marking on roads.
6. We can provide the roadway delineators on the valley side of the road.

4.2 Near Mubarakpur



Fig 1.8: Near Mubarakpur (Mubarakpur - Amb Road).
Source: Site visit photography.

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- This black spot is near Mubarakpur (Mubarakpur – Amb road). Here the condition of road is poor.
- Right edge of road has more height as compare to the left edge of road may be because of inadequate super elevation design.

4.2.1 Suggestions for improvement



Fig 1.9: Suggestions for improvement for Mubarakpur accident spot.
Source: Site visit photography.

- First of all construct the road because the condition of road is poor here.
- Redesign the Super-elevation because here the right side is more raised as compare to the left side. Because of this the unequal pressure on the wheels of vehicles, which result from high value of sideways force between the tyres and the roadway surface. Here the super-elevation is more than 0.12. As per Indian practice the Super-elevation is limited to 0.07-0.10
- Use the sign board on curves to inform the drivers about the curves and also speed limit sign board.

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- Provide the shoulder both side of the road.
- Provide the road delineators.

4.3 Gagret City



Fig 2.1: Gagret city

Source: Site visit photography.

- .In the main bazaar of Gagret the width of carriageway is not according to IRC standards for NH.
- Also the shoulder is absent.
- Sight distance is poor.
- Jams also occur here.
- No space for parking.

4.3.1 Suggestions for improvement



Fig 2.2: Suggestions for improvement for Gagret accident location.
Source: Site visit photography.

- Provide the shoulder.
- Because of the peoples walk on the road the sight distance is poor and also due to the shopkeepers takeover the road sides in front of their shops.
- As there is no space available for increase the carriageway width and shoulder, we can suggest the bye-pass for this because of that the jam condition is also decrease in the main bazaar of Gagret.
- Provide the speed limit sign board.
- As there is no chance of providing the traffic signals, rotary, the traffic police

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should be there for safe movements of traffic.

- Provide the space for parking.

4.4 Near Alfa Hotel



Fig 2.3: Near Alfa Hotel Gagret.

Source: Site visit photography.

- This black spot point is near Alfa Hotel Gagret. Here the width of carriageway and shoulder is satisfactory.
- But on the bridge no space for pedestrians for walking.

4.4.1 Suggestions for improvement



Fig 2.4: Suggestions for improvement for Alfa hotel accident location.

Source: Site visit photography.

- Provide the marking on the road as well as on bridge also.
- Speed limit sign board.
- Before the bridge provide/install the “Narrow Bridge” sign board.
- Provide the safety barriers just before the bridge starting on both sides of road.

4.5Amb





Fig 2.5: Amb city.
Source: Site visit photography.

This spot is near the bus stand and market of Amb city.

- Here the condition of road is not good but the construction work is going on here.
- No marking on the roads.
- No zebra crossings.
- No space for parking.
- Also sometimes the buses are stop on the side of road.
- On intersection of road, no rotary or signal is provided because of which the jams conditions occurs here.

4.5.1 Suggestions for improvement

- Provide the markings on the road.
- Provide the zebra crossings near the bus stand and junction for safe crossing of the pedestrians.
- Provide the parking so that vehicles cannot be stand on the side of the road which creates the problem for pedestrians and for vehicles also.
- No bus should be stand on road which is the responsibility of the traffic police.
- Provide the rotary or signals on junction where the roads are crossing.
- Provide the speed limit sign boards in the city on National Highway.



Fig 2.6: Suggestions for improvement for Amb city accident location.
Source: Site visit photography.

V. Conclusion

- The identification and analysis of accident black spots help in identifying the stretches where accidents are more and these spots reduce the road safety in general. The spot on road where traffic accidents are frequently occurred is termed as black spots. The current study was an attempt to find out the most vulnerable accident locations or black spots on N.H.-3 in Distt. Una, Himachal Pradesh.
- The Weighted Severity Index (WSI) method was used to rank the accident locations. The top five spots were selected as black spots as per the WSI value from the collected data and suggested some possible alternative measures to improve the transportation system. The overall methodology was found to be effective for the identification, evaluation and treatment of accident black spots if sufficient data is available. The deficiencies like non availability of parking lane, no zebra crossing, no guard rails and sign boards and also the no proper road markings and unauthorized parking etc.
- It is also observe that most of the 2-wheelers are not using the helmets and they also over speeding their vehicles. It is also observed that this National Highway is under construction and after construction these deficiencies may be reduce. Implementation of the suggested improvements will help to increase the overall road safety.

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