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Question NO 2: @ write a note on sight distance and its types, write equations for each types.

Ans: sight distance: The visibility of the road ahead of the driver will help in safe and efficient operation of the vehicle. This will hence demand the geometric design to be highly efficient. So, that the length of the road is highly visible to the driver even from a distance ahead. The distance is named as the sight distance.

TYPES OF Sight Distance:

we have these types of sight distance.

- Safe sight distance.
- Head light sight distance.
- Stopping sight distance.
- overtaking sight distance.

① Safe sight distance: The sight distance available to enter an intersection is called the safe sight distance.

② Head Light sight distance: The distance that is available for the driver during the night travel is known as head light sight distance.

③ Stopping sight distance: It is defined as, the sight distance that is available for the moving vehicle in the highway that will enable the driver to stop the vehicle safely without collision. The parameter safe stopping distance is the most important feature in the traffic engineering. safe stopping distance is the distance from the point it first perceives to the time the deceleration is complete. Adequate time is

is necessary for the drivers for them to react to the obstacle spontaneously.

$$\frac{1}{2} mv^2 = \frac{1}{2} \frac{Wv^2}{g}$$

$$fWl = \frac{Wv^2}{2g}$$

$$l = \frac{v^2}{2gf}$$

The stopping sight distance = Lag distance + Braking distance.

$$SSD = vt + \frac{v^2}{2gf}$$

- v is the speed,
- t is the time,
- f is friction co-efficient.
- g is acceleration due to gravity.

$$SSD = vt + \frac{v^2}{2g(f \pm 0.01n)}$$

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Intermediate sight distance:

A distance is equivalent to twice the stopping sight distance is termed as intermediate sight distance.

$$\text{Intermediate sight distance} = 2 \times \text{Stopping sight distance.}$$

The minimum distance is available for the driver to safely overtake the slow vehicle in front of him by considering the traffic in the opposite direction is known as overtaking sight distance.

(b)

GIVEN DATA:

$$AADT = 4000 \text{ Vpd}$$

$$\text{highest hourly volume of year} = 420 \text{ Vpd}$$

SOLUTION:

$$K\text{-factor} = \frac{DHV}{AADT} \times 100$$

Putting values .

$$K\text{-factor} = \frac{420}{4000} \times 100$$

$$K\text{-factor} = \underline{\underline{10.5}}$$

So, the value of K-factor is 10.5

Question NO 2: Briefly describe any five types of Interchanges in your own words.

Ans: Following are the major types of Interchanges which are discussed below.

① Underpass: An underpass or a tunnel is an underground passageway, completely enclosed except for openings for In and out purpose commonly at each ends.

A tunnel may be for pedestrians or for vehicles of road traffic or for rail traffic etc.

A passage running underneath, especially a passage for pedestrians and vehicles are called underpass.

② Overpass:

Overpass can define as, "A bridge by which a road or rail road or railway line passes over another is called over pass.

This is also known as fly over, a bridge or railway or road or similar structure that crosses over another road or railway.

A pedestrians overpass allows ~~to~~ pedestrians safe crossing over busy roads without impacting traffic.

③ Trumpet Interchange: In the field of road transport, an interchange is a road junction, that uses grade separation, and typically one or more ramps, to permit traffic on at least one highway to pass

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through the junction without interruption from another crossing traffic streams.

Trumpet Interchange have been used where one highway terminates at another highway. These involves at least one loop ramp connecting traffic either entering or leaving the terminating expressway with the far lanes of the continues highway. The principle advantage are low construction cost and are useful for highway as well as toll roads.

④ Cloverleaf Interchange: A cloverleaf interchange in which left turns are handled by ramp road.
→ To go left (in right-hand traffic), vehicle first continues as one road is passes over or under the other, there exist right on to one way three-fourth loop ramp (270°) and merge on to the intersecting roads.

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(5) Directional Interchange: A directional Interchange

Provides direct path for left turns.

These interchanges contains ramps for one or more direct or semi direct left turning movements.

Interchanges of two free ways or Interchanges with one or more heavy turning movements usually warrant direct ramp which have higher speed of operation and higher capacities compared to loop ramps.

Questions No 3:

(a) Derive an equation for Mechanical widening on a horizontal curve with a suitable diagram.

Assume,

$OA = R_1 =$ Radius of the path traversed by the outer rear wheel, m .

$OB = R_2 =$ Radius of the path traversed by the outer front wheel, m .

W_m = Mechanical widening due to off-tracking, m.

L = length of base wheel, m.

R = Radius of horizontal curve, m.

Now,

$$OB - OA = R_2 - R_1 = W_m.$$

From

$\Delta OAB,$

$$OA^2 = OB^2 - BA^2$$

$$R_1^2 = R_2^2 - l^2$$

But,

$$R_1 = R_2 - W_m$$

$$(R_2 - W_m)^2 = R_2^2 - l^2$$

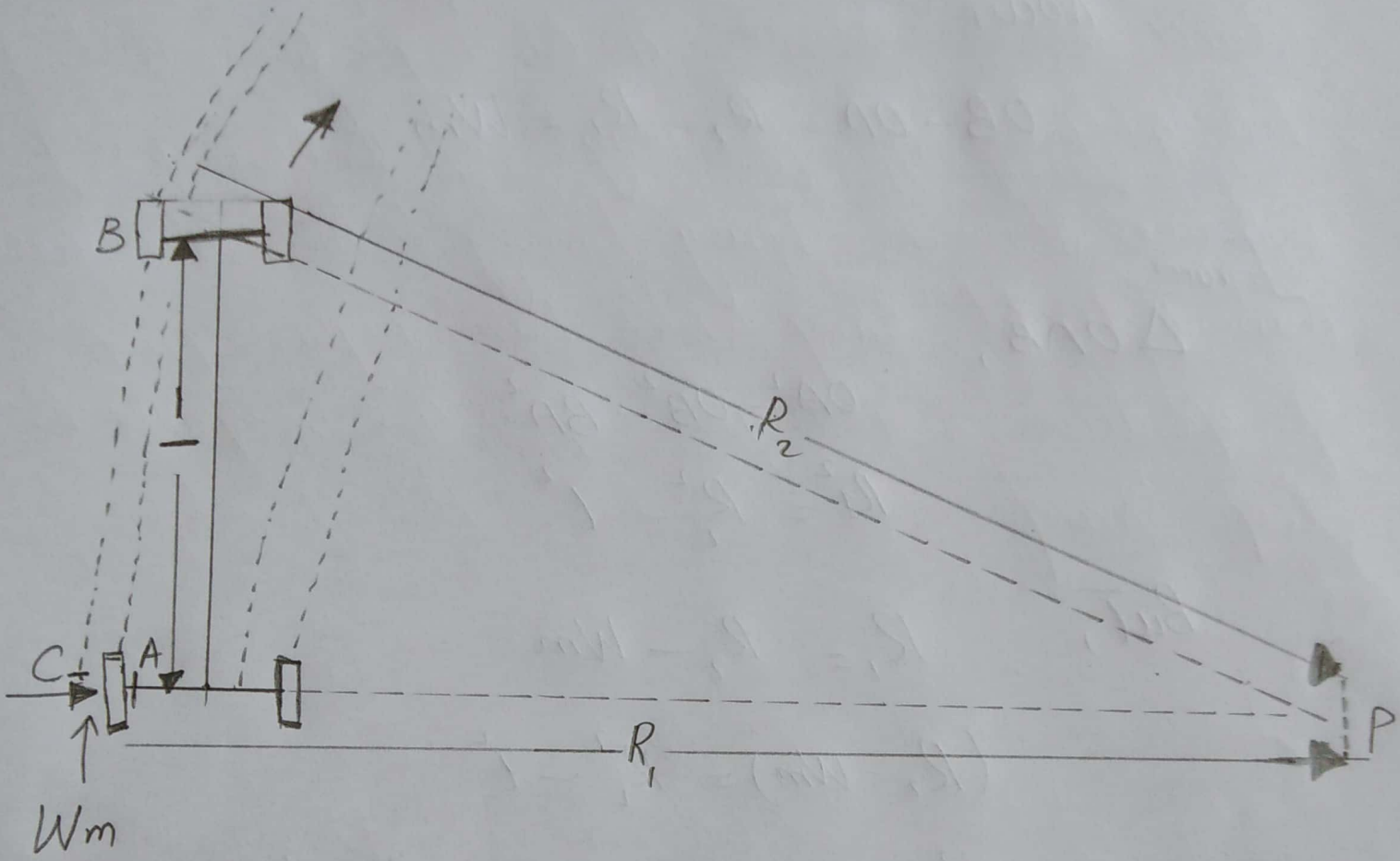
$$R_2^2 - 2R_2W_m + W_m^2 = R_2^2 - l^2$$

$$l^2 = W_m(2R_2 - W_m)$$

$$W_m = l^2 / 2R$$

If road having 'n' traffic lanes and 'n' vehicle can travel simultaneously, Mechanical widening required is,

$$W_m = nl^2 / 2R$$



(b) A Count for road is 200 Vehicle per hour Consisting 100 Cars, 50 trucks and 50 Buses, the traffic Flow on this road in passenger car Unit (PCU) per hour will be ?

GIVEN DATA, Total vehicles = 200

Cars = 100

Trucks = 50

Buses = 50

Here the value of PCU for

Car = 1.0

Truck = 3.0

Buses = 3.0

Now, The equation may be.

$$PCU = (100 \times 1.0) + (50 \times 3.0) + (50 \times 3.0)$$

$$PCU = 100 + 150 + 150$$

$$PCU = 400 \text{ PCU/hour}$$

400 PCU Per hour

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Question No 4:

(a) Write down the equation for finding the length of a Summit Curve when $L > SSD$.

Ans: When $L > SSD$

The equation used for finding length is

$$L = \frac{NS^2}{\left[\sqrt{2H} + \sqrt{2h}\right]^2}$$

Substituting the value of $H = 1.2m$ and $h = 0.15m$

$$L = \frac{NS^2}{4.4} //$$

(b) Write down the values of Rubing, Limiting and Exceptional gradients when the terrain is plane and rolling.

Ans: As per IRC, the recommended value of Rubing gradient for plain or rolling terrain is 1 in 30 or 3.3%.

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As per IRC, the recommended value of Exceptional gradient for plain and rolling terrain is 1 in 15 or 6.7%.

As per IRC, the recommended value of limiting gradient for plain and rolling terrain is 1 in 20 or 5%.

© What should be the width of the width of carriage-way for a single lane road and for two lanes ~~roads~~ with raised kerbs?

Ans.: The maximum permissible width of a vehicle is 2.44 and the desirable side clearance for single lane traffic is 0.68m. This require minimum of lane width of 3.75m for single lane road.

Therefore a two lane road require minimum of 3.5m for each lane.

The width of a carriage way for two lanes with raised kerb is 7.5m.

d) What is the maximum limit of super-elevation on hill roads not bounded by snow and ~~and~~ ^{on} urban roads with intersections.

Ans: According to Indian Roads Congress, on hill roads not bounded by snow a maximum super elevation limit is up to 10% is recommended. And on urban roads stretches with frequent intersection, it may be necessary to limit the maximum super elevation to 4% is recommended.

e) Write down the equation for finding the length of a Summit Curve when $L < OSD$.

Ans: When $L < OSD$.

The general equation for the length of Summit Curve is given by

$$L = 2S - \frac{8H}{N}$$

Substituting the value of $H = 1.2 \text{ m}$

$$L = 2S - \frac{9.6}{N}$$