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Sec A.

Advanced Engineering Surveying

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QNO (01)

TRANSITION CURVE:

A curve of varying radius is called transition curve between tangent and a circular curve. It is also known as spiral curve. It can be inserted in between the two branches of a compound or reverse curve.

Types:

There are three ^{Common} types of transition curves which are given below.

- (i) Cubic Parabola (railways)
- (ii) Clothoid or Spiral (railways)
- (iii) Lemniscate (Highways)

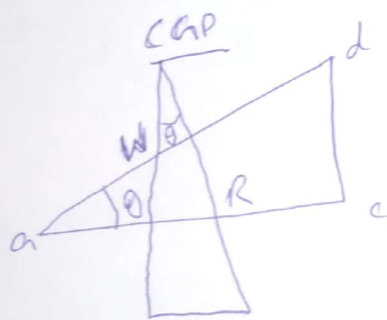
Superelevation:

It is the amount by which the outer edge of a curve on a road or railway is banked above the inner edge. When a vehicle passes to a curved path, the following forces act on it

- (i) Weight of vehicle
- (ii) Centrifugal force both acting through Centre of gravity of vehicle.

The effect of Centrifugal force is to push the vehicle off the track. Now to counteract the action, the plane of the road surface is made perpendicular to resultant of Centrifugal force and weight of vehicle. In other words the outer bank of road is raised above the inner one. This raising of outer bank over the inner one is known as Superelevation.

Mathematically.



W = weight of vehicle.
 P = Centrifugal force.
 v = Speed of vehicle (m/sec).
 g = acceleration due to gravity.
 R = radius of curve.
 h = Superelevation in m.
 b = width of road in m.
 G = Distance between centre of rails.

For equilibrium the resultant of weight and centrifugal force must be equal and opposite to the reaction perpendicular to road.

As we know that

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

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

If θ is the inclination of road surface, the ~~resultant~~ inclination of resultant to vertical is also θ .

So we have

$$\tan \theta = \frac{dc}{ac} = \frac{P}{W} = \frac{bv^2}{gR}$$

On Roads:

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

On Railways:

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

Radius

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

$$R = \frac{v^2}{b \tan \theta g} \quad (\text{for roads})$$

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

$$R = \frac{Gv^2}{b \tan \theta} \quad (\text{for railways})$$

Speed of vehicle:

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

$$v^2 = \frac{b \tan \theta g R}{1}$$

$$v = \sqrt{b \tan \theta g R}$$

(For roads)

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

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

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

(For railways)

TRIANGULATION

In triangulation, All angles of triangles are measured.

In triangulation, The base line of triangle is measured.

In triangulation, Intervisibility between station is essential.

There are more internal checks in triangulation. ~~than~~ as compare to trilateration.

Triangulation relies on timing differences

TRILATERATION

In trilateration, all sides of triangles are measured.

In trilateration the Azimuth of initial line is measured.

In trilateration It is possible to measure the distances without intervisibility.

There are less internal checks in trilateration as compare to triangulation.

Trilateration relies on signal strength.

Principles of Triangulation:

Principles of Triangulation are given below.

In triangulation, the three angles and one base line of each triangle are known.

The predetermined side of first triangle is called base line.

The vertices of triangle are known as ~~constant~~ stations.

The accumulation of errors is to be minimized in length, subsidiary bases at suitable intervals are provided.

Principle of Trilateration:

Following are some of the principles ~~are~~ given below.

It is a way of control survey in which a network of triangles are present just like in triangulation.

In trilateration, All the three sides of each triangle are measured with measuring instrument.

The Horizontal angles in the field are measured

The Angles are computed indirectly from the length of sides of Triangle.

The Trilateration is adjusted after the computation of the angles and then coordinates of the stations are determined.



Hydrographic Survey:

Hydrographic Survey is the survey of physical features present under water. It is science of measuring all factors below water that affects all the marine activities. It comprises all surveys made for the determination of shore lines, soundings, characteristics of bottom, areas subject to scouring and silting, depth available for navigation, velocity and characteristics of flow of water etc. Hydrographic Survey is mainly carried out by concerned authority.

Why we Perform Hydrographic Survey:-

For the attaining the following information we perform hydrographic survey.

Depth of bed.

Shore lines.

Locating Sever fall.

For location of mean sea level.

River and stream discharge measurement.

For planning of bridges and dams etc.

Factors for Conducting Hydrographic Survey:

Factors to be determined for conducting the hydrographic surveys are given below-

- i) Arrangement of Survey equipment.
- (ii) Preparation of a hydrographic Survey Specification
- (iii) Issue to a designated authority/team.
- (iv) Program planning of designated team.
- (v) Resource allocation.
- (vi) Detailed Survey Planning.



Q No (3) (b)

Sounding:-

The measurement of depth below the water surface is called Soundings. This process corresponds to the ordinary spirit leveling that is performed in land surveying.

The object of making sounding is to determine the configuration of the bottom of the body of water.

Purpose of Soundings:-

Sounding is most important for water and also to improve its negligible properties.

It is used in hydrographic surveying for the measurement of depth below the water surface.

In short the main purpose and objective of sounding to measure and finding the depth below water.

Equipments-

Following are the equipment of Sounding.

- Sounding boat.
- Sounding rods and poles.
- Lead lines.
- Sounding Machine.
- Fathometer.



Aerial Photogrammetry:

Aerial photogrammetry is a process in which an aircraft with ~~an~~ camera is used to take photographs from certain heights in the air. A minimum of 3 to 4 control points are needed in one photograph.

Reasons for use of Aerial photogrammetry:

Following are some of the ^{reasons for} uses of Aerial photogrammetry.

It is used because it provides computer-generated 2D and 3D models. These models are topographical in nature. They represent the dimensions and physical features of the area of land and in stunning accuracy. These models can be rotated and zoomed.

Along with surveying, many of the uses of Aerial photogrammetry are in different fields.

Q_{N5} (4) (5):

Procedure of Aerial Photography: Following are the main steps of Aerial photography.

- Establishing Control points
- Flight Planning and Photography.
- Photointerpretation and Stereoscopy.
- Parallax and measurement of Parallax.
- Construction of map and Cartography.

Establishing Control Points:

Control points are points established on ground with known relative positions. The photograph captured is observed by setting these control points as boundaries. There should be minimum 3 to 4 points (control points) in a photograph.

Flight Planning and Photography:

Flight planning is actually knowing the height to be maintained while taking photo, area to be covered in each photograph, Number of photographs, no of strips, and time interval between exposures.

Photo Interpretation and Stereoscopy. Photo interpretation is done by stereoscope which contains magnifiers; We can observe the three dimensional model of area and easily we can go for drawing of maps of photographed area. For Accuracy; Control stations, elevations length of lines should be available.

Five types of Stereoscopes are available.

Lens stereoscope.

Mirror stereoscope.

Scanning mirror stereoscope.

Zoom stereoscope.

Parallax and Measurement of Parallax:

Parallax is a error. It is the displacement of object in photograph when point of observation is shifted to another angle.

Construction of Map and Cartography:

After collecting all Photograph, its time to create or plot the map. Several methods are used for plotting map.