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SECTION :- "C"

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SUBJECT :- Advance Survey

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Question 1(a):-

What is Transition Curve? How super elevation is effected by the speed of vehicle and radius of the curve? Prove it with the help of diagram and equation.

Transition Curve:-

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

Types:-

There are three common types of transition curve which are given below

- i) Cubic Parabola (railway)
- ii) clothoid or spiral (railway)
- iii) Lemniscate (Highway)

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. The raising of outer bank 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.

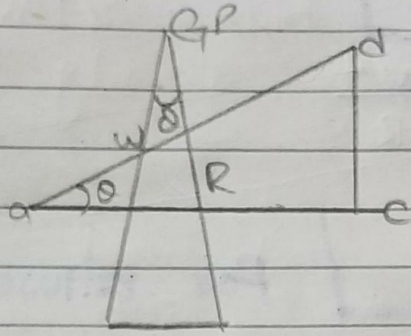
R = radius of curve

h = Super elevation in

b = width of road is in

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

$$P = \frac{w v^2}{g R}$$

$$\frac{P}{w} = \frac{v^2}{g R}$$

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

So we have

$$\tan \theta = \frac{dc}{ac} = \frac{P}{w} = \frac{b v^2}{g R}$$

On Roads:-

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

On Railway:-

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

Radius :-

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

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

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

$$R = \frac{G v^2}{b \tan \theta} \quad \text{For railways}$$

Speed of vehicle:-

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

$$\Rightarrow v^2 = b \tan \theta g R$$

$$v = \sqrt{b \tan \theta g R} \quad \text{For roads.}$$

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

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

$$v = \sqrt{\frac{b \tan \theta g R}{G}} \quad \text{For railways.}$$

Question :- Q:

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

Triangulation:-

- ① All angles are measured in triangulation.
- ② Distance of baseline is measured
- ③ Some check base line are also measured to control scale error
- ④ Intervisibility between stations is essential.
- ⑤ There are more internal checks in comparison with trilateration in the same geometric figure.
- ⑥ The side length are computed on the basis of measured angles applying sine law

* TRIANGULATION :-

- 1- All sides are measured in trilateration
- 2- Azimuth of the initial line is measured
- 3- Some check angles are measured to control azimuth error
- 4- For small areas it is possible to measure distance without intervisibility.
- 5- There are less internal checks in

comparison with triangulation in the
 some geometric figure.

- ii- 6- The angles are computed on the basis of measured side length applying cosine law.

* Principal of triangulation:-

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

→ Again if the coordinates of any vertex of the triangle and azimuth of any side are also known, the coordinate of remaining vertices may be computed.

* Principal of trilateration:-

→ Trilateration is 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 three sides of each triangle are

measured in the field with the distance measuring instrument

→ Horizontal angles are not increased in the field.

→ Angles in this system are computed indirectly from the lengths of sides of triangle by cosine formula

→ Few horizontal angles are measured sometimes measured to provide a check on computed angles.

→ Vertical angles are also measured where elevation have not been established.

Question 3a :-

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 off shore drilling etc

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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.

- i- Depth of bed can be determined
- ii- shore line can be determined
- iii- location sewer fed by measuring direct current.
- iv- locating mean sea level.
- v- Tide measurement
- vi- River and stream discharge measurement
- vii- Massive structure like bridges dams harbours are planned

⇒ Factor to be determined while conducting hydrographic survey.

Following are the factors which would be done while doing and conducting hydrographic surveying.

- i- Survey Equipment.
- ii- Preparation of hydrographic survey Specification (to include a review of existing data).
- iii- Issue to a designated unit.
- iv- Program planning of that unit.
- v- assessment of the task within that unit.
- vi- Reconnaissance requirement.
- vii- Resource allocation
- viii- Detailed survey planning
- ix- Plans for compilation and checking of data.

Question 3 b:-

What is sounding and purpose of sounding
Also name the equipment used to determine sounding?

Sounding:-

The measurement of depth below the water surface is called sounding. This corresponds to the ordinary spirit leveling in land surveying where depth is measured below horizontal line established by level. The object of making sounding is 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 know about silting and scouring etc.

→ In hydrographic 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.
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Question 4(a):-

What is aerial Photogrammetry and why we do it?

* Aerial photogrammetry:-

In aerial photogrammetry an aircraft with camera setup is used to take photographs from the air flying over the ground.

* Why do we do it:-

A bird eye view can allow prospective to appreciate the size and scope of a building and the surrounding landscape which will draw their interest and encourage them to view the property in person. Aerial photogrammetry is also useful in showing land that is open for development to potential investor.

Question 4(b):-

Shortly explain the procedure of aerial photography?

* Establishing control points:-

Control points are points established on ground with known positions. The photograph captured is observed by setting these points as boundaries. So these should be established in such a way that they should be easily identifiable on photograph.

Flight planning and photography:-

Flight planning are nothing but knowing the height to be maintained by flight while taking photos, areas to be covered in each photograph. Thus planning depend upon following factors.

- ① Area to be surveyed
- ② Focal length of camera
- ③ Overlap
- ④ Scale of photo
- ⑤ Speed of aircraft.

* Photo Interpretation & Stereoscopy :-

It is done by the instrument called stereoscope which contain magnifiers. So, one can observe 3 dimensional model of area through it and it also ease the drawing of maps of photographed area. These are four types of stereoscope used for photo interpretation.

- ① Lense stereoscope
- ② Mirror stereoscope
- ③ Scanning mirror stereoscope
- ④ Zoom stereoscope

* Parallax and Measurement of Parallax :-

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

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

* Construction of Map and Cartography :-

After collecting all photographs, it's time to create or plot the map. These are several methods available to plot the detail of map and one of the methods is stereoscope method. In this method, instrument will help to review the overlapped areas in 3 dimensional which helped to view the spatial model. Then the model is measured and orthographically projected as map.