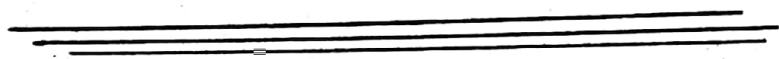


ADVANCE ENGINEERING

SURVEYING



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Section :- A

Date :- 24/6/2020



Q No 1 .

(1)

Ans : Transition Curve :-  
x-----x

Transition Curve as the name suggests, is usually a horizontal curve in plan provided to allow transition from a straight alignment to a circular curve gradually. In other words

"It is curve which connects a with infinite radius and radius "R".

Transition Curve is usually provided between a straight and curved track / road.

Types  
x-----x

There are three main common types of transition curve which are

Following.

(2)

- 1) Cubic parabola (Railways)
- 2) Clothoid<sup>or</sup> spiral (Railways)
- 3) Lemniscate (Highways)

⇒ Superelevation :-

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

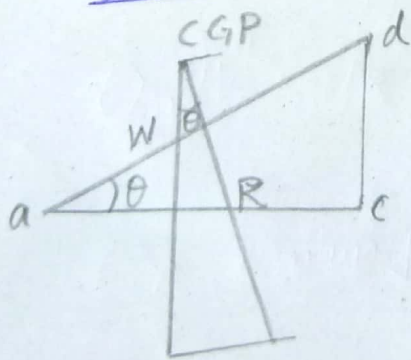
- 1) Weight of vehicle.
- 2) Centrifugal force both acting through 'Centre of gravity of vehicles'.

## Centrifugal Force

(3)

The effect of centrifugal force is the push vehical of track. Now to counteract the action, the plane of the road surface is made perpendicular to resultant of centrifugal force and weight of vehical. 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 super elevation.

### Mathematically:-



- $W$  = Weight of vehical
- $P$  = Centrifugal force
- $v$  = Speed of vehical ( $m/sec$ )
- $g$  = Acceleration due to gravity.
- $R$  = Radius of Curve.
- $h$  = Super elevation 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. (4)

As we know that

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

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

If  $\theta$  is the inclination of road surface, the inclination of resultant to vertical is also  $\theta$

So we have

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

On Roads

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

On Railway

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

Radius :-

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

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

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

$$R = \frac{Gv^2}{b \tan \theta} \text{ (For Railway).}$$

Speed of Vehicle :-

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

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

$$v = \sqrt{b \tan \theta gR}$$

(For Roads)

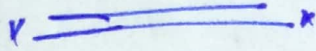
$$b \tan \theta = \frac{Gv^2}{gR}$$

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

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

(For Railway).

Q No 2



Ans:

## Trilaterations

→ In trilaterations Azimuth of initial line is measured

→ In trilateration all sides of triangle are measured.

→ In trilateration it is possible to measure the distance without intervisibility.

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

→ Trilateration relies on ~~single~~ signal strength.

## Triangulation

→ In triangulation the base line of triangle is measured.

→ In triangulation all angles of triangle are measured.

→ In triangulation inter-visibility between station is essential.

→ There are more internal checks in triangulation.

→ Triangulation relies on timing differences.

6

## ⇒ Principle of Triangulation:

(7)

Some of principle 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 stations.

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

## ⇒ Principle of Trilateration:

Following are the principle are given below.

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



Q No 3

(part - a)

8

Ans: Hydrographic Survey:-

Hydrographic Surveying or bathymetric Surveying is the survey of physical features present under water. It is science of measuring all 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? (9)

\*—————\*

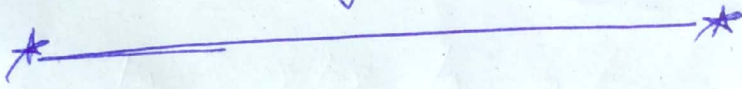
In order to get following information we do Hydrographic Surveying.

- 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.

⇒ Factors to be determined

(10)

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 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.

## Q No 3 (part-b)

11

### Sounding :-

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

### ⇒ Purpose of Sounding :-

→ Sounding is most important for any water body to improve its negligible properties, to

to know about silting and scouring etc. (12)

→ In Hydrographics surveying, sounding is the measurement of depth below the water surface.

→ In short the main purpose and objective of sounding is to measure and find the depth below the water surface.

### ⇒ Equipment :

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

(13)

Q No 4 (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.

(14)

So photogrammetry is the science and technology of obtaining spatial measurement and other geometrically reliable products from photographs.

### Principle Application,

is to determine the spatial position of the 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.

(part - b)

(15)

## 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 this control points as boundaries. So, point should be established in such a way that should be easily identifiable on photographs.

### 2) Flight planning and 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 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.

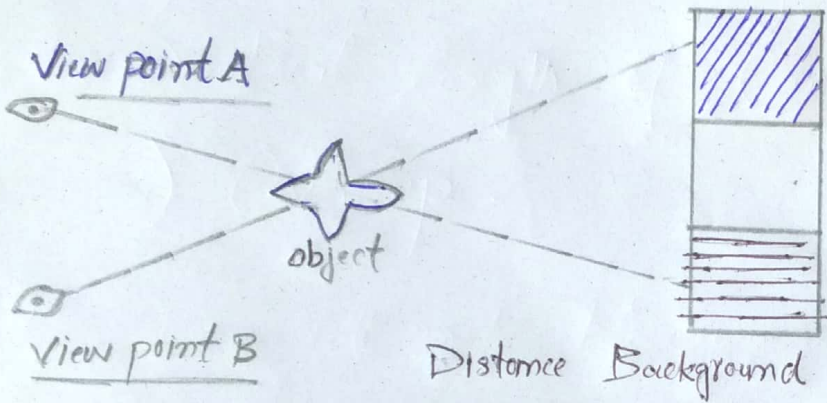
## Parallel and Measurement of parallel

An aerial photograph can be  
studied to get the location of an  
object by its coordinates in  
the photographs.

Similarly, to know the third Dimension  
of some 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".