

Geometric Design of Road

Vivek Mahure¹, Sarang Motghare², Divyanshu Dashriya³, Shubham Parate⁴, Purva Ghodam⁵

Prof. Hemant Sangodkar

Dept. of Civil Engineering, M.I.E.T Shahapur, Bhandara-441906

Abstract –The study of redesign the existing rural road into more wider road for heavy traffic and safe transportation. The road from ganeshpur to wainganga river is located in bhandara city in india . This road for transportation of goods, sand, brick etc. form wainganga river. The studies involves collection of details such as road gradient, width ,deflection angle, radius of curve and length of curve and design them to the formal standards of IRC code. The curve parameters have been measured using survey compass by traversing along center line of the curve.

Keywords—Gradient, compass, deflection angle, IRC code.

I- INTRODUCTION

India is a vast country and to connect its different parts with a good network of road is essential. The deficiency in agriculture and economic progress in India is also due to the lack of good roads specially in villages. In villages mostly fair weather road are there i.e. those road, which can be used only in fair weather and disconnect the villages from towns and railway station during rainy season. Hence for the uplift of villages and economic development of country good and upto date road are very essential. Because of roadway we can travel easily from one place to another place.

The Government of India launched the PRADHANMANTRI GRAM SADAK YOJANA (PMGSY) on 25h December, 2000. The primary objective of the PMGSY is to provide connectivity by way of an all weather road to the eligible un-connected habitations in the rural area, in such a way that all un-

connected habitations with a population of 500 persons and above are to be covered in plain area.

The physical features of road are known as road geometrics. This physical features have direct connection with highway users. These are provided according to their geometrical design in order to facilitate safe and economical operation of vehicles.

As per available space we have designed a single lane road The road comes under the village i.e. village road. We have designed the village road As per IRC recommendation.

The physical features of road are designed as follows:-

(a) RIGHT OF WAY

The area of land acquired and reserved for construction development of a road along it's alignment is known as right of way.

b) CARRIAGEWAY

The portion of roadway constructed for movement of vehicular traffic is called carriageway. The width of carriage way Depends on the width of traffic lane and number Of lane required.

As per I.R.C.

SR. NO.	CATEGORY OF ROAD	CARRIAGE WIDTH IN METER FOR SINGLE LANE ROAD
1	NH& SH	3.75
2	MDR	3.75
3	VILLAGE	3.0

	ROAD	
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secured and reserve to meet the future demand of the development of the road.

(e)ROAD WAY WIDTH

The top width of a highway embankment or bottom width of highway cutting excluding the side drain is called as road way width. Road way width is decided and constructed to meet the present traffic requirement, topographical feature, design needs and ultimate economy of the road.

I.R.C. Recommendation

Sr. No.	Category of Road	Open area and agriculture Country			
		Land width		Buildi ng line	Control Line
		Norma l (m)	Range (m)		
1.	State highway and National Highway	45	30 to 60	80	150
2.	MDR	25	25 to 30	50	100
3.	Village Road	12	12 to 18	25	30

Sr. No.	Category of road	Roadway width in mater
		Plain and rolling terrain
1.	Village Road	7.5m (single lane)

(c) SHOULDER

The portion of the roadway between outer edge of the pavement and edge of the top surface of embankment or inner edges of the side drain incutting are known as shoulder.

Objects of shoulder:

1. To provide lateral stability to the carriageway.
2. They provide space for erecting road signals

Minimum shoulder width as per I.R.C. recommendations

Sr. No.	Category of Road	Shoulder width in meter	
		Plain Area	Hilly Area
1.	Village Road	2.25m	5m

(d)ROAD MARGIN

The portion of land width on either side of the roadway of a road is Known as road margin. Road margin are

(f) SIDE SLOPE

The slope given to the side of earth work of road in embankment or in cutting for its stability is called as side slope.

As per I.R.C. specification for side slope:

In embankment -2:1

In cutting: In ordinary soil 1:1

1 2:1 & 1:1 side slopes for embankment

(g) BERMS

The portion of land width left in between in the toe of a road embankment and the inner edges of barrow pits on the portion in between the top edge of the road cutting and nearest edge of soil banking either side are known as berms.

(h)FORMATION LEVEL

The reduce level of the finished surface of earth work for a road in embankment or in cutting is known as the formation level. Formationlevel of highway should be decided such as to provide economical earthwork inroad project.

G) CAMBER

The convexity provided to the surface of carriageway or the rise given to the center of carriageway above it's edge on straight portion of the road is called as camber.

1. To regulate the vehicles to their proper lanes

2. To improve architectural appearance of the roadway

Types of camber:-

1. Composite camber
2. Sloped or straight camber
3. Two straight line camber
4. Barrel camber

We have adopted slope or straight type camber

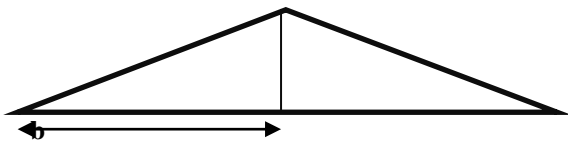


fig:- Slope or straight camber

As per IRC specification

SR. NO.	TYPES OF ROAD SURFACE	
1	THIN BITUMENOUS SURFACING	1 IN 50 TO 1 IN 40 (2 TO 2.5%)

(j) GRADIENT

The rate of rise or fall provided to the formation of a road along its alignment is called as gradient. It is a horizontal slope provided to the formation of the road along its alignment it is expressed as the ratio of rise or fall to the horizontal distance.

Objects:-

1. To connect terminal station situated at different level.
2. To make earthwork of road project economical.
3. To construct side drain economically with convenient depth below to ground level

Different types of road gradients

- a. Limiting gradient
- b. Exceptional gradient
- c. Average gradient
- d. Floating gradient
- e. Minimum gradient
- f. Ruling gradient

(k) DESIGN SPEED

The maximum speed of vehicle assume for geometrical design of road is known as design speed.

The overall geometrical design of any road depends on design speed. It is essential that the assumed design speed should be in for conformity with the high standard of mobility. Safety and efficiency desired on different categories of road.

Design speed of village road as per IRC recommendation.

Sr. No.	Category of road	Design speed in kmph	
		Plain area	
1.	Village road	Ruling	Minimum
		50	40

(l) SIGHT DISTANCE

The distance along the center line of a road at which a driven has visibility of an object, stationary or moving at a specified height above the carriage way is known as sight distance.

AS PER I.R.C.

speed	Perception and break reaction		breaking		Safe S.S.D (meter)	
V(Km/hr)	Time (s)	Distance D1=0.278vt	Coefficient of friction (f)	$D_2 = \frac{v^2}{2.54f}$	(d1+d2)	Design value
50	2.5	35	0.37	27	62	60
40	2.5	28	0.38	17	45	45

• **OVERTAKING SIGHT DISTANCE**

The minimum sight distance needed by a driver on a two way road to enable him to overtake another vehicle a head with safety against the traffic from opposite direction is called overtaking sight distance.

AS PER I.R.C.

Fig: Curve

Intermediate sight distance for 50km/hr speed

Speed (Km/hr)	Intermediate sight distance
50	120
40	90

In SSD the values are based on perception and break reaction time of 2.5sec, and coefficient of longitudinal

Types of curve

1. Horizontal curve
2. Vertical curve

Types of horizontal curve

- a. Simple curve
- b. Compound curve
- c. Reverse curve
- d. Transition curve

AS PER I.R.C

Minimum radii of horizontal curve for different terrain condition.

Sr.no	Category or road	Minimum radii of horizontal curve in meter			
		Plain terrain		Ruling terrain	
		ruling	absolute	ruling	absolute
1	Village road	90	60	60	45

friction varying from 0.4 at 20 km/hr to 0.35 at 100 km/hr.

(m) CURVES

The geometrical arcs provided on the change in alignment or gradient of a road is known as curve. Curve play important role in geometrical design of road.

(n) SUPER-ELEVATION

The inward transverse inclination provided to the cross section of the carriageway at horizontal curve portion of a road is called as super-elevation cant or banking.

AS We know,

$$e + f = \frac{v^2}{127R}$$

e+0.15-50/127*90

e= 0.068

(o)Widening of carriageway on curve

The provision of extra pavement width of sharp horizontal curve is known as widening of carriageway on curves.

Extra pavement width at horizontal curve as per recommendation of IRC

Radius of curve	Up to 20m	21 to 40 m	41 to 60 m	61 to 100 m	101 to 300 m	Above 30m
a. Two lane	1.5	1.5	1.2	0.9	0.6	nil
b. Single lane	0.9	0.6	0.6	nil	nil	nil

II – METHODOLOGY

Planning is essentially needed for to do work effectively, so we can reduce much necessary time and effort of achieving the goals.In planning methodology we had done the following works:-

1. Selection of road alignment

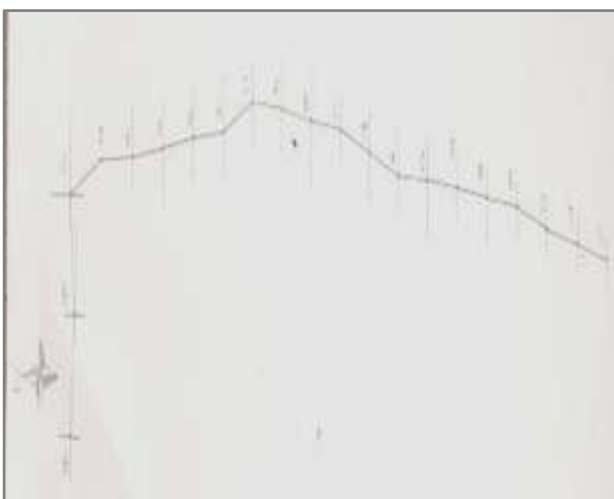


Fig: road Alignment

2. Survey work:

a. Reconnaissance survey

b. Preliminary survey

c. Detailed survey

SELECTION OF ROAD ALIGNMENT

The position of center line of the road on the ground is called as road alignment.

It should be-

a. Shortb.Easy

C.Safe

b. Economical

For selecting a alignment we have taken the following points into consideration such as:-

a. Obligatory points

b. Traffic

c. Geometric design

d. Economics

e. Other consideration

(a)Reconnaissance survey

Before starting the actual survey work, a reconnaissance survey is conducted along the selected alignment with the help of reconnaissance survey. From this survey, we collected the details of obstructions along the route which are not available on the map.

(b) Preliminary survey

The art of finding the details of alternative alignment found suitable during the reconnaissance survey is known as preliminary survey. In preliminary survey the survey instrument to be used are chain, metallic tape, prismatic compass, leveling instrument theodolite.

(C)DETAILED SURVEY

It includes following survey work

1. Profile leveling



Fig: Road Profile

2. CROSS SECTIONING:

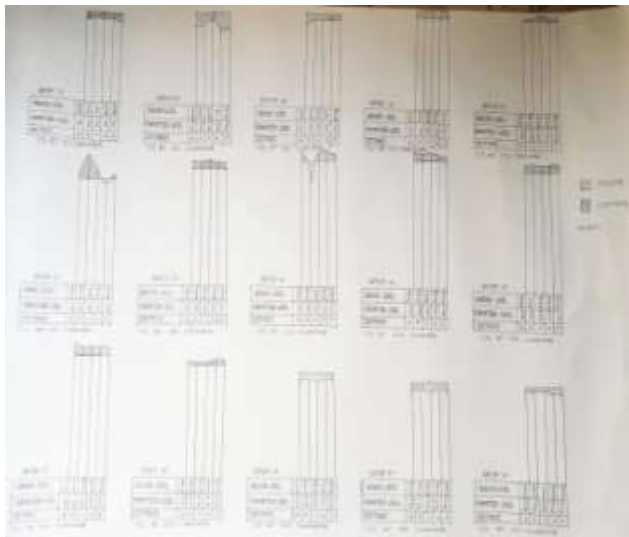


Fig: Cross Sections

4. Curves are provided according to the topography of the area to avoid excessive cutting and filling.
5. For all curves below the desirable standards, warning signs are proposed to restrict the speed of vehicles.

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III) CONCLUSION

1. Geometric design must be give optimum efficiency for traffic movement and safety purpose at reasonable cost.
2. Proper sight distance and vertical alignment can consume less propulsive force leads to low fuel consumption.
3. Horizontal curves at great separation are more dangerous and cause 30% accidents more.