ADVANCED ENGINEERING SURVEY

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SECTION A

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Q.No(02)

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 and 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 vehical moves from tangent on to the curve the forces acting on it

★ Weight of the vehicle.

★ Gravity of the vehicle.

let,

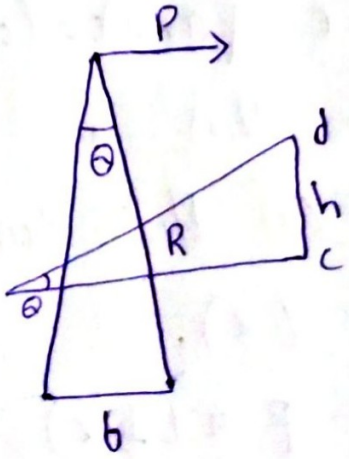
W = weight of vehicle

P = Centrifugal force
V = Space 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.

$$P = \frac{m^2}{R} = \frac{wv^2}{gR} \qquad w = mg$$

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



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

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

$h = b \tan\theta$

$h = b \frac{v^2}{gR}$ ⟶ on highway

$h = b \frac{Gv^2}{gR}$ ⟶ on railway

Where G = distance b/w center of the 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.No(02)

What is the difference between triangulation and trilateration? Also explain the principles of triangulation and trilateration.

Ans

Triangulation	Trilateration
1) All angles are measured in triangulation.	1) All sides are measured in trilateration.
2) Distance of baseline is measured	2) Azimuth of the initial line is measured.
3) Some check base lines are also measured to control scale error.	3) Some check angles are measured to control azimuth error.
4) Intervisibility between stations is essential	4) For small areas it is possible to measure distance without intervisibility.
5) There are more internal checks in comparison with trilateration in the same geometric figure.	5) There are less internal checks in comparison with triangulation in the same geometric figure.
7) The side lengths are computed on the basis of measured angles applying sine law.	8) The angles are computed on the basis of measured side lengths applying cosine law.

✡ Triangulation and its Principles :~

- In triangulation all the three angles of each triangle are measured in the field along with one baseline.
- The side of the first triangle whose length is predetermined is called the baseline and vertices of the individual triangles are known as triangulation stations and the whole figure is called the triangulation system or triangulation figure.
- The length and azimuth of each line is based on the length and azimuth of preceding line
- To minimize accumulation of errors in lengths, subsidiary bases at suitable intervals are provided.
- To control errors in azimuth of stations, astronomical observations are made at intermediate stations.
- The triangulation stations at which astronomical observations for azimuth are made are called Laplace station.

★ Principles of Trilateration :-

- 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 lengths 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.
- Vertical angles are also measured where elevations have not been established.

Q. No(02)

(b) What is sounding and purpose of sounding. Also name the equipment used to determine sounding?

Ans Sounding :~

The process of determining depths below the water surface is called sounding. Sounding is analogous to levelling on land. The reduced level of any point on the bottom of a water body is obtained by subtracting the sounding from the mean sea level.

* Purpose for sounding :~

- Preparation of accurate charts for navigation.
- Determination of the quantities of the material to be filled.
- Obtaining information for design of breakwaters, sea walls etc.
- The sounding points should be selected keeping in mind that all the important irregularities are recorded.
- The soundings are thus made along a series of straight lines at right to the shoreline.

☆ Equipment for sounding :~

The essential equipment and instrument employed for taking the sounding may be grouped as:

- Shore signals and buoys
- Sounding equipment
- Angle measuring instruments

1) Shore Signal and buoys :~

- Shore signal are required to mark range lines.
- Each range line is marked with two signals, at some distance apart, along it on each shore.
- The signals are usually wooden tripods with a white and coloured flag on the top.

2) Sounding Equipment :~

1) Sounding boat :~

- The sounding operation is carried out from a flat bottom boat of low draft.
- The boats are generally provided with openings called wells through which soundings are take

2) Sounding Pole or rod:-

- These are made of strong well seasoned timber usually 5 to 10 cm in diameter and 5 to 8m in length.
- The sounding rods consists of two or three lengths screwed together so that unnecessary length may be removed when not required in shallow water.

3) Weddell's sounding machine:-

- When there is a lot of sounding work, some form of sounding machine attached to sounding line is used.
- Weddell's hand driven machine consists of a cast iron casing carrying on a spindle gun metal barrel.

3) Angle measuring Equipment:-

Most common angle measuring instruments are:

- Theodolite • Prismatic compass • Sextant

The theodolite and prismatic compass are not suitable for angle measurements from sounding boats due to instability of rowing boats

- Sextant has been found to be most suitable for measuring angle in any place.
- Navigators and surveyors measure angles from sounding boat by sextant only.
- When observations are made from the shore, theodolite and prismatic compass are used.
- The sextant used in hydrographic surveying is known as the sounding sextant.

★ Angle measuring Equipments:

- Index glass • Index Arm • Horizon Glass • Pin-hole plate
- Ring carrying telescope • Arc • Vernier • Clamp
- Tangent Screw • Reading Glass or Pin-hole Plate
- Handle.

Q.No 03)

(a) Hydrographic Survey:~

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.

★ Tides:~

1) These are periodical variations in the water surface of oceans due to the attraction of celestial bodies.
2) The principal tide producing agents are the sun and moon, of which moon is more powerful tide producer.
3) Tide produced by unbalanced attracting forces between the moon and earth are known as lunar tide.

Tide gauges:~

1). These are used to determine the exact water surface level.

2) The movement of tides during the time soundings are made.

3) The gauges are read at regular intervals, varying from 1om to 30min.

4) These gauges may be non-registering or self registering types.

5) Non registering types requires a observer to record the water level.

- Staff gauge
- Float gauge
- Weight gauge

Q. No (04) (13)

(a) What is arial Photogrammetery and why we do it ?

Ans Arial Photogrammetery :~

In terrestrial photogrammetry photographs are taken from a fixed position on ground while in the arial photogrammetery an aircraft with camera setup is used to take photographs from the air flying over the ground. In this article we will discuss about the arial photography.

→ Land Surveying :~

As mentioned, sometimes it is difficult to surveys a large area of land on foot. This is where UAVs come in. They make the entire process of surveying land more affordable and efficient. UAVs can fly either several hundered feet in the air or close to the ground depending on the topography of the land being surveyed. Acquiring perspectives from high up is beneficial since the imagery returned will display larger parts of the land all at once.

However, despite the efficiency of drones, surveyors must always allow for areas that present obstacles even to UAVs. These obstacles could be anything from trees to dense brush. In these cases, the vehicles can fly closer to the ground, or the camera pointed at an angle to see what additional information can be gotten feet in the air or close to the ground.

(b) Shortly explain the procedure of arial photography.

Ans Procedure of arial photography:-

1) Establishing control points
2) Flight planning and photography
3) Photo interpretation and steroscopy
4) Parallax and measurement of parallax
5) Construction of map and cartography.

1) 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. So, the points should be established in

such a way that they should be easily identifiable on photograph.

There should be minimum of 3 to 4 control points are needed in one photograph. The establishment of control points depends upon the scale of map. Flight control and cartographical method of mapping.

2) Flight Planning and Photography:-

Fligh planning is nothing but knowing the height to be maintained by flight while taking photos, area to be covered in each photograph member of photograph, no of strips, and time interval b/n exposures. This planning mainly depents upon the following factors.

- Area to be surveyed
- Focal length of camera
- overlap
- Scale of Photograph

* Ground speed of aircraft in still air

There are some formulae are available for different parameters as follows.

Altitude of Aircraft.

It can be computed from

Flying height H = contol interval x c

3) Photo interpretation and stereoscopy:-

Photo interpretation is done by the instrument called stereoscope which contains magnifiers so one can observe the three dimensional model of area through it and it also ease the drawing of maps of photographed area. For accuracy, control stations, elevations length of lines should be sufficiently available.

So, we can say photo interpretations will enable the significance of objects in photograph. Coming to stereoscopes there are four types of stereoscopes are available which are used for the photo interpretation.

They are namely

Lens stereoscope = Mirror

stereoscope = Scanning mirror

Stereoscope = Zoom

stereoscope

→ Shape :-

Shape is an important for an object in photograph. The outline or configuration will deliver the shape of an object.

→ Size :-

Size is also an important factors in photo interpretation. The size should fixed to some scale and properly interpreted on the photograph.

4) Parallax and Measurement of Parallax :-

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

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 when points of observation is shifted to another angle.

5) Construction of Map and Cartography :-

After collecting all photographs it's time to create or plot the map. There are several methods available to plot the details of map and one of the metho