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# Black Spots Studies On National Highway 209 Kanakpura Road Bangalore For A Stretch Of 15km.

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## Abstract

*Accidents in India are attributed to a number of reasons including inadequate road infrastructure, heterogeneity of vehicles, poor road surface conditions, over speeding and lack of traffic education. A major challenge to highway engineers is to plan and operate highways for safe and efficient moment of traffic reducing travel time and accidents. The serious economic loss caused by road accidents demand urgent attention and appropriate measures to reduce the accident rate. Identification of black spots and implementation of remedial measures is one of the road safety measures to bring down traffic accidents. In the present study the National Highway 209 Kanakpura Road Bangalore, was selected for identifying black spots. Traffic surveys were carried out and road inventory data including pavement surface condition were collected to ascertain the causes of frequent accidents. The remedial measures have been suggested. The remedial measures when incorporated will bring down accident rates and make the road stretch safer for traffic moment and pedestrians.*

## 1.0 Introduction

India has been registering the most number of road accidents in the world with very high fatality rate. The Indian Road Federation statistics reveal that nearly 0.12 million people will be killed every year in road accidents in India. China finishes second in the dubious list registering seventy thousand deaths per annum. Though, United States has the highest number of vehicles on road, it is way behind in fatalities with thirty seven thousand deaths every year. What is worse is that while most countries show a downward trend in fatalities, India's roads and highways are showing a steady 2 to 4 percent increase in road fatalities every year. Fatalities have shown a whopping 42 percent increase in just seven years since 2005.

Even though India has registered the highest number of road fatalities, the Government's expenditure on road safety schemes has not been encouraging. The Ministry of Road Transport and Highways has been unable to spend the funds allocated for road safety for over five years. For the Financial Year 2010-11, when fatalities have climbed upto 1.19 lakh, the Ministry had spent less than 35 percent of the allocated funds for road safety.

### 1.1 Objectives

The black spot studies on National Highway 209 Kanakpura road for a stretch of 15km have been taken up with the following objectives:

- To identify the black spots in
- To carry out the investigations for frequent accidents on the identified black spots,
- To suggest short term and long term remedial measures on various spots to mitigate accidents.

### 1.2 Scope of Studies

The studies were limited to identifying the black spots, investigations to reason out the causes for frequent accidents at the identified black spots and suggesting remedial measures to mitigate the recurrence of accidents.

## 2.0 Literature Review

A case study in Bangkok is done on the Black Spots by **Tuenjai Fukuda** titled **"Empirical Study on Identifying Potential Black Spots on through Public Participation Approach"** (2005).[1] Bangkok is developing newly motorized country with more number of road users using different modes of transportation, majority of deaths and injuries are caused by vulnerable road users, where fatalities are increasing continuously

year by year. To overcome the above problems 5-E strategic approach is implemented which are Engineering, Education, Enforcement, Emergency Medical Service and Evaluation. Authors developed a concept called "Hiyari Hatto" which is basically Public Participation Approach where general public or victims are asked to identify and collect the data on the potential hazardous and existing Black Spot locations.

Methodology adopted is through group discussion, workshops and safety survey within institutions, manufacturers and transport related. Study conclude that Hiyari Hatto method not only identifying potential hazardous and existing Black Spot locations but also the correlation between the collision and its causation. (2005)

A paper titled **"The Importance of a Road Accident Data System and Its Utilization"** by **Chris Baguley**, [2] has attempted to give an overview of the main current road accident statistics of developing countries, and highlighted the fact that these countries generate a highly disproportionate amount (85%) of the world's fatalities. The situation also tends to be worsening as these countries' vehicle fleets are growing rapidly, and efforts to improve safety are not keeping pace. However, methods applied in many of the developed countries have demonstrated that it is possible to slow or arrest this growth in accidents. To achieve this requires dedicated safety workers to carry out regular, in-depth analyses of patterns of accidents and to then target many of these with various (low-cost) remedial actions that are likely to yield the most effective results. For this, the establishment of a reliable road accident database and analysis system is of importance, and this must be made accessible to all those bodies able to contribute to accident reduction (like the Police, highway engineers, vehicle engineers, education services, etc).
Indeed, it is likely that an unreliable or inaccessible database will only lead to inefficient management of road safety. The paper has discussed the more important elements of such a system and illustrated these with selected examples from systems in use. (2001)

Improvement of road way safety was major concern in Bangladesh where 3 black spots were identified treated along Dhaka-Aricha highway which is one of the important national highways which connect the Northwestern and Northern region. A study **"Effectiveness of Black Spot Treatments along Dhaka-Aricha Highway"** [3] is carried for the effectiveness of treatment by **Md. Shamsul Hoque** et.al. Black spots identified are Balitha area in Dhamrai upazilla, Golara bridge area and Golara area in Saturia upazilla under the Jamuna Bridge Access Road Project (JBARP), by preparing accidents diagram considering geo-coded accident data and location is considered as Black Spot if at least three fatal accidents reported for period of three years.

Improvement measures for Balitha area are widening of pavement along with alignment correction, construction of separate bus bay, installation of warning gate with speed reducing sign on both entry and exit. Study shows that it significantly worked and accident rate is reduced from 69% to 59%.

Remedial measures adopted for Golara bridge area are widening of pavement and embankment along with alignment correction; installation of marking, signs and guard post, improvement of bridge, which include construction of sub grade and rainwater drain. Accident rate is reduced from 67% to 50% for the year 1990-2000.

Improvement measures for Golara area in Saturia upazilla under the JBARP are widening of pavement and embankment along with correction of alignment, construction of retaining wall, bus bay, passenger shed, construction of separate lane for NMV and MV traffic on the bridge at eastern side, installation of marking, signs, improvement of intersection and accident rates reduced to 36% from 58% for the year 1990-2000.
Road safety is a major concern in the present situation in India, there are many steps required to achieve the road safety measures, hence a paper titled **"Evaluation of Accident Black Spots on Roads Using Geographical Information Systems (GIS)"** by **Deelesh Mandloi** & **Rajiv Gupta**[4] presents a method by which Black Spots can be identified. The methodology adopted requires a road network which shows the prioritization of road attributes analysis is done by incorporating the model of road related factors such as road geometries, which lead to accidents.
The factors considered for evaluating accident prone locations

- Road width.
- Number of lanes.
- Approximate number of vehicles per day.
- Type of road.
- Drainage facilities.
- Surface condition of the pavement.
- Frequent vehicle type.
- Presence of shoulders, edge obstructions, median barriers and ribbon development.
- Radius of horizontal curve.

Authors conclude that the main advantage of using this approach for identifying accident black spots on roads

is that it requires very less additional data other than the road network map. So the results obtained from this model can easily be used for planning road safety measures. Also these can be supplemented with the results obtained by using other approaches. Moreover the results can act as a quick guideline for road network planners and the authorities concerned with accident mitigation measures.
However the accuracy of this model highly depends on the way in which the road network is digitized. The road geometry can be inferred incorrectly if it is not properly digitized. (2003)

Hazardous sites ("black spots") on the roads of Serbia represent significant field of work in traffic safety improvement, hence an attempt by **Krsto Lipovac1** et.al is made by a study called **"Database of Black Spots on Main Roads in Serbia"** [5]. The methodology incorporated is of two types, subjective method of identification and objective method of identification.

- Subjective method includes Polls and interviews of the competent experts who deal at site with construction, maintenance, and supervision over the roads. This database is completed with the data collected at site.
- Objective method of identification of hazardous sites/spots is based on the analysis of traffic accidents and their consequences, and road and traffic characteristic.

Authors conclude the fact that identification methodology of black spots has still not been harmonized at the global level. The conducted researches in the process of identification of black spots on the roads in Serbia enable an organized and system acting of the road managers aimed at reduction of negative impact of the road on occurrence and consequences of traffic accidents. In addition to setting of the database on hazardous sites/spots on the roads, which represents the basis for BSM, another special contribution has been accomplished. It has been accomplished in the field of improvement and integration of joint acting of the competent institutions, primarily of road managers, traffic police, public road inspectors, supervision departments and road companies related to identification of hazardous sites/spots, on the one hand, and scientific workers from the University, on the other hand. This has contributed significantly to setting up of an efficient BSM system on the roads of Serbia. (2009)

# 3.0 Methodology

## 3.1 Identification of Black Spots

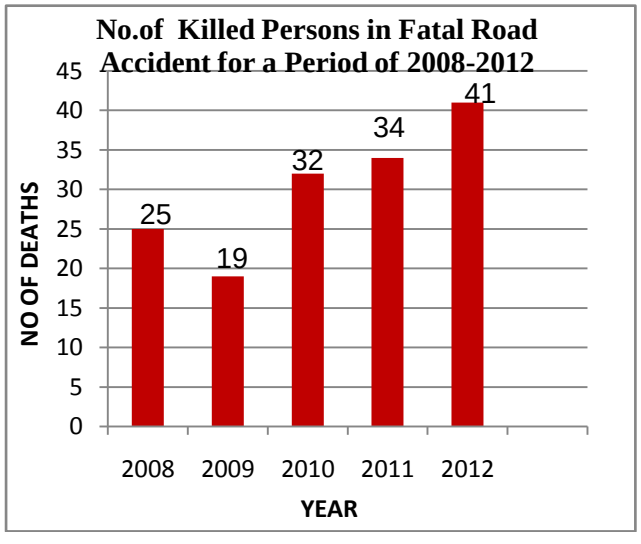
Accident data for NH-209 Kanakpura Road for a stretch of 15km is obtained from Talaghatpura Police Station (Table-1) and chart prepared for the same is shown in Chart-1.

Black spot locations are identified based on the accident data collected from police department and general interviewing with local people are shown in Table-2.

**Table-1: Black Spots with Accident History on NH 209 Kanakpura Road, Bangalore for A stretch of 15km**

| Sl. `No. | Black spots | Frequency of Accidents (Killed) | | | | |
|---|---|---|---|---|---|---|
| | Year | 2008 | 2009 | 2010 | 2011 | 2012 |
| 1 | NICE Road Jn | 2 | 0 | 2 | 4 | 3 |
| 2 | Vaishnavi Palace | 4 | 2 | 3 | 2 | 5 |
| 3 | Udipalya Turning | 4 | 3 | 4 | 5 | 3 |
| 4 | Kaglipura Curve(S) | 3 | 2 | 1 | 4 | 4 |
| 5 | Kaglipura Kere | 5 | 6 | 7 | 4 | 11 |
| 6 | APS College Bus-Stop | 3 | 1 | 3 | 7 | 4 |
| 7 | Nelguri Kere | 2 | 3 | 9 | 4 | 9 |
| 8 | Sadanapalya Gate | 2 | 2 | 3 | 4 | 2 |

**Chart-1: Statistics of killed persons for a period of 2008-2012 on NH 209 Kanakpura Road, Bangalore.**




## 3.2 Road Inventory Data

In road inventory study pavement width, shoulder width, radius at the curves and super elevation wear measured using topographical maps prepared from the use of total station.

**Table-2: Table Showing Road Inventory Data.**

| SL NO | Location of Black Spot | Chainage from Talaghatpura Police Station (km) | Pavement Width (m) | Shoulder Width (m) |
|---|---|---|---|---|
| 1 | NICE Road Jn | 1.5 | 13.80 | 0.7 |
| 2 | Vaishnavi Palace | 4.6 | 11.85 | 0.8 |
| 3 | Udipalya Turning | 6.3 | 11.20 | 0.5 |
| 4 | Kaglipura Curve(S) | 8.3 | 7.5,8.5,9.85,12.4,7.5 | 0.4 |
| 5 | Kaglipura Kere | 9.3 | 8.0 | 0.3 |
| 6 | APS College Bus-Stop | 10.6 | 7.50 | 0.5 |
| 7 | Nelguri Kere | 13.5 | 7.0 | 0.75 |
| 8 | Sadanapalya Gate | 14.2 | 7.70 | 0.5 |

## 3.3 Traffic Surveys

The average daily traffic (ADT) data of Kanakpura road stretch for the year 2008-12 was collected from Public Works Department (PWD) Office, Bangalore. The peak hour traffic data was obtained by carrying out classified traffic volume count during peak hour of the day and shown in Table 3. In addition speed studies were carried out at all black spots. The maximum and average speeds were recorded for major categories of vehicles and shown in Table 4. The local people were interviewed and their opinions about frequent accidents were also recorded.

## 3.4 Spot Speed Studies

Speed is the rate of movement of traffic or of specified components of traffic and is expressed in metric units in kmph.

Procedure for Spot speed Determination [9]

This is one of the simplest of methods for spot speed determination. Two reference points are marked on the pavement at any distance and one observer at each reference point. The observer standing at the reference point when vehicle pass first , signals that a vehicle to be timed is passing the point and the second observer then starts a stop watch . The second observer stops the stop watch when he observed the same vehicle passing the reference point.

## 3.5 Pavement Condition Survey

The visual pavement condition surveys were carried out for selected locations.

**Table-3: Table Showing Spot Speed Data of selected class of vehicles.**

| Speed(km/hour) | Two Wheelers | Car | Bus | Truck |
|---|---|---|---|---|
| Maximum | 85.10 | 87.37 | 67.28 | 58.71 |
| Average | 66.75 | 69.40 | 58.67 | 52.06 |

**Table-4: Peak Hour Traffic Data of NH-209 Kanakpura Road Bangalore.**

| Date | 29-03-2013 | | Total traffic | PCU constants | PCU /hour |
|---|---|---|---|---|---|
| Traffic Up/Down | Up | Down | | | |
| Jeeps/Taxies/Van /Three wheeler ( Auto Rickshaw) | 189 | 243 | 432 | 1.00 | 432 |
| Two wheeler | 210 | 257 | 467 | 0.50 | 234 |
| LCV | 34 | 30 | 64 | 1.50 | 96 |
| Buses | 59 | 48 | 107 | 3.0 | 321 |
| Two axle Truck or Trailer | 51 | 74 | 125 | 3.0 | 375 |
| Multi axle Truck | 14 | 23 | 37 | 4.50 | 167 |
| Tractor with trailer | 0 | 1 | 1 | 4.50 | 5 |
| Cycle or Cycle Rickshaw | 15 | 6 | 21 | 0.5 | 3 |
| Bullock cart | 0 | 0 | 0 | 8.0 | 0 |
| Other specify | 0 | 0 | 0 | -- | -- |
| Total vehicles per hour | 572 | 682 | 1254 | -- | 1633 |

## 4.0 Discussion

Eight black spots have been identified on NH-209 Kanakpura road stretch. At least, a minimum of 40 major accidents do happen every year at the black spots with in the road stretch of 26 km. The causes of accidents and remedial measures have been discussed below.

- The pavement width is not consistent throughout the length of the road. The pavement width measured at black spots varied from 7.0 to 13.8 m. Hence, it is necessary to provide uniform pavement width throughout the length of the road. The changes in the width of the pavement, wherever necessary should be through gradual transitions.
- Minimum shoulder width of 1.875 m has not been maintained throughout the length of the road. At many black spots, particularly road stretches on tank bunds the shoulder width is less than 1.0 m. Hence, it is necessary to widen the road at many locations to provide for adequate shoulders.
- At the time of survey, although minor maintenance measures including potholes filling were carried out by the highway agencies the pavement surface was characterised by high unevenness. The pavement resurfacing is recommended to provide even surface to bring down vehicle operation cost and accidents.
- Illegal parking at the sides of the road is a major cause for accidents. Trucks parked on both sides of the road without parking lights and without sufficient clearance from the edge of the pavements obstruct free movement of traffic and also cause serious accidents. Educating the truck drivers and strict enforcement by traffic police will be helpful in curbing the practice of illegal and dangerous parking.
- The Kanakpura road stretch of 15km passing through a few densely populated villages. Frequent road crossing by pedestrians add to accident proneness. In addition, domesticated animals, pet dogs freely roam on road stretch increasing chances of accidents. Provision of foot paths and zebra crossing with in village limits will be helpful in reducing the accidents.
- The traffic during peak hour goes up to 1200 vehicles per hour. For a two lane road, this leads to traffic congestion severely restricting overtaking opportunities. The impatient vehicle drivers tend to overtake dangerously, many a times leading to serious accidents. The Government and the highway authorities should initiate measures to convert 2-lane highway into a 4-lane highway with a central median.
- Two of the eight black spots are located on tank bunds with narrow shoulder width. Strong barricades have not been erected to protect the vehicles accidentally falling into lakes. As an eco-friendly measure trees can be raised on tank bunds as an alternative to expensive barricades and embankments.
- Visibility on inner sides of the curves is seriously restricted due to the presence of huge trees. The tree trunks are very close to the pavement edges. Any vehicle deviating from the pavement while negotiating curves or during overtaking of slow moving vehicles likely to cause an accident by hitting the tree trunk. Hence, trees which are very close to pavement edges have to be removed in the interest of public safety.
- Although, the geometric design for Kanakpura road stretch provides for restricted sight distances different categories of vehicles move in the speed range of 60 to 80 kmph. The inadequate sight distances contribute for traffic accidents. Hence, at few locations realignment of the highway is recommended to improve sight distances..
- The accidents may also occur due to driving under the influence of alcohol, fatigue, severe mental stress and poor health condition of the drivers. Such issues have to be addressed through proper social engineering.
- Provision of road furniture, warning signs and speed breakers at appropriate locations will be helpful in mitigating accidents. Lane marking and pavement

edge marking with fluorescent paints help drivers to maintain lane discipline, especially during night time. Providing the medians and widening the roads at few black spots will reduce recurrence of accidents.

## 5.0 Conclusions

The black spots on the Kanakpura road, Bangalore for a stretch 15km were identified based on the data collected from the Police Department. At least, a minimum of 30 fatal accidents do happen at the black spots with in the road stretch of 15 km. Traffic surveys, road inventory data collection, alignment surveys and local enquiries were carried out to identify the major causes of accidents. Heavy traffic, poor road geometrics, over speed, limited sight distances and lack of traffic discipline are the important causes of accidents. A few short term measures include providing adequate road furniture, speed breakers, lane markings, pedestrian crossings and good pavement maintenance. The long term measures involve widening of the pavement and shoulders, barricades for tank bunds and realignment of highway at few locations. In addition, control of illegal parking of trucks, checking for drunken driving and enforcing speed restrictions also contribute for accident mitigation.

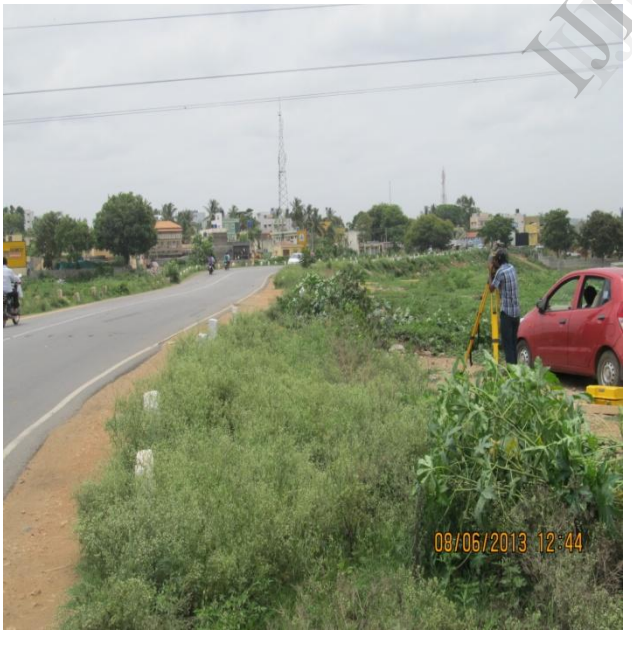



**Plate 1 Absence of barricades along Nelguri kere, Kanakpura Road Stretch Bangalore.**


**Plate 2 Presence of huge trees along Kanakpura Road Stretch Bangalore.**

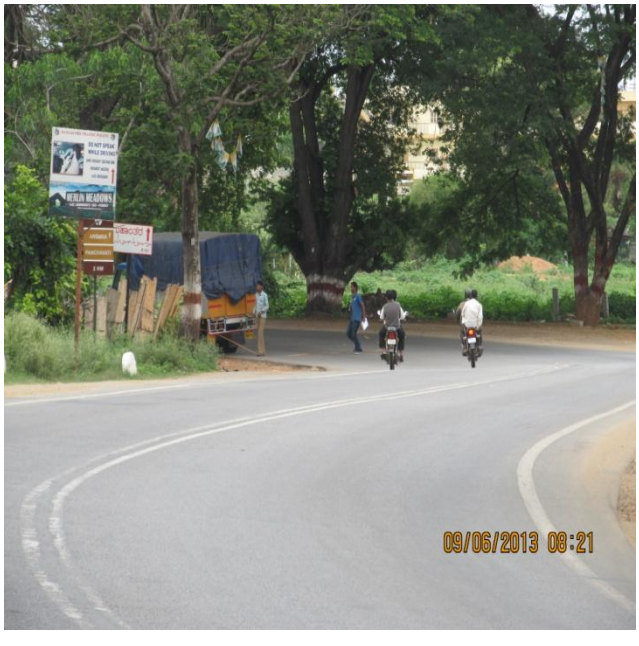



**Plate 3 Blocking the view for driver negotiating s- curve due to Presence of huge tress along Kanakpura Road Stretch Bangalore.**

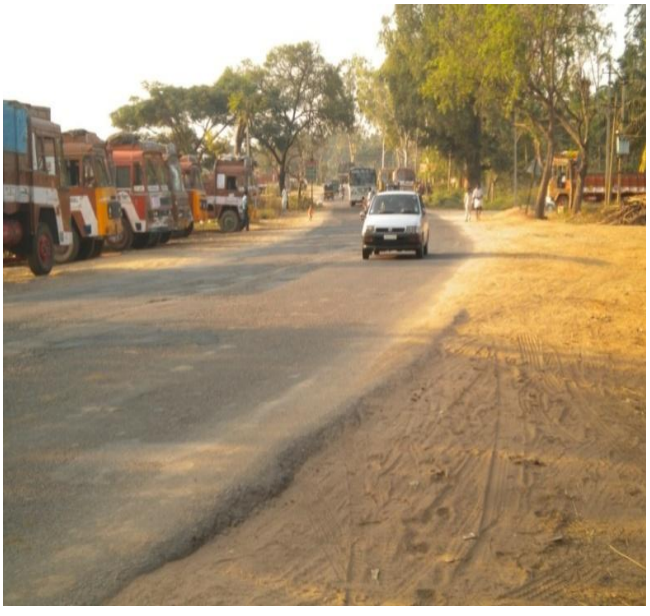


**Plate 4 Illegal parking on the Highway shoulders at Kanakpura Road stretch Bangalore**



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