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Determination of Blackspot on National Highway-37 (New NH-27), Assam

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ABSTRACT: National Highways play a vital role in developing the country's economy. Every day there are over 300 deaths and 700 injuries on the road in India. The NH-37 (New NH-27) in Guwahati has seen an alarming rise in the number of accidents. As a result, the identification of the accident blackspot on this stretch is crucial for road safety. The Accident blackspot is a term used for a section of about 500-600 m, where a minimum of 10 fatal accidents has been reported over the last 3 years. This paper deals with the identification of such blackspots on a stretch in NH-37 (New NH-27), i.e. Jalukbari to Khanapara in Guwahati using the methods of accident rate, accident frequency and weighted severity index. By comparing these three methods, the actual black spot on the selected highway can be easily identified. Some remedies have also been suggested to reduce the number of accidents on the identified blackspot areas.

KEYWORDS: Blackspot, Accident rate, Accident frequency, Weighted Severity Index, NH-37(New NH-27).

I. INTRODUCTION

The alarming rise in road accidents is one of India's worst kept secrets. Around 377 people die every day on road accidents, which is equivalent to a jumbo jet crashing every day. In 2015 alone, 1,46,133 people were killed in road accidents in India, thereby showing a 4.6% rise over 2014 when around 1,39,671 were killed. Such alarming statistics only goes to show the lack of proper road safety measures in the country.

The state of Assam contributes a major part in India's alarming accident count. According to National Crime Records Bureau, road traffic accidents accounted for 50.4% deaths in Assam last year, surpassing the national average of 36.4%. Guwahati, the largest city in Assam, is one of the fastest developing cities in India. With the rapid growth of population in the city, the road traffic problems are also increasing at an alarming rate.

The NH-37(New NH-27) passing through Guwahati is one of the most important National Highways of India as it provides the entrance to various states of North-eastern India and connects the city with other states of Eastern India. It also provides access to the Lokapriya Gopinath Bordoloi International Airport situated at Borjhar, Guwahati as well as to the Inter State Bus Terminus situated at Lohra, Guwahati. Due to the ease of connectivity, there has been an exponential growth in the number of vehicles plying through this area which has subsequently accelerated the number of road accidents. Hence, it has become important to properly analyse the stretch and locate the areas where the frequency of accidents is high. In this paper, an attempt has been made to determine such accident prone areas, called blackspots on NH-37(New NH-27) from Jalukbari to Khanapara. Through further analysis, proper safety measures and laws can be implemented which will drastically reduce the severity of road accidents in these areas.

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II. LITERATURE REVIEW

A number of research efforts have attempted to develop various methods to accurately determine the accident blackspots in an area.

R R Sorate et al. (2015) [1] attempted to identify the accident blackspots on National Highway 4. Three methods of analysis were used, namely-Ranking and severity index methodology, Accident density method, Weighted severity index method. The stretches appearing in all the three methods were taken as the accident blackspots.

AN Dehury et al. (2013) [2] hinted at various methods adopted to identify accident blackspots on NH-55 in Orissa. Using two methods of analysis namely-Accident Rate method and Accident Frequency method, the ranking of the identified blackspots were done. Detailed analysis was then carried out on the top-ranked blackspots.

Vivek and Rakesh Saini (2015) [3] aimed at identifying the major accident blackspots on National Highway- 3 and suggested necessary measures for improvement. The study was carried out by collecting secondary accident data from police stations and prioritising the accident prone areas by using Accident Severity Index (WSI) method.

Agnelo Duarte and Bruce Corben (1998) [4] aimed at improving the effectiveness of various treatment programs related to Victoria's 'Accident Blackspot' Programs. The five treatment types investigated were treatments for skid resistance, bridge guard rail treatments, facilities for pedestrians, improvements in street lighting, and erection of traffic signal mast arms.

From all the methods used, the accident rate method, accident frequency method and the weighted severity index method were found to be most suitable to the concerned area of study i.e. NH-37(New NH-27).

Thus, all the 3 methods were used to identify the accident blackspots on NH-37(New NH-27) from Jalukbari to Khanapara.

III. METHODOLOGY

The three methods for analysis namely: Accident Rate Method, Accident Frequency Method and Weighted Severity Index (WSI) Method are used for identifying the blackspots on the aforesaid section. The methods are adopted by dividing the entire road into smaller sections. In Accident Rate Method, the accident rates of each section are evaluated by using the mathematical formula,

Accident Rate = M/L ,

Where M = Total no. of accidents in a stretch`

L = Length of Stretch

In Accident Frequency Method, the accident frequency of each section is calculated and then the cumulative frequency of these sections are evaluated; mathematically

Accident frequency= $(M/T) \times 100$

Where M=Total no. of accidents in a stretch

T=Total no. of accidents along the whole Road

Weighted Severity Index (WSI) method is used by considering the number of fatal accidents (F), the number of Grievous Injuries (GI) and the number of Minor Injuries (MI). Mathematically it is being designated by

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$$WSI = (41 \times F) + (4 \times GI) + (1 \times MI)$$

Here, the weightage for a fatal accident is taken to be 10.02 times the weightage for the grievous accident ($4 \ll 41$). Moreover, the minor accident has been given a unit coefficient. ($1 \ll 41$).

IV. DATA COLLECTION

The data taken for the study was collected from various traffic outposts. The whole section was divided into six respective stretches each of 3 km as shown in Table 1

Table 1 Table showing the division of the section into 6 stretches

Sl. No.	Location	Stretch(Km)
1	Jalukbari-Somnath Tetelia(I)	146200-149200
2	Tetelia-Boragaon(II)	149200-152200
3	Boragaon-Ahomgaon(III)	152200-155200
4	Ahomgaon-Sarusajai(IV)	155200-158200
5	Sarusajai-Basistha(V)	158200-161200
6	Basistha-Khanapara(VI)	161200-164200

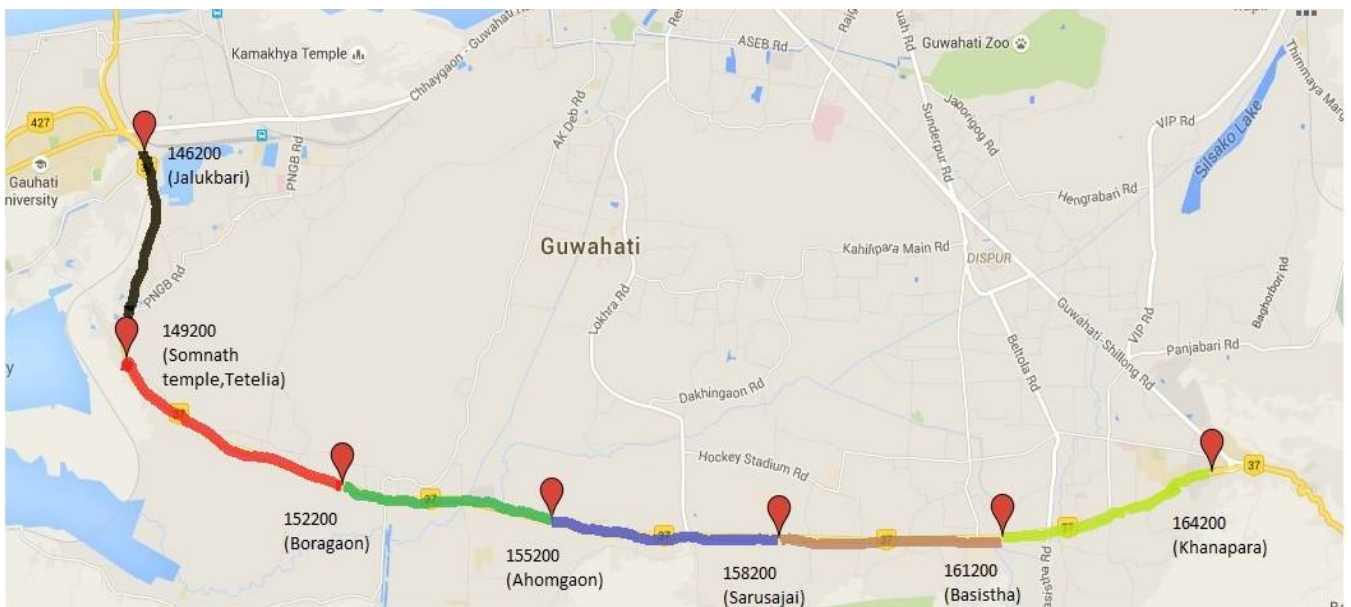


Fig. 1 shows the division of various stretches taken on the map (Source-Google map)

In Fig 1, the division of the section into 6 stretches are clearly indicated on the map. All the stretches taken lie on NH-37, between Jalukbari to Khanapara.

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V. ANALYSIS OF ACCIDENT-PRONE STRETCH

Accident Rate Method:

Table 2 Table showing the accident rate for each section

Location	Length(Km)	Stretch	Accident rate
Jalukbari-Somnath Tetelia(I)	3	146200-149200	23
Tetelia-Boragaon(II)	3	149200-152200	13
Boragaon-Ahomgaon(III)	3	152200-155200	13.67
Ahomgaon-Sarusajai(IV)	3	155200-158200	23.67
Sarusajai-Basistha(V)	3	158200-161200	38
Basistha-Khanapara(VI)	3	161200-164200	37.34

Using the data obtained from various police stations, the accident rate for each stretch was determined as shown in Table 2.

- In the accident rate method, the section with the highest value of accident rate has been considered as the region within which the exact blackspot is located.
- From table 2, it has been found that the section 158200-161200 i.e. Sarusajai-Basistha, has the highest accident rate.
- Therefore, it can be predicted that the exact blackspot over the entire stretch lies within this section.

Accident frequency method

Table 3 Table showing the accident frequency for each section

Distance from origin	Stretch	Frequency
0-3	146200-149200	15.5
3-6	149200-152200	8.8
6-9	152200-155200	9.2
9-12	155200-158200	15.8
12-15	158200-161200	25.6
15-18	161200-164200	25.1
	Total	100

In the accident frequency method, the frequency of accident along each stretch was determined using the formula

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Accident frequency= $(M/T) \times 100$

Where M=Total no. of accidents in a stretch

T=Total no. of accidents along the whole Road

The results obtained were then arranged in the form of Table 3.

- In the accident frequency method, the section with the highest value of accident frequency has been considered as the region within which the exact blackspot is located.
- From table 3, it has been found that the section 158200-161200 i.e. Sarusajai-Basistha, has the highest accident frequency.
- Therefore, it can be predicted that the exact blackspot over the entire stretch lies within this section.

Weighted Severity Index

Table 4 Table showing the WSI for each section

CHAINAGE	WSI
146200-149200	807
149200-152200	760
152200-155200	674
155200-158200	1067
158200-161200	1271
161200-164200	988

As shown in table 4, the WSI values were calculated for each section using the mathematical formula

$$WSI = (41 \times F) + (4 \times GI) + (1 \times MI)$$

Where F=Total number of fatal accidents

GI= Total number of grievous injuries and

MI=Total number of minor injuries

- From this method, the section with the highest WSI value has been considered as the region within which the exact blackspot is expected to lie.
- From table 4, it has been found that the highest value of WSI lies in the section 158200-161200 i.e. Sarusajai-Basistha.
- Therefore, it can be predicted that the exact blackspot over the entire stretch lies within this section.

By using 3 methods it has been found that the highest number of accidents in the Guwahati Bypass occurs within the section 158200-161200 i.e. from Sarusajai to Basistha.

So, further analysis is carried out on the identified section to locate the exact blackspot.

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VI. ANALYSIS OF THE IDENTIFIED ACCIDENT-PRONE ZONE

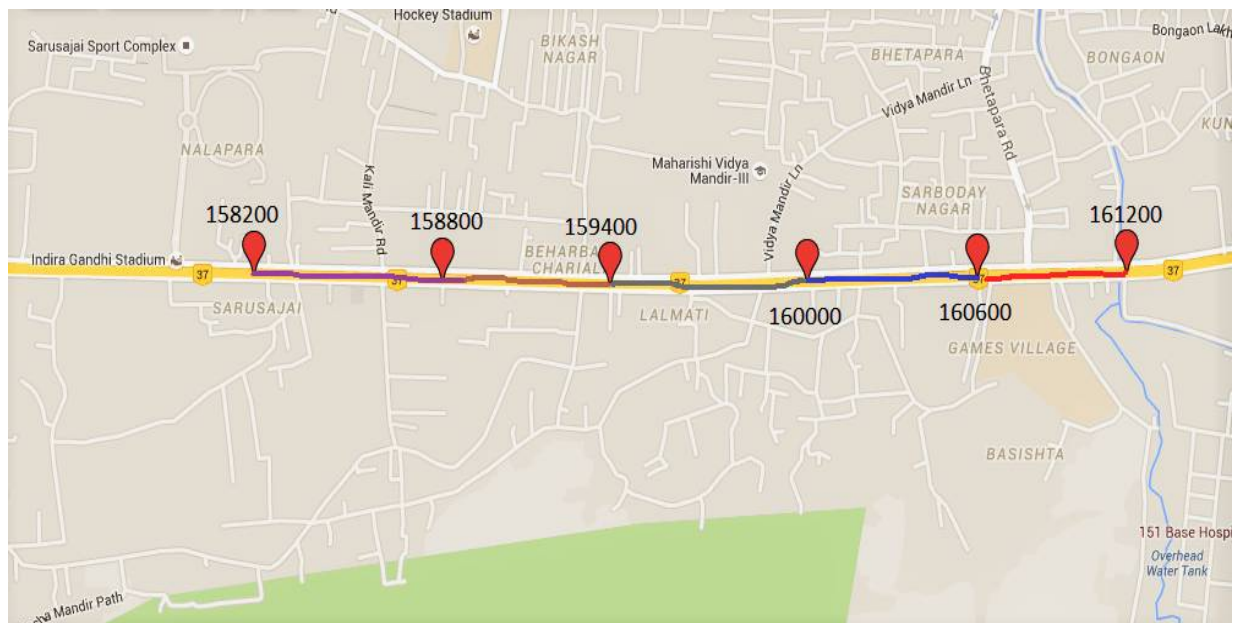


Fig. 2 Identified accident prone zone on NH-37 (New NH-27) (Source: Google Map)

- As shown in Fig 2, the accident-prone stretch i.e. the section 158200-161200 is again further divided into 5 sections of 600 m.
- The 3 methods of analysis i.e. the Accident Rate method, Accident Frequency method and Weighted Severity Index method are then used on this section to locate the exact blackspot.

Accident Rate Method

Table 5 Table showing the accident rate for the accident prone zone

Length(Km)	Stretch	Accident rate
0.6	158200-158800	10.2
0.6	158800-159400	18.33
0.6	159400-160000	41.67
0.6	160000-160600	41.67
0.6	160600-161200	43.33

As shown in Table 5, the Accident Rate is again determined for the identified accident prone zone

- The sections with more than a predetermined no. of accidents are then classified as possible blackspot locations.
- The average number of accidents occurring per unit length is taken as the predetermined number of accidents.

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Determination of average accident rate

$$\begin{aligned} \text{Average accident rate} &= \text{Total no. of accidents} / \text{Length of the entire section} \\ &= 104 / 3 \\ &= 34.67 \end{aligned}$$

Therefore, the sections with accident rate greater than 34.67 are classified as possible blackspots.

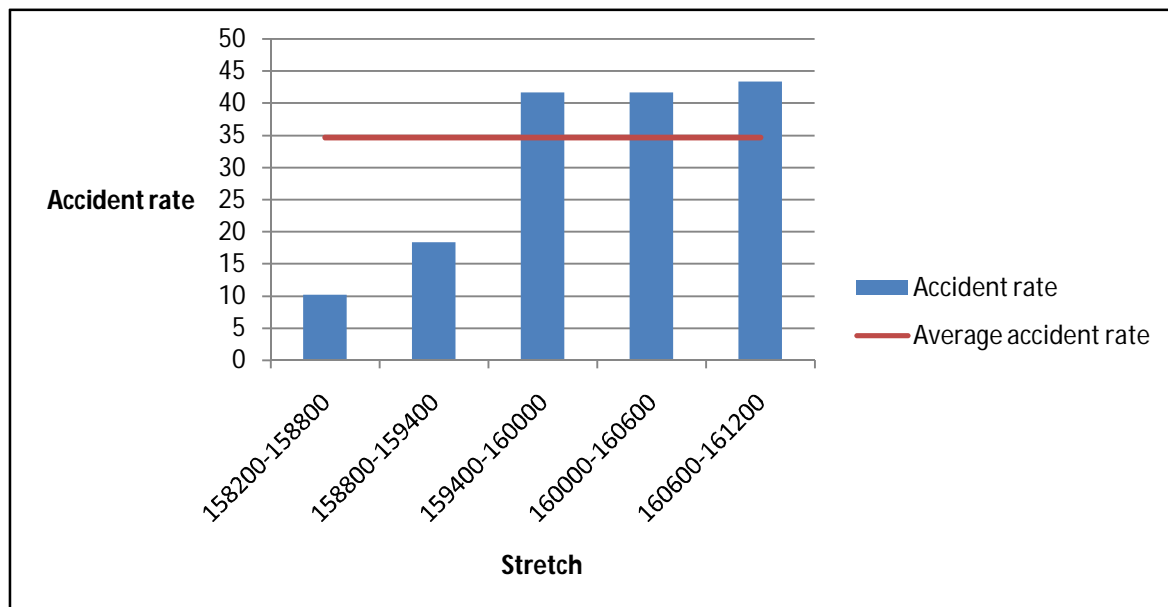


Fig. 3 Graph showing accident rate column plot on the accident prone zone (Source: Police Traffic)

From Fig 3, it is observed that the accident rate along 3 sections are more than the average accident rate of 34.67. These sections are-

1. 159400-160000
2. 160000-160600
3. 160600-161200

Accident Frequency method

Table 6 Table showing the accident frequency for the accident prone zone

Stretch	Accident frequency
158200-158800	16.3
158800-159400	10.6
159400-160000	24.05
160000-160600	24.05
160600-161200	25

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- In this method, the section with the highest accident frequency has been classified as the possible accident blackspot.
- From Table 6, it has been found that the section **160600-161200 has the highest accident frequency.**
- Thus, this section is taken as a possible blackspot.

Weighted Severity Index

Table 7 Table showing the WSI for the accident prone zone

CHAINAGE	WSI
158200-158800	268
158800-159400	104
159400-160000	187
160000-160600	263
160600-161200	449

As shown in Table 7, first the WSI values are determined for the identified accident prone zone using WSI methodology. The sections having WSI values greater than a predetermined value are then classified as possible accident blackspots.

Determination of WSI limit

- The definition of a blackspot states that-
"A section of about 500-600 m, where a minimum of 10 fatal accidents has been reported over the last 3 years is called an Accident blackspot."
- So, taking 10 fatal cases as the minimum limit ,

$$\begin{aligned} \text{WSI} &= (41 \times F) + (4 \times GI) + (1 \times MI) \\ &= (41 \times 10) + (4 \times 0) + (1 \times 0) \\ &= 410 \end{aligned}$$

- Thus, all the sections having WSI value above 410 are classified as accident blackspots.

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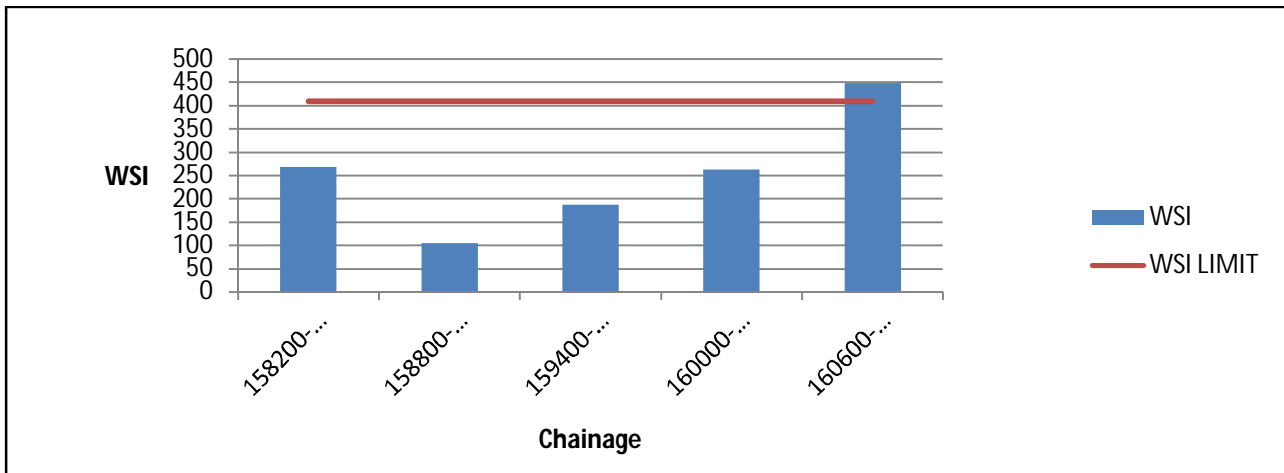


Fig. 4 Graph showing WSI plot on the accident prone zone (Source: Traffic Police)

As shown in Fig 4, by plotting a graph showing the WSI plot on the accident prone zone, it is observed that the value of WSI at the section **160600-161200** is greater than the WSI limit of 410. Hence, this section has also been identified as a possible blackspot.

VII. RESULTS

By analysing the most accident-prone sections using the 3 methods of analysis i.e. accident rate method, accident frequency method and weighted severity index method, it has been found that the section bearing chainage **160600-161200 is the possible blackspot on the highway**. Hence, further investigation is required on this section to find out the actual causes of accidents.

Some remedies which can be drawn out to reduce the number of accidents on the blackspot are-

1. A large number of unauthorised openings were found which should be closed down permanently.



Fig. 5 (a) Unauthorised Openings (Source: Site visit photography)

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From Fig 5(a), it can be seen that unauthorized openings provide easy access for two wheelers to reach the opposing lanes, thereby causing accidents. Thus, all such openings along NH-37 should be closed down permanently to not only prevent accidents but also reduce the number of traffic congestions.

2. The median height should be adequate to prevent the vehicles from passing over it.



Fig 5(b)Low median height(Source: Site visit photography)

From Fig 5(b), it is observed that low median height allows 4-wheelers to easily cross the median and reach the opposing lane. In order to prevent this, adequate median height, suggested by Indian Road Congress (IRC), should be adopted.

3. There should be a restriction on the height of trees in the median.



Fig 5(c)Restriction in vision by the trees (Source: Site visit photography)

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It can be seen from Fig5(c) that the trees along the median obstruct the view of drivers, as a result of which they are unable to see the pedestrians crossing the lanes. This is a root cause for pedestrian accidents which can be prevented by reducing the height of the trees in the median.

4. More traffic control points should be installed in areas with high traffic flow.



Fig 5(d)Open Road Divider in front of Gurudwara(Source: Site visit photography)

As seen in Fig 5(d), vehicles often try to take a U-turn at open road dividers, thereby causing serious accidents at these points. Hence, traffic control points should be installed at these dividers to control the movement of vehicles.

5. Provide sufficient space for parking.



Fig 5(e)Insufficient parking space for vehicles(Source: Site visit photography)

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Fig 5(e) was taken at a section on NH-37. It can be clearly seen that there are no adequate spaces for parking public transport vehicles like buses, tempos and trekkers at this section. As a result, these vehicles are often parked along the road, thereby leading to traffic jams and accidents. So, sufficient parking spaces should be provided along such sections.

6. Take suitable reinforcement measures to reduce the speed of vehicles.
7. Provide adequate drainage near the sides.
8. Provide separate bus bays to avoid jam between passenger's unit vehicles.

VIII. CONCLUSION

The detailed investigation and analysis of black spots help in identifying the stretches where accidents are more and these spots reduce the road safety in general. The current study was an attempt to analyse the black spots on NH-37 (New NH-27), Guwahati, Assam. Three methods i.e. Accident rate method, Accidents frequency method and weighted severity index method were used to identify the black spots on the mentioned highway. The overall methodology applied was found to be effective in locating, evaluating and treatment on the accident black spots. Some additional defaults like pedestrian facilities, bridge treatment, skid resistance and street lighting were also encountered on the highway during the field survey.

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