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Section:

A

Subject:

Advanced Engineering Survey.

Date:

24-6-2020

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Q No 1:

What is transition curve? How super elevation is effected by the speed of vehicle and radius of the curve? Prove it with the help of equation and diagram.

Answer

Transition Curve:

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 and 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.

## 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 centre of gravity of the vehicle.

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

To counteract 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 vehicle
- Radius of the curve .

Let

$w$  = weight of the vehicle

$P$  = centrifugal force

$v$  = Speed of the vehicle

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$g$  = Acceleration due to gravity

$R$  = Radius of the curve, m

$h$  = Super elevation, m

$b$  = width of the road, m

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

Mathematically:

$$P = \frac{mv^2}{R} \quad \text{--- (1)}$$

We know that

$$w = mg$$

$$m = \frac{w}{g} \quad \text{--- (2)}$$

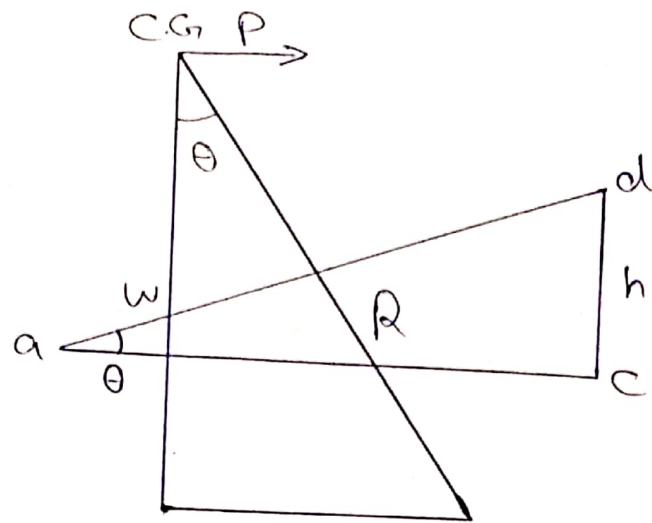
Putting e.q (2) in e.q (1)

$$P = \frac{\frac{w}{g} \times v^2}{R}$$



$$P = \frac{wv^2}{gR}$$

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



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

~~tan~~

In roads:

$$b \tan\theta = \frac{v^2}{gR}$$

In Railways:

$$b \tan\theta = \frac{Gv^2}{gR}$$

Speed of vehicle:

$$b \tan\theta = \frac{v^2}{gR}$$

$$v^2 = b \tan\theta gR$$

$$v = \sqrt{b \tan\theta gR} \quad (\text{For road})$$

$$b \tan \theta = \frac{Gv^2}{gR}$$

$$v^2 = \frac{b \tan \theta g R}{G}$$

$$v = \sqrt{\frac{b \tan \theta g R}{G}} \rightarrow (\text{for railway})$$

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Q2: What is the difference between triangulation <sup>and</sup> trilateration? Also explain the principles of trilateration.

### Answer

#### Difference b/w triangulation trilateration:

##### Triangulation

1. All angles are measured in triangulation.
2. Distance of base lines are also measured to control scale error.
3. Some check base lines are also measured to control scale error.
4. Intervisibility b/w stations is essential.
5. There are more internal checks in comparison with trilateration in the same geometric figure.

##### Trilateration

1. All sides are measured in trilateration.
2. Azimuth of the initial line is measured.
3. Some check angles are measured to control azimuth error.
4. For small areas it is possible to measure distances without intervisibility.

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## Principles of Triangulation:-

- In triangulations, all the three angles of each triangle are in the field along with one base line.
- The side of the first triangle whose length is predetermined is called base line and vertices of the individual ~~triangles~~ triangles are known as triangulation stations.
- To minimize accumulation of errors in lengths, subsidiary bases at suitable intervals are provided.

## Principles of Trilateration:

- It is a method of control survey in which a network of triangles is used as in triangulation.
- All the three sides of each triangle are measured in the field with distance measuring instruments.



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- In trilateration, angles are computed indirectly from the lengths of the sides of triangles.

Q<sub>3</sub>(a) What is hydrographic survey? Why we do it and what are the factors to be determined while conducting the hydrographic survey?

### Answer

#### Hydrographic Surveying:

It is the branch of surveying 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 etc.

⊙  
⊛ Factors to be determined while conducting the hydrographic survey:

a) Survey Equipment

A) b) Preparation of a hydrographic survey = Specification (To include a review of existing data).

c) Issue to a designated unit.

d) Programme planning of that unit.

e) Assessment of the task within that unit.

f) Reconnaissance requirement.

∴ g) Resource allocation.

h) Detailed survey planning

i) Plans for compilation and checking of data.

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Answer No 3 (b)

Sounding:

The measurement of depth below the water surface is called sounding. This corresponds to the ordinary spirit leveling in land surveying where depths are measured below horizontal line established by level. The object of making sounding in this to determine the configuration at the sub-aqueous source.

Purpose:-

Sounding is most important for any water body to improve its negligible properties to know about sitting and scaring etc.

In hydrographic survey, sounding is measurement of depth below the water surface.

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## Equipment:

- ① Sounding boat
- ② Sounding rods and poles.
- ③ Lead lines
- ④ Sounding machines.
- ⑤ Fathometer.

Answer No 4(a)

## Aerial Photogrammetry:

Aerial Photogrammetry is the branch of surveying that deals with production of maps such as planimetric or topographic maps by compiling number of photographs taken in that area.



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Advantages of Aerial Photogrammetry:

It provides a permanent photographic record of conditions that existed at the time the aerial photographs were taken. Since this record has metric characteristics, it is not only a pictorial record but also an accurate measurable record.

Answer 4(b)

Procedure of Aerial Photography:

1. Establishing control points
2. Flight planning and photography
3. Photo interpretation and Stereoscopy.
4. Parallax and measurement of ~~P~~ Parallax.
5. Construction of map and cartography.