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Section = A

Paper = Survey II

Date = 24/6/2020

Q#1 :-

⇒ We will explain Transition Curve and is super elevation is effected by Speed of vehicles.

\* 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) Lemni scale [high way -

## Superelevation:-

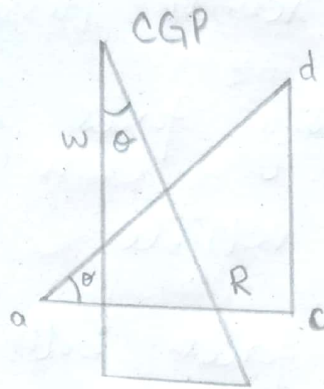
It is the amount by which the outer edge of a curve on a road or railway is banked above the inner edge- when a vehicle passes to a curved path, the following forces acts on it-

- ① weight of vehicle
- ② Centrifugal forces both acting through centre of gravity of vehicle-

→ The effect of centrifugal force is the 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 side the outer bank of road is raised above the inner one

This raising of outerbank over the inner one is known as Super elevation -

Mathematically:-



$W$  = weight of vehicle

$P$  = Centrifugal force

$v$  = Speed of vehicle m/sec

$g$  = acceleration due to gravity

$R$  = radius of Curve -

$h$  = Super elevation in m -

$b$  = width of road in m

$G$  = Distance b/w Center 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  $\theta$  is the inclination of road surface, the inclination of resultant to vertical is also  $\theta$ .

So we have

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

On Roads :-

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

on Railways :-

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

Radius:-

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

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

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

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

Speed of vehicle :-

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

$$V^2 = b \tan \theta g R$$

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

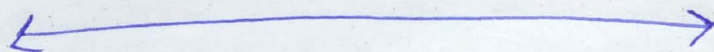
(For Roads)

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

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

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

(For Railways)



Q#02

## Triangulation

## Trilateration

- |   |  |
|---|--|
| <p>① In triangulation, all angles of triangles are measured-</p>                                    | <p>① In trilateration, all sides of triangles are measured-</p>                            |
| <p>② In triangulation, the base line of triangle is measured-</p>                                   | <p>② In trilateration the Azimuth of initial line is measured-</p>                         |
| <p>③ In triangulation, Intervisibility between station is essential-</p>                            | <p>③ In trilateration It is Possible to measure the distances without Intervisibility-</p> |
| <p>④ There are more internal checks in triangulation as compare to <del>tri</del> trilateration</p> | <p>④ There are less internal checks in trilateration as compare to triangulation-</p>      |
| <p>⑤ Triangulation relies on timing differences-</p>  | <p>⑤ Trilateration relies on signal strength-</p>  |

## ① Triangulation:-

Triangulation is a Process in Surveying in which tracing and measurements of a series or a network of triangles is used for determining distances and relative ~~Positive~~ positions of points over an area.

### Principles of Triangulation:-

- \* In triangulations, all the three angles of each triangles are in the field along with one base line.
- \* the side of the first triangles whose length is predetermined is called "base line", and vertices of the individuals " triangles are known as triangulation stations".



\* To minimize accumulation of errors in length, Subsidiary are Provided.

### (b) Trilateration:-

The method of Surveying in which the lengths of the sides of a triangles are measured and from this information angles are Computed-

This method does not involve the measurements of angles

### 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-

\* Horizontal angles are measured in the field.

\* Triangulation is adjusted after the computation of the angles and then ~~the~~ co-ordinates of the stations are determined.

\* In triangulation, angles are computed indirectly from the lengths of the sides of triangles.



Q#03 [Part A]Ans: Hydrographic Survey:-

Hydrographic

Surveying or bathymetric Surveying is the Survey of physical features Present under water -

It is science of measuring all ~~feature~~ factors beneath water that affect all the marine activities like dredging, Marine Construction, offshore drilling etc-

Hydrographic Surveying is mainly conducted under authority concern -

It is mainly carried by means of sensor, Sounding or electronic sensor system for shallow water -

⇒ Why we do Hydrographic

Surveying :-

In order to get following information we do Hydrographic Surveying-

- ① Depth of bed can be determined-
- ② Shore lines can be determined-
- ③ Locating sewer fall by measuring direct current-
- ④ Locating mean sea level-
- ⑤ Tide measurement-
- ⑥ River and stream discharge measurement-
- ⑦ Massive structures like bridges dams harbors are planned-

⇒ Factor to be determined while  
Conducting Hydrographic Survey:-

Following are the factors which  
would be done while doing  
and Conducting Hydrographic Surveying.

- (a) Survey Equipment.
- (b) Preparation of a Hydrographic Survey Specification  
(To include a ~~new~~ review of existing data).
- (c) Issue to a designated unit.
- (d) Programme planning of that unit.
- (e) ~~Assess~~ 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.

Q# 03 [Part B]Ans:- Soundings:-

It is the process of measuring depth below the water surface-

This corresponds to the ordinary spirit leveling in land surveying where depth horizontal line-

The objectives of performing sounding is to determine the configuration of the sub aqueous source-

Purpose of Soundings:-

It is important for water body to improve its negligible properties. to know about silting and scouring etc.

\* In Hydrographic Survey Sounding is the measurement of depth below the water surface -

\* Main Purpose and objective of Sounding to measure and find depth below water surface -

Equipments Used for Soundings:-

- ① Sounding Boat -
- ② Fathometer -
- ③ Lead lines -
- ④ Sounding rods and Poles -



Q#04 [Part A]

Ans:- Aerial Photogrammetry:-

In Aerial Photogrammetry an aircraft with camera setup is used to take photographs from the air flying over the ground-

Photography:-

Procedure of Aerial Photography:-

- Establishing Control Points.
- Flight Plan and Photography
- Photo interpretation and stereoscopy -
- Parallax and measurement of Parallax -
- Construction of map and Cartography -



So Photogrammetry is the Science and technology of obtaining special measurement and other geometrically reliable Products from Photographs-

Principle Application:- is to determine the spatial position of the ~~natural~~ natural and man made features situated on the earth surface-

Purpose of using it / why we

use it:-

Photogrammetry is also used for measuring tools in architectural, industrial design, deformation studies of structures accident investigation, medicent there operation are referred to as non topographic application

Procedure of Aerial Photography:-

① Establishing Control Points:-

Control Points

are points established on ground with known relative position-

The photograph captured is observed by setting these control points as boundaries. So, points should be established in such a way that they should be easily ~~seen~~ identifiable on photographs.

② Flight Plannings and Photograph:-

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 Photograph no of strips  
time interval between exposure-

This Planning mainly depend upon the following factors

- ① Area to be Surveyed -
- ② Focal length of camera -
- ③ Overlap

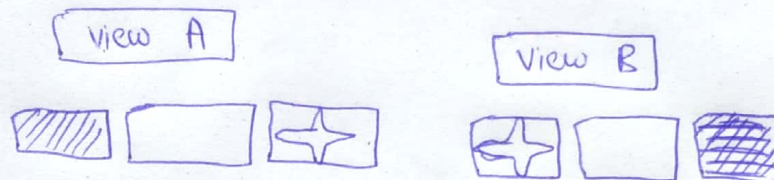
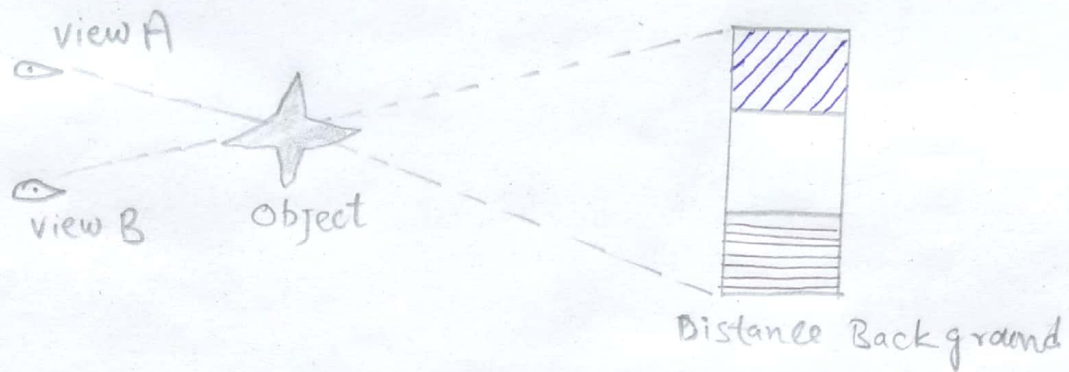
### Parallax and Measurement of Parallax:-

An aerial photograph can be studied to get the location of an object by its co-ordinates in the photographs -

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 - The observation is shifted to another angle -

## Diagram



### Construction of Map and Cartography -

After collecting all photographs, it's time to create or plot the map. Following method used for that but one of the most important method is "stereoscopic Method"