

REVAMPING THE ROAD ACCIDENT BLACKSPOT

¹MRS V.MALARVIZHI,²LAVANYAS,³PRISCILLAP,⁴RAJASREEC,⁵ SAKTHIB

¹²³⁴⁵DEPARTMENT OF CIVIL ENGINEERING, PANIMALAR ENGINEERING COLLEGE, BANGALORE TRUNK ROAD, VARADHARAJAPURAM, NAZARETHPET, POONAMALEE, CHENNAI-600123.

Abstract

The NH-7 stretch between Krishnagiri and Dharmapuri has turned a killer stretch in recent times. Two hundred people have been died in over 1500 road accidents on this particular road in the last three years. In order to control the accidents, we came up with an idea of "Revamping of road accident blackspot" where we made several field study, collected data of errors in the design of highways and ideas which can rectify it. The technical features of the road such as Gradient and Horizontal curve as per IRC has been checked during investigation. The road stretch, we chose is about 8 kms in length and 3m in width per lane. It will start from Kattamedu, the entry point of thoppurghat at road and end at thoppur village.

Keywords: Road accidents, Blackspots, Gradient, Horizontal Curve.

INTRODUCTION

India is a vast country with diverse geological, climatic regions. Indian road network passes through different terrains including hills and mountains. Accidents in highway has become a common feature of the human experience happening worldwide every year. This has made a impact to fear of highways. Thoppur is one such accident the prone area. In survey we found that "The major cause of accidents are occurring due to bends in the thoppurghat way". Drivers negligence is a common cause in accidents. As there are descending curves, vehicles with even low payload find it difficult to make turns. Immediately after the first hairpin bend, the driver has to quickly turn in the opposite direction and because of the speed generated in the descent most vehicles collide with another vehicle because of brake failure.

ROAD ACCIDENTS:

Road collisions in Tamil Nadu, a state in South India, are among the highest in India. In 2013, the state recorded 15,563 fatalities in the 14,504 recorded collisions, the highest for any state in India. The state also topped the list of most collisions in a state for all previous 18 years from 2002 to 2020. According to the report of two experts published in the International Journal of Research in Management and Technology, driving under the influence of alcohol accounts for 82 percent of collision fatalities in India. The increase in number of vehicles from 82 lakh (8.8 million) in 2007 to 1.6 crore (16 million) in 2012 without appreciable change in the road infrastructure is also believed to be the reason for most collisions.

Fig 1: Accident Summary

Year	TOTAL ACCIDENT	MINOR	INJURED	MAJOR	FATAL	FATALITIES	NON-INJURED
2018	88	69	123	1	3	3	25
2019	108	82	103	2	8	10	39
2020	90	67	119	1	4	10	18
Total	297	198	345	4	15	23	82

ROADCOLLISIONS:

According to a report released by the Tamil Nadu Police in 2013, there were a total of 15,563 fatalities in 14,504 recorded collisions. The corresponding number of people sustaining grievous injuries in 4,715 collisions was 6,513, and the number of people who sustained minor injuries was 69,168 in 44,158 collisions. A total of 2,861 people escaped injuries. The state also topped the list of most collisions among all states for all previous ten years from 2002 to 2012. It was estimated that there were around eight collisions every hour and a total of 15 percent of all collisions in the country occurred in the state. The data from National Crime Record Bureau indicated that the state capital, Chennai, had 9,663 collisions, the most of any city in India in 2012. During 1990, the state stood second behind Uttar Pradesh in the country with 6,693 recorded collisions.

IV CAUSES OF ROAD ACCIDENT

According to Tamil Nadu police, the other major reason for the collisions is the increase in the number of vehicles compared to the road length. Some experts believe that the surveillance by traffic police is biased and enforcement of rules alone is not sufficient. Some non-governmental organizations have claimed that urban planning has not kept pace with the increase in number of vehicles. The state-owned buses are also cited as a major cause for the collisions, with a total of 1,300 collisions during 2012. As per the report published by the state transport authority in 2013, 63,658 were caused by the fault of drivers, 779 by passengers other than driver, 1,007 by pedestrians, 206 by mechanical defects, 140 by road condition, 97 by bad weather and 351 by other reasons.

V PREVENTIVE MEASURE

S: The curves in the direction separated by short tangents known as broken back curves be avoided as far as possible and replaced by single curve.

1. Superelevation is required to be centrifugal at horizontal curves to counter the effects of centrifugal force and it is estimated that the centrifugal force corresponding to $3/4$ th of the design speed is balanced by superelevation.
2. Establish and maintain documented procedures to control and verify the design to ensure that specified requirements are met.
3. Inspection and testing shall be carried out to compute the evidence of conformance of the rectified requirement.
4. Documented procedures to control and maintain inspection, measuring and testing equipment shall be established and maintained.

VI BLACK SPOTS:

In road safety management, an accident black spot or black spot is a place where road traffic accidents have historically been concentrated. It may have occurred for a variety of reasons, such as a sharp drop or corner in a straight road, so oncoming traffic is concealed, a hidden junction on a fast road, poor or concealed warning signs at cross-roads. The stretch between Omalur and Teevattipatti was identified as 'black spot' due to frequent accidents and as such it was decided to accord priority to it in undertaking the development works.

VII. PRINCIPLES OF GEOMETRIC DESIGN

Design criteria of hilly terrain shall be applied where stretches of plain/rolling terrain are short and isolated. Similarly, the stretches where hilly terrain intervenes for short and/or isolated stretches in plain/rolling terrain, criteria for such stretches shall be as per standards for plain/rolling terrain. A uniform application of design standards is desirable for safe and smooth flow of traffic. The use of optimum design standards will reduce the possibility of early obsolescence of the facilities likely to be brought about by inadequacy of the original standards. As a general rule, geometric features of a highway except cross-section

CAUSES FOR THE THOPPURHAT BLACK SPOT

The poor planning in the construction of the Thoppurhat road is the primary cause of the repeated accidents in the stretch of the national highway. The geometric calculations are wrong which is needed to be modified. As there are back to back descending curves, vehicles with even low payload find it difficult to make a turn.

Fig 2: ANALYSIS OF ROAD BEHAVIOUR



ALIGNMENT OF HILLROADS

In order to explore the possibility of various alternative alignments, preliminary investigation shall start from the high obligatory or control summit points and proceed downwards. The alignment finally selected linking the obligatory and control points shall fit in well with the landscape. The aim shall be to establish a safe, easy, short and economically possible line of communication between the obligatory points considering the physical features of the region and traffic needs apart from least disturbance to the eco-system and the prevailing High Tension line, existing service lines. Ideal road alignment is the one which will cause the least over-all transportation cost including safety for road users taking into account the costs of construction, maintenance, and recurring cost of vehicle operation.

VII. GRADIENT:

It is the rate of rise or fall of road level along its length. It is expressed either as the rate of rise or fall to the horizontal distance or as per cent rise or fall. In India usually, former practice is used.

TYPES OF GRADIENT:

- I. Maximum Gradient
- II. Ruling Gradient
- III. Limiting Gradient
- IV. Exceptional Gradient

MAXIMUM GRADIENT:

It is the maximum or steepest gradient which is allowed to be provided in a road which must never exceed in any part of the road as steeper gradients are very inconvenient to the traffic, more especially for the slow-moving traffic. The maximum gradient is allowed to be provided when compelled by the topography of the area to affect a larger reduction in the cost of earthwork. Long stretches of such gradients should be separated comparatively flatter gradient or a level section. Thus it is also called a limiting gradient. IRC has recommended the following values of the maximum gradient:

In Flat or Rolling Terrain – 1 in 20 Hilly Terrain – 1 in 15

1. RULING GRADIENT:

This is the desirable upper limit or permissible limit of the gradient in the alignment of the road. This is governed by the mode of transport in the locality. Thus a design engineer must aim to provide a gradient within the ruling gradient limits keeping in view the mode of traffic and topography. This gradient should be such that animal-driven vehicles can overcome long stretches without much fatigue of animals and power-driven vehicles without uneconomical fuel consumption. Indian Road Congress has suggested the value of ruling gradients as below.

In Flat or Rolling Terrain -1 in 30 Hilly Terrain -1 in 20

1. MINIMUM GRADIENT:

The gradient provided on flat or level road to drain off the rain water is called minimum gradient. It should be sufficient to drain off the rain water from the pavement surface. Its value depends upon the topography, type of soil, run-off and other site conditions. In general 1 in 200 gradient is sufficient but for cement concrete surface a grade of 1 in 500 is quite sufficient. The 0.5% value may be reduced to 0.30% for a good quality surface supported on a firm and accurately crowned subgrade.

EXCEPTIONAL GRADIENT:

During the alignment of the road, there may be situations where grades may have to be provided with either lesser than the minimum or greater than the maximum. Thus exceptional gradients are provided in exceptional situations such as in approaches to causeways or near hairpin bends etc. This gradient should be provided only for very short stretches not exceeding 60 to 100 meters in one-kilometre length and should be separated by a minimum length of 100 m.

1. GRADIENT AS PER IRC:

Ruling gradient of mountainous (ghat section) terrain is 5% (1 in 20) and limiting gradient is 6% (1 in 15)

2. GRADIENT AS PER SITE : (LHS- DOWNWARD SIDE-DHARMAPURITO SALEM)

From the Km $159/600$ (kattamedu) to $160/800$ (anjaneyerkovil) the gradient is 1 in 20.60

1. From the Km $160/800$ (anjaneyerkovil) to $161/620$ (thoppukanavai) the gradient is 1 in 22 . The existing gradient is varying from $1:20$ to $1:22$. Hence the gradient is allowable one as per IRC.

IX. HORIZONTAL CURVES:

Horizontal Curves are one of the two important transition elements in geometric design for highways (along with Vertical Curves). A horizontal curve provides a transition between two tangent strips of roadway, allowing a vehicle to negotiate a turn at a gradual rate rather than a sharp cut

1. TYPES OF HORIZONTAL CURVES

- (i) Simple. This simple curve is an arc of a circle. ...
- (ii) Compound. Surveyors often have to use a compound curve because of the terrain...
- (iii) Reverse. A reverse curve consists of two simple curves joined together but curving in opposite directions....
- (iv) Spiral. gradual change in curvature from a straight section of road to a curved section. They assist the driver by providing a natural path

**.2. HORIZONTAL CURVE AS PER IRC:
MOUNTAINOUS AND STEEP**

Desirable minimum radius- 150 m. Absolute minimum radius- 75 m

2. HORIZONTAL CURVE AS PER SITE: (LHS-DOWNWARD SIDE- DHARMAPUR TO SALEM)

- 1 Km 159.978-Radius(R):204.500m
- 2 Km 160.688-R:123.350m
- 3 Km 161.040-R:115.000m increased to 120m*
- 4 Km 161.260-R:94.500m increased to 114m*
- **Within available land under Blackspot mitigation measures
- 5 Km 161.850-R:395.500m
- 6 Km 162.256-R:504.500m
- 7 Km 162.497-R:295.500m
- 8 Km 163.003-R:695.500m

The curves are sharp but within the limit of IRC. Maximum speed allowable is 40 Km/hr. Now, it is proposed that the additional safety measures in the existing alignment with a view to reduce accidents apart from proposed re-alignment.

X. ANALYSIS OF THE ACCIDENT:**1. BACKGROUND OF THE ACCIDENT**

A truck rammed into multiple cars that were stationed at Km 161+650 due to another accident occurred ahead of Km 161+650 location.

2. THE TRUCK (6 AXLE TRAILER)

- permissible load as per MV Act: 57.750 ton
- Load carried cement bags: 56.770 ton
- Time the truck crossed toll: 14:44:40 hrs
- Time of accident: 14:55:40 hrs
- Time taken to reach: 11 min
- distance travelled: (Km 161.650-Km 154.440)
- = 7.2 km
- Avg speed of the truck: 65.45 Kmph

XI CONCLUSION:

So hereby we conclude that, redesigning of the hilly road at NH-44 by reducing the horizontal curve and changing gradient may ultimately result in minimizing the accidents.

Rather than driver's fault, improper geometrical design are notable reasons for the problems faced in the hilly road.

- In accordance with IRC 52 2019, the proper norms should be taken but the negligence of this norm paved the way to the inappropriate happenings. Considering the Indian road congress, the road should be redesigned accordingly.

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