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SUBMITTED TO : Engg Farhan

SUBJECT : Advance Engg  
Surveying.

Q No 1

Ans:

## TRANSITION CURVE:

A curve of varying radius is called transition curve.

It is also called spiral curve, it is used in both highway and railway b/w tangent & circular curve in order to have smooth transition from tangent to the curve and from curve to the tangent.

It is also inserted b/w two branches of compound curve.

When the vehicle moves from tangent on the curve the forces acting on it are.

- Weight of the vehicle
- Gravity of the vehicle.

Let

$w$  = weight of vehicle.

$P$  = Centrifugal force.

$v$  = speed of vehicle m/s

$g$  = Acceleration due to gravity.

$R$  = Radius of the curve.

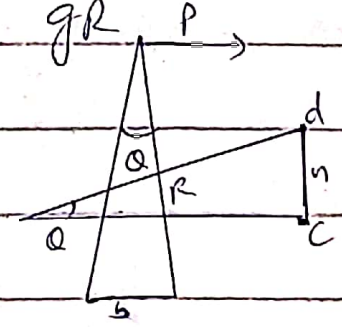
$h$  = super elevation.

$b$  = width of the road.

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

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

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



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



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

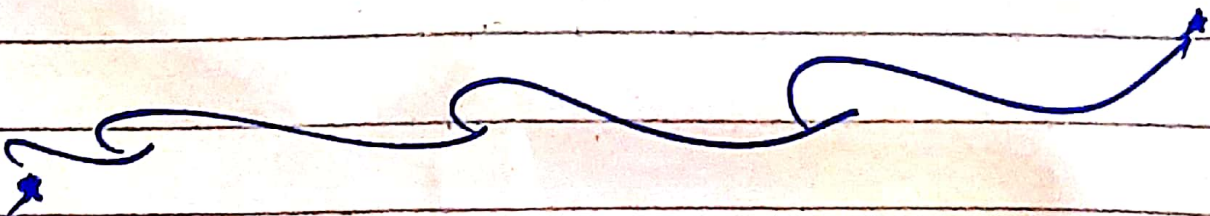
$$h = b \tan \theta$$

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

$$h = \frac{b G v^2}{gR} \quad \text{on railway.}$$

where  $G =$  distance b/w center of rail.

Super elevation is gradually applied along a transition curve. Full super elevation is attained in junction of the transition curve with the circular curve.



Q#2

What is the difference between triangulation & Trilateration?

### \* TRILATERATION:-

- ⇒ All sides are measured in trilateral.
  - ⇒ Azimuth of the initial line is measured.
  - ⇒ Some check angles are measured to control azimuth error.
  - ⇒ For small areas it is possible to measure distances without intervisibility.
  - ⇒ There are less internal checks in comparison with triangulation. Some geometric figure.
- The angles are computed on the basis of measured side lengths applying cosine law.



★ TRIANGULATION:-

- ⇒ All angles are measured in triangulation.
- ⇒ Distance of baseline is measured.
- ⇒ Some check base lines are also measured to control scale error.
- ⇒ Intervisibility between station is essential.
- ⇒ There are more internal checks in comparison with trilateration; in the same geometric figure.
- ⇒ The side lengths are computed on the basis of measured angles applying sine law.

## TRILATERATION AND ITS PRINCIPLES

- ⇒ Trilateration is a highly accurate and precise method of establishing and expanding horizontal control.
- ⇒ Method of control survey in which a network of triangles is used as in triangulation system.
- ⇒ All the three sides of each triangle are measured in the field with the distance measuring instruments (EDMs, tapes, other apparatus).
- ⇒ Horizontal angles are not measured in the field.
- ⇒ Angles in a trilateration system are computed indirectly from the length of the sides of triangle by cosine formula.
- ⇒ Few horizontal angles are also sometimes measured to provide a check on computed angles.



- ⇒ Trilateration is adjusted after the computation of the angles and then coordinates of the stations are determined.
- ⇒ Astronomical observations for azimuth are also made at selected stations.
- ⇒ Vertical angles are also measured where elevations have not been established.

### Cosine Rule.

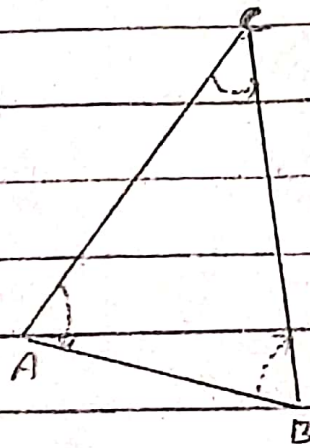
$$a^2 = b^2 + c^2 - 2bc \cos A.$$

## \* TRIANGULATION AND ITS PRINCIPLES:-

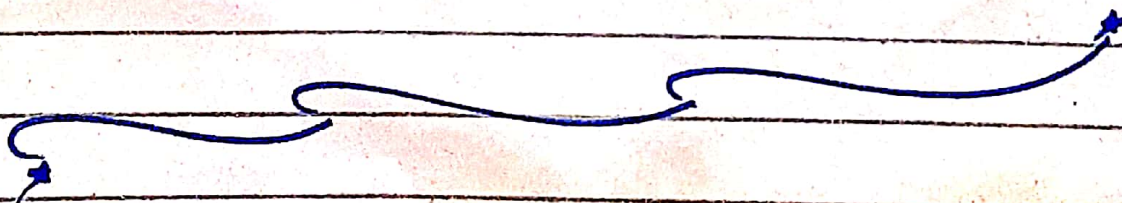
- ⇒ It is the process of measuring the angles of a chain or network of triangles formed by stations marked on the surface of the earth.
- ⇒ The system consists of a number of interconnected



triangles in which the length of only one base line and the angles of the triangles are measured very precisely which are used to calculate the coordinate of vertices.



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



Q No: 3  
(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 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 fact by measuring direct current.
- 4) Locating mean sea level.
- 5) Tide measurement.
- 6) River & Stream discharge measurement
- 7) Massive structures like bridges dams are planned.

## Factors to be determined while conducting Hydrographic

### Survey:-

Following are the factor 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

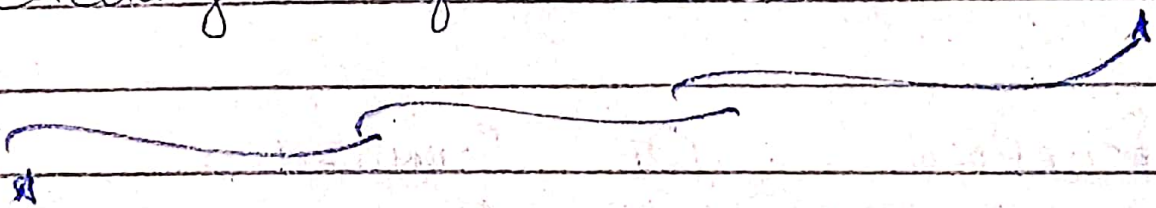
e. assessment of the task with in that unit

f. Reconnaissance requirement.

g. Resource allocation.

h. Detailed survey planning.

i) Plans for compilation & checking of data.





## Q No 3 (Part - b)

### 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 in this to determine the configuration of the subaqueous source.

### \* PURPOSE OF SOUNDING:-


⇒ Sounding is most important for any water body to improve its negligible properties to known about sitting and scouring etc.

⇒ In Hydrographic Surveying Sounding is the measurement

of depth below the water surface.

⇒ In short the main purpose & objective of sounding to measure & finding the depth below the water surface.

### ★ EQUIPMENT:

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

What is aerial  
photogrammetry and why  
we do it?

⇒ Photogrammetry is the art  
science and technology of  
obtaining reliable information  
about physical objects, &  
the environment through processes  
of recording measuring and  
interpreting photographic images  
& pattern of recorded radiant  
electromagnetic energy and other  
phenomena.

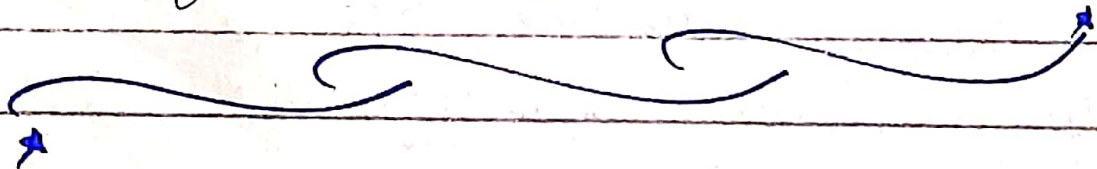
⇒ In terrestrial photogrammetry  
photographs are taken from  
a fixed position on ground.  
Photogrammetry An aircraft  
with camera setup is used  
to take photographs from  
the air flying over the  
ground.

## Reason for use of aerial Photogrammetry:-

Following are some of the reason for uses of aerial Photogrammetry.

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

Along with surveying many of the uses of aerial photogrammetry in different fields.





Q No 4 Part (b)

### PROCEDURE OF AERIAL PHOTOGRAPHY:

- 1) Establishing control points.
- 2) Flight planning and photography.
- 3) Photo interpretation stereoscopy.
- 4) Parallax & measurement of parallax.

### Establishing Control Point:-

⇒ Control points are points established on ground with known relative position.

### FLIGHT Planning & Photography:-

⇒ Flight planning is nothing but known the height to be maintained by flight while taking photos.

## \* PHOTO INTERPRETATION & Stereoscopy:-

⇒ Photo interpretation is done by the instrument called stereoscopy which contains magnifiers, so one can observe the 3D model of area through it.

## \* Parallax & Measurement of Parallax:-

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

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

## \* Construction of map & Cartography:-

After collecting all the photographs it is time to create or plot the map. There are several methods available to plot.