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Sec "B"

Sub: Advanced Survey.

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fourth semester.

Department of Civil

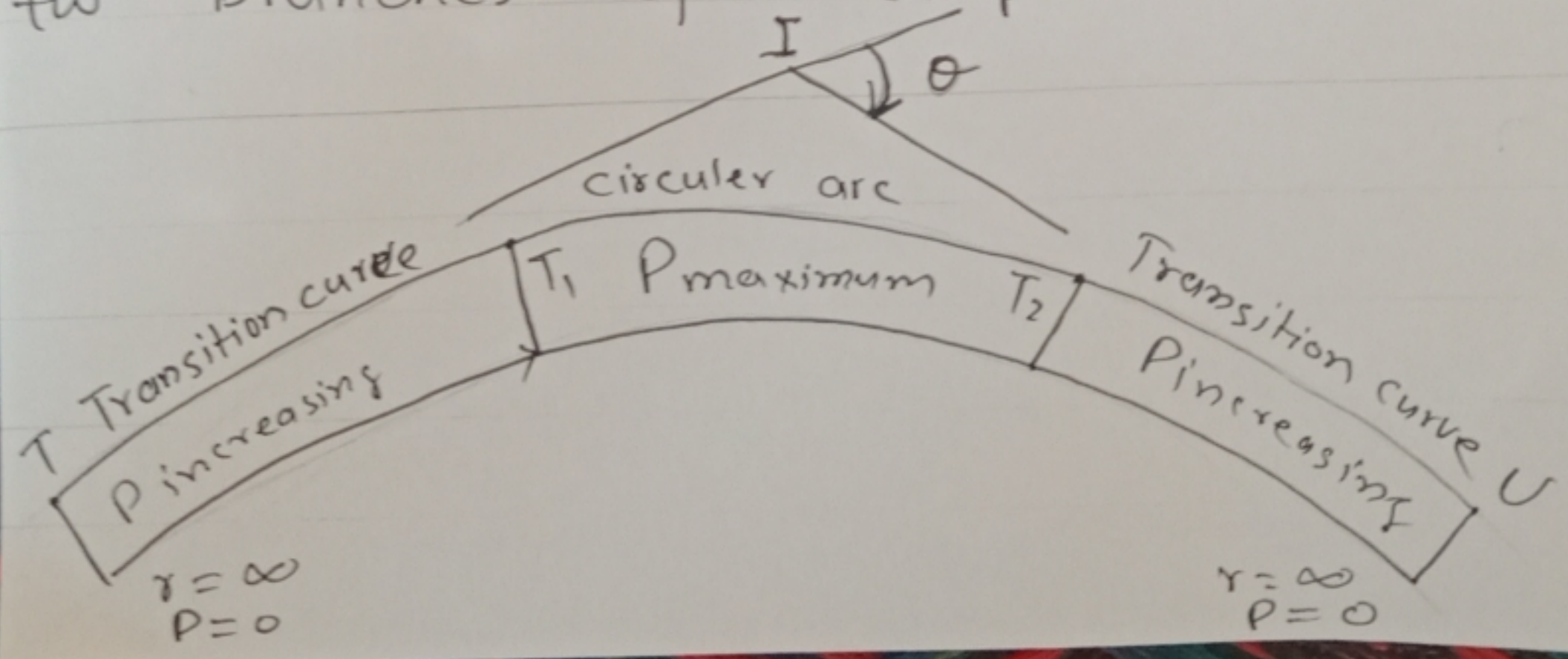
Engineering



QNO #01  $\Rightarrow$  what is transition curve.  
 How super elevation is effected by  
 Speed of vehicle and Radius of  
 the curve? Prove it with the help  
 of equation and diagram.

ANS  $\Rightarrow$  TRANSITION CURVES:

A curve of varying Radius is called a transition curve. It is also called spiral curve OR Easement curve. It is used on both highway between tangent and a circular curve in order to have a smooth transition from tangent to the curve and from curve to the tangent. It is also inserted between tw branches of Compound curve.





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→ Circular curves are limited in Road design due to the forces which act on a vehicle as they travel around a bend.

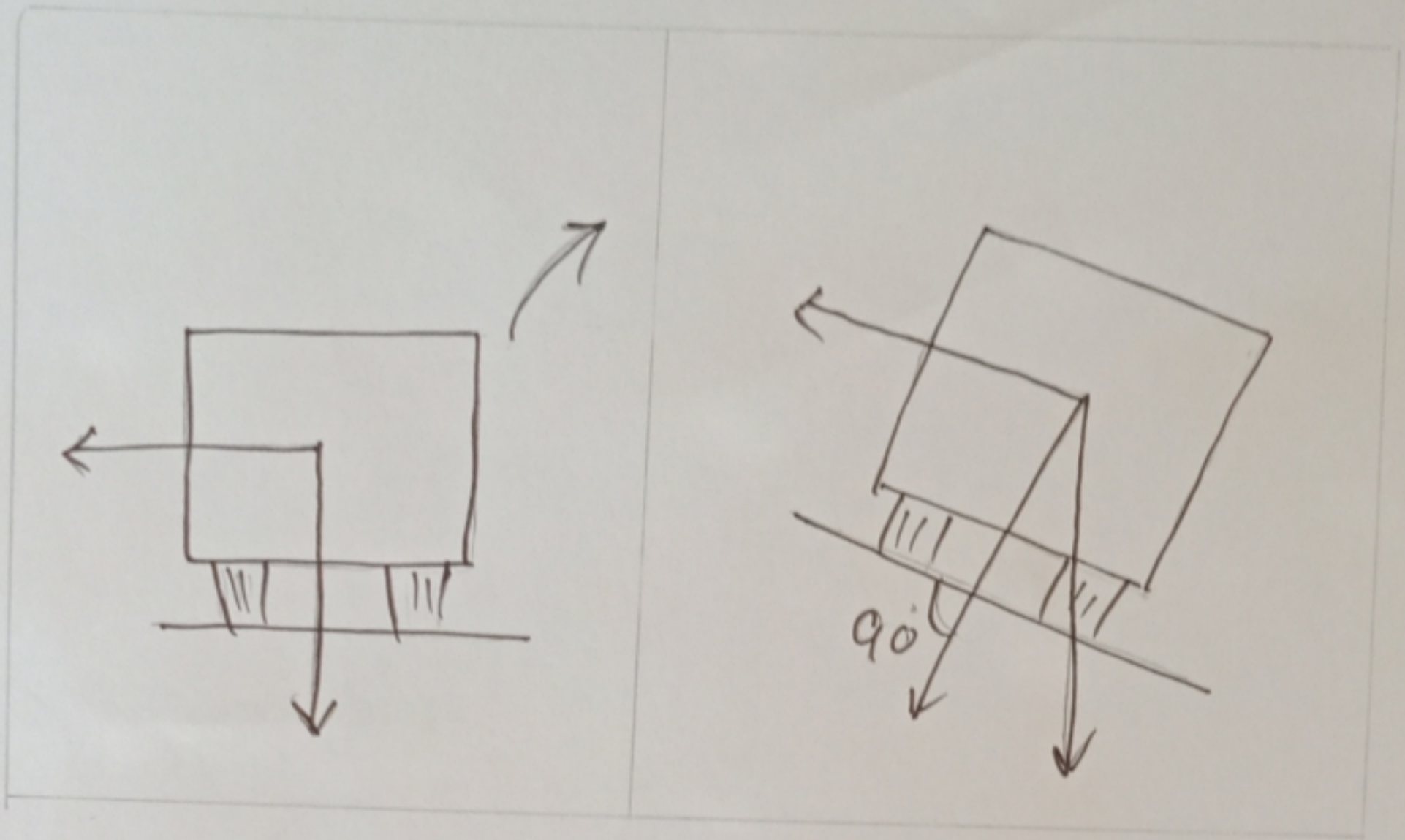
→ Transition curves are used to built up those forces gradually and uniformly thus ensuring the safety of passenger.

→ Allow for gradual application of super elevation OR Cant.

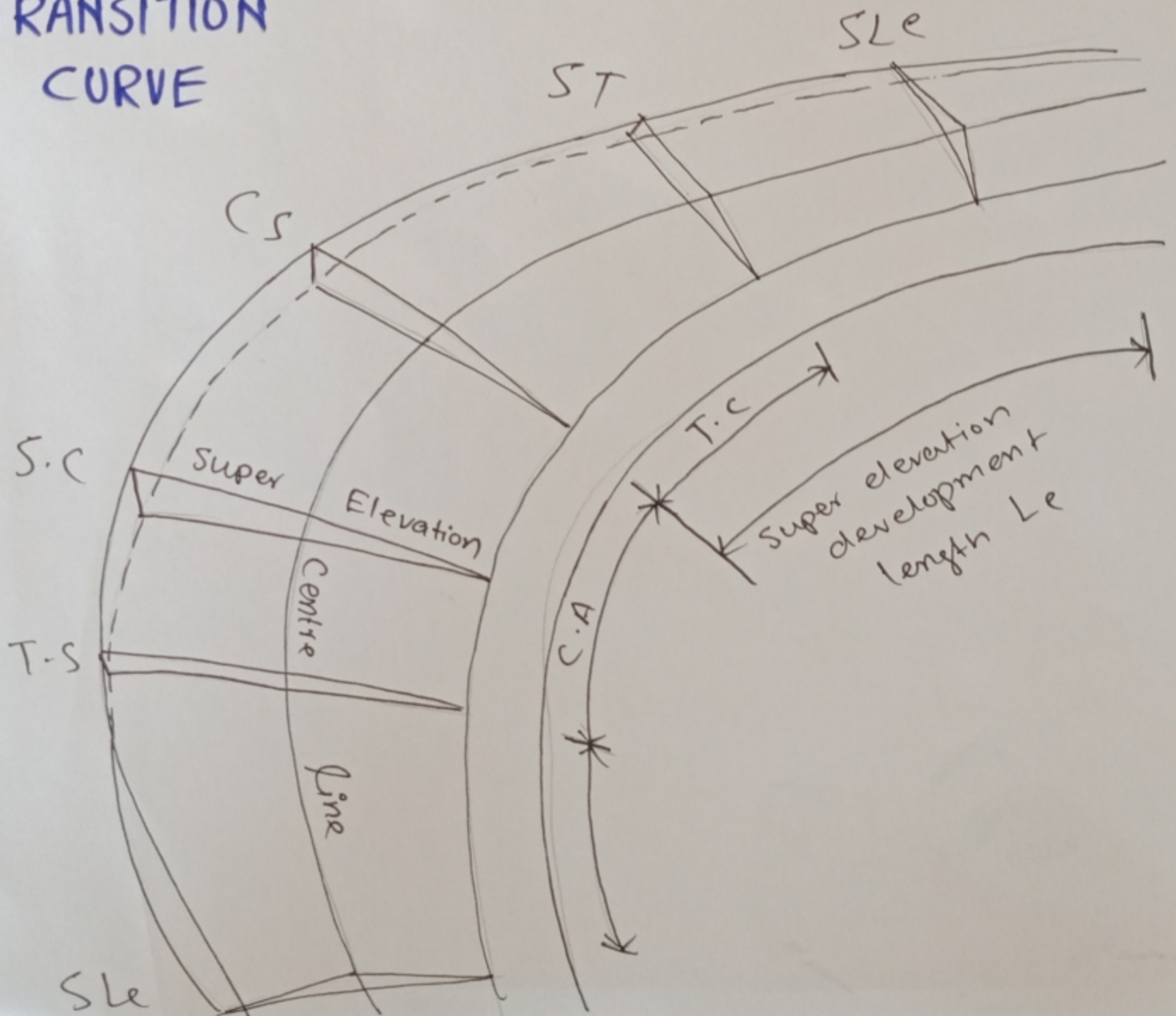
→ The super elevation is designed such that the Road surface is near Perpendicular to the Resultant force of gravity and centrifugal inertia.

→ in order to transition from a flat roadway to a fully super elevated section and still maintain the balance of forces, the degree or sharpness of the curve must begin at zero and increase steadily until maximum super elevation is reached. This is precisely what a spiral curve does.





# TRANSITION CURVE





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**Super Elevation:** → when vehicle moves from tangent on to the curve the forces acting on it are.

- \* weight of the vehicle
- \* centrifugal force, Both acting through the center of Gravity of the vehicle.

→ The Effect of the centrifugal force is to push the vehicle off the rail or road.

→ The counter act the action the outer rail or outer edge of the road is raised above the inner one is called is super elevation or cant.

The amount of super elevation is depend upon the

- \* Speed of the vehicle
- \* Radius of the curve.

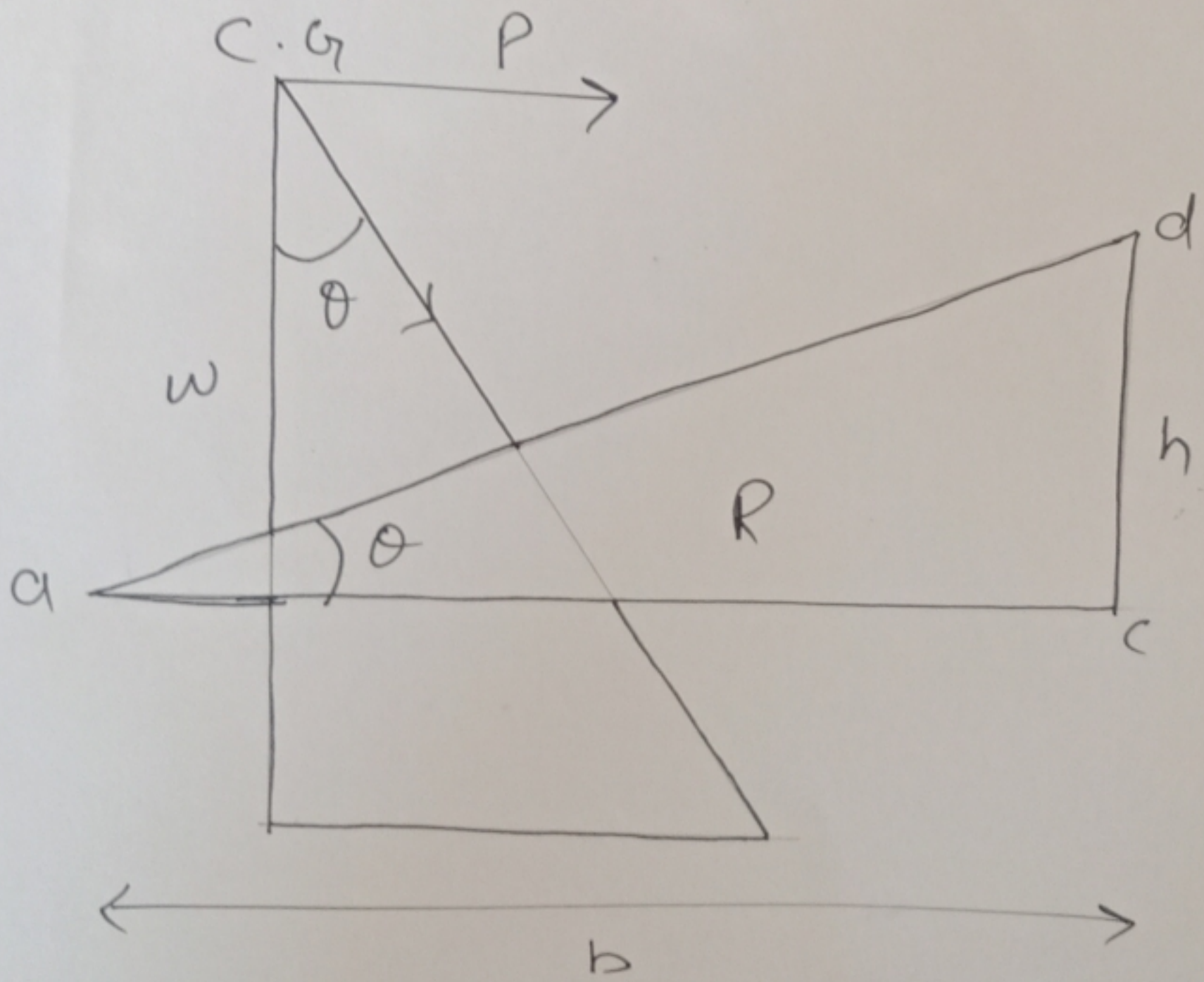
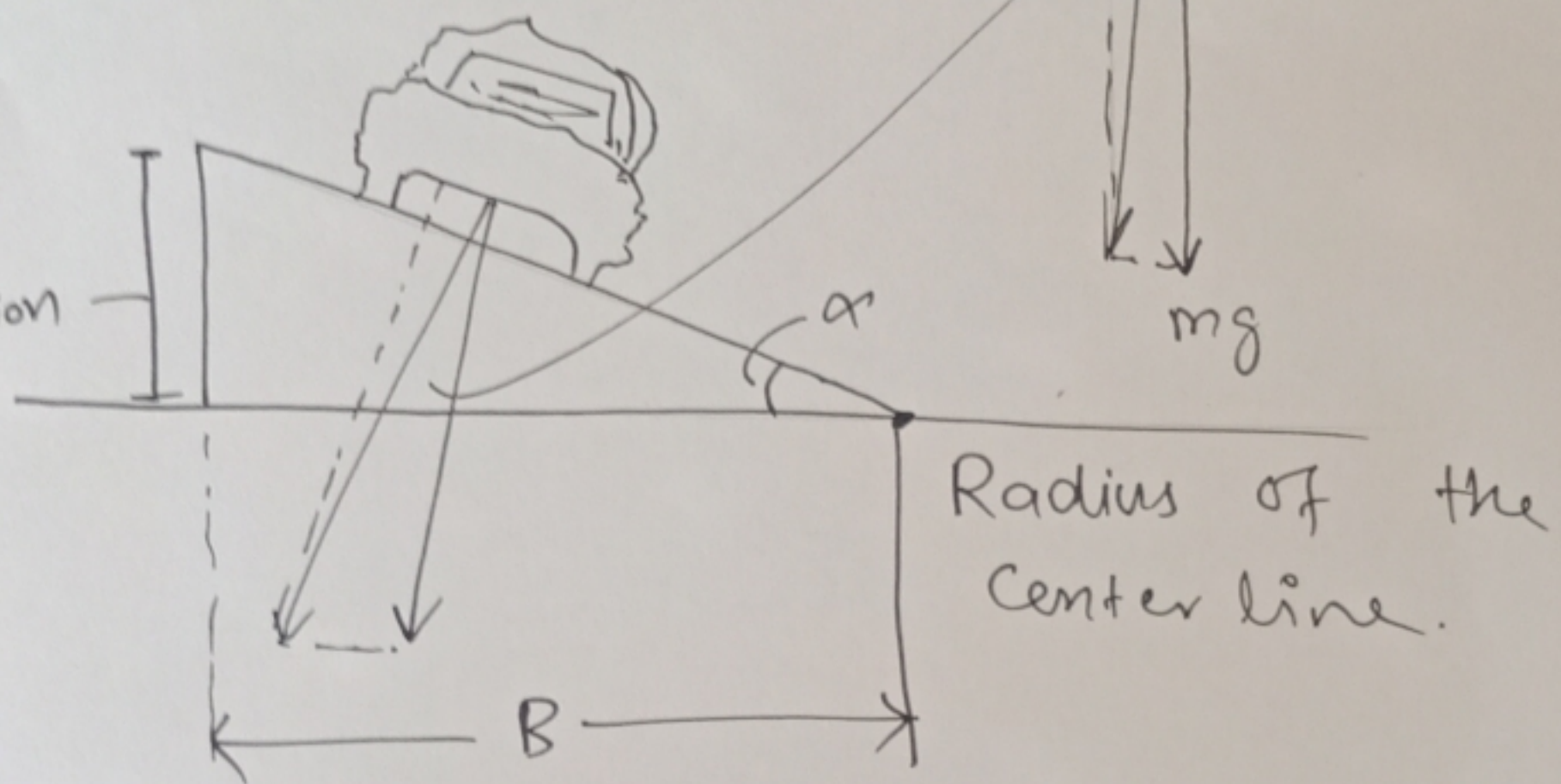


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$$P = \frac{mv^2}{R}$$

Resultant force

Super Elevation (SE)





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let

$W$  = weight of the vehicle

$P$  = Centrifugal force

$v$  = Speed of the vehicle  $m/s$

$g$  = Acceleration due to gravity  $m/s^2$

$R$  = Radius of the curve  $m$

$h$  = super elevation in  $m$

$b$  = width of the Road in  $m$

For equilibrium the Resultant  $R$  of the  $P$  &  $w$  must be equal & opposite to the Reaction perpendicular to Road or rail surface

$$P = \frac{mv^2}{R} = \frac{Wv^2}{gR} \quad \therefore W = mg$$

$$\frac{P}{W} = \frac{v^2}{gR}$$

$$\epsilon \quad \tan \theta = \frac{h}{b} = \frac{dc}{ac} = \frac{P}{W}$$

$$\Rightarrow \tan \theta = \frac{h}{b} = \frac{P}{W} = \frac{v^2}{gR}$$



$$h = b \tan \theta$$

$$h = b \frac{v^2}{gR} \text{ — on highway}$$

$$h = b \frac{Gv^2}{gR} \text{ — on Railway}$$

where  $G$  = Distance b/w the centre of the Rail.

Super elevation is gradually applied along a transition curve. Full super elevation is attained at junction of the transition curve with the circular curve.

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Q NO # 02 : what is the difference between triangulation and Trilatration Also Explain the principles of Triangulation and Trilatration?

ANS :->

DIFFERENCE BETWEEN TRIANGULATION AND TRILATRATION :-> Triangulation is consists of a number of inter-connected triangles in which the



length only one base line and the angle of the triangle are measured very precisely which are based used to the calculate of coordinates.

- \* All angle are measured in triangulation
- \* Distance of Baseline are also measured. to control scale error.
- \* Intervisibility between station is essential.
- \* There are more internal check in comparison with trilateration in the same geometriz figure.
- \* The side length are computed on the basis of measured angles applying sine law.

While Trilateration as:

- \* All sides are measured in trilateration
- \* Azimuth of the initial line is measured.
- \* Some check angles are measured to control azimuth error.
- \* For small Areas it is possible



(9)

to measure distances without intervisibility

\* There are less internal checks in comparison with triangulation in the same geometric figure

\* The angles are computed on basis of measured side lengths applying cosine law.

### PRINCIPLE OF TRIANGULATION:

→ If all the three angles and length of one side of a triangle are known. Then by trigonometry the length of remaining side of the triangle can be calculated.

\* Again if the coordinates of any vertex of the triangle and azimuth of any side are also known. Then coordinates of the remaining vertices may be computed.

### PRINCIPLE OF TRIANGULATION:

→ Triangulation is highly accurate and precise method of establishing and extending horizontal control.

\* Method of control survey in which a network of triangles is used as



in triangulation system.

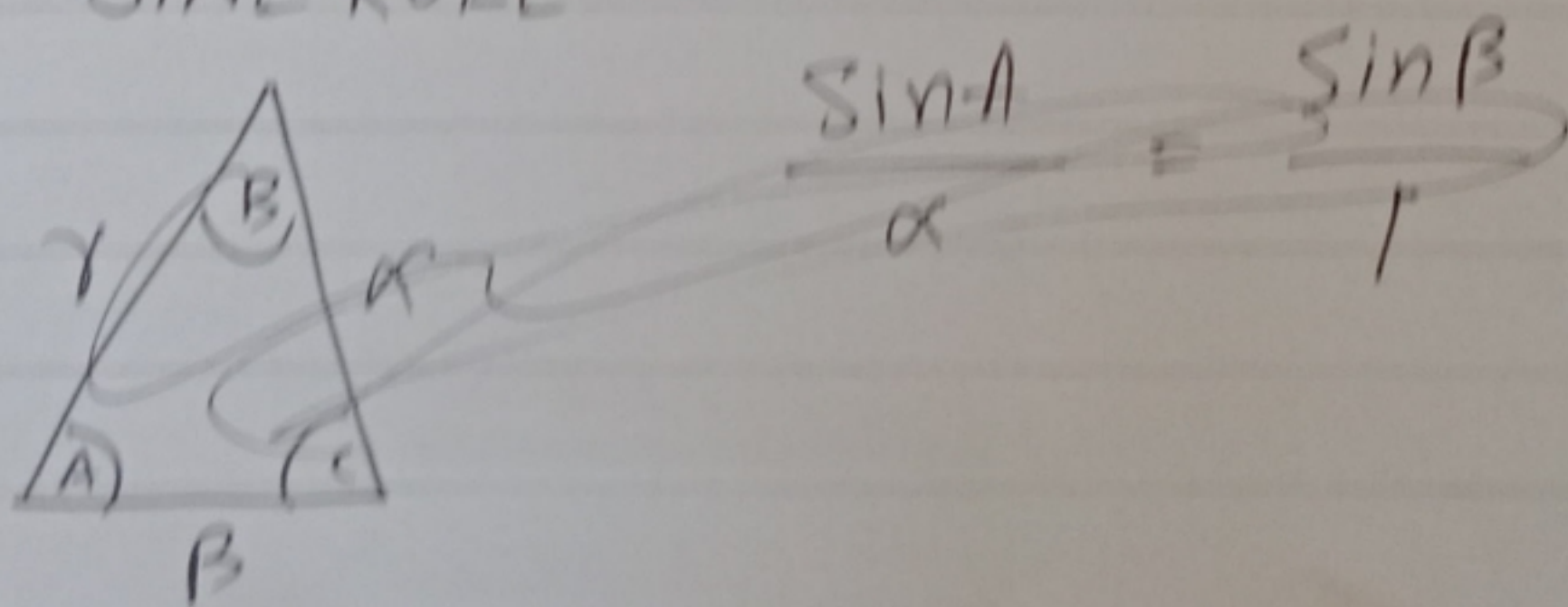
\* All the three side of each triangles are measured by in the field with the distance measured by in field with the distance measuring angle not measured in the field.

\* Angle in a trilateration system are computed indirectly from the length of the side of the triangle by Cosine formula.

\* Few Horizontal angle are also some time measured provide a check on computed angles.

\* Vertical angle are also measured where elevation have been Not Established.

### SINE RULE





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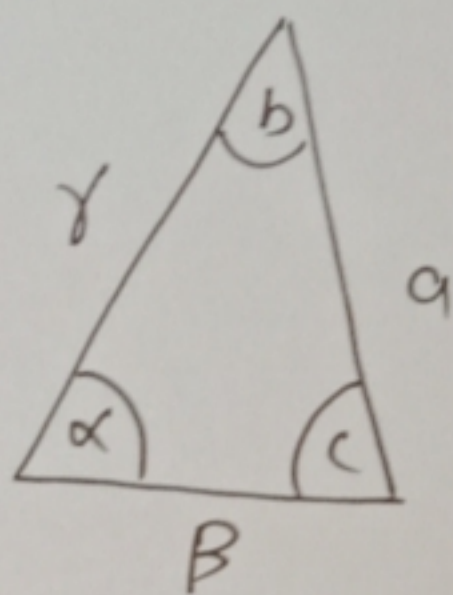
\* Vertical angle are also measured where elevation have been Not Established.



Sine Rule

(11)

$$\frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c}$$



Cosine Rule

$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

OR

$$\cos \alpha = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos \beta = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos \gamma = \frac{a^2 + b^2 - c^2}{2ab}$$

XXX



Q No #03 part (a)

What is hydrographic survey? why we do it and what are the factors to be determined while conducting the hydrographic survey?

Hydrographic Survey:→

→ it is the branch of surveying which deals with water bodies e.g lake, river.

→ The usual fundamental principle of surveying and leveling are adopted for acquiring data for determination of

\* Volume of the water.

\* Rate of flow.

\* To determine the shape of the area underlying the water surface.

PURPOSE OF Hydrographic Survey :

It means that why we do it the hydrographic survey.



- ① To determine the Quantities of subsequent excavations.
- ② Measure areas subjected to scouring or silting in harbours or docks.
- ③ Locate rocks and other objects such as buoys, lights etc. to aid safe navigation.
- ④ To prepare navigation charts exhibiting the depth available for navigation.
- ⑤ Control floods and to plan water supply and storage from river.
- ⑥ To develop water Resources for power Irrigation and Recreation.

### Factors while conducting Hydro-Graphic Survey.

- \* The measurement of depth of water at various point is term as sounding
- \* Depth of sounding is referred to the water level at time it is made.
- \* Therefore, The sounding are reduced to the datum water level. to account for tidal water such undergo continual change of the



elevation with the help of gauges.

\* A Number of B.M are established at frequent intervals along the shorelines and gauges. are set on them

\* the field work consist of Both the Horizontal and vertical control.

\* The Horizontal control established by traversing or Triangulation.

\* For the vertical control, the tide gauge are kept in operation continuously since the water level at that gauge must also be known when soundings are recorded.

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Q no #03 part (b) What is sounding and purpose of sounding? Also name the equipment used to determine sounding?

ANS: SOUNDING: → The process of determining depths below water surface is called sounding.

\* Sounding is analogous to leveling on land. The Reduced level of any point on the bottom of a water body is obtained by ~~st~~



Subtracting the sounding from the mean sea level.

## Purpose of Sounding:

- \* Preparation of accurate charts for Navigation
- \* Determination of the quantities of the material to be filled.
- \* obtaining information for design of break-water, sea wall etc.

## Equipment for Sounding :->

The essential equipment and instrument employed for taking the sounding may be grouped as.

- \* Shore signal and buoys.
- \* Sounding equipment
- \* Angle measuring instrument

## Sounding equipment :->

- \* Sounding boat
- \* Sounding pole
- \* Lead line
- \* Weddell's sounding machine
- \* Echo sounding machine



# Angle Measuring Equipments.

- \* Theodolite
- \* Prismatic Compass
- \* Sextant.

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QNO#04 part (a) what is aerial photogrammetry and why we do it?

ANS:→ Photogrammetry OR Aerial Photography is the branch of surveying that deals with production of maps such as topographic maps by compilling Number of Photographs taken in that area. Photogrammetry

Consist of two Branches.

- (1) Terrestrial photogrammetry
- (2) Aerial photogrammetry.

In Aerial photogrammetry an aircraft with camra setup to take photo graphs from the air flying over the ground.



# Purpose of Aerial photography:

Photography offers views of Building and Landscapes that cannot be captured from the Ground. Aerial Photographs are especially useful in the Real estate industry to show overall views of large building or properties or land that is open to development. as well as the surrounding landscape, roads and another building and features.

Pictures can attract potential buyers to a property, but ground level shot often cannot do a home or to Commercial building Justice.

Photo taken from the ground cannot convey the size of the majestic home or the scenery on a large piece of the property



(17)

Q No # 04 part (b) Shortly explain the procedure of Aerial photography?

ANS: → Procedure of Aerial photography:

- ① Establishing Control point
- ② Flight Planning and photography
- ③ Photo interpretation and Stereoscopy
- ④ Parallax and Measurement parallax
- ⑤ construction of map and Cartography

→ Establishing Control points:

Control points are points established on ground with known relative position. The photograph captured is observed by setting these control point is boundaries. So the points should be established in such away that they should easily identifiable on photograph. There are should be of 3 to 4 control points minimum needed in one photograph. The established control point depending upon scale of map, flight control etc.



### → Flight Planning and Photography:

Flight planing is nothing but knowing the height to be maintained by flight while taking photos, area to be covered in each photo-graph, number of photo-graphs, no of strips, and time interval between exposures. Following factor depend upon planning.

- \* Area to be surveyed
- \* Focal length of camera
- \* Overlap
- \* Scale of photograph
- \* Ground speed of Aircraft in still air.

### → Photo Interpretation and Stereoscopy:

Photo Interpretation is done by the instrument called Stereoscope which contain mignifiers, so, One can observe the three-dimensional model of area through it and it also ease the drawing of maps, of photographed area. For accuracy, control points, elevation, length of lines should be sufficciently availible.



There are four types of stereoscope are available which is used to the photo interpretation. That are:

- \* lens Stereoscope
- \* Mirror Stereoscope
- \* Scanning Mirror Stereoscope
- \* Zoom Stereoscope.

The following characteristics should be follows for good interpretation of photo. shape, size, pattern, shadow, texture and site.

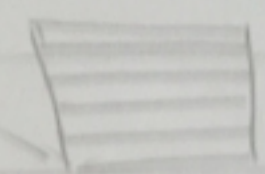
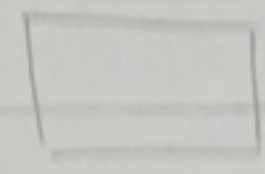
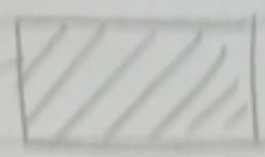
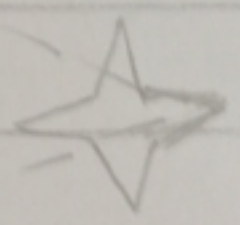
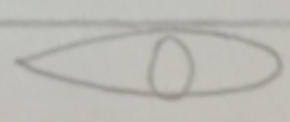
### → Parallax and Measurement of -the

#### Parallax:

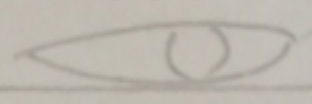
An aerial photograph can be studied to get the location of an object by its co-ordinates in the photograph. Similarly, to know the third dimension of the same object there should be minimum of two points of the observation is needed from different angles. Parallax is nothing but a displacement of an object in the photograph when points of observation is shifted to another angle.



view point A

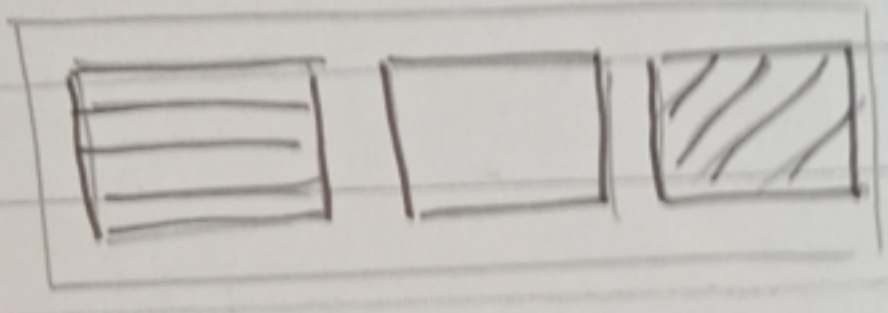
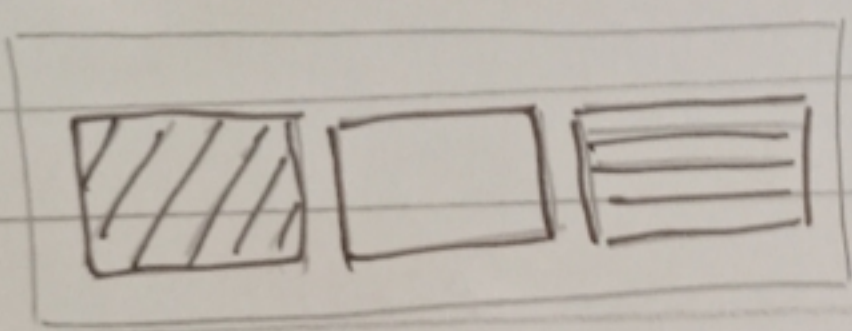


view point B



view point A

view point B



### → Construction of Map and Cartography:

After collecting All photograph, it's time to create or plot the map. There are several method to plot the details of map and one of the method is

#### \* Stereoscopic Method:

In stereoscopic method an instrument called plotter is used for preparing maps. The maps prepared by this method is high precision. In this method instrument will help to view the overlap area in three dimensional which help to view the spatial model. then the model is measured and orthogonally projected is map. It more accurate and this Method is used by large mapping Organizations.