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Survey

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Q No. 1:

Ans: 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 & railway 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 two branches of compound.

→ 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 centre of gravity of the vehicle.

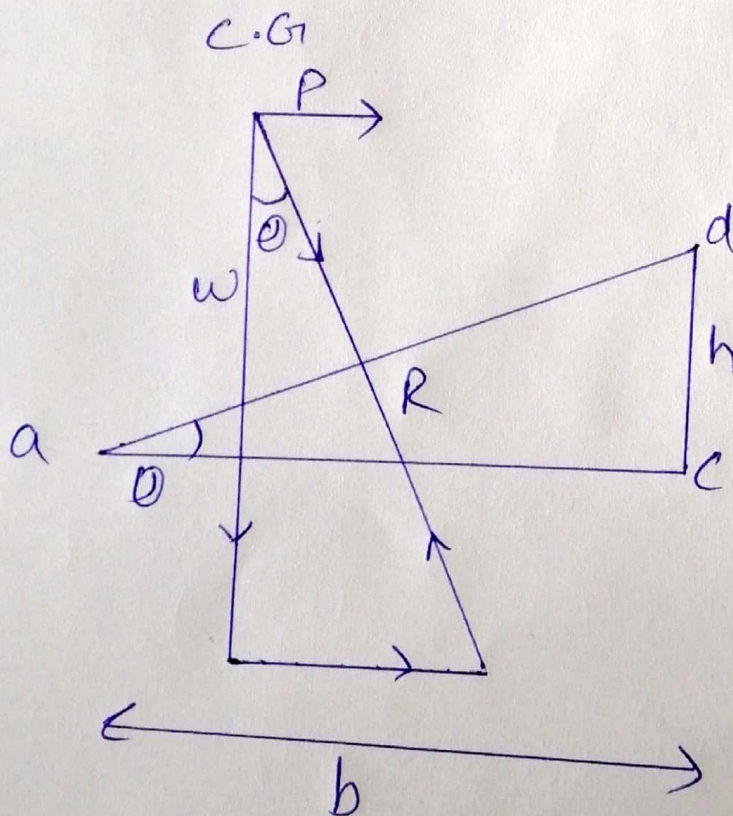
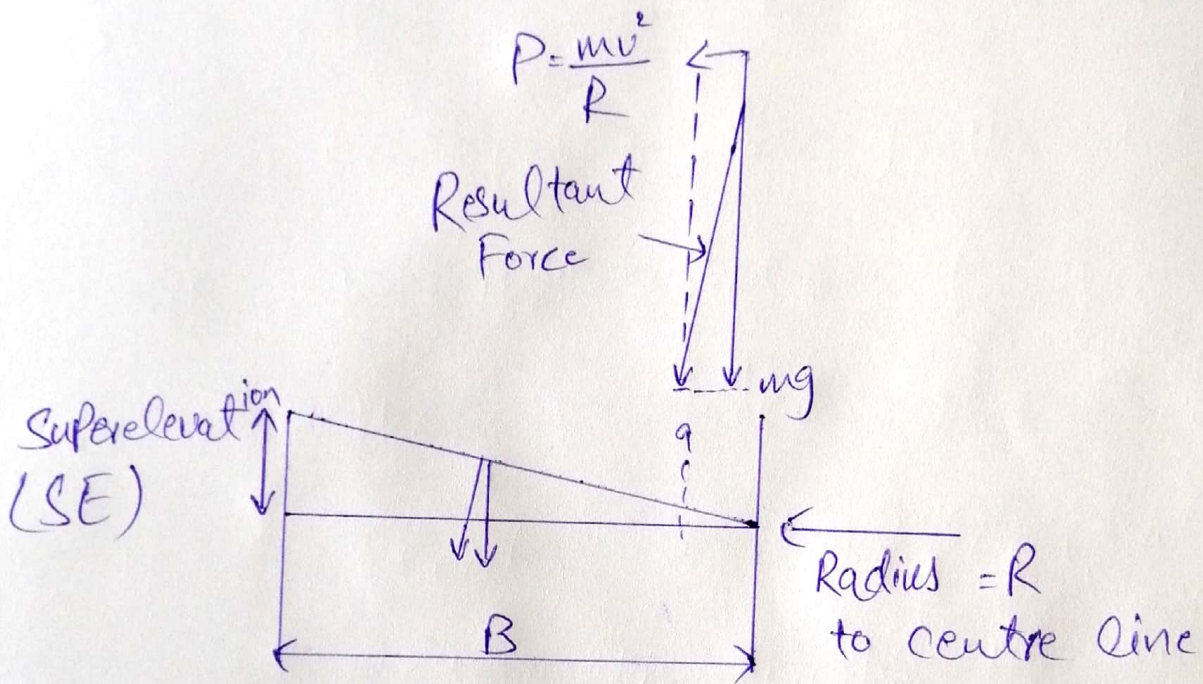
→ The effect of the centrifugal force is to push the vehicle off the rail or road.

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

→ The amount of super elevation depends upon.

⇒ Speed of The vehicle.

⇒ Radius of The curve.



Let;

$w$  = weight of The vehicle.

$P$  = centrifugal Force.

$v$  = speed of The vehicle, m/s.

$g$  = Acceleration due to gravity, m/s<sup>2</sup>.

$R$  = Radius of The curve, m.

$h$  = super elevation, m.

$b$  = width of The road, m.

For equilibrium The resultant  $R$  of The  $P$  &  $w$  must be equal & opposite to The reaction perpendicular to road or rail surface.

$$P = \frac{mv^2}{R} \quad \frac{wv^2}{gR} \quad \because w = mg$$

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

$$\tan \theta = \frac{h}{b} = \frac{dc}{ac} = \frac{P}{w}$$

$$\tan \theta = \frac{h}{b^2} = \frac{P}{w} = gR$$

$$h = b \tan \theta$$

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

$$h = b \frac{Gv^2}{gR} \text{ ----- on railway.}$$

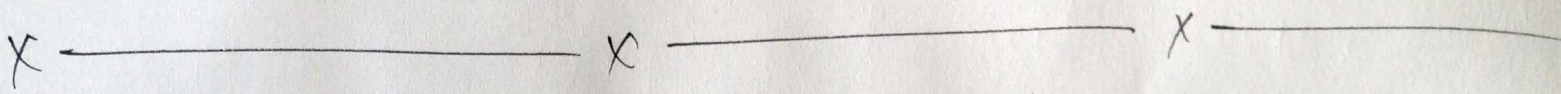
where  $G$  = Distance b/w The centre of The rail.

$\Rightarrow$  Super elevation is gradually applied along a transition curve.

Full Super elevation is attained at Junction of The transition curve with The circular curve.

→ As in the above equation  
"b" is width of the road  
and "g" is gravitational  
acceleration.

(ie b and g are constants), so  
from the above equation it is  
proved that super elevation  
depends upon speed of the  
vehicle and radius of the  
curve.



Q No. 2:

Ans:- Difference b/w Triangulation

and Trilateration:

Triangulation

Trilateration

- |  |  |
|--|--|
| 1. All angles are measured in triangulation.   | 1. All sides are measured in trilateration.  |
| 2. Distance of baseline is measured.   | 2. Azimuth of the initial line is measured.  |
| 3. Some check base lines are also measured to control scale error.                               | 3. Some check angles are measured to control azimuth error.                                      |
| 4. Intervisibility b/w stations is essential   | 4. For small areas it is possible to measure distances without intervisibility.                  |
| 5. There are more internal checks in comparison with trilateration in the same geometric figure. | 5. There are less internal checks in comparison with triangulation in the same geometric figure. |



⇒ Principal of triangulation:-

→ If all the three angles and the length of one side of a triangle are known, then by trigonometry the lengths of the remaining sides 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.

⇒ Principal of Trilateration:-

→ Trilateration is a highly accurate and precise method of establishing and expanding horizontal control.

- Method of control survey in a network of triangles is used as in triangulation system.
- Horizontal angles are not measured in the field.
- Angles in a trilateration system are computed indirectly from the lengths of the sides of triangle by cosine formula.
- Few horizontal angles are also sometimes measured to provide a check on computed angles.
- Vertical angles are also measured where elevations have not been established.

cosine Rule:

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

Triangulation network

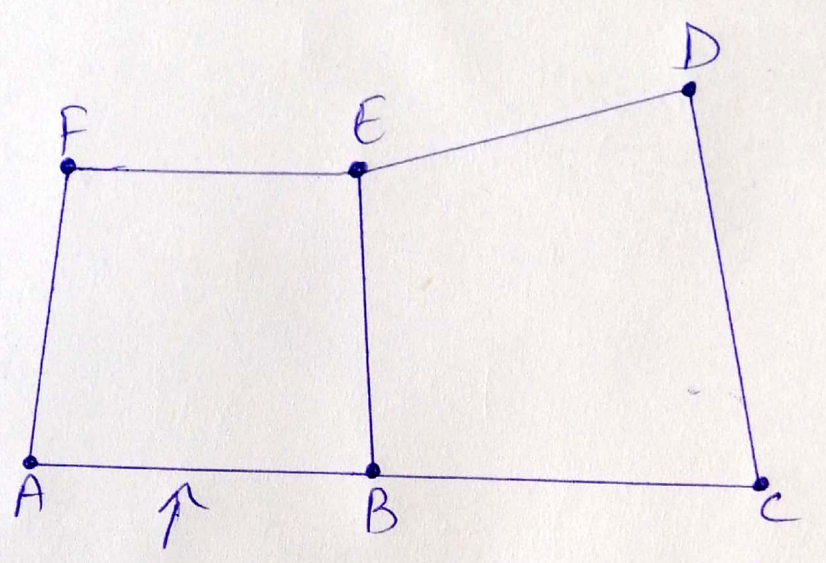


Fig:

Base line

Triangulation station

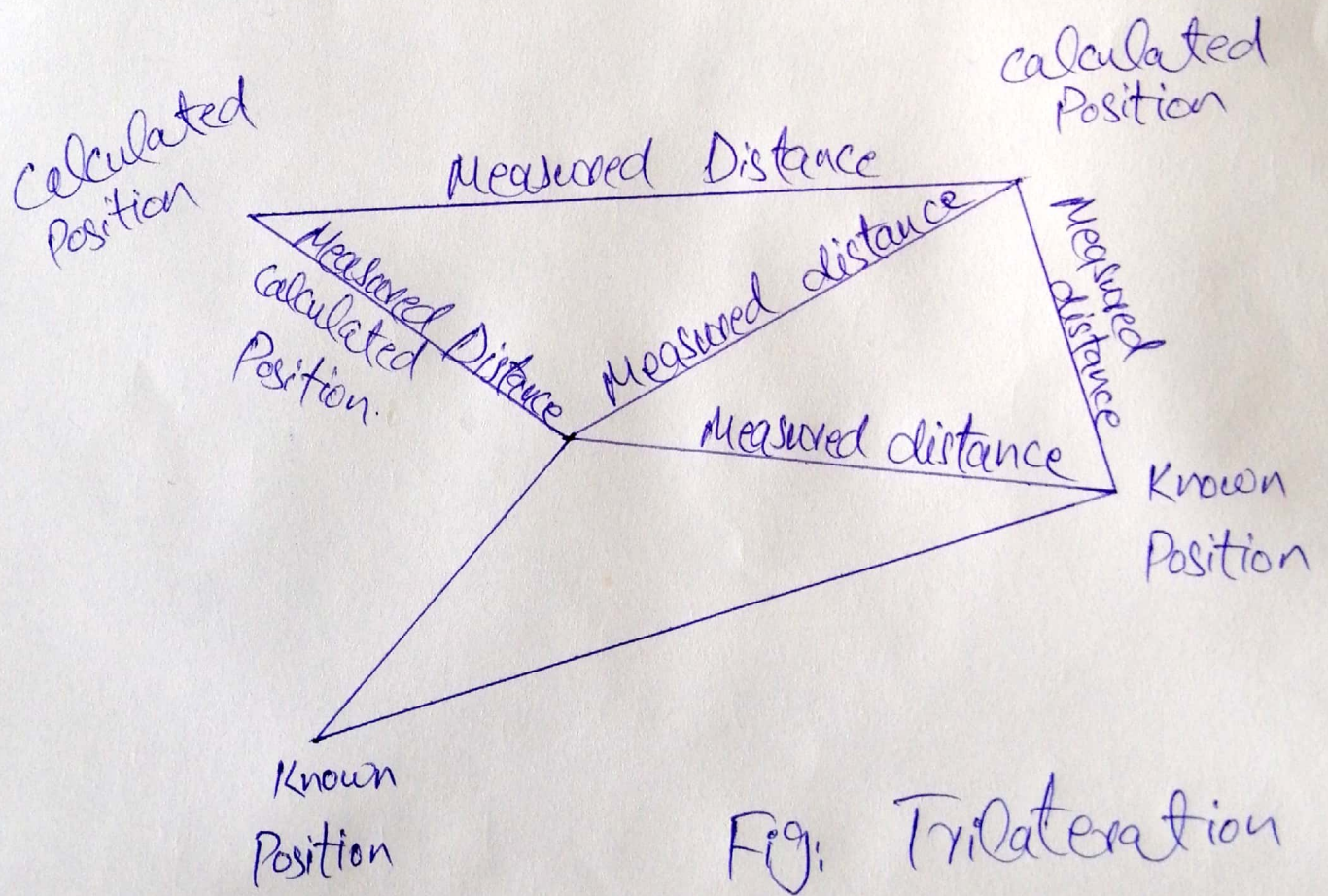


Fig: Trilateration Network

Q No. 3 Part (a)

## Hydrographic Surveying:-

→ It is the branch of survey which deals with water bodies e.g; lake, river etc.

→ The usual fundamental principles of surveying and levelling are adopted for acquiring data for determination of:

1. water volume.
2. Rate of flow.
3. To determine the shape of the area underlying the water surface.

⇒ Reason for conducting Hydrographic survey:

1. To determine the quantities of subaqueous 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 depths available for navigation.
5. control floods, and to plan water supply and storage from rivers.

⇒ Factors to be determined while conducting hydrographic survey are sounding and tides.

→ The measurement of depth of water at various point is called sounding. while The periodic variations in The water surface of ocean due to attraction of celestial bodies is called tides.

Q No. 3 Part (B)

⇒ Sounding:

1. The <sup>Process</sup> of determining depths below The water surface is called Sounding.
2. Sounding is analogous to levelling on land.
3. The reduced level of any point on The bottom of a water body is obtained by subtracting The sounding from The mean sea level.

→ The sounding points should be selected keeping in mind that all the important irregularities are recorded.

→ The soundings are thus made along a series of straight lines at right angles to the shoreline.

→ usually spacing b/w sounding lines is kept 30m and spacing b/w sounding points is kept 7.5m to 15m.

Purpose for sounding :-

1. Preparation of accurate charts for navigation.
2. Determination of the quantities of the material to be filled.

3. obtaining information for design of breakwaters, sea walls etc.

Equipment for sounding :-

The essential equipment and instrument employed for taking

The sounding may be grouped as:

1. Shore signals and buoys.
2. Sounding equipment.
3. Angle measuring instruments.

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Q No. 4 Part (a)

## Aerial Photogrammetry:-

Photogrammetry or Aerial Photography is The branch of Surveying That deals with Production of maps such as topographic maps by compiling number of photographs taken in That area.

In The aerial Photogrammetry, an aircraft with camera setup is used to take photographs from The air flying over The ground.

Reason for doing aerial survey:-

we do aerial Photography for The following reasons.

1: Accuracy:-

Drones utilise cameras That can shoot up 5.2 K resolution image

and video. The greater Pixel density ensures that the overall accuracy of aerial surveys is maximised.

## 2: Safety:-

All data is captured easily from the air, with limited health and safety concerns. This in turn reduces planning time.

## 3: Access any subject:-

Drone can access tower, masts, roofs tall buildings and wind turbine with ease and with excellent result.

## 4: Speed:-

Due to the flexibility of drones, very large areas of land can be covered in a short amount of time. This reduce the time for survey.

5: cost savings:-

with relatively low overheads and significantly reduced costs when compared to terrestrial, light aircraft and helicopter surveys.

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Q No. 4 Part (b)

Procedure of Aerial Photography:-

- 1) Establishing control points.
- 2) Flight Planning and Photography.
- 3) Photo interpretation and stereoscopy.
- 4) Parallax and measurement of Parallax.
- 5) construction of map and cartography.

Establishing control point:

→ control points are points established on ground with known relative position. The points should be established in such a way that they should be easily identifiable on photograph.

Flight Planning of Photography :-

→ Flight Planning is nothing but knowing the height to be maintained by flight while taking photos, area to be covered in each photograph, number of photographs, no of strips, and time interval b/w exposures.

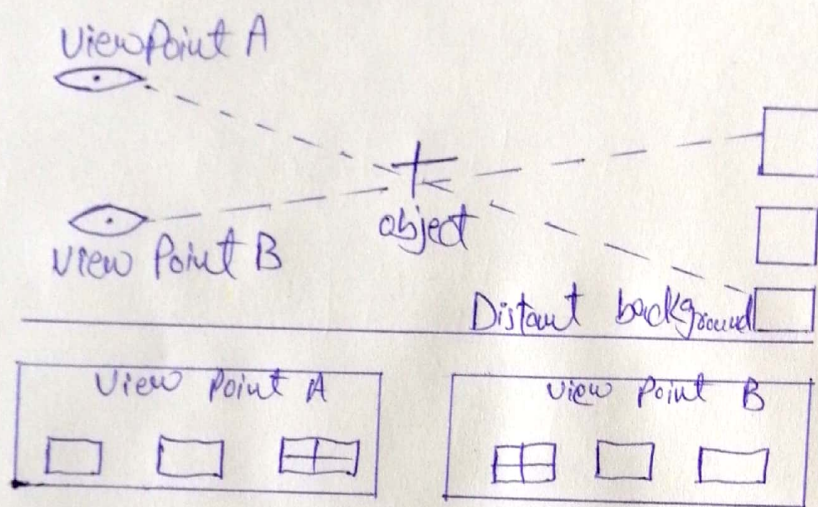
## Photo Interpretation & Stereoscopy:

→ Photo Interpretation is done by the instrument called stereoscope which contains magnifiers. 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 station, elevations, length of lines should be sufficiently available.

## Parallax and Measurement of Parallax:

→ Similarly, to know the third dimension of same object, there should be minimum of two points of observation is needed from different angles.

Parallax is nothing but a displacement of an object in the photograph when point of observation is shifted to another angle.



Construction of Map & cartography:-

After collecting all photographs, it's time to create or plot the map. There are several methods available to plot the details of map and one of the methods is. it is more accurate and this method is used by large mapping organization.