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ACCIDENT RATE COMPARISION OF VARIOUS NATIONAL HIGHWAYS AND PREVENTIVE MEASURES FOR ACCIDENT REDUCTION

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ABSTRACT

Road safety is an issue of prime importance in all motorized countries. The road accident results a serious social and economic problems. Studies focused on geometric design and safety aim to improve highway design and to eliminate hazardous locations. The effects of design elements such as horizontal and vertical curves, lane width, shoulder width, super elevation, median width, curve radius, sight distance, etc. on safety have been studied. The relationship between geometric design elements and accident rates is complex and not fully understood. Relatively little information is available on relationships between geometric design elements and accident rates. Although it has been clearly shown that very restrictive geometric elements such as very short sight distances or sharp horizontal curve result a considerably higher accident rates and that certain combinations of elements cause an unusually severe accident problem. In this paper, road geometric design elements and characteristics are taken into consideration, and explanations are given on how to which extent they affect highway safety.

INTRODUCTION

Motor vehicle accidents kill about 1.2 million people in a year world-wide and the number will grow to more than 2 million in 2020 unless steps are taken; a study released by the World Health Organization (WHO) and the World Bank. [Washington: Article-Traffic accidents becoming one of world's great killers, By Matthew Wald, April 8, 2004]. Any design solution mitigating this kind of individual human behavior cannot be predicted, only some safety rules can be enforced. Also, vehicle factors, related to mechanical behavior of vehicles are not the scope of civil engineering study. Hence, road factors are only considered as part of this study. It is very important for the highway to establish a harmony between all the three factors at the design stage of highway. With a geometrically good design, it is possible to compensate for the other factors and thus decrease the number of traffic accidents.

Basic Parameters of Highway Geometric

Terrain/Topography

The classification of the terrain is done by means of cross slope of the country, i.e., slope approximately perpendicular to the center line of the highway location. To characterize variations in topography, engineers separate it into four classifications according to terrain as listed in Table 1.1

Terrain Classification	Cross slope of country (%)
Plain	Less than 10
Rolling	Greater than 10 up to 25
Mountainous	Greater than 25 up to 60
Steep	Greater than 60

Horizontal Alignment

The horizontal alignment is the route of the highway, defined as a series of horizontal tangents and curves. Horizontal curve is the curve in plan to change the direction of the center line of the highway. The geometries of horizontal alignment are based on inappropriate relationship between design speed and curvature and on their joint relationship with super elevation and side friction. Typical horizontal curve furnished in figure 1.1as per Indian Road Congress (IRC) guidelines (IRC: 38-1988 & IRC: 73-1980)

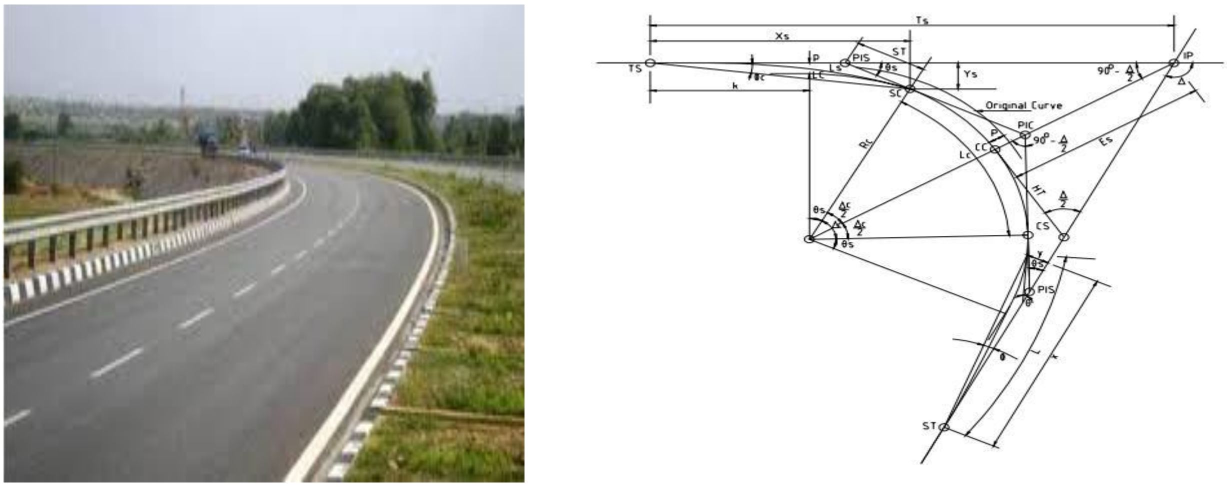

Figure 1.1: Typical Horizontal Curve

Vertical Alignment

Vertical alignment is the longitudinal section of a roadway to provide easy and safe change of gradient. It is defined as a series of gradients and vertical curves. Gradient is the rate of rise or fall with respect to the horizontal along the length of a road expressed as a percentage or as a ratio or in degrees. Vertical curves to effect gradual changes between gradients with any one of the crest or sag types and result is safe and comfortable in operation, pleasing in appearance, and adequate for drainage. The typical vertical curve in crest condition is furnished in figure 1.2 as per IRC: 23-1989.

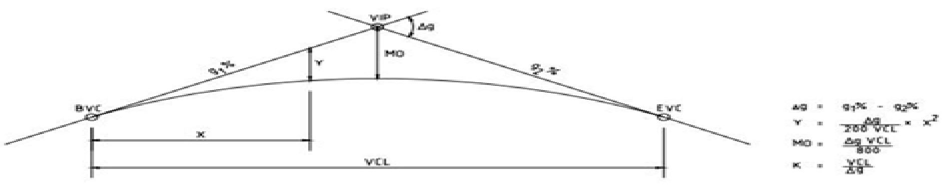

Figure 1.2: Typical Vertical Curve

IJARSE
ISSN: 2319-8354

Where

VIP	:	Vertical point of intersection.
g	:	Gradient
MO	:	Mid-ordinate
Δ g	:	Algebraic difference in grades (percent) of the grades tangents.
VCL	:	Vertical curve length measured horizontally.
BVC	:	Beginning of vertical curve
EVC	:	End of vertical curve
K	:	Horizontal distance required to effect a one percent change in gradient.

RESULTS AND DISCUSSION

Determining Cross Section

The Flow Chart showed in Figure 4.1 details a procedure to help determine the most appropriate cross section to be used. References to other relevant sections of the Manual are given for assistance.

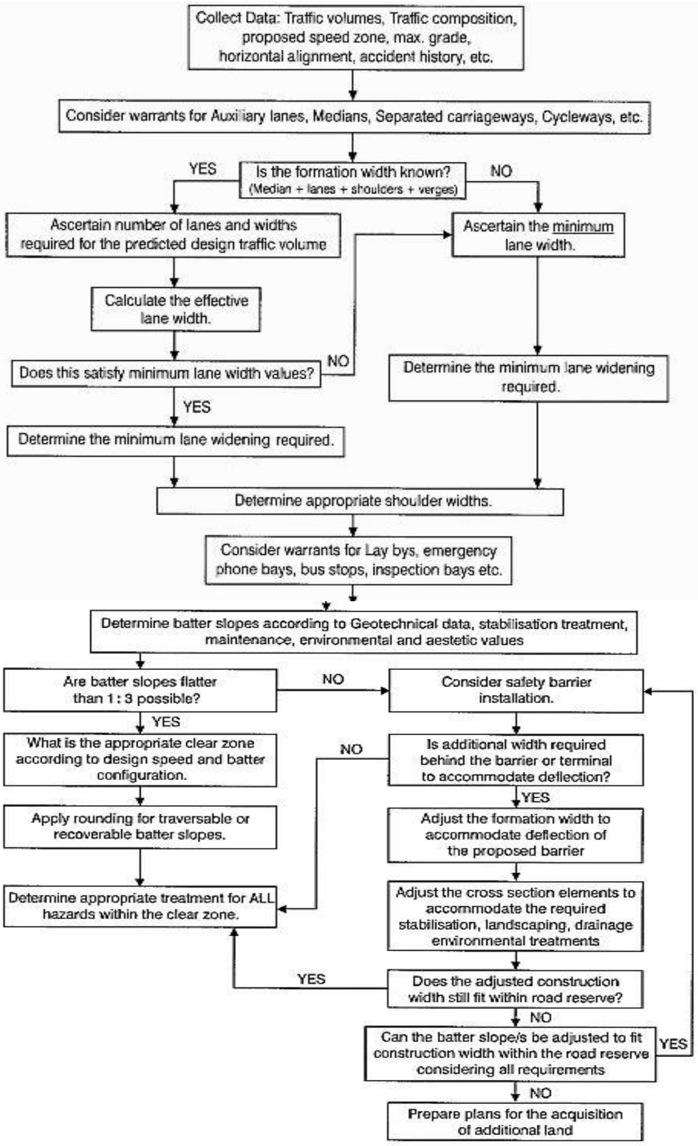

Figure 4.1: Cross Section Determination Flow Chart

IJARSE
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A traffic lane is that part of a roadway reserved for the normal one way movement of a single stream of vehicles. Traffic lanes provide a variety of functions important to the overall efficient function of the road hierarchy, such as:

- through road,
- special - bus, transit, etc.,
- auxiliary (turning or overtaking),
- parking,
- cycling.

Traffic lane width is normally determined after consideration of the road's annual average daily traffic (AADT) and peak hour traffic volumes, where relevant. Vehicle dimensions and the combination of speed and traffic volume should also be taken into account.

Drivers also tend to reduce their travel speed, or shift closer to the centre of the lane/road, or both, when they perceive a hazardous object is too close to either the nearside or offside of their vehicle. The most common driver reaction to this type of hazard is, however, a movement of their vehicle away from the hazard. The offset of a fixed hazard from the edge of the traffic lane beyond which this reaction is not observed is termed the 'Shy Line'. The shy line is normally taken as the distance from the edge of the traffic lane to the outer edge of shoulder, or the distance shown in Table 4.1, whichever is the greater.

Design or 85th Percentile Speed (km/h)	Shy Line Offset (m)	
	Nearside (Left)	Offside (Right)
≤ 70	1.5	1.0
80	2.0	1.0
90	2.5	1.5
≥ 100	3.0	2.0

Table 4.1: Shy Line Offsets

Reductions in lane width reduce the lateral clearance between vehicles and also to fixed obstacles. This leads to reduced travel speed and lane capacity and Tables 4.2 and 4.3 show the reduction in lane capacity caused by a fixed hazard close to the road.

Clearance to fixed obstacle close to the road	Lane Capacity (% of 3.5m lane capacity)			
	3.5 m lane	3.3 m lane	3.0 m lane	2.7 m lane
1.8	100	93	84	70
1.2	92	85	77	65
0.6	81	75	68	57
0.0	70	65	58	49

Table 4.2: Two-lane Two-way Road Lane Capacity

IJARSE
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Clearance to fixed obstacle close to the road	Lane Capacity (% of 3.5m lane capacity)			
	3.5 m lane	3.3 m lane	3.0 m lane	2.7 m lane
1.8	100	95	89	77
1.2	98	94	88	76
0.6	95	92	86	75
0.0	88	85	80	70

Table 4.3: Four-lane Dual Carriageway Road Lane Capacity

Two-Lane Two-Way Rural Roads

The minimum traffic lane width for a two-lane two-way rural state highway should be determined from Table 4.4. Where the AADT lies near to a boundary between groups the use of the higher value must be carefully considered.

Where the design speed in mountainous terrain exceeds 80 km/h, or 120 km/h in undulating terrain, or where there are a high percentage of heavy vehicles (20% for 500 AADT and 5% for 2000 AADT), a lane width of 3.5 m is desirable.

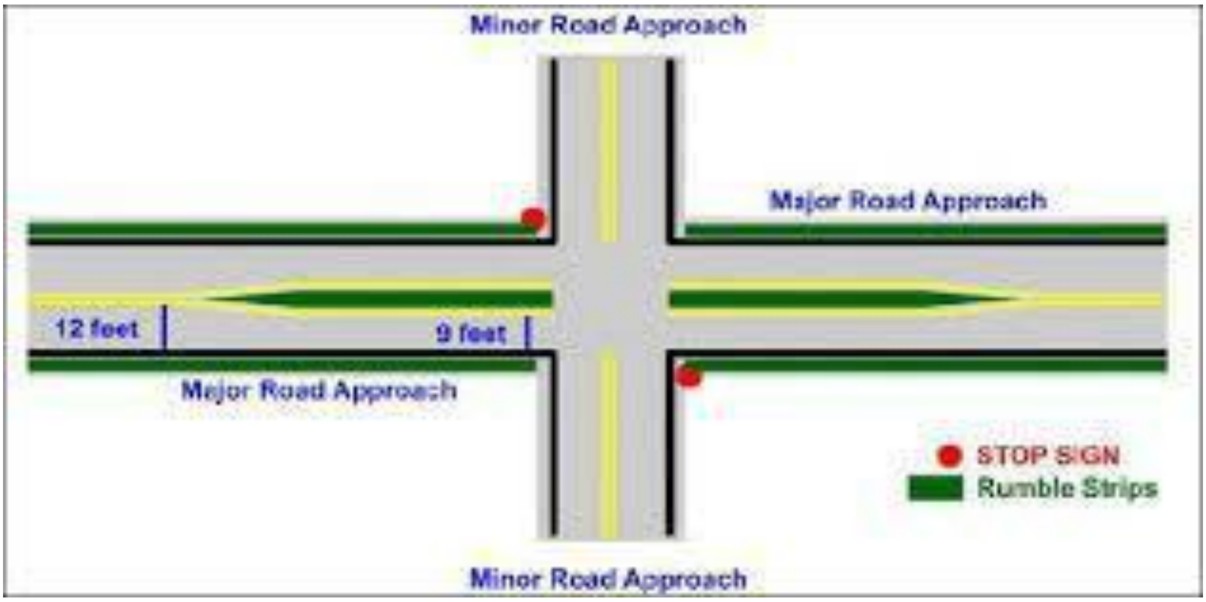

Figure 4.5:Two Lane Two Way Rural Roads

Multilane Rural Roads, Expressways and Motorways

The minimum traffic lane width for multilane rural roads, expressways and motorways is 3.5 m. Desirably, any rural road consisting of four lanes or more should have a central median to separate the opposing traffic flows.

Effective Width of TwoTraffic Lanes (m)	Anticipated AADT at Opening		
	Low Future Growth (< 3%)	Reasonable Future Growth (3 - 6%)	High Future Growth (> 6%)
6.6	up to 700	up to 500	up to 300
6.5	700 - 1700	500 - 1200	300 - 900
7.0 *	over 1700	over 1200	over 900

** Where local conditions dictate widths in excess of 7.0 m may be considered*

Table 4.4: Traffic Lane Width Guidelines for Two-lane Two-way Roads

Urban Roads

The desirable state highway traffic lane width in urban areas is 3.5 m. Where the road reserve width is restricted, lane width(s) may, with Standards and Strategy Manager approval, be reduced.

The differing functions and uses of each lane must be taken into account when 'squeezing' an extra lane from an existing or partially widened road formation, or fitting the required number of lanes into the space available, is necessary. Lane widths must be allocated on an equitable basis in these situations and the widths varied in 0.1 m increments from the desired 3.5 m to a minimum of 3.0 m, with the following provisions:

- On Straight Alignments: 3.l m is the minimum width for a lane. All other lanes must be at least 3.0 m wide.
- On Curved Alignments: Widening in accordance with Table 4.5 must be applied.

Normal Lane Width (m)	Radius (m)	Widening (m per lane)
3.5	60 - 100	0.6
	100 - 150	0.3
3.0 to 3.4	60 - 100	0.9
	100 - 150	0.6
	150 - 300	0.4
	300 - 450	0.3

Table 4.5: Lane Widening on Curves in Urban Areas

It is desirable to locate a barrier kerb at least 0.5 m clear of the edge of the adjacent traffic lane, to compensate for a driver’s tendency to shy away from them. Usually, the width of the channel will provide an adequate clearance.

Where over-dimension vehicles use the road, e.g. heavy haulage by-passes, wharf access routes, etc, allowance must to be made for the size of these vehicles and their tracking characteristics. The local heavy vehicle operators must be consulted and a suitable design vehicle developed for these routes.

CONCLUSIONS

After reviewing on the many studies which are related the safety of cross-section and alignment elements can be concluded the following:

●The presence of a median has the effect of reducing specific types of accidents, such as head-on collisions. Medians, particularly with barriers, reduce the severity of accidents

●Rates of ROR and OD accidents decrease with increasing lane and shoulder width. However, the marginal effect of lane and shoulder width increments is diminished as either the base lane width or shoulder width increases.

●On multilane roads, the more lanes that are provided in the traveled way, the lower the accident rates.

●Shoulder wider than 2.5m give little additional safety. As the median shoulder width increase, accidents increase.

●From the limited information available, it appears that climbing lanes can significantly reduce accident rates.

●Lane width has a greater effect on accident rates than shoulder width.

●Horizontal curves are more dangerous when combined with gradients and surfaces with low coefficients of friction. Horizontal curves have higher crash rates than straight sections of similar length and traffic composition; this difference becomes apparent at radii less than 1200 m.

● Fixing the cameras everywhere and if the reaction of the traffic police works accordingly may create fear in the drivers then they also follow the rules it leads to decrease in the accident rate.

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